Ecosystem Services for Poverty Alleviation in Amazonia

A report of a capacity-building project to design a research agenda on the links between the natural capital of Amazonian forests and water, food, health, livelihood, climate and energy securities.

– Global Canopy Programme
– Grupo de Trabalho Amazônico
– Instituto Nacional de Pesquisas Espaciais
– London School of Economics
– Met Office Hadley Centre
– Universidade Federal do Rio de Janeiro
– Universidad Nacional Agraria La Molina
– Universidad Nacional de Colombia
– University of Edinburgh
– University of Oxford
– University of Vermont

This Report presents the activities and results of an ESPA capacity-building project (grant NE/G008531/1) entitled: Valuing rainforests as global eco-utilities: a novel mechanism to pay communities for ecosystem services provided by the Amazon. The project was led by the University of Edinburgh and the Global Canopy Programme in the UK; Universidade Federal do Rio de Janeiro (UFRJ) and Instituto Nacional de Pesquisas Espaciais (INPE) in Brazil; Universidad Nacional de Colombia (UNAL) and Universidad Nacional Agraria La Molina (UNALM) in Peru in collaboration with a number of academic and NGO partners.

The views expressed in this publication do not necessarily reflect the views of the organisations involved in this project, or those of its funders.

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A report of a capacity-building project to design a research agenda on the links between the natural capital of Amazonian forests and water, food, health, livelihood, climate and energy securities.

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WHY IS THIS PROJECT IMPORTANT?

These are critical times for Amazonia and the people who depend on the region for their livelihoods and their climate, food, water, and energy security. Although predictions are uncertain, over time, deforestation and climate change could substantially alter the functioning of large portions of the forest and even tip the region over a threshold into a regime supporting reduced forest cover and impacting regional and global climate.

Amazonia's forests also represent places of spiritual importance to their indigenous peoples, acting additionally as a symbol of nature that resonates across societies globally. Despite the physical resources and cultural value of the region, its forests have historically experienced substantial land use change. The region is under pressure from infrastructure development, natural resource extraction and conversion of land to agriculture. Hence, there is a need for research that explores the risks, opportunities and trade-offs, and the winners and losers expected from alternative development scenarios.

One route to supporting reductions in deforestation and extending them across the region is to work towards informing change in the political economy. This requires the recognition of the importance of forests to the economy. Researchers in Latin America have shown that Amazonia's forests comprise vital natural capital, generating ecosystem services such as carbon sequestration and storage, cooling from evapotranspiration, freshwater filtration, nutrient and water cycling, moderation of extreme climatic events, maintenance of genetic diversity, medicines, fuel, fibres and food that benefit populations both in the forest and far beyond it.

Economic studies suggest that standing Amazonian forests are more valuable for their ecosystem goods and services than alternative uses of the land. However, the long-standing assertion of substantive value has not yet translated into large-scale financial flows and distribution to those people for whom the use of forests is integral to a sustainable livelihood.

Fortunately, the tide may have begun to change as Amazonian nations and the wide international community have become more aware of the need to reduce emissions of greenhouse gases from land use change. Deforestation rates have declined in the Brazilian Amazon in recent years and the government has set a target to reduce rates by 72% by 2017. Coupled with growing political will is substantial interest among Amazonian countries in the emerging UN climate policy framework 'Reducing Emissions from Deforestation and forest Degradation' (currently REDD+), which would involve industrialised nations compensating developing countries for conserving and restoring forests.

Although the implementation of the policy remains uncertain, early REDD+ preparations are taking place (with Norwegian, German, Japanese, UN and World Bank support) in all Amazon Basin countries except Venezuela. The rapidly evolving situation in the region underlines the immediate importance of feeding research results into emerging national REDD+ policies. This is especially relevant in terms of developing flexible and adaptive agendas which recognise the preferences and circumstances of local populations, to avoid what some commentators see as a potential for a top-down approach which limits the participation at the grassroots level of forest and indigenous populations.

PROJECT LEGACY

1 A new network for research on Ecosystem Services for Poverty Alleviation in Amazonia, including researchers from leading Southern and Northern institutions, Intermediary organisations and Community networks across Amazonia.

2 A submitted proposal for a basin-scale research consortium project, comprising 13 major institutions from the UK, USA and the Congo Basin with leadership from South America.

3 Key decision-makers are more aware and ready to engage in future work on Ecosystem Services for Poverty Alleviation.

KEY OUTPUT INDICATORS

Amazon basin-scale ESPA research agenda
– Submitted £4m ESPA consortium research project proposal for PRISMA Amazonia
– Led by Prof. Carlos A. Llerena, La Molina University, Peru

First Pan-Amazon community leaders knowledge sharing on ESPA
– Community knowledge needs report
– Policy brief to UNFCCC

First Andean Amazon research forum focused on ESPA
– Andean Amazon research gaps assessment report

Pilot research projects and literature reviews
– Beyond Carbon: Realising the Value and Continued Stewardship of Tropical Forest Ecosystem Services in a Changing Climate
– Cash Transfer Programmes in Amazonia
– Turning the Tide in Amazonia? From Perverse Incentives to Environmental Services
– Counting the Costs of the 2005 Amazon Drought: A Preliminary Assessment
– Risks To Amazonia: A Summary of the Past, Present and Future Pressures from Land Use and Climate Change
– Amazonia's Aerial Rivers and Lakes: Investigating Large Scale Moisture Transport, its Relation to Amazonia and Subtropical Rainfall in South America
– Exploring the Value of Amazonia's 'Transpiration Service'
– Mapping the Benefits and Costs of Amazonia's Ecosystem Services

Thirteen reports and papers produced linked to the project (see Appendix)

Newly-funded ESPA Framework project with a Political Economy theme
– Led by University of Edinburgh with partners in Brazil, Malawi and Nepal

Latin American policymakers engaged
– Knowledge needs assessment with local and regional policymakers engaged through partnership with TEEB, UNDP and AVINA

Private sector actors more aware and engaged
– Knowledge needs assessment on climate and deforestation risks to business through partnership with the Forest Footprint Disclosure Project and The Royal Society

KEY ISSUES FOR FUTURE RESEARCH

Although there is uncertainty, were deforestation to exceed 40% of the original forest extent or if global warming were to exceed 3–4°C, Amazonia – especially the south and south-east – could be tipped into a new climate-forest equilibrium, experiencing lower rainfall and forest cover. How will Amazonia respond to the interacting pressures of deforestation and climate change and how resilient are its biodiversity, ecosystem services and coupled socio-economic systems?

Recent droughts and floods in Amazonia demonstrate that extreme events can have a significant impact on transport, health, freshwater and food supplies. What groups within and beyond Amazonia are most vulnerable to changes in climate and ecosystem services? Which ecosystem management strategies are most likely to foster poverty alleviation and local resilience and are able to be applied across the region?

We cannot yet quantify to what extent the climate, carbon, biodiversity and hydrological regulating functions of Amazonian forests underpin Latin America's economy, which in turn provides goods and services regionally and to the world. Answering this question would constitute a principal step towards understanding the components of a new 'green' economy.

Amazonia's forests are potentially worth US$ billions to the agriculture and hydropower sectors, which are a key part of the Latin American economy. Can regional economic growth and poverty alleviation be sustained over the long-term if Amazonia's natural capital shrinks? If not, what mode of economic development can be sustained within the limits of the biosphere? What trade-offs between water, food, livelihood, health, energy and climate securities are embodied within different policy options?

Conventional valuation methods underestimate the impacts of changes in ecosystem service provision on the poor, who are the most reliant on ecosystems for their basic needs. Hence there is a need to develop and apply novel valuation techniques.

The capacity-building discussions in this project helped to define the meaning in the Amazonian context of terms such as 'poverty reduction'. The planned consortium research project would enable a more systematic analysis of this issue, especially with regards to indigenous peoples.

While increasingly popular and widely applied in Latin America, cash transfers – on their own – may not be the most appropriate means to reduce poverty and protect ecosystem services such as forest carbon storage. What delivery mechanisms are appropriate for sharing resources and benefits to promote local self- sufficiency, poverty reduction and continued forest stewardship?

If new benefit-sharing mechanisms are to emerge, multi-dimensional measures of poverty will be needed which take account of how standard poverty measures and ecosystem services intersect (and potentially interact) to influence wellbeing. High resolution, spatially extensive datasets on ecosystem services have recently become available for Amazonia, although not so for its Andean headwaters. The challenge is to use such data and metrics to develop policy-relevant tools that integrate poverty and ecosystem services in order to help inform the design of appropriate socio-environmental programmes and that can aid in the near-term, political decision-making process.

EXECUTIVE SUMMARY

The challenge

Latin America is a biodiversity superpower and Amazonia is perhaps its greatest natural capital asset. Amazonian forests provide ecosystem services that underpin food, water, energy and livelihood securities. Research shows that Amazonia's forests are threatened by unsustainable land use practices and climate change, which could lead to large-scale impacts on ecosystem services. Maintaining the integrity of Amazonian ecosystems while reducing poverty and vulnerability is a key challenge for the region.

The response

This report summarises the work of a capacity-building project entitled: *Valuing rainforests as global eco-utilities: a novel mechanism to pay communities for ecosystem services provided by the Amazon*. The aim was to build a team and research agenda that would provide the evidence base for reducing poverty in the region through positive incentives for sustainable ecosystem management (SEM). The idea for the project stemmed from the realisation that although the scientific evidence for the importance of Amazonia's ecosystem services for human wellbeing was becoming clearer, this was not being translated sufficiently effectively into policies that could shift development rapidly enough from business as usual (BAU) towards SEM.

The funding

The capacity-building project was funded by the Ecosystem Services for Poverty Alleviation (ESPA) research programme, which is funded jointly by the UK Government's DfID, NERC and ESRC. ESPA aims to 'deliver high-quality, cutting-edge research that will improve our understanding of the way ecosystems function, the services they provide and their relationship with the political economy and sustainable growth'. A number of ESPA capacity-building projects were undertaken in 2009 and 2010, of which this is one. The objective of this cadre of projects was to help build teams of researchers who could then bid for further ESPA funds with which to carry out full-scale projects.

The process

A series of workshops was held in São José dos Campos, Manaus and Curitiba in Brazil and Medellín in Colombia, in addition to meetings in the UK. At these events, the team and collaborating partners from NGOs as well as stakeholders from government, forest communities and the private sector brought their ideas and perspectives to the table to help create the framework for a large-scale research project. Local community leaders from across Amazonia were given the opportunity to come together to discuss their concerns over existing development approaches and their visions for ecosystem services for poverty alleviation in their communities and territories. Forest community organisations in the Brazilian Amazon used the information generated in the Manaus workshop to elaborate a position paper that was taken to the UNFCCC COP15 in Copenhagen. Pilot studies and literature reviews were also carried out on key issues in climate science, public policy, development and economics. Participants at the first workshop noted that unsustainable and inequitable development in Amazonia was a political problem rather than a technical one. As a result, policy processes became a more important focus of the project. This also contributed to the successful application of an additional project proposal, this time using insights from Amazonia to help build a socio-ecological framework for the 'Political Economy' theme of ESPA.

The team

Over the course of two years, an interdisciplinary team has been formed of leading Southern and Northern researchers. The team's expertise spans social science, economics, anthropology, climatology, ecology and development. Crucially, partnerships have been forged with key organisations such as the UNDP and with policy-focused processes such as TEEB. This should help to ensure that the team's future research is targeted at producing evidence that meets the needs of decision-makers. In line with the key aim of the capacity-building project which was to promote Southern leadership in research, the full-scale project proposal emerging from this initial phase was led in January 2011 by the National Agrarian University of La Molina in Peru. Another goal of the project was to stimulate South-South transfer of knowledge. This has been ensured through partnerships between research institutes in Brazil and other Amazonian countries. In addition, we have made links to partners in Africa, with the aim of transferring knowledge and capacity between Amazonia and the Congo.

The future

The capacity-building project created momentum for a new basin-scale project that promises to help regional decision-makers to see development and poverty alleviation through a new prism: ecosystem services. The team and its partners submitted a consortium research proposal to ESPA in January 2011 for a project entitled *PRISMA Amazonia*, which would aim to deliver evidence needed to help shift Amazonia from BAU to SEM while reducing both poverty and the vulnerability caused by the loss of ecosystem services.

SUMÁRIO EXECUTIVO

O desafio

A América Latina é uma super-potência de biodiversidade, e a Amazônia provavelmente o seu mais importante patrimônio natural. As florestas amazônicas oferecem serviços ecossistêmicos que garantem a segurança alimentar, hídrica, energética e de subsistência. Estudos demonstram que as florestas amazônicas estão ameaçadas por práticas insustentáveis de uso da terra e pelas mudanças climáticas, as quais podem causar impactos de grande escala aos serviços ecossistêmicos.

A resposta

Este relatório resume o trabalho de um projeto de capacitação denominado: *Valorando florestas tropicais como provedoras naturais de serviços ('eco-utility'): um novo mecanismo para remunerar comunidades pelos serviços ecossistêmicos oferecidos pela Amazônia*. Esse projeto teve por objetivo a formação de uma equipe e a elaboração de um plano de trabalho que pudessem fornecer uma proposta sólida para a redução da pobreza na região, oferecendo incentivos positivos para a gestão sustentável de ecossistemas (GSE). A ideia do projeto partiu da constatação de que não obstante haver maior evidência científica sobre a importância dos sistemas ecoss-istêmicos da Amazônia para o bem-estar da humanidade, sua tradução em políticas que conduzam a uma mudança de business as usual (BAU) para GSE na velocidade necessária ainda não se deu de forma suficientemente efetiva.

Os recursos/O financiamento

O projeto de capacitação foi financiado pelo programa de pesquisa ESPA - Serviços Ecossistêmicos para Redução da Pobreza (do inglês, Ecosystem Services for Poverty Alleviation), o qual é financiado de maneira conjunta pelo DfID, NERC e ESRC, do governo britânico. O objetivo do ESPA é "fornecer estudos de alta qualidade e de ponta que contribuam ao nosso entendimento sobre como os ecossistemas funcionam, quais serviços eles oferecem e como eles se relacionam com a economia política e com o crescimento sustentável". Uma série de projetos de capacitação ESPA foi conduzida durante 2009 e 2010, dentre os quais o presente projeto. Esse conjunto de projetos teve por fim ajudar a formar equipes de pesquisadores que poderiam a partir daí concorrer a mais fundos ESPA que permitiriam executar projetos em escala real.

O processo

Uma série de workshops foi realizada em São José dos Campos, Manaus e Curitiba no Brasil e em Medelín na Colômbia, além de reuniões realizadas no Reino Unido. Nesses eventos, a equipe e colaboradores de ONGs, bem como do governo, dos povos da floresta e do setor privado apresentaram suas principais ideias e perspectivas, de forma a ajudar a criar as diretrizes para um projeto de pesquisa de grande escala. Líderes comunitários locais de toda a Amazônia tiveram a oportunidade de reunir-se para discutir suas preocupações em relação às abordagens de desenvolvimento atuais, assim como suas próprias visões quanto ao papel dos serviços ecosistêmicos para a redução da pobreza em suas comunidades e territórios. As organizações que representam os povos da floresta da Amazônia brasileira utilizaram as informações geradas no workshop de Manaus para preparar a posição que levaram para a COP15 da UNFCCC em Copenhagen. Além disso, foram realizados projetos piloto e uma revisão da literatura nas áreas de ciência climática, politicas públicas, desenvolvimento e economia. Durante o primeiro workshop os participantes constataram que o desenvolvimento insustentável e desigual na Amazônia constitui um problema político, e não técnico. Essa constatação também contribuiu para a implementação com sucesso de uma proposta de projeto adicional, a qual utilizou ideias sobre a Amazônia para ajudar a construir as diretrizes socio-ambientais para o tema de "Economia Política" do ESPA.

A equipe

Ao longo dos últimos dois anos, pesquisadores de países do Norte e do Sul formaram uma equipe interdisciplinar. As áreas de expertise dessa equipe cobrem as áreas de ciências sociais, economia, antropologia, climatologia, ecologia e desenvolvimento. Sobretudo, foram estabelecidas parcerias com organizações chave, tais como o PNUD, e com processos focados na construção de políticas, tais como o relatório TEEB – A Economia de Ecossistemas e Biodiversidade. Essas parcerias devem ajudar a garantir que as novas pesquisas estejam focadas na geração de evidências que atendam às necessidades dos tomadores de decisão. Na linha do principal objetivo do projeto de capacitação, de promover uma liderança de pesquisa no Sul, resultou dessa fase inicial uma proposta de projeto completa, conduzida pela Universidade Nacional Agrária de La Molina no Peru. Outro objetivo do projeto foi estimular a transferência de conhecimento Sul-Sul. Esse objetivo foi atingido por meio de parcerias estabelecidas entre centros de pesquisa situados no Brasil e em outros países amazônicos. Além disso, estabelecemos contatos com parceiros na África, com o objetivo de transferir conhecimento e capacitação entre a Amazônia e o Congo.

O futuro

O projeto de capacitação criou um momentum para a proposição de um novo projeto, na escala da bacia hidrográfica, que busca ajudar tomadores de decisão na esfera regional a verem o desenvolvimento e a redução da pobreza sob um novo prisma: o dos serviços ecossistêmicos. Em janeiro de 2011 a equipe e os seus parceiros submeteram ao ESPA uma proposta de pesquisa conjunta para um projeto denominado *PRISMA Amazônia*, o qual tem por objetivo fornecer aos tomadores de decisão a evidência necessária para subsidiar a mudança de um desenvolvimento de BAU para uma GSE, que seja capaz de reduzir a pobreza e também a vulnerabilidade causada pela perda dos serviços ecossistêmicos.

RESUMEN EJECUTIVO

El desafío

Latinoamérica es una súper potencia en términos de biodiversidad y la Amazonía es quizás su mayor patrimonio de capital natural. Los bosques amazónicos producen servicios ambientales que sustentan la producción de alimentos, agua, energía y medios de subsistencia. La investigación muestra que los bosques Amazónicos están amenazados por prácticas no sostenibles en el uso del suelo y por el cambio climático, lo cual puede generar impactos de amplia escala sobre los servicios ambientales. Mantener la integridad de los ecosistemas amazónicos, al tiempo que se reducen la pobreza y la vulnerabilidad, constituye un desafío clave para la región.

La respuesta

Este reporte resume el trabajo de un proyecto de fortalecimiento de capacidad titulado: *Valorando el bosque tropical como eco-utilidades globales: un mecanismo novedoso para el pago a las comunidades por los servicios ambientales generados por el Amazonas*. El propósito de este proyecto fue el de construir un equipo y una agenda de investigación que proporcionara evidencia base para reducir la pobreza en la región, a través de incentivos positivos para el manejo sostenible de los ecosistemas (MSE). La idea del proyecto surgió a partir del entendimiento de que, aunque la evidencia científica a favor de la importancia de los servicios ambientales de la Amazonía para el bienestar humano se tornaba cada vez más clara, esta no estaba siendo traducida de forma suficientemente efectiva en políticas que pudieran transformar el desarrollo bajo "prácticas habituales" (Business as Usual – BAU) a MSE con la suficiente rapidez.

La financiación

El proyecto de fortalecimiento de capacidad fue financiado por el Programa de Investigación de Servicios Ambientales para el Alivio de la Pobreza (ESPA), el cual es financiado conjuntamente por DfID, NERC y ESRC del Gobierno del Reino Unido. ESPA tiene el objetivo de 'producir investigación innovadora y de alta calidad que mejorará nuestro entendimiento sobre la forma en la que los ecosistemas funcionan, los servicios que estos producen y sus relaciones con la economía política y el crecimiento sostenible'. Varios proyectos ESPA de fortalecimiento de capacidad fueron llevados a cabo en 2009 y 2010 y este es uno de ellos. El objetivo de este grupo de proyectos era el de contribuir a la creación de equipos de investigadores, quienes luego podrían aplicar por mayores fondos ESPA con los cuales implementar proyectos a escala total.

El proceso

Una serie de talleres fueron llevados a cabo en San José dos Campos, Manaos y Curitiba en Brasil y en Medellín en Colombia, adicionales a las reuniones en el Reino Unido. En estos eventos, el equipo y los aliados de las ONGs, así como stakeholders del gobierno, de las comunidades forestales y del sector privado, trajeron sus ideas y perspectivas a la mesa para contribuir a la creación de un marco de un proyecto de investigación a gran escala. Líderes comunitarios locales de toda la Amazonia tuvieron la oportunidad de reunirse para discutir sus preocupaciones frente a los enfoques actuales de desarrollo, así como en torno a sus propias visiones en cuanto al papel de los servicios ambientales en el alivio de la pobreza en sus comunidades y territorios. Las organizaciones de las comunidades forestales en el Amazonas brasilero usaron la información generada en el taller de Manaos para formular un documento con su posición que fue presentado en la UNFCCC COP15 en Copenhague. También se llevaron a cabo estudios piloto y revisiones bibliográficas en temas clave como ciencia climática, política pública, desarrollo y economía. Los participantes en el primer taller señalaron que el desarrollo no sostenible e inequitativo de la Amazonía era un problema político y no uno técnico. Como resultado de esto, los procesos políticos se convirtieron en un objetivo de mayor importancia dentro del proyecto. Lo anterior también contribuyó a la exitosa aplicación de una propuesta de un proyecto adicional, el cual empleó aportes de la Amazonía para ayudar a construir un marco socio-ecológico para el tema de 'Economía Política' de ESPA.

El equipo

Durante dos años se ha formado un equipo interdisciplinario bajo el liderazgo de investigadores del sur y del norte. La experticia del equipo abarca ciencias sociales, economía, antropología, climatología, ecología y desarrollo. Un elemento crucial es la formación de alianzas con organizaciones clave, como por ejemplo el PNUD y con procesos enfocados en política, tales como TEEB. Esto debe ayudar a asegurar que la futura investigación del equipo esté dirigida a la producción de evidencia que satisfaga las necesidades de los tomadores de decisiones. En concordancia con el propósito clave del proyecto de fortalecimiento de capacidad, el cual era promover el liderazgo del sur en investigación, la propuesta del proyecto en su escala total que surge de esta fase inicial fue liderada en enero de 2011 por la Universidad Nacional Agraria La Molina en Perú. Otra meta del proyecto era el estimular la transferencia de conocimiento sur-sur. Esta meta ha sido asegurada a través de alianzas entre institutos de investigación en Brasil y otros países amazónicos. Adicionalmente, se han generado vínculos con aliados en África, con el propósito de transferir conocimiento y capacidad entre la Amazonía y el Congo.

El futuro

El proyecto de fortalecimiento de capacidad generó momentum para un nuevo proyecto a escala de la cuenca amazónica que promete ayudar a tomadores de decisiones regionales a ver el desarrollo y el alivio de la pobreza a través de un nuevo prisma: los servicios ambientales. El equipo y sus aliados sometieron, como consorcio, una propuesta de investigación a ESPA en enero de 2011, por un proyecto titulado *PRISMA Amazonia*, el cual tendrá como objetivo producir la evidencia requerida para contribuir a que la Amazonía cambie de un modelo basado en "prácticas habituales" (o Business as Usual) al Manejo Sostenible de los Ecosistemas (MSE), al tiempo que se reducen tanto la pobreza como la vulnerabilidad causadas por la pérdida de servicios ambientales.

01 Introduction

This report summarises the work undertaken during an ESPA-funded (www.espa.ac.uk) project intended to strengthen capacity to build a team and design an interdisciplinary research project that could help provide evidence to inform decision-making on forests, ecosystem services and development.

Part 1 of the report summarises the outcomes from the three main workshops held during the project in Brazil and Colombia. These meetings brought together researchers in development, ecosystem science and climate science, economics and public policy to provide a spectrum of perspectives on the question of ecosystem services for poverty alleviation in Amazonia.

As a result of the workshop discussions, a number of pilot studies and reviews were conducted and are presented in Part 2. The overall aim of these studies was to learn lessons from existing approaches to ecosystem services and poverty alleviation in the region and to collate datasets and trial analyses that would help to build a future full-scale research and knowledge creation programme.

Some chapters have been further revised by their authors for publication in academic journals. Furthermore, the capacity-building project has created a network of policymakers and community leaders in Amazonia who are the change agents through which a potential future related ESPA-funded project would achieve its impacts.

CAPACITY-BUILDING ACTIVITIES

Meetings and Workshops

An important part of the capacity-building process was to consult widely with researchers and community development practitioners working in Amazonia. More than 100 people attended meetings and workshops held as part of the project.

Creating a new vision

February 2009: University of São Paulo

A preliminary meeting was hosted by Professor José Eli da Veiga of the University of São Paulo (USP). Representatives of NGOs present at the meeting, including WWF and Amigos da Terra, highlighted the need for a focus on public policy within the project.

The science basis

April 2009: INPE, São José dos Campos

A kick-off workshop was hosted by Professor Carlos Nobre at the Brazilian Space Research Institute (INPE), which brought together 50 participants from a wide range of disciplines, plus representatives of indigenous communities and NGOs, including the Grupo de Trabalho Amazônico (GTA). One of the original ideas behind the capacity-building project was to look at the role of Amazonia in supporting the transport of moisture from the Atlantic down to the Plata Basin. Climate scientists directly involved in studying this process questioned the rationale of focusing solely on reductions in rainfall in one location, when climate variability across the region was perhaps a better focus. This dialogue also helped to shift the discussion to a broader set of ecosystem services that would have support from across the group of researchers and practitioners. In addition, the complexity of the concept of 'poverty' was a focus of discussions, with agreement on the need for multi-dimensional approaches that can accommodate the diversity of contexts in Amazonia and Latin America more generally.

Communities and Economies

July 2009: Oxford and Edinburgh

Brazilian Co-Investigator, Professor Carlos Young of the Universidade Federal do Rio de Janeiro (UFRJ), met with the UK-based members of the project team at the universities of Oxford and Edinburgh to discuss the economic and community aspects of the project and generated ideas and momentum for graduate student exchanges between Latin America and the UK.

Community case study

September 2009: Bolsa Floresta field visit plus Latin American REDD Symposium, Manaus

Members of the team and Ecuadorian indigenous community representatives were hosted by Professor Virgílio Viana of Fundação Sustantável Amazonas (FAS) on a visit to a forest community receiving *Bolsa Floresta* cash transfers in Amazonas. Team members and indigenous community leaders attended the Latin American REDD Symposium, also in Manaus.

Bringing communities together

September 2009: IPA Permaculture Centre, Manaus

GTA organised a workshop at a permaculture demonstration centre in the heart of Amazonia, bringing together 42 people from across the region including representatives of communities affiliated to the GTA and the CNS (National Rubber Tappers Council) networks, indigenous leaders (from Brazil, Colombia, Ecuador, Guyana and Peru), researchers and NGOs. Community leaders shared experiences of PES and developed principles that PES (including REDD+) should follow in order to meet community needs. This resulted in a GTA/CNS policy brief delivered at the UNFCCC conference in Copenhagen. The initial intention behind the capacity-building project was to work with community-based organisations to devise mechanisms for local development. However, during the course of the project it became clearer that ESPA aims were more closely focused on a programme aimed at funding research to inform development, rather than creating development mechanisms per se.

Andean perspective

21–23rd September 2009: Medellín, Colombia

A workshop coordinated by Professor Germán Poveda (Universidad Nacional de Colombia) brought together 20 researchers from the Andean Amazon region to discuss research priorities. This was the first time the group had been given the opportunity to meet and discuss their common visions for research in the upper Amazon. The workshop proposed areas of work for a large-scale ESPA project that would be feasible and desirable.

Defining the focus

December 2009 & May 2010: London

Members of the consortium (from the UK, Colombia and Brazil) discussed the future full-scale project. The direction and mission of the UK Government's ESPA programme was becoming clearer and the focus on research (rather than demonstration activities) was more apparent. This necessitated a shift in the capacity-building project away from the original idea of working directly with local communities to develop models of 'bottom-up' development towards a more academic research-driven agenda.

Decadal modelling of climate and land use change linked to vulnerability assessments of communities and the wider economy were suggested as the core focus of the proposed future full-scale ESPA project across Amazonia.

Engaging policymakers

September 2010: Curitiba, Brazil

The GCP and the AVINA Foundation teamed up with the UNDP, TEEB (The Economics of Ecosystems and Biodiversity) and Curitiba Mayor's office to hold a workshop for local and regional policymakers from across Latin America to celebrate the launch of the *TEEB for local and regional policymakers'* report.

Key Amazonian representatives, including the mayors of Alta Floresta, Brazil, and Cobija, Bolivia, attended the meeting and shared their insights on how to construct policies to maintain natural capital and support local development. This event helped the team to build a network of policymakers who could be engaged as stakeholders and end-users in the potential full-scale ESPA project.

Research and Reviews

The meetings and workshops identified a number of areas that required further investigation and review by the team in order to prepare a full-scale research project. Eight short research projects and literature reviews were undertaken in order to fill these information gaps. The resulting papers are in preparation for publication in international refereed journals.

The first five papers reviewed some of the current understanding of Amazonia's ecosystem services and developed methods to analyse them spatially and economically.

Mandar Trivedi (Global Canopy Programme), Liana Anderson (University of Oxford), Julia Queiroz (UFRJ) and colleagues made a preliminary study of the impacts of the 2005 Amazonian drought, demonstrating significant effects on health, fisheries, transport, crops and carbon emissions.

David Galbraith (universities of Oxford and Edinburgh) reviewed the potential impacts of climate and land use change on Amazonian forests. This paper has not been refereed, but provides an expert 'mini-review' of the main issues.

Josefina Arraut and colleagues at INPE and USP presented their findings from their research into Amazonia's role in regulating atmospheric moisture and contributing to moisture transported to other parts of Latin America in so-called 'aerial rivers'.

Matthew Cranford (LSE), Mandar Trivedi (GCP) and Julia Queiroz (UFRJ) explored the value of the water recycling function of Amazonia, which helps to regulate moisture flow to other parts of Latin America. They gave a first pass estimate of economic values, providing a starting point for further data collection, analysis, critical thinking and theoretical development.

Mark Mulligan (King's College, University of London) and Sophia Burke (Ambiotek) built on the previous ESPA Situation Analysis for the Andes-Amazon (produced by a consortium led by the Iniciativa Amazônica) to bring together spatial datasets at an Amazon basin scale to map out some of the key ecosystem services in Amazonia: carbon storage, water flow regulation, and biodiversity maintenance.

The final three papers discussed the links between ecosystem services, public policies and mechanisms for poverty alleviation and vulnerability reduction in Amazonia. Lauro Mattei (Federal University of Santa Catarina) investigated the different Cash Transfer Programmes operating in Amazonian countries to provide a first inventory of the current schemes, how they differ and what role they have in poverty alleviation among Amazonian communities. Payments for Ecosystem Services (PES) are a form of conditional cash transfer and so much can be learned from evaluating the effectiveness of existing large-scale cash payment programmes.

Anthony Hall (London School of Economics) reviewed the public policy options available to 'turn the tide' in Amazonia away from perverse incentives towards environmental services.

In the final paper, Patrick Meir (University of Edinburgh), José Marengo (INPE), Richard Betts (UK

Met Office) and colleagues synthesised literature across policy, biophysical science and PES and pointed towards an emerging framework for poverty alleviation and vulnerability reduction based on the role of Amazonia in providing a suite of ecosystem services beyond carbon.

KEY OUTPUTS

The project has built an interdisciplinary team that has produced a set of research papers and literature reviews, as listed above. A number of additional peer reviewed journal papers were also facilitated by collaborations supported by this project and are listed in the web-based NERC final report. The project has also fostered new and exciting interdisciplinary collaborations. These have enabled members of the team to apply for two follow-on projects. The first was a successful bid, led by the University of Edinburgh, to develop a socio-ecological framework for ESPA's political economy theme (NE/I002952/1). The second bid was the primary focus of the project: a full-scale ESPA consortium research project that will help to deliver evidence to meet the challenges and opportunities presented in this report. This project is called *PRISMA Amazonia* and is in review.

Part 1: Workshops

The central goal of the ESPA strengthening research capacity project was to build an interdisciplinary team to design an Amazonia-wide research and knowledge creation programme. The main tools used to achieve this goal were three workshops that brought together expertise from across the region. The inception workshop was held at the headquarters of the Brazilian National Institute for Space Research (INPE). INPE has been leading biophysical research in Amazonia for many years through the Large-Scale Biosphere-Atmosphere Experiment (LBA).

The LBA's two basic research questions were: (i) How does Amazonia currently function as a regional entity? (ii) How will changes in land use and climate affect the biological, chemical and physical functions of Amazonia, including the sustainability of development in the region and the influence of Amazonia on global climate?

The aims of the workshop were to create a link between the biophysical research carried out under the LBA and the broader 'sustainability science' goal of providing evidence that could inform decision-making to harmonize resource use with poverty alleviation, economic development and the maintenance of Amazonian ecosystems and the services they provide.

The inception workshop stimulated a rich discussion across disciplines. It became clear during the discussions that the project would benefit from dialogue with two key groups. First, the Andean Amazon region has not received the research attention that has been afforded to the lowlands. Therefore, a workshop was organised by the Universidad Nacional de Colombia (UNAL) in Medellín, to bring together Andean Amazon researchers who had not previously had the opportunity to meet and exchange ideas.

The second key gap identified at the inception workshop was the views and experiences of communities living and working in Amazonia. In order to help shape the future direction of the project based on community needs and perceptions of poverty and development a workshop was organised in partnership with the Amazon Working Group (Grupo de Trabalho Amazônico – GTA) to bring together community leaders from across the countries of the Amazonian region at a permaculture demonstration centre in Manaus, Brazil. The permaculture centre was an ideal location to hold the meeting, enabling the participants to learn about sustainable agricultural methods and sample the resulting produce.

The following three chapters document the workshop discussions and summarise their findings.

02

Inception Workshop

23–24 April 2009
Inter-American Institute for Global Change Research
Instituto Nacional de Pesquisas Espaciais
São José dos Campos, Brasil

SUMMARY

Forty-one participants representing 26 institutions from six countries took part in the workshop. The group made the following key points:

Biophysical Science

1 The Amazon contains 20% of the world's freshwater. Amazonia's rainforests play an important role in evaporating water back into the atmosphere, thereby recycling rain that maintains rainforest ecosystem processes and services, including carbon storage.
2 Rainfall recycling may show a threshold response (or 'tipping point') to forest loss. Some studies have estimated the tipping point at 60–70% forest cover.
3 On reaching the tipping point, small changes in forest area will have a large impact on wellbeing, biodiversity and carbon storage; i.e. a large cost to society.
4 Moisture is transported to other regions, providing rain that contributes to food, economic, energy, health and water security in the Andes-Amazon region and beyond.
5 It is hard to quantify and value the moisture transported to these other regions.
6 These supporting/regulating hydrological ecosystem services could be damaged by deforestation and climate change.
7 There is uncertainty over what impact these drivers will have on the service, but they could result in more intense/frequent extreme events such as droughts and floods.
8 Improvements are needed in the parameterization of climate models, e.g. better surface-atmosphere feedbacks, clouds.

Economic Development

9 Since the probability of passing a threshold is hard to estimate, but the impacts on wellbeing through the loss of critical natural capital (CNC) could be immense, the precautionary principle should be applied.
10 The insurance industry has to deal with the uncertainty surrounding low-probability/high-impact events, and may provide insight to the project.
11 Hydrological regulation is only one of a set (or 'bundle') of ecosystem services that contribute to the value of the forest.
12 Valuation methods and markets have to be adapted to ecological reality rather than the other way around.
13 South American institutions are calling for a new vision of economic development in Amazonia that would make the forests worth more alive than dead through recognizing and adding value to the forest's natural capital, and transforming the concept of wealth.

Benefits to Communities

14 Payments for Ecosystem Services (PES) could be part of the new vision if they can be designed to achieve both conservation and development objectives.
15 Local communities in the Amazon-Andes region are increasingly aware and interested in receiving benefits (not just payments) through PES schemes.
16 Experience of existing forest monitoring, protection and restoration projects show that implementation costs can be high.
17 There are several types of PES, appropriate for different types of service. Public goods like hydrological regulation may require government regulation.
18 The needs of communities should be assessed as a first step in the design of PES schemes.
19 Local people's perceptions of ecosystem services need to be understood in order to design appropriate PES schemes that support sustainable activities.
20 In order to understand the nature of 'community' it is necessary to understand historical and current migration patterns and demographic changes.
21 Lessons can be learned from PES-type schemes in the region.
22 Training is crucial in order to help local communities move towards more sustainable activities and cope with environmental change, particularly climate impacts.
23 Communities need to be strengthened, so that they are enabled to engage in PES schemes and follow the criteria for payment.

Public Policy and Communication

24 Special focus should be given to the role of public policy and existing institutional structures in creating an environment within which PES schemes could work.
25 In addition, different policies can contradict each other, so new PES-type measures may fail without a more holistic approach to public policy development, involving civil society as stakeholders.
26 The science-policy interface is crucial. Scientific evidence for the value of ecosystem services and the

risks and uncertainties of their loss need to be translated through dialogue in order to support policymaking.

27 Uncertainty is not a reason for inaction: current trends and future projections of change in the Andes-Amazon system indicate the potential for large reductions in ecosystem service provision and declines in wellbeing.

Suggested Next Steps to Complete by Sep 2009

1 Re-draft project framework and circulate it to the group.
2 Develop an interactive website for dialogue among the group.
3 Provide resources to groups to advance key components and work with individuals and institutions to carry this work forward in the period to September for delivery at the next workshop:
   – Valuation methods for deforestation and climate change impacts on critical natural capital, including implications of tipping point scenarios.
   – An assessment of the needs of different community groups.
   – Analysis and lessons learned from PES-type schemes in the region.
   – Development of links to the Dangerous Climate Change project in Brazil.
   – Development of an Andes region working group.
   – Case studies of potential impacts of rainfall reduction on for e.g. agriculture in Mato Grosso, hydropower, Andean water resources, cloud forests. 2005 Amazon drought.
   – Compilation and analysis of public policies related to environmental services and how these will influence the development of PES.
4 Identify available databases/tools, e.g. climate datasets.
5 Identify key research gaps that could be supported by a large-scale project.
6 Framing of full-scale proposal for discussion at workshop.

SUMÁRIO

Participaram do workshop quarenta e uma pessoas, representando vinte e seis instituições, provenientes de seis países. Esse grupo estabeleceu como assuntos prioritários:

Ciência biofísica

1 A Amazônia detém 20% de toda a água doce do planeta. A floresta amazônica desempenha um papel importante no processo de evaporação da água, devolvendo a água para a atmosfera, ao mesmo tempo em que mantém os serviços florestais e funciona como reguladora do estoque de carbono atmosférico.
2 O regime de chuvas pode indicar o ponto de inflexão em termos de perda da floresta. Alguns estudos estimaram esse ponto em 60–70% da cobertura florestal.
3 Uma vez atingido o ponto de inflexão pequenas mudanças na área florestal terão grande impacto no bem-estar, na biodiversidade, e no estoque de carbono, gerando um alto custo para a sociedade.
4 A umidade da floresta amazônica contribui para a produção de alimentos, economia, energia, saúde e segurança hídrica na região Andes-Amazônia e também em outras regiões.
5 É difícil quantificar e valorar a umidade transportada para essas outras regiões.
6 Os serviços de apoio e regulação do sistema hidrológico podem ser impactados pelo desflorestamento e pelas mudanças climáticas.
7 Há incerteza quanto ao impacto dessas mudanças sobre serviços ambientais, mas elas podem resultar em um aumento da intensidade/freqüência de eventos extremos, tais como secas e inundações.
8 É preciso aprimorar os parâmetros de modelos sobre o clima, por exemplo, quanto à interação superfície-atmosfera e nuvens

Desenvolvimento econômico

9 Ainda que seja difícil estimar a probabilidade de ultrapassar o ponto de inflexão, os impactos à qualidade de vida decorrentes da perda de capital natural crítico (CNC) podem ser enormes. O princípio da precaução deve portanto ser aplicado neste caso.
10 A indústria de seguros deve lidar com a incerteza presente em cenários de alto impacto e baixa probabilidade, e pode vir a contribuir com idéias para o projeto.
11 A regulação hidrológica constitui um de varios serviços ecossistêmicos que contribuem para a valoração da floresta.

12 Métodos de valoração e mercados devem se adaptar à realidade ecológica, e não o contrário.
13 Instituições sul-americanas estão pedindo uma nova visão de desenvolvimento econômico da Amazônia que faça a preservação florestal valer mais do que sua exploração. Para isso é preciso reconhecer e computar o valor do capital natural das florestas e transformar o atual conceito de riqueza.

Benefícios às comunidades

14 O Pagamento por Serviços Ambientais (PSA) pode fazer parte dessa nova perspectiva desde que auxilie tanto a conservação como o desenvolvimento.
15 As comunidades locais na região Andes-Amazônia estão mais cientes e interessadas em receber benefícios (e não apenas pagamentos) por meio de esquemas tipo PSA.
16 Prévias experiências de monitoramento e proteção de florestas e projetos de reflorestamento indicam que os custos de implementação podem ser altos.
17 Existem diferentes tipos de PSA para diferentes tipos de serviço. Bens comuns tais como a regulação hidrológica podem requerer uma legislação própria.
18 O estabelecimento de esquemas de PSA deve partir de uma análise das necessidades das comunidades envolvidas.
19 A percepção da comunidade local sobre os serviços ecossistêmicos deve ser levada em conta no estabelecimento de esquemas de PSA que busquem apoiar atividades sustentáveis.
20 Para entender a natureza da 'comunidade' envolvida será preciso entender os padrões históricos e atuais de migração e mudanças demográficas.
21 É possível tirar lições de varios exemplos de esquemas de PSA existentes na região.
22 É essencial promover a capacitaçao das comunidades locais, para ajudá-las a adotarem atividades sustentáveis e a lidarem com as mudanças ambientais, especialmente aquelas decorrentes de mudanças climáticas.
23 As comunidades devem ser fortalecidas para que possam participar dos esquemas de PSA e acompanhar os critérios de pagamento.

Políticas públicas e comunicação

24 Políticas públicas e instituções existentes devem ser consideradas na criação de um arcabouço dentro do qual os esquemas de PSA possam funcionar.
25 Além disso, para superar eventuais contradições entre políticas existentes, a implementação de esquemas de PSA requer uma abordagem mais holística, que envolva a participação da sociedade civil como uma das partes interessadas.
26 A interface entre política e ciência é crucial. Evidências científicas sobre o valor dos serviços de ecossistemas — e os riscos e incertezas de sua perda — devem ser traduzidos por meio de diálogos que subsidem a elaboração de políticas.
27 Incertezas não podem ser usadas como justificativa para a falta de ação: tendências atuais e projeções futuras sobre mudanças no sistema Amazônia— Andes já mostram um potencial de significativa redução na oferta de serviços ecossistêmicos e qualidade de vida.

Sugestão das etapas a serem completadas até setembro de 2009

1 Re-esboçar a minuta do projeto e circulá-la entre os membros do grupo.
2 Desenvolver um site internet interativo para facilitar o diálogo entre os membros do grupo.
3 Fornecer recursos para que os grupos avancem em questões centrais e trabalhar com indivíduos e instituições, com o objetivo de, até o próximo workshop em setembro:
   – Considerar métodos de valoração do desflorestamento e de impactos das mudanças climáticas sobre o capital natural crítico, incluindo implicações em cenários de pontos de inflexão (tipping points)
   – Levar em consideração as necessidades das diferentes comunidades envolvidas
   – Analisar os resultados de projetos de Pagamentos por Serviços Ambientais (PSA) desenvolvidos na região.
   – Desenvolver vínculos com o projeto Dangerous Climate Change (DCC) no Brasil.
   – Criar um grupo de trabalho para a região Andina.
   – Apresentar estudos de caso sobre potenciais impactos de uma redução pluviométrica, por exemplo, para a agricultura no Mato Grosso, para o potencial hidroelétrico, para fontes de recursos hidroelétricos, para a floresta nublada ou floresta de altitude, para a seca de 2005 na Amazônia.
   – Compilar e analisar políticas públicas relacionadas a serviços ambientais, e como elas podem influenciar o desenvolvimento de esquemas de PSA.
4 Identificar base de dados e instrumentos disponíveis, por exemplo, bases de dados climáticas.

5 Identificar lacunas na literatura, que poderão vir a ser estudadas no âmbito de um projeto de larga escala.
6 Definir uma proposta completa a ser discutida no workshop.

RESUMEN

Cuarenta y un participantes, representantes de 26 instituciones de seis países, tomaron parte en el taller. El grupo formuló los siguientes puntos claves:

Ciencia biofísica

1 El Amazonas contiene el 20% del agua dulce del mundo. El bosque amazónico juega un papel importante en la evaporación del agua hacia la atmosfera, reciclando de esta forma la lluvia que mantiene los procesos y servicios del ecosistema forestal, incluyendo el almacenamiento de carbono.
2 El reciclaje de la lluvia puede mostrar un umbral de respuesta (o punto de inflexión) a la pérdida forestal. Algunos estudios han estimado el punto de inflexión en el 60–70% de la cobertura forestal.
3 Al alcanzar el punto de inflexión, pequeños cambios en el área forestal tendrán un alto impacto en el bienestar, la biodiversidad y el almacenamiento de carbón, es decir un alto costo para la sociedad.
4 La humedad es transportada a regiones ubicadas más allá del bosque, proporcionando lluvia que contribuye a la seguridad alimenticia, económica, energética, hídrica y de la salud en la región Andino-Amazónica y más allá.
5 Es difícil cuantificar y valorar la humedad transportada a estas otras regiones.
6 Estos servicios de apoyo y regulación del sistema hidrológico pueden ser afectados por la deforestación y el cambio climático.
7 Existe incertidumbre sobre el impacto que estos factores tendrán sobre este servicio, pero estos pueden producir mayor intensidad/frecuencia de eventos extremos tales como sequías e inundaciones.
8 Se requieren mejoras en la parametrización de modelos climáticos como por ejemplo en términos de retroalimentación entre superficie – atmosfera, nubes.

Desarrollo económico

9 Dado que la probabilidad de traspasar un umbral es difícil de estimar, pero los impactos en el bienestar por medio de la pérdida de capital natural crítico (CNC) podrían ser inmensos, el principio de precaución debe ser aplicado.
10 La industria de seguros se ocupa de la incertidumbre relacionada con eventos de baja probabilidad – alto impacto, por lo cual podría proveer un mejor entendimiento al proyecto.
11 La regulación hidrológica es sólo uno dentro de un abanico de servicios de los ecosistemas que contribuye al valor del bosque.
12 Los métodos de valoración y mercados deben ser adaptados a la realidad ecológica y no viceversa.
13 Las instituciones Suramericanas están pidiendo una nueva visión del desarrollo económico en la Amazonía que valore más al bosque vivo que muerto, reconociendo y añadiendo al valor del capital natural de los bosques y transformando el concepto de riqueza.

Beneficios a las comunidades

14 Los pagos por servicios ambientales (PSA) podrían formar parte de la nueva visión si ellos pueden ser diseñados para alcanzar objetivos tanto de conservación como de desarrollo.
15 Las comunidades locales de la región Andino-Amazónica están cada vez más al tanto e interesadas en recibir los beneficios (y no únicamente los pagos) a través de esquemas tipo PSA.
16 Experiencias de proyectos de monitoreo, protección y restauración forestal existentes muestran que los costos de implementación pueden ser altos.
17 Existen varios tipos de PSA, apropiados para diferentes tipos de servicios. Bienes públicos tales como la regulación hidrológica podrían requerir de regulación estatal.
18 Las necesidades de las comunidades deben ser evaluadas como un primer paso en el intento de diseñar mecanismos tipo PSA.
19 Las percepciones de los habitantes locales sobre los servicios de los ecosistemas deben ser entendidas con el fin de diseñar esquemas PSA apropiados, que apoyen actividades sostenibles.
20 En el propósito de entender la naturaleza de la 'comunidad' es necesario entender los patrones migratorios históricos y actuales y los cambios demográficos.
21 Existen varios ejemplos de esquemas tipo PSA en la región de los cuales se pueden aprender lecciones.
22 La capacitación es crucial para ayudar a comunidades locales a moverse hacia actividades

más sostenibles y a sobrellevar el cambio ambiental, particularmente el cambio climático.

23 Las comunidades necesitan ser fortalecidas de tal forma que sean capaces de involucrarse en esquemas PSA y de seguir los criterios para el pago.

Política pública y comunicación

24 Se debe dar un énfasis especial al papel que tienen la política pública y las estructuras institucionales existentes en la creación de un ambiente dentro del cual los esquemas PSA puedan funcionar.

25 Adicionalmente, diferentes políticas pueden contradecirse unas a otras de tal forma que nuevas medidas tipo PSA podrían fracasar en la ausencia de una visión más holística de la política publica para el desarrollo, que involucre a la sociedad civil como una de las partes interesadas.

26 La interlocución entre ciencia y política es crucial. La evidencia científica sobre el valor de los servicios de los ecosistemas y los riesgos e incertidumbres de su pérdida debe ser traducida a través de un dialogo que apoye la formulación de política.

27 La incertidumbre no es razón para la inacción: tendencias actuales y proyecciones futuras sobre el cambio en el sistema Andino-Amazónico muestran el potencial para altas reducciones en la provisión de servicios de los ecosistemas y disminuciones en el bienestar.

Pasos sugeridos para ser completados antes de septiembre de 2009

1 Re-esbozar el marco del proyecto y circularlo a los miembros del grupo.

2 Desarrollar un sitio web interactivo para el dialogo entre los miembros del grupo.

3 Proveer recursos a los grupos para avanzar en los componentes claves y trabajar con individuos e instituciones para desarrollar este trabajo en el periodo comprendido hasta septiembre para presentarlo en el próximo taller:
   – Métodos de valoración para impactos de la deforestación y el cambio climático en el capital natural crítico, incluyendo implicaciones de escenarios de puntos de inflexión.
   – Una evaluación de las necesidades de diferentes comunidades.
   – Análisis y lecciones aprendidas a partir del uso de esquemas de tipo pago por servicios ambientales (PSA) en la región.
   – Desarrollo de conexiones con el proyecto Cambio Climático Peligroso en Brasil.
   – Desarrollo de un grupo de trabajo de la región Andina
   – Estudios de caso de los impactos potenciales de la reducción de lluvias en, por ejemplo, la agricultura en Mato Grosso, la energía hidroeléctrica, los recursos hídricos andinos y los bosques de niebla. La sequía amazónica de 2005.
   – Compilación y análisis de políticas públicas relacionadas con los servicios ambientales y como estas influenciarán el desarrollo de pagos por servicios ambientales (PSA).

4 Identificar bases de datos y herramientas disponibles como por ejemplo las bases de datos climáticas.

5 Identificar vacíos de investigación claves que podrían ser apoyados por un proyecto a gran escala.

6 Preparación de una propuesta completa para discutir en el taller.

INTRODUCTION

The Amazonian 'Eco-Utility'

This report documents the discussions during the first workshop for the pilot project *Valuing Rainforests as Global Eco-Utilities: A Novel Mechanism to Pay Communities for Regional Scale Tropical Forest Ecosystem Services provided by the Amazon*. The aims of the initiative are both to understand and value the ecosystem services of the region's forests and to design sustainable financial mechanisms to reward forest communities as guardians of the forest, recognising that they maintain a giant 'eco-utility' providing services to populations over vast distances.

This pilot project builds on the findings of the successful Large-scale Biosphere-Atmosphere Experiment in Amazonia (LBA), an international experiment led by Brazil. LBA brought together researchers from Brazil with others from around the world to study how Amazonia functions biophysically. Amazonia's forests evaporate vast quantities of water into the atmosphere every day, helping to regulate regional rainfall that is critically important to the maintenance of the rainforest itself.

This abundant water resource underpins human wellbeing, feeds agricultural and energy production, and maintains great biological and cultural wealth in Amazonia.

Drivers of Change

Unless deforestation is halted these ecosystem services could be lost, with major impacts. In 2005, the south-western and western portions of Amazonia experienced one of their worst droughts in 60 years, compounded by extensive forest fires. The cause appears to have been warmer global temperatures, which led to hotter sea temperatures in the northern tropical Atlantic Ocean, and ultimately lower rainfall in these parts of Amazonia. The diminished rainfall resulted in exceptionally low water levels in the River Amazon, draining many floodplain lakes and streams and isolating hundreds of riverine villages and communities. The government called a state of emergency and mobilized the army to provide water and medical supplies to these communities and contend with the intense forest fires in Brazil's western state of Acre.

Climate change and deforestation will not only affect the communities living in the forest but could also impact people far beyond its boundary. Some climate models also suggest that Amazonian deforestation could impact rainfall very far away in North America, Europe or Africa. Paying forest communities as stewards of the 'eco-utility' could be a way to help them cope with climate change while keeping the ecosystem services flowing to the rest of society, and thereby helping to build the resilience of the economy.

Building a New Research Agenda

During 2009, the aim is to build an interdisciplinary team to exchange our understanding of the ecology, climate and hydrology of Amazonia's forests, the ecosystem services they provide to society; and examine the options through which communities could be rewarded for maintaining the forest. The team held its first workshop at INPE headquarters on 23–24 April to draw up a research agenda that integrates their combined knowledge of biophysical science, ecological/environmental economics, political economy and community development. Over the coming months they will design a 4 or 5-year project to understand, value and explore the mechanisms available to pay for these vital services.

What is ESPA?

Running for 1 year, the pilot project is funded by the Ecosystem Services for Poverty Alleviation (ESPA) programme of the UK government (see Annex 2 for more details). The ESPA Programme is supporting multi-disciplinary research to tackle the complex problems associated with the sustainable management of ecosystems for poverty reduction in developing countries. This project has been awarded ESPA funds for 'activities to strengthen research capacity', i.e. to build an international consortium to develop a research agenda for a multi-year programme. ESPA is due to launch a call for such consortium bids at the end of 2009.

The ESPA Programme commissioned a series of Situation Analyses to highlight the research issues in a number of target regions, including the Andes-Amazon region (see Annex 3 for more details). The Andes-Amazon Situation Analysis (*www.ecosystemsandpoverty.org*) defined ecosystem services and poverty as follows:

– "We adopt the most inclusive of definitions of ecosystem services set out at the beginning of this introduction, i.e. the benefits that people obtain from ecosystems (Millennium Ecosystem Assessment, 2005)."
– "It was not possible to adopt a single concept or definition of poverty that equally satisfied the different analytical approaches and stakeholder perceptions. In an attempt to align stakeholder perceptions with the needs of analytical approaches, poverty could be defined as "unacceptable conditions of well-being", where "acceptability" refers to the subjective dimension of poverty and "conditions" comprise more objective dimensions such as the lack of access to basic public services and natural resources, income and asset endowment, education, and health among others."

Some of the key insights from the Andes-Amazon Situation Analysis were:

1 A large degree of inequality in wealth and wellbeing across the region.
2 High vulnerability of ecosystem services from land-use and climate change.
3 Hydrological services (e.g. freshwater) are especially important.
4 Payments for ecosystem services (PES) show promise for promoting wellbeing and conserving biodiversity, but need more testing.

PRESENTATIONS AND DISCUSSIONS

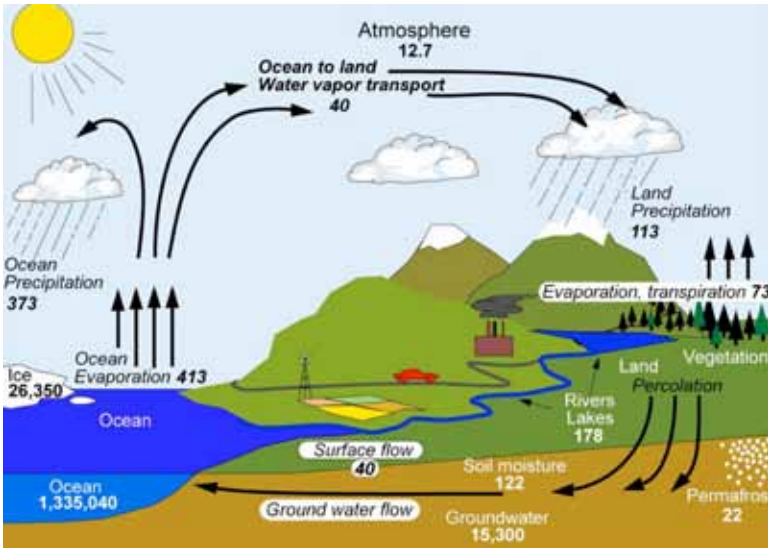
Day 1. 23 April 2009
Session 1. Introduction

9.40–10.10

Carlos Nobre (INPE) *gave the welcome and introduction to the workshop and an overview of rainfall in the Amazon*. Carlos put the Amazon hydrological cycle in the context of the global climate system. Vegetation plays a critical role in the climate system. It is very important for some areas and perhaps in the Amazon. We have one good example historically where there's evidence for the importance of vegetation. 6000 years ago the Sahara had more vegetation, like the modern Sahel. Changes in insolation and ocean circulation affected the vegetation and this had feedbacks to the climate.

Why is vegetation important? Without vegetation, most of the incoming solar energy goes to heating the air and only a little goes to evaporation. Water runs-off the surface in rivers. When there is vegetation much more energy goes to evaporation. Root systems increase the residence time of water on the land, allowing more evaporation.

Numerical experiments (models) have been carried out on the global water balance. In one simulation, all of the planet's land is desert and there is no vegetation. In another simulation, all land is forested. In the first simulation (desert) the ratio of evaporation:precipitation (E/P) = 0.44. In the second simulation (forested), E/P = 0.79.



↑ Hydrological Cycle: C. Nobre, 2009

This experiment is not reality, but it highlights that a vegetated surface that mediates transfer of water from the soil to the atmosphere provides an opportunity for water recycling – it doubles rainfall. This gives us an idea of the theoretical maximum power of vegetation.

The Amazon has three times more rainfall than the average for land. However, the E/P ratio is 0.5 (7/14), this is less than the global mean. This indicates that tropical forests are not the best water recyclers, proportionally speaking. This is because of tropical storms: tropical rain comes in downpours and saturates the soil, creating a lot of run-off. Trees are conservative in their water use and limit their transpiration; at the same time the short, intense storms give little time for the rainfall intercepted by the canopy to evaporate directly from the leaves. But there is still a high level of evaporation (E) that returns water to the atmosphere, contributing to rain. If we did not have the forest, if we replaced it with grassland, recycling would decrease by about 10–20%.

10.10–10.40

Josefina Moraes Arraut (INPE), *a post-doc in Carlos Nobre's lab, presented her research on atmospheric moisture flow over S America east of the Andes and the role of the Amazon forest*.

Josefina explained that there is a large inflow of moisture into the continent from the Atlantic Ocean from the north, all year round. Some of this moisture flows down to the continent's subtropics (e.g. southern Brazil and Uruguay). This outflow from Amazonia shows large variability during the year. Southeastern Brazil receives most of its moisture from the southern Atlantic (without passing over the Amazonian forests).

The question is: What is the importance of Amazonian moisture outflow for subtropical South American rainfall throughout the year?

The annual cycle of subtropical rainfall does not follow closely the astronomical seasons, and we defined other seasons that represent it more appropriately. Summer is when the South Atlantic Convergence Zone pattern predominates and the interior of the continent east of the Andes has its rainy season. In spring (September and October) and autumn (April, May and June) most of the subtropics are dry, except for southern Brazil and Uruguay, which show high precipitation. Winter (July and August) is the driest season over the continent, as high precipitation has migrated to the southwestern Atlantic. However, there is still an important amount of rainfall over southern Brazil and Uruguay.

The seasons defined above are also appropriate to represent the annual cycle of tropical rainfall and moisture transport over the continent. Summer is the rainy season for southern hemisphere Amazonia, which is most of the total area of the forest. During autumn, high rainfall is confined to a zonal strip straddling the equator that migrates north during the season. During winter, high rainfall is confined to the extreme north of the continent. Spring is a transition season when rainfall begins to return to western Amazonia. Outflow from Amazonia to the continent's subtropics is very high during summer, lower but still considerably strong during spring and very low during autumn and especially winter.

During summer the trade winds enter Amazonia with a northerly component that favors their southward channeling by the Andes cordillera. A continuous pathway for moisture flow can be traced from the northern Atlantic all the way to the continental subtropics. Atmospheric currents of moisture such as this are known as 'flying rivers' – a term coined by Dr. Marengo. Over Amazonia, this current is more moist than over the ocean. This has led to claims that Amazonia is a source of moisture for the continent. However, flow speed over the forest is lower. Continuing with the river analogy, Amazonia can be seen as a pool of moisture within the flying river, with a higher water level but a lower flow speed. This moisture takes part in cycles of precipitation and evapotranspiration. The moisture pool can be connected to the forest's underground water reserves through rainfall and evapotranspiration, and viewed as a single reservoir with one tributary: the moisture inflow from the Atlantic; and two distributaries: moisture outflow and surface runoff. If the forest were consistently a source of moisture it would dry out. *Its ability to store moisture in the soil may allow it to function as a source of moisture during it's drier seasons and possibly also during drought years. This regulating capacity is what would largely be lost with deforestation.*

Summer, the most important season for subtropical rainfall and tropics to subtropics moisture transport, is the season when Amazonian outflow is likely to have its most important role for subtropical rainfall.

We explored the dependence of subtropical rainfall on Amazonia's moisture outflow through correlation analyses.

During summer, correlations were largest over southern Brazil, while during winter they were only slightly lower, in both cases ranging from 0.4 to 0.6 in large regions. During autumn and spring correlations were very low. When interpreting these results it must be taken into account that two conditions are necessary for rainfall: moisture availability and an unstable atmosphere which will allow for ascending air motions. In the subtropics the second condition is mostly dependent on atmospheric dynamics (e.g. cold front incursions), especially in the seasons other than summer, when insolation is less intense. The absence of correlations in autumn and particularly in spring may indicate only that moisture availability is not the limiting factor. When considering the possible effects of deforestation, it must be noted that summer is the rainy season for the southern tropics in general. It is the time of year when the region is warmer and there is energy and moisture available for convection. This would not change if the forest cover were removed, even though some reduction in the amount of rainfall is indicated by numerous modeling experiments. When rain is abundant and frequent the upper soil layers are kept moist and vegetation evapotranspires large amounts of water. It is during the drier seasons, especially winter, that the forest's ability to store and use soil moisture becomes in demand and a large difference between forest and pastureland evapotranspiration can be observed. Furthermore, the summer season presents greater challenges for modeling studies because tropical rainfall, which models have trouble reproducing satisfactorily, has a large impact over atmospheric dynamics.

For these reasons we have begun by focusing on winter, our aim being to better understand the dependence of rainfall on outflow indicated by our correlations. We considered individually the 22 winter seasons of our study period. We found that instead of having a moderate importance during all or most of the years, the intensity of Amazonian outflow is very important to determine the intensity of rainfall in a small number of years, giving rise to the moderate correlations observed. This is leading us to postulate the existence of different interannual regimes of moisture transport and subtropical rainfall. The next steps are to: perform similar analyses on model outputs of deforestation experiments and further investigate the existence and dynamics of the postulated interannual regimes.

Why does the Atlantic forest extend to Paraguay? One hypothesis is that moisture flow and transience combine to create rainfall in the interior. It may be possible to show a connection between the Amazon and the interior Atlantic forest for winter rainfall. The next step is to ask what will happen to winter rainfall if you deforest the Amazon?

Summary Atmospheric moisture from Amazonia flows west to the Andes and south over Southern Brazilian states and then is subject to mixing with moisture from the Pantanal region and the Atlantic to the east, where it flows south to the Plata Basin. The proportions of these sources are difficult to determine at present, as is the potential impact of deforestation, and would need further analysis.

10.40–11.00

Patrick Meir *(Project Principal Investigator; University of Edinburgh) described the aims of the project, the funding context, and the aims of the meeting.*

Patrick was involved in both ABRACOS (a DFID/NERC-funded project in the 1990s) and LBA. Within the LBA he worked on drought impacts on forest functioning. Their rain exclusion project in Pará is still ongoing with Brazilian leadership. Patrick explained that we are in a preparatory phase with funding from the UK Government's ESPA programme (*www.espa.ac.uk*), with the opportunity to apply for a larger fund once a call for proposals is announced later in the year. The aim of the ESPA fund is to improve ecosystems management policies to help alleviate poverty in the developing world. The Millennium Ecosystem Assessment divided ecosystem services into supporting, regulating, provisioning and cultural services. It showed that the loss of services from ecosystems (for example deforestation, soil degradation, water purification) is a significant barrier to reducing poverty, hunger and disease. Tackling this set of problems requires a combination of environmental science, ecological economics and political economy.

Three organisations; NERC, the Economic & Social Research Council (ESRC), and the Department for International Development (DFID) have joined forces to explore the potential for a multi-disciplinary research programme that will address how to achieve sustainably managed ecosystems. It is a pleasure and a privilege to have everyone here. We are in Phase 1: a thinking/pilot phase. If we develop a subsequent proposal, we could win more money with which we can do action and research.

The proposal for the pilot project was predicated on a paper by José Marengo that suggested that Amazonia recycles moisture to the south. José's and Richard Betts' (Met Office Hadley Centre) Dangerous Climate Change in Brazil project relates to this whole issue. The core question is: can a realistic Payments for Ecosystem Services (PES) be devised? We need to work across disciplines. The initial project components were: science, economics and communities, but this can evolve over time. We have a wide stakeholder group – this is essential. We are also now thinking of creating a challenge panel (and several names have been suggested). Progress so far has been in consulting widely. A meeting was held in February in São Paulo (hosted by Professor José Eli da Veiga), and following that meeting we developed three cross-cutting questions. The anticipated outputs from the workshop will be a framework and draft model, a paper, and a design for the training component, including a potential MSc/distance learning course.

11.00–11.10

José Eli da Veiga *(Project Co-Investigator; University of São Paulo) provided further context to the project.*

Zé Eli said, "There is a big question that came before this project, which is important to say at the beginning. It is a strategic political question concerning the human right to development. We don't have historical cases of development and conservation. Maybe payments for ecosystem services (PES) are part of the solution, but it's a very difficult question. There are so many difficult things in this problem. I don't think we can expect to have easy answers in one year. It's very important to understand that we're trying to do something completely new in this project."

11.10–11.30

Andrew Mitchell *(Project Co-Investigator; GCP) introduced the work of the Global Canopy Programme and the rationale behind helping to instigate the project. He made the following points:*

– The GCP has worked for several years to help promote the scientific understanding of the value and importance of tropical forests.
– GCP has been working with Brazilian institutions for five years (LBA, INPA, MMA, MCT) developing ideas which have led to this project proposal.
– Andrew took part in a high-level ESPA strategy workshop convened by the funding bodies and the project's aims fit well with ESPA's aims.
– This is not a science project on ecosystem services from the Amazon, but a toolkit/framework for a PES mechanism to promote human wellbeing.
– We should expect this project to be hard because it has not been done before and forces many disciplines to work together.

– For this to work, this project must be a Brazil/ Amazonia project with strong leadership from the region. GCP has helped to provide a framework and initial funding.
– Co-financing opportunities exist in the region and externally.
– Application of the project's framework to other forested regions should be considered.

11.30–12.00

Antonio Nobre *(INPE/INPA) provided new and intriguing ideas about the potential role of tropical forests in regulating moisture flows.*

People want to receive rewards for the services provided by restored ecosystems. In southern Minas Gerais, PES schemes are helping to maintain and restore forests. Here in Vale do Paraiba a PES scheme charges water users to pay rural populations for restoring watershed forests. This project should help to spread these small-scale experiments and learn from them.

Traditional meteorology and climatology may have overlooked some fundamental physical processes that could mean that forests act as a biotic water pump. There is still much uncertainty over this hypothesis, but it could mean that deforestation will push the forest over a tipping point into a drier climatic state sooner than we expect. The scale of the deforestation and climate issue means that policymakers have to act, even though the science is uncertain. The non-linear nature of climate impacts means that traditional decision-making based on the gradual accumulation of scientific information might not be appropriate. The insurance sector may provide an example for how to behave in the face of uncertainty. Insurance has to be able to deal with extreme events of low probability and high impact. For example, we do not know if or when a car will be stolen, but we take out insurance in case it happens. How can we learn from insurance to deal with the risks and uncertainties?

Discussion

José Marengo (INPE/CPTEC): The Amazon Co-operation Treaty is working on environmental services, and it will be worth connecting with them before the next workshop.

Muriel Saragoussi (GTA): We must be careful when talking about the social point of view because we cannot speak for other countries.

Carlos Nobre (INPE): I'm interested in this project for the poverty alleviation aspects. We've been studying long enough to know that perhaps the most critical aspect of mitigating climate change is understanding how to reduce poverty. We need people who can make the transition from social science and poverty alleviation. Even in a perfect world, where ES are important and paid for, it's not clear at all that the payments will alleviate poverty. I'm more and more convinced that the *Bolsa Floresta* is not the way. Is it possible to have a concept like forest guardians? If we don't make progress on poverty alleviation, we will not succeed. We have to understand how to tackle poverty. We've been talking in Brazil, in the Academy of Sciences, of what would be the new economic paradigm for the Amazon. What would be a new way to add value to biodiversity? Not only to protect the forest but to alleviate poverty.

Session 2. Research Gaps
1. Biophysical Science

12.30–12.50

José Marengo *(INPE/CPTEC) presented the biophysical science research gaps that he, Richard Betts and Gillian Kay (Met Office Hadley Centre, UK) had identified, and summarized below.*

José described some of the work undertaken as part of their UK Foreign and Commonwealth Office (FCO)-funded Dangerous Climate Change project. Readers are directed to *www.ccst.inpe.br/relatorio_eng.pdf* for the final report of this project, published in April 2011. He presented a model simulation of the implications of the loss of Amazonian forests for Brazilian climate, which could result in (i) rainfall reduction in (western) Amazonia due to reduced water recycling; (ii) changes in rainfall across the rest of Brazil due to changes in wind patterns; and (iii) impacts on moisture transport from Amazonia to La Plata Basin and throughout the South American Monsoon System (SAMS) region, potentially affecting rainfall extremes.

Research gaps

1 Roles of Amazonia in rainfall regimes: export of moisture from Amazonia, and roles of deforestation in modifying atmospheric circulation. A key research gap relevant to this project concerns the quantification of the export of moisture from Amazonia to other regions e.g. São Paulo. There may be some difficulties in trying to give economic value to moisture transport from Amazonia, as if Amazonia produces vapour and rainfall. It may be safer to consider the wider role of

deforestation in modifying rainfall regimes through a number of mechanisms.

2 Partial deforestation and forest fragmentation. The role of partial deforestation and forest fragmentation, as opposed to large-scale complete forest removal, is also poorly understood.

3 Effects of biomass burning on aerosols. Do aerosol emissions from biomass burning significantly affect rainfall regimes? Again, there is speculation and conceptual arguments but little hard evidence or quantification.

4 Effects of climate change. There is currently poor understanding of how such processes will change as a result of climate change. Some models (e.g. Hadley Centre) predict die-back of Amazonia near the end of the 21st Century, others do not. There is a need to assess the benefits of preserving the forest in the shorter term even if it will be lost to climate change in the longer term, as well as quantifying the risk of long-term climate impacts.

5 Effects of CO_2 rise on plant physiology and feedbacks to climate. Do plant physiological responses to CO_2 (stomatal closure) have an influence on the hydrological cycle in the region?

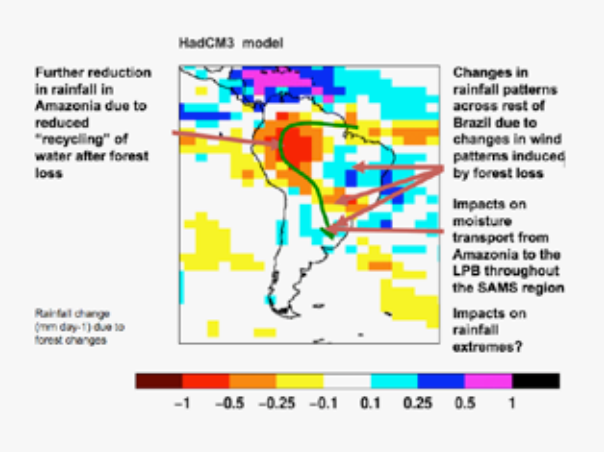
6 Interactions between climate change and deforestation. So far most work has focused either on impacts of climate change or effects of deforestation. In reality the two will interact, for example through changes in fire risk and ignition. There is much work to be done here.

Next, José identified a number of issues surrounding three cross-disciplinary questions that had been suggested to the workstream leaders for consideration prior to the workshop:

1 Eco-Dependency: What are the ecosystem services provided by the hydrological cycle of Amazonia's forests; particularly their role in supporting the carbon cycle; and who are the 'suppliers' and 'beneficiaries'?
   – Defining ecosystem services from the hydrological point of view. How do you measure and know what to charge for moisture transport from Amazonia to other regions? What about moisture from non-Amazon origin? How do they change in time and space?
   – Uncertainties in the estimates of the components of the hydrological cycle in present times, and in the future, considering land use changes, GHG concentration increase and natural climate variability.
   – Improvements in physical parameterizations (clouds, land-surface interactions, biotic pumping) are needed and detailed observations also needed for parameterizations to allow model development as a long-term activity (would this be a part of this project?).

2 Risks/Uncertainties: What are the risks to these services and what impacts could their loss have on local livelihoods, and the food and energy security of the region?
   – There is a risk of increased frequency/intensity of extreme rainfall events in La Plata Basin (that may lead to avalanches, floods)
   – Uncertainty surrounds projections of extremes from current generation of climate models.

3 Payments/Stewardship: How might a PES mechanism be designed, which enhances the resilience of forests and the well-being of forest peoples in return for maintaining the ecosystem services they supply?
   – Payments for forest people, but what about payments for people that are affected by extreme rainfall events that may be generated by deforestation or by increase in GHG concentration? Will Amazon people be liable for the occurrence of rainfall extremes in southern Brazil, generated by weather phenomena, both for the present and future?



Discussion

Germán Poveda (UNAL): We need to think about the upper Amazon, and stress much more strongly the role of the upper Amazon in the system as a whole. The upper Amazon/Andes region receives moisture in the air from the rest of Amazonia, and exports this water back in rivers. The system feeds back on itself very

↑ Implications of loss of forests for Brazilian climate. J. Marengo, 2009. From the Dangerous Climate Change in Brazil project. Please see *www.ccst.inpe.br/relatorio_eng.pdf* for the final report of this project, published in April 2011

efficiently. *What will happen to glaciers in the Andes as a result of deforestation? How will this affect run-off and discharge back into the Amazon?*

José Marengo: We need to take into account the benefits of the Amazon to Andean countries, e.g. water regulation. We have to include human beings as part of biodiversity. One interesting question is: what were the economic costs of the 2005 Amazon drought?

Ivaneida Cardozo (Kaninde): *What will be the effect of climate change on fruit production?* The observation of the indigenous Surui people in Rondonia is that trees are fruiting at different times of year. We only know the names of the fruits in indigenous language, so no one is studying them. Does this phenomenon occur with other species that are being studied?

José Marengo: In Rondonia, there has been a recorded change in low clouds, which affects the climate, and an increase in temperature. Something's changing, clearly, but we can't pinpoint what it is. If clouds and temperature change, it will change times of year fruits appear.

Patrick Meir: Our drought experiment showed effects on fruit production.

Muriel Saragoussi (Grupo de Trabalho da Amazônia): Can we think more broadly than water, and consider other ecosystem services, such as biodiversity and soil maintenance? Cultural diversity is not counted in these terms, but should be considered when we talk about communities. If we want to make payments that are more than just water, how will the project deal with the equation needed to arrive at fairer payments?

Reynaldo Victoria (USP CENA): We can start with water and then move on to other services.

Theresa Williamson (CatComm): Isn't the point we're making just that the Amazon needs to be preserved? Why do we actually need a VALUE if we know what needs to be done? If we know, and we know the value is huge (regardless of specifics), then it will cost little in comparison to guarantee the Amazon by PES. Thus the justification exists. So a very rudimentary sense of the values is enough, especially if we can show even the lowest prediction of value is much higher than the cost of maintaining the forest (which I expect is the case).

Andrew Mitchell: Ultimately, economic valuations are based on what people are willing to pay. We may place a high value on ES, but if people aren't willing to pay for them, then economic value cannot be realised. The value is in the regional scale services, not biodiversity alone. So we need to focus on the services that biodiversity provides, rather than the biodiversity itself when designing a PES system. In the case of carbon storage/sequestration, carbon has been monetized (governments have created markets in a public poison). And what we're trying to do is to create a form of 'market' in a public good (water). International negotiations are looking for information on services other than carbon.

Zé Eli da Veiga: There's a question regarding the relationship between the scientific approach, and the goals of the project. You may have good evidence for regional hydrological services, but global donors will not necessarily pay for them. In order to find a novel mechanism for regional scale ES do we really need a sub question about hydrology?

Andrew Mitchell: The service we are describing is regional and will uncover awkward political questions on a global scale. But there is a global question – who is eating the food that comes from Latin America? The world. There is a global dependency. Banks, investment houses and pension companies are going to ask the food industry for their forest footprint. If they are sourcing products in ways that damage forests, they are at risk.

Zé Eli da Veiga: It's easier to convince people to pay for a bug!

2. Economics

12.50 – 13.10

Joshua Farley (Gund Institute for Ecological Economics, University of Vermont) *presented the economic research gaps*. Josh explained that we need to consider what our goals are before we can value things. Economists want to maximize all present economic value (this is called 'efficient allocation'). Markets only recognize people's presence if they have money. Forests provide many ecosystem services, including erosion control, climate regulation (local to global), disturbance regulation, and water purification, regulation and provision. Their estimated value is US 2006/ha/yr (Costanza *et al.* Nature, 1997). But if you go to the Atlantic forest, farmers make US$20/ha/year. If they convert the forest to pasture, they get to keep US$20/ha; whereas if they keep it as forest they're giving US$2000/ha of value to the public. In recent years, US$3–4 trillion/year has been spent paying people to convert forest to pasture, whereas US$800 million has been spent to save it. Economists say they can put a price on nature. Great, but that's not enough, for several reasons:

1 Conventional valuation:
   – Markets fail to value resources that cannot be owned
   – Incorrectly valued resources may not be depleted through use (non-rival)

– Market prices may be estimated for non-market ecosystem services:
  – Approximate marginal benefit for existing supply
  – Problems with rival vs. non-rival services
  – Provides feedback signal to decision makers' efforts to supply amounts that maximize monetary values.

2 Major concerns with valuation:
– Maximizing monetary value is not an appropriate goal. Maybe we should be thinking about maximizing resilience.
– Incommensurability: some things cannot be compared, like asking: "How much for your daughter?"
– Marginal valuation, ecological and economic thresholds, uncertainty and ignorance. Ecological systems are non-linear; if we cross an ecological threshold, it may be irreversible.
– Ignores values to the poor and to future generations.

The ESPA project has different goals:
– Desirable scale: how much natural capital should be allocated towards economic production? How much should be left intact to generate ecosystem services? How much ecosystem structure has to be left intact? How much economic activity can an ecosystem sustain before it collapses?
– Just distribution: who is entitled to natural capital, shared inheritances? Allocation of shared inheritance should not be determined by existing purchasing power
– *Efficient allocation*: maximize ratio of ES gained/ economic services lost
– Finance payment schemes with equitable distribution

Sustainable scale: Critical Natural Capital:
– These are components of natural capital that are essential to human survival and for which there are no adequate substitutes (food, water, energy, etc.)
– If a resource is essential and has no substitutes, a small change in quantity has a big effect on price: when global grain reserves went down, prices increased four-fold. The same occurs with energy; the Amazon creates a central and non-substitutable service
– This presents a serious challenge for valuation

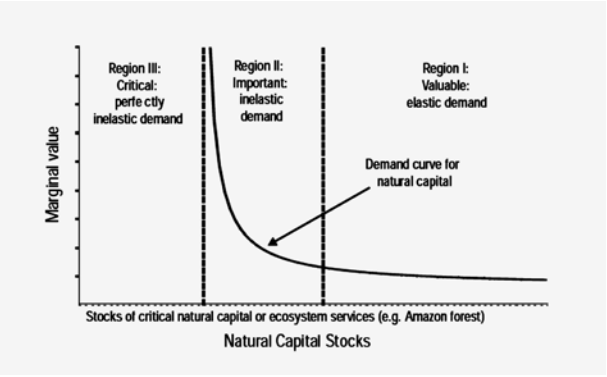
Demand curve for natural capital

The curve has three regions. In Region I, it is okay to lose some area of forest. In this region of the demand curve, large changes in quantity (of forest) lead to small changes in value (of services). Eventually, however, you reach a point (Region II) where deforestation creates a different climate where things can burn more easily, reducing rainfall in the region, increasing malaria. *Here, small changes in quantity result in large changes in value.*

The Amazon is now in region II of the curve, where we are unsure about how much deforestation it can take. When we pass the collapse threshold the system can't sustain itself without active intervention. Thresholds are very hard to estimate. We should target key biophysical indicators. Our goal is to finance conservation. Scale should determine price and payments. Payments must adjust to conservation constraints, as ecosystems cannot adjust to inadequate payments. Knowledge of thresholds and other ecological criteria may be more relevant than marginal value. How much of the ecosystem needs to be sustained to prevent collapse? Target a level – how much payment is necessary to sustain this level? Just looking at water values won't be enough, so keep adding up ES and keep finding beneficiaries who are willing to pay for those to keep the system from collapse.

The Atlantic Forest provides an example of a region that has already passed through the threshold. It is threatened with collapse. Theory suggests that if you lose 90% of an ecosystem, you will lose 50% of the species. (The Amazon will reach this point in 30 years.) So we need to find out how to finance restoration. We need to find the people willing to pay for ES. Their willingness to pay is, however, a poor measure of value. We need to figure out the cost of supplying restoration. The cost of supplying is the cost of actively restoring it every year to keep the system from collapsing until it has been restored enough that it regains the ability to regenerate itself.

We need to trace the flows of damages and benefits, and combine the 'polluter pays' principle with the



↑ The Demand Curve for Natural Capital. J. Farley, 2009

'beneficiary pays' principle. A good example is given by the new "ICMS Ecológico" in Brazil, in which municipalities penalize those who destroy, and pay those who provide services. The more a municipality meets the criteria for service provision, the more money it gets. Each municipality receives in proportion to how much it provides relative to others, since the budget is limited. We need to do this at a global level and get wealthy countries to pay. Right now, the ICMS Ecológico pays according to ecological criteria, but it needs to be augmented to take into account distributional criteria too.

Our goal is to maintain life support functions and other services. Ecosystems provide a bundle of services. If we try and create markets for one at a time, it will be counterproductive. Markets must be adapted to ecological necessities, not vice versa.

Discussion

Laura Rival (Oxford University): How do you see humans as being important in the system?

Josh Farley: We need to focus on the services and benefits the system provides for local people, as well as regionally and globally. In the Amazon there isn't a trade-off between people and the environment. Wealthy nations receive a lot of benefits, particularly in terms of resilience.

Jean Ometto (IGBP): Do we need to regulate?

Josh Farley: I don't think PES has to be a pure market. There are very few examples of PES that are market mechanisms. They work better when there are single players (e.g. the water bottling company Perrier pays upstream landowners to maintain the water supply). The Government has to regulate to make them work. In the US, we should regulate by telling people what they can and cannot do.

But the US can't tell Brazil what to do; it can only reward Brazil when it does the right things. We know that the Amazon provides a plethora of global benefits we don't understand. We know every day we're closer to tipping points. We can't afford not to act. Not acting is acting.

Muriel Saragoussi: You discussed two kinds of payments: to stop destroying, and to restore. We need to include another way: paying for adding value to forest. The forest can be used in sustainable ways, e.g. certified extractive products.

Josh Farley: There is a framework for thinking about types of PES (See table):

TYPE OF SERVICE	EXCLUDABLE	NON-EXCLUDABLE
Rival	Market Good: Purchase of waste absorption capacity CO_2 (CDM); water supply (Perrier)	Open Access Regime: Create common property regimes; e.g. cooperatives, government payments, caps on CO_2 emissions
Congestible	Club/toll goods: e.g. ecotourism	N/A
Non-Rival	N/A	Pure Public Good: Government payments; Green certification
Anti-Rival	Tragedy of the commons: (Not PES) Avian flu, Ozone depleting compounds...	Public provision: Public investment in and free use of technologies that protect ecosystem services

Session 3. Research Gaps Continued
3. Community Development

14.30–15.00

Laura Rival (Department of Anthropology and Department of International Development, University of Oxford) presented the community research gaps, making four main points:

1 *Population dynamics/demographics*. There has been a lot of movement and demographic change across Amazonia. There are lots of issues to be understood. When we talk about poverty and wellbeing we have to recognize that some environments are more degraded than others. Many organizations are already involved in on-the-ground efforts and we do not want to duplicate efforts, but offer some synthesis or be part of something that is bigger. Which communities are we going to focus on in terms of replicability?

2 *Existing payments*. There are many kinds of payments in the Amazon region which are related to sustainable land use, even though they are not called PES. Because they exist, they influence the way that people think about payments. It seems that the idea of PES fits well into the Brazilian mindset. The Bolsa Familia has been immensely popular and this may have contributed to the thinking behind PES in the Amazon region. We should look into this. We should also look into what constitutes a PES: who should pay, and for what? These questions apply to cross-cutting Question 1 identified before the workshop

↑ Framework for considering different forms of PES

(What are the ecosystem services provided by the hydrological cycle of Amazonia's forests; particularly their role in supporting the carbon cycle; and who are the 'suppliers' and 'beneficiaries'?).

3 *Local values, perceptions and aspirations.* We need to understand these, as they are crucial for understanding human behaviour. They apply to cross-cutting Question 3 (How might a PES mechanism be designed which enhances the resilience of forests and the well-being of forest peoples in return for maintaining the ecosystem services they supply?). There are many fascinating issues that we may want to consider. For example, local knowledge. Local people have their own cultural understanding of rain and how it is generated. People have their own notions of wellbeing, and we need to understand what they are.

4 *Do we need an additional workstream on Policy?* Antonio mentioned the car insurance metaphor: it would not occur to people to drive a car without being insured. We could add to the metaphor: at least in Europe it's illegal to drive without insurance. We need to document existing institutional arrangements that could potentially support or be developed to support PES. Real-life markets don't exist without society. What existing institutional structures do PES schemes have to embed within? There are issues of contradictory policies. This topic applies to with cross-cutting Question 2 (What are the risks to these services and what impacts could their loss have on local livelihoods, and the food and energy security of the region?) and how risks and uncertainties are handled by government.

The final topic to consider is vision and focus. Laura & Carlos Miller (AVINA) have identified two important issues:

1 PES are not silver bullets, they are part of something bigger. There are huge destructive economic forces out there. How can PES be used as an opportunity to support something greater? For Carlos it is 'wealth creation'. How can PES be part of a transformative process in which wealth is redefined.

2 One important mission of the funders is training: this project could be a great opportunity to train people about PES as a way to move forward on sustainability. That is also a form of transformative agenda. This is to do with education and it is why the Masters course we hope to design is so important. Who do we train and how? Farmers and/or decision makers? What kind of education do we mean? The role of education in sustainability is crucial. Maybe PES should be called PECS (Payments for Environmental and Community Services), which includes education.

Discussion

Patrick Meir: We were thinking of looking at a number of projects. How many projects do we have a handle on that we can make a start on?

Laura Rival: We can look at community in a standard way, but we have a much wider understanding of community which is about people working together. Community is only interesting and relevant if it has a comparative dimension. We need to choose very carefully some example PES schemes in order to be able to compare them.

Andrew Mitchell: For me, it would be helpful to know where there are case studies. One thing we could do is compile case studies of PES. Payments can be in any form, not just cash. Benefits could be social rather than financial. We have several people working with communities on PES-type activities. Wouter Veening (Guiana Shield Initiative), among others, is working with Guiana Shield communities to create legal contracts. There's also the *Bolsa Floresta*. Others, such as chief Almir Surui and his people are also thinking about PES. What does Almir think about the PES concept?

Almir Suruí: I'm happy to be representing my community here. Amongst all people, the Surui recognize the importance of the forest. The Surui have only had 40 years of contact with outsiders. It's hard to communicate in any language other than our native language. Ten years ago, we started talking about a management plan for our territory. We saw the need for dialogue between traditional knowledge, and science and technology. Through this we saw that our ways are different: we guard our knowledge and pass it on orally. As of 10 years ago, we started putting our knowledge on paper: how the forest is, and can become, an important instrument for humanity. For us indigenous peoples, the forest has everything for life — that is where our life is. Today I'm here, but I carry the forest with me (necklace). Our immediate need is the survival of our people, but we also understand that it is important to think about humanity as a whole. To think of humanity and the world as a whole, the rest of humanity has to think about the services the forest provides. Some people think it's not right to pay for services, but we think it's right because the services mean life. The forest provides us with water, clean air, medicines, and a library for scientists to study to find new medicines. To recognize the services the forest provides to humanity, we're trying to implement this in our territory of 240,000 ha. It's a pity the Surui territory is across two States

that are recognized as the biggest destroyers of forests (Rondonia, and Mato Grosso). This does not discourage us, but motivates us to tell the governors of our States that the forest can be part of the solution. We're reforesting areas destroyed in the past, over the last four years we've planted 120,000 saplings. We're also discussing carbon credits, REDD and avoided deforestation within our communities to find the best ways to keep their home safe. What we want is through dialogue to jointly find a way for the future.

Muriel Saragoussi: I wanted to add a small experience of *Proambiente*. It started in the trans-Amazonica region, organised by the trade unions of family agriculture. People started to discuss ES at the start of the 1990s. The project was implemented by the Ministry of the Environment of Brazil with very little money. There's still no way to pay for ES from the national budget. They started with property planning, discussing where they need to maintain the forest, and better soil management. It continues with local farmers at a small scale in many parts of the Amazon. I think we should look at this project and it could inspire us. They have a number of rules and principles to follow. It involves collective watching to see who's doing what.

Carlos Miller: What are the projects that we can identify? I don't think there are a lot of projects dealing with this issue. How do we create new models? How do we take this opportunity? It's not only about PES. How do you guarantee that the ecosystem will be there in the future to provide those services? We have to use the opportunity to build up the systems that you need in the Amazon. Masters degrees are a good idea, but what type of education do you need in the Amazon so that kids in the forest will have sufficient tools to be players in the future? Obviously we need to build an education process that builds leadership in the region. In the February meeting in São Paulo, Roberto Smeraldi said we have to be careful that PES are not characterized as paying people to do nothing. We have to think of a process that is merit-based. Finally, I understand the logic of working with water because it's a commodity, like carbon. But we don't know what markets will be next year. Maybe the markets will want to have forests as a commodity, not only water and biodiversity. When Fundo Amazonica was being developed, people said that nobody would put any money in it, but now it has US/R$1 billion. It's not exactly a market, it's a government.

Ivaneida Cardoso: Protection is a tremendous amount of work, and expensive – it isn't sitting around doing nothing. Those people who work to protect those areas should be paid because they're doing it for humanity. Traditional knowledge is important, but so is other knowledge, e.g. law, science, and other areas necessary for protection. We put together a report (with Brent Millikan — Amigos da Terra) that showed that the best protected areas were indigenous areas. But the indigenous communities are not paid for that work, while cattle ranchers and loggers destroy the forest and earn compensation for it. It doesn't make sense to me to pay compensation for ES to the deforesters but not those who are protecting the forest. Research and the presentations need to go to the community – in their language, or the situation will get worse. While people are discussing how much biomass is worth, the forest is being lost. My appeal to you is to get away from your desks and present results of your research to the communities and show your concern for what is happening. The Surui people are an example to the academy and the entire world, because they decided to unite traditional and scientific knowledge. Almir doesn't understand English, but he's traveling the world and making himself available to unite with scientists and researchers. For the communities, climate change is looked at differently. Indigenous, rubber tappers, riberinhos, and Maroons, need to join up with the researchers. This conversation is a privilege for a few. It doesn't stay in a small room; we can join up all sectors of society for a planetary equilibrium.

Wouter Veening (Guiana Shield Initiative): We are working with EU funding and the UNDP to develop contracts for PES; for example with the Iwokrama International Centre. They have very specific benefit sharing mechanisms. The local people are involved as guardians. Payment is a generic term, more about equitable benefit sharing. In Colombia, a contract is about to be signed with a collective of indigenous chiefs. Part of the contract is that they are involved in monitoring and guarding the area, which is at risk from illegal mining and coca. There is a training component: interpret satellite images, and training from the Von Humboldt Institute how to ID species, disturbances etc. On the other hand, we learn from traditional knowledge how to interpret the situation on the ground. There are baselines: if it goes negative we need to understand why and whose fault it is. If there's an internal reason, e.g. management shortfalls, we don't think you should pay them less, but maybe you should have a system to remedy the situation. We have bundled the ecosystem services into a payment scheme.

Josh Farley: 'Silver bullet or Fools gold' has 286 case studies looking at the distributional impacts of PES scheme.

Brent Millikan (Amigos da Terra – Amazonia Brasileira): I wanted to return to what Carlos Nobre was talking about earlier: a new economic model; and what Ivaneide was saying. There's an inherent economic logic of people pursuing individual goals without considering long-term impacts on natural resources and ecosystem services. My key question is: What is the role of public policy to address that externality? Traditionally, many public policies have done exactly the opposite: they've encouraged bad behaviour to the detriment of environmental services. One study that AdT just conducted was about large subsidies from the Brazilian National Bank to beef processing plants whose suppliers are all deforesting illegally. That's an example where an economic incentive is driving deforestation. If we don't address perverse incentives, we're going to come up against problems, making it harder for communities to get payment, creating unfair competition. What's the role of policy in stimulating good behaviour and valuing environmental services, but perhaps facilitated by some payment by people who are doing the destruction. How should that be done in terms of policy?

The second point is that there was a meeting of forest peoples about a year and a half ago. One of the key themes was climate change. Some key points discussed by people from the field were: (i) access to resources and respect for their territories so that they are not being invaded – the state needs to regularize access and provide protection; (ii) support for community management activities such as what Almir was talking about; (iii) support for sustainable activities that value traditional knowledge, that can involve supply chains and value adding activities; (iv) social services: how can support for ES also strengthen basic services — not substitute the role of other public policies, but strengthen them. One thing to think about is what are the pilot activities that have already gone along those lines. There are interesting initiatives, e.g. the Lei Chico Mendes – ES of rubber tappers is represented in price of rubber. Others include *Bolsa Floresta*, *Proambiente*. It would be interesting to systematize some of the lessons learned from those initiatives, and how can those initiatives be supported based on what the communities say they need or are key for them to continue to help maintain ES and a dignified quality of life?

Zé Eli da Veiga: I wonder if the NGOs have any comments.

Carlos Scaramuzza (Conservation Director of WWF Brazil): There are still uncertainties surrounding the hydrological cycle. Maybe we're not ready to pursue this specific payment mechanism. There's still knowledge to be produced. One specific question: are we able to re-discuss the framework, and consider a portfolio of ES in a basket. Some ES are ready; others are in development and need more science. There's a proposed Brazilian law on ES: there's a project to consider this. One of the missing points is the framework. We need to disseminate information on ES in the right language for policymakers, but also for public to understand these connections. It will be much easier to convince people to pay if they can get used to environmental services. One lesson learned from the LBA is that it would be useful to understand how to translate scientific knowledge into good public policies. The key question is: *What kind of knowledge and what form is needed to influence public policy development?*

José Marengo: What is the point of working in workstreams? Perhaps the best way is to influence policymakers who could then go to the communities. Perhaps we could find another way to break up the groups or we'll end up in polarized disciplinary groups.

Germán Poveda: There are tremendous gaps in knowledge in the region. We need an LBA for the Andes-Amazon.

Carlos Scaramuzza: We could consider these three dimensions — Technical: what kind of knowledge do we need? Financial: what are the financial needs? Legal/institutional: what are the policy needs over the next 5–10 years?

Andrew Mitchell: We can't fill in all the gaps in information. But what case can be made even though we don't have all the information?

Zé Eli da Veiga: In order to pay for ES, why should I have certainty?

Reynaldo Victoria: We can use the precautionary principle.

José Marengo: What we can say is this: "We have some scientific consensus, there are uncertainties, this is the info we can provide."

Josh Farley: We could look at concrete examples. Costa Rica didn't work out all the values first. There was no fancy analysis. We need a good story for policymakers. How do we act when things are very uncertain? We'll never get around value judgments. We should pay close attention to what information people need to change their behaviour. Can we get beneficiaries to pay? What is the cost of stopping the activity?

Reynaldo Victoria: We can't compare Costa Rica with the Amazon.

Tony Hall: This is not a technical issue, but a political one. We have a particular model of Amazonian development. The prospect of vast new resources from REDD etc., could result in a similar battle over

a new pot of gold. Once we've established some level of credibility that ES exist, and based on the precautionary principle, then we get on with it. Then it becomes a feeding frenzy of people trying to stake their claim. Unless we establish civil society as stakeholders in public policy development, we'll end up in the same situation. There needs to be some kind of balance between equity, social justice, etc. effectiveness and efficiency with payments going to the 'guardians'. But that balance won't be struck unless pressures from different levels are fed into the process in a very affirmative way. We should use science in a socio-political context.

Almir Surui: I have two comments:

1 Specific projects can provide lessons. It is possible to work with ES in Amazonia. A journalist asked me if it was possible to achieve sustainable development in Amazonia. The answer is yes: by involving the local population – they decide if they deforest or not.
2 Why do the US, UK etc. want to influence the Amazon, when they have cut down the forest? They are giving us the benefit of their mistakes.

Lelys Bravo: Politicians react when they know they are close to dangerous thresholds. Are we reaching this dangerous threshold? What is the uncertainty or certainty on reaching this threshold? At which point are we vulnerable?

Josefina and Eduardo Arraut: If the science is not strong, your story could be undermined easily. We all know we need a model for tropical development. We also know we need traditional knowledge. Maybe a good story is to find a route for tropical development, rather than valuing a particular service.

Laura Rival: We know that the project terms of reference have to be worked with. How do we create a knowledge base? We'll create knowledge that will inspire other people. We can rethink science. We can still work on the issue that there is a climate story, and a rainfall story. We are going to do it together, to go beyond disciplinary boundaries. The challenge is not solving a particular academic debate, but it's the problem of the complicated interface between basic and applied science.

Ali Sharif: *I've spent 20 years in the Amazon. I do repair work: rebuilding the forest and communities. People want two things: education (through the internet) and payment (income).* Education has to be organized as Carlos said. The other issue is that payments etc. have been along the lines of the *Bolsa Floresta*. Income does not always produce the right result. There have to be strict standards of why you're paying. We have the issue of education. The only thing that would tackle the education problem is a massive reforestation programme. Reforestation is more than just putting trees in the ground. It's a massive employment activity, we're also talking about payments for services, soil science, maths, etc. and if you're introducing computers at the same time (Mac mini), you provide free computer classes.

Zé Eli da Veiga: We're saying 'Paying for ES'. When we use this verb 'to pay' we think in monetary units. Sometimes people say compensate, which could be other services related to poverty alleviation. We should not limit compensation to education and health. We need to build a scientific and technological infrastructure in the Amazon. Carlos Nobre mentioned this. *What we really need is a model of development in tropical regions. Money must be used for community development.*

Josh Farley: When people think in terms of money (rewards), they're less interested in the community. Money changes the way people behave, it can make them more selfish. *Compensation might be a better way to think about it than payments.*

Theresa Williamson: The Amazon is the fastest urbanizing region in Brazil. How do we avoid perverse incentives?

Muriel Saragoussi: PES are collective payments. GTA is a network of 600 different organizations. We have experience of collective certification of products. In some places where collectivity is stronger and better organized, compensation works better than when people don't feel as part of the community. We need to strengthen communities, so they are better actors to follow the principles that lead to payment. We need to have better representation of the communities in the project. We need moments of validation with broader communities to be more secure about what we're going to propose at the end of the project. We cannot speak for other countries and communities.

Wouter Veening: If you want to have an international transfer of funds, you need to work with international conventions. The world has binding conventions, e.g. CITES, etc. The world community is willing to pay for specific performances of tropical countries.

Day 2. 24 April 2009
Session 1. Break-Out Groups

Before breaking out into groups Patrick Meir provided some details on guiding principles of the ESPA programme:

– Scientific/methodological breakthrough
– Different ecosystem services and drivers
– Innovative contribution to 'sustainable systems science'
– Variability over space and time
– Replicability
– Research into action (users can access/implement/benefit)
– Positive impact on economic diversification
– Urban-rural interface
– Delivering information scaled to support decision making
– Interpreting uncertainty

Break-Out Groups — Synthesis

The participants broke-out into three groups. See Annex 1 for their reports.

1 *Ecosystem service assessment*. Map out the services provided by Amazonia (as an eco-utility). Key questions:
   a Who benefits from the services?
   b Who provides these services?
   c What is their value and the cost of their loss?
   These are questions mainly of ecosystem and economic science.
2 *Policies for ecosystem service recognition*. Map out the existing policies and the drivers of those policies (a power map). Key questions:
   a What policy measures will help to construct a logic of wealth in Amazonia based on its value as an eco-utility?
   b What are the conflicts between existing policies and how can they be rectified?
   c What is the cost of policy inaction?
   Questions (a) and (b) relate to political economics and law, while (c) links back to 1(c).
3 *Mechanisms: communities and finance to pay for the services*. Assess community needs and mechanisms to satisfy those needs. Are we trying to overcome opportunity costs of conservation or provide livelihood strategies that improve wellbeing (bearing in mind the donors are interested in improving ecosystem management for poverty alleviation/wellbeing improvement)?
   Key questions:
   a Who should pay for the services and how?
   b Who should receive benefits?
   c What are the needs among Amazonian-Andean communities?
   d What mechanisms exist and are they sufficient to meet these needs?
   Questions (a) links back to 1(a). Q (b) links to 1(b). Q's c) and d) are for social and economic science

Session 2. Plenary Discussion

José Marengo: How will we be explicit about poverty alleviation?

Laura Rival: We have to define terms like 'poverty' through research. There are some clusters of words that we need to work on and refine what we mean.

Muriel Saragoussi: It's more about 'quality of life'

Zé Eli da Veiga: The conventional metric is the poverty line, but this is impossible to fix. Quality of life or wellbeing might be better.

Brent Millikan: It might be useful to carry out a quantitative analysis of different scenarios: what are the social impacts, and the impacts on the maintenance of ecosystem services?

Vasco van Roosmalen (Amazon Conservation Team ACT): We need to know what the needs are on the ground in order to protect the ecosystem services.

Muriel Saragoussi: We need capacity-building that translates academic knowledge into tools and information for civil society.

Carlos Young (Instituto de Economia, Universidade Federal do Rio de Janeiro): The Zero Deforestation Pact has produced much less than what we had expected. It was a big alliance between NGOs in 2007. The NGOs are very different from each other, and it was the first time they came together. It raised the issue to sub-national governments on the potential benefits of avoided deforestation. The Governors of the Amazonian States are looking at deforestation with a slightly different perspective. They are aware of the foregone opportunities if deforestation continues. At the Katoomba meeting in Cuiaba, five Amazonian governors signed a letter. For the first time, sub-national governments are taking a lead on something that has been considered a federal issue. From a policymaking perspective, it makes a big difference because State governments are in charge of command and control measures. The second good effect was that the new head of the national development bank (Prof Luciano Coutinho) had brainstormed deforestation issues before he took up leadership of BNDES. Fundo Amazonia is okay – it needs to grow, but don't expect too much. It's not only the possibility of extra funds, but there are technical skills with people from BNDES working on forest conservation and poverty alleviation, so we'll have a qualitative improvement in the debate. It will also be respected in the continent. The National Development Bank is taking these issues seriously for the first time. On the other hand, it is very hard to present a solution

for everyone with different contexts, e.g. Guyana and Amazonas. Some parts of Amazonia are under high pressure, so one single instrument will not be enough: we need a basket of instruments. The second thing is the budget issue. It doesn't make sense to gather different financial mechanisms if the ordinary flows of funds are cut. This year there was a 1/3 cut in the environmental budget. How can we then ask for foreign money? The third message was the economic and social importance of conservation of biodiversity and ES.

There's been a kind of revolution in state governments. Every state has its own legislation. Federal law is above any state law. But now Santa Catarina State has defied the federal ministry for environment, and Rio Grande do Sul is taking the same line. The Forest code is under pressure to be changed. There are many bad signs. It doesn't make any sense to make small funds if the whole picture is wrong. It is very important to present a very clear message – *what are the benefits of conserving ES*. Finally, there is a UNDP initiative that has the support of CEPAL and UNEP. Trying to answer why is it important to conserve biodiversity and ES for the whole region. We are carrying out a literature review, and asking what are the gaps. *One of the gaps is water – we don't have good evidence and we need to advance on that. What is the relationship between forests and water?* The report should be ready by the end of the year, with a first draft complete by late June/early July. Please send in your comments. Send in relevant material on water and forests. We're covering the whole continent.

Session 3. Next Steps

Patrick Meir: Patrick presented a proposed draft project framework that had developed as a result of the discussions over the course of the two days, and will be developed further. Essentially, the project is at the science-policy interface and needs to understand: how the two interact; what are the most policy-relevant questions; and how to best provide evidence for decision-making aimed at poverty alleviation/improved wellbeing. Patrick described the potential next steps as:

1 Distill breakout group reports and cards
2 Re-draft project framework and circulate it to the groups
3 Communications: develop an interactive website for dialogue among the group
4 Resources to advance key components, for example:
   – to support Carlos Young and Josh Farley to develop one element
   – to support Muriel Saragoussi, Laura Rival and Carlos Miller
   – José already has the Dangerous Climate Change project and we need to think about how to support and interact with that effectively
5 Identify database/tools — what is available, e.g. climate datasets, etc.
6. Take the idea of a paper forward to bring different elements of the project together. In essence, it will present a state of knowledge relevant to this project and build the case for this project.

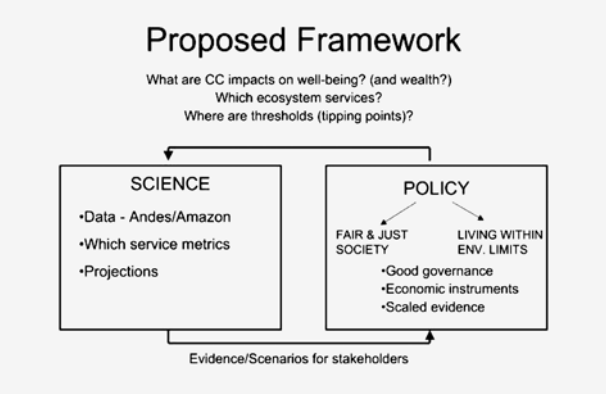
Andrew Mitchell: In terms of next steps there's more work that needs to be done before the next workshop. We need to carry out a set of case studies investigating or collating the state of knowledge on for example:
– community payment mechanisms
– the potential impacts of rainfall changes on different economic sectors or states
– the economic impact of the 2005 drought
– policies that exist relevant to the project
– a needs assessment at the community level

Muriel Saragoussi: We need to produce a list of case studies that fit within the framework and lead us onto the proposed project.

Patrick Meir: We need an assessment of the state of knowledge. We also need to think about how to link the on the ground experiences with the economic instruments and processes.

Carlos Young: What we could do now is create an information centre to hold all the information so that we can summarise the state of knowledge.

Muriel Saragoussi: There is a BCDam database *(www.bcdam.gov.br)* covering the Brazilian Amazon that is shared among NGOs and governmental organizations.



Brent Millikan: The next steps for three workstreams feeding into a project proposal could be:

1 *Summary of state of art of knowledge on land use change (trends and scenarios; e.g. forest management vs. pasture) in Amazonia in terms of impacts on maintenance of ES* — including hydrological and climate regimes / water and carbon; implications of scenarios for "tipping point"; ecosystems and services (e.g. water in Mato Grosso), systematization could include logic of key actors involved, and social equity implications of different land use scenarios:
   – Applied research to support policy dialogue.
   – Take advantage of LBA and other databases.
   – Identify key research gaps, that could be supported by project – proposals and dialogue.
2 *Compilation/systematization of state of art / analysis on public policies vs. environmental services* (influence on economic activities associated with maintenance of forests <carbon, water, biodiversity> vs. economic activities that imply deforestation) (pro and contra – analysis – logic on influencing land use, marco zero, basis for proposals for existing instruments? New instrument for ES – niche? (laws in congress).
3 *Compile case studies:* lessons learned (community development and environmental services of forests)? (*Bolsa Floresta*, *Proambiente*, Lei Chico Mendes, Fundo Amazônia, etc.)

Carlos Nobre: Suggested that Brazilian project counterparts are more interested in leading on deforestation since it is an important issue for society. It's hard to uncouple water from carbon. Water can be a unifying theme and we can link land use change to water. Deforestation creates a seasonal depletion of soil moisture.

Germán Poveda: We should also talk to the Earth System Science Partnership *(www.essp.org)*.

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ANNEXES

Annex 1. Break-Out Group Discussions
Break-Out Group 1 – Ecosystem Services

What are the services, who provides them and who benefits?

Providers / Keepers
– Indigenous groups
– Local/traditional people
– Government (local, state, fed)(Protected areas)
– Farmers / land owners

Beneficiaries. Local, regional and out-regional. Who will receive benefits?
1 Those who protect the actual forest
2 Those who will stop deforesting
3 Actions or instruments that add value to forest products

Recommendations
– To distribute the benefits, study local forms of organization (consortium, fora, councils, etc) – enforce local governance
– Link project circumstances to services provided and define territories, forming a matrix:

	SERVICES
KEEPERS	TERRITORIES

Tasks
Definition of the services — scale, contents, cross-scale

Bibliography.
WWF report & Geo Amazonia – UNEP

Break-Out Group 2 – Policies

The challenge is to reconstruct the logic of wealth in Amazonia based on natural capital assets. Brazilian Science Academy has developed a Strategy for Amazonia that considers this issue. The logic of wealth could be reconstructed through e.g. banks/trusts that are based on the value of the forest.

Many of the problems of deforestation result from inconsistent policies, some of which create perverse incentives to deforest. So policies need to be changed to address this. In 2008, nine Brazilian NGOs created a pact to stop deforestation by 2015 through the use of economic policy measures.

Some in the group felt that it was not so much an issue of policy, but a need for new mechanisms. Furthermore, there was a division in the group between those who wanted to create new mechanisms and those who wanted to use/modify existing ones such as the Bolsa Floresta, Bolsa Familia, Agricultural Conservation, the Federal budget, Fundo Amazonia.

A dual system is needed: (1) Stopping deforestation and (2) Rewarding/meriting those who have maintained the assets/services, i.e. how to give value to those not deforesting?

There is a need for education and skills, health services, etc. These are also needed in urban areas, where poverty can be greatest in Amazonia.

Break-Out Group 3 – Mechanisms: Community & Financial

The challenge is how to make a fund to achieve the objective of poverty alleviation/improvement in wellbeing.

Case studies are needed to assess the needs of indigenous territories, extractivists, ribeirinhos, etc.?

Some principles to be borne in mind:
1 Pre-investment is needed for management (plans, associations, institutions, structures, etc.) so that people are not waiting to be paid;
2 Contracts are needed because people are paying to maintain services;
3 Monitoring is needed because those paying for the services want to know if payments are achieving results.

The proposed structure would be:
1 Measure the needs on the ground (not just an academic exercise)
2 Use micro-credits to influence economic activities
3 What cases already exist? There are many examples in Brazil that require study and evaluation to determine if they are conserving or destroying services
4 What is the structure of the fund: regional or national?
   – Combine functions (capacity-building, set-up, fixed capital/endowment in perpetuity – invested in international capital market, micro-credits for revolving funds, refill micro-credit fund)
   – How to relate fund to geographical unit?
5 How do you transfer resources? Look at Fundo Amazonica and other models. What is politically possible as well as technically possible?
6 Sell C credits to raise resources. How to value other services? See Josh's different mechanisms for different types of services. A 'Hectare of forest' could be more difficult than a tonne of carbon

Other considerations to include in the argument/proposal:
1 Seven rural securities: food, water, energy, health, transport, micro-credit, training
2 Build an argument of the opportunity costs of doing nothing – the Costs of Policy Inaction (see TEEB CoPI study)

3 Need a better idea of state of art of toolkit of economic incentives

Annex 2 . The UK Government's ESPA Programme

The following is taken from:
www.nerc.ac.uk/research/programmes/espa

The Millennium Ecosystem Assessment showed that the loss of services from ecosystems is a significant barrier to reducing poverty, hunger and disease. Tackling this set of problems requires:

1 environmental science to understand why ecosystems are becoming degraded, and how to reverse this
2 ecological economics to better value the services
3 political economy (a combination of economics, law and political science) to ascertain what institutional changes are needed in order to equally distribute the costs and benefits of improved ecosystem management to the poor.

Three organisations: NERC, the Economic & Social Research Council (ESRC) and the Department for International Development (DFID) join forces to explore the potential for a multi-disciplinary research programme that will address how to achieve sustainably managed ecosystems. This work aims to contribute to reducing poverty and improving wellbeing in developing countries.

We propose that the programme addresses major ecosystem services challenges that hamper poverty reduction measures in four regions. Examples of regional challenges include:

1 adapting to monsoon variability in South Asia
2 equitable delivery of ecosystems services in China
3 reducing environmental vulnerability in semi-arid areas of Africa
4 securing biological stability in the Amazon and Andes

Key drivers of these regional challenges are population and economic growth associated with large-scale land-use changes and climate change.

Four regional and two thematic situation analyses will inform the development of the programme.

The analyses will provide evidence identifying key regional ecosystem services challenges and propose ways to best address these challenges through research to alleviate poverty. The analyses will be performed by consortia of researchers from the region, the UK and elsewhere in collaboration with national governments and local partners. The outcomes will inform a research programme to support developing countries to use the benefits of ecosystems for poverty reduction.

At this stage, the three partners organisations (NERC, ESRC and DFID) are developing the concept of the programme. Final approval of the programme by DFID Ministers is pending. Financial support for the launch of the full programme, following the regional situation analyses, is dependent upon DFID Ministerial approval and the outcome of the 2007 Comprehensive Spending Review.

Annex 3. Amazon-Andes Situation Analysis: Key Research Issues And Questions For ESPA

Conducted by Roberto Porro and 18 others (Available at: *www.ecosystemsandpoverty.org*)

These are the key research issues and questions for ESPA that the Situation Analysis identified (those in italics are particularly relevant to this project):

1 Water quality and quantity
   – Development and unhindered distribution of satellite-based climate datasets for improved continental scale hydrological analyses and modeling.
   – *Assessment of the relative impacts of land use and climate change on water availability and flow within the Amazon Basin, including feedback processes and assessment of potential land cover, or climatic thresholds that can generate significant hydrological change.*
   – *Assessment of the hydrological sensitivity of the basin to climate change that moves beyond the standard scenario application approach in which the results are highly dependent on the scenario used; and in which different scenarios can produce very different outcomes towards an approach that recognises sensitivity to climate change. Assessment can include use of ensemble simulations.*
   – A more detailed treatment of spatial (geographical) variability across the Amazon and its implications for scaling up of site studies.
   – *Better understanding of the relationships between water and poverty in water-rich environments and the extent to which these are mediated by water access and quality as much as quantity, including analysis of the issues of dams for HEP generation.*
2 Local Climate Regulation
   – *Deeper analysis of the impacts of forest cover change on cloud and rainfall generation, and application of these feedbacks in hydrological models (that look at the impacts of forest cover on evaporation and runoff while ignoring the*

feedback of evaporation to cloud cover and rainfall). Although most models (as the one used here) indicate that deforestation leads to increases in runoff, deforestation may lead to decreases in runoff, with impacts on rainfall generation and recycling at the continental scale, though evidence presented in the Amazon wide precipitation analysis indicates that forest loss can lead to either increases or decreases in rainfall, depending on the context. Questions: What are the full cycle impacts of large scale land use change on water resources in the Amazon? and how will these impacts interact with regional climate change and human well-being?

– *More data based analysis of rainfall recycling processes, and response to land cover change at the basin scale. Question: What is the role of rainfall recycling in the provision of water at the Amazon scale and how is this mechanism sensitive to land use and climate change?*
– *Need for climate regulation services is much less developed than the provision side. Although there are local needs for the maintenance of the climatic status quo, there are also global needs, such as the role of the Amazon in global climate regulation. Further research should focus on questions such as: What is the resilience of Amazon livelihoods to changes in climate, and the nature of livelihood responses (positive and negative) to climate change?*

3 Carbon and biomass
– Most studies of the impact of land use change do not consider the impact of changes in sequestration, only of carbon stock losses. There is still much debate as to the role of the Amazon as a global carbon sink (Houghton *et al.* 2000; Clark 2002; Laurance *et al.* 2001). More research is needed to scale up the plot and tower scale studies to Amazon-wide estimates capable of tackling the issue of the overall contribution of the basin. Question: *How will the carbon budget of the entire Amazon respond to environmental change? and what are the implications for reduced emissions from deforestation and degradation (REDD) in developing countries?*
– Given the potential incorporation of avoided deforestation in the post Kyoto climate change treaty through REDD, a mechanism now exists for payments for carbon services. Key questions concerning how to ensure that this mechanism works for the poor include: how much carbon is sequestered by different ecosystems; and how does this vary spatially, seasonally and inter-annually? How can areas at risk of deforestation be assessed? And how could PES (payments for environmental services) schemes contribute?
– The global need for carbon sequestration services is apparent; but there remains a great deal of uncertainty as to the long-term carbon balance implications of particular carbon management strategies (avoided deforestation, plantation forest, protection, conservation, regeneration, tree planting and biofuel cultivation). Critical questions include full cycle impacts (i.e., all aspects considered from production through consumption). Moreover these studies need to take into account the changing ecology of Amazon forests under climate change and CO_2 fertilisation effects and must be carried out at the Amazon scale.

4 Soil erosion and productivity losses
– Where and under what conditions is soil erosion poverty relevant on and off-site?
– Identify best practices and economically, culturally, and agronomically feasible technologies to reduce soil erosion.
– What factors constrain farmers in adopting practices and technologies that minimize soil erosion?
– What is the economic loss associated with soil erosion on-site? Where is it high? Where is it negligible?
– Measure the downstream costs of soil erosion and evaluate whether they could cover opportunity costs of preventing it upstream. Evaluate tradeoffs and identify cost-effective management options.

5 Ecosystem functioning
– *Better understanding of the scale (potential thresholds) and land cover characteristics required to maintain ecosystem services related to biodiversity (there is no information available regarding the scale for maintaining supporting services such as nutrient cycling or ecosystem stability).*
– Establishing the links between biodiversity at different levels (i.e. species, ecosystems), and the provision of specific ecosystem services (ES) such as nutrient cycling, ecosystem stability and disease control.
– How human disturbances and habitat degradation can affect the provision of different ecosystems services provided by natural ecosystems. What are the thresholds, resilience and resistance of natural ecosystems to change before they start losing the

capacity to provide different ES?
- Better knowledge about biodiversity products (e.g., sustainable extraction rates, phenology, etc.) provided by the Amazon is needed to improve management and sustainable use; information is not well systematized for the region; some countries have only very basic information (e.g., Guyana).
- Information on distribution of timber and non-timber forest products species and their use needs to be improved. Without precise information on species distributions, it is hard to estimate real provision or provision of forest products in the region.
- Better understanding of the relationships of species valuable for humans, their ecosystems, the economics of extraction, and related value chains is needed to ensure sustainability of product extraction.
- A lot of the existing information is unorganized and hard to find. A coordinated effort among countries in the region to create and manage a long-term biodiversity (existence and use) information system that can maintain updated information on biodiversity and forest products that benefit human livelihoods is needed.

6 Aquatic biodiversity
- Fish stocks and population dynamics are not well understood. Provision studies in the Amazon have been limited in scope, isolated, and are of limited use for comparative studies. In the lower Ucayali in the Peruvian Amazon, Montreuil *et al.* (2003) evaluated species composition and provision by monitoring dock unloadings. Riofrio (1998) estimated provision by relating capture amounts vs. fishing effort in Pucallpa; as did Tello and Bayley (2001) for the commercial fleet at Iquitos. Guerra *et al.* (1990) and Granados (1987) estimated fish biomass (ichthyo-mass) by acoustic means.
- Sustainable catch rates and required close seasons need to be established for threatened fish species.
- The economics of fish supply and consumption have to be better understood in order to develop effective resource management strategies.
- Fishery based value chains are not well studied and supposedly very heterogeneous across the region. It is not clear where degraded fish resources will compromise the wellbeing of the poor.
- Fish resources are not just threatened by over fishing. ES that support fish resource maintenance need to be better understood to evaluate impacts of deforestation, hydroelectric dam construction and other measures.

7 Management options (MO)
- *Research on the relative importance of particular ES flows in causing or reducing poverty, especially in the long term.*
- *Work to elicit and understand stakeholder perceptions (valuation) regarding ES flows.*
- *Research to understand the private and social benefits associated with ES flows, costs associated with changes in these flows, how benefits and costs vary across stakeholders, and how society can use this information to make the right policy choices.*
- *Work to understand how ES flows can be affected by policy action and to understand to what degree human behaviour is responsive to alternative policy actions.*
- *Identifying the conditions (and their spatial distribution) under which incentive-based MO can be cost-effective alternatives to disincentive-based MO.*
- *Promote pilot experiences in a comparative framework to determine how enabling MO can be used to increase the capacity of the poor to capture the benefits of incentive providing ES.*

8 Lessons learned from case studies: Contribution of ES management options to improved well-being
- *Improve impact monitoring (ES and poverty indicators, such as those used in this and the previous chapter) in projects and programmes that address poverty and environment linkages.*
- *Build on the lessons learned set out in this chapter to derive critical conditions for the success and failure of interventions. Ecotourism and certification are promising options, where are they feasible and where not?*
- *Develop new indicators that capture ecosystem services provision at temporal and spatial scales relevant for management, which may differ depending on management contexts and objectives.*
- *Developing methodologies to estimate (both ex-ante and ex-post) total implementation costs, which may require cost monitoring frameworks especially in the case of large-scale government programs.*
- *Define criteria for replicability in differing socio-cultural and political contexts.*

Annex 4. Participants

- Ali Sharif: AVINA/Permaculture
- Almir Suruí: COIAB/Surui
- Andrew Mitchell: Global Canopy Programme

– Antonio Donato Nobre: INPE/INPA
– Arnaldo Carneiro Filho: Instituto Socioambiental
– Brent Millikan: Amigos da Terra
– Carlos Miller: AVINA
– Carlos A. Nobre: INPE
– Carlos A. de M. Scaramuzza: WWF Brasil
– Carlos Young: Federal University of Rio
– Eduardo Mencarini: McKinsey & Company
– Eduardo Moraes Arraut: INPE, DSR
– Gabriel Cardoso Carrero: INPA
– Germán Poveda : Universidad Nacional de Colombia
– Gillian Kay: Met Office Hadley Centre
– Guarany Osorio: Greenpeace Brasil
– Humberto R. da Rocha: University of São Paulo
– Ivaneide B. Cardozo:
Associação de Defesa Etnoambiental, Kanindé
– Jean Ometto: INPE
– John Gash: Centre for Ecology and Hydrology
– José Antonio Marengo: INPE, CCST
– José Eli da Veiga: University of São Paulo
– Josefina M. Arraut: INPE, CCST
– Joshua Farley: University of Vermont
– Laura Rival: University of Oxford
– Lelys Bravo de Guenni: Universidad Simón Bolívar
– Mandar Trivedi: Global Canopy Programme
– Manoel da Cunha: Conselho Nacional dos Seringueiros
– Muriel Saragoussi: Grupo de Trabalho Amazônico
– Myanna Lahsen: INPE
– Patrick Meir: University of Edinburgh
– Patricia Pinito: INPE, CCST
– Reynaldo Victória: University of São Paulo
– Samuel Roiphe Barreto: WWF Brasil
– Sarah Cornell: Bristol University
– Sergio Leitão: Greenpeace Brasil
– Theresa Williamson: Catalytic Communities
– Tony Hall: London School of Economics
– Vasco M van Roosmalen: Amazon Conservation Team
– Victoria Ballester: University of São Paulo
– Wouter Veening: Institute for Environmental Security

03

Sharing Knowledge and Experience of Payments for Ecosystem Services (PES) Workshop

17–18 de Setembro de 2009
Instituto de Permacultura da Amazônia (IPA), Manaus

Place: Instituto de Permacultura da Amazônia, IPA, Manaus.
Date: 17th and 18th September, 2009

Organisation and Facilitation

Luis Meneses (GTA), Mandar Trivedi (GCP), Muriel Saragoussi (GTA), Wendy-Lin Bartels (University of Florida) and Maria Fernanda Gebara (OCTF)

Participants

A total of 41 people took part in the workshop, as can be seen at the end of this chapter. These included 19 people representing communities (12 were representatives of the GTA network and the CNS, and 7 were indigenous leaders); there were also researchers and others linked to NGOs, totalling 22 people (14 researchers and 8 NGO representatives). Out of all participants, 20 were Brazilian, 13 from other Amazonian countries (Colombia, Ecuador, Guyana and Peru), 6 from Europe and 2 from the United States.

INTRODUCTION

Deforestation and climate change threaten forests, and the livelihoods and food security of the communities that live in them. Forest peoples and communities are generally the best stewards of the forests but have received little recognition of their role. PES schemes aim to recognise and pay for the environmental services provided to society as a result of their forest management and conservation activities. However, to date there is no conclusive evidence as to the effectiveness of PES schemes. As such, this project prioritized the holding of a workshop with representatives of grassroots and community organisations, as well as NGOs and scientists, to provide a forum for the exchange of experiences, ideas, and solutions for PES schemes that would help in the design and implementation of the project, as well as increase the community representatives' awareness in relation to PES.

Over the coming months, the team intends to develop proposals for a 4 or 5-year project that will aim to examine potential schemes and mechanisms to compensate communities and groups that deliver vital services from the forest. The project will focus on bringing together scientific knowledge, and traditional and indigenous knowledge aiming to build a sustainable scientific model; and the creation of institutionalised practices that will be implemented through cooperation between natural scientists, economists, and forest communities.

WORKSHOP OBJECTIVES

– To provide a space in which community representatives and researchers have the opportunity to engage with each other and exchange ideas on PES schemes, with the aim of developing options and tools for the construction of effective and egalitarian compensation schemes for environmental services;
– To generate understanding of the ideas and concepts which provide direction for the project;
– To generate understanding of the concepts and potential of Environmental Services and PES, including how they can contribute to community well-being and development, as well as to forest conservation;
– To ensure that community representatives contribute to the design of the project, proposing recommendations and guidelines for the PES schemes;
– To generate understanding of next steps and project opportunities.

WORKSHOP PROGRAMME

Day 1. Thursday 17th September

– Welcome
– Participant introductions
– Gathering of expectations for the workshop
– Clarifications on the 'Valuing Rainforests as Global Eco-utilities' project
– Workshop objectives
– Environmental Services and Payment for Environmental Services – Concepts and Group Work: generating understanding on PES, communities' development needs and forest conservation.
– Existing PES initiatives in the Brazilian Amazon: *Bolsa Floresta*

Day 2. Friday 18th September

– Existing PES initiatives in the Brazilian Amazon: *Proambiente*, Rubber Subsidy Programme and *Bolsa Floresta*

– Recommendations and Guidelines for PES schemes: Group Work
– Presentation on Catalytic Communities – Wiser Earth communications platform for communities
– Opportunities and Next Steps
– Workshop Evaluation
– Close

PRESENTATIONS

During the workshop, 8 presentations were given. These are listed below.

Presentations 1 and 2
Clarifications on 'Valuing Rainforests as Global Eco-Utilities' (one by Mandar Trivedi and one by Andrew Mitchell, from the Global Canopy Programme)

Presentation 3
Payments for Ecosystem Services: Sustainability, Justice and Efficiency (by Joshua Farley, University of Vermont)

Presentation 4
Follow up to the *Bolsa Floresta* Programme in Amazonas State (by Aginaldo Queiroz, GTA network)

Presentation 5
Analysis of the *Bolsa Floresta* Programme in the Juma Sustainable Development Reserve (by Maria Fernanda Gebara, Oxford Centre for Tropical Forests)

Presentation 6
Analysis of the *Proambiente* (Socio-Environmental Development of Rural Family Production) programme (by Wendy Lin Bartels, University of Florida)

Presentation 7
Minimum Prices policy for socio-biodiversity products (by Manuel Cunha, CNS)

Presentation 8
Catalytic Communities and the Wiser Earth Communication Tool (by Theresa Williamson, Catalytic Communities)

WORKSHOPS RESULTS

Workshop Expectations

For the sessions on 'Gathering Expectations' and discussions on PES, participants were divided into 5 working groups according to language (1 English language group, 1 Spanish group and 3 Portuguese language groups). These last three groups were divided up so as to ensure a mix of participants. Two questions were suggested for the groups to answer and report in plenary:
1 Why are you here?
2 What do you hope to take away from this workshop?

These expectations have been grouped in broad categories listed below.

Why are you here?

1 Invitation received by my organisation
2 Interested in learning about PES and replicating experiences in my own organisation or workplace.
3 Interested in sharing, understanding, discussing and developing concepts and themes related to PES and its relationship with forest communities.
4 Strengthening links to develop PES schemes

What do you hope to take away from the workshop?

1 Ability to develop PES projects
2 Concepts discussed and developed that guarantee benefits for forest communities.
3 Information sharing
4 Align the ESPA project with the views and needs of the communities
5 Learning that supports grassroots political processes
6 Establishing partnerships between the organisations

Environmental Services and Payments for Environmental Services

The presentation by Joshua Farley on 'Ecosystem Services and Payment for Ecosystem Services' aimed to bring all participants up to speed on the concepts and range of possibilities associated with environmental services and PES. After the presentation, a session was held with the five working groups to get an idea of the understanding participants have of PES and their experience with PES to date. It also aimed to draw out views on communities' needs and well-being, and on

forest conservation from representatives of community organisations. Four guiding questions were given to the working groups.

– *What is your understanding of payment for environmental services?*
– *What does your community need so as to be able to maintain the forest?*
– *Complete this sentence: For my community to have its needs met, we need…*
– *What examples of PES do you have knowledge of?*

The groups' responses did not correspond to all the guiding questions, and are organized below.

What is your understanding of Payment for Environmental Services?

Definitions

– Maintaining a service
– A task, and an active commitment
– We work on these issues in our projects. Sustainability for riparian families. Forest management.
– Creating a mechanism to maintain the forest.
– It's what guarantees a way of life that protects the forest and benefits the community, and the people and ecosystems of other regions.
– The importance of the forest for the planet's equilibrium. Communities are responsible for maintaining the forest and this is a service
– If we find a way for the whole world to live better as a result of us preserving the forest, then this is a service. The people who benefit from the service pay us for this
– Environmental Service is all the interaction that exists in the forest (Food x Animals x Biodiversity).
– We need to take in both visible and invisible services (carbon is visible and air is invisible).
– Legal recognition of the rights of traditional peoples to this compensation.
– Payment through carbon trading for REDD
– Environmental credit paid for action that is remunerated
– Environmental services by hectare of the forest (unit)
– Remuneration for the outcomes of the way nature is used
– Payment is not just about money
– We have always been in the forest, conserving it, but this is not a service for other people. The system should work based on territorial security in the local context.
– PES is not a gift – it is something that will need to be lobbied for.

Questions and Thoughts on PES

– Is it a payment for doing something, or for not doing something?
– How do we define resources, and get on to the concept of sustainable use?
– Difference in values – on what is important for people who live in the forest. PES cannot be 'charity'. We cannot become beggars.
– Paying just one part of the whole will lead to the impoverishment of the whole.
– There needs to be investment in families' ability to support themselves: education, protection of life, water, health
– The government should create incentives to maintain the forest and the people that live in it. This will need education
– Valuing the products of the forest. We need to make a study of what we have
– We need to know the potential of the forest. To change reality we have to pass down knowledge. We need to discuss the specifics.
– Indigenous people understand things in one way, riparian people and those engaged in extractive activities in another. We need to have discussions separately, so that afterwards we can meet and draw out proposals together. Each community thinks differently.
– This discussion isn't happening in Peru. The indigenous people will ask: Why will they pay us for this? What do they want in return?
– It's a fairy tale that will probably turn into another boom (I don't like the terminology: services = servitude).
– We need to think about what we do with what we have, what could be marketed, and many projects for the future.
– It's a problem of global development. The premium is environmental services, and the priority is the exercise of collective rights. Resources get appropriated by others (tourism, loggers…) even when indigenous people have land titles.
– If there are going to be payments, they need to be payments that really compensate. Something people will be proud to receive.
– PES needs a baseline, to monitor the service provided.

What are the needs of your community to maintain the forest?

With regards to the needs indicated by the communities for the maintenance of the forest, five conditions were considered to be priorities:

1 economic incentives for sustainable production;

2 provision of social services and development of public policy;
3 financial and legal support that encourages sustainable activities;
4 identification of the supply and demand of environmental services;
5 guarantee of land rights, and community sovereignty with regards to land use.

A number of points were made as open questions, relating to the conditions listed above, such as: cultural aspects of the community in relation to the dynamics of deforestation and land use; the need to develop a scheme that clearly demonstrates to local governments the importance of the environment, so as to prevent activities that damage the forest and bring about deforestation; and a guarantee of social development.

Incentives for Production
– Government policies that are oriented towards study of the forest's potential, the protection of natural resources and fiscal incentives for forest production.
– Increasing the value of extractive activity and its products
– Payment should be for production
– Giving value to forest products.
– Undertaking a study of the economic potential that exists in the forest
– Create a policy of fair prices for forest products. There needs to be a market.
– There will need to be technical assistance to put a value on forest products
– Technological advances
– Carry out training for community members, showing how to extract wealth from the forest, without degrading it.

Social Services and Policies
– Develop public policies that are oriented towards community needs
– Compensation for improvements in living conditions in the form of public policies
– Carry out a planning process, and develop a 'life plan' that is based on the reality of the community itself, so that what comes out of the forest does not destroy the forest. We have to combine technical knowledge with traditional wisdom.
– There is a need for services, but having some money in your pocket never hurt anyone
– Generate interest in, and carry out, courses and activities that guarantee sustainability
– Having needs is the price of citizenship: Education like there is in the city, but made relevant to the culture of each indigenous group, access to health
– Heavy investment in education
– Valuing community organisations
– Capacity for economic development without risking biodiversity
– The model of development that has already gone wrong should not be repeated
– Poverty comes from the absence of the state. We don't need acts of charity

Financial and Legal Support
– There is a lack of financial and legal support to develop local inventories and local sustainable development plans.
– Legal and financial support and structures
– New and improved legislation
– The need to dress like the rest of society. Society 'makes you have' these needs, and that's where the need for money comes from.
– Handing over money is not the answer. We need to be compensated through an integrated development programme that brings social transformation, using the knowledge that we generate, and the contributions of the critical mass of the population.
– Excluding the crooks in the market, and the intermediaries

Identifying Supply and Demand
– Promoting exchange and finding a way of accommodating the needs of communities and the needs of outsiders

Territorial Guarentees
– Territorial control
– Having a system for administration of resources
– Having a 'life plan' and self-government.

Doubts about the Meaning of Points Raised
– The communities are not deforesting. It's your culture, isn't it?
– Communities will maintain the forests with or without their needs met
– Creating mechanisms that show local governments the importance of the environment so that access is not given to companies that damage the forest
– There is no vision for Amazonian development.

In order for my community to have its needs met, we need...

Knowledge and Technology
– Universities working with local students
– Contact with the world through internet and digital technology
– To improve the process of production

Health and Education
– To improve the process of production

Leadership and Participation
– Community ownership
– De-bureaucratization (the less government is involved the better local management will be)
– Opportunity
– Organisation
– Being able to do something oneself
– Exchanges between the world's traditional peoples
– Funding to get organized and to carry out studies
– Maintaining one's way of life
– Participating in public decision-making spaces
– Communities need more knowledge about their rights so they can demand these from government

Financial Resources and Credit
– Need for a local bank with a fund for payments and micro credit
– Financial agent to provide low cost loans
– Mechanisms to support community development
– Credit for sustainable production
– Improvine understanding of 'economy with solidarity'
– Incentives
– Investments
– There's a need for credit, not charity
– My community needs financial support to work on land management.

Regularization of Land Tenure and Territorial Management
– Land tenure regularization
– There is need for a management plan and support to implement the plan
– Territorial security
– Government (self-government?)
– Life plans

Technical Assistance and Capacity Building
– A system for technical assistance
– Capacity building and training
– Capacity building for community members, showing them how to extract wealth from the forest without degrading it
– Education
– Capacity building for communities on environmental legislation

Infrastructure
– Infrastructure for production based on natural resource extraction
– Infrastructure
– Electricity supply

What examples of PES have you heard of?

– Guyana: Taxes on the use of the forests
– Guyana: Experience of the Canopy Walkway for tourists; travel agents, local firms and indigenous communities, replication of local business and guide training.
– Guyana: Experience of making peanut butter and the logging business (training)
– Guyana: Experience with UNDP on poverty reduction that disappeared after 2 years, like with the waterfalls on the Rio Potaro. (President of Guyana's Low Carbon Development Strategy?)
– Ecuador: Valley communities pay mountain communities to preserve water (city residents and city council)
– Projeto SocioBosque (SocialForest Project), Ecuador: 2 million hectare project set up by the Schuar people, which the government then took over, turning it into a conventional development plan and calling it REDD.
– Peru: Communal Reserve: State and indigenous people. The community doesn't know what it wants, because it doesn't know what it has. All the projects fail. Only coffee production has worked, and that's because it already existed.
– Costa Rica: The government pays land owners for increases in forest coverage (quantified results).
– IPAM, Brazil: Rural workers receive money from the city for the recuperation of riparian vegetation.
– *Proambiente*, Brazil: Payment for changes in land management and protection of the environment. (It came out of a proposal by the agricultural workers movement and became a 'timid' public policy).
– Municipality of Manacapuru, Amazonas, Brazil: The city council has been paying 62 families for 12 years to preserve the Sustainable Development Reserve in Piranha, (monitoring, cleaning, protecting the lakes). The project was suspended a month ago.
– Bolsa Floresta, Amazonas, Brazil: The idea is fine but state politics have distorted it.
– Rondônia, Brazil: The carbon belonging to the Surui people is being developed on the indigenous territory '7th September'.

Recommendations and Guidelines for PES Projects

This was the main session of the Workshop, as its objective was to identify recommendations and guidelines that should be taken into account in the development of PES schemes, so as to benefit the forest communities. The discussion did not aim to exhaust the debate about recommendations and guidelines, but involved setting out the first steps that should be taken in the development of projects in this area. The application of these recommendations and guidelines will be taken into account in the new project to be presented for funding to the British Government's ESPA Project. However, these recommendations and guidelines are applicable to all the organisations present at the Manaus Workshop that helped to define them. They have a wide relevance, both to the direction taken by projects related to PES, and for the political positioning of these organisations in relation to these projects. As such, it is anticipated that what was produced collectively will be used by all of those involved, so as to improve the quality of activities undertaken by these organisations in relation to environmental services. One important outcome of the workshop was the position paper called *Payments for Environmental Services — Amazon Community Leaders' Perceptions* released in COP 15 by GTA (Amazon Working Group) and CNS (Extractive Populations Council) — two of the most important community representative organisations in the Brazilian Amazon. The position paper was made based on the Manaus workshop report, as these organisations believed it was the first time that their leaderships had the opportunity to come up with a collective view on PES.

The procedure

The development of recommendations and guidelines for PES projects was undertaken in working groups. These were formed according to personal choice, based on interest in and/or relevance of the theme. The themes, described in the Box on this page, were chosen according to a quick categorisation of the findings of the working groups in the '*Environmental Services and Payment for Environmental Services*' session, particularly the responses to the question *'What are the needs of your community to maintain the forest?'*. When grouping the responses, four broad themes emerged that merited further discussion. These were *Rights and Public Policy; Land Management and Sustainable Production; Participation and Training* and *Compensation Schemes for Environmental Services*. To these, the workshop organizers added the theme of *Monitoring and Credibility*, on the understanding that this is of fundamental importance to the issue of demand for environmental services, and is not prioritized by those on the supply side. The Box displays the issues drawn from the session on PES, grouped under the five themes, which were then discussed by the working groups.

Themes for the discussion of Payments for Ecosystem Services

Rights and Public Policy
– Human rights
– Land issues: Rights and security of property
– Recognition of traditional populations
– State provided services
– "Florestania" — Forest-citizenship
– Environmental legislation

Land Management and Sustainable Production
– Technical knowledge
– Valuing projects
– Production without degradation
– Productive income-generating alternatives
– Technological advances

Participation and Training
– Participation
– 'Life plans'
– Capacity building
– Social Organisation

Compensation schemes for Environmental Services
– Mechanisms for distributing benefits
– Managing compensation schemes

Monitoring and Credibility
– How to guarantee that services will be provided?
– How should this be monitored?
– Who should do the monitoring?

For each theme analysed, the groups were asked to identify risks and warning signs that should be taken into consideration in the elaboration of schemes for PES. They were also asked to identify recommendations and guidelines that should be taken into account in the design of these schemes. Finally, they were asked what type of studies and further questioning were needed for the development of schemes for payment of environmental services.

Findings

The most significant findings from the working groups on each of the five themes for the development of schemes for PES are related below.

Land Management and Sustainable Production

Warning signs and risks
- Income from land should not be in the form of money payments. It should be channelled into a system of diverse production. The community should be the direct beneficiary of project results
- A lack of market for products

Recommendations for PES schemes
- Forms of production should be focused on land management and should show respect for people's traditions.
- Incentives for the introduction of 'Pedagogy of alternation': a programme that trains specialists who want to find solutions to local level problems and who value traditional knowledge
- Payments should not be in the form of money. Income should be used to bring solutions to communities, build up capacity, and provide infrastructure. It should also be used to support health and education projects, etc
- Payments should be made so that all resources are channelled to the benefit of the community.
- Training so as to be able to get involved with the 'economy with solidarity' movement, and education for sustainable consumption

Questions for further discussion
- What will the project do to guarantee that there is an education model in place that allows forest people to really achieve sustainable development?
- What will the project offer as alternatives to PES?
- What will be done to avoid project spending getting diverted (with resources being spent on activities that do not directly benefit communities)?
- What will the project do to guarantee products are marketed at a fair price?

Compensation Schemes for Environmental Services

Warning signs and risks
- The scheme (a fund or other mechanism) fails to provide entry points that are adapted for its intended beneficiaries. 'Treating those who are not equal as equals, perpetuates inequality' Paulo Freire
- Intermediaries are gaining more benefits than the guardians of the forest
- The mechanism promotes activities that are not sustainable or that have perverse impacts that are contrary to a harmonious relationship with nature.
- The mechanism creates dependency and does not promote self-sufficiency.

Recommendations for PES schemes
- The scheme should be clear and accountable in its implementation and management. Everyone must know the rules and the conditions that are applied. The scheme should be designed, managed and implemented in a participatory way and adapted/ adaptable to each local context.
- As well as being efficient, it should provide a real incentive to maintain or recuperate the service.
- It should permit/provide incentives for communities and indigenous peoples to organize themselves
- Resources should not be used as a substitute for government commitments. They should be used to strengthen communities' autonomy and self-sufficiency.
- All beneficiaries should pay, and all guardians should receive benefits. It is important to guarantee equality in the distribution of benefits amongst service providers.

Questions for further discussion
- What is well-being/quality of life for each community/ indigenous group in each situation?
- What is the ethical and cultural reality of each community?
- What are the characteristics of a scheme that will be adaptable to different contexts (robustness, flexibility, accountability)?
- How do you provide incentives for existing sustainable traditional practices, whilst also allowing for innovation without causing damage?

Public Policy and Rights

Risks
- Public policy designed without participation or oversight by those who will be affected.

Issues raised about the theme
- PES schemes need a lot of information. It will be necessary to define clearly which environmental services the project will focus on.
- Opportunity for projects related to PES to support the social struggle of indigenous people and to guarantee their rights.

Guidelines for PES schemes
– Public policy should resolve issues such as territorial and cultural rights as a prerequisite for the implementation of PES projects.
– PES should not repeat the governments' failures to fulfil its responsibilities.
– Public policy should take both sides of the relationship into account: providers and beneficiaries.
– The governance of PES projects should link up the rights of each social group to public policy.
– Recognising that knowledge can be interpreted in different ways, it will be necessary to learn alternative ways of thinking that are based on different values and motives, so as to understand how best to compensate and distribute resources to different social groups (indigenous people, riparian people, settlers, those engaged in extractive activity).
– Concern with the definition of concepts and indigenous culture. There is a need for an exchange of learning and for joined up thinking to bring about conservation.
– Suggestion of creating a network to generate discussion and understanding of PES amongst organisations across Amazonia.

Questions for further discussion
– How to develop communication processes that will ensure forest people are involved in the discussion of these themes?
– How to work with the question of ethics in the PES projects?
– PES could result in governments taking greater or lesser responsibility in relation to communities?
– How to deal with issues of long-term engagement and perverse incentives of PES projects?

Participation and Training

Warning signs and risks
– Often these [PES] processes do not have real participation. It is just a formality, and not a real commitment to the people. It ends up being an imposition based on the mentality of the person that makes the invitation and persuades people to get involved.
– Participation does not happen when there is inequality, a lack of trust, or disrespect.
– Participatory methods may be imposed as a subtle pretext for manipulation. Participation will not be amongst equals, because of the two different types of knowledge (traditional and scientific), which may be either subjective or objective (for example reticence vs. type of knowledge).
– Passive participation that does not generate commitment versus the type of participation that gradually creates commitment. We may not be able to identify which type of participation is occurring.
– Academic knowledge is valued, and traditional knowledge is not. It happens that there is still a type of self-denial of traditional knowledge. When there is inequality of knowledge, only one type is valued.

Recommendations for PES mechanisms
– There is a need for participation that is deliberative and inclusive. Both participation and the whole process should be inclusive.
– Social movements' participation works when they have the ability to mobilize people, negotiate, implement and evaluate.
– Participation requires confidence.
– Participation makes sense when there is social organisation, and the society is held together by bonds of trust.
– Participation only works when there is real bargaining power that allows for negotiation to happen.
– Capacity will be built when there is dialogue between academic and traditional knowledge. We need training processes that lead to an exchange of learning (between academic and traditional knowledge) and that generate strategic alliances.

Monitoring and Credibility

Risks and warning signs
– There is a risk that the wrong people will be disadvantaged (ie the community) as a result of unforeseen consequences like fires and land invasions.

Recommendations for PES schemes
– PES schemes should take different services into account (carbon, animals, climate, rainfall).
– Monitoring processes should establish different levels of agreement between beneficiaries and others involved (governments, purchasers, beneficiaries, third party certification)
– Monitoring should provide certainty that the services are bringing about the desired conservation results, through clear rules stipulated in the contract.
– From the start, there should be monitoring of social issues within the communities involved.
– Monitoring should be carried out in situ by the service providers: for example, indigenous environmental agents, and community agents.

– Monitoring will require equipment (GPS, maps & computers) and training that respects traditional knowledge.
– Monitoring should also be carried out within purchasing firms to guarantee that they are fulfilling their own roles (such as reducing emissions).
– It will be necessary to create a committee to discuss and evaluate the PES monitoring.
– Different levels of monitoring should be established for different types of benefits.

Questions for further discussion
– Monitoring of selective deforestation.
– Improvement of monitoring techniques.
– Development of systems to monitor commitments made by the buyers of PES.

NEXT STEPS

The pilot-project 'Valuing Rainforests as Global Eco-utilities', as discussed in the introduction to this document, aims to build an interdisciplinary team for the exchange of knowledge on Amazonian ecology, climate, and hydrology, and the ecosystem services that the forest provides to society. It will analyse the options through which communities could be compensated for maintaining the forest. An initial workshop was held in April, as were working meetings to define various issues related to the development of the project outline. More recently, two further workshops were held: the one described here with community members in Manaus; and another held in Medellin, Colombia, with scientists specialising in the Andean region.

The next steps that are proposed for this pilot project are related to the design of the project, taking into consideration all the information gathered during 2009, particularly the 'questions for further discussion', and submitting the project to the British Government's ESPA fund when the call is announced. It is hoped that the call will have been published by December 2009 or January 2010, and we will be able to adapt the project concept to the ESPA call. If the project is approved, the coordination team would like to invite all the Workshop participants to share knowledge and experience of Payment for Environmental Services, so as to set up a network to help develop PES schemes that go beyond carbon for the Amazonian/Andean region. The project coordination team has made the following commitments to every workshop participant:

– To send them the Workshop report along with copies of the presentations.
– To send them the Project proposal and receive feedback so as to improve it.
– To develop an ethics proposal for the Project based on the discussions that took place during the workshop.
– To keep them informed as to the progress of the Project.

WORKSHOP EVALUATION

Due to the early finishing of the workshop, it was not possible to carry out a complete evaluation of the workshop. Instead, the organisation team decided to gather general impressions from the participants through a 'satisfaction matrix' relating to a few key criteria:
– Process: facilitation, working groups and participation
– Content: agenda, content and findings
– Atmosphere: relationships and environment

Each person was given stickers to place on a poster according to their level of satisfaction (good, average, unsatisfactory) for each of the criteria shown above. Only 20 people did this (half the total number of participants) as can be seen in the summary table below:

CRITERIA	☺	AVERAGE	☹
Process	7	13	0
Content	7	13	0
Atmosphere	14	6	0

The aim of the workshop was to bring together community representatives, researchers, and technicians in order to exchange knowledge and experiences of ecosystem or environmental services as well as PES schemes. The idea was to better understand what communities are seeking by getting involved in PES schemes, and to start to understand their concerns about such schemes. This information would be useful in preparing a proposal for a project that could help to address these desires and concerns.

Several participants said that this was the first time that such a diverse group of people from across Amazonia had been brought together to share their experiences on the theme of environmental services.

As can be seen in the evaluation matrix above, the participants were happy with the relationships that were established during the workshop. Also, the Instituto de Permacultura da Amazonia provided a very good environment for the participants' discussions and interactions. The participants were satisfied with the workshop processes and content, although there is scope for improvement. Areas for improvement seem to relate primarily to the lack of information provided to participants in advance of the workshop. Although the meeting was organized within a short timeframe, the lack of information about the workshop could have been addressed via e-mail and perhaps through the creation of a dedicated website where documents and information could be posted regularly to keep people updated.

Several people also felt that the 'project' that will be designed based on the results of the workshop had not been fully explained to them. Again, more information in advance of the workshop and at the start would have been very helpful for participants to understand the aims of the event.

Despite the improvements needed on these issues, the workshop produced a very rich discussion and a set of guidelines, recommendations, and issues for further consideration that can be used by all participants in their own areas of interest.

SUMMARY OF WORKSHOP FINDINGS

The information generated in the workshop is summarised below, according to the findings discussed in earlier sections of this report. They are grouped under the following themes: Understanding Environmental Services and Payment for Environmental Services (PES); Needs for forest communities' well-being (so as to understand communities' perceptions of well-being and quality of life); and Communities' needs for conservation of the forests, which summarises communities' perceptions on actions needed for the continued provision of environmental services from their forests.

Understanding Environmental Services and Payment for Environmental Services (PES)

Environmental Services are understood by community leaders as resulting from all the interaction that goes on in the forest; reflected in food, biodiversity, water etc. These leaders also understand that Environmental Services provided by community forest conservation have an impact on the quality of life of the planet's populations and as such, these beneficiaries should be paying for the services provided, as a way of maintaining the forest and its services.

Needs for forest communities' well-being

1. The communities want to have leadership and ownership of everything that is related to their own development: participating in decision-making, strengthening their organisations, and having access to information.
2. Communities see health and education as priority issues for their development and well-being.
3. Communities believe territorial guarantees and land tenure regularisation to be fundamental, as well as land management based on development plans elaborated by communities.
4. Income generation based on sustainable productive activities is considered to be of fundamental importance for a life with dignity. This also requires knowledge and appropriate technology, production infrastructure, access to financial resources such as facilitated credit, technical assistance and training adapted to community reality.

Communities' needs for conservation of the forests

1. Incentives for sustainable production were considered fundamental for the maintenance of the forest. These include government policy on fiscal and financial incentives, technical assistance and training adapted to the community context. They also involve the development of technology appropriate to the economic and social context of the forests, infrastructure and access to markets.
2. Compensation for Environmental Services should promote improvements in living conditions in the form of social policies and services oriented towards education, health and social organisation within the communities that are providing environmental services.
3. Compensation for Environmental Services should strengthen rights over territory for the people who live in the forest, as well as strengthening their capacity and autonomy in the management of these territories.

Recommendations for the development of PES schemes

1. Public policy should provide solutions to the issues

of territorial and cultural rights as a prerequisite for the implementation of PES projects.

2 The benefits received from PES should not repeat governments' failure to fulfil their responsibilities to communities, particularly in relation to health and education.
3 PES project interventions should be based on respect for communities' rights and traditions.
4 PES projects should be designed and implemented through a process of empowered and deliberative participation with the communities that will provide services.
5 Mechanisms for the distribution of benefits from PES should be clear, accountable, and adapted to the different realities of the people providing services.
6 Benefits coming out of PES should be channelled towards the social and economic development of communities that are providing services in a way that is compatible with environmental sustainability, so that
   – All benefits are channelled back to the communities that provided the services in an egalitarian and fair manner. They should not just be based on payment for services, but should be used for investment and services;
   – Investments are focused on land management and sustainable production and should be used for productive infrastructure, technical assistance, training based on exchange of learning and access to fair markets.
   – They provide an incentive for and strengthen autonomous community organisation, as well as increasing ability to influence policy.
7 Monitoring of results from PES schemes should take into account environmental factors (in relation to environmental services provided) as well as economic and social factors (related to community development).
8 Monitoring should cover all of those involved in the PES scheme (communities, governments, NGOs, companies). Communities should be trained to undertake monitoring of their own commitments to the PES project.

CONCLUSIONS

This section is given over to participants' and workshop organizers' opinions and conclusions. We would like to draw attention to the qualitative issues that were raised during discussions and presentations that were not written up by working groups. We would like to invite all participants to add any outstanding findings they believe to be important and relevant from the two days' discussions at the Manaus workshop, as a type of qualitative record of the event. There were four warnings and concerns about public policies on payments for environmental services:

1 That public policy has not been adequately submitted for consultation with indigenous communities, particularly in Peru and Ecuador.
2 That PES policies could absolve governments of their legal responsibilities to provide services for their citizens. PES should be additional to government commitments, not an excuse for being relieved of them.
3 The possibility of perverse incentives and negative consequences of PES projects and policies, even if they are based on good intentions. For instance, cash payments could create a culture of dependence.
4 The possibility that PES could be used by governments and companies to give small sums to local communities whilst these same governments and companies benefit from contracts that exploit the communities.

As a safeguard against these concerns, a rights-based approach in the design of PES projects and policies was felt to be critical. Land rights are absolutely critical for guaranteeing that PES will both get off the ground, and be viable. Strong opinions were raised about REDD/PES from indigenous community representatives about the importance of sovereignty over land use and territoriality. This is especially important considering that governments could be the intermediary for global financial flows to local communities.

Community representatives have emphasized a preference for PES/REDD revenues to be channelled to communities in the form of policies and benefits that allow for improvements in community quality of life, rather than periodic money payments to service providers. Such benefit sharing mechanisms demand governance structures that are closer to communities, such as state (sub-national) governments and civil society organisations, in order to provide services and capital flows to the community service providers.

Social movement representatives questioned the type of partnership that would be established with scientists/researchers within the ESPA project. They were concerned with the need to build a relationship based on trust, as well as the level and type of participation for movement leaders and community members. One decision from the workshop was that ethical

guidelines would be drawn up for the project to help to guide the working relationships between scientists/researchers/activists and community representatives during the proposed future project.

One important result of the meeting that ought to be emphasized is the proposed creation of a network amongst Amazon leaders around PES and REDD. A concrete suggestion would be to construct a regional PES working group by email to exchange ideas and experiences of PES from the perspective of different countries.

ACKNOWLEDGEMENTS

The organisers of the workshop would like to thank all those who gave up their time and contributed their knowledge and experience to make the workshop a success. Many people travelled great distances from remote locations to attend the workshop.

We would particularly like to thank GTA and CNS members who spent a week away from their families to attend a week of meetings at the Permaculture Centre. We would also like to thank a number of people without whose help, skill and dedication; this event would not have been possible.

First of all, we thank Ali Sharif and Eldany Souza of the Instituto Permacultura da Amazônia (IPA), and Carlos Miller of AVINA for making the IPA available for the workshop, and for hosting everybody in such a beautiful and inspiring setting. We are extremely grateful to Kátia de Souza, who coordinated the logistics for the meeting with efficiency and great patience. Wendy-Lin Bartels and Fernanda Gebara Abifadel provided their knowledge of PES schemes as well as their skills and time to help facilitate the meeting. Their help was invaluable.

ANNEX

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04

Oficina compartilhando conhecimentos e experiências em pagamentos por serviços ambientais (PSA).

17–18 de Setembro de 2009
Instituto de Permacultura da Amazônia (IPA), Manaus

Local: Manaus,
Instituto de Permacultura da Amazônia
Data: 17 e 18 de Setembro de 2009

Organização e Facilitação

Luis Meneses (GTA), Mandar Trivedi (GCP), Muriel Saragoussi (GTA), Wendy Lin Bartels (Universidade da Florida) e Maria Fernanda Gebara (OCFT)

Participantes

Um total de 41 pessoas participaram da oficina como pode ser visto ao final deste capítulo: 19 pessoas representantes de comunidades sendo 12 pessoas ligadas a rede GTA e ao CNS e mais 7 liderancas indígenas e 22 pessoas entre pesquisadores e pessoas ligadas a ONGs (14 pesquisadores e 8 ONGs). Do total, 20 pessoas eram brasileiros, 13 de países amazônicos (Colômbia, Equador, Guiana Inglesa e Peru), 6 da Europa e 2 dos Estados Unidos.

INTRODUÇÃO

O desmatamento e as mudanças climáticas ameaçam as florestas, os meios de subsistência e a segurança alimentar das comunidades que vivem nelas. Povos e Comunidades das Florestas são geralmente os melhores manejadores das florestas, mas têm recebido pouco reconhecimento por seu papel.

Mecanismos e regimes de PSA visam ao reconhecimento e ao pagamento pelos serviços ecossistêmicos prestados à sociedade, como resultado das atividades de manejo florestal e de conservação do ecossistema. No entanto, mecanismos e regimes de PSA ainda possuem resultados inconclusivos quanto a real efetividade dos mesmos.

Nesse sentido, este projeto priorizou a realização de uma oficina com representantes de organizações de base e de comunidades, além de organizações não governamentais e cientistas a fim de proporcionar um fórum para o intercâmbio de experiências, idéias e soluções para mecanismos de PSA que auxiliem na concepção e concretização do projeto, assim como auxilie no aumento do conhecimento dos representantes das comunidades em relação a PSA.

Nos próximos meses, a equipe pretende construir propostas para um projeto de 4 ou 5 anos que visa explorar e valorar os mecanismos e regimes disponíveis para compensar comunidades e grupos que colaboram para a prestação dos serviços vitais oriundos da floresta. O projeto terá como foco unir conhecimentos científicos com conhecimentos tradicionais e indígenas visando a construção de um modelo cientifico sustentável e a criação de práticas institucionalizadas implementadas através de uma cooperação entre cientistas naturais, economistas e comunidades da floresta.

OBJETIVOS DA OFICINA

– Ser um espaço onde representantes de comunidades e pesquisadores tenham a chance de conversar e trocar idéias sobre mecanismos de PSA, objetivando o desenvolvimento de elementos e ferramentas para a construção de regimes efetivos e igualitários de compensação por serviços ambientais;
– Ter conhecimento sobre as idéias e conceitos que orientam o projeto;
– Compreender conceitos e possibilidades de Serviços Ambientais e PSA e como eles podem contribuir com o bem estar e desenvolvimento das comunidades, assim como para a conservação da floresta;
– Obter a contribuição dos representantes de comunidades para o desenho do projeto, propondo orientações e diretrizes para os mecanismos de PSA;
– Compreender os próximos passos e oportunidades do projeto.

PROGRAMAÇÃO DA OFICINA

Dia 1. Quinta 17

– Boas vindas
– Apresentação dos participantes
– Levantamento de expectativas da oficina
– Esclarecimentos sobre o Projeto de Valorização das Florestas Tropicais como Eco-Utilidade Global
– Objetivos da Oficina
– Serviços Ambientais e Pagamentos por Serviços Ambientais – Conceitos e Trabalhos de Grupo: entendimento sobre PSA e necessidades de desenvolvimento das comunidades e conservação da floresta.
– Experiências existentes em PSA na Amazônia Brasileira: *Bolsa Floresta*

Dia 2. Sexta 18

– Experiências existentes em PSA na Amazônia Brasileira: Pro Ambiente, Programa de Subsidio da Borracha e *Bolsa Floresta*
– Orientações e Diretrizes para mecanismos de PSA: Trabalhos de Grupo
– Apresentação sobre Comunidades Catalíticas – Plataforma de comunicação Wiser Earth para comunidades
– Oportunidades e Próximos Passos
– Avaliação da Oficina
– Encerramento

APRESENTAÇÕES REALIZADAS

Foram realizadas durante a oficina 8 apresentações:

Apresentação 1 e 2
Esclarecimentos sobre o Projeto de Valorização das Florestas Tropicais como Eco-utilidade Global (uma por Mandar Trivedi e outra por Andrew Mitchell, Programa Global Canopy)

Apresentação 3
Pagamentos para Serviços Ecossistêmicos: Sustentabilidade, Justiça e Eficiência (por Joshua Farley, Universidade de Vermont)

Apresentação 4
Acompanhamento do Programa *Bolsa Floresta* do Estado do Amazonas (por Aginaldo Queiroz, Rede GTA)

Apresentação 5
Análise do Programa *Bolsa Floresta* na Reserva de Desenvolvimento Sustentável do Juma (por Maria Fernanda Gebara, Oxford Centre for Tropical Forests)

Apresentação 6
Programa PRÓ-AMBIENTE (por Wendy Lin Bartels, Universidade da Florida)

Apresentação 7
Política de Preços Mínimos para Produtos da Sociobiodiversidade (por Manuel Cunha, CNS)

Apresentação 8
Comunidades Catalisadoras e a Ferramenta de Comunicação WiserEarth (por Theresa Williamson, ComCat)

RESULTADOS DA OFICINA

Levantamento de expectativas

Para a sessão de "Levantamento de Expectativas" e de "Discussão sobre Serviços Ambientais e PSA", foram divididos em 5 grupos de trabalho seguindo o critério de idioma (um grupo de língua inglesa, outra de língua portuguesa e 3 grupos de língua portuguesa), estes três últimos grupos foram subdivididos de maneira heterogênea. Como procedimento foram sugeridas duas perguntas para que os grupos respondessem e posteriormente apresentassem à plenária:

1 Por que você está aqui?
2 O que espera levar desta oficina?

As expectativas elaboradas por cada grupo de trabalho estão agrupadas em categorias mais amplas abaixo:

Por que você está aqui?

1 Convite realizado à Organização
2 Interesse em aprender sobre PSA e replicar o conhecimento junto às suas organizações e/ou trabalho
3 Interesse em compartilhar, compreender, debater e desenvolver conceitos e temas relacionados a PSA e sua relação com comunidades da floresta.
4 Fortalecer alianças para desenvolvimento de mecanismos de PSA

O que você espera levar da oficina?

1 Capacidade para desenvolvimento de projetos de PSA
2 Conceitos discutidos e desenvolvidos que garantam benefícios para as comunidades da floresta
3 Compartilhamento de informação
4 Alinhamento do projeto ESPA com a perspectiva e necessidades das comunidades
5 Aprendizado que auxilie processos políticos em suas bases
6 Estabelecimento de alianças entre as organizações

Serviços ambientais e pagamentos por serviços ambientais

Após a apresentação de Joshua Farley sobre Serviços Ambientais e Pagamentos por Serviços Ambientais, cujo objetivo era nivelar os participantes quanto aos conceitos e o escopo de possibilidades relacionadas a serviços ambientais e PSA, foi realizada uma sessão dos mesmos 5 grupos de trabalho que teve como propósito

levantar os conceitos que os participantes possuem sobre PSA e as experiências de PSA conhecidas pelos mesmos, além de colher dos representantes das organizações comunitárias suas compreensões em relação as necessidades de bem estar das comunidades e para a conservação das florestas.

Foram fornecidas 4 perguntas orientadoras para cada grupo de trabalho:

– *Qual seu entendimento sobre pagamentos por serviços ambientais?*
– *Quais as necessidades de sua comunidade para conservar a floresta em pé?*
– *Complete a sentença: A fim de minha comunidade ter suas necessidades atendidas, nós precisamos de...*
– *Qual exemplo de PSA você conhece?*

As respostas dos grupos não seguiram todas as perguntas e estão sistematizadas abaixo.

Qual o seu entendimento sobre Pagamentos por Serviços Ambientais?

Definições

– Manutenção de um serviço
– Uma tarefa, um compromisso ativo
– São trabalhados em nossos projetos. A sustentabilidade da família ribeirinha. Manejo Florestal.
– Criar mecanismo para a floresta ficar em pé.
– É o que garante a manutenção do modo de vida protegendo a floresta e beneficiando a comunidade, as pessoas e os ecossistemas de outras regiões.
– Importância da floresta no equilíbrio do planeta. Comunidades são responsáveis por manter a floresta em pé e isso é um serviço.
– Se a gente possibilita que a sociedade mundial possa viver melhor por causa de nós preservando aquela floresta, então isso é um serviço. Quem se beneficia deste serviço paga a gente por isso.
– Serviço Ambiental é toda interação que existe na floresta (Alimento x Animais x Biodiversidade).
– Precisa olhar os serviços visíveis e invisíveis (carbono é visível e ar é invisível)
– Reconhecimento legal dos direitos das populações tradicionais a essa compensação.
– Pagamento através do mercado de carbono para REDD.
– Crédito ambiental remunerado para uma ação que é remunerada.
– Serviços ambientais por hectare de floresta (unidade).
– Remuneração dos resultados das formas de uso da Natureza.
– Pagar não se resume ao dinheiro.
– Sempre estivemos na floresta conservando-a, mas não é um serviço para outros. Deve funcionar sobre a base da segurança territorial no contexto local.
– PSA não é presente é algo que necessita de lobby

Questionamentos e consideracoes sobre PSA

– É pagamento para fazer alguma coisa ou não fazer nada?
– Como definimos recursos e movemos para o conceito de uso sustentável?
– Diferença de valores do que é importante para quem mora na floresta. PSA não pode ser "esmola". Não podemos ser mendigos
– Pagar só um elemento do conjunto é empobrecer o conjunto.
– Tem que ter investimento na capacidade de sustentação das famílias: educação, proteção dos seres vivos, Saúde, Água.
– Governo criar incentivos para manter a floresta e o povo que nela vive. Isto envolve Educação.
– Valorizar os produtos da floresta. Precisa fazer estudo do que temos.
– É preciso conhecer o potencial da floresta. Para mudar a realidade tem que repassar conhecimento. Tem que discutir as especificidades.
– O entendimento dos indígenas é um, dos ribeirinhos e extrativistas é outro. Precisamos fazer as discussões em separado, para depois nos reunirmos e tirar propostas conjuntas. Cada comunidade pensa diferente.
– Esta discussão não existe no Peru. Os indígenas perguntam porque irão nos pagar por isso? O querem em troca?
– É um conto que tende a se transformar em outro boom (não gosto do tema: serviços = servidão)
– Pensar que fazemos com o que temos, que se pode lançar ao mercado e muitos projetos no futuro.
– É um problema do desenvolvimento global. O bolo são os serviços ambientais e a prioridade é o exercício dos direitos coletivos. Os recursos são apropriados por outros (turismo, madeireiras,..) mesmo que os índios tenham os títulos
– Se for pagar, tem que ser um pagamento que recompensa. Algo que a pessoa terá orgulho de receber aquilo
– PSA precisam de ter uma linha de base para monitorar o serviço prestado

Quais as necessidades de sua comunidade para conservar a floresta em pé?

Em relação às necessidades apontadas pelas comunidades para manutenção da floresta em pé, 5 condições, analisadas abaixo, foram consideradas como prioritárias:

1 incentivos econômicos a produção sustentável;
2 prestação de serviços sociais e desenvolvimento de políticas públicas;
3 apoio financeiro e legal que favoreça atividades sustentáveis;
4 identificação da demanda e oferta dos serviços ambientais;
5 garantia do direito territorial e soberania das comunidades em relação ao uso da terra.

Alguns pontos foram colocados como questões em aberto relativas às condições enumeradas acima, tais como: aspectos culturais da comunidade em relação à dinâmica de desmatamento e uso da terra; necessidade de criar um mecanismo que ofereça clareza acerca da importância do meio ambiente junto aos governos locais, para não permitir atividades que prejudiquem a floresta e proporcionem o desmatamento; e garantia de desenvolvimento social.

Incentivos a Producao
– Políticas governamentais que estejam voltadas a estudos sobre o potencial da floresta, de proteção dos recursos naturais e incentivos fiscais a produção da floresta.
– Valorizar mais o extrativismo e seus produtos.
– O pagamento deve ser por produção.
– Dar valor aos produtos da floresta.
– Fazer o estudo do potencial econômico existente na floresta
– Criar uma política de preços justos para os produtos da floresta. Tem que ter mercado.
– Necessário ter assistência técnica para valorizar os produtos da floresta.
– Avanços tecnológicos.
– Realizar capacitação para os membros da comunidade, mostrando como retirar a riqueza da floresta, sem a necessidade de degradá-la.

Servicos e Políticas Sociais
– Criar políticas públicas voltadas para a necessidade da comunidade.
– Compensação para melhorias na condição de vida na forma de políticas públicas.
– Fazer um planejamento, um plano de vida a partir realidade da própria comunidade para evitar que aquilo que vem de fora destrua a floresta. Temos que casar o conhecimento técnico com o saber tradicional.
– Necessidades de serviços, mas dinheiro no bolso não faz mal a ninguém.
– Incentivar e realizar cursos e ações que garantam a sustentabilidade.
– A necessidade é o preço da cidadania: educação como há na cidade mas adequada à cultura de cada povo, acesso à saúde.
– Investimento pesado em educação.
– Valorizar as organizações de base.
– Capacidade de desenvolvimento econômico sem colocar em risco a biodiversidade.
– Não pode repetir o modelo de desenvolvimento que já deu errado.
– Pobreza vem da ausência do estado. Por exemplo, não há necessidade de comida.

Apoio Financeiro e Legal
– Falta apoio financeiro e legal para desenvolver inventários locais e planos de desenvolvimento sustentável locais
– Apoio e estrutura legal e financeira
– Legislação nova e melhorada
– Necessidade de vestir como o resto da sociedade, a sociedade te "obriga" a essas necessidades, daí a necessidade do dinheiro.
– A solução não é repasse de recursos. Precisamos receber compensação dentro de um programa integrado de desenvolvimento que traga transformação social usando o conhecimento gerado, a massa crítica da população.
– Excluir os picaretas do mercado e da intermediação.

Indentificacao de Demanda e Oferta
– Ponte e fluxo de duas vias entre necessidades das comunidades e necessidades de pessoas de fora

Garantia do Território
– Controle de território
– Ter um sistema de administração dos recursos
– Ter um plano de vida e autogoverno

Dúvidas Quanto ao Sentido das Colocações Abaixo
– Comunidade não desmatando (não é sua cultura) ??
– Com ou sem necessidades atendidas comunidades já mantêm as florestas.
– Criar mecanismo que ofereça clareza a cerca da importância do meio ambiente junto aos governantes, para não permitir a entrada de empresas que prejudicam a floresta.
– Não existe visão de desenvolvimento amazônico

A fim de minha comunidade ter suas necessidades atendidas, nós precisamos de...

Conhecimento e Technologia
– Universidades trabalhando com estudantes locais

– Contato com o mundo, internet e tecnologia digital.
– Melhorar o processo produtivo

Saude e Educacao
– Programas de saúde e educação e aprendizagem com base na ciência

Protagonismo e Participacao
– Apropriação pelas comunidades
– Desburocratização (quanto menos o governo estiver envolvido melhor gestão própria)
– Oportunidade e organização.
– Poder fazer por si próprio.
– Intercâmbios entre as populações tradicionais do mundo.
– Recursos para se organizar, realizar os estudos.
– Manutenção do seu modo de vida.
– Participação em espaços públicos de tomada de decisões.
– Comunidade precisa de mais conhecimentos sobre seus direitos para cobrar dos governantes.

Recursos Financeiros e Crédito
– Necessidade de um banco local com fundo para pagamentos e micro crédito
– Agência financiadora para prover empréstimos a baixo custo
– Mecanismos para apoio ao desenvolvimento comunitário
– Crédito associado á produção sustentável.
– Acesso ao crédito facilitado (microcrédito).
– Melhorar o entendimento sobre a economia solidária.
– Incentivo.
– Investimentos.
– Não precisa de esmola mas de crédito.
– Minha comunidade precisa de apoio financeiro para trabalhar a gestão da sua terra.

Regularização o Fundiária e Gestão de Território
– Regularização fundiária.
– Precisa de plano de gestão e apoio para a implementação do plano.
– Segurança territorial
– Governo (auto governo?)
– Plano de Vida

Assistencia Tecnica e Capacitacao
– Sistema de assistência técnica.
– Capacitação e treinamento.
– Capacitação para os membros da comunidade, mostrando como retirar a riqueza da floresta, sem a necessidade de degradá-la.
– Educação.
– Capacitação da comunidade em legislação ambiental.

Infraestrutura
– Infraestrutura para produção extrativista.
– Infraestrutura.
– Energia elétrica.

Qual exemplo de PSA você conhece?
– Guiana: Taxas sobre o uso da floresta
– Guiana: Experiência de turismo da Canopy Walk: agência de turismo, empresa local e comunidade indígena, replicação de negócio local e treinamento de guias
– Guiana: Experiência de fábrica de pasta de amendoim e empresa madeireira (treinamento)
– Guiana: Experiência do PNUD para erradicação da pobreza e depois de 2 anos desapareceu como nas cachoeiras do rio Potaro (President: Low Carbon Development Strategy) (?)
– Equador: Comunidade do vale paga comunidade da montanha para preservar a Água (moradores da cidade: Prefeitura).
– Equador, Projeto SocioBosque: Projeto de 2 milhões de hectares criado pelo povo Schuar e o Governo se apropriou, tornando-se um plano de desenvolvimento convencional e chamam de REDD
– Peru – Reserva Comunal: estado e indígenas. A comunidade não sabe o que quer, porque não sabe o que tem. Todos os projetos fracassaram. Só o café teve sucesso, porque já existia antes.
– Costa Rica: Governo paga proprietário pelo aumento da floresta (Resultados quantificados).
– IPAM, Brasil: Trabalhadores rurais recebem da cidade pela recuperação das matas ciliares.
– Pró-Ambiente, Brasil: Pagamento pela mudança da gestão da propriedade e proteção do ambiente (Nasceu da proposta dos movimentos de agricultores e virou uma tímida política pública).
– Município Manacapuru, Amazonas: Prefeitura pagava há 12 anos 62 famílias para preservar a RDS do Piranha, (Fiscalização, Limpeza, Proteção dos lagos) – (Projeto suspenso há 1 mês).
– *Bolsa Floresta*, Amazonas: Deturpada a política estadual não a idéia.
– Rondônia, Brasil: O carbono do Povo Surui, que está sendo desenvolvido na terra indígena 7 de setembro.

Orientações e diretrizes para projetos de PSA

Esta é a principal sessão da Oficina uma vez que teve por objetivo identificar orientações e diretrizes que devem ser considerados no desenvolvimento de mecanismos de PSA a fim de beneficiar as comunidades da floresta.

Esta discussão não pretendeu exaurir o debate sobre orientações e diretrizes, mas consistiu na determinação de primeiros passos que deverão ser observados na elaboração de projetos associados a este tema.

A aplicação destas orientações e diretrizes será levada em conta no novo projeto a ser apresentado ao Projeto ESPA do Governo Britânico para financiamento. No entanto, compreendemos que a utilização destas orientações e diretrizes é universal a todas as organizações presentes na Oficina de Manaus que ajudaram na elaboração das mesmas, tendo aplicabilidade ampla, tanto na orientação de projetos relacionados a Pagamentos por Serviços Ambientais como no posicionamento político das organizações em relação a esses projetos. Portanto, pretende-se que este resultado coletivo seja utilizado por todos aqueles que o construíram de maneira a melhor qualificar as ações das organizações no tocante a questões associadas a serviços ambientais.

Um dos importantes resultados do workshop foi o documento de posicionamento chamado de *Pagamentos por Servicos Ambientais – Percepções de Lideranças Comunitárias da Amazônia* lançado na COP 15 pela rede GTA e CNS – duas das mais importantes organizações de representantes de comunidades na Amazônia Brasileira. O documento de posicionamente foi elaborado com base no relatório da oficina de Manaus, pois estas organizações afirmaram ser a primeira vez que um grupo diverso de lideranças comunitarias tiveram a oportunidade de debater uma visão coletiva em relação a PSA.

Procedimento utilizado

O desenvolvimento de orientações e diretrizes para projetos de PSA foi implementado em grupos de trabalho, cujos integrantes foram auto elegidos de acordo com o interesse e/ou maior afinidade em relação ao tema.

Os temas, descritos no Box da práxima página, foram selecionados a partir de uma breve sistematização dos resultados dos trabalhos de grupo na sessão "*Serviços Ambientais e Pagamentos por Serviços Ambientais*", em especial a primeira pergunta "*Quais as necessidades de sua comunidade para conservar a floresta em pé?*". A partir do agrupamento das respostas chegou-se a 4 temas mais abrangentes, para os quais seria importante o aprofundamento na discussão , são eles: *Direitos e Políticas Públicas; Gestão da Propriedade e Produção Sustentável; Participação e Capacitação* e *Formas de Compensação Pelos Serviços Ambientais*. A estes temas, a organização da oficina acrescentou um tema de *Monitoramento e Controle* por entender que este é de fundamental importância para a questão da demanda por serviços ambientais e não priorizado pelo lado da oferta dos mesmos. O Box mostra os elementos retirados da sessão sobre Pagamentos por Serviços Ambientais agrupados nos 5 temas que foram trabalhados posteriormente nos grupos.

Temas para discussão sobre Pagamentos por Serviços Ambientais (em negrito os temas e nos tópicos os elementos retirados da definição sobre PSA)

Direitos e Políticas Públicas
– Direitos humanos
– Questão fundiária: direito e segurança de propriedade
– Reconhecimento das populações tradicionais
– Serviços do Estado
– "Florestania"
– Legislação ambiental

Gestão da Propriedade e Produção Sustentável
– Conhecimento técnico
– Valorização dos projetos
– Produzir sem prejudicar
– Alternativas produtivas de renda
– Avanços tecnológicos

Participação e Capacitação
– Participação
– Plano de vida
– Capacitação
– Organização social

Formas de Compensação Pelos Serviços Ambientais
– Mecanismos de distribuição de benefícios
– Gestão das formas de compensação

Monitoramento e Credibilidade
– Como garantir que os serviços serão providos?
– Como deve ser monitorado?
– Quem deve monitorar?

Foi sugerida uma definição de *orientações e diretrizes* como sendo ferramentas e elementos para atingir os objetivos e limites éticos que um projeto deve ter, assim como regras fundamentais a serem seguidas em sua implementação. Aos grupos foi solicitado que para cada tema de análise fossem levantados alertas e riscos que deveriam ser considerados na elaboração de mecanismos de Pagamentos por Serviços Ambientais relacionados a cada tema, assim como quais orientações

e diretrizes deveriam ser levadas em conta no desenho desses mecanismos e, por último, quais estudos e processos de aprofundamento para aquele tema seriam necessários para o desenvolvimento de mecanismos de pagamentos por serviços ambientais.

Resultados

Abaixo estão relacionados os resultados de cada grupo de trabalho para os cinco temas analisados considerados importantes na elaboração de mecanismos de Pagamentos por Serviços Ambientais.

Gestão da Propriedade e Produção sustentavel

Alertas e Riscos
– Se a assistência técnica não for adequada à vocação e aos resultados, o projeto não alcançará os objetivos.
– O rendimento da propriedade não pode estar centrado no pagamento em dinheiro, precisa estar integrado a um sistema produtivo múltiplo.
– A comunidade tem que ser a beneficiária direta dos resultados do projeto.
– Falta de mercado para os produtos.

Orientações para mecanismos de PSA
– Os modos de produção devem estar enfocados na gestão da propriedade e respeitar os costumes das populações
– Incentivo à implantação do modelo da "Pedagogia da alternância", que forme técnicos com vocação para a solução dos problemas locais e que valorizem os saberes tradicionais.
– Os pagamentos não podem ser em dinheiro precisam trazer soluções para as comunidades e que gerem capacidade além de infraestrutura, assim como também apóiem de projetos de saúde, educação, etc.
– Os pagamentos devem ser efetuados de maneira que a totalidade dos recursos sejam revertidos em prol da comunidade.
– Capacitação para inclusão no movimento da economia solidária e processos educativos para consumo consciente.

Questões para aprofundamento
– O que fará o projeto para garantir um modelo de educação que leve aos povos da floresta o desenvolvimento sustentável de fato?
– O que o projeto pode oferecer como alternativas de PSA?
– Que ações serão efetivadas para evitar desvios de função, isto é que os recursos sejam gastos em atividades que não beneficiam diretamente as comunidades?
– O que fará o projeto para garantir a comercialização da produção com preço justo?

Formas de compensação por serviços ambientais

Alertas e Riscos
– O mecanismo (fundo ou outro) deve permitir portas de entradas adaptadas ao seu público. "Tratar os desiguais como iguais é perpetuar a desigualdade " Paulo Freire
– Intermediários se beneficiam mais que os guardiões.
– O mecanismo promove atividades que não são sustentáveis ou tem resultados perversos, contrários à relação harmônica com a natureza.
– O mecanismo cria dependência e não promove autonomia.

Orientações para mecanismos de PSA
– O mecanismo deve ser claro, transparente na elaboração e gestão, todos devem conhecer as regras, as condições. Ele deve ser desenhado de forma participativa, gerenciado e implementado de modo participativo e adaptado/adaptável à cada realidade.
– Além de eficiente, ele deve ser um incentivo real a manutenção do serviço ou à sua recuperação.
– Ele deve permitir/incentivar a organização das comunidades/povos e seus coletivos.
– O recurso não deve substituir as obrigações dos governos mas sim fortalecer a autonomia e a auto-suficiência das comunidades.
– Todos os beneficiários pagam, todos os guardiões recebem. Sendo importante garantir a igualdade na repartição dos benefícios entre os provedores.

Questões para aprofundamento
– O que é bem estar/qualidade de vida para cada comunidade/povo em cada situação?
– Qual é a realidade ética e cultural de cada comunidade?
– Quais são as características de um mecanismo que seja adaptável a realidades diferentes (Robustez, Flexibilidade, Transparência)?
– Como incentivar as práticas tradicionais sustentáveis existentes permitindo também inovação, mas sem ruptura?

Politicas Públicas e Direitos

Riscos
– Políticas públicas desenhadas sem participação e verificação por parte dos envolvidos.

Observações sobre o tema
– Esquemas de PSA demandam muita informação, é necessária a definição clara sobre quais são os serviços ambientais que o projeto estará enfocado.
– Oportunidade de projetos relacionados a PSA apoiarem a luta indígena e a garantia pelos direitos.

Orientações para mecanismos de PSA
– Políticas Públicas devem resolver questões como direitos territoriais e culturais como pré requisito a implementação de projetos de PSA.
– PSA não deve reiterar a omissão dos governos em relação às suas responsabilidades.
– Políticas Públicas devem considerar dois lados: dos doadores e dos beneficiários.
– A governança de projetos de PSA devem articular os direitos de cada grupo social às políticas públicas.
– Reconhecendo que interpretação de aprendizagem varia, é necessário aprender outras lógicas a partir de valores e motivações para entender como seria a melhor maneira de compensar e distribuir recursos considerando os diferentes grupos sociais (indígenas, ribeirinhos, colonos, extrativistas).
– Preocupação com a definição de conceitos e cultura indígena, necessidade de interaprendizagem e articulação para conservação.
– Sugestão de criar uma Rede para discussão e entendimento sobre PSA entre organizações em nível de Pan-Amazônia.

Questões para aprofundamento
– Como desenvolver processos de comunicação que alcance os povos da floresta na discussão destes temas?
– Como trabalhar com a questão da ética nos projetos de PSA?
– PSA podem gerar maior ou menor responsabilidade dos governos em relação às comunidades?
– Como lidar com questões de permanência e incentivos perversos em projetos de PSA?

Participacao e Capacitacao

Alertas e Riscos
– O comum são processos em que a participação não é real, é apenas uma formalidade e não um compromisso real com a população. Ocorrendo a imposição da lógica de quem convida e induz.
– Não existe participação onde existe desigualdade, falta de confiança ou desrespeito.
– Participação é uma forma sutil de manipulação. Imposição da lógica participativa é um risco e um pretexto sutil de manipulação. Pois a participação é entre desiguais por conta dos dois saberes (tradicional e cientifico) e também pode ser subjetiva ou objetiva (ex. timidez vs. tipo de conhecimento).
– Participação passiva que não gera comprometimento versus aquela que aos poucos vai gerando compromisso. O risco é a gente não ser capaz de identificar qual tipo de participação é o caso.
– Conhecimento acadêmico é valorizado e o tradicional não é. Ocorrendo ainda uma auto negação do conhecimento tradicional. Quando há desigualdade do conhecimento apenas um tipo é valorizado.

Orientações para mecanismos de PSA
– Necessita-se de participação vinculante e deliberativa. A participação e todo o processo deve ser vinculante.
– Participação dos movimentos sociais funciona quando estes detêm um poder de mobilização, negociação, execução e avaliação.
– A participação requer confiança.
– Participação tem sentido quando existe organização social. E uma sociedade está amarrada por laços de confiança.
– Participação só funciona quando existe um real poder de barganha que permite abrir negociação.
– Capacitação é quando os saberes acadêmicos e tradicionais dialogam. Necessidade de processos de capacitação que levem à Inter-aprendizagem (entre saberes acadêmicos e tradicionais) associado a alianças estratégicas.

Monitoramento e Credibildade

Alertas e Riscos
– Risco de punição de pessoas erradas (comunidade) em função de imprevistos como fogo e invasões.

Orientações para mecanismos de PSA
– Mecanismos de PSA devem considerar os diferentes serviços (carbono, animais, clima, chuvas,...).
– Os processos de monitoramento devem criar diferentes níveis de acordo com os benefícios e envolvidos (governos, compradores, beneficiários, certificadora).
– Monitoramento deve oferecer certeza de que os serviços estão causando os resultados desejados dos efeitos de conservação através de regras claras estipuladas em contrato.
– Monitoramento dos aspectos sociais da comunidade envolvida deve ocorrer desde o início.
– Necessário que o monitoramento seja realizado in loco pelos provedores do serviço. Ex: Agentes indígenas ambientais, comunitários.

– Monitoramento requer equipamentos (GPS, mapas e computadores) e capacitação com respeito ao saber tradicional.
– Monitoramento deve ser realizado também junto a empresas compradoras garantindo que estão cumprindo o papel delas (como redução de emissões em sua base).
– Necessário criar um conselho para debater e avaliar o monitoramento de PSA.
– Cria níveis diferentes de monitoramento de acordo com os benefícios.

Questões para aprofundamento
– Monitoramento do desmatamento seletivo.
– Aprimoramento de técnicas de monitoramento.
– Desenvolvimento de sistemas de monitoramento de compromissos assumidos pelos compradores de PSA.

PRÓXIMOS PASSOS

O projeto-piloto "Valorização das Florestas Tropicais como Eco-utilidade Global" conforme descrito na introdução deste documento tem como objetivo construir uma equipe interdisciplinar para o intercâmbio de conhecimentos relativos a ecologia, clima e hidrologia da Amazônia, os serviços ecossistêmicos que a floresta presta à sociedade, analisando as opções por meio das quais comunidades poderiam ser recompensadas por manter a floresta em pé. Conforme pode ser observado na linha do tempo na figura abaixo, foram realizados uma oficina inicial em abril e reuniões de trabalho para definição de vários aspectos relacionados ao desenvolvimento do conceito do projeto e, mais recentemente, duas oficinas: esta com representantes de comunidades em Manaus e outra com cientistas especializados nos Andes realizada em Medellín na Colômbia.

Os próximos passos que este projeto piloto se propõe a realizar, referem-se a elaboração do projeto, levando em consideração todos os subsídios colhidos durante o ano de 2009, em especial as "questões de aprofundamento", e a submissão do projeto ao fundo ESPA, do Governo Britânico, quando o edital for lançado. Espera-se que dezembro ou janeiro, o edital tenha sido publicado e poderemos adequar o conceito do projeto ao edital do fundo ESPA.

Caso o projeto seja aprovado, a coordenação do mesmo gostaria de convidar todos os participantes da Oficina que compartilhem conhecimentos e experiências em Pagamentos por Serviços Ambientais para constituir uma rede e ajudar a desenvolver mecanismos de PSA além do carbono (voltados a exportação de água da Amazônia para outras regiões) para a região Amazônia/Andes. A coordenação do projeto se compromete junto a cada participante desta oficina com:
– Enviar o relatório da Oficina juntamente com todas as apresentações realizadas
– Mantê-los informados quanto ao progresso do Projeto
– Enviar a proposta do Projeto e obter comentários para aperfeiçoamento da mesma
– Desenvolver uma proposta de ética para o Projeto com base nas discussões realizadas durante da oficina.

AVALIAÇÃO DA OFICINA

Em função do avanço no horário de conclusão da oficina, não foi possível realizar um processo de avaliação da oficina mais formal e completo. A organização optou por apenas colher impressões gerais dos participantes através de uma quadro de satisfação em relação a algum critérios importantes:
– Quanto ao processo: facilitação, grupos de trabalho e participação
– Quanto ao conteúdo: Agenda, conteúdo e resultados
– Quanto ao clima: relações e ambiente

A cada pessoa foi dado adesivos para que fixassem no cartaz a sua satisfação (bom, regular e insatisfatório) para cada um dos critérios mencionados acima. Apenas 20 pessoas (metade do número total de participantes responderam a avaliação) conforme pode ser visto no quadro resumo abaixo:

CRITÉRIOS	☺	REGULAR	⊗
Processo	7	13	0
Conteúdo	7	13	0
Clima	14	6	0

O propósito desta oficina foi reunir representantes comunitários juntamente com pesquisadores e técnicos a fim de fazerem um intercâmbio de conhecimentos e experiências em serviços ecossistêmicos ou ambientais,

assim como, de mecanismos de PSA. A intenção era de melhor compreender o que as comunidades estão buscando quando envolvidas em mecanismos e esquemas de PSA e de iniciar a compreensão das preocupações em relação a estes mecanisos. Estas informações seriam úteis para a elaboração de uma proposta de projeto que poderia equacionar e atender estas preocupações e desejos.

Diversos participantes disseram que esta foi a primeira vez que um grupo tão diverso de pessoas de diferentes partes da Amazônia se reuniram para compartilhar suas experiências no tema de serviços ambientais. Conforme pode ser observado na matriz de avaliação acima, os participantes ficaram satisfeitos com as relações estabelecidas durante a oficina. Também, a Instituto de Permacultura da Amazônia propiciou um ambiente de qualidade para as interações e discussões dos participantes. Os participantes ficaram também satisfeitos com os procedimentos e conteúdo da oficina, embora que haja espaço para melhorias. Questões de aperfeiçoamento parecem ser principalmente relacionadas com a falta de informações fornecidas aos participantes previamente a oficina. Embora que o encontro tenha sido organizado em pouco tempo, a falta de informação sobre oficina poderia certamente ser melhorada tanto via email e talvez, através do estabelecimento de um site dedicado a oficina onde documentos e informações seriam postados regularmente para manter pessoas atualizadas. Diversas pessoas também sentiram que o 'projeto' que será desenhado com base nos resultados da oficina não foi devidamente explicado. Novamente, mais informações fornecidas previamente a oficina e no começo da oficina seriam muito úteis para os participantes compreenderem os propósitos do encontro. Apesar destas questões que demandam melhoria e aperfeiçoamento, a oficina produziu discussões muito ricas, assim como um conjunto de diretrizes, orientações e questões para aprofundamento que poderão ser usadas pelos participantes nos seus contextos e interesses.

SUMÁRIO DOS RESULTADOS DA OFICINA

Abaixo são resumidas as informações geradas na oficina a partir dos subsídios descritos nos itens anteriores para os temas de entendimento sobre Serviços Ambientais e Pagamento por Serviços Ambientais (PSA); necessidades para o bem estar das comunidades da floresta a fim de compreender a visão das comunidades sobre bem estar e qualidade de vida e necessidades das comunidades para a conservação da floresta que resume a visão das comunidades para ações necessárias para continua provisão do serviço ambiental de suas florestas.

Entendimento sobre serviços ambientais e pagamentos por serviços ambientais (PSA)

Serviços Ambientais são compreendidos pelas lideranças como resultado de toda a interação existente na floresta expressa em alimentos, biodiversidade, água, etc. E também estas compreendem que os Serviços Ambientais promovidos pela conservação das florestas pelas comunidades tem efeito sobre a qualidade de vida das populações do planeta e, portanto, estes beneficiários devem remunerar pelo serviço prestado e como forma de manter estas florestas e seus serviços.

Necessidades para o bem estar das comunidades da floresta

1 As comunidades querem ter protagonismo e apropriação no que se refere ao seu desenvolvimento, participando da tomada de decisões, fortalecendo a sua organização e acessando informações.
2 As comunidades entendem que saúde e educação são temas prioritários para o desenvolvimento de suas comunidades e seu bem estar.
3 As comunidades consideram como fundamental a garantia sobre o território e a regularização fundiária assim como gestão destes a partir de planos de futuro desenvolvidos pelas comunidades.
4 A geração de renda a partir de atividades produtivas sustentáveis é considerada de fundamental importância para uma vida digna e requer conhecimento e tecnologia apropriadas, infraestrutura de produção, acesso a recursos financeiros como crédito facilitado e assistência técnica e capacitação adequada a realidade das comunidades.

Necessidades das comunidades para a conservação das florestas

1 Incentivos a produção sustentável foram considerados fundamentais para a manutenção da floresta em pé. Tais incentivos incluem políticas governamentais de incentivos fiscais e financeiros, assistência técnica e capacitação adequadas ao contexto das comunidades

e o desenvolvimento de tecnologias apropriadas ao contexto econômico e social das florestas, infraestrutura e acesso a mercados.
2 Compensação pelos Serviços Ambientais devem promover melhorias na condição de vida na forma de políticas e serviços sociais voltados à educação, à saúde e à organização social das comunidades que provêem o serviço ambiental.
3 Compensação pelos Serviços Ambientais devem fortalecer o direito sobre os territórios das populações que vivem na floresta, assim como a sua capacidade e autonomia na gestão destes territórios.

Orientações para o desenvolvimento de mecanismos de PSA

1 Políticas Públicas devem solucionar questões como direitos territoriais e culturais como pré requisito a implementação de projetos de PSA.
2 Os benefícios de PSA não devem reiterar a omissão dos governos em relação às suas responsabilidades junto às comunidades, principalmente em relação a educação e saúde.
3 Intervenções de projetos de PSA devem estar baseadas no respeito aos direitos e costumes das comunidades
4 Projetos de PSA devem ser elaborados e implementados a partir de um processo de participação deliberativa e empoderada das comunidades provedoras do serviço.
5 Os mecanismos de repartição de benefícios de PSA devem ser claros, transparentes, adaptável às diferentes realidades dos provedores do serviço.
6 Benefícios provenientes de PSA devem ser dirigidos ao desenvolvimento social e econômico das comunidades provedoras do serviço em consonância com a sustentabilidade ambiental, de maneira que:
   – Os benefícios sejam revertidos em sua totalidade para as comunidades provedores do serviço de forma igualitária e justa e, não sejam estruturados apenas em pagamentos para provedores do serviço mas em investimentos e serviços;
   – Investimentos tenham como foco a gestão da propriedade e a produção sustentável e sejam realizados em infraestrutura de produção, assistência técnica, capacitação com base na inter-aprendizagem e acesso a mercados justos;
   – Incentivem e fortaleçam a organização comunitária e autonomia, assim como sua capacidade de influenciar políticas.
7 O monitoramento dos resultados de mecanismos de PSA devem considerar os aspectos ambientais (quanto aos serviços ambientais prestados), econômicos e sociais (relacionados ao desenvolvimento da comunidade).
8 O monitoramento deve abordar todos os envolvidos na implantação do mecanismo de PSA (comunidades, governos, ONGs, empresas). Comunidades devem ser capacitadas para realizar o monitoramento de seus compromissos junto ao projeto de PSA.

CONCLUSÕES

Esta seção é dedicada para as opiniões e conclusões dos participantes e organizadores da oficina. Queremos enfatizar aspectos qualitativos que foram levantados durante os debates e apresentações e que não foram registrados nos grupos de trabalho. Aqui convidamos todos os participantes para adicionar os resultados que consideram importantes e relevantes destes dois dias de discussões na oficina de Manaus como uma forma de registro qualitativo. Foram quatro alertas e preocupações sobre políticas públicas para serviços ambientais:
1 O primeiro alerta é que políticas públicas não tem sido adequadamente submetidas a consultas junto a populações indígenas, principalmente no caso do Peru e Equador.
2 Uma segunda preocupação é que políticas de PSA podem absolver Governos de sua responsabilidade legal de prover serviços para seus cidadãos. PSA devem ser adicionais aos compromissos governamentais, e não uma desculpa para ser absolvidos destes compromissos.
3 O terceiro alerta é sobre a possibilidade de incentivos perversos ou conseqüências negativas de projetos e políticas de PSA, mesmo que sejam estruturadas com boa intenção. Pois, como exemplo, pagamentos em dinheiro podem criar uma cultura de dependência.
4 A quarta preocupação está associada a possibilidade que PSA pode ser usado por governos e empresas de maneira a dar quantias pequenas a comunidades enquanto que estes mesmos governos e empresas podem ser beneficiar destas comunidades com base em contratos que exploram as comunidades.

Como medida de salvaguarda e de proteção contra estas preocupações, uma abordagem baseada em direitos foi

considerada crítica durante a formulação de projetos e políticas PSA. Os direitos fundiários são absolutamente cruciais e constituem-se no mais importante direito a fim de garantir e viabilizar o contexto de PSA. Opiniões fortes foram levantadas sobre REDD/PSA por representantes das comunidades indígenas quanto a importância da soberania sobre o uso da terra e territorialidade. Especialmente quando se considera que os governos podem ser intermediários entre os fluxos financeiros globais para as comunidades locais.

Representantes das comunidades têm enfatizado a sua preferência por receitas de PSA/REDD serem canalizadas para as comunidades sob a forma de políticas e benefícios que permitam o aumento da qualidade de vida das comunidades em vez de dinheiro em pagamentos periódicos para os prestadores de serviço. Tais mecanismos de partilha de benefício exigem estruturas de governança mais próximas às comunidades, como governos estaduais (subnacionais) e organizações da sociedade civil, a fim de prestarem serviços e fluxos de capital para as comunidades provedoras do serviço. Representantes do Movimento Social questionaram o tipo de parceria que estaria sendo criada com os cientistas/pesquisadores no âmbito do projeto ESPA, preocupados com a necessidade de construir uma relação de confiança, bem como o nível e as formas de participação dos líderes do movimento e membros da comunidade no projeto. Uma decisão da oficina foi a elaboração de diretrizes éticas para o projeto a fim de orientar as relações de trabalho entre cientistas/pesquisadores/ativistas e representantes da comunidade durante o proposto futuro projeto.

A formação de uma rede entre líderes amazônicos em torno de PSA e REDD parece ser um dos importantes resultados da oficina que deve ser enfatizado. Uma sugestão concreta seria a construção de um Grupo de Trabalho Regional de PSA por e-mail para trocar idéias e experiências de PSA a partir das perspectivas dos diversos países.

AGRADECIMENTOS

Os organizadores do workshop gostariam de agradecer a todos aqueles que deram o seu tempo e contribuiram com seu conhecimento e experiência para tornar o seminário um sucesso. Muitas pessoas viajaram grandes distâncias a partir de locais remotos para participar da oficina. Agradecemos especialmente o GTA e os membros da CNS, que passaram uma semana longe de suas famílias para assistir a uma semana de reuniões no Centro de Permacultura. Gostaríamos também de agradecer a um número de pessoas cuja ajuda, competência e dedicação a este evento foram decisivos para sua realização. Em primeiro lugar, agradecemos Ali Sharif e Eldany Souza do Instituto de Permacultura da Amazônia (IPA) e Carlos Miller da AVINA por disponibilizar o IPA para a oficina e para acolher a todos em um espaço tão bonito e inspirador. Estamos extremamente gratos a Kátia de Souza, que coordenou a logística para o encontro com paciência e grande eficiência. Assim como a Wendy-Lin Bartels e Fernanda Gebara Abifadel pela sua contribuição com o conhecimento de sistemas de PSA, bem como suas habilidades e tempo para ajudar a facilitar o encontro. Sua ajuda foi inestimável.

ANEXO

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05

Andean Amazon International Workshop

21–23 September 2009
Recinto Quirama, Medellín (Colombia)

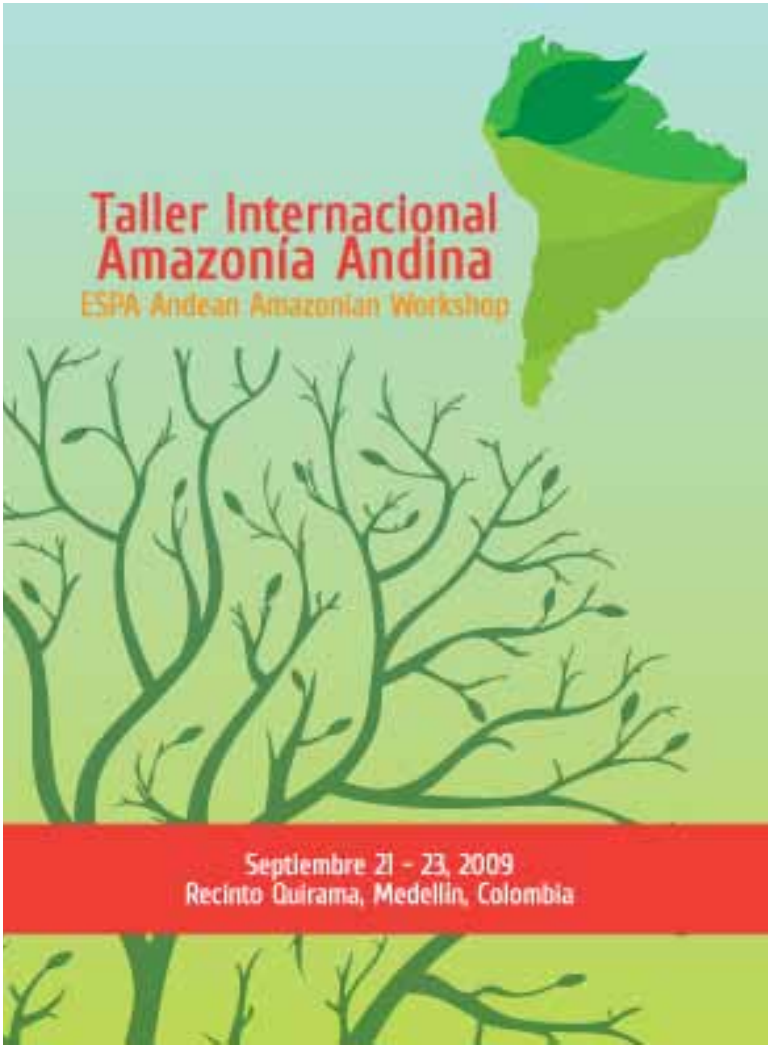
Place: Recinto Quirama, Medellín, Colombia
Date: 21st to 23rd September, 2009

Organized by

Germán Poveda and Juliana Arango (Universidad Nacional de Colombia, Medellín); Andrew Mitchell and Mandar Trivedi (Global Canopy Programme)

Participants

Nineteen people from 15 organisations, including universities, NGOs and commercial organisations, from six countries (Bolivia, Colombia, Ecuador, Peru, United Kingdom and Venezuela) participated in the workshop.



WORKSHOP SUMMARY

The Andean Amazon Region (AMAR) encompasses a great diversity of species, ecosystems, and human cultures; with nature and society inextricably linked through the provision of ecosystem services from the forests, glaciers, rivers, paramos, and wetlands of the region. As emphasised in the Millennium Ecosystem Assessment, human wellbeing depends on ecosystem services. Strategies to improve wellbeing and reduce poverty therefore need to ensure that ecosystems are resilient, in order to maintain services that underpin food, climate, energy, bio-ecological integrity and water security. The degradation of ecosystem services associated with deforestation and climate change could result in an increase in vulnerability of populations in the AMAR. Furthermore, the link between lowland Amazonia and the Andean highlands means that human-induced changes in one part of Amazonia could have impacts on populations living in another part.

It is within this context, that the forthcoming ESPA (Ecosystem Services for Poverty Alleviation) programme of the UK government provides a significant opportunity to advance understanding of the socio-ecological system in the AMAR, and the potential mechanisms to ensure improvements in wellbeing and reductions in poverty and vulnerability among the region's populations. This workshop brought together a group of 19 researchers, NGO practitioners, and government officials from five AMAR countries (plus three from the UK) to generate and discuss ideas for potential projects that could be put forward as part of a future pan-Amazonian consortium bid to ESPA in 2010.

The participants raised a number of issues and topics that a future ESPA-funded research and capacity-building project could include and identified three priority activities that were both important and feasible to carry out:

1 Mapping/GIS — developing and integrating spatial datasets for AMAR
2 Developing and consolidating the AMAR network
3 Masters course curriculum for training students in sustainability science

At the time of the workshop, the call for ESPA proposals was expected in late 2009 or early 2010. The next steps following on from the workshop are listed below:

1 *Proposal*: Put together a detailed project proposal and circulate it among the AMAR group prior to submission to ESPA.

2 *Stakeholder engagement*: Any future ESPA project will need to have clear 'impact pathways' for sharing and building knowledge with decision makers in government and civil society so that the research helps to provide the evidence base for better ecosystem management. Thus, an effort will be made to engage these decision-makers as part of the broader stakeholder group for the project.
3 *Potential alternative sources of funding*: There will be significant competition for the ESPA funding, so alternative potential sources of funding will also be investigated. This will be especially important since the ESPA fund may not wish to fund the consolidation of research networks

INTRODUCTION

The pilot project "Valuing Rainforests as Global Eco-Utilities: A Novel Mechanism to Pay Communities for Regional Scale Tropical Forest Ecosystem Services provided by the Amazon" has long-term aims to both understand and value the ecosystem services of the region's forests, and to contribute to the design of sustainable financial mechanisms to reward forest communities as guardians of the forest; recognising that they maintain a giant 'eco-utility' that provides services to populations over vast distances. The project is currently in a discussion phase, in which we are trying to gather the opinions of a diverse group of people; including climate scientists, anthropologists, ecologists, community representatives, economists, and NGOs.

During 2009, the aim of the project is to build an interdisciplinary team to exchange understanding of the ecology, climate, and hydrology of Amazonia's forests, the ecosystem services they provide to society; and examine the options through which communities could be rewarded for maintaining the forest. The team held its first workshop at INPE headquarters on 23–24 April 2009 to start to draw up a research agenda that integrates their combined knowledge of biophysical science, ecological/environmental economics, political economy and community development.
Over the last few months, the team has generated ideas for a 3- to 5-year project to understand, value, and explore the mechanisms available to pay for Amazonia's vital ecosystem services. The intention is to submit a funding proposal for this larger project to the UK Government's Ecosystem Services for Poverty Alleviation (ESPA) programme. The ESPA fund will be making a call for proposals in the final quarter of 2010. At the time of the workshop, it was possible that the ESPA fund would be seeking projects that work across more than one region, e.g. Amazon and Africa.

During the April, workshop it was decided that two particular topics required further attention and deserved their own workshops. The first was the needs of communities in terms of ecosystem services and payments for ecosystem services (PES). A workshop was held on this topic in Manaus, 17–18 September 2009, bringing together representatives from the Amazon basin region to share their views and experiences of PES schemes. The second topic was the importance of the Andean Amazon region, and the need to integrate it into the project design, which is the focus of the present workshop. Funds were obtained from the Prince Albert II of Monaco Foundation in order to support the Universidad Nacional de Colombia in holding the workshop in Medellín.

This preparation/consortium-forming project builds on the findings of the successful Large-scale Biosphere-Atmosphere Experiment in Amazonia (LBA): an international experiment led by Brazil. LBA brought together researchers from Brazil with others from around the world to study how Amazonia functions. The following is taken from the AMAR Technical Proposal, 2007:

"The Amazon Basin is the key to climate stability in the region. Through the services of the rainforest, and the large portion of the precipitation which is recycled as local evapotranspiration, vast quantities of fresh water are transported from the tropical Atlantic Ocean to the Andes through atmospheric moisture transport, thus feeding the high altitude tropical glaciers, lakes, wetlands, punas, paramos, yungas, and mountain cloud forests."

"A large body of scientific research aimed at understanding the physical functioning of Amazonia has been developed by the Large-Scale Atmosphere-Biosphere Experiment in Amazonia (LBA; lba.inpa.gov.br/lba). However, LBA has focused for the most part on hydroclimatology, land-use/land-cover change, biogeophysical, and biogeochemical cycles on the low-lying areas of the Amazon basin."

"In spite of the important scientific achievements of LBA, no concomitant research efforts have been developed to link the hydrological, ecological, bio-geochemical and climatic dynamics of the Amazon River basin with its Andean headwaters, let alone to study the interactions between their natural and social systems (Poveda, Nature, Vol. 431, 9 Sept. 2004, p. 125)."

Focus of the AMAR workshop

'Applied science needs for poverty alleviation & human wellbeing in the Andes-Amazon region'

WORKSHOP OBJECTIVES

– To bring together researchers from across the Amazonian Andes Region (AMAR) to discuss the development of a research agenda on ecosystem services and poverty alleviation
– To generate ideas that could be integrated into a pan-Amazonian project proposal to be submitted to the UK government's Ecosystem Services for Poverty Alleviation (ESPA) fund

WORKSHOP AGENDA

Day 1. Monday 21st September

– Welcome
– Participant introductions
– Gathering of expectations for the workshop
– Clarifications on:
  – 'Valuing Rainforests as Global Eco-utilities' project
  – UK government's Ecosystem Services for Povert Alleviation (ESPA)
  – Ecosystem services and poverty: Malawi case study
– Roundtable discussion of issues to be considered

Day 2. Tuesday 22nd September

– Roundtable discussion of issues to be considered
– Break out group – session 1

Day 3. Wednesday 23rd September

– Break out group – Session 2
– Synthesis and priority-setting
– Next steps
– Close

PRESENTATIONS

During the workshop, 11 presentations were given, listed below.

All the presentations will be available to download from: *www.globalcanopy.org*

Presentation 1
The 'Valuing Rainforests as Global Eco-Utilities' project (Mandar Trivedi)

Presentation 2
The emerging paradigm for funding tropical forests (Andrew Mitchell)

Presentation 3
'REDD Horizons'— a perspective on ESPA from a case study of research in Malawi (Iain Woodhouse)

Presentation 4
Review of participants' expectations and tabulation of issues, potential actions, and potential projects (Mandar Trivedi)

Presentation 5
Presentation of the plan for the day's work and a recap on the 'Valuing Rainforests as Global Eco-Utilities' project (Andrew Mitchell and Mandar Trivedi)

Presentation 6
Colombian situation (Germán Poveda, Néstor Ortiz Pérez, Alvaro Cogollo Pacheco, Sandra Patiño Gallego, Fernando Salazar)

Presentation 7
Colombia's approach to ecosystem service payments (Néstor Ortiz Pérez)

Presentation 8
Venezuelan situation (Lelys Bravo de Guenni, Juana Figueroa)

Presentation 9
Bolivian situation (Eduardo Rodrigo Palenque, Jaime Argollo Bautista, Alberto Camilo Vera)

Presentation 10
Ecuador situation (Víctor López Acevedo, Augusto González Artieda)

Presentation 11

Synthesis of workshop results and discussion of priority actions and next steps (Andrew Mitchell, Global Canopy Programme)

WORKSHOP RESULTS

Expectations of the Participants

In the first session of the workshop, each participant introduced themselves and explained their expectations for the workshop and what this initiative could bring. These expectations could be divided into two broad areas: networking; and development of a project concept (details in Annex 2):

1. Networking/collaboration
– Creating an inclusive network for researchers in the region
– Coordination of efforts: using human resources efficiently
– Consolidation of a network: avoiding isolation
– Prevent duplication of efforts
– Sharing of experiences
– Involve UK institutions (e.g. Edinburgh, GCP)
– Synthesize existing research projects

2. Concept development
– Generate ideas for projects for 5–10 years
– Create a concept for a proposal
– Foster ecosystem service science for policy
– Bridge social and environmental disciplines
– Create local benefits of the science
– Make science relevant to solving local problems

Day 1. Sessions on ESPA and the 'Valuing Forests as Eco-Utilities' Project

After hearing presentations on the ESPA funding programme, and the ESPA-funded preparation project 'Valuing forests as eco-utilities', the next four sessions were spent discussing issues raised by the group in a roundtable format. These issues are summarised below.

Scale

The participants viewed the issue of scale as important. For instance, climate models have quite coarse spatial resolutions, whereas impacts of climate change and deforestation will be felt locally. Furthermore, the Andean region is not well represented in global climate models, because the coarse resolution of the model grid boxes necessitates the smoothing of mountain ranges. To overcome the scale problem, Salazar and colleagues have recently used a regional climate model (RCM), nested within a general circulation model (GCM), to investigate the potential impact of climate change in the region. Their work indicates that climate change would seriously impact rainfall, with important feedbacks from the vegetation to the climate. In order to translate these results into local impacts, it might be necessary to use basin or catchment scale studies. Thus, a view prevailed that cross-scale studies would be required in the large project.

Case studies

Following on from the discussion of scale, the issue arose of case studies. Case study locations could be identified that would help to relate the 'big picture' Amazonia basin-scale research to a more tangible, community-relevant scale.

Ecosystem services framework

The Millennium Ecosystem Assessment (2005; *www.maweb.org*) has documented, categorised, and assessed the status of ecosystem services across the globe. The MA groups services into supporting, provisioning, regulating, and cultural categories. Some of the key ecosystem services in the AMAR relate to the role of forest ecosystems in regulating the water cycle: helping to provide water for urban and rural use, and hydropower.

Communication

An area that many participants considered important was communication and knowledge transfer. The AMAR research network could benefit from more effective communications that would help to connect researchers and projects. Some participants felt that this network should be restricted to the AMAR, while others felt that a more effective basin-wide communications network could be preferable.

Valuation of ecosystem services

Some previous valuation exercises have demonstrated the immense value of ecosystem services. This information has not necessarily produced the desired policy changes needed to maintain the services. Hence, a complementary approach that assesses 'willingness to pay' might produce more policy-relevant results. The cost of loss might also be an important aspect to assess, e.g. what is the cost to hydropower and water supplies,

or human health outcomes from deforestation? Sectoral studies investigating costs of ecosystem service loss on energy, drinking water, agriculture, etc. could be a part of the larger project.

Deforestation is often caused by large-scale projects, such as those developed as part of regional integration programmes like UNASUR and IIRSA. One avenue for research would be to quantify the impacts of mega-projects on ecosystem services and poverty.

Cultural diversity

There is great cultural/linguistic diversity in the AMAR and across Amazonia more generally. This diversity is important for adaptation to climate change, but is being eroded. Hence, valuation should not just focus on the monetary value of ecosystem services but on the other forms of benefit that people obtain (e.g. adaptive capacity). Indigenous Peoples and local communities have been shown to be important guardians of their forests, if given appropriate legal status and rights. Furthermore, these people have been actively managing forests for a long time. Their role in stewardship, management and monitoring should also be a part of the project.

Mapping

Fernando Salazar and a number of other researchers (including ISA) have constructed an initiative (Iniciativa Amazonica) to build a platform for spatial data on forests and threats. There are many other efforts ongoing to build environmental and social datasets, e.g. a geo-referenced hydro-climatic database for Colombia. There is potential to link some of these mapping and modelling efforts together as part of the larger project, with the aim of reducing replication and enhancing synergies.

Education

Some participants felt that the research needed to be translated into education/knowledge transfer tools for decision makers who plan activities that ultimately cause deforestation. Such education will help to make people more interested in ecosystem services. Hence, this project could try to influence the planning process. Indeed, the ESPA Programme specifically states the need for providing the 'evidence-base' for decision-making.

Compensation schemes

Different forms of compensation for reducing/halting deforestation will be required in different contexts. In some situations, benefits could be delivered in the form of basic services (although some community groups feel that such services should be provided by the state without conditions).

The cash economy becomes more important towards the periphery of forest areas, where migrant workers are often found, and so financial compensation schemes could be more appropriate (where people have access to banks and other financial services, e.g. credit, micro-credit).

Another important aspect raised by the group was the issue of property rights. In order to be compensated for providing a service, people need to have property rights over those services. In some instances, such as the Socio Bosque scheme in Ecuador, governments have provided financial 'incentives' rather than 'payments' for ecosystem services, which reflects the difficulty of paying people for providing a service.

In many instances, the economic drivers of deforestation come from outside forests (in the form of cocaine, mining, oil, biofuels, highways and infrastructure, etc.). As one participant said, "The solution to deforestation is outside the forest, not inside". So there is also a need to diminish the impact of these economic forces, in addition to compensating forest dwellers for their management and stewardship within the forest. The question was raised as to how to tackle these large-scale, external economic forces. As mentioned above, there is potential to gather evidence for the impact of large-scale deforestation on ecosystem services and economic development, which could help to inform policymaking.

Definition of poverty

The group felt that the working definition of poverty needed to be clarified in order to understand the problem that needs to be solved. For instance, what does poverty/quality of life mean to forest communities? What are the minimal conditions a person should have? Quality of life is context specific, so there will be no 'one size fits all' solution, just as there will be no single form of compensation scheme that suits all contexts. It was stated by one participant that there are three ways to measure poverty: (1) the classic economic measure of less than US$1 income per day; (2) the more structural definition based on satisfaction of minimal needs (the poverty threshold); and (3) in terms of capabilities: if a person has developed capacities that mean they can overcome difficulties/shocks. Under this last measure, if a person or collective relies on those who give them the cash or services, then those people are going to be dependant, and exist in a form of poverty. This was highlighted as one of the risks with cash payments to communities.

Definition of the Amazon

Research in the Andean Amazon has been inspired by the LBA, which has focused on the lowlands. About five years ago the ACTO (Amazon Cooperation Treaty Organization) developed a 'concept' of Amazonia. The EU provided European experts to create a first definition that would be discussed with people in Amazonia, but these discussions never materialised. It was felt that it would be important to use a definition of Amazonia that is inclusive in order not to forget anyone.

Evidence base

Some participants felt that they are part of a 'race against time' to halt deforestation. There are many uncertainties in the science, and there always will be. Therefore, there is a need to deal with these uncertainties, and produce evidence that can inform policy-making now, rather than waiting until all the details of the science are known. Given that the ESPA fund is unlikely to be able to support large-scale natural science field research, it will be necessary to take information, such as coefficients, measured in lowland Amazonia, and use them in the Andean region. This might work in some instances, but in others the differences from one forest to another will be too great to make such extrapolations. Therefore, there is a need to collate more baseline information across the Andean region.

Experience of working with policymakers has demonstrated to some of the participants that environmental conservation is as much about politics as it is about science. Hence the project needs to think about how to influence policymakers. One of the main policies identified as needing to be changed was the public policy to occupy and clear forest land. Ecosystem services could help to change the formula that means that people occupy and clear land in order to own it.

Sustainability and vulnerability science

Another way of looking at poverty that was raised by participants was 'vulnerability' to multiple interacting stressors such as deforestation, climate variability and change, and market fluctuations. These interactions and feedbacks in the socio-ecological system can mean that small changes in stressors can have large impacts on 'vulnerable' populations. The ESPA project could identify the stressors on ecosystem services and use a definition of vulnerability that is linked to the impacts associated with a change in the provision of ecosystem services.

In many cases, the poorest will be most vulnerable in part because they do not have legal land title and access to credit, which can provide them with some security (assets) during periods of environmental or economic stress. Hence, it was proposed that part of the project could help to research and refine the kinds of (policy) mechanisms needed to reduce the vulnerability of poor people.

Day 2

Land rights

Several participants suggested that land rights lie at the heart of the problem faced in Amazonia. One issue that arises when communities are paid for providing ecosystem services is that other people from outside the region will see an economic opportunity, and migrate into the area. The issue also goes beyond land rights, extending to property rights over trees, carbon, and other ecosystem services. Legal frameworks often do not exist for ecosystem services, making it difficult to transfer finances to relevant communities.

Degraded lands

There are large areas of degraded land that could be recovered and used more sustainably to produce food and economic development. It is unclear to what extent ESPA will fund work to look at this issue.

Food security

Participants highlighted the potential trade-off between reducing deforestation and food security if agricultural expansion is reduced. As noted above, there are large areas of degraded land that could be used to help to take pressure off forests for land use conversion. It is also possible to increase efficiency and intensify production in some systems such as cattle rearing, which is often very unproductive (<1 animal per ha). Alternative forms of agricultural production, such as permaculture, could help to maintain forests, provide ecosystem services (e.g. store carbon and conserve water), and enhance food security.

However, one participant observed that permaculture has not been very popular in Peru, but that this could represent an opportunity. Halting land uses that degrade forests will favour water quality. One participant spoke of three management tools related to forests and water:

1 economic diversification involving improved cattle management and improved income;
2 use of organic waste to make gas, compost etc.;
3 a micro-bank which supports small farmers

SCALE	ISSUE	ACTION
Regional	Networking & training	Meetings, WiserEarth group
	Ecosystem Service Assessment	Water, carbon, energy balances Mapping benefits & costs at basin scale
	Forecasting risks/vulnerability	Integrated climate-land use impact models
	Rethinking public policy	Communication?
National	Rethinking public policy	Communication?
	Planning for sustainable development	Maps and scenarios for priority-setting
	Monitoring: forests, water & threats	Remote-sensing (MRV)
Local	Participate/compensate/adapt	Look at existing PES case studies, Create pilot projects, Principles for 'compensation'
	Cultural/Traditional knowledge	Community-based monitoring for MRV & local benefits
	Training/capacity	Graduate/MSc course

	PAGO SERV. ECOS	VALOR
Provision	Water	Economica ambientales
	Food security	Escuela
	Timber	Mercados
	Biodiversity	Compensacion
	Energy	Nuevas economia
	Fishing	Ecoeconomia
Regulation	Cimate	
	Water	
	Control	
	C sequestration	
Cultural	Eco-tourism	

QUIEN/QUE?	QUIEN GESTION?
Humanos	Management of vulnerability has a cost – who pays for it?
Environment	

The issues raised by the group in plenary were placed into a table in order to develop a set of specific actions that the potential future ESPA-funded project could carry out (Table 1).

Break-Out Group Session 1

The participants were split into three groups, with each group developing a vision and mission for the project as well as a framework for the approach to the project.

Group 1

Group 1 placed the mission for AMAR in the context of ESPA, as follows: reducing poverty and vulnerability to threats/impacts of climate change. The types of services they would include in the project would be based on those in the Millennium Ecosystem Assessment.

The services vary according to scale, from global to local. The Amazonian region is characterized by the meeting of the Amazon basin and the steep slopes of the Andes. Some river basins are shared across two or three countries (e.g. Napo, and Putumayo respectively). This provides an opportunity for hydropower, an economically-important sector that depends to some extent on the forest. However, some values of ecosystem services are non-monetary. But people need to find incentives through the capture of these values. In between these two extremes (high monetary value services and non-monetary services), there is a need for an intermediate level of compensation for the services. The group developed a framework for thinking about the services and the beneficiaries of those services (Table 2) and a framework for considering vulnerability (Table 3).

Group 2

Group 2 focused its discussion on the vision for the project. They began by questioning whether the vision should be built on that of the workshop participants, or a larger AMAR vision. The end result of the discussion was a short vision for AMAR:

A los cinco años los paises AMAR integrados alcanzan un major conocimiento de la cuenca alta de la Amazonia incluyendo a los actores locales, respetando

↑ Issues Raised by Participants Arranged by Spatial Scale, Alongside Potential Actions for a Future ESPA Project
↑ A Framework for Considering the Beneficiaries of Ecosystem Services
↗ Table 3. A Framework for Considering Vulnerability Reduction, Especially Linked to Climate Change

sus particularidades socio culturales, mejorando su calidad de vida y complementan el conocimiento de la gran cuenca amazonica.

In five years, the integrated countries of the Amazonian Andes (AMAR) have achieved a major advancement in knowledge of the high basin of the Amazon, including local actors, while respecting their particular socio-cultural contexts; resulting in improvements in their quality of life, and complementing the knowledge of the vast Amazon basin.

The group felt that it was important for AMAR researchers to work together in an integrated way and solve practical problems, while exploring the biophysical relationship between the high and low basin (with Brazil).

Group 3

This group defined their Vision as follows:

1 Long-term: to reduce deforestation by 100%
2 Medium-term: In 2015 we have gained a vision of the AMAR region and the value of its ecosystem services, and also a 25% reduction in deforestation. Quality of life will have been improved.

They defined their Mission as:

– To know the ecosystem services and have applied that knowledge to compensate communities for ecosystem services (in the broad sense).

In order to meet these targets the group felt the following activities were important:

– Identification of ecosystem services based on the Millennium Assessment.
– Communicate knowledge to national and sub-national and local community decision-makers.
– Articulate with other projects and networks with which we share the AMAR vision.
– Donations should be used to make projects self-sustaining.

Break-Out Group Session 2

A second round of break-out groups was held to focus on the specifics of individual countries in the AMAR. Working groups were split by country, and each group was asked to bring together their knowledge of the current situation in their country, the existing projects or case studies on ecosystem services, and the alliances that could be developed and the research questions they regarded as being important.

Bolivia

This group focused on two examples of PES schemes already functioning in the country:

– Noel Kempf Mercado National Park, which is selling carbon credits on the voluntary market.
– Golden Forest (Noel Kempf's 'grandson'). The Environment Ministry is the certifying organisation for the project.

Proposed study

The study region would be the Bolivian Andes, with a focus on the interface between the high mountain chain and the plains. There would be three focal sites:

1 Madidi, a megadiverse area that stretches from the highlands down to the lowlands.
2 Chapare, in which low altitude clouds are generated to produce a high rainfall regime.
3 Rio Grande and Rio Parapeti, South Bolivia, is an open area with high deforestation and no national parks or protected areas.

Services provided

PROVISIONING	REGULATING	CULTURAL
Water	Climate	Myths etc.
Wood	Erosion control	
Biodiversity	Flood control	
Food		

Study ideas

1 Who has land rights?
2 Observe climate impacts in the valleys
3 Evaluate biodiversity (need support for this)
4 Climate variations and change will produce variations in the forest
5 Transport and generation of moisture from Amazonia: very humid area in middle of country. How much moisture goes to the other side?

Strategic alliances

National institutes, International institutes

Discussion in plenary

What international alliances could be useful? There is a network of glacier studies that could be relevant in terms of strategic alliances.

What is the specific type of ES you're going to study and the impacts on population and poverty? The specific ecosystem services to be studied are not clear. There are a lot of pressures on the forest. Avalanches occur all the time. We know people are vulnerable, but we need to understand if these communities can overcome these difficulties.

Ecuador

The group listed several extant projects and case studies:
– Caudales ecológicos en cuenca del Pastaza I (tesis método hidrológico) y II (método holístico)
– FONAG?¿ en aprovechamiento por trasvase de la cuenca del Napo a Quito
– Programa de Servicios Ambientales (PSA) de El Chaco (G.M.CH y EcoCiencia)
– Proyecto FGL III: CC, paisajes y escenarios de gestión (adaptación en base a ecosistemas) para MICH con esquemas financieros e incentivos para conservación en Quijos-Coca
– Paramo-Ciudad y Agua: Observatorio Socioambiental de Quito-PPA-EcoCiencia
– CC-coberturas glaciares y paramos: EPN-Senacyt-IRD-INAMHI
– Glaciares-CC-Antisana: CARE
– PRAA: MAE-CAN (mitigación al CC en glaciares)
– Socio Bosque y Capitulo Páramo (SA y REDD): MAE y Presidencia
– Degradación de los recursos naturales en la cuenca alta y media de los ríos Napo (terminado) y Pastaza (ejecución)
– CRO: CC en Cordillera Real Oriental (Ve,Co,Ec y Pe), FNatura-CAN y otros
– Proyecto "Energy Bridges: Sustainable energy for poverty reduction", Klima Buednis (Climate Alliance-Alianza del Clima Internacional in Ecuador, Peru and Bolivia) with FDA (Amazonía Ecuatoriana)
– Propuesta Yasuni-ITT: Gobierno central-MREE

Case studies needed in the future
– Conflicts over the use and exploitation of water (including for hydro-electricity generation in the Napo (CCS, EMAAP) and Pastaza (Topo, Agoyan, San Fco) basins).
– Conflicts over access and distribution of water resources in the high part of the Pastaza basin (with extreme variation: droughts in the upper and floods in the lower parts)

What studies are needed?
– New institutional and regulatory frameworks (transition) on environmental services (no misappropriation of funds), water (not grants) and OT.
– Compensation for water services for electricity generation and Coca Codo Sinclair.
– Water balance: based on collecting information, management, and projections (gauging stations in Rocafuerte, Tiputini, Coca, Baeza, Papallacta and Antisana). This requires data collection from valleys up to glaciers. For instance, make a hydrological balance of the Napo valley.
– Change of land use and vegetation cover from the perspective of adaptation and mitigation to climate change
– Wellbeing, poverty alleviation and sustainability of ecosystem services by local initiatives.

The group observed that some people believe that marketing nature is mistaken.

Possible alliances
– REDIAM and its organisations and member organisations
– INAMHI
– SENPLADES
– AMAR Perú, co
– EMAAP
– CocaSinclair SA
– Local government: parish councils, municipalities, prefecture, region
– D.M.Quito
– Comisión técnica Yasuní ITT
– Social and indigenous organisations

Peru

This group started by thinking about the connections between the high and low Amazon basin. The golden fish, a type of catfish, migrates between the Atlantic and the high basin (they lay their eggs in Peru), and could be used to capture the idea of one linked system. Animal protein is important in rural nutrition.

Sedimentation is an important process in the region (the 'Meeting of the waters' in Manaus highlights the importance of the Andes in taking sediments and nutrients down to the lowlands (see McClain ME and Naiman RJ. 2008. Andean Influences on the Biogeochemistry and Ecology of the Amazon River. BioScience 58: 325–338)).

The group also pointed out that there is a series of archaeological sites across AMAR, illustrating that pre-Colombian civilisation developed in the region based on the distribution of important natural resources.

The group listed a number of projects across Peru from north to south, including:

– French hydrological project across the Amazon basin
– Amazon Research Group (Finland)
– BIOCAN

In terms of ecosystem services, the group felt that the project should start with water.

Possible alliances

CGIAR Challenge Program on Water & Food

Plenary discussion

There are 19 linguistic families in the region. Much of the information on these families is held locally. So part of the work that is required is systems management, cataloguing the known published ethnographic information. This information would help projects to work with communities in a culturally-sensitive way.

Venezuela

The group presented its thoughts on a potential case study that would be focused on the Parque Nacional Canaima (PNC), which covers 12% of Bolivar State. This project would build on previous and ongoing studies undertaken during the LBA. A series of dams runs along the main river, which runs into the Rio Orinoco. The local population living in and around the park is of Pemón ethnicity. The national park provides a number of ecosystem services at local, national, regional (AMAR) and global scales, but these are experiencing a number of pressures and impacts, including population growth, deforestation, climate change and biodiversity loss.

Food insecurity is a particular issue in the region and this would be the focus of a research project, with the question:

How can the Pemón community be compensated to reduce deforestation in the PNC, which is linked to fire threats and climate change, in order to improve food security and also maintain ecosystem services of water production, carbon sequestration, carbon and climate regulation in the region?

De qué manera podemos compensar a la comunidad Pemón para disminuir las amenazas del factor fuego y cambio climático en su seguridad alimentaria y en la reducción de la cobertura boscosa del PNC, lo que a su vez afecta los servicios ecosistémicos de producción de agua, secuestro de carbono y regulación climática de la región.

Strategic alliances
– EDELCA
– Gobernación Estado Bolívar
– INPARQUES
– ONGs
– Consejos Comunales Indígenas
– Universidades e Institutos de Investigación

Colombia

The group highlighted that 40% of Colombia is Amazonian, effectively divided into two parts, with different pressures.

Colombia has five research institutes: IDEAM, SINCHI, IAP (Pacific), von Humboldt. In addition to environmental institutions, there are indigenous populations that are important for conservation. Indigenous areas are protected by law.

There is an information system for biodiversity (*www.siac.net.co*), which includes a list of researchers, some of whom work in Amazonia. The Mesa Amazonica acts as a consultation table between indigenous groups and the government. Indigenous groups acting at a regional level are UNAMAZ and COICA.

The Colombian Amazon
– 42% is indigenous reserves
– 26% forest reserve
– 10% protected areas
– 4% integrated management districts
– 7% extraction for private use
– 4% Double legal allocation
– 7% undetermined (colonizers without deeds)
– 86% of the land has a tendency towards conservation, i.e. has low deforestation rates. The Andean Amazon zone has mostly been affected by deforestation since the 1950s.

Legislation

Law 99 of 1993 created a legal obligation to conserve natural resources. Articulo 106 de la ley del PND Article 111 covers water resources. Municipalities are dedicated to provide 1% of their income to maintaining areas for ecosystem services.

Relevant projects
– Biocan is a Regional biodiversity program
– The ACTO strategic plan is an action plan for biodiversity
– Mesa Ambiental Colombia-Brasil — Plan Frontera Verde (corridors)
– Integrated management of water (3 year study), involving:
  – Interactive mapping of water in Colombia

  – Hydro-climatology Atlas of Colombia: HidroSIG
  – Satellite imagery
– CAN: Integrated water management in the Andean region. This will be a base document for water management in the region

Case studies and proposal
– Apaporis – indigenous protection areas – near border with Brazil
– 3 others in Andean region

All regions have opportunities for PES schemes. One of the issues the group raised was that if indigenous communities are looking after the forest anyway, what is the rationale for paying them? The group proposed that community participation has to be a lot more proactive: involving community-based monitoring and making people feel part of the research.

Ecosystem services
– Water supply for Bogotá (water from Amazonia falls on the Páramo and is carried to Bogotá by an aqueduct)
– Possibilities for partnership with water and electricity companies
– There was a suggestion that hydropower companies should give 6% of revenues for conservation of basins
– Vulnerability of public health. Malaria, dengue, and chagas are influenced by climate change and deforestation (effects on population dynamics). ESPA should not just focus on poverty, but also vulnerability. We need case studies to investigate this.
– Wealth creation from sustainable use of resources: biodiversity, biochemicals, etc.
– Fishing contributes to food security. Roads, dams, etc. affect migration and food security
– Influence of deforestation and climate change – impacts on and reduction of vulnerability

What do we have to study?
– Balances of water, energy and carbon at multiple scales, from glaciers to basin. The daily temperature range is most important from a climate change perspective, but also other oscillations
– Estimation of base line and quantification of ecosystem services
– Hydro-climatic dynamics and the carbon cycle
– How much water is produced in Amazonia and how much is internal to the páramos?
– How much water is transported from the Amazon to the Andes?
– Spatial and temporal dynamics of intense storms that produce disasters. Early warning systems are required

What to study and develop?
– Needs new inventories and development
– Consolidate information and make available in a database
– Land use change
– Relationship between climate change and variability and deforestation impacts on human health
– Capacity-building and education must be strong

Plenary discussion

One participant commented that it is not always possible to retain information collected by communities if it does not meet international standards. Often this wastes valuable information. Data collection should follow protocols, involving training of personnel in data collection. Beyond that, experience of community-based monitoring of health demonstrates the potential for monitoring to result in the receipt of greater financial resources, enabling communities to administer their own education (and health) systems. After training, they collect information very well. Now, the communities want to monitor new aspects.

The Colombian government is designing a PES scheme, like Ecuador's Sociobosque. One participant asked if the project could help with this initiative.

The Venezeulan participants noted that there had been successful discussions with the Pemón community to discuss fire and traditional management.

Synthesis of Workshop Results

During the course of the workshop a number of potential ideas/concepts, knowledge gaps, and research themes were put forward by the participants. This information was captured in a framework that attempted to link together the different components of the socio-ecological Amazonian system being considered.

The framework (see Figure 1) focused on three broad areas: ecosystem services, benefit-sharing and stewardship (mantenimiento). Within each of these broad areas, the participants listed their ideas under the following headings: definitions, evidence and knowledge gaps.

In addition, the participants drew up a synthesis of ideas on specific 'products' that could be used during the project.

A set of ten activities or 'products' that could form part of the future ESPA project was generated as part of the discussion (see also Figs. 2 and 3):

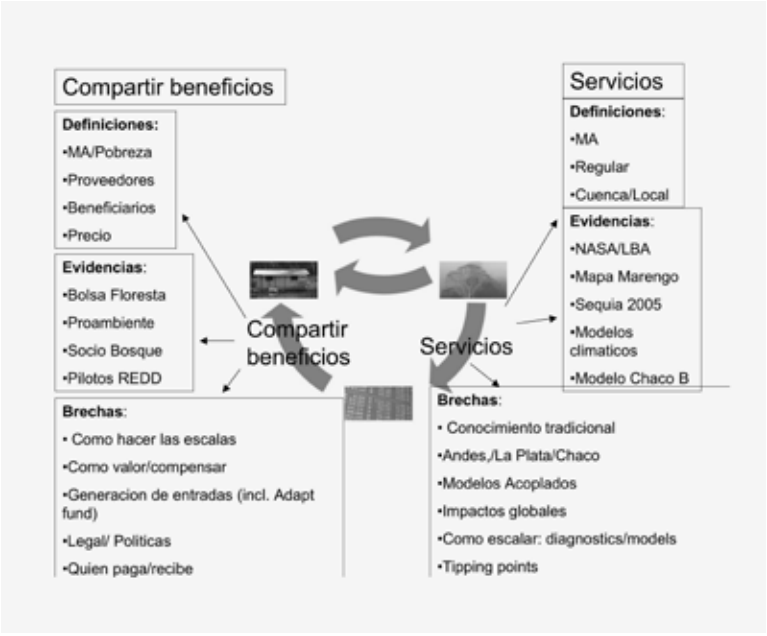
1 *Maps and GIS* of social and environmental data for development planning in AMAR
2 *Scenarios* of future changes in the region, including climate and development (land use)
3 *Network development and social networking website* to facilitate coordination of research and communication to decision-makers
4 *Financial mechanisms* that can work at scale
5 *Masters course* to train the next generation of researchers and policymakers
6 *Common strategies* for research across the AMAR
7 *MRV protocols* to foster community-based monitoring for PES and REDD+ schemes
8 *Research papers* produced by teams from across the region
9 *Scenarios* for the Congo Basin*
10 *Links to and scenarios* for China*

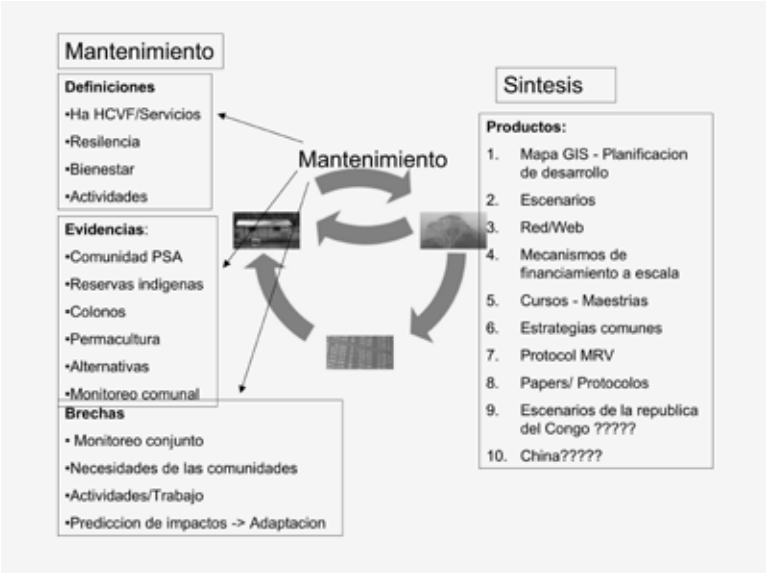
*The last two suggestions were based upon indications from the donor (ESPA) that, where appropriate, projects could seek to make linkages across regions/continents. ESPA has the following priority regions: Amazonia, China, South Asia and sub-Saharan Africa.

Priority-setting exercise

In the final session of the workshop, the participants were asked to rank the ten activities that had been suggested during the workshop in order of both importance and feasibility as part of a potential future ESPA project.

The most important activities were GIS mapping, scenario building, and network development. The most feasible were GIS mapping, network development, designing an MSc course, and creating an MRV protocol. Combining importance and feasibility into a single score for each activity produces the ranking depicted in Figure 4; with GIS mapping, network building and MSc Course creation as the top priorities, followed closely by scenario-building and a communications strategy for decision-makers.





↑ (Fig. 1) A general framework for considering the ecosystem services of Amazonia, the benefits they provide to people and the benefit-sharing and stewardship mechanisms that could be used to conserve the forests
↗ (Fig. 2) The definitions requiring clarification, evidence (e.g. case studies) and knowledge gaps identified by participants under 'Benefit-sharing' and 'Ecosystem services'
↗ (Fig. 3) The definitions requiring clarification, evidence (e.g. case studies), and knowledge gaps identified by participants under 'Stewardship/Mantenimiento'

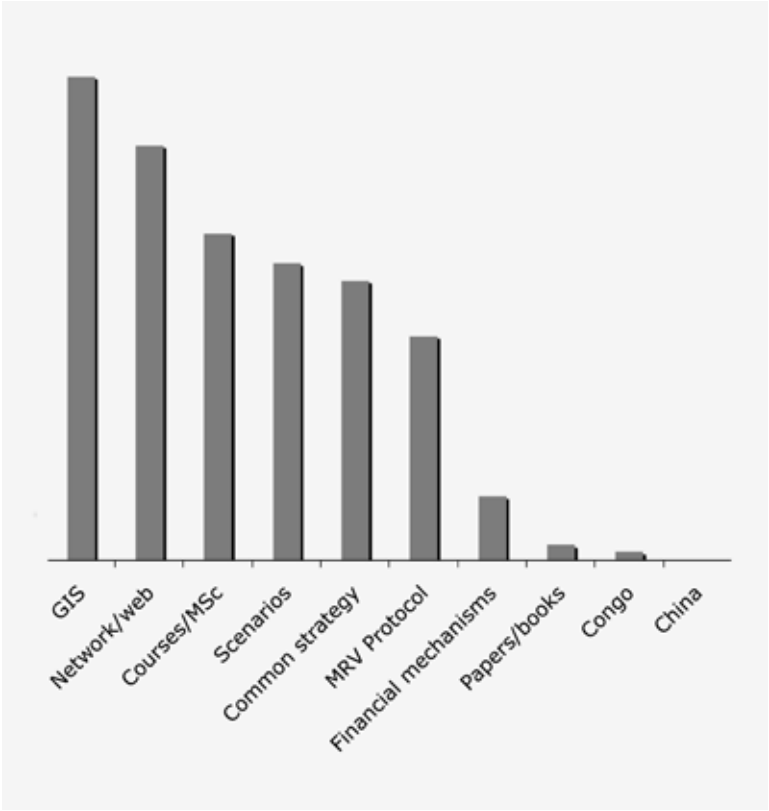
CONCLUSIONS

This meeting was the first time that this interdisciplinary group of researchers from across the AMAR had come together to discuss their common interests and goals. It was clear that participants had two broad expectations from the workshop. Firstly, they were keen to discuss ways to foster an AMAR network of researchers, of which this meeting would be the inception point. Secondly, they were keen to take the opportunity presented by the ESPA fund to develop a research strategy that brought together their varied expertise to build the evidence base that could be used to develop policies to help poor and vulnerable populations in the region.

Focusing on the first expectation, the group felt that the development of a social-networking website for the AMAR researchers could help to foster their integration and collaboration. This could be implemented relatively cheaply but would require time and effort on the part of the network to make it a useful tool. The second expectation, to develop ideas for a future ESPA project, generated a great deal of discussion. Part of the challenge recognised by the group is that the Andean Amazon is a very large, diverse, and dynamic region, even without considering its connections to the lowlands. An 'ecosystem services for poverty alleviation' research project spanning the whole of Amazonia, including the AMAR, will need to focus on large-scale biophysical processes that underpin ecosystem services, such as climate regulation and freshwater supply, that benefit the regional economy (e.g. through sustainable hydropower). at the same time, they will have to deal with the 'on-the-ground' situation faced by local communities who depend on these services for their wellbeing.

One of the solutions proposed to address the challenges of spatial scale in the region was to develop high-resolution maps and GIS that could integrate ecological and socio-economic information from researchers across the region. This exercise could help to provide the raw data needed to analyse the impacts of changes in ecosystem service delivery on human wellbeing. However, as emphasised by the participants, this form of in silico analysis would need to be coupled with 'ground-truth' data gathered in local communities. The development of community-based monitoring protocols could be one way to achieve this. The participants highlighted a number of issues that would need to be dealt with in the planning stages in order to design a project that had relevance to local communities. These included clarifying the definitions and approaches the project would use with respect to poverty, wellbeing, vulnerability, and quality of life; as well as clearer referencing and use of the ecosystem services framework developed by the Millennium Assessment.

The participants shared their knowledge of existing projects looking at ecosystem services, which illustrated that there is already a significant body of work and understanding of this concept in the region. However, it was felt by some participants that the Andean Amazon region still lacked baseline data on some topics. Strategic alliances with existing projects and networks were felt to be important to overcome these challenges. This makes it especially important to enhance networking and build greater collaboration among researchers across the region. Finally, workshop participants noted that decision-making was often based on politics rather than scientific evidence. They highlighted the need to involve policymakers in any future ESPA project so that knowledge on ecosystem services and wellbeing could be effectively created, shared and translated into public policies. Hence, a stakeholder



↑ (Fig. 4) The ranked importance of potential activities identified during the workshop. Highly-ranked activities were seen by participants as both important and feasible.

engagement and communications strategy would be vital to the impact and success of the project.

ACKNOWLEDGEMENTS

The organisers of the workshop would like to thank all those who gave up their time and contributed their knowledge and experience to make the workshop a success. Participants travelled great distances to attend the workshop. We would particularly like to thank our simultaneous translator, Cristina González, who had to work the hardest of everyone at the workshop. Thanks also to our hosts at the Recinto Quirama conference centre for making our stay and work comfortable and enjoyable. The evening hosted by Prof Alvaro Pacheco at the Botanic Gardens in Medellín was especially enjoyable and enlightening. The workshop would not have been possible without the generous support of the Prince Albert II of Monaco Foundation and the UK Government's ESPA fund.

ANNEXES

Annex 1. Participants

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GAIA Amazonas

Annex 2. Expectations Of The Participants

Remigio Galárraga Sánchez
– Place: Escuela Politécnica Nacional (Ecuador)
– Activities/Experience: Engineer; Water resources; engineering; Sabbatical in Michigan; Napo river, model of hydrological basin. In 2008, National Polytechnic acquired $0.5 million to study glaciers. In 2008, 36 institutions involved in network – for investigations in Amazon (ARAM). Act signed by many institutions – strengthen network to present projects to ministry.
– Expectations: To share experiences of research. Hope this meeting is first step in big project

Carlos A. Llerena
– Place: Universidad Nacional Agraria La Molina, Peru
– Activities/Experience: Basin and forest hydrology. Trying to push forward LBA to upper parts of the basin, more recently thinking of the high Andes to be more inclusive.
– Expectations: Be as inclusive as possible both within and outside countries. Synthesis of the previous projects (RAINFOR, ARAM, etc.). Almost 12 projects have to be put in the Andean-Amazon. Finnish group working in Amazon for 25 yr. Can't afford luxury of wasting these efforts by not bearing them in mind

Eduardo Rodrigo Palenque
– Place: Universidad Mayor de San Andrés, Bolivia
– Activities/Experience: Physicist; Environmental physics
– Expectations: Need to work on current problem of degradation of Andean Amazon. Lines of action — ideas of projects to execute in next 5–10 years

Alberto Camillo Vera
– Place: Universidad Autónoma Tomás Frías, Bolivia
– Activities/Experience: Lawyer; environmental law. Masters in environment management. Association of environmental lawyers.
– Expectations: Looking for technical information, need information to make good laws. October Curitiba, REDD meeting. Workshop will help him to do his job better. Bolivia seeing a lot of modification because of new laws. Law 1700 changed – need to give proposals based on ecosystem services that forests provide

Jaime Argollo Bautista
– Place: University San Andres, La Paz, Bolivia
– Activities/Experience: Geologist. Working on climate history using different records. Project on water cycle, precip, climate. Impact of CC on high mountain ecosystems. Finding monitoring indicators of CC. Danish funding. Multi-disciplinary. Developing project on dendroclimatology – indicators Polylepis Tropicana (up to 5000m high forest). Record of environment.
– Expectations: Finish with document that can be negotiated or sold to find financing for these projects (not only scientific but human dimension, which is fundamental).

Sandra Patiño Gallego
– Place: Universidad Nacional, Colombia
– Activities/Experience: Trained at Smithsonian, hydraulics. PhD at Edinburgh: plant ecophysiology. 2001 post-doc at Max Plank – C sink component of LBA: biogeoscience of whole Amazon. Part of RAINFOR – biogeoscience (B), one of few groups working in whole Amazon: quantification of carbon. One result – we don't know how trees work or how they will respond to change in water. The conclusions are often based on studies on temperate trees. We know very little about tropicaltrees responses. RAINFOR continuing. Sample all trees from all parcels to test ecological theories. 6 months ago started in National Univ in Amazon with different panorama, see the need to do social projects.
– Expectations: Questions: How to create PES that are interchange — e.g. clean energy or people don't receive money. In Amazon part of the university we are surrounded by people with few economic resources. How to create economic opportunities with our science?

Dennis del Castillo Torres
– Place: Instituto de Investigaciones de la Amazonía Peruana, Peru
– Activities/Experience: Ecosystem services. Originally agronomist – rice cultivation Born and raised in region where coca is important. Cutting trees down to produce coca. Show other economic benefits of keeping forests. Working with University of Leeds and RAINFOR.
– Expectations: Have to coordinate efforts and take advantage of human resources.

Augusto González Artieda
– Place: Clirsen, Ecuador
– Activities/Experience: Agronomist, specializes in soils, remote sensing. Amazon basin is one of the last clean water sources. Only at this moment of danger do we react. Studies of high basin in Ecuador — expansion of agriculture, degrading the paramos, loss of this vital resource. Waterheads being damaged. Agroecological zoning.
– Expectations: Interested in consolidating a network because efforts are scattered. Lots of duplication of effort. Propose concrete way to avoid isolation of work.

Néstor Ortiz Pérez
– Place: Ministerio del Medio Ambiente y Desarrollo Territorial, Colombia
– Activities/Experience: Economist. Biodiverity action plans in Amazon region. Colombia – formulating policy coordinated by natonal planning. CC policy. Need to rethink Amazon policy. Sinchi Institute – technical support for Ministry
– Expectations: to bring science and decision-making closer together. Important to see where science conclusions inform policy. Synergy with other project: Biocan project, that is in implementation phase. Regional processes ACTO – science and technology programme. May be possibilities of financing.

Víctor López Acevedo
– Place: Ecociencia, Quito, Ecuador
– Activities/Experience: Anthropologist. Ecoscience Foundation. Advisor on regional project on Andean paramo. Strengthening local government. Public policies – environmental management. Need to strengthen/generate environmental governance especially water resources. Adaptation to CC, with focus on human safety.
– Expectations: Can we effectively strengthen coordinated action? Ecociencia is part of several networks.

María de los Ángeles La Torre
– Place: Universidad Nacional Agraria La Molina, Peru
– Activities/Experience: Biologist. Masters in environmental restoration. Sustainable Development in Ecosur. Pool of researchers in RAINFOR Andes. Projects in central Peru. Moore Foundation: network of teachers working with AMNH in NY – give local people strategies for conservation: eco-tourism. Including locals and training to understand conservation and seeing Protected areas as opportunities. Indicators of resource use.
– Expectations: Looking for bridge between social and environmental. Ethnobiology – dialogue between nature, use of nature and social dimension

Alvaro Cogollo Pacheco
– Place: Jardín Botánico de Medellín, Colombia
– Activities/Experience: Most botanic gardens in Colombia are in Andean region. Met with Oliver Phillips to monitor Andean region in RAINFOR. Endangered species programme. Humboldt Inst. Specialise in sustainable use of resources. Biodiesel: problem of oil palm.

Iain Woodhouse
– Place: School of Geosciences, Edinburgh University
– Activities/Experience: Remote sensing
– Expectations: How can I contribute and what action when back in Edinburgh?

Llelys Bravo de Guenni
– Place: Universidad Simón Bolívar, Venzeula
– Activities/Experience: Environmental statistics. Masters in water resources. Got interested in environmental issues when LBA started. Science committee for several years. 1998 study to look at biosphere-atmosphere in great savanna reserve as contribution to LBA. Social components didn't have the relevance they should have. In LBA second phase involved in project to look at risk factors of national park Conaima. Interdisciplinary group working with communities to look at risk factors. How do communities see their future? How can we understand their problems?
– Expectations: To be able to finish with a proposal to effectively reflect how science knowledge can be transmitted to communities. Communicate how this can be a factor of poverty reduction. How can we transmit to population that the science is relevant to solve their problems?

Juanita Figueroa
– Place: Universidad Experimental de Guayana, Venezuela
– Activities/Experience: Sustainable development with emphasis on environmental assessment, especially NTFPs. Environmental and ecological economics. Combine social and science. Working with indigenous communities in Peru, Ecuador, Bolivia, Brazil to understand how rural communities use natural resources. At which point agroforestry contributes to communities. Method: Poverty Environment Network

(PEN). ESPA workshop with Tim Baker and Rosa Maria in Leiticia
– Activities/Experience: Many organizations working in isolation, so need to take advantage – incorporate the efforts. Solidify in a form that can really alleviate poverty in rural communities. Consider the need of communities.

Fernando Salazar
– Place: GAIA Amazonas & Andes University, Bogota, Colombia
– Activities/Experience: Remote sensing, conservation of biodiversity. Many years working with indigenous communities to conserve. Colombia-Pacific region: framing of lands. IDEAM: construction of map of marine/coastal systems. Water basins. Semi-automatic generation of maps. Gaia Amazon Foundation dedicated to support of law, health, education related to communities. Dept of Amazonas and Guyanea looking to support community monitoring. Network of georeferenced areas – aiming to generate maps of deforestation working with Imazon.
– Activities/Experience: Local benefits of science. Economic problem but giving out money does not solve it. Big need for health, energy. Batteries are polluting. Need clean energy, market access. Debt mechanisms are very complicated and create more poverty.

Germán Poveda
– Place: Universidad Nacional, Medellín, Colombia
– Activities/Experience: Civil engineer. Hydroclimatology, postdoc at Boulder. 20 year UNAL at Medellín in water resources. Member of National Academy, IGBP. Many projects. Challenge is to be specialists in everything. Eclectic agenda: circulation, CC, health (malaria/dengue), local circulation up to climate variability (El Niño), hydropower: cheaper to generate energy from water than coal.
– Activities/Experience: Strong path/direction/agenda that has clarity of concepts how are we going to combine both types of knowledge in science: biogeophysical and social that contributes to reduction of poverty.

Part 2: Research and Reviews

The three workshops identified a number of areas that required further investigation and review by the team in order to prepare a full-scale research project. This part of the report presents the results of several small research projects and literature reviews that were undertaken in order to fill these information gaps.

The first five papers review some of the current understanding of Amazonia's ecosystem services and develop methods to analyse them spatially and economically:

Mandar Trivedi, Liana Anderson, Julia Queiroz and colleagues analyse the available data on the 2005 Amazon drought to provide a preliminary assessment of the impacts on food, water, transport, agriculture and health.

David Galbraith reviews the potential impacts of climate and land use change on Amazonian forests. This paper has not been refereed, but provides an expert 'mini-review' of the main issues.

Josefina Arraut and colleagues at INPE present the findings from their research into Amazonia's role in regulating atmospheric moisture and contributing to moisture transported to other parts of Latin America in so-called 'aerial rivers'.

Matthew Cranford, Julia Queiroz and colleagues explore the value of the water recycling function of Amazonia, which helps to regulate moisture flow to other parts of Latin America. They give a first pass estimate of economic values, providing a starting point for further data collection, analysis, critical thinking and theoretical development.

Mark Mulligan and Sophia Burke build on the previous ESPA Situation Analysis for the Andes-Amazon (produced by a consortium led by the Iniciativa Amazônica) to bring together spatial datasets at an Amazon basin scale to map out some of the key ecosystem services in Amazonia: carbon storage, water flow regulation, and biodiversity maintenance. They create a method that begins to analyse the potential win-wins and trade-offs between these services and development.

The final three papers discuss the links between ecosystem services, public policies and mechanisms for poverty alleviation and vulnerability reduction in Amazonia.

Lauro Mattei investigates the different Cash Transfer Programmes operating in Amazonian countries to provide a first inventory of the current schemes, how they differ and what role they have in poverty alleviation among Amazonian communities. Payments for Ecosystem Services (PES) are a form of conditional cash transfer and so much can be learned from evaluating the effectiveness of existing large-scale cash payment programmes.

During the inception workshop several of the participants noted that the continued loss of Amazonia and the coupled lack of sustainable, equitable development in the region was a political problem, rather than a technical one. Anthony Hall reviews the public policy options available to 'turn the tide' in Amazonia away from perverse incentives towards environmental services. Hall goes on to suggest possible future research avenues that could provide the evidence base needed for a policy transformation to occur.

In the final paper, Patrick Meir, José Marengo, Richard Betts and colleagues synthesise literature across policy, biophysical science and PES and point towards an emerging framework for poverty alleviation and vulnerability reduction based on the role of Amazonia in providing a suite of ecosystem services, beyond carbon, which is currently the focus of policy attention under the UN's REDD system.

06

Counting the Costs of the 2005 Amazon Drought: A Preliminary Assessment

– Liana O. Anderson*, University of Oxford
– Mandar Trivedi, Global Canopy Programme
– Julia Queiroz, Universidade Federal do Rio de Janeiro
– Luiz Aragão, University of Exeter
– José Marengo, Instituto Nacional de Pesquisas Espaciais
– Carlos Young, Universidade Federal do Rio de Janeiro
– Patrick Meir, University of Edinburgh

This unrefereed working paper was presented at the Earth System Science 2010: Global Change, Climate and People conference held in Edinburgh, 10–13 May, 2010.

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As described in Meir *et al.* (*Beyond carbon*, this volume), the 2005 drought in Amazonia was one of the worst droughts on record in the western Amazon (Aragao *et al.*, 2007; Marengo *et al.* 2008a, b; Tomasella *et al.* 2010). It has been linked to warming in the tropical North Atlantic rather than to El Niño, the usual cause of droughts. As such, it could form an analogue for future conditions in Amazonia as the climate warms.

Anecdotal evidence indicates wide-ranging impacts of the drought on sectors such as fisheries, river and air transport, health and agriculture. As rivers dried up, remote communities were isolated and commerce slowed to a standstill. Thousands of square kilometers of land burned for months (Shimabukuro *et al.*, 2009), releasing more than 100 million metric tonnes of carbon into the atmosphere. The impacts were even felt in intact forest, with research demonstrating a widespread mortality of trees (Phillips *et al.* 2009).

In this working paper, we collate data from online sources on environmental and socio-economic variables that can help to provide an indication of the impacts of the drought. The ultimate goal is to further develop this work in collaboration with other institutions to give a more complete understanding of the impacts and costs of the recent droughts.

METHODS AND ANALYSIS

The analysis was dependent on data availability, making it difficult to provide more than an overview to the subject at a large scale. We start by assessing the relationship between fire and rainfall anomalies across Brazilian Amazonia. Data were available for agriculture at a national level, but since the drought was concentrated in a particular sub-region, we primarily focus on this scale. Specifically, the impacts of the drought are considered in more detail for Acre State, Brazil, the area where the drought was felt most strongly.

Biophysical data

Remotely-sensed and modelled data were used to generate maps of the distribution of key environmental variables, including rainfall, fire occurrence and soil moisture.

Rainfall anomalies (deviations from mean monthly values) were calculated from data derived from the Tropical Rainfall Measuring Mission (TRMM), product 3B43-version 6. Fire occurrence was estimated during the period 2000–2006 from counts of hot pixels in daily, 1km resolution satellite data held in the NOAA-12 of INPE's Queimadas project. Hot pixels are indicators of fires and may well underestimate their occurrence. However, in order to evaluate the seasonal patterns and changes over time, the underestimations are irrelevant.

To investigate the impact of the fires on air quality, we obtained data on Aerosol Optical Depth (AOD), a dimensionless measurement of the reduction in the transmission of light by airborne particles such as dust, cloud droplets and smoke. AOD varies from zero to 1, where zero corresponds to a completely transparent atmosphere. AOD data for 2000–2006 were acquired from the MODIS MOD08 level 3 collection 5-monthly product (Hubanks *et al.*, 2008).

Carbon emissions

Data were compiled from the literature to estimate the total carbon emissions from Acre State. Tree mortality data from forest plots in Acre surveyed in 2005 were taken from Phillips *et al.* (2009). The areas of anthropogenic and standing forest burnt in 2005 were obtained from Shimabukuro *et al.* (2010). The primary forest area was taken from INPE's Program for the Estimation of Gross Deforestation in the Brazilian Amazon (PRODES; available at: *www.obt.inpe.br/prodes*).

Carbon losses to the atmosphere from pasture fires were estimated by multiplying the total area burned in deforested areas by the lower (11 Mg C ha-1) and upper (21 Mg C ha-1) values reported by Kauffman *et al.* (1998). The same procedure was repeated for the forest area burned. We used a range of forest biomass loss due to fires of 15–140 Mg ha-1 (Cochrane *et al.*, 1999) and a conversion factor of 0.5 to obtain the total C released to the atmosphere.

Health

Impacts on health were considered only for the state of Acre. Time series (2000–2006) data on respiratory and waterborne diseases were acquired for Acre from the Unified Health System (Sistema Único de Saúde, SUS; available at: *www2.datasus.gov.br/DATASUS*). The selected respiratory diseases for this study were: asthma, bronchitis, chronic obstructive pulmonary disease (COPD) and upper respiratory tract infection (URTI). Waterborne diseases selected for this study were: typhoid fever, cholera and diarrhoea. The SIH/SUS data included the number of admissions, the

number of paid Authorisations for Hospital Admissions (AIH), the total value spent on the focal disease, the median cost, the median admissions cost, the number of days that people stayed at hospital with the disease, the average of these days, the number of deaths and the mortality rate. All these variables were segregated by municipality in each micro-region: Cruzeiro do Sul, Tarauacá, Sena Madureira, Rio Branco and Basiléia.

Transport

Air traffic data from airports in the states of Acre, Rondônia and Amazonas were sourced from the Brazilian airport service, available at: (*www.infraero.gov.br/movi.php?gi=movi*). Although river levels were significantly reduced and navigation impossible in some areas, no data were found on river traffic.

Agriculture

Agriculture was analyzed at two scales: state and municipalities. A time series (2000–2006) of annual censuses of permanent and temporary crops (see Table 1) in 771 Amazonian municipalities were acquired from the Instituto de Pesquisa Econômica Aplicada (IPEA; available at: *www.ipeadata.gov.br/ipeaweb.dll/ipeadata?65370046*). The variables were: production (tonnes), area planted and area harvested (ha) and value of production (in Brazilian Reais (R$), adjusted to the year 2000). A yield index was calculated in order to evaluate the losses in 2005.

PERMANENT CROPS	TEMPORARY CROPS
Banana	Beans
Cocoa	Corn
Coffee	Cotton (herbaceous)
Orange	Manioc
Black pepper	Rice
	Soybean
	Sugarcane

Fisheries

Impacts on fisheries were analysed using data from fishery statistics documents on the IBAMA website (Brazilian Institute of Environment and Renewable Natural Resources, *www.ibama.gov.br*). Taking aquaculture and continental extractive fisheries separately, we constructed a historical series of production quantities in tonnes by state for the period 2000–2007 in order to determine the extent of any loss in 2005.

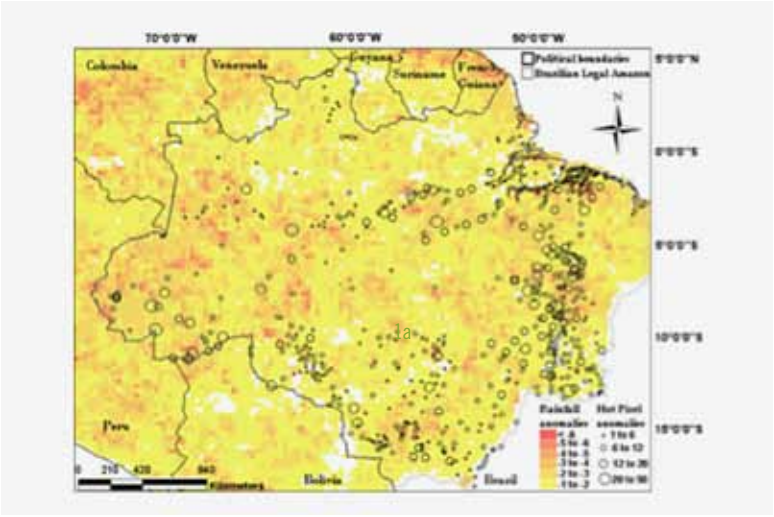
Production values in Reais (R$) were only available by state for 2006 and 2007. In order to estimate losses in production in 2005, we needed a historical time series of values and so we estimated the prices for the years with missing data.

Then we converted the 2006 prices per tonne (Pt) into the value for 2007, using the 2006 IPCA (National Consumer Price Index) as a deflator, equivalent to 3.14% (IPEADATA, 2007).

RESULTS

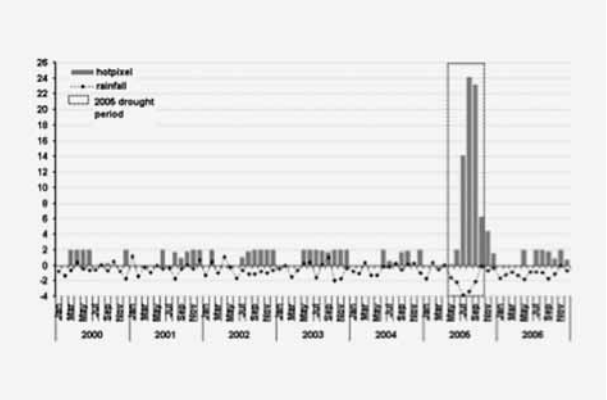
Fires

Incidences of fire were spread across the region, with a particular concentration in southwestern Amazonia (Fig. 1a). The peak in hot pixel anomalies coincided with the period of lowest rainfall (Fig. 1b).

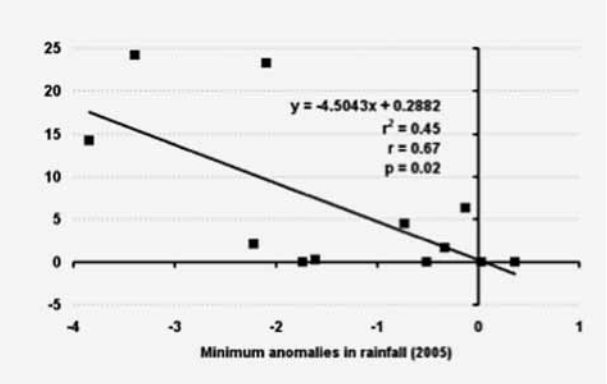


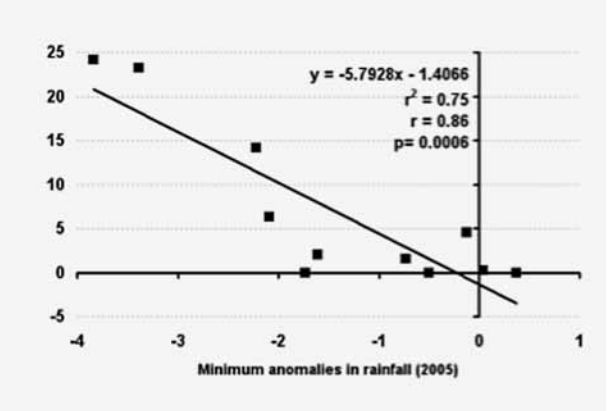
↑ Crops for which data were obtained from IPEA

↗ (Fig. 1a) Fire incidence ('hot' pixels) and the 2005 drought in Amazonia. In (a) and (b), hot pixels indicate the highest positive anomalies during 2005, while rainfall anomalies indicate minimum values during 2005. Anomalously high hot pixel counts in the southwest region of Amazonia, particularly in the State of Acre, were coincident with areas of anomalously low rainfall during the drought period. Anomalies were calculated as z-scores and are significant at 95% when values are lower than -1.96 or higher than 1.96. Rainfall data are from TRMM (http://trmm.gsfc.nasa.gov/data_dir/data.html).

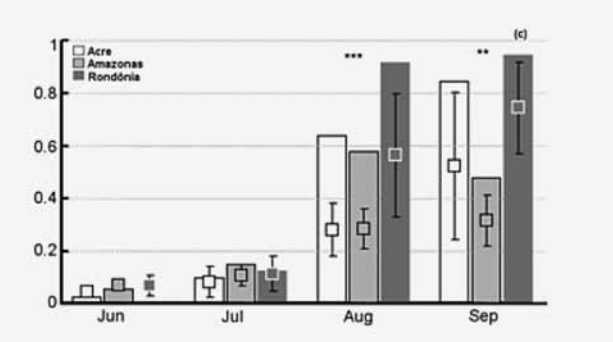


In Acre, rainfall (anomalies in minimum monthly rainfall) and fire incidence (anomalies in fire pixel counts) were inversely related across the state (Fig. 2a). The relationship becomes stronger (r^2=0.75, P<0.001) when a lag of 1 month is introduced such that maximal fire anomalies lag behind minimum rainfall anomalies (Fig. 2b).



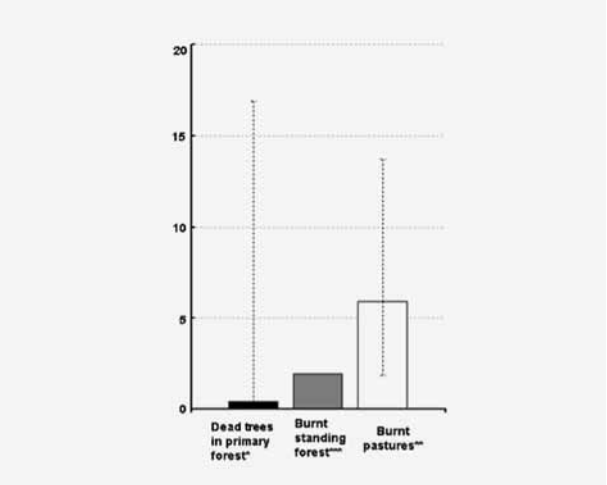


Aerosol Optical Depth (AOD) over western Amazonian states was significantly higher in August (P <0.004) and September 2005 (P <0.05) than on average for those months during the 2000–2006 period (Fig. 3). This means that atmospheric transparency was especially low during these two months across the region.



Carbon emissions

Multitemporal analysis with MODIS data showed that about 6500 km² of the land surface experienced some degree of burning in the state of Acre (Shimabukuro *et al.* 2009). Of this, 3700 km² corresponded to previously deforested areas and 2800 km² corresponded to areas of standing forest (Shimabukuro *et al.* 2009). Pasture burning produced the most carbon emissions (c. 6 m tonnes C), while burnt standing forests and the commited emissions from dead trees in primary forest contributed a total of c. 2.4 m tC (Fig. 4).



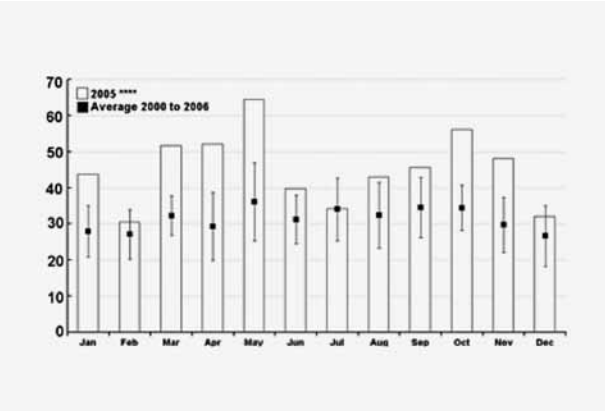
↑ (Fig. 1b)
↑ (Fig. 2a & 2b) Relationship between fire incidence ('hot' pixels) and rainfall anomalies in the State of Acre in 2005. a) Minimum rainfall anomaly and maximum hot pixel anomaly January to December 2005. b) Same as in (a), but with a 1-month time lag.
↗ (Fig. 3) Aerosol Optical Depth (AOD) over Acre, Rondônia and Amazonas states, Brazil. Bars represent 2005, while boxes and whiskers represent the average and SE for the 2000-2006 period. ** P < 0.05, *** P < 0.001
↗ (Fig. 4) Commited carbon emissions from dead trees in primary forest and carbon emissions from different sources on burnt areas in Acre in 2005.

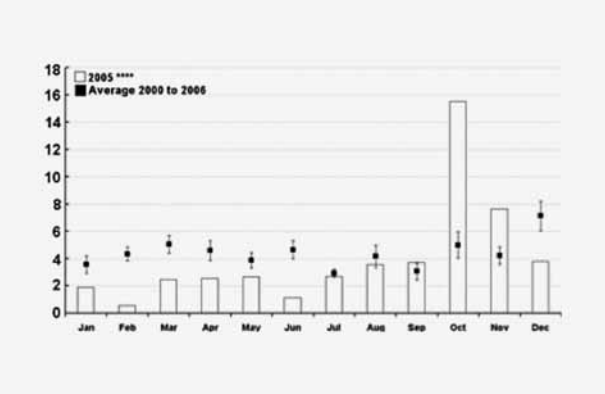
Health

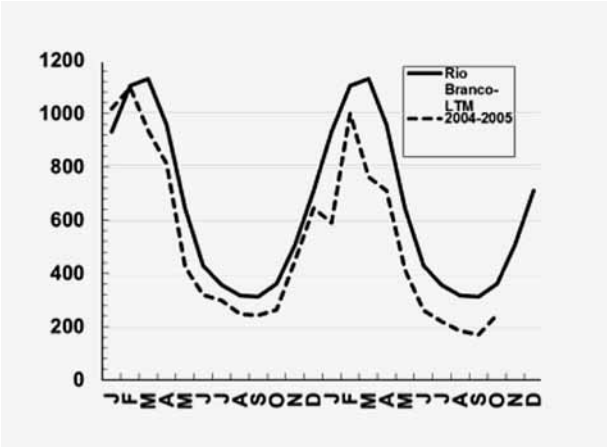
Health service data for Acre indicate that there was an increase in the number of admissions and the cost of treatments for both respiratory illnesses and waterborne diseases (Fig. 5).

Ordinary least squares regressions with cost as the dependent variable and number of admissions, total number of in-patient days, number of death certificates and month (a dummy variable coded as 1 for drought months) as independent variables suggest that there is a correlation between the months of drought (Jun–Dec 2005) and the costs of treatment for both respiratory illnesses ($n = 84$, $r^2 = 0.99$, $P < 0.001$) and waterborne diseases ($n = 84$, $r^2 = 0.97$, $P < 0.001$).

Waterborne diseases could have been linked to low water quality as a result of reduced flow volumes. River guage data from the Rio Branco in Acre illustrate the extent of the reduction in water level compared with the long-term mean (Fig. 6).



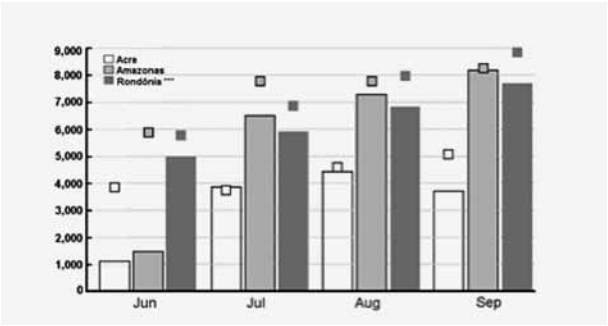


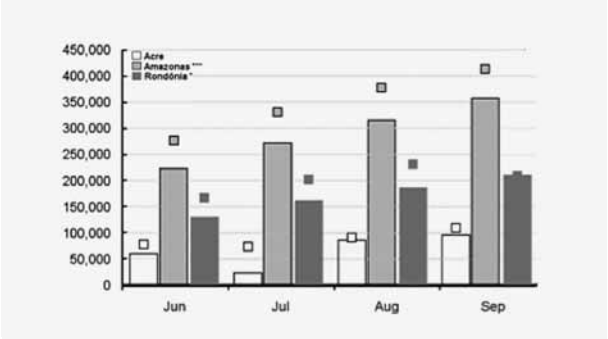


Transport

Analysis of flight records indicates that the number of domestic flights and the number of passengers flying declined during the months of the drought in Rondônia and Amazonas (Fig. 7).

In Rondônia, flights in 2005 were significantly lower than average ($P < 0.002$). In Amazonas and Rondônia, the number of passengers in 2005 was significantly





↑ (Fig. 5a & 5b) Costs of hospital treatment in Acre state for (a) respiratory illnesses and (b) waterborne diseases. Bars represent 2005 while black squares represent averages for each month during the 2000-2006 period. **** indicates $P < 0.0001$

↗ (Fig.6) Comparison of flow levels in Rio Branco, Acre, in 2005 versus the long-term mean (1967-2005). (Marengo et al. 2008a)

↗ (Fig. 7a & 7b) Bars indicate (a) numbers of flights and (b) numbers of passengers for 2005. Squares indicate average over the 2003-2009 period. ** $P < 0.05$, *** $P < 0.001$

lower than average (P <0.001 and P <0.07, respectively). There was no significant difference in the flight or passenger frequencies in Acre during the same period.

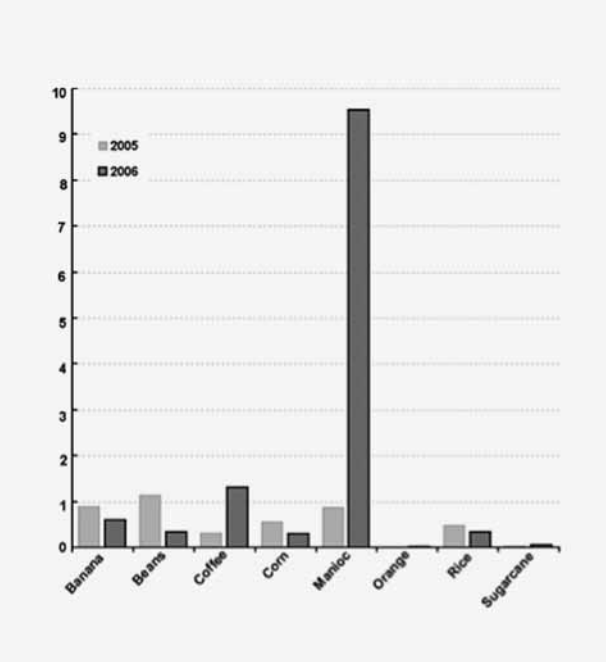
Agriculture

Rondônia experienced the biggest loss in production, representing 7% and 19% of total production value for the years 2005 and 2006, respectively. Coffee appears to have been the most affected crop in Rondônia, with losses in production value of 75% and 82%, respectively, in 2005 and 2006.

Pará exhibited the second biggest loss in the volume of agricultural production, but this was not so high relative to the total annual production from the state. Banana and pepper production decreased the most. Manioc exhibited a large loss in production between 2005 and 2006, falling from R$ 8,165,741 to R$ 3,196,709.

Amazonas did not experience high losses in comparison with other states, but its losses represent around 8% of the total production value of 2005 and 2006, with manioc being the most affected crop.

The state of Acre exhibited a 15% loss in its total production value in 2006. Its biggest losses were in manioc in 2006, followed by coffee in the same year and beans in 2005 (Fig. 8).

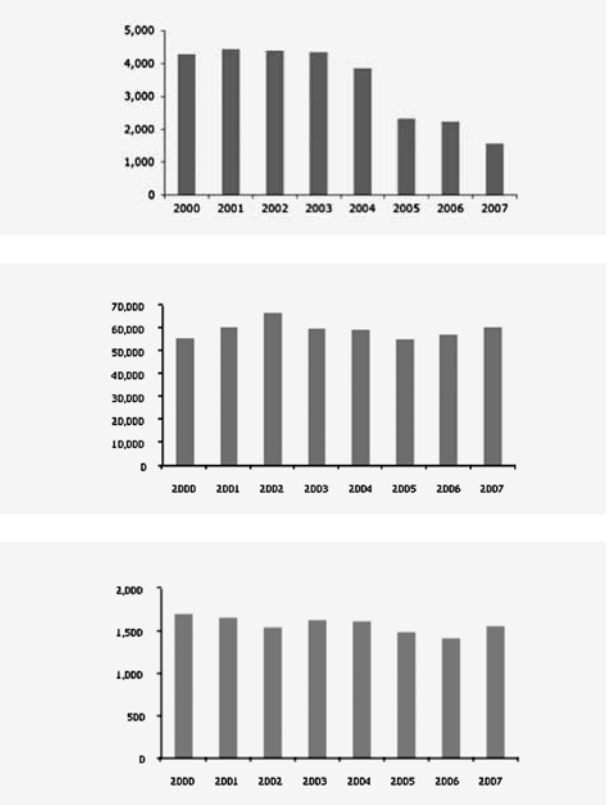


Fisheries

Aquaculture fisheries did not exhibit significant reductions in production in 2005. In contrast, extractive fisheries showed losses in the three western Amazonian states: Rondônia, Acre and Amazonas (Fig. 9). The reduction was particularly marked in Rondônia, dropping by almost a half from previous levels (Fig. 9a). The data show that production varies among years, making it difficult to determine the actual impact of the drought. Nevertheless, IBAMA (2007) records demonstrate that in 2005 the North of Brazil (i.e. Amazonia) saw a general decrease in production of 3.8% compared to 2004.

The states of Pará and Amazonas are the largest fish producers in the North. Pará produced 60,853 t, a decrease of 2.7% in 2005 compared to 2004. The species that contributed most to this decrease were: curimatã (74.2%), tambaqui (35%), and peacock piramutaba (4.2%).

The state of Amazonas, with a production of 55,413 tonnes, saw a drop in total catch size of 7.2% in 2005.



↑ (Fig. 8) Total economic losses from agricultural production in Acre, Brazil, in 2005 and 2006. Data from IPEA.

↗ (Fig. 9) Fish catches (tonnes) in (a) Rondônia, (b) Amazonas and (c) Acre states, Brazil in 2005. Note the different y-axis scales.

CONCLUSIONS

Although the analysis was limited by the paucity of data, our preliminary results indicate that the drought was felt across a wide range of sectors.

The reduction in rainfall was spatially and temporally correlated with fire incidence across Amazonia (Figs. 1 and 2). In addition, the increased incidence of fire in western Amazonia – where the drought was strongest – appeared to be linked to reduced atmospheric transparency (Fig. 3), probably due to the large amounts of smoke being emitted.

Fires affected 2,800 km^2 of standing forest, emitting approximately 2 m tonnes of carbon (Fig. 4). In addition tree mortality due to water stress could potentially contribute 0.4 m tonnes of carbon, released over time as the trees decompose. Drought-related carbon emissions across Amazonia may have resulted in a net release of carbon to the atmosphere compared with Amazonia's normal functioning as a net carbon sink (Phillips *et al.* 2009), however, analyses of the impacts of the 2005 and 2010 droughts on forest functioning are still ongoing.

The incidence of respiratory illnesses and waterborne diseases increased during the drought period in Acre, with hospital costs peaking in October 2005 (Fig. 5). An increase in the recorded costs of treating respiratory illnesses may have been the result of increased atmospheric aerosol loads resulting from fires (Fig. 3). There was a marked increase in waterborne diseases (Fig. 5b), just after the period of lowest water levels (Fig. 6). Hence, although the data are not conclusive, they indicate that there was an impact of the drought on health, potentially due to the increased airborne pollution (smoke) and reduced water level and quality. Support is given by the fact that the government drafted in emergency aid for local populations, distributing basic commodities, medical kits and sodium hypochlorite ampules for water purification (Rolim *et al.* 2006).

It is unfortunate that we were not able to locate data on river transport. The population of Northern Brazil has a special connection with the region's rivers. They are a major means of transport, far more important for rural communities than roads. Eye witness statements published in the media during the time of the drought demonstrate the large impact of river level reductions on transport, with some towns and villages becoming cut-off from food and fuel supplies.

Data on aircraft flights were available and showed that passenger and flight volumes were reduced in western Amazonia, particularly in Amazonas and Rondônia (Fig. 7). Again, we do not have direct evidence for causality, but there were anecdotal reports that the smoke-laden skies prevented flights from taking place during the peak of the fires.

With regard to agricultural production, we considered both 2005 and 2006 to account for reduced soil water levels at the start of the 2006 growing season. The data indicate some quite significant reductions in crop yields across the region. Coffee production in Rondônia fell particularly sharply. It is the most widespread permanent crop in the state and is thought to have a vulnerable production system that depends on reliable water supplies.

Manioc production fell in several states, with a marked reduction in yields in Acre in 2006 (Fig. 8). Manioc is a very important crop in tropical countries, being a key source of carbohydrate. One hypothesis for the reduction in manioc yield is that the lack of rainfall made the ground too hard to cultivate the soil and harvest the root crop.

Fishing is an important source of food and income mainly for riverine communities (comunidades ribeirinha), providing much of the protein consumed in Amazonia. The IBAMA fisheries data indicated that aquaculture was not affected by the drought, whereas continental extractive fisheries did appear to exhibit a reduction in catches. Rondônia saw a particularly large reduction in total catch (Fig. 9a).

The IBAMA records do not include subsistence fisheries and therefore the changes in fish catch are an underestimation. It is likely that the records are for fisheries in the major rivers, whereas artisanal fisheries would use smaller tributaries, which would have been most adversely affected by the drought. Media reports during the drought showed photographs of large-scale fish mortality as rivers dried up.

In conclusion, the available data demonstrate that the drought had a significant impact on ecosystem functioning and there were also widespread changes in a number of sectors, including fisheries, health, agriculture and transport. We lacked data on hydropower generation and river transport, which are likely to have been affected by the drought.

The analysis is also limited by the lack of data on causative processes, but all of the observed changes are in keeping with what would be expected from drought conditions; i.e. reduced river levels, increased smoke from fires and reduced soil moisture. Due to the lack of precision in the impacts of the drought, we have not focused on costing the impacts in economic terms.

Rather, we have tried to provide a picture of the drought using available online datasets, which can be improved through more focused research. The poorest members of society would have been most negatively affected by the drought but since they tend to be the least economically active group, it is likely that the economic impacts would be underestimated. Hence, focusing on non-monetary impacts is justified from a poverty perspective. Future research should aim to assess directly how droughts affect the health and livelihoods of those who depend most closely on Amazonian ecosystems and who have the fewest resources at their disposal to cope with adverse conditions.

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07

Risks To Amazonia: A Summary of the Past, Present and Future Pressures from Land Use and Climate Change

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The Amazon Basin is the largest watershed in the world, with a total drainage area of ~7 million km² [1]. Its forests occupy a total area of ~5.5 million km² [2] and store 70–140 Pg (1 Pg = 1 x 1015 grams) of carbon in their biomass [3–4] equivalent to ~10% of global vegetation carbon stocks [5]. Amazon rainforests are responsible for 10–15% of global net primary productivity [6–7] and recycle 25–50% of the rainfall that falls on them [8–10]. Deforestation and climate change in Amazonia, therefore, could have major consequences for the global carbon and hydrological budgets.

HISTORIC TRENDS IN LAND USE AND CLIMATE IN AMAZONIA

Detailed deforestation data are only available for Brazil, which accounts for ~70% of the area of the Amazon basin [2]. It is estimated that ~18% of the originally forested area in the Brazilian Amazon has now been deforested [11], a third of which is thought to be re-growing secondary forests [5]. However, deforestation rates have fallen considerably since 2004, averaging less than 7,000 km² per year in 2009–2010, compared to an annual average of over 20,000 km² per year in 1995–2005 [12]. The vast majority of deforested land has been replaced by pasture, as cattle ranching has been the main driver of deforestation in the 1990s and 2000s [11, 13] although the northward expansion of the Brazilian agricultural frontier has also played a part [14–15]. Forest degradation by selective logging has been found to match or even exceed deforestation rates [16] and constitutes another significant threat to the ecological integrity of Amazonian rainforests.Recent analyses of climate data suggest that Amazonian climate is becoming warmer. Average temperatures in the period 1976 – 1998 increased across all Amazonian regions, but were most significant in southeastern Amazonia, where temperature increases of 0.4 °C per decade occurred [17]. The lowest increases during this period were in the northwestern Amazon where increases of 0.15 °C per decade were found [17]. Analyses of precipitation trends in Amazonia point to no statistically significant changes in mean annual rainfall in recent decades [17–19]. However, a recent study using an alternative precipitation index has suggested that dry conditions in southern Amazonia increased between 1970 and 1999 [20]. In recent decades, the Amazon region has been hit by several large drought events. Large droughts in central and eastern Amazonia in 1983 and 1997/1998 were related to El-Niño Southern Oscillation (ENSO) while the drought events in 2005 [21] and 2010 [22] were associated with anomalously warm tropical North Atlantic temperatures and were centred on western Amazonia. The 2005 drought was one of the strongest to hit the Amazon in the last 100 years [21] and the 2010 drought is believed to have been more severe than the 2005 drought [22].

FUTURE LAND USE AND CLIMATE SCENARIOS FOR AMAZONIA

Future projections of deforestation in Amazonia range from 'business-as-usual' scenarios where recent deforestation trends will persist into the future, to optimal 'governance' scenarios which assume maximum implementation of environmental legislation and expansion of the network of protected areas [23]. The network of protected areas has increased in recent years in the Brazilian Amazon and now encompasses 54% of remaining Amazonian rainforests [24]. Climate change projections over Amazonia vary widely and depend on future emissions pathways as well as climate model projections. For one mid-range emissions scenario (IPCC SRES 'A2'), climate models project future temperature increases over Amazonia of 3–8 °C [25] until the end of the century. Rainfall projections vary greatly across models but there is a general trend towards an increase in dry season length [25]. In the most extreme climate model scenario, Amazonian rainfall is projected to be reduced by ~50% up to the end of the century [26]. The same model also suggests that 2005-like drought events are expected to increase in frequency this century [27]. However, it is important to note that uncertainty in climate model projections remains high and many models fail to adequately simulate contemporary rainfall patterns over Amazonia [25, 28].

POTENTIAL IMPACTS ON FOREST COVER AND ECOSYSTEM SERVICES

Under more severe climate model scenarios, a number of vegetation models simulate a large-scale loss of

Amazon rainforest cover and carbon stocks ('die-back') [26, 29–33], although the underlying mechanisms that lead to this result are model-specific [32]. Key uncertainties in this result include the potential of a physiological CO_2 fertilisation effect to mitigate against climate-driven forest losses [32–35] and the ability of the forest to acclimate to higher temperatures [32, 35–36]. Field studies at experimental drought sites that mimic the most extreme reductions in rainfall simulated by climate models (~50%) show that the forest is initially able to withstand such high drought levels. However, after a period of 3–4 years, large increases in tree mortality and losses of aboveground biomass were reported at these sites [37–38]. Unfortunately, there are no existing warming or high CO_2 experiments in Amazonia that can be used to inform predictions of the impacts of these drivers on future forest function. The impacts of climate change and deforestation on Amazonian ecosystems could be further amplified through positive feedbacks on fire frequency and intensity [35, 39–41] which would result in further increases in tree mortality and increased CO_2 emissions to the atmosphere. Analyses of field data from a large number of forest inventory plots in Amazonia have shown that the Amazon rainforest is most likely to be acting as a considerable carbon sink, absorbing atmospheric CO_2 and slowing down the rate of increase in atmospheric carbon dioxide concentration, thus also acting as a likely brake on global warming [42–43]. Integrated across the whole basin, this carbon sink is believed to be of a similar magnitude to the atmospheric emissions resulting from deforestation [44]. This carbon sink is responsive and most probably vulnerable to climate. Indeed, field measurements made shortly after the 2005 drought revealed increases in tree mortality in the drought-affected regions that were, according to one study, sufficient to reverse the pan-Amazonian above-ground carbon sink [45]. Deforestation can also affect climate. Flux tower measurements in Amazonia have shown that forests have lower albedo, greater net radiation and greater evapotranspiration than pasture areas, resulting in a cooler and moister boundary layer [46]. Climate modelling studies suggest that large-scale deforestation will result in a warmer and drier Amazon region [47] and that the resulting decreases in rainfall are particularly striking in a scenario where Amazon rainforest is replaced by soybean [48]. The impacts on rainfall depend critically on the scale of the associated deforestation: local (< 100 km²) deforestation may exhibit reduced evapotranspiration but may be too small to affect rainfall, areas of regional (100 – 100,000 km²) deforestation are large enough to influence circulation, strengthen convection and can result in either increased or decreased rainfall, while continental (>100,000 km²) deforestation would lead to severe reductions in evapotranspiration and on the precipitation recycled by the forest [49]. A number of atmospheric teleconnections have been proposed between Amazonian deforestation and climate in other regions such as reduced rainfall in the Midwestern United States [50] and warming in Eurasia [51]. Conversely, Amazonian rainfall patterns may be affected by deforestation in the Brazilian Cerrado [52].

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08

Amazonia's Aerial Rivers and Lakes: Investigating Large Scale Moisture Transport, its Relation to Amazonia and Subtropical Rainfall in South America

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This chapter is based on a research paper that has been accepted for publication by the Journal of Climate. For the purposes of this report, the Methods and Results sections have been omitted in order to reduce the length of the chapter. Full reprints of the original paper can be obtained from the first author (josefina.arraut@cptec.inpe.br).

ABSTRACT

This is an observational study of the large scale moisture transport over South America, with some analyses of its relation to subtropical rainfall. The concept of Aerial Rivers is proposed, and used as a framework, under which a symmetry/analogy is identified between the main pathways of moisture flow in the atmosphere and surface rivers. Opposite to surface rivers, Aerial Rivers gain water through evaporation and lose it through precipitation. The magnitude of the vertically integrated moisture transport is equivalent to river discharge and precipitable water in the atmosphere is analogous to the height of the liquid column. Multiplication of precipitable water by an equivalent speed gives discharge. Trade wind flow into Amazonia and the north/northwesterly flow to the subtropics, east of the Andes, are Aerial Rivers. The trade winds show difluence when entering the continent, like water flowing from a river into a lake. We say there is an Aerial Lake of moisture over Amazonia, deeper in the central western region, where precipitable water is highest. In the dry season, moisture from the aerial lake goes mostly northeastwards. However there is weaker flow over southern Amazonia, which according to the data used is a source of moisture, which heads towards the subtropics. The subtropical Aerial River discharge is comparable to that of the Amazon River. The amount of moisture coming from Amazonia has large spread, introducing important variability to the discharge. Correlations between flow from Amazonia and subtropical rainfall are not strong. However, some months within the set of dry seasons showed strong increase (decrease) occurring together with important increase (decrease) in subtropical rainfall.

INTRODUCTION

This paper is a study of the large scale moisture transport in South America throughout the year and its relation to subtropical rainfall, from the climatic stand point. An important concern is the role of Amazonia in this context. Special attention is dedicated to the tropics to subtropics flow east of the Andes and the contribution it receives from Amazonian outflow. During summer, this contribution is so large that a continuous pathway can be devised from the tropical Atlantic, over the forest and to the subtropics, as will be seen. Amazonia's hydrological cycle affects this moisture transport in various ways, both through the dynamical impacts of its influence over atmospheric heating and through its effects over the atmosphere's moisture content. Factors introducing variability to the precipitation over Amazonia, such as the El Niño Southern Oscillation phenomenon (Ropelewski and Halpert (1997), Marengo *et al.* (2010) and references therein), may introduce variability to this transport. Regarding the second point, some consideration is given to the ongoing debate on whether the forest may act as a source of moisture for the atmosphere and what may be the variability in time and space of this source.

The potential effects of deforestation are an important background concern to this work (see Nobre *et al.* (2009) and Marengo *et al.* (2009) for reviews on the subject) and the driest season, here found to be July and August, receives special attention because it is likely to experience the largest reduction in air moisture content over Amazonia, for reasons which will be dealt with further.

Aerial Rivers

The term 'atmospheric river' was proposed in Newell *et al.* (1992), Newell and Zhu (1994) and Zhu and Newell (1998) in reference to filamentary structures in the vertically integrated moisture flow field, which are responsible for very intense transport. These are typical of the extra-tropical latitudes where the flow shows turbulence in the large scale. At any given time a small number of these structures, generally around 4 or 5, can account for over 90% of the poleward moisture transport in the midlatitudes. The moisture flow east of the Andes was identified as a filamentary structure and therefore an atmospheric river in Newell *et al.* (1992), but is little mentioned in the subsequent literature on the subject, probably because it holds little dynamical resemblance to the more poleward lying rivers.

In the tropics, preferential pathways of moisture flow can also be identified, although they could not be described as filamentary. Oftentimes moisture will flow over large distances from the deep tropics to the subtropics and beyond. Observations show that long term mean high rainfall in the southern subtropics during southern summer occurs where the trade winds flow poleward after undergoing sharp turns: the South Pacific Convergence Zone (SPCZ), the South Atlantic Convergence Zone (SACZ) (Kodama 1992) and South America east of the Andes (Arraut and Satyamurty

(2009). This last pathway was called an aerial river in Arraut and Satyamurty (2009). The section of this flow lying adjacent to the Andes will, on some occasions, develop a core of particularly high speed called the South American Low Level Jet (SALLJ).

Intense moisture fluxes are often called moisture conveyor belts in the literature. However, this analogy draws attention away from the fact that exchanges between the surface and the atmosphere take place all along the way. In some cases these may be quite intense as with moisture coming from the tropical Atlantic and going over Amazonia on its way to the South American subtropics. The term aerial river is here proposed for all preferential pathways of moisture flow, filamentary or broad, because a near complete analogy can be established with the surface rivers. Aerial rivers lose water through precipitation and gain it through evaporation, while with surface rivers just the opposite takes place. Furthermore, precipitable water is the analogue of the height of the column in a body of liquid, both can be multiplied by an equivalent column speed to give the column discharge. Use of the aerial river image also allows for the slower and broader sections of a moisture pathway, such as over Amazonia, to be suitably described as aerial lakes, as will be done later in this paper.

Seasonal aerial rivers

When studies aiming to relate moisture transport and rainfall are carried out in the time scale of the weather, the path of moisture towards the precipitating area can be directly identified. However, in this work we intend to identify the preferential pathways, or aerial rivers, in the longer, climatic time scale.

Any continent must receive more water from the atmosphere than it releases into it, the excess being the total surface discharge into the ocean. Evaporation may exceed precipitation in some places, most probably in flooded areas. On the other hand, one can assume the reverse to take place in the areas of high rainfall, particularly where it attains its local maxima, which are source regions for river basins. These locations must therefore be characterized by large scale convergence of moisture transport in the atmosphere. In this way, mean rainfall can be used to identify the main regions of mean convergence of moisture transport. If the long term mean moisture transport exhibits a predominant pathway leading to an important rainfall region, then that is the flow showing the mean convergence. It can be inferred to be often the pathway of moisture during individual rainfall events. This way of linking the weather and the climate time scales was used in Arraut and Satyamurty (2009). In the present work it is used to identify predominant pathways of moisture flow to the subtropics throughout the year, or seasonal aerial rivers.

East of the Andes moisture transport and Subtropical weather and climate

The South American subtropics are quite humid in comparison to the usually drier subtropical belts of the planet (generally under the subsidence branch of the Hadley cell). Particularly during summer and adjacent months, the region's weather and climate result in large part from the interplay between the inflow of moisture from the tropics and the incursion of synoptic disturbances originated in the midlatitudes. Garreaud and Wallace (1998) showed this flow to intensify preceding cool air incursions, in response to the deepening of the North Western Argentinian Low (NAL), moistening the subtropical plains. Consequently intense rainfall occurs ahead of the incursion. Salio *et al.* (2002) undertook a systematic study of summertime Chaco Jet events, a special case of the South American Low Level Jet with large southward extension, finding their northerly moisture transport into the subtropics to be ten times stronger than climatology, fostering intense rainfall, which accounts for an important part of the seasonal total. A baroclinic wave train extending from the Pacific into the continent was found in the extratropics. Seluchi *et al.* (2003) and Saulo *et al.* (2004) showed that, south of 25S, intense moisture flow to the east of the Andes is mostly synoptically driven and due to the intensification of the NAL. Siqueira and Machado (2004) studied convective systems associated with frontal incursions, finding enhancement of moisture transport from Amazonia towards them to occur in the majority of cases. Salio *et al.* (2007) show that subtropical Meso-Scale Convective Complexes (MCCs) are 3.5 times more common on days when a Chaco Jet is present than on other days. The northeastward advancement of a baroclinic zone causes their displacement. Mendes *et al.* (2007) studied cyclogenesis over the southern region of South America and observed a moist-entropy reservoir northwest of the cyclone formation region, due to an intensification of the northerly flow along the eastern flanks of the Andes. Arraut (2007) presented a systematic study of summertime fronts, showing intense moisture transport from the tropics to take place prior to and during the frontal events, geostrophically accelerated by an intense NAL. Saulo *et al.*

(2007) find the intense convergence of low level winds associated with deep convection to introduce ageostrophic components in the northerly moisture flow into the subtropics.

Although the whole year is considered in this paper, the dry season is the main focus. The forests of Amazonia, with their elaborate root systems, are capable of storing large volumes of water in the soil and also of using it and releasing it to the atmosphere, drawing from deeper underground layers than do other kinds of vegetation cover (see Borma *et al.* (2009) and references therein). There is evidence of the forest keeping evapotranspiration rates almost constant throughout the year (see Table 1). It is to be expected that summer would remain the rainiest season even under deforestation, since moisture would be delivered by the trade winds and energy by the season's high insolation. In fact, most deforestation simulations give a rainfall reduction no larger than 25% (again, see Nobre *et al.* 2009 for a review). It is thus during the drier months that the forest's ability to administer soil moisture becomes in demand.

Is Amazonia a source of moisture for the atmosphere?

The possible role of Amazonia as a source of moisture for the atmosphere and the variability in time and space of this source is presently under debate, largely motivated by observations of moister air over the forest than over the adjacent Atlantic during southern summer (see for instance Nobre *et al.* (1991)). The water balance for the whole basin can be considered, in principle. In this case precipitation is the only external source, while water is lost to evaporation and to river discharge into the ocean. The basin cannot be an all year round systematic moisture source to the atmosphere, or it would dry out. The moisture balance equation for the surface (Peixoto and Oort (1992)) is considered.

$$P - E = Rt + S$$

where P is precipitation, E is evaporation, Rt is the total runoff (surface + underground, $Rs + Ru$), S is the variation in soil and surface water storage.

For the whole basin $Rt > 0$ always. If $P - E < 0$ then $S < -Rt < 0$. If $S > 0$, then $P - E > Rt$. In other words, net evaporation occurs at the expense of soil moisture, which must be decreasing by a value larger than runoff. If the soil is moistening, then precipitation is exceeding evaporation by more than the value of runoff. The hydrological response to rainfall in such a large basin as Amazonia is a complicated matter. However, during the wet season, there is overall moistening of the soil, leading one to expect that the basin is acting as a sink of moisture, even though atmospheric humidity is at its highest, as will be seen. Nothing can be inferred from soil drying alone. It is worth investigating if the forest acts as a source of moisture during its driest season.

Aerial Rivers and lake over South America

Applying the aerial river concept to the situation over South America, it can be said that the trade winds flowing into Amazonia form an aerial river. So does the moisture flow east of the Andes, towards the subtropics.

Moisture transport decreases inland, downstream of the trade wind confluence. This decrease is, at least in part, due to difluence. The pattern is very similar to that of a liquid flowing into a wider channel. It can also be seen in Figure 1 that there is generally a broadening of the moisture pathway when coming from the ocean into Amazonia. These are the reasons for here referring to the atmosphere over Amazonia as an aerial lake of moisture. Precipitable water increases inland from 50W to 65W and the Equator to 10S, so the decrease in transport must be due to diminishing wind speed in the low levels. Use can be made of the analogies proposed above. The aerial lake over Amazonia is deeper in the west, but flow speed diminishes in such a way that discharge is lower. In the dry season most of the moisture leaving the aerial lake system goes towards Central America. In the wet season most of the outflow is towards the South American subtropics.

CONCLUSIONS

This paper considers the large scale moisture transport in South America throughout the year and its relation to subtropical rainfall (illustrated in Fig. 1). A central issue is the role of Amazonia in this context, with the potential effects of deforestation as an important background concern that lead to an emphasis on the dry season, considered likely to be most strongly affected by drying of the air over the forest.

Some new terms were proposed for the study of large scale moisture transport. Preferential pathways of moisture flow in the atmosphere are called 'aerial rivers',

because an analogy can be established with surface rivers. Aerial rivers gain water through evaporation and lose it through precipitation. With surface rivers, the opposite takes place. Furthermore, precipitable water is the analogue of column height in a body of liquid, in the sense that both can be multiplied by an equivalent column speed to give the column discharge. Places where aerial rivers slow down and broaden, such as over Amazonia, which is downstream from the trade wind confluence, are termed 'aerial lakes' because of the similarity with the difluence situation of a surface river flowing into a wider lake. It is believed that this image helps elucidate the relation between precipitable water and moisture flow: the former may be higher over Amazonia during summer, but moisture transport lower, like a deeper but slower flowing surface lake.

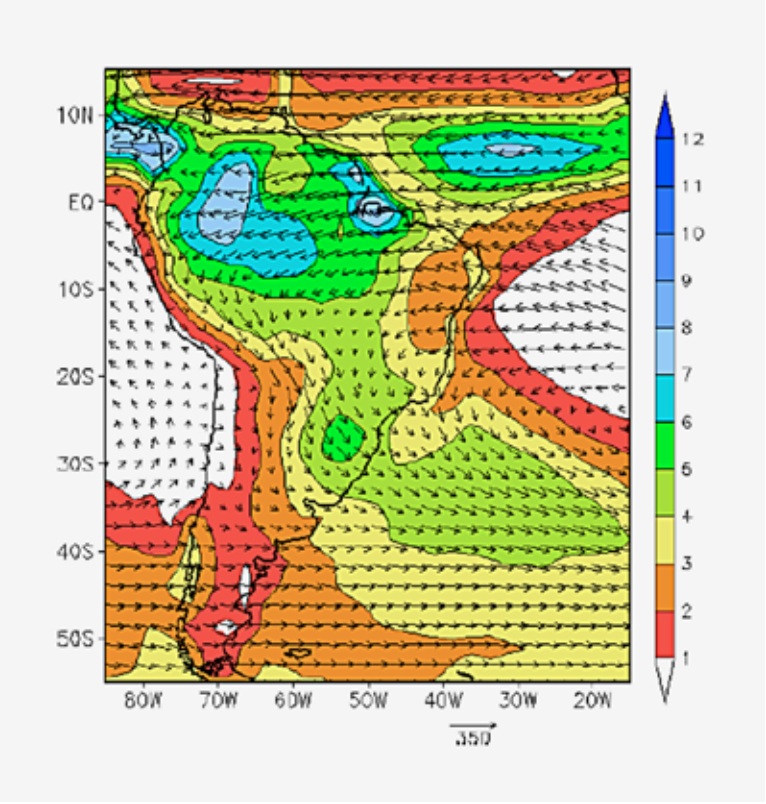
In this paper aerial rivers were considered in the climatic time scale and termed seasonal aerial rivers. They are identified in long term mean moisture transport fields assuming that, if a strong mean moisture current flows into a large scale mean convergence region it must result from the averaging of similar patterns in the weather time scale, which in addition will be important in fuelling precipitation. In other words, it is the climatic signature of an aerial river flowing into a precipitating area. Aerial rivers may not have a distinct climatic signature if they "move about" too much from one occurrence to the other. The fact that such a clear one exists in South America is most probably due to the barrier effect of the Andes over the flow.

Moisture convergence fields are considered unreliable. For this reason observed rainfall is used, the assumption being that convergence occurs where rainfall attains local maxima over the continent, since these are regions that feed the surface river basins. An aerial river was seen all year round adjacent to the eastern slopes of the Andes. The contribution of flow from Amazonia to the aerial river varied greatly during the year, being larger in the warm seasons and smaller in the dry ones. In the wet season this contribution was so large that the aerial river could be thought to extend from the tropical Atlantic, having the Amazonian aerial lake within it.

The aerial river east of the Andes was the main supplier of moisture to the regions of high rainfall in the subtropics in the dry season and in the two transition ones. In the wet season it shared its importance with the eastern branch of the South Atlantic Subtropical High, considered another aerial river, which fuels the subtropical SACZ.

Contributions from net evaporation to aerial river discharge are considered important, since they alter specific humidity and not flow speed, resulting in moister, more unstable, air, and not more air to be delivered to rainfall regions. In order to identify these contributions the divergence of moisture transport was considered, validated by comparison of the strong convergence regions with observed rainfall. Only the two dry seasons bore the comparison well. Both showed divergence under the aerial river east of the Andes, suggesting net evaporation to be occurring. The dry season (July to August) showed divergence over most of the latitudinal strip from 5S to 25S, suggesting southern Amazonia to be a source of moisture to the atmosphere at this time of year.

The water balance for the July/August aerial river was calculated, quantifying the flow contributions from Amazonia, zonally from the Atlantic as well as discharge into the high rainfall region and net soil evaporation as a residue. Amazonia gave the largest contribution, closely followed by zonal flow from the Atlantic. These



↑ (Fig. 1) Mean annual precipitation (kgm–2) and vertically integrated moisture transport (kgm–1 s–1) (Jan 1980 to Dec 2001) for South America and adjacent oceans. (Source: Fig. 4 in Arraut et al. (Accepted, J. Clim.)

two were mainly responsible for modulating the discharge variability, particularly the former, which shows a somewhat larger spread. Surface evaporation contributed from 20% to 35%.

An exploratory correlation analysis of the relation between outflow from Amazonia and subtropical rainfall was carried out. All seasons show areas of moderate correlations, above the 95% significance level where rainfall is highest in the subtropics, but these areas are larger for NM and SO.

The moisture in the Aerial River can be seen to come from three "sources": flow from Amazonia, flow that comes zonally from the Atlantic, and net soil evaporation under its course. According to the data used here, these three contributions are not very different in their mean importance, although evaporation is slightly smaller. However, the amount of moisture coming from Amazonia has a large spread. For this reason it impacts strongly the variability of the Aerial River discharge. Months were selected within the dry seasons, when flow from Amazonia, discharge and subtropical rainfall were all particularly strong (weak). They were found to present moisture transport patterns which were an intensification (weakening) of climatology, with increased (decreased) transport all the way from the tropical Atlantic to the subtropics. Given that tropical and subtropical flow are subject to very different dynamical influences, it would be interesting to investigate how these coherent anomaly patterns of such large scale arise.

FUTURE WORK

Our study using monthly means gave relevant insight into the relation between moisture outflow from Amazonia and subtropical South American rainfall. As was seen, this approach revealed the existence of two modes of large scale moisture transport, in which enhanced (weakened) flow from Amazonia to the subtropics was associated with higher (lower) subtropical rainfall. These modes are features of the large scale atmospheric variability, which could in principle be affected in a scenario of deforestation in Amazonia. An interesting study would be to look for these regimes in atmospheric model runs with the standing forest and observe if and how these are altered in simulations with deforestation. Additionally, when considering the overall potential impacts of deforestation, understanding if the moisture supplied to the subtropics is in excess or acting as a limiting condition becomes a central issue.

In the first case a reduction in the air's moisture content would not translate into reduced rainfall, all other conditions remaining unaltered. It is thus important to undertake a study of the most relevant types of rainfall events contributing to the seasonal totals and the dependence of their rainfall on the moisture content of the tropical air that fuels them.

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09

Exploring the Value of Amazonia's 'Transpiration Service'

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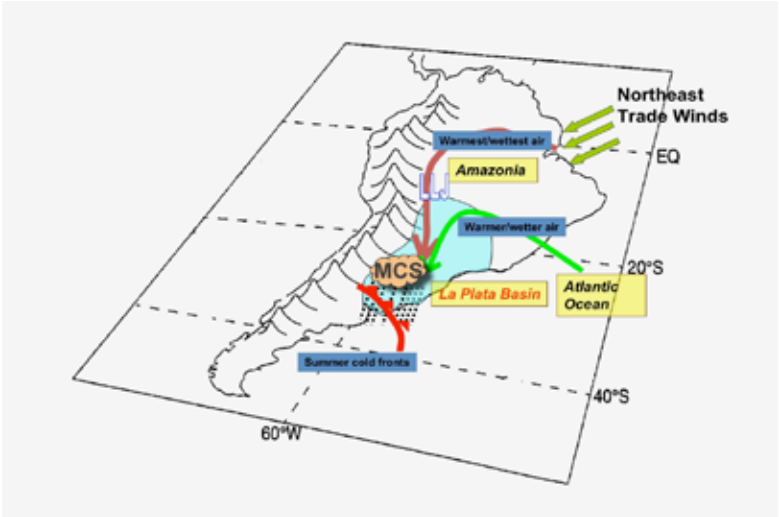
Amazonian forests play a crucial role in regulating climate. For decades, scientists have recognised the importance of the vast forest canopy in helping to maintain precipitation across the Amazon Basin through transpiration (Salati and Vose, 1984). This process could be the most important regional ecosystem service (Malhi *et al.* 2008), helping to regulate rainfall across the region and beyond the forest. Modelling studies suggest that large-scale Amazonian deforestation may affect precipitation in the region and across South America, and even globally, with impacts as far away as the Midwest of the United States (Avissar and Werth, 2005). Here we explore the economic values associated with this regional ecosystem service.

THE AMAZONIAN 'TRANSPIRATION SERVICE'

A continental-scale gyre (climate rotation) transports moisture westward from the tropical Atlantic Ocean to the Amazon Basin, and then southward toward the sub-tropics of South America. The gyre begins with trade winds that bring moisture from the tropical North Atlantic Ocean to Amazonia, providing the abundant rainfall that characterises the region. However, about 20–30% of the precipitation that falls in Amazonia is the result of local recycling from the forest (Lean *et al.*, 1996), in which evapotranspiration from the vegetation returns moisture to the atmosphere where it again forms rainclouds.



Amazonia's vegetation is efficient in storing moisture in the soil and releasing it to the atmosphere. In this the root system plays a double role. On one hand, it increases the interception of rainfall, hindering its progress into the river system. Typically, one meter of waterlogged soil can be found below the rainforest, as opposed to 15cm under pastureland. On the other hand, it is able to use this water in such a way that evapotranspiration is kept almost constant throughout the year. Table 1 compares forest and pasture evapotranspiration for the local dry and wet seasons.

An estimated 10 × 1012 m^3 (10 trillion metres cubed) of water enters Amazonia annually in the easterly trade winds, while the annual flow of the Amazon River at its mouth totals 6.6 × 1012 m^3 (Salati, 2001, as cited in Fearnside, 2006). The difference, or 3.4 × 1012 m^3, must either remain in Amazonia or be exported to other regions (Fearnside, 2006), for example via 'aerial rivers' (see Arraut *et al.*, Chapter 8).

Atmospheric moisture is carried by the gyre as it curves southward just east of the Andes. According to analysis of climate data by Arraut *et al.* (in press), this aerial river was the main supplier of moisture to the regions of high rainfall in the subtropics in the dry season and in the two transition seasons.

The section of the aerial river lying adjacent to the Andes will, on some occasions, develop a core of particularly high speed called the South American Low Level Jet (SALLJ; Marengo *et al.*, 2004; Vera *et al.*, 2005). The SALLJ can carry moisture from the Amazon Basin to La Plata Basin (Figure 1) (Marengo *et al.*, 2004; Marengo, 2006).

After the tropical Atlantic, the Amazon Basin is the most important non-local evaporative source of precipitation in La Plata Basin, with an estimated annual contribution of about 19% of the total rainfall in the region (Sudradjat *et al.*, 2002).

Modelling experiments suggest that large-scale deforestation of Amazonia would likely impact transpiration, thereby impacting the level of precipitation

	MEAN EVAPOTRANSPIRATION (MM/DAY)	
	WET SEASON	DRY SEASON
Tropical forest	2.8-3.6	2.4-3.9
Floodplain (Cerrado)	3-3.8	2.4-3.9
Pastureland	2.2-2.9	1.2-3.2

↑ (Fig. 1) Conceptual model of climatic phenomena in South America (Summer). From Marengo et al., (2004)

↗ (Table 1) Evapotranspiration measured using eddy covariance for ecosystems in Amazonia and Cerrado in the wet and dry seasons. Data summarised from Table 2 in da Rocha et al. (2009). Kindly provided by J. Arraut, INPE

recycling, with more water running off in rivers. This could potentially increase the variability of the amount of moisture carried in the SALLJ, which could in turn increase rainfall variability in La Plata Basin.

ECONOMICS OF RAINFALL IN LA PLATA BASIN

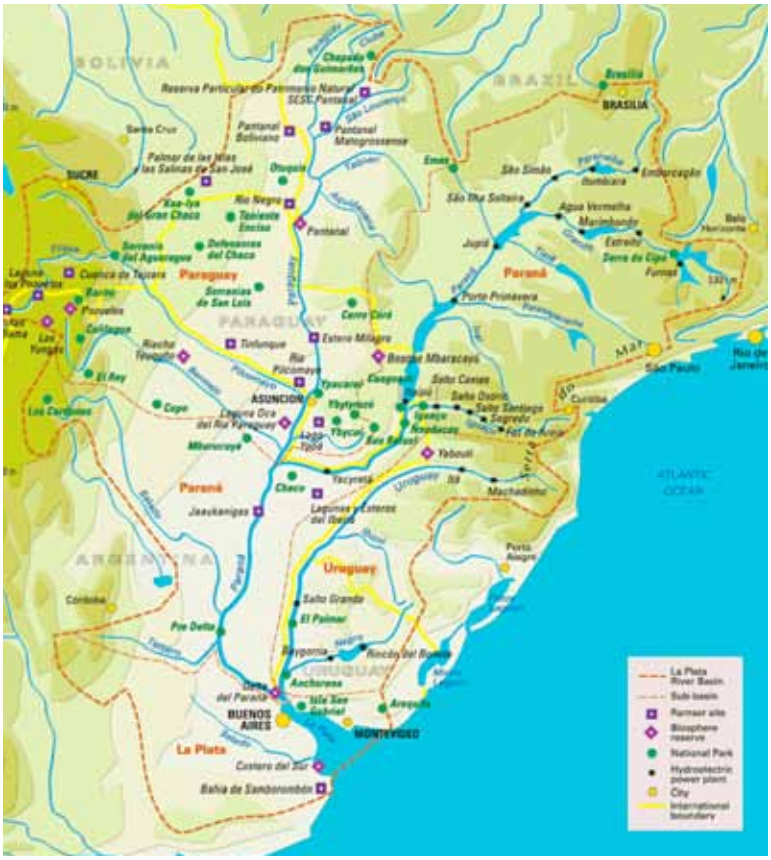
La Plata Basin is the second largest river system in South America, the fifth largest in the world, and includes the sub-basins of the Paraná, Paraguay, Uruguay and Plata Rivers (Figure 2).

The Basin covers nearly one-fifth of South America, extending over 3.1 million km² into Argentina, Bolivia, Brazil, Paraguay and Uruguay. It includes over 100 million inhabitants and an economy that represents 70 percent of the GDP of the five basin countries (UNESCO, 2009), equivalent to over US $1.8 trillion per year (PPP adjusted; IMF, 2009).

Precipitation is a continual factor of production for the economy of La Plata Basin. In addition to providing drinking water and water for industry, there are two economic sectors in the basin that are highly dependent on precipitation: agriculture and hydropower.

Agriculture holds the largest share of overall water consumption in the five basin countries, ranging from 62 percent in Brazil to 96 percent in Uruguay (FAO, 2009a), where the proportion of irrigated land to the overall agricultural area is between 2 percent in Paraguay and 17 percent in Uruguay (WWAP, 2007). These statistics imply that agriculture is highly dependent on rainfall in the basin, which averages about 1100 mm annually (WWAP, 2007). Furthermore, La Plata Basin is an important agricultural zone, so these statistics – based on averages over agricultural and non-agricultural zones – provide a lower bound of the importance of rainfall to agriculture in the region.

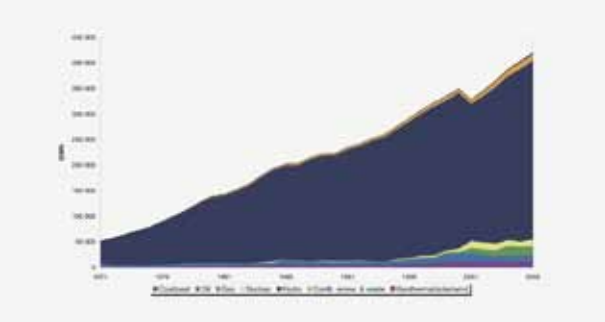
Rainfall is also an important factor of production in electricity generation in La Plata Basin, particularly for Brazil (Fig. 3) and Paraguay (Fig. 4), which are both heavily dependent on hydroelectricity (represented by dark blue in Figs 3 and 4). Brazil's heavy reliance on hydroelectric power has caused issues during low-rainfall periods in the past (EIA, 2009a), indicating its vulnerability to such events under a changing climate. Paraguay, being wholly dependent on hydroelectricity is clearly similarly vulnerable.

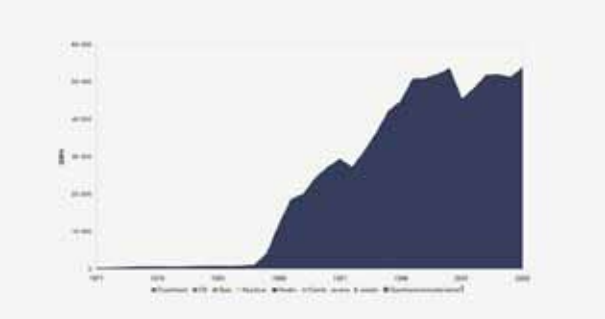


↑ (Fig. 2) La Plata Basin (from WWAP, 2007)

EXPLORING THE VALUE OF RAINFALL IN LA PLATA TO BRAZIL AND PARAGUAY

Initial approaches to valuing the Amazonian 'transpiration service' focused on potential agricultural loss due to reduced rainfall. Fearnside (1997) estimated the value of water cycling by the Amazon at US$ 19 per hectare per year by estimating the economic damage to Brazilian agriculture outside the Amazon per hectare of forest loss. The assumption was that 10 percent of agricultural harvest depends on water from the Amazon. Andersen (1997) estimated the net present value (NPV) of water cycling at US$ 1000–3000 (per hectare of forest lost) according to productivity loss. Both estimates give an initial indication of the value of the 'transpiration service', but they are based on broad assumptions, including the assumption that a loss of forest function would reduce the amount of rainfall in other regions.





Here, we do not assume that forest loss will reduce rainfall, instead we assume that there may be an increase in variability in moisture transport which could translate into more variable rainfall in La Plata Basin. The approach is to understand the value of the Amazonian 'transpiration service' from the point of view of the economic sectors in La Plata Basin that are on beneficiaries of the flow of value from Amazonia's 'transpiration service' in the form of precipitation regulation.

Detailed economic analysis may be developed for the value of rainfall to both agriculture and hydropower in the basin, but our early estimates indicate that value to be in the range of US$ 10s of billions per year.

Agriculture

The agricultural output of the basin is believed to be greater than US$ 100 billion annually (Killeen and Portela, 2010). We compiled detailed data on agricultural production from Southern Brazil and Paraguay.

Agricultural production values were based on 2000 prices, inflated to 2010 and adjusted to international US$ based on implied purchasing power parity. Both inflation and PPP adjustments were those listed in the database of the International Monetary Fund's World Economic Outlook 2009 (IMF, 2009).

Brazilian data were compiled by municipality. Approximately 3% of Brazilian municipalities that are in La Plata Basin only partially intersect the basin. As such, a conservative estimate of total crop value was achieved by assuming 5% of those Brazilian municipalities were only 50% within the basin, providing a downward adjustment to total crop value of 2.5%.

Our analysis shows that the annual gross value of crop production averaged US$ 41.38 billion in 2000–2007 (IPEA, 2009) and US$ 4.21 billion in 2000–2005 (FAO, 2009b), respectively. From this information a rough estimate can be derived of the value of precipitation to agriculture in the Brazilian and Paraguayan portions of La Plata Basin that is attributable to moisture transported across Amazonia. The average value of agriculture in each of these areas was adjusted based on the proportion of non-irrigated cultivated area (Table 2), to conservatively account for only the agricultural area directly dependent on rainfall. Of the resulting value, 19 percent can be considered dependent on rainfall attributable to water that has passed across Amazonia (Sudradjat *et al*., 2002). Based on prices inflated to 2010 and adjusted by purchasing power parity, that value is US$ 7.27 billion in Southern Brazil and US$ 0.80 billion in Paraguay (Table 3). It should be noted that these estimates of agricultural value are conservative as they likely underestimate the importance of rainfall to agriculture in the region. Additionally, they are only for crop production and do not account for livestock rearing, which depends on pastureland that is predominantly rain-fed.

COUNTRY	% SHARE OF TOTAL WATER USE BY AGRICULTURAL SECTOR (IN 2000)	% SHARE OF TOTAL CULTIVATED AREA THAT IS IRRIGATED (ESTIMATES VARY 2000-2003)
Argentina	73.7	2.7
Bolivia	80.6	6.7
Brazil	61.8	7.5
Paraguay	71.4	0.3
Uruguay	96.2	16.8
Source	*FAO, 2009*	*WWAP, 2007*

↑ (Fig. 3) Electricity generation by fuel in Brazil (IEA, 2008)
↑ (Fig. 4) Electricity generation by fuel in Paraguay (IEA, 2008)
↗ Agriculture and water in La Plata basin, national averages (2000-2003).

Hydropower

In general terms, land use change and climate change — acting in concert — would be expected to increase the variability of water available to hydropower generation, making management of the system more difficult and costly.

Rainfall is an important input to hydropower in La Plata Basin, a region that is critical for energy generation in the basin countries. In Brazil, for example, dams on the Paraná River produce 46% of all the country's electricity (CIC, 2004), which is about 201BkWh (EIA 2009a). Rainfall transported across Amazonia could represent 0–20% of the water used for hydroelectricity in La Plata Basin. Here, a mid-range assumption of 10% is explored, for illustrative purposes only.

Conservatively assuming constant marginal value of water used for hydroelectric generation, the value of water for hydroelectricity can be roughly estimated using replacement costs.

Based on the current regulated tariff for electrical energy in Southern Brazil of US$0.08/kWh, the replacement cost of 10% of hydroelectric power produced in the Brazilian portion of La Plata Basin could be US$ 1.6 billion per year (2009 prices), the majority of that value attributable to the Itaipú hydropower facility (generating nearly 95BkWh). Paraguay produces all of its electricity from hydropower, totalling 53.25BkWh (EIA, 2009b). Using a similar rough estimation as for Brazil, the replacement cost of electricity generation in Paraguay could be US$ 0.43 billion per year.

Importantly, however, hydropower generation depends on the pressure head of water, thus as water level falls in a reservoir the generation becomes less efficient in terms of volume of water needed per kWh produced. As such, the relationship between water level and electricity generation is not linear, but there are increasing marginal costs to a decrease in water, meaning the value of rainfall to hydropower would be higher than any estimates based on a linear relationship as carried out above.

	TIME PERIOD**	MINIMUM	AVERAGE	MAXIMUM
Southern Brazil	2000-2007	5.27	7.27	9.55
Paraguay	2000-2008	0.76 (0.82)	0.80 (0.87)	0.83 (0.90)

↑ (Table 3) Estimated value of the portion of agriculture in La Plata Basin dependent on rainfall attributable to moisture transported across Amazonia (International US$ billions, inflated to 2010 and PPP adjusted). *Minimum and maximum derived by taking minimum and maximum price (Intl US$) over years for which data are available and applying that to the average volume of production (tonnes).
**Price data were available 2000-2005 for Paraguay, but volume of production available to 2008. Values in parentheses represent prices from 2000-2005 applied to average volume of production 2000-2008.

CONCLUSIONS

Through projects such as the Large-scale Biosphere-Atmosphere experiment, climate and ecosystem sciences have taken great strides in understanding the interaction of forest canopies and the atmosphere. It is now clear that tropical forests provide ecosystem services at multiple scales, one of which is the support of precipitation in distant locations through the recycling of moisture back into the atmosphere via evapotranspiration.

As previously mentioned, detailed scientific and economic analysis is necessary to more accurately understand the value of precipitation attributable to the Amazonian 'transpiration service' that falls in La Plata Basin. In particular, a better understanding is needed of the impacts of Amazonian deforestation on moisture transport and rainfall.

Our rough estimates, however, do provide an idea of the magnitude of that value. It is possible that more than US$ 7 billion of annual crop production in Southern Brazil and nearly US$ 1 billion of that in Paraguay is dependent on rainfall contributed to by moisture transported across Amazonia.
The value of hydroelectricity production across the two countries which is dependent on rainfall linked to moisture transported across Amazonia could also be US$ billions.

Not only are these values likely conservative in their estimation, but they only represent a small portion of the South American economy that depends on the Amazonian 'transpiration service'. For example, they only represent the value to the Brazilian and Paraguayan portions of La Plata Basin and do not account for the manufacturing or domestic sectors of any Basin country. Nor do they consider Amazonia's role in regulating rainfall in the Andean region, where large cities and populations depend on water from glaciers, which are already showing signs of the impacts of climate change.

These initial estimates of the value of the Amazon 'transpiration service' are based on a fairly crude analysis that does not assume that rainfall will become less frequent in the future. More research is required to understand how changes in Amazonia could have 'downstream' impacts via the passage of moisture in the atmosphere. However, our preliminary analysis suggests that the value is potentially of the order of US$ 10s of billions per year, which contributes to the livelihoods of 100 million inhabitants and 70 percent of the GDP of five South American countries. This

illustrates the importance of Amazonian forests as ecological infrastructure, providing a flow of ecosystem services as valuable inputs to the economy of South America.

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10

Mapping the Benefits and Costs of Amazonia's Ecosystem Services

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– Sophia Burke, AmbioTEK

Amazonian forests provide a wealth of ecosystem services at multiple scales. One of the capacity-building actions to come out of the *'Valuing forests as global eco-utilities'* project's Inception Workshop was the collation and analysis of existing socio-environmental data from across the Amazonian region. The previous ESPA Situation Analysis for Amazonia and the Andes (ESPA-AA 2008) had collated a large quantity of spatial data and this was used as a basis for further policy-relevant analysis. There is substantial policy interest in Reducing Emissions from Deforestation and Degradation in developing countries (REDD), a financing mechanism that could be part of a future international climate treaty. If designed appropriately, REDD policies and measures could maintain the delivery of ecosystem services at a regional scale across Amazonia, helping to reduce vulnerability among the region's poor. By conserving forests, however, REDD might generate a trade-off between these services (and the benefits they provide to people) and economic development (i.e. opportunity costs) in the form of agriculture, which is one of the primary drivers of deforestation. In this chapter, the spatial patterns of different ecosystem services: 'A' (agua = water), 'B' (biodiversity) and 'C' (carbon), are compared with the land's potential for economic development ('D') to explore the potential trade-offs that could arise through the protection of Amazonia under a future REDD system. The aim is to carry out an analysis of costs and benefits associated with Amazon forest protection/degradation taking into account water, biodiversity, carbon and poverty/development outcomes of forest loss and forest protection.

The analysis is a preliminary assessment of the issue and provides a stepping-stone to a more detailed analytical tool that could aid decision-makers in designing policies to protect forests, address climate change, support poor communities and foster economic development.

OBJECTIVES

- To develop an index for the distribution of realisable water service value at the Amazon scale.
- To develop an index for the distribution of realisable carbon value at the Amazon scale.
- To develop an index for the distribution of significance and importance of biodiversity at the Amazon scale.
- To combine these maps into an aggregate index of ecosystem service value and its geographical distribution.
- To map the potential benefits from development of agriculture, timber and pasture at the Amazon scale.
- To indicate the distribution of trade-offs between agricultural potential and ecosystem value potential.

In this analysis we consider direct human-use values only (not for example the importance of water for environmental flow maintenance).

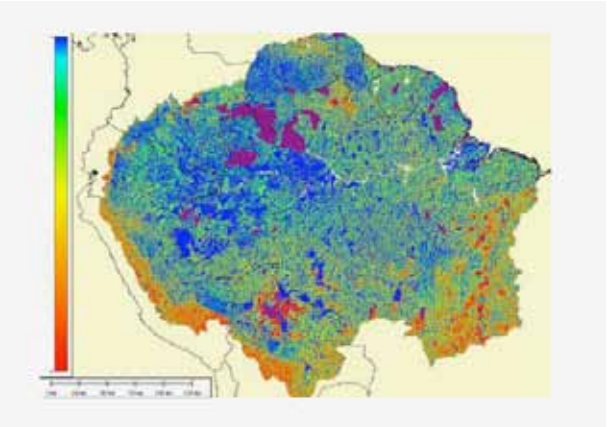
METHODOLOGY AND RESULTS

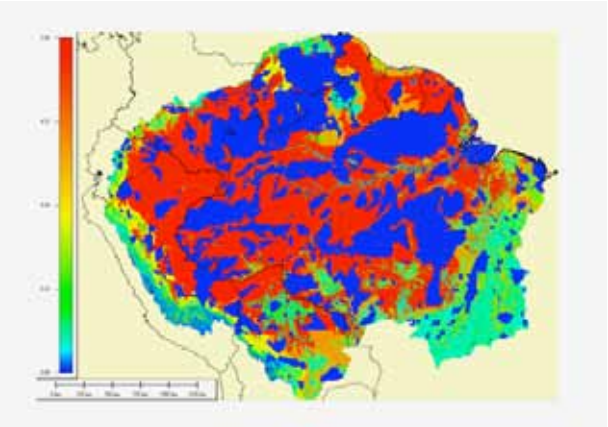
The best available global and regional databases from the simTerra database were used to develop this analysis using raster grids with a common spatial resolution of 1km and an extent covering the Amazon hydrologic basin and beyond as defined by OTCA (Organização do Tratado de Cooperação Amazônica). Data are generally from the 2000s onwards with the exception of climate data in which a more representative period (1950–2000) are used.

Realisable Water Value

We first calculate a realisable water value index. This is composed of three calculations. First we cumulate population density for 2005 from the GPW dataset down the Amazon water flow direction network derived using a d-9 algorithm from a 1km digital elevation model based on the SRTM to give downstream accumulated population (acc_pop). We then calculate the total downstream population of any point and assign the value to that point as variable downstr_pop. Finally realisable water value (water_avail) is considered as zero if there are either no downstream populations and no downstream dams or else water_avail is calculated as the downstream accumulated rainfall (based on 50 year mean rainfall from WORLDCLIM) weighted by a human footprint index (Mulligan, 2009a) indicate the quality of the water supplied rather than just the quantity. This quantity (in m3 water/year) is converted to an index for better integration with the other services by expression of the value in each pixel as a ratio of its value to the maximum value within the OTCA area.

The realisable water value index is shown in Figure 1. The index is high where there are substantial volumes of rainfall falling on areas with a low human footprint in terms of agriculture, pasture, mining, urban areas and oil and gas. This produces large volumes of clean





rainfall converted to clean runoff. If there are then dams or persons downstream to consume this resource, the resource is considered an environmental services and its value index is thus high (blue). Good examples of high water value generation areas are the NW Amazon. Low water value generation areas include the Andean slopes of Ecuador, Peru and Bolivia since these have both lower rainfall (less runoff production) and a high human footprint on the quality of that water. Note that the few areas coloured purple indicate areas in which there may be plentiful water generation but there are no significant downstream human uses.

Realisable Carbon Value

Carbon value is calculated on the basis of both carbon stocks present in the standing biomass (excluding the soil carbon) and the carbon sequestration by the standing biomass. Carbon stocks were calculated from the map of Ruesch *et al.* (2008) expressed in tonnes of carbon per hectare. Carbon sequestration is calculated from an analysis productivity (sequestration) estimates based on 10-daily data from the SPOT-VGT system ten year over the ten years 1998–2008 (Mulligan, 2009b), expressed in tonnes of carbon per hectare per year. The total carbon value is expressed as the sum of these two components over a single year. Clearly the longer the time horizon taken the greater would be the emphasis of geographical variability in sequestration over geographical variability in stocks. Once again this total carbon value is ratio-ed relative to the maximum value across the OTCA area in order to derive a carbon value index (0–1). Finally the map is masked to give a value of zero to protected areas (defined according to the WDPA , 2009) if these areas are excluded from obtaining carbon funds through the REDD mechanism on the basis of not delivering additionality (as was the case under the UNFCCC Kyoto Process Clean Development Mechanism (CDM), where only afforestation and reforestation projects were eligible to be used as offsets).

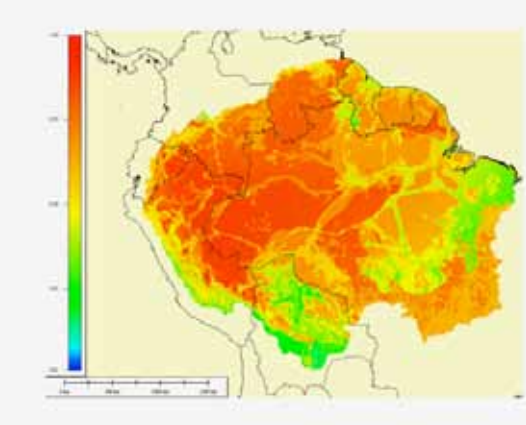
Biodiversity and Ecosystem Value

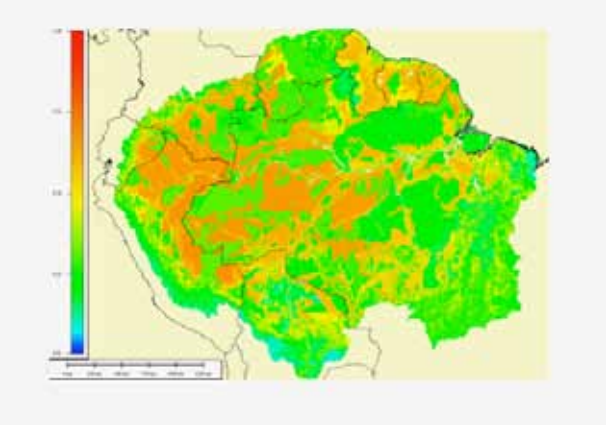
The value of water and (increasingly) carbon to human societies is clear. The value of biodiversity itself is much more difficult to quantify since biodiversity has no direct realisable (marketable) value though it is a clear component underpinning the value of many other environmental services. We chose to value biodiversity on the assumption that (a) its value is correlated with species richness (a measure of the number of species present) and endemism richness (a measure of the rarity of those species) and (b) its value is correlated with numerous assessments of conservation prioritisation made by major conservation organisations globally. The spatial distribution of biodiversity value was calculated as species richness and endemism richness for three groups for which data are available: mammals (IUCN *et al.*, 2008a), amphibians (IUCN *et al.*, 2008b) and birds (Ridgely *et al.*, 2007). Species richness and endemism richness have been previously calculated for these datasets on a 1km pixel basis (Mulligan, 2009, unpublished) and those values were used here. These values were combined and added to an index of conservation priority based on five published datasets: frontier forests, global 200 priority eco-regions, conservation hotspots, last of the wild and mega-diversity countries as outlined in Annex 1.

Finally the biodiversity value index is calculated as the sum of the conservation priority index and the biodi-

↑ (Fig. 1) Realisable water value index. The index is high (blue) where there is water generation and there are water consumers downstream to realise the value of this water. Some catchments (purple) have no or few direct consumers downstream. Most water productive areas are in the NW of the basin.

↗ (Fig. 2) Realisable carbon value. Protected areas are given zero carbon value because they are assumed to be excluded from the REDD mechanism for realising carbon benefits. Includes C stocks and sequestration. The pattern is dominated by stocks but would change with the time period over which sequestration values are accounted.





versity index above and, once again, rationed by the maximum observed value in the study area for comparability with the carbon and water indices. The resulting index is shown in Figure 3 and indicates greatest value in the intact forests of the western Amazon, especially near the transition zone with the Andes.

Total environmental service value is thus the combination of realisable carbon value, water value and biodiversity value, each of which is given an equal weighting in the final environmental service benefits (ESB) index (Figure 4). The index is high where potential benefits from ES provision (water, carbon, biodiversity) are high. Protected areas are lower on average than surrounding forests because in this analysis they are excluded from the REDD mechanism for realising carbon benefits.

Forest Conversion or Development Values

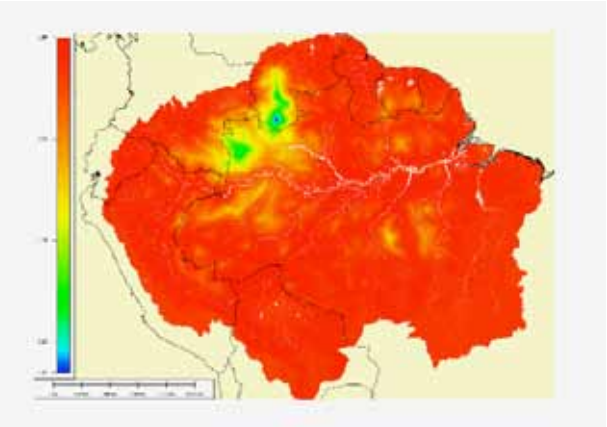
1 *Crops*. The potential development benefits index calculated here considers the spatial distribution of potential value for cropping, logging and pasture. The distributions of major crops considered were based on the maps of Ramankutty *et al* (2008). Current agricultural value (for areas already under agriculture) was estimated as the hectarage of each crop type multiple by a crop specific price estimate for the Amazon for the following nine crop groups present in the region.
2 *Logging*. The potential gain from logging is calculated as the tree cover fraction per pixel according to MODIS VCF as a measure of the available resources multiplied by the one-off timber harvest value i.e. before conversion to pasture/ agriculture (Stern 2007) of 236 USD/ha conditioned by accessibility as a measure of the profitability of timber extraction and transport to export markets. Accessibility follows Uchida and Nelson (2009) and is used here in ratio form as fractional accessibility scaled between 0 and 1. Where accessibility to markets is high then we apply the full 236 USD/ha and as accessibility falls (gets closer to 1), this economic gain falls to zero linearly.
3 *Pasture*. The value for current pastures is calculated is calculated by combining the pasture distribution for 2000 of Ramankutty *et al* (2008) with the USD 390/ha. Value for pastures used by Stern (2007).

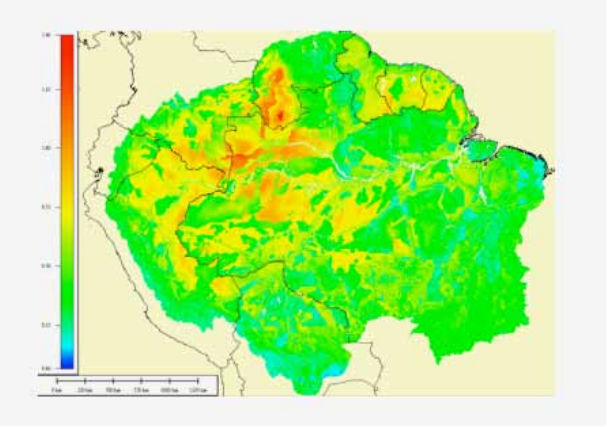
In order to extend the value calculations for cropland and pasture to areas which are currently forested we first assume that the costs of developing these land uses increase with distance outwards in all directions from their existing distribution with the cost of developing each pixel weighted by the accessibility of that pixel such as development is most economically productive and viable in the most accessible areas that are nearest to the existing distributions of each crop. This accessibility-weighted distance criterion was applied to each crop type and to pastures in order to obtain potential value surfaces. Profitability for these conversion functions is assumed to be unaffected by protected areas.

Combining these surfaces for pasture, logging and crops gives a total potential conversion value. We then ratio this value against the maximum for the study area such that it is comparable to give the potential development benefits (D) index of Figure 5.

The D surface shows high benefits from conversion throughout the basin except in the most inaccessible

↑ (Fig. 3) Biodiversity and ecosystem value index. Calculated by combining a range of conservation prioritization schemes with known species and endemism richness for amphibians, mammals and birds.
↗ (Fig. 4) Combined environmental service benefits (ABC). The index is high where potential benefits from ES provision (water, biodiversity, carbon) are high. Protected areas are lower on average than surrounding forests because they are assumed to be excluded from the REDD mechanism for realising carbon benefits in this analysis.





areas where costs of development from the existing infrastructure are very high. In this way the infrastructure is already sufficiently developed to allow conversion of most of the basin if the environmental service values are ignored.

The ABC:D trade-off (where ABC and D are relative indices varying from 0 to 1 where 0 is lowest value in the Amazon basin and 1 is highest value in the Amazon basin)) is a measure of the spatial congruence of potential service benefits and potential development benefits. Since both are relative measures (against the maximum for the basin), they are not directly comparable in economic terms. The ABC:D trade-off surface (Figure 6) indicates in yellows and reds where the benefits from ES are high compared with the rest of the basin and the benefits from conversion are low compared with the rest of the basin. The red and yellow areas are those with higher than average ES values and lower than average productive values. The green and blue areas have higher than average conversion values and lower than average ES values. Note that because of their exclusion from carbon services in this analysis protected areas come out as having lower than average ES values. The ABC:D trade-off is relative ES value minus relative conversion value and is thus a measure of the ranking of areas in terms of the magnitude of their ES value minus the magnitude of their conversion value (i.e. not a dollar value but an index of the importance of a pixel for ES – compared with the rest of the basin — versus its importance for conversion – compared with the rest of the basin).

ASSUMPTIONS

The main assumptions behind these analyses are as follows. A number of these can be addressed through more detailed analyses with more specific objectives in mind.

- Protected areas do not receive carbon value in this analysis (on the basis that they are already protected and this carbon additionality might be difficult to prove).
- Carbon, water and biodiversity have equal weighting in the overall ES value.
- Agriculture and pasture has greater likelihood of appearing near its existing distribution and its value declines with distance from existing distribution with a weighting according to accessibility to markets.
- Logging potential is proportional to tree cover (as a measure of the resource) and its potential value a declines with lower accessibility to markets.
- Total conversion value is the sum of pasture value, logging value, cropland value (for 9 crop groups each with a different price in order to account for high versus low value crops with differing distributions).
- Total ES value is the sum of values for biodiversity and conservation priority, water and carbon.
- The distribution of biodiversity value is a function of measured spp. richness and endemism richness for mammals, amphibians and birds combined with a compound index for conservation priority giving equal weight to each of five conservation priority assessments, specifically: frontier forests, Global 200 Ecoregions, CI Hotspots, Last of the Wild and Megadiversity countries.
- The distribution of water value is a function of the quantity of clean (i.e. low water quality human footprint) water where there is downstream demand for it (i.e. population or dams).

↑ (Fig. 5) Potential development benefits index. The index is high where potential benefits from development (agriculture, timber and pasture) are high. Accessibility is a strong driver as are the current distributions of land use and the potential for timber production.

↑ (Fig. 6) ABC:D trade-off surface

PROSPECTS

This work represents a sophisticated but still very preliminary analysis of the distribution of environmental and developmental priorities and relative values for the Amazon. A number of the assumptions made here could be made differently for analyses with more specific objectives and this would affect the outcome both in numeric terms and potentially also in geographic terms. As it stands the analysis provides:

1 A preliminary assessment of the spatial patterns of biodiversity priorities (values) based on multiple datasets,
2 A preliminary assessment of the carbon stocks and sequestration value across the Amazon using a short time horizon for CO_2 sequestration accounting and considering that protected areas are left out of offset trading due to difficulties in proving additionality.
3 A preliminary assessment of Amazon-wide realisable water services based on the quality as well as quality of input water and considering the presence of downstream consumers of the service.
4 An assessment of the distribution of current and potential value of forest conversion for logging, pastures and croplands for nine major crop groups and with an emphasis on the reduction in profitability as a result of (in)accessibility of markets based on the existing Amazon-wide infrastructural situation.
5 By comparing the distribution of ranked ES value and ranked conversion value we can see that the NW of the Amazon has the greatest ES value compared with its conversion value.

CAVEATS

Since these are all geographically relative indices of value (not dollar values), they are not directly comparable and one should not try to define a value of the ESB:PDB index that is the boundary for conversion profitability. This map only serves to define the priority areas for ES provision in the Amazon compared with the priority areas for conversion profitability and indicate where conversion profitability is low compared with the rest of the Amazon and where that also coincides with high ES values for water, carbon and biodiversity. There are, of course, other environmental services that are not taken into account here. Not least of these are cultural and indigenous values but also environmental (unused) flows, climate regulation through land surface hydroclimatic effects etc.

ANNEXES

Annex 1.
Representative Amazonian Crop Prices

CROP	PRICE (USD)
Cereals (rice, corn, sorghum, wheat	692
Fibre (jute, mallow)	815
Fruit (pineapple, avocado, banana, guava, orange, lime, papaya, mango, passion fruit, tangerine, grape)	3369
Oil crops (only based on palm oil)	1004
Legumes (peanut, beans, castor, soya, broad beans)	1046
Roots and tubers (yams, cassava)	1622
Sugar crops (sugarcane)	2043
Trees and nuts (cashew)	173
Vegetables and melons	3997

Annex 2.
Conservation Prioritization Schemes Used

Mega-diverse countries

A group of countries that harbor the majority of the Earth's species and are therefore considered extremely biodiverse. Reference: Mittermeier and Werner (1990).

Global 200 ecoregions

Relatively large units of land or water containing a characteristic set of natural communities that share a large majority of their species, dynamics, and environmental conditions list of WWF Ecoregions identified by the World Wildlife Fund (WWF) as priorities for conservation. Reference: Olson and Dinerstein (1998).

Biodiversity hotpsots

To qualify as a hotspot an area must contain at least 0.5% or 1,500 species of vascular plants as endemics, and it has to have lost at least 70% of its primary vegetation. Reference: Myers *et al.* (2000)

↑ Data from IBGE

Frontier forests

The world's remaining large intact natural forest ecosystems – undisturbed and large enough to maintain all of their biodiversity. Reference: Bryant *et al* (1997)

Last of the Wild

The c.17% of the Earth's land's surface that is relatively less influenced by human activities. Reference: Sanderson *et al* (2002)

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11

Cash Transfer Programmes in Amazonia Programas de Transferencia de Renda Na Regiao Amazonica

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EXECUTIVE SUMMARY

The principle challenge of the 21st Century speaks to the exploitation of natural resources, which should be used by present generations in a sustainable manner so that future generations may also have access to these resources. In debates on the theme of sustainability, the "Amazon Region" is refered to in discussions and formulations on new development proposals, which go beyond technological, economic, social, political, and cultural spheres.

It is in this context that the theme of Payments for Ecosystem Services (PES) has recently gained support. Ways of slowing down the destructive processes of harnessing natural resources is sought through adequate financial remuneration for the people and communities who live and reproduce in those ecosystems considered to be essential for the future of humanity and towards the sustainability of the planet.

According to several analyses, the PES mechanisms based on local ecosystems with global reaches may contribute to poverty alleviation, as well as to the conservation of forests and to community development. This is because climatic change associated with the destruction of forests not only affects local communities but also impacts other regions of the earth's surface.

The reality of persistent poverty and social exclusion on the Latin-American Continent has driven initiatives by governmental organizations, multi-lateral agencies, and civil society institutions seeking to alleviate this problem. With respect to those countries geographically located within the Amazon region, it is important to mention that there are several monetary payment programs in place geared towards combating poverty, but the great majority of these are not directly related to PES. However, they may be relevant in the debate about ecosystem services, and actors involved in monetary payment programs make associations between monetary transfers and these new payment mechanisms.

This study systematically analyzed Cash Transfer Programs (CTPs) in selected countries in the Amazon Region of Latin America, with a focus on the specific actions taken for families residing in the Amazonian areas of Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela. To achieve this, a general overview of CTPs across the six countries that make up the Amazon Region was developed, as well as specific analyses of information from each country.

The overview of the CTPs across the countries revealed that the the mechanisms adopted and the logic behind them are practically identical, varying only in terms of the monetary values transferred to the beneficiaries and the form of payment. This is because all the programs adopted some conditions related to health care and education.

Only Venezuela presents a distinct situation, as there is not aspecific CTP in the traditional sense, but actions related to the areas of education, health care, and nutrition. For example, food is sold in the popular supermarket network (MERCAL) at prices subsidized up to 50% in comparison with market prices.

In general, the majority of the direct cash transfers were established quite recently. In the cases of Brazil and Ecuador, the current programs result from fusions and mergers of programs implemented since the end of the 1990s. In the other countries, national CTPs have not existed for very long. Thus, in terms of geographic coverage, only in Brazil and in Colombia do the programs have a universal reach, encompassing practically all the counties in each of these two countries.

Specifically in the areas of the Amazon region, one notes a rather distinct scenario among countries. While in Brazil, close to 20% of families targeted across the country are located in the Brazilian Amazon region, in the remaining countries, attention to the Amazon populations is much lower. The number of poor families residing in the entire Amazon Region that is not included in the CTPs is considerable.

In the case of Colombia, around 5% of the country's poor families, are located in the Colombian Amazon Region. In this area, fewer than 50% of poor families receive any type of social benefit from the CTPs. However, in Ecuador, only 21% of the poor families residing in the Ecuadorian Amazon were included in the CTPs. In the case of Peru, the proportion was 3% of the poor families. It was not possible to analyze the situations in Bolivia and Venezuela, due to the absence of relevant information.

Another issue with CTPs in the Amazon region is that the budgetary resources depend strongly on the capacity of each country to raise funds together with international financial organisations, in particular the World Bank and the Inter-American Bank of Development, which are the principle supporting agencies of these initiatives.

From the point of view of the existing poor families who reside in the Amazon Region in the countries considered, their participation in these social programs is reduced. Even in the case of Brazil and Colombia, with more extensive coverage, the percentage of

coverage for poor Amazon-area families is around 57% and 50%, respectively. On the other hand, the situation is extremely deficient in the Peruvian and Bolivian cases, with only a minority of the poor families able to access the benefits of the CTPs.

This study concludes that there are many poor families residing in the Amazon areas of the countries selected who do not receive any type of cash transfer and continue to survive in precarious social conditions. These conditions are aggravated by the distances between communities and by the difficulties arising from the lack of basic infrastructure, especially in terms of transportation, housing, basic sanitation, and market access.

These aspects, in addition to the difficulty in accessing health care, educational, and nutritional services, perpetuate the conditions of poverty and social exclusion to which much of of the population inhabiting the Latin American Amazon are subjected.

INTRODUÇÃO

O século XXI apresenta velhos e novos desafios para a humanidade, ambos relacionados ao modelo de desenvolvimento econômico, social e político em curso no mundo. Sem dúvida, um desafio secular (antigo) diz respeito ao processo de exclusão social de parcelas expressivas da população, sobretudo nos países em desenvolvimento, as quais sobrevivem em precárias condições materiais e sócio-culturais.

A síntese destes problemas foi denominada de "pobreza", existindo atualmente diversas ações de organismos governamentais e de instituições da sociedade visando aliviar o problema, quando na verdade se deveria ter como meta prioritária sua erradicação ou eliminação.

Um novo desafio para o século XXI diz respeito ao processo de sustentabilidade dos recursos naturais, os quais deveriam estar sendo usados pelas gerações presentes de forma sustentável para que futuras gerações também possam ter acesso aos mesmos. Neste caso específico, aparece com força na agenda pública no limiar do século XXI a questão da sustentabilidade, aqui concebida em seu sentido mais amplo.

Nos debates sobre o tema da sustentabilidade observa-se que a "Região Amazônica" aparece como referência para as discussões e formulação de novas propostas de desenvolvimento, as quais perpassam as esferas tecnológica, econômica, social, política e cultural. É neste contexto que recentemente ganhou força o tema dos Payments for Ecosystem Services (PES), ou seja, procura-se encontrar alguma maneira de se frear o processo de destruição dos recursos naturais através de uma remuneração financeira adequada às pessoas e/ou comunidades que vivem e se reproduzem em ecosistemas considerados essenciais para o futuro da humanidade e para a sustentabilidade do planeta.

Segundo diversos analistas, os mecanismos dos PES, baseados em ecossistemas locais, mas com alcances globais, também poderão contribuir para aliviar a pobreza, além de contribuir decisivamente na conservação das florestas e no desenvolvimento das comunidades, uma vez que tanto as mudanças climáticas como a destruição das florestas afetam não somente as comunidades locais, mas provocam impactos em outras regiões do globo terrestre.

Especificamente em relação aos países que se localizam geograficamente na região Amazônica é importante mencionar que existem diversos programas de pagamentos monetários voltados ao combate da pobreza, sendo que a grande maioria deles não guarda uma relação direta com os PES. Porém, deve-se registrar que os mesmos podem ter efeitos indiretos no debate sobre a temática ambiental, uma vez que normalmente as pessoas vinculadas a estes programas fazem associações entre as transferências monetárias e esses novos mecanismos de pagamentos.

Neste sentido, o estudo procurou sistematizar e analisar os principais aspectos relativos aos programas de transferência de renda em curso em países que se localizam na região Amazônica da América Latina, tendo como foco apenas as ações específicas voltadas às famílias que residem nas áreas amazônicas de seis deles: Bolívia, Brasil, Colômbia, Equador, Peru e Venezuela. Para tanto, o relatório é composto por mais quatro seções, além desta introdução.

A primeira delas faz um breve histórico das políticas sociais de combate à pobreza, destacando-se a trajetória recente dos programas de transferência de renda.

A segunda seção elaborada um panorama geral desses programas de transferência de renda (CTP) em cada um dos seis países que fazem da região Amazônica, realçando os seus mecanismos e a dimensão social dos mesmos. A terceira seção sistematiza as diversas informações para o conjunto dos países, enquanto que a quarta seção apresenta as considerações finais do trabalho.

BREVES NOTAS SOVRE POLÍTICAS SOCIALIS E PROGRAMAS DE TRANSFERÊNCIA DE RENDA DESTINADOS AO COMBATE DA PROBREZA NA AMERÍCA LATINA

A realidade de pobreza e de exclusão social persistente no Continente Latino-Americano fez com que recentemente diversas iniciativas fossem implementadas por órgãos governamentais, por agências multilaterais e também por instituições da sociedade civil visando aliviar esse problema.

No âmbito internacional a principal ação no campo do combate à pobreza diz respeito ao compromisso político assumido por todos os países membros da ONU, quando da definição das "Metas do Milênio" na Assembléia geral de 2000. Na verdade, esse compromisso já começou a ser desenhado ainda em 1995 durante a realização da Conferência Mundial sobre Desenvolvimento Social, quando chefes de Estado e de Governos de todo o mundo se comprometeram a erradicar a fome e a pobreza no planeta. Assim, todos os representantes dos países presentes na Assembléia Geral da ONU de 2000 ratificaram o compromisso de cinco anos antes, ao reafirmar na "Declaração do Milênio" que se comprometiam politicamente no sentido de libertar todos os homens, mulheres e crianças da condição de pobreza até o ano de 2015. Este compromisso ficou consubstanciado naquilo que passou a ser conhecido como "os oito objetivos do milênio".

O primeiro deles refere-se à redução pela metade, entre 1990 e 2015, das pessoas que padecem de fome e que se encontram em estado de pobreza. Para se atingir esta meta, definiu-se que seis políticas seriam cruciais: investimento em desenvolvimento humano; investimento in infra-estrutura; implementação de políticas de desenvolvimento industrial; implementação de políticas para aumentar a produtividade agrícola, especialmente dos pequenos agricultores; promoção da sustentabilidade ambiental; e adoção de políticas de defesa dos direitos humanos e de equidade social.

No âmbito específico do combate à fome na região, os Governos do Brasil e da Guatemala, com apoio do Governo da Espanha, lançaram em Setembro de 2005, durante a Conferência Latino-Americana sobre Fome Crônica realizada na Guatemala, o programa "Iniciativa para América Latina sem Fome 2025". Neste caso, definiu-se como meta ERRADICAR a fome na América latina e Caribe até 2025 e não mais reduzi-la pela metade até 2015, como foi estipulado pelas Metas do Milênio das Nações Unidas. O objetivo desta ação é incentivar os países da região a adotarem políticas públicas voltadas a erradicar a fome até 2025. Por ser uma meta bastante ambiciosa, os organizadores desta iniciativa entendem que o sucesso da mesma depende do compromisso político, tanto dos governos como das sociedades de todos os países latino-americanos.

Além dessas duas iniciativas de ordem geral, verifica-se que ao longo dos últimos anos diversos países implementaram programas de transferência de renda, com o objetivo de combater a pobreza através da visão da 'focalização' das ações de política pública. Esta visão foi fortemente influenciada pelas experiências pioneiras realizadas em países como Brasil e México, ainda em 1996 e 1997, respectivamente.

Segundo ZEPEDA (2008), os programas de transferências de rendas condicionadas são identificados como uma nova geração de políticas de combate à pobreza por se caracterizar como transferências focalizadas em domicílios pobres, baseadas na condição de que os beneficiários protejam e construam suas capacidades humanas, como por exemplo, que as crianças freqüentem as escolas e que todos os membros das famílias acessem regularmente os serviços de saúde.

Esses programas de transferência de renda (Cash Transfer Programmes em inglês) destinam mensalmente certa quantia monetária para as famílias classificadas como pobres ou extremamente pobres, tendo por objetivos melhorar as condições de saúde e de educação desta parte da população excluída socialmente do mercado de bens e serviços. Para tanto, são exigidas certas responsabilidades dos beneficiários relativas aos cronogramas de execução de cada programa. Quando há algum tipo de condicionalidade esses programas passam a ser denominados de Conditional Cash Transfer Programmes (CCTPs)

De um modo geral, esses programas geralmente são políticas focalizadas a partir de dados e informações socioeconômicas sobre as famílias e domicílios, destinando recursos monetários diretamente aos beneficiários. Há, todavia, situações que incluem, além de recursos financeiros, doações de alimentos e complementos nutricionais. A maioria dessas políticas estabelecem que os beneficiários devem cumprir certas tarefas para continuar recebendo os benefícios a que têm direito.

Com isso, observa-se que os CTP exercem um duplo efeito: por um lado, a demanda por benefícios se amplia à medida que parcelas expressivas de pessoas pobres

se escrevem nas atividades e, por outro, geram-se efeitos sobre a oferta dos serviços básicos, especialmente nas áreas de saúde, educação e nutrição, os quais têm sua grandeza determinada pelas condicionalidades estipuladas por cada programa.

Registre-se que ações de complemento da renda familiar, tanto através de subsídios como de transferências monetárias diretas, já faziam parte da agenda de programas sociais de combate à pobreza. A novidade é que esses programas introduziram recentemente mecanismos que condicionam as referidas transferências ao cumprimento, por parte dos beneficiários, de um conjunto de atividades vinculadas particularmente às áreas de saúde, educação e nutrição, com o objetivo de melhorar os padrões nutricionais e educacionais desta parcela da sociedade no curto prazo.

Este tipo de política social está fortemente condicionado pela idéia da focalização, a qual tem como pressuposto as análises de custo-impacto. Por isso, as ações destinam-se preferencialmente aos grupos mais vulneráveis da população visando, por um lado, gerar compensações sociais devido aos desajustes criados pelo modelo de desenvolvimento econômico (desemprego, queda da renda, exclusão, etc.) e, por outro, proteger minimamente aquela parcela de cidadãos submetidos ao círculo vicioso da pobreza e da desigualdade.

Para Orozco & Hubert (2005), os mecanismos de focalização surgiram como parte de uma estratégia governamental que buscou fazer a transição de sistemas de assistência social universal e não condicionados para um modelo de transferência direta de recursos, cada vez mais escassos, às populações mais pobres do país, visando desenvolver as capacidades desta parte da população que vive em condições sociais desfavorecidas.

Deve-se registrar, também, que o ideário da 'focalização' procura justificar sua existência enaltecendo as falhas e os defeitos existentes nas redes tradicionais de assistência social. Neste caso, destacam-se: a) os programas de assistência social normalmente não têm uma abrangência adequada, gerando, inclusive, distorções no atendimento do público prioritário; b) os programas de assistência social geralmente são ineficientes devido, sobretudo, ao alto custo administrativo, levando a redução efetiva dos recursos destinados às famílias pobres; c) muitos programas socais apresentam sobreposição de ações, além de metas difíceis de serem atingidas; d) a maior parte desses programas destina pouca atenção aos problemas estruturais da pobreza.

Segundo Garrett, Bassett & Marini (2009), esses programas podem diferir em termos de seus objetivos, uma vez que alguns deles podem focar as ações em aspectos setoriais, enquanto outros concentram suas atividades no curto prazo visando responder às demandas imediatas, como no caso do desemprego ou no atendimento de necessidades básicas de saúde e de educação.

Em geral, verifica-se que a maior parte dos programas de transferência de renda procura atacar, primeiramente, problemas crônicos das populações pobres, especialmente nas áreas de alimentação, nutrição e cuidados básicos de saúde. Mas há, também, ações voltadas para o desenvolvimento do capital humano, particularmente nos casos em que se busca melhor o nível educacional dos membros das famílias pobres.

Hoddinott & Bassett (2008) destacam, ainda, que alguns programas definem como objetivo central elevar o nível nutricional das crianças na idade pré-escolar por entender que investimentos nutricionais na pré-escola reduzem os riscos da mortalidade infantil, bem como ajudam a elevar o nível de bem-estar social.

Para o Banco Mundial (2003), que tem financiado a maior parte desses programas na América Latina, Ásia e África, o objetivo básico das transferências monetárias é auxiliar economicamente as famílias que vivem abaixo da linha de pobreza e que nem sequer conseguem enviar suas crianças às escolas e participar das atividades básicas de saúde. Acredita-se que com essa transferência de recursos é possível elevar o nível social das famílias e integrá-las ao conjunto da sociedade.

Todavia, não se deve deixar de mencionar também que estes programas foram concebidos para aliviar minimamente os impactos negativos das crises econômicas que se abateram sobre os países dos continentes anteriormente citados, afetando mais agudamente as famílias pobres e marginalizadas socialmente. Por isso, todos eles têm praticamente o mesmo design (focalização das ações) e as mesmas condicionalidades (atividades nas áreas de saúde, educação e, em alguns casos, nutrição).

Numa perspectiva evolutiva, Bassett (2008) mostra a existência de diversas gerações de programas de transferência de renda. Segundo essa autora, a primeira geração desses programas começou na América Latina no final do século XX (1990's), os quais concentraram suas ações nas áreas de saúde e educação. Estes programas foram sendo aperfeiçoados e continuam bastante populares atualmente em todo Continente Latino-Americano.

A segunda geração emergiu no início do Século XXI nas regiões Sul e Leste da Ásia, cujas ações procuram aumentar o acesso às escolas exclusivamente das crianças

e jovens do sexo feminino. Estes programas, no geral, destinam bolsas de estudos a esse público específico, com a condicionalidade da freqüência escolar.
A terceira geração é bastante recente e procura atender as situações de emergência, tanto no âmbito internacional como de um país, bem como aos planos e programas de desenvolvimento urbano. No primeiro caso destacam-se situações de alguns países africanos, enquanto no segundo são programas anti-pobreza desenvolvidas por algumas localidades, como é o caso da cidade de Nova York que desde 2006 faz transferência de renda visando reduzir os níveis de pobreza de seus habitantes.

Para Handa & Davis (2006), apenas o caso do programa Progesa (México) e Bolsa Escola (Brasil) podem ser consideradas idéias natas, uma vez que a primeira fase de implantação dos mesmos foi totalmente desenhada e financiada por ambos os países, sem apoio dos bancos de desenvolvimento. Todavia, as fases de expansão subseqüentes já foram moldadas pelos sistemas dos bancos de desenvolvimento, fato que marca também todas as demais experiências nesta área.

De um modo geral, pode-se dizer que até 2008 aproximadamente 36 experiências estavam em curso nesta área, sendo que a metade delas (18 programas) localizava-se na América Latina e Caribe. Já as experiências no Continente Africano são mais recentes, observando-se ações em apenas cinco países daquela região.

Algumas razões, segundo Behrman (2008), explicam a popularidade obtida pelos programas de transferência de renda na América Latina, destacando-se:

1 Os programas são atrativos para os políticos e agentes de desenvolvimento (policymakers) por causa da disponibilidade de indicadores de curto prazo que procuram mostrar a eficácia dos programas já em suas fases intermediárias, fato que é muito útil nas definições orçamentárias e nas próprias estratégias políticas;
2 as co-responsabilidades assumidas nos processos de transferência monetária podem significar menos estigmas por parte dos beneficiários e uma ótima aceitação política por parte da sociedade, comparativamente aos programas sem condicionalidades;
3 a existência de uma visão paternalista por parte dos políticas e dos agentes de desenvolvimento, bem como do restante da sociedade, de que os recursos são melhor usados quando algumas condicionalidades são estipuladas. Isto implica dizer que políticos, agentes de desenvolvimento e o restante da sociedade, sabem mais que os pobres o que é melhor para os mesmos;
4 os pobres podem não estar informados sobre a importância de investimentos em recursos humanos e a segunda melhor maneira de lidar com o problema é condicionar os pagamentos a alguns compromissos por parte dos beneficiários dos referidos programas (a primeira seria disponibilizar as informações);
5 avaliações de programas iniciais, como foi o caso do PROGRESA (México), realizadas por "experts" bem relacionados com a política internacional e com centros de estudos transformaram-se em uma rede de disseminação do ideário desses programas.

Em termos de características, Hoddinott & Bassett (2008) afirmam que esses programas têm três características bem definidas: a) são intervenções focalizadas, geralmente baseadas em dados sócio-econômicos que identificam regiões e famílias pobres que necessitam auxílio financeiro; b) são disponibilizados recursos financeiros, normalmente pagos às mães ou ao responsável principal pelas famílias, além de casos em que também são distribuídos suplementos nutricionais; c) ao receber recursos os beneficiários se comprometem a desenvolver um conjunto de ações relacionadas, geralmente, às áreas de saúde, educação e nutrição.

Além disso, é possível observar que alguns programas assumiram outras características ao mudar a natureza de sua intervenção. Por exemplo, no caso do Progresa (México) passou-se de um programa de subsídio alimentar para um programa focalizado de transferência de renda, enquanto em outros casos (Honduras e Nicarágua) buscou-se organizar um sistema mínimo de proteção social através de financiamentos externos. Já no caso do Brasil (Bolsa Família), procurou-se centralizar um conjunto de ações governamentais na área social que se encontravam dispersas em várias esferas da estrutura governamental.

Em síntese, registre-se que há uma enorme diversidade de modelos operacionais de transferência de renda em curso atualmente. Todavia, na maioria dos casos observa-se que as famílias classificadas como pobres e com crianças são o alvo principal dos programas, enquanto que as atividades escolares, de saúde e nutrição se constituem no foco de atenção. Na média, os pagamentos às famílias beneficiárias variam entre 10 a 20% dos gastos com consumo alimentar familiar.

Além de todas essas iniciativas antes mencionadas, deve-se registrar, ainda, o papel crucial que é desempenhado pelas diversas políticas públicas que conformam o precário sistema de proteção social existente em alguns países do Continente Latino-Americano, apesar

do ataque ideológico liberal praticado contra o mesmo, especialmente nas últimas décadas.

Desta forma, considerando-se as diretrizes e ações das políticas e programas destinados ao combate à pobreza em curso em um grande número de países da América Latina a partir da década de 1990, é possível construir uma tipologia de políticas sociais de combate à pobreza, a partir de quatro grupos básicos [1]:

a Políticas e programas de transferências sociais: aqui estão incluídos os programas de transferência de renda (condicionados e não-condicionados), além de outros benefícios sociais (aposentadorias, pensões, etc.);
b Programas assistenciais emergenciais: aqui estão incluídos as ações sociais emergenciais, como distribuição de cestas básicas de alimentos, auxílio social nas redes de saúde, auxílio aos desempregados, etc;
c Políticas estruturais de combate à pobreza, destacando-se os programas públicos de incentivo ao emprego, projetos produtivos, micro-crédito e estímulo ao auto-emprego, apoio à construção de redes de infraestrutura social básica, fortalecimento de organizações comunitárias, etc;
d Políticas destinadas aos grupos sociais específicos: aqui destacam-se os programas destinados ao atendimento focalizado das causas da pobreza, destacando-se o apoio às crianças, às mulheres nutrizes e chefes de família, aos jovens, aos grupos étnicos específicos, aos grupos portadores de deficiência, etc.

Estas políticas e programas podem ter distintas abrangências, combinando ações que se situam em unidades territoriais menores até aquelas com alcance nacional. Por uma questão de delimitação analítica, neste estudo serão sistematizados e descritos apenas os programas de transferência de renda com alcance nacional em curso em seis países localizados na região Amazônica do Continente Latino-Americano.

DESCRIÇÃO GERAL DOS PROGRAMAS DE TRANSFERÊNCIA DE RENDA EM CADA UM DOS PAÍSES SELECIONADOS

Nesta seção faz-se uma breve discussão dos programas de transferência de renda em cada um dos países selecionados pelo estudo, destacando-se as especificidades e a dinâmica recente de cada um desses programas. Registre-se que a lógica de funcionamento e os mecanismos adotados são praticamente idênticos em todos os lugares, apenas variando alguns itens, especialmente em termos de valores monetários que são transferidos aos beneficiários em cada localidade.

Bolívia

O Programa "Plan Bolívia" faz parte de um conjunto de programas sociais contra a pobreza implementados na Bolívia a partir de 2002, ainda sob a Presidência de Gonzalo Sánchez de Lozada, cujo mandato terminou em 2007. A estratégia para combater a exclusão social está ancorada na transferência de benefícios sociais e monetários de forma condicionada, a partir de dois subprogramas.

O primeiro deles é o programa "Bolsa Educação", cuja finalidade é incentivar a permanência das crianças das famílias pobres nas escolas de primeiro grau. O programa disponibilizava inicialmente 100 bolivianos por ano para todas as famílias com filhos nestas condições, tendo-se como condicionalidade a aprovação no grau correspondente. A partir de 2007 este valor passou a ser de 200 bolivianos por ano. Indicadores extra-oficiais do programa revelaram que aproximadamente 1 milhão de crianças foram beneficiadas por esta ação governamental no ano de 2007, contemplando cerca de 13 mil escolas.

O segundo programa é o "Bono Saúde", que tem como finalidade melhorar as condições de saúde básica das crianças, aumentando os controles médicos. Esta ação, inicialmente destinada às famílias pobres das áreas rurais com crianças menores de cinco anos, distribui 25 Bolivianos duas vezes ao ano às respectivas famílias. A condicionalidade para receber o benefício é apresentar o carnê de controle de saúde dos filhos.

A partir de 2007, com a instalação do Governo Evo Morales, o "Plan Bolívia" foi bastante alterado, com estabelecimento de prioridades no combate à desnutrição infantil, uma vez que se constatou que mais da metade das mortes das crianças ocorriam devido aos graves problemas de desnutrição infantil. Esta estratégia foi consubstanciada em um novo programa denominado de "Plano Bolívia Desnutrição Zero 2007–2011", o qual focaliza suas atenções nas áreas com maior vulnerabilidade, particularmente nas famílias residentes em áreas rurais.

O objetivo fundamental é erradicar a desnutrição infantil das crianças com até 5 anos de idade, sendo

1 Registre-se que certos programas podem estar associados a mais de um grupo de políticas.

priorizado o atendimento às crianças com até 2 anos, através de transferência de recursos às famílias com elevado grau de desnutrição.

O programa conta com recursos da ordem de 15 milhões de dólares emprestados pelo Banco Mundial. Tendo como foco melhorar a qualidade nutricional das crianças e das famílias beneficiárias, o programa destina 280 Bolivianos ao ano para as mães, sendo distribuído em 4 cotas de igual valor. Já para o conjunto das crianças de uma família são destinados mensalmente 135 Bolivianos, perfazendo um total anual de 1620 Bolivianos.

A partir de 2008, no âmbito do programa "Bolívia Digna", passou a funcionar também o programa "Renda Digna" que destina uma verba mensal aos bolivianos e bolivianas maiores de 60 anos de idade, como forma de reparar uma injustiça histórica cometida contra diversos setores de trabalhadores que permaneciam desamparados quando adentravam na terceira idade. Tal programa faz parte do capítulo V da Nova Constituição do país que trata dos Direitos Sociais e Econômicos.

Quanto aos beneficiários, o programa atende a todos bolivianos e bolivianas maiores de 60 anos de idade, estabelecendo remunerações mensais distintas, de acordo com as seguintes condições:

a pessoas que não recebem renda ou jubilación: recebem pagamento mensal de 200 bolivianos;
b pessoas jubilados e rentistas: recebem pagamento mensal de 150 bolivianos
c pessoas que recebem algum benefício monetário do Tesouro Geral da Nação não têm direito aos recursos do programa "Renda Digna".

O programa tem três diferentes fontes de financiamento: recursos provenientes do Imposto Direto dos Hidrocarburantes (IDH), dos Fundos de Capitalização Coletiva (FCC), e do Tesouro Geral da Nação (TGN). Os recursos podem ser obtidos junto às 582 agências bancária existentes no país.

Com esta ação o Governo da Bolívia espera atender 676.009 pessoas maiores de 60 anos de idade nos seguintes Departamentos: Chuquisaca (46.376); La Paz (218.069); Cochabamba (123.053); Oruro (36.808; Potosí (65.952); Tarija (31.514); Santa Cruz (129.531); Beni (21.616); e Pando (3.090).

Brasil

Os programas de transferência de renda condicionada foram sendo introduzidos no Brasil durante a década de 1990. No final dela foram criados, no âmbito do Governo Federal, três programas nacionais de transferência de renda: Bolsa Escola, Bolsa Alimentação e Auxílio Gás. No início do Governo Lula (março de 2003) foi criado o Cartão Alimentação – que corresponde ao programa cupom de alimentos na versão original do Programa Fome Zero (PFZ) – também com o objetivo de transferir renda para parcelas da população que se encontrava em estado de insegurança alimentar e nutricional.

Em Outubro de 2003 foi criado o programa "Bolsa Família", com o objetivo de unificar todos os programas sociais de transferência de renda já existentes anteriormente (Bolsa Escola, Bolsa Alimentação, Cartão Alimentação e Auxílio Gás). Além deste objetivo geral, o programa pretendia dar maior agilidade ao processo de liberação mensal dos recursos financeiros às famílias necessitadas, bem como reduzir os entraves burocráticos e facilitar o sistema de controle de recursos, visando aumentar sua transparência junto à sociedade. Com isso, inicialmente foi fixado como meta para 2004 o atendimento de 6.5 milhões de famílias; para 2005 atender 8.7 milhões de famílias; e para 2006 o atendimento de 9 milhões de famílias. Registre-se que em 2009 estão sendo atendidas 11 milhões de famílias e para 2010 a meta é atingir até 12 milhões de famílias.

De uma maneira geral, o programa Bolsa Família articula-se a partir de três aspectos básicos: ampliação dos serviços de saúde, educação e nutrição, através dos mecanismos de condicionalidades; integração dos programas de transferência renda com os demais programas de assistência e proteção social; e busca da superação direta da pobreza através da focalização das transferências monetárias decorrentes das ações governamentais.

Os beneficiários são aquelas famílias com renda *per capita* mensal de até R$ 100,00, que já estavam cadastradas nos programas Bolsa Escola, Bolsa Alimentação, Cartão Alimentação e Auxílio Gás, bem como as novas famílias cadastradas em cada municipalidade. Em termos de mecanismos, há dois tipos de benefícios: o básico e o variável. No primeiro caso, são concedidos R$ 50,00 às famílias com renda mensal *per capita* de até R$ 50,00. No segundo caso, recebem o benefício de R$ 15,00 famílias com renda mensal *per capita* entre R$ 51,00 e R$ 100,00 e que tenham filhos de até 15 anos matriculados e freqüentando as escolas, sendo este benefício limitado em até três filhos por família, podendo chegar, com isso, até R$ 45,00. Desta forma, os benefícios agregados variavam entre R$ 50,00 e R$ 95,00.

Em 2009 esses valores foram reajustados, sendo que o teto de atendimento passou a ser para todas as famílias com renda familiar de até R$ 140,00. Já os valores passaram a ser de R$ 68,00, para aquelas famílias com renda *per capita* de até R$ 70,00; e de R$ 22,00 para famílias com renda *per capita* de até R$ 140,00 e com até três filhos até 15 anos de idade freqüentando as escolas. Neste segundo caso, as famílias poderão receber até R$ 66,00. Além disso, foi criado um novo benefício no valor de R$ 33,00 para famílias com adolescentes entre 16 e 17 anos de idade e que estejam inscritas no programa. Com essas reformulações, o valor total dos benefícios transferidos se situa atualmente entre R$ 68,00 e R$ 167,00.

A contrapartida é determinada ao responsável pela família e diz respeito aos seguintes itens: manter as crianças em idade escolar freqüentando a escola, manter o sistema de vacinação das crianças, pessoas grávidas fazer os exames recomendados e promover a alfabetização naqueles casos em que há analfabetos adultos no seio da família beneficiada.

Do ponto de vista do número de famílias beneficiadas, no ano de 2003 verificou-se que o fluxo dos recursos estava majoritariamente direcionado à região Nordeste, que concentrava 59% dos beneficiários do programa. As demais regiões apresentaram a seguinte participação percentual: Sudeste com 20%; Sul com 10%; Norte com 8% e Centro-Oeste com 3%. Com isso, nota-se certa focalização do programa na região que efetivamente detém o maior percentual de pobres no âmbito do país.

Colômbia

O programa "Famílias en Acción", coordenado pela Agência Presidencial para a Ação Social e Cooperação Internacional, faz parte do plano geral de recuperação econômica e social da Colômbia denominado de "Herramientas para la Paz", que está em curso desde o ano de 2000. O objetivo central do programa "Famílias en Acción" é garantir níveis adequados de nutrição e atenção à saúde das crianças menores de sete anos de idade, além de estimular a permanência na escola dos filhos com idade entre 7 e 17 anos das famílias classificadas como pobres.

Desta forma, busca-se complementar a renda familiar visando, por um lado, reduzir as deserções nos níveis escolares primários e secundários e, por outro, ampliar os gastos com alimentação no sentido de melhor as condições nutricionais da população, especialmente das famílias com filhos com idade de até sete anos.

Para tanto, há dois tipos de benefícios. Um primeiro dirigido às famílias pobres com crianças menores de sete anos, as quais recebem 20 dólares por mês como forma de subsídio alimentar. Esta transferência, paga a cada dois meses durante todo o ano, é destinada diretamente às mães independentemente do número de filhos e está condicionada aos cuidados da saúde infantil, especialmente controle do crescimento e desenvolvimento dos filhos, bem como a participação, por parte das mães, em atividades de capacitação profissional.

O segundo benefício diz respeito à transferência monetária durante 10 meses ao ano às famílias pobres com filhos em idade escolar entre 7 e 17 anos de idade. Para receber o benefício, a condicionalidade é a freqüência escolar. O montante de recursos varia de acordo com o grau escolar. Assim, famílias recebem 6 dólares mensais por filhos matriculados no ensino fundamental (primeiro grau) e 12 dólares no ensino básico (segundo grau), sendo o pagamento realizado a cada dois meses.

O "Famílias en Acción" é um programa de caráter nacional implementado em todos os 27 departamentos do país. Sua organização é nacional, departamental e municipal. No âmbito nacional funciona a Unidade Coordenadora Nacional (UCN) que articula e organiza o programa no âmbito do país. Nos departamentos existem as Unidades Coordenadoras regionais (UCR) com a finalidade de executar o programa e coordenar as ações nos municípios sob sua jurisdição. Finalmente, no âmbito local as administrações municipais nomeiam um funcionário que é o responsável direto para operacionalizar o programa no município.

Informações preliminares revelam que entre 2005 e 2008 as famílias elegíveis ao programa passaram de 725.507 para 2.437.379, respectivamente. Já as famílias efetivamente atendidas passaram de 514.300 para 1.541.482, no mesmo período. Registre-se que somente em 2008 se inscreveram no programa mais 44.399 novas famílias.

A partir de 2007 e 2008 o programa passou a atender também as comunidades indígenas, as quais representavam 3,3% da população do país no ano de 2005. Isso significava mais de 933 mil pessoas que estavam domiciliadas em 214 municípios. O atendimento e as condições são as mesmas adotadas pela linha geral do programa para o conjunto dos beneficiários.

Inicialmente foi implementado um projeto piloto em quatro municípios, causando impactos positivos em diversas comunidades indígenas. Com isso, o "Plano dos Povos Indígenas" deverá expandir-se de formal

gradual para o conjunto dessas comunidades, sendo que para 2009 a meta de atendimento definida foi de 70 mil famílias indígenas.

Equador

O Programa "Bono Solidário" — "Bono de Desarrollo Humano" foi lançado pelo governo do Equador em 1998 [2] com o objetivo de garantir certo nível de consumo dos segmentos mais vulneráveis da população, especialmente as camadas pobres, visando combater a indigência no curto prazo. Assim, no início foi transferido um montante monetário mensal às famílias cuja renda familiar não ultrapassava US$ 40, não se verificando nenhum tipo de condicionamento às referidas transferências.

É um programa dirigido às mães com pelo menos um filho menor de 18 anos de idade; às pessoas da terceira idade (maiores de 65 anos) que não sejam afiliadas ao Instituto Nacional de Seguridade Social [3]; às pessoas que apresentam incapacidade maior ou igual a 70%; e às pessoas que não possuem um salário fixo mensal.

Os repasses de recursos são flexíveis e diferenciados por categorias de beneficiários. Por exemplo, em 2001 os incapacitados recebiam ao redor de 7 dólares, enquanto as mães recebiam aproximadamente 12 dólares. O pagamento é feito através das agências do Banco Nacional de Fomento e também através de agências da rede bancária privada. Dados deste período revelam que a cobertura do programa foi de cerca de 1 milhão de mães e de aproximadamente 237 mil pessoas da terceira idade.

Em 2003 o Bono Solidário foi reformulado visando adequar suas ações aos moldes dos demais programas semelhantes em curso no Continente Latino-Americano. Para tanto, as atenções concentraram-se nas áreas de saúde e educação. No entanto, o programa manteve a não diferenciação entre as famílias, a partir do número de filhos. Com isso, todas elas passaram a receber a mesma quantidade de recursos mensalmente.
Estes recursos sofreram algumas alterações ao longo dos anos, especialmente após a dolarização da moeda local. Assim, nota-se que após algumas reduções, em 2007 as transferências atingiam 30 dólares, tanto para as mães bem como para as demais categorias atendidas pelo programa. Em 2009 este valor passou para U$ 35. Ainda durante a reformulação do programa em 2003 procurou-se implementar algumas condicionalidades à semelhança dos demais programas de transferências de renda. No entanto, esta alteração não foi efetivada, realizando-se apenas campanhas de esclarecimentos juntos aos beneficiários. Desta forma, não se observa a existência de nenhum mecanismo de exclusão, caso os beneficiários do mesmo não cumpram com as obrigações escolares ou então não mantenham os cuidados básicos de saúde.

Peru

O Programa Nacional de Apoio Direto aos mais Pobres — JUNTOS — foi criado pelo governo do Peru no ano de 2005 através do decreto 032 da Presidência do Conselho de Ministros (PCM), com o objetivo de facilitar o acesso aos serviços básicos de saúde e educação das famílias caracterizadas como extremamente pobres.

Este programa, integrante do Plano Nacional para a Superação da Pobreza, procura apoiar as famílias pobres através de uma transferência monetária mensal da ordem de US$ 33,00 por família (valores de 2007), cabendo ao Estado ofertar os serviços nas áreas de saúde, nutrição e educação e às famílias beneficiárias participar das atividades dessas áreas específicas.

A partir de um mapa da pobreza realizado pelo Ministério da Economia e das Finanças, optou-se pela focalização geográfica em nível dos distritos. Para isso, foram estabelecidos alguns critérios de seleção dos beneficiários, priorizando-se aquelas localidades com desnutrição infantil crônica; extremamente pobres e com necessidades básicas insatisfeitas, além daquelas comunidades afetadas pela violência.

As transferências dos recursos monetários às famílias são condicionadas ao atendimento dos seguintes quesitos: manter um controle integral da saúde das crianças até 5 anos de idade através de visitas programadas aos centros de saúde; manter a freqüência nas escolas das crianças entre 6 e 14 anos de idade, visando a obtenção do ensino fundamental; e manter a documentação de todos os filhos, especialmente do Documento Nacional de Identidade (DNI). Os beneficiários que não cumprirem essas condicionalidades por 3 meses são excluídos do programa.

No primeiro ano o programa encontrava-se operando em 110 distritos, atingindo aproximadamente 23 mil famílias. Em 2006 o atendimento passou a 160 mil famílias e no terceiro ano (2007), o programa já estava presente em 638 distritos, atendendo aproximadamente 355 mil famílias. Em 2008 o programa passou a atender 420 mil famílias domiciliadas em áreas rurais de 14 departamentos do país.

Avaliações da Comissão Interministerial de Assuntos Sociais (CIAS) revelam o alto percentual de atendimento

2 Em 2003 esse programa passou a se chamar "Bono de Desarrollo Humano", ao incorporar dois pequenos programas de combate à pobreza que já vinham funcionando desde o final da década de 1990.

3 Exigência que posteriormente deixou de ser solicitada.

das condicionalidades por parte dos beneficiários. Assim, dos 128 mil domicílios avaliados entre outubro e dezembro de 2006, apenas 4% deles deixaram de cumprir as referidas condicionalidades. Já dos 217 mil domicílios avaliados entre abril e junho de 2007, apenas oito mil deixaram de cumprir as condicionalidades.

No plano institucional, todavia, observam-se dificuldades que impediram uma rápida expansão para todos os distritos que comportam a população pobre. Em grande parte, essas dificuldades estão relacionadas à infra-estrutura inadequada, à falta de um sistema integrado de informação e aos atrasos na esfera de gestão do programa. Isto coloca como necessidades para os próximos anos melhorar a gestão institucional, aperfeiçoar a operacionalidade do programa, ampliar a articulação entre os vários setores envolvidos com o combate da desnutrição crônica, além de acompanhar o cumprimento das responsabilidades por parte dos beneficiários.

Venezuela

A Venezuela apresenta uma situação distinta em relação aos demais países considerados, uma vez que não existem programas de transferências de renda da forma que vem sendo usada atualmente, apesar de que muitas ações também estejam relacionadas às áreas de educação, saúde e alimentação. Na primeira, está em curso o "Programa de Bolsas Escolares", cujo objetivo é contribuir para a permanência na escola da população estudantil oriunda de famílias pobres. Neste caso, os estudantes das famílias pobres recebem um suporte financeiro, não reembolsável e não-transferível, para permanecer nas escolas, desde o período pré-escolar até a conclusão do ensino médio.

Na área de saúde, o programa SUMED (Suministro de Medicamentos) disponibiliza medicamentos a um custo 80% inferior aos preços de mercado. Está voltado, especialmente, às mulheres grávidas, às crianças e aos idosos.

Na área de segurança alimentar, o Programa Alimentar Estratégico (PROAL) procura atender as necessidades nutricionais da população pobre, visando melhorar sua qualidade de vida. Na verdade, trata-se de um subsídio indireto aos alimentos da cesta básica (arroz, farinha de milho, azeite, leguminosas, sardinhas, etc.), os quais são vendidos na rede de mercados populares a um preço subsidiado de até 50% em relação aos preços de mercado.

Nesta área de segurança alimentar o governo constitui a MERCAL, que é uma empresa estatal que faz a comercialização direta de produtos alimentares e outros gêneros de primeiras necessidades, visando atender as famílias pobres. Há diversos tipos de Mercal: modelo padrão nacional; modelo do tipo II, com estrutura e capacidade variadas; bodegas mercal, que são pontos de vendas inscritos no programa; megamercados ao céu aberto, que são locais de vendas de produtos alimentares e de primeira necessidade em áreas populares das principais cidades e municípios do país.

Dentro da rede social de proteção registre-se, ainda, a existência do "Programa de Máxima Proteção – casas de alimentação", que consiste na distribuição, três vezes ao dia, de comida para as famílias mais pobres de cada comunidade. Esta é uma atividade realizada conjuntamente entre o PROAL e o MERCAL.

Apesar destas informações básicas, não foi possível realizar uma análise comparativa das ações realizadas neste país, tendo em vista a total falta de dados, especialmente sobre as famílias atendidas e os locais beneficiados. Esta é razão pela qual as seções seguintes passam a conter apenas as análises de cinco dos seis países anteriormente selecionados.

ITENS	1	2	3	4	5
Ano de início dos programas	2002	2003	2000	2003	2005
Total de municípios de cada país	327	5.563	1.120	216	1.813
Número de municípios atendidos	148	5.563	1.096	182	638
Municípios atendidos localizados na área Amazônica	27	807	36	25	33
Atendimento diferencial entre áreas urbanas e rurais	Não	Não	Não	Não	Sim
Outros tipos de distinções	Sim	Sim	Sim	Não	Não

↑ (Table 1) Aspectos relativos à dimensão dos programas de transferência de renda
Nota: 1=Bolívia; 2=Brasil; 3=Colômbia; 4=Equador; 5=Peru.

ANÁLISE DOS PROGRAMAS DE TRANSFERÊNCIA DE RENDA EM PAÍSES LATINO-AMERICANOS LOCALIZADOS NA REGIÃO AMAZÔNICA

Síntese Geral Das Informações Quantitativas E Qualitativas

Este item apresenta uma síntese geral, a partir das diversas informações quantitativas e qualitativas coletadas para cada país relativas ao processo de implantação dos programas, aos beneficiários e aos mecanismos de funcionamento dos mesmos. Neste caso, elaborou-se uma síntese a partir de três variáveis-chave: dimensões dos programas, mecanismos de funcionamento e aspectos relacionados aos beneficiários, procurando construir uma visão global dos mesmos no âmbito dos países considerados, ao mesmo tempo em que se procura realçar também possíveis diferenças entre esses países.

A tabela 1 apresenta uma síntese das informações relativas aos marcos legais e dimensões dos programas. Em linhas gerais, observa-se que a maioria das transferências diretas de renda é bem recente. Nos casos do Brasil e do Equador, os programas atuais decorrem de fusões e junções de programas implementados a partir do final da década de 1990. Nos demais países, os programas de transferência de renda com amplitude nacional têm pouco tempo de existência. A Venezuela transforma-se em um caso especial, uma vez que neste país não ocorre o mecanismo tradicional da transferência monetária direta, mas sim um subsídio governamental à cesta básica alimentar das famílias.

Do ponto de vista da cobertura geográfica, observa-se que no Brasil e na Colômbia os programas têm uma capilaridade global, atingindo praticamente todas as municipalidades. O mesmo não se verifica nos demais países devido à perenidade das experiências, por um lado, e ao próprio foco adotado pelas distintas ações governamentais, por outro. Chama a atenção os casos da Bolívia e do Peru onde menos de 50% dos municípios estão sendo atendidos. Em parte, este comportamento pode ser explicado pelo pouco tempo de existência dos programas nestes locais. uanto à existência de ações desses programas nas áreas da região Amazônica, mesmo com informações precárias, foi possível fazer um quadro para todos os países da região. No caso brasileiro, nota-se que aproximadamente 15% do total dos municípios atendidos se localizam nos oito estados que perfazem a área Amazônica brasileira, sendo que cerca de 2.200.000 famílias estão sendo atendidas na referida região. Isto corresponde a quase 20% do total de famílias atendidas em todo o país. Nos demais países verifica-se uma incidência menor desses programas nas áreas amazônicas, especialmente nos casos da Bolívia e do Peru. Como afirmamos anteriormente, por serem experiências relativamente novas, o grau de cobertura dos programas ainda é restrito a algumas regiões e a alguns

ITENS	1	2	3	4	5
Valor dos benefícios (em US$ de Setembro, 2009)	23,00	37 - 93,00	65-80,00	35,00	34,00
Periodicidade dos recursos	M/Quadr	Mensal	Bimensal	Mensal	Mensal
Formas de Pagamento	Direto	Direto	Direto	Direto	Direto
Condicionalidades	Sim	Sim	Sim	Não	Sim
Tipos de condicionalidades	Saúde Educac.	Saúde Educac.	Saúde Educac.	?	Saúde Educac.
Fontes dos recursos orçamentários	Tesouro Emprés-timos	Tesouro Emprés-timos	Tesouro Emprés-timos	Tesouro Emprés-timos	Tesouro Emprés-timos
Recursos orçamentários	Central	Central	Central	Central	Central

↑ (Table 2) Aspectos relatives aos mecanismos de funcionamento dos programas

segmentos sociais necessitados. Do ponto de vista do atendimento geográfico diferencial, nota-se que apenas o Peru adotou uma estratégia de priorizar o atendimento inicial aos pobres residentes no meio rural. Como o programa é relativamente recente (2005) até o momento está presente somente em 14 dos 25 Departamentos.

Mas há outros tipos de distinções. Na Colômbia, por exemplo, além das famílias pobres, nota-se o atendimento às famílias de grupos indígenas residentes nas áreas rurais do país, bem como das famílias de refugiados devido aos confrontos entre as forças governamentais e a facção política denominada de FARC.

No Brasil, verifica-se um atendimento especial a algumas comunidades indígenas e também às famílias Quilombolas, grupamento étnico remanescente do período de escravidão. No entanto, não existem informações oficiais precisas sobre o atendimento destas comunidades especificamente na região Amazônica.

Já na Bolívia, além dos tradicionais sistemas de transferências monetárias vinculadas aos setores de saúde e educação, foi introduzido em 2008 um sistema de transferência de renda vitalícia aos idosos como forma reparar uma injustiça social, uma vez que amplos setores de trabalhadores não tinham nenhuma renda após cumprir seu tempo de trabalho. Esta é uma ação de abrangência nacional, sem que se observem distinções entre áreas geográficas e também entre aquelas áreas localizadas na região Amazônica ou fora dela.

Quanto ao "Bono Educação", nota-se que a Bolívia optou atender, a partir de 2007, todas as crianças de famílias pobres matriculadas em escolas públicas de todos os municípios do país, sem estabelecer qualquer tipo de diferenciação entre as famílias localizadas no meio urbano e espaço rural. No entanto, dados oficiais revelam que uma parcela importante das crianças oriundas de famílias pobres ainda não consegue ser atendida, especialmente daquele contingente localizado em áreas rurais distantes.

A tabela 2 apresenta diversos aspectos relativos ao funcionamento dos programas. Quanto aos valores, inicialmente nota-se a formação de grupos distintos de países, sendo que Brasil e Colômbia apresentam valores que podem chegar até US$ 93,00, no primeiro caso, e até US$ 80,00, no segundo. Este comportamento se deve ao mecanismo variável de fixação dos benefícios, o qual está atrelado ao número de filhos das famílias pobres que freqüentem as escolas.

No caso brasileiro os valores transferidos variam de acordo com o número de crianças que se encontram em idade escolar e que estão matriculadas e freqüentando as escolas. Assim, famílias com renda até R$ 140,00 recebem transferência de R$ 68,00 e mais R$ 22,00 por cada criança na escola, até um máximo de três pagamentos, ou seja, R$ 66,00. Recentemente foi definido mais um benefício para essas famílias que possuem jovens entre 16 e 17 anos freqüentando as escolas. Com isso, uma família que atenda todas as condições acima especificadas poderá receber até R$ 167,00. Estes valores pela cotação da moeda norte-americana de setembro de 2009 indicavam um intervalo de gasto entre US$ 37,00 a US$ 93,00 para cada família pobre que está sendo atendida.

Por ser um programa massivo e com valores superiores aos outros países, verifica-se que os efeitos do mesmo no combate à pobreza tornam-se mais visíveis, uma vez que o Brasil, juntamente com o México, figura entre os países da América Latina com as maiores taxas de redução na pobreza no último decênio. Um segundo grupo de países é formado pelo Equador e Peru, com valores muitos próximos situados na faixa entre US$ 35,00 mensais, porém com variações entre eles na periodicidade dos pagamentos, conforme comentaremos posteriormente.

Por fim, nota-se que as transferências de renda na Bolívia se situam em patamares inferiores, comparativamente aos demais países. Neste caso, o valor se situa na faixa de US$ 23,00 mensais.

Do ponto de vista da periodicidade dos pagamentos, têm-se situações bastante distintas entre os países. A Colômbia define um valor anual considerando os 10 meses do calendário escolar, o qual é transferido às famílias a cada dois meses, enquanto que as transferências relacionadas aos serviços de saúde dizem respeito ao ano integral, porém pagas também a cada dois meses.

Já na Bolívia a periodicidade dos pagamentos está ancorada em dois procedimentos distintos: as transferências relativas à educação são mensais, enquanto que as transferências relativas à área de saúde são realizadas a cada quatro meses, ou seja, após definido o valor anual este é pago em quatro parcelas de igual valor. Nos demais países as transferências ocorrem mensalmente. Quanto à forma de pagamento, em todos os casos o pagamento é feito diretamente às mães através de agências bancárias, sendo que na maioria dos casos estudados usa-se um cartão magnético específico para este fim.

Do ponto de vista das condicionalidades, exceto no caso do Equador, todos os demais países adotaram o princípio da co-responsabilidade. Desta forma, verifica-se que na área de saúde as famílias precisam levar regularmente os filhos de até cinco anos de idade

aos centros de assistência em saúde e nutrição, enquanto que na área de educação exige-se que as crianças em idade escolar estejam matriculadas e freqüentando as escolas. Em alguns países, como é o caso do Peru, exige-se também a confecção de documentos de identidade de todos os membros da família.

Ainda no quesito condicionalidade chama a atenção o caso do Equador por ser o único país a não adotar nenhum tipo de condicionalidade. Nas reformulações do programa realizadas no ano de 2003 tentou-se implantar algumas condicionalidades à semelhança dos demais países latino-americanos, mas isto permaneceu apenas como campanhas de esclarecimentos. Assim, não se vê nenhum mecanismo de exclusão caso as famílias não mantenham as crianças nas escolas e nem freqüentem os serviços básicos de saúde.

Quanto aos recursos orçamentários dos programas, observa-se que em todos os casos os recursos financeiros têm origem no Tesouro Nacional de cada país, além de empréstimos junto aos agentes financeiros internacionais, especialmente o Banco Mundial (WB) e o Banco Interamericano de Desenvolvimento (BID), que são as instituições bancárias que efetivamente mais patrocinam monetariamente este tipo de política social em escala global.

Ainda sobre o quesito orçamentário, nota-se que em todos os países o controle do mesmo é exercido pelo Governo Central, que disponibiliza os recursos diretamente aos beneficiários, via a rede de agências bancárias existente em cada país.

A tabela 3 apresenta um conjunto de informações sobre os beneficiários dos programas de transferência de renda. Do ponto de vista do número de famílias classificadas como pobres deve-se destacar que os critérios de classificação "dos pobres" não são necessariamente idênticos em todos os países, podendo levar a distorções sobre os índices reais de pobreza em cada país. Por exemplo, dados oficiais da Colômbia informam que em 2008 existiam 2.437.379 famílias pobres. Já informações da ONU revelaram existir no país 21 milhões de pessoas vivendo abaixo da linha de pobreza, ou seja, com menos de um dólar ao dia. Se considerarmos uma média de quatro filhos por família, teríamos mais de 5 milhões de famílias pobres no referido país. Este fato se repete em praticamente todos os demais países pesquisados. No Brasil existem diversos indicadores que mensuram a pobreza. Pelo Cadastro Único (que é o instrumento em que as famílias pobres se registram para obter benefícios sociais do governo) existiam em 2008 mais de 22 milhões de famílias enquadradas como pobres. Deste total, mais de 17 milhões de famílias estavam demandando os benefícios sociais. Mas somente ao redor de 11 milhões delas estavam recebendo os benefícios do programa Bolsa Família. Registre-se que apenas no Brasil observou-se a existência de um cadastro que dimensiona nacionalmente a demanda por este tipo de benefício social.

ITENS	1	2	3	4	5
Número de famílias pobres	1.4 milh	22 milh	2.4 milh	1.2 milh	2.8 milh
Famílias cadastradas	?	17 milh	?	?	?
Número de famílias atendidas	68 mil	11 milh	1.6 milh	292 mil	300 mil
Atendimentos especiais	Não	Sim	Sim	Não	Não

Na Colômbia existiam, segundo informações de 2007, mais de 2.4 milhões de famílias classificadas como pobres, sendo que cerca de 1.6 milhões delas estavam sendo atendidas, o que correspondia a um percentual de aproximadamente 66% do total de famílias pobres. No Equador, segundo informações divulgadas pelos órgãos governamentais, havia aproximadamente 1.2 milhões de famílias pobres dentre uma população total de cerca de 3.2 milhões de famílias. Deste total de famílias pobres, menos de 300 mil famílias recebiam algum tipo de benefício do programa de transferência de renda, o que correspondia a 25% do total de famílias pobres. Registre-se que os pagamentos não diferenciam as famílias pelo número de filhos, como é ocaso brasileiro. Com isso, todas as famílias recebem mensalmente a mesma quantidade de recursos.

No Peru, segundo a Encuesta Nacional de Hogares de 2004, havia 2.8 milhões de famílias classificadas como pobres, dentre uma população total de cerca de 7 milhões de famílias. Além disso, os dados oficiais revelavam que do total de pobres, mais de um terço vivam em condições de pobreza extrema. Observa-se que ao redor de um décimo das famílias pobres estão sendo beneficiadas atualmente pelo programa de transferência de renda.

Finalmente, a Bolívia revela-se o país com um dos menores índices de atendimento, tendo em vista que

↑ (Table 3) Aspectos relativos aos beneficiários dos programas de transferência de renda
Nota: 1=Bolívia; 2=Brasil; 3=Colômbia; 4=Equador; 5=Peru.

de um total de mais de 1.4 milhões de famílias pobres existentes em 2007, menos de 69 mil estavam sendo beneficiadas pelas transferências de renda.

Do ponto de vista do atendimento a grupos especiais dentre as populações pobres, nota-se que apenas Brasil e Colômbia desenvolvem ações voltadas especificamente a determinados grupos populacionais. No caso da Colômbia o Programa Famílias em Ação tem duas linhas para grupos específicos: a primeira delas destina-se ao atendimento das famílias indígenas residentes nas áreas rurais do país, enquanto que a segunda linha destina benefícios a um número crescente de pessoas que o governo chama de "em deslocamento", mas que realidade são famílias refugiadas dos conflitos entre as forças do governo e as FARC.

Já no caso do Brasil, como o programa está presente em todas as regiões e municipalidades, nota-se que a preocupação em atender a determinados grupos específicos de populações pobres só passou a fazer parte do programa recentemente, quando populações indígenas pobres e famílias pobres remanescentes dos quilombolas passaram a receber tratamento especial.

Dimensões dos programas de transferência de renda nas áreas amazônicas dos países selecionados

Este item apresenta as ações dos programas de transferência de renda nas áreas Amazônicas dos países selecionados, tomando-se como referência dois indicadores: o número de famílias pobres existentes e o número de famílias efetivamente atendidas.

A tabela 4 apresenta as informações sobre o Brasil. Inicialmente observa-se que do total das famílias pobres existentes no país aproximadamente 16% delas localizam-se nas áreas geográficas compreendidas pela região amazônica brasileira. Registre-se que desta região fazem parte nove das vinte e sete unidades da federação (estados).

Do ponto de vista das famílias pobres cadastradas no sistema governamental para receber os benefícios, aproximadamente 17% delas residem na área geográfica da região Amazônica brasileira.

Finalmente, quanto às famílias pobres efetivamente atendidas pelos programas de transferência de renda, ao redor de 18% delas localizam-se na Amazônia. Especificamente em relação a esta região, nota-se do total de famílias pobres existentes no ano de 2008 (3.4 milhões de famílias), aproximadamente 57% delas estavam recebendo algum tipo de benefício social. Isto indica que um número considerável de famílias pobres residentes na área Amazônica brasileira ainda não está sendo contemplado pelos programas de transferência de renda.

A tabela 5 apresenta as informações sobre a Colômbia. Inicialmente observa-se que do total das famílias pobres existentes no país ao redor de 5% delas localizam-se nas áreas geográficas compreendidas pela região amazônica colombiana. Registre-se que desta região fazem parte apenas oito do total de 34 Departamentos existentes no país.

Por outro lado, do total de famílias pobres atendidas pelos programas de transferência de renda no país, menos de 5% delas se encontravam localizadas nas áreas geográficas da Amazônia colombiana.

Especificamente em relação a esta região, nota-se do total de famílias pobres existentes no ano de 2008 (102 mil famílias), aproximadamente 50% delas estavam recebendo algum tipo de benefício social. Isto indica que um número considerável de famílias pobres residentes na área Amazônica colombiana também não está sendo contemplado pelos programas de transferência de renda

A tabela 6 apresenta as informações relativas ao Equador. Do total de famílias pobres existentes no referido país, ao redor de 6% delas se localizava nas áreas amazônicas. Registre-se que fazem parte da

ESTADOS	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES CADASTRADAS	Nº FAMÍLIAS POBRES ATENDIDAS	ESTADOS	Nº FAMÍLIAS POBRES
Acre	92.349	87.183	58.209	Acre	92.349
Amazonas	417.803	326.252	237.787	Amazonas	417.803
Amapá	68.649	69.418	41.943	Amapá	68.649
Maranhão	1.118.581	1.053.089	791.449	Maranhão	1.118.581

↑ (Table 4) Famílias pobres e famílias atendidas pelo programa Bolsa Família nos estados localizados na região Amazônica brasileira

região Amazônica equatoriana apenas seis províncias (departamentos) de um total de vinte e uma províncias existentes no país.

Do total de famílias pobres atendidas pelos programas de transferência de renda no país, 4,5% delas se encontravam localizadas nas áreas geográficas da Amazônia equatoriana. Do ponto de vista específico da região Amazônica equatoriana, nota-se que do total de famílias pobres existentes no ano de 2009 (70.534 famílias), aproximadamente 21% delas estavam recebendo algum tipo de benefício social. Isto indica a existência de um percentual elevado de famílias pobres residentes na área Amazônica equatoriana que ainda precisa ser contemplado pelos programas de transferência de renda.

A tabela 7 apresenta as informações relativas ao Peru. Do total de famílias pobres existentes no referido país, ao redor de 30% delas se localizava nas áreas amazônicas. Registre-se que fazem parte da região Amazônica peruana apenas cinco departamentos de um total de vinte e quatro existentes no país.

Do total de famílias pobres atendidas pelos programas de transferência de renda no país, menos de 4% delas se encontravam localizadas nas áreas geográficas da Amazônia equatoriana.

Especificamente em relação à região Amazônica peruana, nota-se que do total de famílias pobres existentes no ano de 2008 (395.785 famílias), aproximadamente 3% delas estavam recebendo algum tipo de benefício social. Isto indica que um número considerável de famílias pobres residentes na área Amazônica

DEPARTAMENTOS	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Amazonas	968	625
Caquetá	53.789	24.163
Guainia	548	325
Guaviare	10.256	3.933
Putamayo	36.441	21.973
Vaupes	370	216
Total Amazônico	*102.372*	*51.235*

PROVÍNCIAS	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Morona Santiago	19.442	3.129
Napo	13.109	2.610
Pastaza	8.043	1.505
Sucumbios	18.166	4.743
Zamora Chinchipe	11.775	2.571
Total Amazônico	*70.534*	*14.558*

peruana ainda não está sendo contemplado pelos programas de transferência de renda. Registre-se que não foi possível proceder da mesma forma para o caso da Bolívia, tendo em vista a indisponibilidade de informações necessárias às análises comparativas.

CONSIDERAÇÕES FINAIS

Conforme vimos anteriormente, grande parte das ações atuais voltadas ao combate da pobreza na América Latina diz respeito aos programas de transferência de renda, que podem ser condicionados ou não condicionados. As primeiras experiências nesta esfera foram realizadas ainda na segunda metade dos anos noventa, destacando-se os casos do Brasil, com o programa Bolsa Escola, e o caso do México, com o programa Progresa, como os pioneiros.

De um modo geral, o objetivo desses programas é combater a pobreza através de melhorias nas condições sociais das famílias classificadas como pobres, através de ações voltadas ao combate da desnutrição visando diminuir as taxas de mortalidade infantil; ao suplemento alimentar e nutricional de crianças e adolescentes; aos cuidados com a saúde básica; bem como ao estímulo à melhoria da formação do capital humano. A forma de transferência dos recursos às famílias normalmente é direta e individual. Porém, em termos de valores verifica-se uma diversidade de situações, indo desde valores únicos até valores mensais definidos a partir do número de filhos matriculados e presentes às escolas. O fato relevante é que, na média, os valores transferidos ainda são bastante baixos.

↑ (Table 5) Famílias pobres e famílias atendidas pelo programa Famílias em Ação nos departamentos localizados na região Amazônica da Colômbia

↗ (Table 6) Famílias pobres e famílias atendidas pelo programa Bolsa de Desenvolvimento Humano nas províncias da região Amazônica Equatoriana

Um dos aspectos ainda pouco abordado pela literatura especializada sobre o tema é o sistema de acompanhamento e monitoramento desses programas. Por exemplo, muito tem sido comentado sobre a expansão do número de matrículas na educação básica após a implementação dos programas de transferências de renda, mas pouco tem sido estudado e documentado sobre a permanência das crianças nas escolas e, menos ainda, sobre a qualidade do ensino que está sendo ministrado. Ou seja, o que tem prevalecido na maioria dos casos são avaliações meramente quantitativas, que são importantes, porém insuficientes no contexto de uma política global de combate à pobreza.

Outro aspecto visível é o baixo nível de conexão entre este tipo de programas de assistência social e as demais políticas sociais em curso. Em parte, essa desconexão tem origem na própria formulação dos CTP, uma vez que os mesmos, ao pressupor a falência das políticas de assistência social tradicionais, se colocam como alternativa e/ou como a política que poderia substituir os sistemas de proteção social.

No caso específico dos CTPs implementados em áreas localizadas na região Amazônica Latino-Americana, destacam-se alguns aspectos. Sobre a cobertura geográfica dos mesmos, observa-se que apenas dois países (Brasil e Colômbia) conseguem, ao mesmo tempo, atender praticamente todos os municípios e um grande número de famílias. Já nos demais países, especialmente na Bolívia e no Peru, além da cobertura geográfica ser bastante limitada, o número de famílias atendidas é extremamente reduzido. Paralelamente ao ponto anterior menciona-se a enorme disparidade dos benefícios monetários mensais, sendo expressiva a diferença entre os valos extremos (Bolívia ao redor de US$ 23,00 e Brasil chegando a atingir US$ 93,00). Esta disparidade não deriva apenas dos distintos mecanismos de funcionamento dos programas, mas fundamentalmente da capacidade fiscal e financeira de cada país, bem como de suas prioridades no atendimento da população pobre. Já um dos fatores de identidade regional desses programas é que em sua grande maioria os recursos orçamentários dependem fortemente da capacidade de cada país de levantar empréstimos junto aos organismos financeiros internacionais, especialmente junto ao Banco Mundial e ao Banco Inter-Americano de Desenvolvimento, que são os principais agentes apoiadores destas iniciativas. Do ponto de vistas das famílias pobres existentes nos países considerados e que residem em áreas abrangidas pela região Amazônica, nota-se uma reduzida participação das mesmas nestes tipos de programas sociais. Mesmo no caso do Brasil e da Colômbia, países com um grau elevado de cobertura, os percentuais de atendimento às famílias pobres amazônicas ficam ao redor de 57% e 50%, respectivamente. Por outro lado, a situação é extremamente deficitária nos casos do Peru e da Bolívia, sendo que apenas uma minoria das famílias pobres consegue ter acesso aos benefícios dos programas de transferência de renda.

DEPARTAMENTOS	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Amazonas	66.266	5101
Loreto	148.455	5441
Madre de Dios	4.314	0
San Martin	121.123	0
Ucayali	64.627	0
Total Amazônico	*395.785*	*10.542*

↑ (Table 7) Famílias pobres e famílias atendidas pelo programa Juntos nos departamentos localizados na região Amazônica Peruana

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ANEXOS

Anexo 1.
Total de Famílias Pobres, Cadastradas e Atendidas No Brasi. Fonte: MDS, 2009

ESTADO	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES CADASTRADAS	Nº FAMÍLIAS POBRES BENEFICIADAS
Acre	92.349	87.183	58.209
Alagoas	569.245	502.376	372.936
Amazonas	417.803	326.252	237.787
Amapá	68.649	69.418	41.943
Bahia	2.322.784	2.136.426	1.482.776
Ceará	1.376.048	1.289.272	906.834
Distrito Federal	194.370	139.066	78.987
Espírito Santo	419.774	295.803	180.155
Goiás	682.699	467.912	282.921
Maranhão	1.118.581	1.053.089	791.449
Minas Gerais	2.283.444	1.874.090	1.046.346
Mato Grosso do Sul	271.675	196.329	113.780
Mato Grosso	337.904	255.685	142.187
Pará	1.010.425	833.737	576.408
Paraíba	632.336	622.052	435.131
Pernambuco	1.445.313	1.395.632	945.843
Piauí	545.950	540.156	377.043
Paraná	1.089.807	880.464	445.882
Rio de Janeiro	1.425.020	877.509	607.419
Rio Grande do Norte	487.567	471.432	309.199
Rondônia	199.193	157.075	109.624
Roraima	58.708	52.451	38.121
Rio Grande do Sul	1.057.660	740.691	416.317
Santa Catarina	415.346	292.524	131.545
Sergipe	3.188.926	291.957	197.754
São Paulo	3.188.926	1.932.879	1.099.702
Tocantins	192.224	177.703	108.852
Total Brasil	*22.231.781*	*17.959.345*	*11.535.150*

Anexo 2.
Total De Famílias Pobres e Atendidas na Colômbia. Fonte: MIS, 2009

DEPARTMENTO	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Amazonas	968	625
Antioquia	217.030	125.924
Arauca	28.011	15.573
Atlantico	83.293	56.894
Bogotá	207.000	59.130
Bolivar	183.807	123.917
Boyacá	73.772	53.852

DEPARTMENTO	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Caldas	35.810	23.831
Caquetá	53.789	24.163
Casanare	29.510	20.703
Caica	111.947	96.056
Cesar	84.432	49.139
Choco	41.209	21.762
Córdoba	178.111	128.247
Cundinamarca	90.516	64.820
Guainia	548	325
Guaviare	10.256	3.933
Huila	85.659	63.545
La Guajira	33.355	19.600
Magdalena	111.334	69.222
Meta	45.553	21.002
Nariña	130.762	117.640
Norte de Santander	77.834	46.600
Putamayo	36.441	21.973
Quindio	23.027	15.134
Risaralda	36.913	21.265
San Andrés	2.118	1.548
Santander	95.684	65.479
Sucre	89.876	59.329
Tolima	98.106	60.903
Valle del Cauca	125.954	87.364
Vaupes	370	216
Vichada	4.404	1.668
Total Colômbia	*2,437.379*	*1,641.482*

Anexo 3.
Total De Famílias Pobres e Atendidas no Equador. Fonte: PPS, 2009

PROVÍNCIA	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Azuay	45.919	12.798
Bolívar	27.554	6.942
Cañar	22.624	5.513
Carchi	22.304	3.903
Chimborazo	48.549	12.210
Cotopaxi	53.213	11.300
El Oro	37.943	12.371
Esmeraldas	46.317	13.700
Francisco de Orellana	12.852	3.259
Guayas	281.640	73.641
Imbabura	41.250	9.185
Loja	48.429	11.102
Los Rios	72.291	24.773
Manabi	162.979	44.322
Morona Santiago	19.442	3.129
Napo	13.109	2.610

PROVÍNCIA	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Pastaza	8.043	1.505
Pinchincha	150.829	22.922
Sucumbios	18.166	4.743
Tungarahua	42.925	9.954
Zamora Chinchipe	11.775	2.571
Total Equador	*1,188.153*	*292.449*

Anexo 4.
Total De Famílias Pobres E Atendidas no Peru.
Fonte: JUNTOS, 2009

DEPARTMENTO	Nº FAMÍLIAS POBRES	Nº FAMÍLIAS POBRES ATENDIDAS
Amazonas	66.266	5.101
Ancash	12.094	15.511
Apurimac	81.569	17.712
Arequipa	74.794	0
Ayacucho	91.736	20.098
Cajamarca	2564.476	41.327
Cusco	185.753	21.282
Huancavelica	101.164	24.744
Huánuco	150.187	31.493
Ica	28.291	0
Junin	142.579	5.526
La Libertad	159.497	23.707
Lambayeque	132.218	0
Lima	425.439	0
Loreto	148.455	5.441
Madre de Dios	4.314	0
Maquegua	6.964	0
Pasco	41.436	1.395
Piura	194.457	15.958
Puno	224.950	67.045
San Martin	112.123	0
Tacna	18.211	0
Tumbes	11.141	0
Ucayali	64.627	0
Total Equador	*2,842.739*	*299.367*

12

Turning the Tide in Amazonia? From Perverse Incentives to Environmental Services

Anthony Hall, London School of Economics

These are critical times for Amazonia. Brazil, in which almost two-thirds of the 6.4 million km² biome is located, faces some stark choices over the next few years. The economic expansion of Brazilian Amazonia since the 1960s has been driven by commercial stimuli and official subsidies, which have encouraged and actively supported an unashamedly predatory development model based on cattle ranching, logging, farming and mining. As a direct consequence, the region has already lost around one-fifth of its 3.5 million km² of forest cover, associated biomass, and carbon stocks [1].

A range of other well-known negative consequences have resulted; including forest degradation and fragmentation, soil erosion, rainfall cycle changes and biodiversity loss, as well as social conflicts due to struggles over land.

Yet what may have been seen until quite recently as the inevitable (and even welcome) 'price of progress' is now increasingly viewed as a major threat to the regional, national, and global environment. Deforestation and land-use change account for around 18% of greenhouse gas (GHG) emissions across the globe, but a much higher proportion of those in Brazil. According to official figures for the period 1990–2005, deforestation, land-use change (three-quarters of which in the Amazon is for pasture), and livestock production together account for 76% of the nation's total emissions. The Amazon contributes up to 1.9% the world's GHG emissions[2]. Not only does Brazil enjoy a prominent economic ranking as the world's largest exporter of beef cattle and soybean (a large proportion of which originates in Amazonia), it also carries a major responsibility amongst middle-income nations to reduce deforestation in the Amazon as part of the battle against global climate change.

The challenge facing Amazonia is how to reconcile economic growth and social development on the one hand; while cutting historic rates of forest destruction, and preserving the natural resource bases on the other. In other words: to what extent will it be possible to switch from policies which actively support environmental destruction as a means of generating individual wealth and economic growth, to policies which promote economic progress, while simultaneously sustaining people's livelihoods and the natural resources upon which they depend?

This paper will discuss how traditionally 'perverse' financial and political incentives have distorted Amazon development over the past four decades, and how this paradigm is at last being challenged. The paper will critically consider a number of policy instruments developed in recent years; ranging from 'green taxes', to PES, which seek to provide positive incentives to help promote sustainable and ecologically sound development in the region. The question then arises of whether these changes constitute a substantive challenge to the familiar mainstream Amazon development model based on perverse incentives, or whether they represent mere window dressing to disguise a 'business-as-usual' scenario.

PERVERSE INCENTIVES AND AMAZONIAN DEVELOPMENT

A 'perverse' incentive is one that produces unexpected negative or undesirable side effects, unrelated to the economic motivations they were devised to promote. It is often associated with a condition of 'moral hazard': when the actors' behaviour is modified by the knowledge that they are protected from risks associated with their actions. In the case of Amazonia, various official incentives and subsidies have been provided since the 1960s to promote settlement and economic development, which has resulted in widespread negative environmental and social impacts. Arguably, these incentives were not 'perverse' in the strictest sense of the word, as they were deliberately calculated to encourage forest conversion as a vehicle of development. Instead, the development model itself has been 'perverse' and shortsighted in view of the destruction entailed. Furthermore, the recipients of such incentives have rarely had to bear economic costs for their actions. On the contrary, for property titling and credit purposes, forest removal was considered proof that land was being put to 'productive' use. Public land was, and still is, officially distributed to small settlers at virtually no cost; and unofficial settlement was encouraged. Without these incentives, it is highly unlikely that the scale of forest loss and its related ills would have approached anything like the levels currently witnessed. There is abundant evidence to demonstrate the power of such incentives in fuelling the occupation and development of Brazilian Amazonia.

For example, from 1971 to 1987 the regional development agency SUDAM and the regional bank BASA channelled over US$5 billion in heavily subsidised financial incentives through the FINAM scheme to encourage the expansion of cattle ranching

1 Forest loss has averaged 15,000 to 20,000 km² a year since the 1990s but has declined since 2005anddropped to 7,000 km² in 2008-09 (INPE, 2009). It is estimated that a further 15,000 km² is damaged annually through forest fires and illegal logging (Nepstad *et al.*, 1999).

2 MCT (2009)

into the Amazon [3]. These incentives consisted of both tax exemptions on ranching activities, and credit granted against taxes owed elsewhere in Brazil [4]. Many such 'productive enterprises', portrayed by government as being in the vanguard of regional modernisation, were subsequently found to have been mere fronts for land speculation and fraud. One evaluation found that only 3% of agro-livestock enterprises funded in this way were economically viable [5]. Cattle ranching became not only the main driver of Amazonian deforestation, but was also closely associated with land speculation, land grabbing (grilagem), land concentration, and other social ills such as the adoption of slave-like work conditions, and growing pressure on indigenous peoples [6].

In the face of growing disquiet, new fiscal incentives for cattle were suspended in 1991, although other inducements for existing ranches, such as subsidised credit, were continued and will not, according to official statements, be totally phased out until 2023 [7]. Nevertheless, ranching has continued to expand as a result of growing profitability through improved production and adaptation to local conditions, better management, and increased exports [8]. By 2007, one-third of Brazil's fresh beef exports came from the Amazon [9]. Brazil's National Economic and Social Development Bank (BNDES), the financial arm of the Ministry of Development, Industry and Foreign Trade, also provides strong support to the livestock sector. From 2007 to 2009, the BNDES invested US$2.65 billion in major livestock enterprises in the Amazon in exchange for shares in these companies [10]. This 'joint venture' with the Brazilian government has been heavily criticised for driving deforestation. Protests have come not just from environmental NGOs but also from Brazil's Congress, which has requested an official investigation into BNDES lending policies and practices [11].

Other activities, such as highway construction, continue to underpin the perpetuation of deforestation and conversion of land use to pasture. The paving of the BR-163 'soya highway', linking Cuiabá to the Amazon grain export terminal at Santarém, represents an attempt to plan highway contruction with a view to minimising deforestation though it is still too early to say how successful it will be [12]. On the other hand, restoration of the BR-319, connecting Porto Velho with Manaus, is consistent with the existing use of infrastructure development to 'open up' the frontier for commercial production; despite provisions for establishing protected areas [13]. Furthermore, subsidies for soybean production indirectly push cattle farming further into Amazonia by taking over degraded pastures in Mato Grosso; as does sugarcane occupation of former soybean fields and pasture in the Cerrado [14]. Cross-border transport and infrastructure integration plans under IIRSA will also act as a perverse incentive, likely to provoke major negative social and environmental impacts, such as accelerated deforestation, as the Amazon improves links with global markets [15]. Improved river transport and highways will make agricultural commodities, timber, minerals and biofuels from the Amazon more competitive, as connections are established with Pacific coast ports in Peru.

Of course, it should be remembered that perverse incentives apply not just to wealthy, asset-rich producers such as cattle ranchers, loggers and large farmers. Although these groups tend to enjoy the lion's share, humbler settlers have also benefited from various government inducements. In the 1970s, the official drive to occupy Amazonia, and integrate it into the national economy, included plans to allocate 'land without men to men without land' [16]. In addition to this strategic aim of occupying vast, so-called 'empty' spaces, Amazonia would simultaneously act as a social 'safety-valve' to diffuse tensions in the Northeast and South of the country, where agricultural modernisation and land concentration were marginalising the poor and squeezing them out. Government sponsored colonisation schemes along the Trans-Amazon highway and other major roads such as the BR-364 (Cuiabá to Porto Velho) attracted thousands of small farmers. Private colonisation schemes benefited from land concessions by the military government, and persuaded semi-capitalised small farmers from the South to exchange their homesteads there for larger tracts of land in the Amazon [17].

Lacking proper technical support or production and social infrastructure from the colonisation agency INCRA, such projects have enjoyed little success in developing ecologically adapted agrarian systems on a significant scale, perpetuating an imported model of slash-and-burn farming, combined with cattle ranching (as a means of capitalisation) where possible. This has accelerated forest loss, especially along the infamous 'arc of deforestation' [18]. Lacking any significant realistic alternatives, this model has been emulated by the vast majority of small farmer settlers. Thus, while by no means the major culprit small farmer, settlement has certainly contributed to deforestation. Surveys carried out in the late 1990s indicated that about 25% of Amazonian deforestation occurred on properties of up to 100 hectares [19]. Agrarian reform settlements are

3 Schneider (1992)
4 Mahar (1988)
5 Gasques and Yokomizo (1985), Gasques (2000)
6 Branford and Glock (1985), Hall (1989), Fearnside (2000)
7 Fearnside (2000), May (2005)
8 Margulis (2004)
9 Smeraldi and May (2008)
10 Greenpeace (2009a). According to Greenpeace, these capital injections included US$485 million to Bertin, US$728 million to JBS and over US$50 million to Marfrig.
11 The congressional Committee on 'Amazonia, National Integration and Regional Development' has asked the National Audit Office (Tribunal de Contas da União — TCU) to investigate loans issued by the BNDES to livestock companies to ascertain whether these enterprises are promoting deforestation. See 'TCU vai investigar se recursos do BNDES estimulam desmatamento'. *www.amazonia.org.br/noticias/noticia*.cfm?id=333079 Accessed 5.11.09
12 Fearnside (2007)
13 Fearnside (2008), Fearnside and Alencastro Graça (2006)

particular culprits, accounting for 15% of total forest loss between 1970 and 2002 [20].

In addition to continuing subsidies for large producers, there has been a major expansion of credit awarded to small- and medium-sized farmers in Amazonia through the Constitutional Fund for the North (FNO), and the National Programme for Strengthening Family Agriculture (PRONAF) — established in 1995 and expanded in 2003 when the present administration came to power. Small producers receive 45% of FNO loans. The 'subsidy' in these loans takes various forms: interest rates below market levels; discounts for timely repayment; and amnesties for unpaid debts [21]. According to the Bank of Brazil, the FNO default rate stands at 20%; while for PRONAF loans aimed at poorer farmers, it was 14% in 2008 (of two million loans in Brazil overall) [22].

This suggests that farmers of all categories often 'play the system', treating loans as outright grants while complacent in the knowledge that there is little accountability in the long run. Such perverse incentives are directly linked to forest loss. Studies show that rates of deforestation are especially high on official settlement projects where farmers have access to heavier subsidies (especially those from PRONAF). Historically, the bulk of FNO lending has been for cattle, underpinned by an institutional culture within the Amazon Development Bank BASA which favours this sector [23]. In 2006, over half of credit granted for cattle ranching under the FNO was allocated to small farmers through PRONAF, contributing to the record expansion of cattle herds in the Amazon to over one-third of the national total of 206 million head [24]. The national audit office (TCU) has drawn attention to the fact that granting of PRONAF credit continues to favour livestock investments, and is made conditional upon land clearing [25].

Private sector credit has also played a major role in supporting agribusiness expansion in the Amazon. In 2008, Cargill provided US$500 million to its soybean suppliers in the region, including around its grain port at Santarém [26]. This led to accusations that the company might be actively stimulating rainforest removal for grain production in the Santarém region, making soya a direct rather than indirect driver of deforestation.

Funding from international financial institutions has also strengthened perverse incentives. The support of the World Bank for highway expansion and frontier development in north-west Amazonia (*Polonoroeste*) during the 1980s, which rapidly accelerated forest loss in Rondônia, is a well documented example [27]. In 2004, the International Finance Corporation (IFC) approved a US$30 million loan for the André Maggi Group (Amaggi), the largest soya producer in the world. The project was classified by IFC as 'Category B', exempting it from rigorous environmental review in a decision strongly criticised by NGOs, and even by the organisation's own evaluation unit for ignoring the indirect impacts of soy on the Amazon environment as it pushed forward the cattle frontier towards intact rainforest [28].

Despite a wave of international criticism, the World Bank's endorsement of Amaggi no doubt helped it to secure a further US$230 million from a consortium of international private banks just two years later, not to mention support from the BNDES [29]. Undaunted by such opprobrium, in 2007 the IFC made a similar loan of US$90 million to Bertin, Brazil's second largest meat processing company (before it was taken over by RBS Friboi to form the largest), to expand and modernise its operations, ostensibly to make them more 'sustainable'. However, in June 2009, in the face of mounting evidence collected by NGOs that Bertin was ignoring environmental safeguards, the loan was cancelled [30]. Since then, the company has made conciliatory gestures to improve its social and environmental image.

Our attention has so far been focused on the incentives, perverse or otherwise, that have supported ranching, timber extraction and commercial farming as major drivers of deforestation in the Amazon. It should not be forgotten, however, that mining activities have also played a significant role in this process, both directly and indirectly. For example, the Carajás iron-ore project, run by the then state-owned Companhia Vale do Rio Doce (CVRD), while confined to an enclave in southern Pará, has had far-reaching consequences since its inception in the 1980s. Not only did it give rise to associated industries such as pig-iron smelting, fuelled by rainforest timber, but also stimulated a rapid process of land occupation which greatly accelerated the pace of deforestation and intensity of social conflict in the region (Hall, 1989; Redwood, 1993). As part of the Greater Carajás Programme (PGC), aluminium smelting was established, and had a similar effect. The Carajás iron-ore project benefited from strong government investment and World Bank loans, while Japanese and US investors in aluminium smelting were supported by cheap electricity from the Tucuruí hydropower scheme, as well as other privileges. A series of eleven dams planned for the Amazon, including Santo Antonio on the River Madeira, and Belo Monte on the Xingu, along with

14 Feltran-Barbieri (2009)
15 Killeen (2007)
16 Bourne (1978), Hall (1989), Schmink and Wood (1992), Branford and Glock (1985)
17 Ozório de Almeida and Campari (1995)
18 FSP (2009)
19 Fearnside (2005)
20 IMAZON (2006)
21 'Crédito fácil do governo contribui com o desmatamento na Amazônia'. *www.socialismo.org.br/portal/ecologia/96-noticia/197-estudo-relaciona-aumento-do-desmatamento-com-creditos-financeiros.* Accessed 31.10.09
22 Ministry of Agrarian Development. *www.pronaf.gov.br/dater/index.php?ctuid=15617&sccid=104.* Accessed 14.12.09
23 Costa (2005)
24 Smeraldi and May (2008)
25 TCU (2009)
26 'Cargil amplia crédito para produtores de soja no Brasil'. *www.agrolink.com.br/sementes/NoticiaDetalhe.aspx?codNoticia=75110.* Accessed 24.11.09
27 Hall (1989), Rich (1994), Redwood (1993), Millikan (1992)

other infrastructure developments, are expected to have similar impacts.

TURNING THE TIDE?

To date, the development path chosen for Amazonia has been quite effective in serving a number of complementary State objectives, some of which are declared, and others latent. These include boosting commercial production for both domestic and overseas markets in the cattle and soybean sectors, and serving interests of both the agribusiness elites and local farmers. Whilst promoting economic growth and integrating the region into the geopolitical mainstream, the model also accommodated large numbers of land-hungry poorer farmers, helping to diffuse conflicts in other regions of Brazil, such as the North-East and Centre-South.

Yet the environmental and social costs of this process have mounted inexorably, and will continue to grow for the foreseeable future. Private investment, government infrastructure expansion, and highly unequal patterns of human occupation have led to rapid rates of forest loss and natural resource depletion, closely accompanied by land conflict and rural violence [31]. Certain underlying factors have facilitated the emergence of this situation. These include the availability of cheap land, the weak rule of law, and precarious governance on the expanding frontier. However, as noted in the preceding paragraphs, the availability of financial incentives, especially for the expansion of large-scale cattle ranching, has greatly accelerated the process with its attendant negative impacts. It is also probably true that perverse incentives toward large-scale ranching have pushed small-scale producers to more fragile lands at the advancing frontier, as well as swollen the ranks of the urban unemployed. The population of Northern Brazil is now about two-thirds urbanised [32].

In terms of environmental policy to address these problems in Amazonia, so far the emphasis has been placed on a combination of command-and-control restrictions on deforestation activities, and on reinforcing protected areas which, if we include indigenous reserves, cover over 40% of Brazilian Amazonia. There is indeed evidence to show that the establishment of protected areas such as those supported by WWF under the ARPA programme can act as an effective bulwark against encroaching deforestation; especially where federal and state governments collaborate, and where adequate resources are applied to police particularly vulnerable areas and strengthen conservation management [33]. Yet it is often extremely difficult to enforce such policies in an area as vast as the Amazon, which is larger than Western Europe. Even if abuses are detected (for example, through satellite surveillance), sheer lack of enforcement capacity on the ground means that the vast majority of environmental crimes go unpunished. From 2002–2007 protected areas in the Brazilian Amazon lost 10,000 square kilometres of forest, accounting for 8% of regional deforestation during that period.

Another indicator of general impunity is that less than 1% of environmental fines imposed in Brazil are actually collected [34].

An alternative approach under these circumstances is based not on punishing ecological crimes, but on providing positive incentives to discourage such abuses, and stimulate good practice. Brazil has witnessed the beginnings of a slow move towards incorporating elements of a sustainable development approach in the Amazon, based on the introduction of economic incentives [35]. Archaeological evidence bears witness to the widespread use of non-destructive patterns of land-use in the Amazon over centuries [36]. In the modern era, practices offered as alternatives to rampant forest destruction started to become more widely acknowledged in the late 1980s and 1990s [37]. Rubber tappers led the fight for extractive reserves following the murder of Francisco 'Chico' Mendes in 1988, while inland fishing communities undertook a similar, aquatic-based struggle for protected areas to sustain their livelihoods. Even groups of small farmer settlers along the Trans-Amazon highway and other areas (not hitherto renowned for their ecological sensitivity) have introduced systems of agroforestry and sustainable forest management.

The perverse nature of mainstream Amazonian development incentives, and the need to make adjustments, has been officially recognised for some time [38].
A range of economic inducements is now being introduced in an the attempt to stimulate and support activities which reconcile conservation of natural resources with enhanced production, the generation of economic surplus, and overall support of local livelihoods. These include green credit mechanisms, fiscal tools designed to reward forest conservation and sustainable production, responsible sourcing and product certification, as well as payments for environmental services.

28 IFC (2005), World Bank (2008)
29 'Grupo André Maggi obtém US$230 milhões em empréstimos'. *www.amazonia.org.br/noticias/noticia.cfm?id=211181.* Accessed 31.10.09.
30 The Economist (2009)
31 Hall (1989), Fearnside (2005)
32 Browder and Godfrey (1997)
33 Hall (2011)
34 Ricketts *et al.* (2010), Barreto *et al.* (2009),
35 Anderson (1990), Hall (2000), May (2005)
36 Heckenberger (2005, 2009)
37 Hall (1997, 2000)
38 Haddad and Rezende (2002)

Green Taxes

While no panacea, a number of fiscal measures designed to encourage conservation and more environmentally sensitive development have emerged in recent years, marking a promising if slow change in attitudes.

1 *Ecological value-added tax* (ICMS-E). This was first introduced in the 1990s in the state of Paraná, then in Minas Gerais, São Paulo, Rio Grande do Sul, Rondônia and Mato Grosso. The original law allocates between 0.5 and 2.5% of state VAT revenues to compensate municipalities for tax income lost due to the designation of standing forest as protected areas, including indigenous reserves. They can represent a major source of income for municipalities with high levels of conservation. A complex formula is used to allocate ICMS-E revenues to municipalities, while state governments carry out registration automatically. Although the ICMS-E has raised awareness of the importance of conservation areas and indigenous reserves as potential income generators, there was no guarantee that protected areas would be strengthened in practice [39]. Furthermore, due to the weighting criteria, municipalities with less than 25%of their territory under protection, or with mainly 'direct use' units, benefited relatively less. This has given rise to criticisms regarding the potentially adverse distributional impacts of the ICMS-E.

   Mato Grosso addressed this problem through a state constitutional amendment (LC 73/2000) determining that 25% of the ICMS would take into account environmental criteria. From 2002, 5% of the ICMS was allocated to support protected areas in the state. In the case of Mato Grosso, such redistribution can have a potentially significant impact at municipal level; 68 municipalities in the scheme saw their incomes increase by over 50%, amounting to a total of R$25 million in 2004 [40]. However, the extent to which these transfers are effectively applied to strengthen protected area expansion and management remains a moot point. Furthermore, as a revenue-neutral mechanism, the ICMS-E is limited in the amount that can be reallocated in any given year. As more and more conservation units are set up, total available resources will be diluted unless more weight is eventually given to ecological factors.
2 *Green FPE*. This bill (PLC 351/02) was introduced to Congress in 2002 by Senator Marina Silva [41]. It proposes compensating states with protected areas via a 2% allocation of the 'state participation fund' (FPE) distributed by the federal government. Under the 'Green FPE', financial support would be proportional to the area under protection in each state, and could generate substantial monies for conservation. However, the bill has languished in Congress for almost a decade, and has only recently obtained wider political support amongst state governors.
3 *Ecological Income Tax*. Also passing through Congress is the bill for an ecological income tax (PL 5974/05) that would allow income tax to be offset against donations to environmental projects. Given that such fiscal incentives in the Amazon (and the Northeast through SUDENE) have traditionally favoured cattle ranching, this would be a welcome development to support conservation rather than pasture formation and degradation.
4 *Rural Land Tax (ITR)*. A significant perverse incentive that existed until the 1990s under ITR rules classified forested areas (except legal reserves and APPs) as 'unproductive', and taxed them at a higher rate than cleared land. In 2009, a new legal provision (the Environmental Declaration – ADA, amending Law 9.393/06), made it possible for rural property owners to obtain a discount of up to 100% on rural property taxes to compensate for protected areas, such as those under permanent protection (APP), legal reserve (ARL), private natural reserves (RPPN), ecological interest (AIE), forest or environmental service (AFSA), and native forest (AFN) [42]. As with the ecological income tax, this measure should provide some economic incentive to conserve forests. The Ministry of Finance has proposed that this mechanism be used to reduce deforestation and create protected areas on the agro-livestock frontier [43].

Environmental Compensation Measures

Various proposals exist to compensate resource-users for conservation efforts and encourage maintenance of existing forest cover.

1 *Environment compensation fund*. The 'Fundo de Compensação Ambiental' was set up in 2000 as part of the law that created the National System of Conservation Units (SNUC). Based on the 'polluter pays' principle, it requires companies building projects with a significant environmental impact to set aside up to 0.5% of investment costs as funds

39 Grieg-Gran (2000), May *et al.* (2002)
40 Maciel and Viana (2005) Diniz (2005)
41 Diniz (2005)
42 'Ato Declaratório Ambiental'. servicos.ibama.gov.br/cogeq/index.php?id_menu=76 Accessed 5.11.09
43 'Fazenda defende que Brasil adote metas para redução das emissões'. *www.amazonia.org.br/noticias/print.cfm?id=328896.* Accessed 5.11.09

to strengthen fully protected areas. Federal and state environmental agencies identify the projects concerned, and calculate the amount of compensation based on levels of impact determined in environmental impact assessments, rather than demanding a fixed percentage of project cost [44]. The private companies involved are then tasked with directly financing measures such as land regulation. While the Fund has been welcomed as a potentially valuable source of revenue for conservation purposes, reservations have been expressed over the prioritisation of protected areas, and possible conflicts of interest within environmental agencies involved in both regulating and benefiting from the Fund.

2 *Forest reserve restoration.* A bill (PLS 34/08) has been introduced to Congress that would provide a financial reward for landowners who maintain larger areas of their property as 'forest reserve' than is legally required under the Forest Code of 1965 (80% in the case of Amazonia). An 'environmental swap' arrangement is being discussed to allow landowners on properties of up to 400 hectares to compensate illegally deforested 'reserva legal [45]' land with forest preserved elsewhere, while an amnesty is contemplated for those guilty of creating pasture on APPs [46]. Forest Reserve Certificates (CRF) would be issued for up to 200 hectares per property up to R$10,000 a year. Such payments could also be used to offset official bank debts.

Such incentives for conservation, however, could be seriously undermined by changes to Brazil's Forest Code proposed by Federal Deputy Aldo Rebelo (Bill 1876/99), which might become law in 2011. Lauded by the agribusiness lobby as a means of lifting restrictions on productive activities, it is heavily criticised by environmentalists as a license to deforest that could have accelerate forest loss significantly [47]. Amongst other changes, the bill suggests reducing areas designated for permanent preservation (APPs) along riverbanks and hilltops, exempting small properties from the legal reserve requirement altogether and pardoning all illegal deforestation undertaken before 2008.

3 *Green Protocols.* As early as 1995, the Brazilian government signed a 'green protocol' with official banks to promote environmentally friendly lending policies. These agreements were renewed in 2008 between the Ministry of the Environment (MMA) and the Federation of Brazilian Banks (Febraban), and in April 2009 with the BNDES, Caixa Econômica Federal, Bank of Brazil, Bank of Amazonia (BASA) and Bank of the Northeast (BNB). A similar protocol was signed in September 2009 between the MMA and the insurance industry as part of company risk assessment strategy [48].

However, serious doubts have been raised as to whether expressions of good intentions on the part of the financial sector actually translate into effective action. Critics find it difficult to believe that banks will ever shed their core institutional belief in deforestation as an indicator of development, especially at the level of the local branch manager [49].Such protocols with their positive statements of intent are also belied by the debacles involving Bertin, the IFC and BNDES, as well as continued funding of the livestock processing industry, the main driver of Amazon deforestation.

4 *Support for extractivism.* Subsidising the market price of sustainably produced forest products, such as rubber and Brazil nuts, represents another form of supporting conservation through positive incentives. The rubber tappers' movement led by Chico Mendes, and the subsequent formation of extractive reserves as a major environmental policy instrument in the Amazon, has demonstrated the potential power of organised natural resource-users as a bulwark in against the rising tide of deforestation.

In 1999, the government of Acre introduced the 'Chico Mendes Law' (Law 1,277) to boost stagnating rubber production in the face of declining world prices and lack of official support. Paid through producers cooperatives and associations, this subsidy stood at R$0.70 per kilo in 2004, on top of a market price of R$1.50 per kilo. Together with federal subsidised credit through PRODEX, latex production quadrupled to 3.3 million kilos by 2004 [50]. In 2009, the subsidy (representing 50%of total payments to producers) was increased to R$3.50 per kilo, benefiting 1400 families in Acre [51].

The Brazil nut sector in Acre has been under pressure for some time from cheaper Bolivian competition. To strengthen the industry, it was supported in 2009 with R$7.2 million from the BNDES to the producer cooperative Cooperacre to improve storage, production, and training facilities. According to the Ministry of Agrarian Development (MDA), over R$15 million has been invested in the Brazil nut production chain through PRONAF, and via CONAB through the Programme for Food Acquisition (PAA). This helped double the producer price from R$6.50 to

44 'Lula reduz valor pago por impacto ambiental', Folha de São Paulo, 19.5.09. oglobo.globo.com/pais/noblat/posts/2009/05/19/lula-reduz-valor-pago-por-impacto-ambiental-187410.asp Accessed 15.12.09.

45 The area located within a rural property or possession, except for the permanent preservation, necessary to the sustainable use of natural resources, conservation and rehabilitation of ecological processes, biodiversity conservation and shelter, and protection of native flora and fauna. *www.reservalegal.com.br.* Accessed August 2010

46 'Pacote regulariza situação ambiental de propriedades rurais'. *www.amazonia.org.br/noticias/noticia.cfm?id=334535.* Accessed 14.11.09

47 Greenpeace (2010)

48 'O MMA e os seus protocolos'. *www.amazonia.org.br/noticias/noticia.cfm?id=331973.* Accessed 5.11.09

49 'Instituções financeiras devem mudar de atitude'. *www.amazonia.org.br/noticias/noticia.cfm?id=321439.* Accessed 5.11.09

50 Hall (2008b)

51 'Vitória: Governo Federal pagará R$3,50 pelo quilo da borracha do Acre'. *www.amazonia.org.br/noticias/print.cfm?id=306897.* Accessed 30.10.09

R$12 per can in 2004 [52]. As part of the federal government's poverty reduction umbrella programme known as Fome Zero, CONAB is implementing similar measures in the PAA programme to support basic foods and forest products in other Amazon states [53]. The General Policy for Minimum Prices (PGPM) aims to guarantee prices for ten forest products, including rubber, Brazil nuts, babaçu, carnauba, copaiba, and andiroba [54].

If this strategy is successful, support for rubber and Brazil nuts should help to reduce levels of rural out-migration and protect the forest from illegal activities. However, subsidised prices would have to be higher than regional prices to offer a significant incentive. Yet this potential may be undermined by the continuing presence of perverse incentives for smaller producers through subsidised credit which, on top of livelihood pressures, may perpetuate forest removal and degradation. For example, there is increasing evidence that illegal cattle ranching has spread within extractive reserves in the Amazon [55].

Rural Credit

As noted above, subsidised official credit has been one of the most important perverse incentives in supporting pasture formation by large and small producers through BNDES, FINAM and the FNO.

1 *Resolution 3.545*. A step towards rectifying this bias has been taken with the introduction of environmental criteria for official loans in Amazonia. Resolution 3,545 of the National Monetary Council stipulates that from July 2008 applications for rural credit must be supported by key documents such as official property registration (CCIR) and environmental license. Agrarian reform settlements and small family farms obtaining credit via PRONAF require only a declaration from INCRA that the project or landowner in question conforms to environmental regulations. On this basis, resolution 3.545 has come under criticism for appearing to relax environmental eligibility criteria. If a larger landowner does not have a full environmental license, s/he may obtain a temporary declaration from the state control agency that is valid for banking purposes. Such flexibility is viewed as being conducive to abuse of the system. Thus, it remains to be seen how effective this screening device is over the longer term, since to date there has been no evaluation of this programme's impact.
2 *FNO/PRONAF-Florestal*. In response to criticisms of the heavy livestock bias in official credit allocation, PRONAF-Floresta was introduced to support forestry, agroforestry and extractivism. Renamed PRONAF-Florestal in 2007, with mono-species reforestation such as eucalyptus now excluded, this credit is highly subsidised. It could be a valuable tool for encouraging the reforestation of legal reserve areas and APPs. However, the scheme has been criticised for the complexity of its rules and regulations, and its accessibility for small producers has been called into question [56]. Furthermore, data from the Bank of Amazonia show that forest-based activities absorbed just 0.3% of investment value under PRONAF in 2007. As far as local bank managers are concerned, this represents a high-risk activity. While in theory there is clearly much scope for expansion, such issues will first have to be addressed.
3 *World Bank SEM/DPL*. The World Bank is attempting to influence this scenario through its US$1.3 billion First Programmatic Development Policy Loan for Sustainable Environmental Management (SEM/DPL) to the BNDES [57]. Approved in March 2009, this sector loan supports nine policy objectives, several of which address Amazon deforestation and unsustainable land-use. These include the formulation and implementation of a new Environmental and Social Institutional Policy for the BNDES, including the Green Protocol, applied across its portfolio. Other measures relate to instituting investment guidelines to manage social and environmental risk across key sectors such as agriculture. It is hoped that such institutional strengthening will support BNDES-funded activities, for example, in the field of responsible sourcing in the livestock and soybean sectors.

However, a number of shortcomings in the loan design have been highlighted [58]. From the point of view of the topics addressed in this paper, several issues stand out. First, given that BNDES provides 70% of its financing through private sector companies, monitoring compliance with environmental standards and ensuring transparency becomes problematic.

Certification for the cattle sector as a loan performance indicator is not included as a conditionality. Furthermore, the project risk analysis does not take account of recent changes to Brazil's landownership law (MP458) or proposed modifications to the Forest Code, discussed above.

52 'Governo investe R$7,2 mi na cadeia produtiva da Castanha-do-Brasil'. *www.amazonia.org.br/noticias/print.cfm?id=333212*. Accessed 30.10.09
53 'Governo quer ampliar participação de produtores em programas de incentivo no Amazonas'. *www.amazonia.org.br/noticias/noticia.cfm?id=326838*. Accessed 30.10.09
54 'Campanha vai informar extrativistas sobre plítica de preços mínimos', MMA, 1 October 2009. *www.sipam.gov.br/index2.php?option=com_content&do_pdf=1&id=2228*. Accessed 22.11.09
55 Machado (2008), Greenpeace (2009b)
56 Contag (2007)
57 World Bank (2009)
58 McElhinny (2009)

Responsible Sourcing, or 'Greening', of Commodities

As noted above, official support through price subsidies and government funding for traditional rainforest products such as rubber and Brazil nuts has been increasing. However, while laudable, their environmental impact will be limited until the direct drivers of deforestation are also addressed more forcefully. The 'greening' of commodity supply chains for timber, cattle, and soya may provide powerful incentives to minimise forest loss. This approach plays on the current hope that, as one campaigner has noted, 'Being associated with deforestation is bad business [59].' A price premium in niche markets for 'sustainably' produced goods could provide some commercial advantage, along with guaranteed market access for 'reliable' entrepreneurs. An alternative view is that companies placed in the spotlight are cynically using this as a smokescreen to acquire a responsible image while carrying on business-as-usual.

1 *Timber.* It is estimated that 80–90% of Amazonian timber is illegally harvested, most of which supplies the Brazilian market, especially São Paulo [60]. Yet there is a growing demand both within and outside Brazil for products manufactured using sustainably harvested timber, such as that certified by the Forest Stewardship Council (FSC) [61]. Globally, over 100 million hectares of forest are certified according to FSC –level standards, representing 5% of productive forest. Brazil has almost seven million hectares of certified forest, half of which is in Amazonia [62]. However, this represents just 1–2% of Amazonian timber production [63]. Acre, known as 'the forest state', has the highest proportion of certified timber, with 80% sourced from sustainably managed forests. Its three largest suppliers, as well as four furniture manufacturers, are FSC-certified [64].

Latin America's first outlet for certified timber, Brazil's EcoLeo, reported a 75% increase in sales in 2007 from 2006, and a further 55% increase in 2008. This is due largely to growing demand from corporate customers, such as Pão de Açúcar and McDonald's [65]. In March 2009, as part of its Madeira é Legal campaign, WWF Brazil signed a voluntary cooperation agreement with the state and municipal governments of São Paulo, as well some 25 corporate and official actors, to promote the sale of certified timber, whose activities were to be monitored by IMAFLORA [66]. Faithful to its environmental commitment, the state government of São Paulo is now Acre's biggest customer [67]. In October 2008, major companies in the cattle, timber, and soybean sectors signed a series of commitments not to do business with Amazon properties judged guilty of environmental crimes [68].

In spite of market expansion for certified timber products from Amazonia, there are still major problems to be addressed. A common practice is that of illegally certifying and exporting wood that has been harvested from protected areas and indigenous lands. Although a forest area may be certified once extracted timber enters the chain of custody it may comprise only a small part of the final delivery [69]. Furthermore, being caught by IBAMA does not pose a serious disincentive to offending enterprises, as only a small fraction of fines is collected.

Inadequate land titling could also pose a problem for enterprises requiring accreditation. As REDD projects are implemented in future (see below), the demand for certification services is likely to grow considerably, and this could outstrip the supply capacity of FSC and associated agencies.

Another continuing barrier to promoting environmentally sound consumption is the lack of public awareness of production options in Brazil; and an unwillingness to pay environmental premiums, which is why most timber products with FSC certification are exported to niche markets overseas. However, information on 'green' production and consumption in Brazil is increasingly available, although potential demand has probably been undermined by the financial crisis [70].

2 *Cattle.* In the livestock sector as well, there have been moves to create environmentally and socially friendly markets for Amazonian beef. This has been largely in response to domestic and international lobbying by environmental NGOs (for example, Greenpeace and Friends of the Earth-Brazilian Amazon), and to growing market pressures. Some 160 Brazilian companies, including the largest firms and associations, have signed the National Plan for the Eradication of Slave Labour. In 2008, 19 Mato Grosso meat companies and associations signed an agreement (TAC) with the state and federal governments to officially comply with the Plan. At the same time, Pará created a state fund to support compliance with traceability requirements. Following criticism over its IFC loan, Bertin promised to clean up its production chain by

59 TNC (2009b): 5
60 Campos *et al.* (2008)
61 Represented in Brazil by the Conselho Brasileiro de Manejo Florestal (FSC-Brasil). The principal Brazilian certifier under this standard is the Instituto de Manejo e Certificação Florestal e Agrícola (IMAFLORA), but FSC certification is also performed by other certifiers active in Brazil, such as SCS and SGS. A competing national standard, CERFLOR, was developed by the national standards authority, INMETRO, with less rigorous social performance criteria (May, 2006).
62 'Especialistas descartam lei para certificação do manejo florestal'. *www.amazonia.org.br/noticias/noticia.cfm?id=333452.* Accessed 6.11.09
63 'Programa Madeira é Legal...' *www.amazonia.org.br/noticias/noticia.cfm?id=304286.* Accessed 6.11.09
64 'Produtos madeireiros ganham certificação'. *www.amazonia.org.br/noticias/noticia.cfm?id=321489.* Accessed 6.11.09
65 'Cresce 55% venda de madeira certificada'. *www.amazonia.org.br/noticias/noticia.cfm?id=294667.* Accessed 30.1009
66 *www.wwf.org.br*
67 'No Acre, 80% da madeira industrializada é proveniente de manejo florestal'. *www.amazonia.org.br/noticias/noticia.cfm?id=308325.* Accessed 30.10.09

disowning several ranches identified as employers of slave labour [71]. In July 2008, a presidential decree (6.514) banned the sale of products from areas identified as sources of illegal deforestation.

Also in 2008, Friends of the Earth-Brazilian Amazon publicly exposed the rapid expansion of cattle production in Amazonia and its negative environmental impacts [72]. In June 2009, Greenpeace published a damning report directly associating major companies and prominent meat products with illegal deforestation that had international repercussions [73]. Just days later, major supermarkets in Brazil (Pão de Açúcar, Carrefour and Wal-Mart) announced that that they would not sell meat sourced from ranches guilty of illegal forest destruction, while Bertin saw its US$90 million IMF loan cancelled. Nike and Wal-Mart have announced that they will require chain-of-custody certification from suppliers of beef and leather goods. In June 2009, the UK/DFID-funded 'Forest Footprint Disclosure Project' was set up to encourage companies to reveal how their activities and supply chains impact on forests, and what is being done to address any issues the arise [74].

At the same time, the Working Group for Sustainable Cattle Ranching (GTPS) was set up in June 2009 to bring together 18 institutions, including Brazil's largest companies in this sector (JBS-Friboi, Bertin, Minerva and Marfrig), as well as banks, NGOs, academics and others. The offices of JBS-Friboi and other meat processing companies were raided, and executives arrested for fraud and corruption, while a federal prosecutor filed a major lawsuit against the industry for environmental damage [75]. In response, the GTPS drew up a three-year plan to introduce certification and monitoring to help ensure that beef and leather will not be produced as a result of new forest clearing.

Preceding this initiative by several years, the NGO Aliança da Terra, was set up in 2004 by Mato Grosso-based American rancher John Carter, working together with IPAM and the Woods Hole Institute. It aims to reward cattle producers who obey the Forest Code and practice sound land management by protecting riparian zones, preventing soil erosion, and controlling fire use [76]. A certification system would allow ranchers and farmers to command higher prices for their products by directly supplying major supermarkets and restaurant chains. Together with payments for ecosystem services, entry into such niche markets could provide positive incentives to encourage the adoption of sustainable practices and reduce deforestation rates.

3 *Soybean*. In recent years, soybean production has also been identified as a significant indirect (and sometimes direct) driver of deforestation [77]. In 2006, major suppliers, purchasers, and environmental NGOs declared a moratorium on the purchase of soya grown on recently deforested areas, which has recently been renewed until July 2010. The Working Group on Soya (GTS) is monitoring land use and forest removal through satellite surveillance and field visits. The disincentive is that offenders, both large and small, could be denied credit, and excluded from major markets. In terms of positive incentives, there is a strong expectation that, in the long run, compliant farmers would be financially compensated through systems of PES, and that a 'green' market for soy could be created [78].

Payments For Ecosystem Services (PES)

1 *Background*. Of all the potential mechanisms for rewarding conservation and sustainable development, the most lauded at present seems to be that of paying resource-users for the environmental services they supply (carbon sequestration, biodiversity and landscape preservation, rainfall cycle regulation, soil conservation, etc.). Some three-quarters of Brazil's GHG emissions – mainly CO_2 and methane – are generated by a combination of deforestation, forest degradation, and the expansion of livestock farming. In this context, PES could establish significant positive incentives to help maintain standing forest, and encourage more sustainable forms of forest use.

Brazil is now officially committed to reducing deforestation rates by 80% by 2020 against a baseline average (1996–2005). This reduction makes up half of all GHG reductions proposed at a national level, and would be achieved through cuts in deforestation – mostly in Amazonia. According to Brazil's National Climate Change Plan, it would avoid some 4.8 billion tons of CO_2 emissions between 2006 and 2017, and restore GHG to 1994 levels in 2020 [79]. It has been estimated that the ending of Amazon deforestation would result in a 2–5% reduction in global carbon emissions [80]. Action for mitigation and adaptation will be supported through Brazil's

68 'Empresas assinam pactos contra produtos ilegais originários da Amazônia.' *www.bancodoplaneta.com.br/group/amazonia/forum/topic/show?id=1741754%3ATopic%3A166775*
69 Campos *et al.* (2008)
70 See, for example: compradores.amazonia.org.br
71 Campos *et al.* (2008)
72 Smeraldi and May (2008)
73 Greenpeace (2009a)
74 See *www.forestdisclosure.com*
75 'Brazilian beef giants agree to moratorium on Amazon deforestation'. *www.amazonia.org.br/noticias/noticia.cfm?id=330929.* Accessed 5.11.09.
76 *www.aliancadaterra.org.br*
77 Steward (2007), GTF (2008), GTS (2009)
78 'Indústria da soja não vai comprar de quem desmatou a Amazônia'. *www.amazonia.org.br/noticias/noticia.cfm?id=307466.* Accessed 5.11.09
79 Brazil (2008).
80 Nepstad, *et al.* (2009)

National Climate Change Fund (FNMC), formally approved in December 2009 [81]. Resources for the Fund will be channelled through the BNDES, derived from petrol revenues and the central government budget, as well as public and private overseas donations.

As the world's fourth largest emitter of GHG, Brazil has acquired a prominent position in negotiations under the United Nations Framework Convention on Climate Change (UNFCCC). The Kyoto Protocol (1997) made no provision for compensating countries to preserve existing forests, merely for reforestation and afforestation. International lobbying by the Coalition for Rainforest Nations and other organisations has resulted in proposals to introduce policies for the mitigation of climate change through policies to support Reduced Emissions from Deforestation and Forest Degradation (REDD+) in a post-Kyoto scenario over the next UNFCCC commitment period, after 2012 [82].

Having been formalised at COP13 in the Bali Action Plan, a commitment to address deforestation was one of the few firm conclusions to emerge from COP15 in Copenhagen in December 2009 and endorsed at COP16 in Cancun, Mexico a year later. In the Copenhagen Accord, 'new and additional resources' were pledged by industrialised countries to address issues such as forests [83]. Although no specific figures were included in the Accord, US$10 billion a year has been promised in the short term as a 'fast start', with a further US$30 million expected during 2010–2012. Some bilateral monies have been earmarked for REDD+ initiatives in poorer countries [84]. Furthermore, multi-lateral programmes of support for setting up REDD+ national strategies ('REDD Readiness') and funding pilot projects have been established by the UN and World Bank pending formal incorporation into a UNFCCC framework after 2012 [85]. Brazil has not requested UN or World Bank technical support for its own REDD initiatives, but it has received financial aid from the Norwegian and German governments through the Amazon Fund, discussed below.

Brazil was initially reluctant to support the principle of market-based REDD financing. However, in the run-up to Copenhagen, Amazonian state governors and civil society institutions exerted growing pressure on President Lula to modify this stance. Following a much-publicised governors' meeting in Palmas, Tocantins in June 2009, an official REDD task force was set up to make recommendations that would be carried by Brazil's negotiators to COP15 in Copenhagen. These mechanisms were grouped into three categories: (i) government sources such as the Amazon Fund, (ii) market mechanisms without offsets against industrialised (Annex 1) country emissions, and (iii) market tools with compensation, a major innovation in Brazil's REDD position [86]. Environment minister Carlos Minc later confirmed Brazil's support for REDD with compensation for Annex 1 countries, but proposed that this should be limited to 10% of a nation's emissions reduction commitment [87].

It is generally agreed that the Amazon has the greatest potential to contribute to global climate change mitigation through REDD policies. REDD has become the focus of much interest amongst all stakeholders involved in using Amazon forest resources; from peasant farmers and indigenous populations, to large agribusiness interests. Arguably, over 400,000 indigenous and traditional people have been the most effective custodians of the forest, but have received scant reward for their efforts. A similar number of small settler farmers in the Amazon on forested and marginal lands could be encouraged to shift towards more sustainable production systems [88]. Larger commercial farmers could also be incorporated within compensatory strategies, as noted above.

Notwithstanding their respective environmental sensitivities and public commitments, there are high expectations that compensatory measures for financing 'avoided deforestation' could generate significant income flows for the parties involved. Everyone wants a share of the environmental cake. So much so that governors have been anxious to promptly establish the principle of equitable sharing of such revenues amongst Amazon states, should they materialse [89]. At the Copenhagen conference, Amazonia's governors were strong proponents of sub-national responsibility for managing REDD funds, as opposed to the federal government's support for national-level implementation.

It has been estimated that reducing deforestation rates by just 10% globally could generate up to US$13 billion in carbon finance [90]. In the Brazilian Amazon, over a 30 year period, REDD payments totalling US$7 to US$18 billion could reduce carbon emissions by six billion tons below the historical baseline [91]. Meanwhile, in the absence of national PES

81 Law 12.014/09

82 The term 'REDD' is used in this paper as all-encompassing but it has been disaggregated in the literature as follows: REDD = adding value to the forest equivalent to the emissions reductions gained through its preservation; REDD+ = REDD plus conservation, sustainable forest management and increasing carbon stocks; and REDD++ = REDD+ as well as improved agricultural practices to avoid deforestation.

83 UNFCCC (2009a): 3. Funds for kick-starting REDD were promised by Australia, France, Japan, Norway, the US and UK. See also the draft decision on REDD at Copenhagen (UNFCCC, 2009b)

84 Funds to the tune of US$3.5 billion for kick-starting REDD were promised by Australia, France, Japan, Norway, the US and UK. See, 'Paises ricos anunciam US$3.5 bilhões para salvar florestas'. *www.bbc.co.uk/portuguese/noticias/2009/12/091216_copenhagueflorestas_ebc_ac.shtml.* Accessed 19.12.09

85 The UN-REDD programme and Forest Carbon Partnership Facility (FCPF) of the World Bank together currently support national REDD preparation programmes in all Latin American countries except Brazil, Belize, Uruguay and Venezuela.

86 Viana (2009)

87 'Brazil to support REDD in Copenhagen'. *www.amazonia.org.br/noticias/print.cfm?id=333087.* Accessed 5.11.09

88 Nepstad *et al.* (2009)

funding mechanisms, voluntary carbon markets and private donations have been harnessed to support pilot projects such as *Bolsa Floresta*. In addition to carbon trading, government sources such as the Amazon Fund, set up with an initial grant of US$120 million from Norway and administered through the BNDES, is also supporting avoided deforestation projects. In December 2009, Norway increased its contribution by a further US$150 million in recognition of the 40% reduction in the rate of Amazon deforestation in 2008–09 over the previous year.

2 *Operational projects*. Latin America is something of a pioneer in promoting PES, with Costa Rica operating the world's first national forest conservation programme (established 1996). Brazilian Amazonia has seen many REDD-type projects under various guises, which have encouraged and financially supported forest maintenance, albeit on a relatively small scale [92]. Brazil's first formal PES scheme in the Amazon was *Proambiente*, launched by civil society institutions in 2000, and transferred to the federal government in 2004. Based on the principle of paying small farmers to minimise deforestation, introduce environmentally friendly systems such as agroforestry, and minimise the use of fire, *Proambiente* has had a mixed record [93]. Although activities were developed on 12 'poles' originally, several of these rapidly became moribund, while others were more successful (usually the more politically organised at the grassroots level). However, lack of regular funding and capacity-building has limited its impact, and the role of *Proambiente* is currently being reconfigured by the MMA and is currently inactive. It has nevertheless yielded important lessons for the future development of similar schemes.

Amazon states are increasingly taking the initiative to develop PES/REDD projects. The best known of these is *Bolsa Floresta*, run by the Fundação Amazonas Sustentável, attached to the state government of Amazonas. Operational since 2008, it is targeted at 14 protected areas (conservation units) with a population of over 5,700 families spread over ten million hectares. Initial activities have been concentrated in the Juma Reserve area with 320 families. In order to encourage forest conservation, the management plan includes monthly payments of R$50 (US$30) to resident mothers, in addition to R$350 (US$200) per year per family to support agricultural production; and a similar amount for community infrastructure investment in education, health, transport, etc [94].

The project is supported by Bradesco and a number of private donors including the Marriot hotel chain and Coca Cola, allowing activities to be funded through a US$60 million trust fund [95]. *Bolsa Floresta* has become emblematic, and is regularly upheld as a shining example of what is achievable. However, given its very recent inception, judgements over its impact and sustainability could be premature. Criticisms have been made concerning issues such as shortfalls in family payments, the absence of significant threats to the forest in areas benefited by programme, a lack of effective community participation, and the exclusion of the state conservation agency (CEUC) from planning or running the scheme [96].

3 *Planned projects*. A number of other state government-sponsored REDD schemes in the Amazon are at the design or early planning stage. Pará is introducing its Campo Cidadão programme to strengthen ecologically friendly, small-scale family farming. Official plans state that no fewer than 120,000 producers will be benefited over four years via 12 sub-programmes, one of which will comprise PES (a 'social-environmental bonus', worth R$100 per family, per month) for the recovery of 'legal reserve' land improperly deforested beyond the 20% allowed under the Forest Code (known as the 'passivo ambiental'), and for avoided deforestation [97].

Also in Pará, the 'REDD for Amazon Smallholders' project (RAS), will build upon earlier work under the federal *Proambiente* scheme along the Transamazon highway to support 350 small producers. Supported by IPAM and the Amazon Fund, RAS would compensate farmers for the opportunity costs of avoided deforestation and the transition costs of moving towards more sustainable production and land management models, thus avoiding over three million tonnes of CO_2 equivalent emissions over ten years [98].

The state of Acre has introduced its 'PSA Carbono' PES scheme that will increase small farmers incomes by supporting the recuperation of degraded areas, sustainable agrarian systems and protection measures in six vulnerable areas [99]. As part of state programmes for adding value to and certifying sustainable production, emphasis will be placed on technical assistance rather than direct payments, with a view to strengthening extractivism.

89 'Fórum de governadores fecha acordo para COP-15' *www.amazonia.org.br/noticias/noticia.cfm?id=331830*. Accessed 23.10.09
90 Ebeling and Yasué (2008)
91 Nepstad at al. (2009)
92 Hall (2008b)
93 Hall (2008a)
94 FAS (2009)
95 FAS (2009)
96 GTA (n.d.)
97 Pará (2008)
98 IPAM (2009)
99 Acre (2009)

In Amazonas, Pará and Acre, most incipient REDD programmes focus on the needs of small producers. Yet in order to reduce rates of forest loss, the main drivers must be confronted. Arguably, therefore, REDD initiatives should target incentives at large producers to effectively contain forest destruction and GHG emissions. Two demonstration projects will be implemented in Pará and Mato Grosso, which are responsible for 70% of Brazilian deforestation, arising from cattle, soya, and timber production. Covering 1.8 million hectares, these two large-scale carbon projects are expected to reduce CO_2 equivalent emissions by 980 million tonnes [100]. These initiatives are underpinned by strong government commitment at all levels to enforce environmental laws, as well as by growing private sector interest in securing environmental service payments, and expanding sustainable production of beef, soya, and timber under responsible sourcing arrangements.

In southern Pará, the environment secretariat is collaborating with IPAM and TNC to plan a project in São Félix do Xingu (RSRX), the municipality with the country's second highest rate of forest loss [101]. Environmental planning and enforcement capacity in the state will be bolstered, and a Registry of Social-Environmental Responsibility of private properties at the headwaters of the River Xingu will be compiled. Interventions will follow with the 46 participating properties to recognise, encourage, and reward conservation and positive land management practices; cutting potential deforestation by over 600,000 hectares, and reducing GHG emissions by an estimated 216 million tonnes of CO_2 equivalent.

A similar approach towards the private commercial farming sector will be taken in Mato Grosso, where 38% of the original forest cover has been lost [102]. A state-wide programme to reduce deforestation and fire-use is planned for the future. In the meantime, a REDD pilot project is being set up in the north-western part of the state covering ten million hectares, supported largely by the ICV. Focused on the priority municipality of Cotriguaçu, it is at an early stage of development, involving consultation with stakeholders, and diagnostics [103]. In addition to improving forest governance, including strengthening and extending its environmental control and licensing system, PES instruments would provide economic incentives to promote forest conservation and sustainable practices. This would compensate the opportunity cost of non-conversion to pasture or cropland, and of recovering degraded areas. However, although some agrarian reform settlements and small farmers are included in the project, concern has been expressed that large landowners (who dominate the landscape) might monopolise funding [104]. This experience could provide an interesting case study of how to balance and reconcile the interests of diverse stakeholder groups.

At the REDD pilot stage, the projects discussed above have focused on the potential of small farmers and larger commercial producers to reduce deforestation. Yet arguably the single most important group from a conservation perspective comprises the indigenous groups and local or traditional communities (such as rubber tappers), who act as the forest stewards for 60% of Amazonia's protected area, or 25% of the total forest. These reserves protect a stock of 15 billion tonnes of carbon, one-third of the regional total [105]. Their rights to participation in REDD resource-sharing and to self-determination have been recognised in REDD policy discussions. In Brazil, indigenous groups have become increasingly vociferous in this regard. For example, Legal opinion in the case of the 1200-strong Surui tribe of Rondônia state has favoured their right to carbon credits in return for sustainable management of their 243,000 hectares of forest [106]. If successful, this could set a much wider precedent across Brazil, and beyond.

4 *Challenges for REDD*

A number of problems threaten to undermine the efficacy of PES schemes in providing new incentives to slow down the rate of Amazon deforestation. An overarching issue is the lack of a national legal framework, which hindered implementation of *Proambiente* [107]. A Bill is currently going through Congress (PL 5487/2009) to introduce a National Policy for Environmental Services, and a National Programme of Payments for Environmental Services. Unusually, but not unsurprisingly, this has cross-party support since groups as diverse as environmentalists and the agrarian lobby all have an interest in its timely execution. In the meantime, Amazonas and Acre have instituted their own its own state laws to facilitate PES, while Mato Grosso is planning to follow suit.

Several other fundamental characteristics of REDD initiatives may undermine such potential. A first major dilemma is reflected in the 'equity

100 TNC (2009a)
101 IPAM (2009), Amazon Initiative (2010)
102 TNC (2009a), Micol *et al.* (2008). Technical support in developing the project has been provided by the ICV, ISA and TNC.
103 MT (2009)
104 Fatheuer (2008)
105 IPAM (n.d.)
106 'Firm seeks carbon deal for Brazilian tribes'. Financial Times, 10 December, 2009.
107 Hall (2008a)

versus efficiency' debate [108]. This is particularly critical in a country such as Brazil, where landownership is so unequally distributed. Should PES focus on the needs of small producers (farmers, extractivists, fishers, indigenous groups) in the interests of social justice and equity, despite the fact that they are responsible for a relatively small proportion of forest destruction? Or should PES target the main drivers of deforestation (cattle ranchers, loggers, large commercial farmers), persuading them to modify their environmentally destructive behaviour, but probably swallow up the bulk of funds in the process? The high transaction costs of implementing REDD might also favour large landowners rather than more numerous and geographically dispersed forest dwellers and farmers.

A politically negotiated balance will have to be struck on the allocation of PES revenues in a post-Kyoto scenario after 2012. In the case of Brazil, IPAM has proposed a model for allocating REDD funds based on 'target, stock and deforestation reduction' [109]. An equitable distribution among the nine states would be based on a calculation of opportunity costs of reduced deforestation, compensation for forest conservation, and payment for demonstrable, reduced levels of forest loss. Such a model could address the moral hazard problem of 'paying the villains' and provide incentives to actively preserve existing forested areas or reduce deforestation rates. Special consideration would have to be given in terms of REDD benefits distribution to ensure recognition of the rights of indigenous groups and traditional populations [110].

A second problem concerns 'leakage', where illegal activities are simply displaced from a managed area to one that is unprotected, thereby neutralising overall environmental gains. Forest users could benefit twice: once from the PES arrangement and a second time from the perverse incentive created to shift destructive activities elsewhere. Well-managed community-based PES schemes may be less problematic in this regard, compared with large commercial operations owning multiple landholdings where leakage options are considerably greater. Guaranteeing the 'permanence' of emissions reductions in the face of continuing pressures on the forest, whether assessed on a local, regional, or national and international basis, would also have to be addressed. One of the principal arguments for the REDD approach is that it is supposed to address the national policy framework, and thus confront the leakage problem, although this would not deal with the problem of international leakage.

Another major challenge is how to determine 'additionality' generated by PES. That is, the quantity of reduced deforestation and GHG emissions when set against a baseline. The problem of measuring additionality can be addressed through the development of appropriate methodologies. But another perhaps even more fundamental issue concerns whether incentives should be channelled only to those resource-users who have demonstrably curtailed destructive activities, such as cattle ranchers or slash-and-burn farmers, under a form of 'compensated reduction'. Additionality also relates to the logic of directing a major share of REDD finance toward areas where there is little or no threat of near term deforestation, such as the interior of Amazonas, compared with the active frontier forests of Mato Grosso and Pará, where most deforestation has actually occurred.

A related and equally important issue, especially for traditional populations such as extractivists and indigenous peoples who have historically conserved forests, is how they can be rewarded for their past and present 'preventive' stewardship. If resource-users cannot be rewarded under REDD rules for their 'good practice', perverse incentives might be unwittingly generated for deforestation to be accelerated by excluded groups. These groups could either reap the benefits of deforestation out of sheer frustration, or claim financial compensation when they 'step in' to take 'corrective' action.

If requests to take part in PES programmes exceed available resources (as they surely will), policy-makers and planners must target interventions based on potential environmental benefits and costs [111]. Issues to be factored into such assessments would have to include calculations of real ecological threats, likely additionality and permanence, and the political demands of the many stakeholder groups competing for attention. In practice, it may well be the case in Amazonia that political influence and pressures will determine the distribution of PES programmes rather than purely technical criteria.

A number of other design and implementation concerns for PES schemes need to be considered. First, it is assumed within a neo-liberal logic that monetary compensation is the major incentive that will help transform behaviour and reduce deforest-

108 Wunder (2006)
109 Lima *et al.* (2009)
110 IPAM (n.d.)
111 Engel *et al.* (2008)

ation. The blind introduction of REDD schemes based on conservation may well have adverse impacts on the local economy and labour markets [112]. While it is undoubtedly true that for larger commercial farmers, and perhaps most small producers, financial compensation is a key factor in covering opportunity costs and transitioning towards more sustainable practices, this might not be the whole story.

Research evidence from *Proambiente* suggests that small farmer conservationist motivations are more complex and not necessarily conditioned solely, or even primarily, by cash inducements [113]. Non-economic values have been shown to strongly influence attitudes towards resource conservation, as in the case of Andean water rights [114]. Furthermore, strong vested interests may operate to oppose PES schemes and undermine the system of governance. It is therefore necessary to understand the social, cultural, and political complexity of PES situations to ascertain context-specific factors that might facilitate or impede such policies, and to modify project design accordingly.

The literature on PES suggests that compensation must cover all costs, including at a minimum the complete opportunity costs of alternative uses. However, this vision does not take into account how policy is shaped by different types of social relations. Landholders will certainly be happy to receive full opportunity costs, but they can be also convinced through negotiation to accept less to bring themselves into compliance with land use codes. This is especially true since in the Amazon, few landholders have complete property rights, but many would like to legitimize their holdings, and adhering to environmental regulation can help them to achieve this [115].

Looking beyond REDD, questions over the long-term sustainability of forest-based economic activities designed to conserve natural resources have always been asked and will continue to be asked [116]. REDD financing, whether from voluntary government funds or based on carbon markets, may be unpredictable in supply and will certainly have a finite life span. Some observers fear that an influx of credits onto the carbon market might depress prices. Such external support runs the risk of creating dependence that may run counter to promoting sustainability over the long term, especially if heavy reliance is placed on international donor funding beyond the pilot stage. The real challenge will be how to integrate REDD into wider policies for generating stable incomes and livelihoods. As far as traditional and indigenous populations are concerned, arguably the principal guardians of the rainforest, this signifies mainstreaming currently small-scale activities, such as permaculture farming, agroforestry, extractivism, and sustainable forest management. For the commercial sector, a new vision will have to underpin the production of export commodities as well as production for the growing and increasingly discriminating domestic marke.

CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

For over four decades, Amazonian development has been supported and stimulated by a series of perverse incentives and policies, with frequently disastrous environmental consequences. During the past decade, attempts have been made to create a more favourable policy environment for implementing sustainable development, but these have tended to focus on command-and-control policies. They include: the 2004 federal deforestation control programme for Amazonia (PPCDAM) with subsequent commitments from Amazon states; advanced remote sensing and monitoring through INPE and NGO watchdogs, with similar expertise and greater agility to interpret and channel information to the public; the creation of over 19 million hectares of protected areas between 2003 and 2008, and strengthening of conservation laws under SNUC; the public forests management law (11.284) of 2006; and the 'sustainable BR-163' development plan [117]. At the same time, other economic and political factors threaten to undermine what progress has been achieved. Brazil's Accelerated Growth Programme (PAC) continues with plans for regional infrastructure development to stimulate macro-economic growth and, within IIRSA, continental integration. Although environmental arguments have gained currency, political opposition remains strong. Attempts by agribusiness interests to undermine Brazil's Forest Code legislation continue apace (as noted above), while the government attempts to simultaneously satisfy both agricultural and environmental lobbies, which remain largely antagonistic towards each other. Many believe that the government's environmental commitments are severely compromised by the

112 Costa (n.d.)
113 Bartels (2009), Muradian *et al.* (2010)
114 Wunder *et al.* (2008)
115 Muradian, *et al.* (2010)
116 Hall (1997)
117 Millikan (2009)

continuing strength of the agrarian lobby in Congress. Land 'regularisation' has often been highlighted as a *sine qua non* of any attempt to establish environmentally sound development in the Amazon. However, this is proving to be politically controversial. Provisional Executive Order (MP) 458 became law (11.962) in June 2009. It is intended to legalise claims of small and medium landowners with up to 1500 hectares who settled on public lands by December 2004, and is designed to stimulate compliance with forest and environmental laws. However, this has been labelled the 'land-grabbers' decree', and there are fears amongst environmentalists and lawyers that this may encourage land speculation, social conflict and further forest loss [118].Federal public prosecutors have drawn attention to major legal and constitutional shortcomings with the legislation [119].

SUGGESTIONS FOR FURTHER RESEARCH

Further research will help to shed light on the effectiveness of positive incentives in slowing down deforestation. Initial suggestions are as follows:

REDD in the Amazon

1 A comprehensive survey of REDD initiatives across the Amazon Basin would provide a useful database of the range of these projects in their different contexts.
2 Once implemented, a selective and comparative analysis of representative REDD projects in the region and their early results would allow an assessment to be made of their appropriateness (in economic, ecological, social, and cultural terms) and effectiveness, and their likely sustainability, as well as impacts on the local economy. This could perhaps complement similar comparative international research proposed by CIFOR [120].
3 Should funding actually be available to support the anticipated growth in REDD schemes in Amazonia, limited implementation capacity is likely to be a major problem. This dimension is often conveniently forgotten in the planning process and would merit a study in its own right.

Brazil's Forest Code and land ownership laws

An analysis of the likely consequences of proposed modifications to the Forest Code currently being negotiated in Congress would be revealing, and could inform future policy-making. Linked to this issue, a study should be made of the implementation of Law 11.962/2009 which legalises land claims of up to 1500 hectares, to determine its impact on deforestation and social conflicts.

Responsible commodity sourcing

An independent examination of the market potential of certified, 'sustainable' production of major commodities such as cattle, timber, and soya is necessary. The actual and potential effectiveness of these recent Brazilian initiatives in responsible sourcing would be analysed. This should include the impacts of 'environmentally sensitive' banking practices (BASA, FNO, BNDES), and scrutiny of the World Bank's SEM/DPL sector loan in leveraging change.

Green financial mechanisms

The time is ripe for an analysis of the effectiveness of environmentally sensitive financial instruments, for which little or no empirical evidence currently exists, despite the fact that it is mandated in article 170 of the Federal Constitution. These instruments are intended to provide positive incentives to conserve the Amazon forest, linked to compliance with land tenure and environmental legislation. For example: (i) ecological value-added taxes and creating a more direct link with conservation, (ii) support for extractivism, and (iii) subsidised credit for production through channels such as the BNDES and FNO/PRONAF. We need to discover how effective are they proving to be and what modifications, if any, are required.

FINAL REMARKS

It would be unrealistic to claim that the tide of ecological destruction in Brazilian Amazonia has turned or is, indeed, likely to be reversed in the forseeable future. Growing world demand for soya, beef and timber, along with the quest for regional economic integration in Latin America, is likely to drive deforestation as the Amazon is further opened up to fuel economic growth. Any fall in the pace of forest loss, such as that witnessed from 2005 to 2009 in the Brazilian Amazon, may be attributed to a reduction in the growth

118 Millikan (2009)
119 'Procuradores do MPF apontam 9 pontos inconstitucionais na "MP da grilagem"'. *www.amazonia.org.br/noticias/noticia.cfm?id=316445*
120 Learning From REDD: A global comparative study (2009), CIFOR: Indonesia.

of soya and cattle industries as well as to the imposition of more effective environmental controls [121]. Yet there are indications that the tide is at least slowly beginning to shift as diverse groups search for new policies and practices which both facilitate enhanced production while maintaining the resource base relatively intact. Initiatives ranging from tax incentives and green credit lines to payments for environmental services offer some hope for the future in terms of generating 'low deforestation livelihoods' [122].

Within an undoubtedly hostile policy context, attention is being turned increasingly to stimulating change through the use of economic and other incentives to support the preservation of natural resources as an integral part of the development process in Amazonia. Having finally recognised the destructive impact of decades of perverse incentives on the Amazon, the challenge now is to modify this pattern. The question we face is how to harness the power of economic and other incentives to promote environmentally sound development. Although this process has commenced, as illustrated by the initiatives discussed in this paper, they are still largely embryonic. Further research is needed to fill the gaps in knowledge, create innovative solutions, and help re-direct Amazon development. If this challenge is not taken seriously, we run the risk of emulating the fabled King Canute and his futile attempts to turn the tide. In this case, however, the consequences will be rather more serious than wet feet.

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121 Nepstad *et al.* (2009)
122 Nepstad *et al.* (2009)

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13

Beyond Carbon: Realising the Value and Continued Stewardship of Tropical Forest Ecosystem Services in a Changing Climate

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ABSTRACT

Tropical rain forests play an important role in regulating climate and in providing other 'ecosystem services' (ES) to humanity. Deforestation leads to the loss of these services, impacting global climate, regional weather and local livelihoods and culture. Recognising these impacts, the UN's REDD+ mechanism aims to generate incentives to encourage the maintenance or enhancement of tropical forests. REDD+ represents one mechanism whereby forest-dwelling communities may be compensated for their role as forest stewards. We report on the emerging results from a project to analyse ES delivery by rain forest in tropical South America, to investigate the impact of likely climate and land use change this century, and to consider what compensation mechanisms for maintaining the ES (in the face of such changes) are likely to be seen as acceptable by forest-dwelling communities here, and in other tropical regions. Climate projections for the 21st century indicate a risk of substantial changes in ES at local and regional scales, related to changes in global climate and/or land use. In the case of reduced rainfall, we use the 2005 drought in Amazonia to document the diverse impacts of drought, by quantifying the costs of state-level health treatment and region-wide fire incidence. Compensation mechanisms designed to link forest conservation with the maintenance of ES are likely to be most successful if the range of ES considered is wider than a single metric such as carbon, and if the mode of compensation addresses social and cultural resource needs, as well as financial ones.

INTRODUCTION

Tropical rain forests are inextricably linked with global climate, both directly through their substantial roles in the exchange of mass and energy with the atmosphere (Bonan, 2008); and indirectly through the impact of deforestation and forest degradation on the atmospheric concentration of greenhouse gases (GHGs), primarily carbon dioxide (CO_2), and on sensible and latent heat flux (Gullison *et al.* 2007, Bonan 2008). However, their importance to humanity goes far beyond these fundamental climatic metrics. The roles forests also play — the 'ecosystem services' (ES) they provide (Costanza 1997) — range from the provision of biodiversity and soil fertility, to cultural heritage and economic sustainability (Shvidenko 2005).

Healthy forests are important natural assets in the livelihood strategies of many of the world's poorest groups of people (Sunderlin *et al.* 2008). About 1.2 billion living in extreme poverty are dependent on forests (World Bank 2004). Whilst the protection of natural ecosystems has occasionally been considered capable of creating a poverty trap for indigenous communities (van Gardingen 2003), this has rarely been thought appropriate to tropical rain forests. Instead, the potentially large contribution that halting deforestation could make to reducing global CO_2 emissions (Malhi, Meir and Brown 2003, Gullison *et al.* 2007) has focused debates around the avoidance of forest loss; ES; and potential payments for the retention of ES that could benefit tropical rain forest nations, and the often resource-poor communities dwelling in, and providing stewardship of, their forested regions (Peskett 2008). The concept that maintenance of the ES and related co-benefits from intact tropical rain forests might be compensated for has gained ground rapidly in recent years (Laurance 2007). However, the justification, permanent utility, and acceptability of different forms of compensation all remain under close scrutiny, and are linked to national and international policy development (Parker 2008).

Here we examine initial outcomes from a project designed to link expertise across disciplines in the Amazon-Andes region. The aim was to raise research capacity to advance understanding of ES and how projects to implement 'Payments for Ecosystem Services' (PES) might work, with particular reference to enhancing or protecting the well-being of forest-dwelling communities in the region. Whilst a key element of the project was to raise the collaborative capital necessary to do this work, a series of outputs were also sought, spanning the policy and economic frameworks (Hall 2009, Araújo 2009, Cranford 2010, Trivedi *et al.* 2009, Karousakis 2009), the physical science (Marengo *et al.* 2008, Marengo *et al.* 2010, Poveda *et al.* 2004, Meir *et al.* 2009), and the needs of forest communities in relation to PES (Mattei and Rival, 2009, ESPA AA 2010). We focus here on three questions:

1. How does climate science frame the background of the PES debate in Amazonia?
2. Can the 2005 drought provide examples of economic vulnerability in relation to climatic extremes?
3. Is the concept of PES appropriate for improving the well-being — or reducing the vulnerability to ES loss — of forest dwelling communities in Amazonia and other tropical rain forest regions?

EMERGING POLICY: REDD

Emissions of CO_2 from deforestation and the loss of tropical peat lands contribute approximately 15% of global emissions (van der Werf 2009, IPCC 2007, Ryan 2009). Forest degradation adds a substantial additional efflux (Nepstad *et al.* 1999, Asner *et al.* 2006), but this has not been well-quantified globally. Given this large role in global CO_2 emissions, tackling tropical deforestation and forest degradation has been identified as one of the quickest and most cost-effective climate change mitigation options (Stern 2006, Gullison *et al.* 2007).

The success of efforts to reduce deforestation and forest degradation will depend on the capacity to change the economic land use assessment made daily by millions of forest users: whether it is possible to make forests worth more standing than cleared. The value of the global climate regulation service provided by tropical forests has been estimated at roughly US$2000/ha/yr (TEEB 2009), and the challenge therefore is to create an international mechanism – perhaps a Payment for Ecosystem Service (PES) mechanism – to capture that value and transfer it in the form of appropriate incentives to those nations and communities who are maintaining and enhancing their forests.

In combination with a perceived need to control the rise in atmospheric CO_2 concentration (IPCC 2007) and an emerging global market in carbon (Stern 2006), the UN policy process 'REDD' has been seen as a way to put a greater value on standing forests rather than on their conversion to other land uses (REDD = Reducing Emissions from Deforestation and forest Degradation). REDD has rapidly developed into 'REDD+' which is now described as: "Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries" (UNFCCC Decision 2/CP.13–11). While the initial policy goal was to reduce CO_2 emissions from deforestation and forest degradation, the negotiations among nations have broadened its scope to acknowledge the validity of related land use activities. The "+" in REDD+ refers to forest conservation, sustainable forest management and enhancement of forest carbon stocks, e.g. through forest rehabilitation and regeneration (Parker 2008). Enlarging the area of forests through afforestation and reforestation (A/R, which is part of the Clean Development Mechanism — an instrument of the earlier Kyoto Protocol to the UNFCCC), also increases forest carbon stocks. However, it is not clear whether A/R will be part of REDD+.

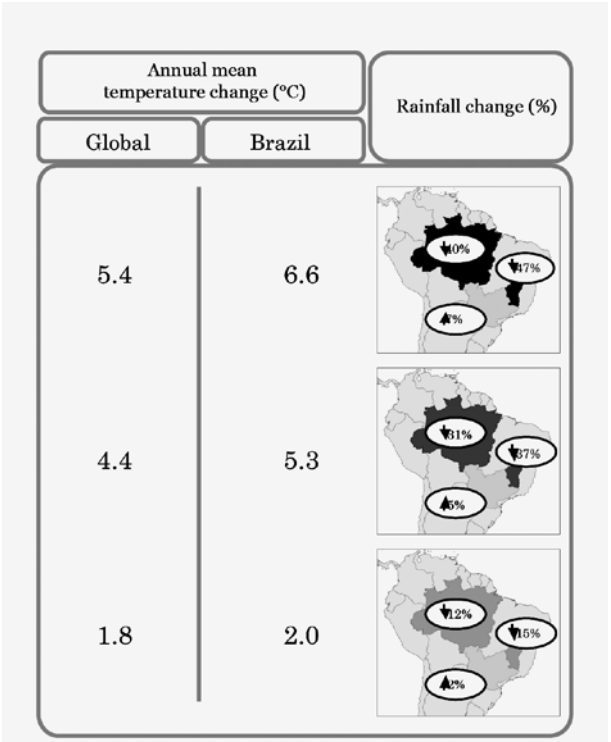
The development of REDD+ incorporated and substantially widened some ideas from the Clean Development Mechanism, and also recognised the multiple ES co-benefits that forests provide. The evolution of REDD+ is likely to continue following the recent UN Climate Conference in Copenhagen (LCA Draft Decision FCCC/AWGLCA/2009), and the South American tropics provide an excellent example of this debate as rates and modes of forest loss vary within and among countries such as Brazil, Peru, Ecuador and Guyana, as do land use opportunities (ESPA-AA 2008, Trivedi *et al.* 2009.

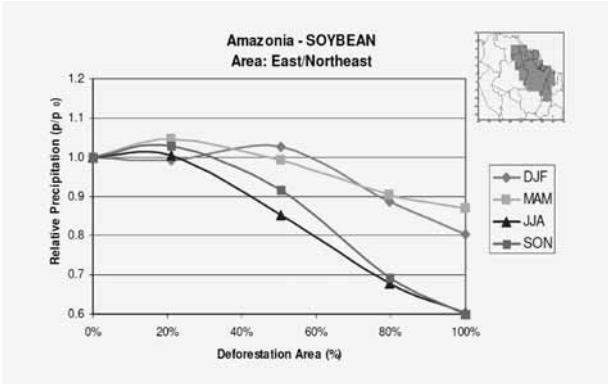
CLIMATE, CARBON & WATER

The ES impact of the CO_2 emissions from deforestation and biomass burning operates at a global scale and is why the REDD policy process focuses on carbon. However, tropical forests perform climatic ES at other scales. Maximum air temperatures and the diurnal range in air temperature both tend to be less extreme over continuous rain forest than pasture, and the evaporation of moisture into the atmosphere is substantially larger because of both greater soil water access by deep rooting trees, and the rougher surface of the forest canopy (Culf *et al.*, 1995). Locally, deforestation can result in higher precipitation in some areas, because of small-scale effects on convection (Correia *et al.* 2008, Werth and Avissar 2002), although overall, rainfall totals seem to be lower (IPCC 2007, Marengo 2006). At large scale, however, widespread forest conversion to pasture and agriculture is expected to reduce rainfall in the region and increase temperatures by reducing the amount of evaporative cooling and altering cloud cover (Werth and Avissar 2002; Chagnon and Bras 2005; Costa *et al.* 2007; Nobre *et al.* 1991, Sampaio *et al.* 2007) and, potentially, because of the increased regional atmospheric aerosol loading from land use change (Betts *et al.* 2008, IPCC 2007). Drought has become a touch-stone issue for environmental science and governance in Amazonia for at least three reasons: (i) the recent occurrence of severe droughts in 1998 and 2005 (Marengo *et al.* 2009, Marengo *et al.* 2008); (ii) the projections of long term climatic drying in the region (Christensen *et al.* 2007); and (iii) because of the potential impact of drought on forest functioning and the ES supplied by rain forest (Betts *et al.* 2004, Meir *et al.*

↗ (Fig. 1a) Projected climate change over Brazil by the 2080s relative to 1961-1990 associated with different levels of global warming. These projections used the UK Meteorolgoical Office global climate model and INPE regional climate model driven by different CO_2 emissions scenarios using different model variants to assess uncertainties in climate response. Projected global warming is within the range projected by other models, and the projection of faster warming over Brazil in comparison to the global average warming is also made by other models. Regional rainfall responses to global warming vary widely between different models; the UK Met Office model predicts greater than average rainfall reductions, but there is inter-model agreement in the prediction of reduced rainfall the region during the 21st century (see text). If the general pattern is for global warming to decrease rainfall in north and north-east Brazil (as shown here for the December-January-February season), greater global warming results in greater reductions in rainfall. From top to bottom, the emissions scenarios are the IPCC SRES scenarios A1FI, A1B, and B1; the B1 projection shown here uses a model with lower climate sensitivity.

2009). Although climate models differ in their scenarios for the 21st century, multi-model analyses have tended to show good agreement in warming trends across tropical South America, and 20–70% agreement in scenarios of substantial precipitation reductions, especially in the east of Amazonia (Fig. 1a; Christensen *et al.* 2007, Malhi *et al.* 2008, Marengo *et al.* 2009). Experimental and observational evidence for the impacts of severe drought on forest functioning do not yet extend much beyond a 5–10 year timeframe, but indicate rapid and potentially strong reductions in transpiration (30–40%) and gross primary productivity (10–15%), accompanied after a period of resistance to drought, by increases in mortality and large reductions in above ground biomass (Fisher *et al.* 2007, Nepstad *et al.* 2007, Meir *et al.* 2009, Phillips *et al.* 2009). Whether or not a secular change to a much drier climate will induce large scale vegetation change from forest to savanna this century remains difficult to test directly. The indications from modelling and experimental studies (Sampaio *et al.* 2007, Oyama and Nobre 2003, Costa *et al.* 2010) suggest that some form of tipping point in climate and vegetation is possible, perhaps after deforestation exceeds 40% (Sampaio *et al.* 2007, Malhi *et al.* 2009, Nobre and Borma 2009), although the capacity of dynamic vegetation models to capture the response to drought currently remains poor (Galbraith *et al.* 2010). Feedbacks associated with expected land use change and fire incidence will almost certainly enhance any trends set in place by climatic change (Golding and Betts 2008, Aragao *et al.* 2007, Nobre and Borma 2009), increasing the likelihood of forest loss under a business as usual development scenario for the region (Soares Filho *et al.* 2006). At large scale, climate change resulting from deforestation and the increase of GHG concentrations could interrupt or alter moisture transport from the Amazon region to south-eastern South America, where the economically important Rio de La Plata river basin is located (Soares and Marengo 2008). The recycling of water between land and atmosphere via repeated evaporation, convection and precipitation, is intensified over forest. Thus, a substantial proportion of water vapour originating in the tropical Atlantic Ocean and transported by trade winds eastwards towards South America, is repeatedly recycled as air masses move over forest towards the Andes. Perhaps 25–50% of rainfall in the region is recycled in this way (Eltahir and Bras 1994, Marengo 2006). This east-west air current is deflected south-east by the Andes, forming the South American Low Level Jet (SALLJ) and supplying warm moist air to the mesocale convective systems that generate rainfall in the vast Plata river basin (Marengo *et al.* 2004). The Plata basin covers nearly one-fifth of South America, including parts of Argentina, Bolivia, Brazil, Paraguay, and Uruguay. It supports more than 100 million people and produces about 70% of the total GNP of the five basin countries, equivalent to US$1 trillion in 2004. Numerous hydroelectric plants provide three-quarters of the region's energy, while agriculture and livestock are





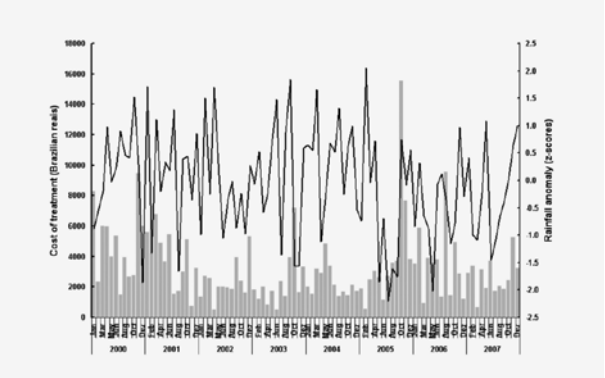
↑ (Fig. 1b) Simulated impacts of deforestation on rainfall in Amazonia (from Sampaio et al. 2007). The curves show the fraction of rainfall in eastern Amazonia for different levels of deforestation across the whole of Amazonia, compared to the original forest extent, for each season. In the model, deforested land was converted to soybean plantations. These results were generated with the INPE global climate model which has a low resolution; the Met Office's regional climate model PRECIS is being used to repeat this study at higher resolution, and to assess the resulting impacts on the remaining areas of intact forest and water resources.

among the region's most important resources (Vera *et al.* 2006). The SALLJ transports considerable amounts of moisture from Amazonia to the basin (Vera *et al.* 2006, Marengo *et al.* 2004), supporting drinking water, agricultural and hydroelectric concerns. If deforestation in eastern Amazonia, where land use pressure is highest, was complete enough to provide a barrier to the transport of recycled moisture to the SALLJ, it is possible that the amount of moisture transported via the SALLJ could be altered, by increasing either the frequency or the intensity of the SALLJ events, causing both long dry spells and very intense rainfall events (Soares and Marengo 2008, da Silva *et al.* 2008). Preliminary research as part of this capacity-building project indicates that precipitation changes, in amount, intensity and distribution in La Plata Basin could have significant economic impacts, but more research is required to estimate the potential regional costs of different forest loss-precipitation change scenarios (Cranford *et al.*, this volume), in addition to the direct consequences of such changes on ES supply for local populations within Amazonia. Despite its importance there remains uncertainty in the magnitude of this regional-scale moisture transport mechanism, its variability and its sensitivity to deforestation and climate change in Amazonia (Sampaio *et al.* 2007, da Silva *et al.* 2008). These questions contribute to an ongoing research agenda addressing regional climate science and forest ecosystem science in South America (Keller *et al.* 2009). For now, the severity of the impacts of global climate change and/or deforestation on ES supply at community or regional scales remain difficult to quantify with high precision, but a risk of their loss is widely and increasingly acknowledged. The REDD+ policy framework and related PES mechanisms address this risk by incentivising the maintenance or enhancement of rain forest ecosystems, and thus promoting the practice of the precautionary principle in relation to the avoidance of declines in ES from tropical rain forests, and their associated co-benefits.

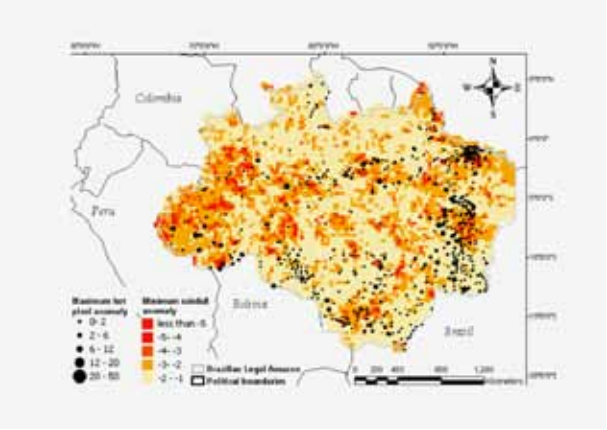
THE 2005 DROUGHT IN AMAZONIA

Extreme changes in precipitation – drought or intense rainfall events – have the potential for negative impacts on communities and local or regional economies. The recent 2005 drought in Amazonia, provides one example. During 2005, the south-western and western portions of Amazonia experienced one of their driest periods in 60 years, compounded by extensive forest fires. Although previous recent droughts in the region have been associated with El Niño Southern Oscillation, the cause of the 2005 drought was warmer global temperatures, leading to raised sea surface temperatures in the northern tropical Atlantic Ocean, and ultimately lower rainfall in Amazonia (Marengo *et al.* 2008, Cox *et al.* 2008). The diminished rainfall resulted in exceptionally low water levels in the Amazon River, draining many floodplain lakes and streams and isolating hundreds of riverine villages and communities. The government called a state of emergency and mobilized the army to provide water and medical supplies to these communities and to contend with the intense forest fires in Brazil's western state of Acre (Brown 2006). Many fires were clustered close to forest edges, indicating that human activities made the forest more fire prone (Aragão *et al.* 2007). The drought led to substantial CO_2 emissions from forest to atmosphere through increased fire incidence (Aragao *et al.* 2007) and widespread increased tree mortality (Phillips *et al.* 2009).

Our preliminary analyses of the economic costs of the 2005 drought indicate that the impacts were felt across multiple sectors supported by rain forest ES, including: river fisheries, human health, agricultural production and river transport. The emerging picture is that within the Amazon region the impacts were severe at both regional and local levels. We illustrate this here with analysis of the impacts on health and fire incidence. Compilation of data from Brazil's health service (*www.datasus.gov.br*) on the costs of treating waterborne diseases in Acre State, Brazil, where the drought was felt particularly strongly, indicate a large (up to 2-fold) increase in the cost of treating water-borne diseases at the time of the drought (Fig. 2). Similarly, colonized and developing regions across



↑ Monthly costs in Brazilian reais (R$) of treating waterborne diseases in Acre State, Brazil, 2000-2007 (columns) and the coincident rainfall anomaly (z-scores; dots and lines). The data from Sistema Único de Saúde (SUS; www.datasus.gov.br) indicate a spike in costs during 2005; comparing by month this spike is up to 100% larger than experienced in any other year under



Amazonia showed an increase in fire incidence during 2005, particularly in Acre State (Fig. 3). These data demonstrate a high vulnerability within Amazonian communities to the impacts of drought, and a high associated cost with their management. Increasing the ability to resist and mitigate the impacts of such change (Nepstad *et al.* 2001) is likely to be a priority for regional governments and local communities alike. A PES system that contributed to reducing vulnerability to such ES loss might thus be very attractive, if it was considered acceptable and workable.

CAN PES WORK?

Unlike many previous attempts to conserve forests, a core component of REDD+ is performance-based compensation or payments for ecosystem services (Angelsen 2009) at the international level. While REDD+ has been formulated as an international financing mechanism enacted by participating nations, it is dependent on reinforcing or modifying the activities of local forest users through the delivery of incentives for conservation. Thus, a link is made between international financing for ES (climate regulation) at large scale, with action on the ground and a multivalent suite of ES at local scales.

The REDD+ mechanism will need to find a way to encompass the different perspectives of global and regional beneficiaries and local service providers within a form of PES. PES schemes have been defined as:

1 voluntary transactions where
2 a well-defined ES is
3 being "bought" by a minimum of one ES buyer
4 from a minimum of one ES provider
5 if and only if the ES provider secures ES provision (conditionality; Wunder, 2005).

Few schemes conform to this definition, leading Sommerville *et al.* (2009) to define PES as approaches that aim to:

1 transfer positive incentives to environmental service providers that are
2 conditional on the provision of the service, where successful implementation is based on a consideration of additionality and varying institutional contexts.

This broader framework focuses attention on the two key aspects of PES – positive incentives and conditionality – that also define REDD+. Hence, it should be possible to learn lessons for REDD+ from existing local and regional PES schemes (Wunder, 2009).

A global review of different PES projects is beyond the scope of this paper (see Landell-Mills 2002, Wunder 2008) but a key question emerges as to how the new resources required to encourage enhanced or changed behaviour patterns are best derived and then made available within different PES schemes (Cranford & Mourato 2010, Meridian Institute 2009). According to Wunder (2009), few formal performance evaluations of PES schemes have been made so far, but there is already some evidence that well-designed schemes can result in efficient, cost-effective and equitable conservation (Wunder 2008). Property rights assigned to individuals or communities are a prerequisite for the establishment of PES systems, but property rights are often unclear, overlapping and contested in Amazonia's arc of deforestation (e.g. Börner *et al.* 2007). Therefore, in the short to medium term, national REDD+ strategies will have to rely heavily on policies other than PES (Angelsen 2009). Nevertheless, several REDD+ demonstration schemes involving local communities in PES are underway across Amazonia (Cenamo 2009), from which lessons can be learned for future large-scale implementation activities (e.g. Hall, 2008).

Where studied, indigenous lands and community-conserved areas have proved equally or more effectively to reduce deforestation compared with nationally governed protected areas (Nepstad *et al.* 2006, Ellis 2008). This has given rise to calls for the inclusion of indigenous lands and protected areas (ILPAs) within REDD+ efforts in Amazonia (Ricketts *et al.* 2010);

↑ Fire incidence ('hot' pixels) and the 2005 drought in Amazonia. Hot pixels indicate the highest positive anomalies during 2005, while rainfall anomalies indicate minimum values during 2005. The coincidence of anomalously high hot pixels in the southwest region of Amazonia, particularly in the State of Acre was coincident with areas of anomalously low rainfall during the drought period. Anomalies were calculated as z-scores and are significant at 95% when values are lower or higher than 1.96. Rainfall data are from TRMM.

with communities receiving compensation/payment for their role as forest stewards and monitors. As part of this capacity-building project, 25 representatives of networks of more than 600 community groups from across the Amazon-Andes shared their experiences of PES schemes. A view prevailed that whilst traditional forest management systems delivered multiple ecosystem services (from cultural, through provisioning to economic resources), current policy often did not support these activities, preventing poverty reduction activities and enhancing vulnerability to (exogenous) changes in climate or land use (GTA CNS 2009). Furthermore, community leaders proposed that incentives for continued forest conservation should take the form of improvements in social policy and services oriented towards education, health, and community social organisation. Among the communities represented (GTA CNS 2009), it was felt that this form of compensation — to increase social capital — was preferable to, and more effective than direct payments.

The state of Acre in south-western Amazonia, Brazil, provides an example of the more holistic interpretation of PES/REDD+ espoused by this large group of community leaders. The state government of Acre is planning to introduce a REDD+ scheme that will increase farmers' incomes by supporting the recuperation of degraded areas, sustainable agrarian systems and protection measures in six vulnerable areas [1]. As part of state programmes for adding value to production, and certifying its sustainability, emphasis will be placed on technical assistance rather than direct payments, with a view to strengthening extractivism (Hall 2009). This view of a PES system, that is flexible with respect to the needs of communities and different community members, and to the ES that are enhanced (or protected) by the new activities, appears to have met with success in very different circumstances. For example, the *Bolsa Floresta* programme of the Fundação Amazonas Sustentável (Viana 2008, 2009) in Brazil and the Miombo Community Land Use & Carbon Management Project in Mozambique (Grace *et al.* 2009) have both demonstrated how new resources can provide accepted incentives to enhance forest or woodland conservation and expansion. Importantly, they both also demonstrate how new resources are most effective when invested to increase local social capital, such as the capacity for local communities to manage and benefit from their forest resource independently, rather than only from an increased availability of external financial resources.

What is needed now is a wider analysis of the relative merits of direct cash payments versus indirect social improvements and technical support in building the resilience of forest-dependent communities to ES loss through exogenous change in climate or land use. The outcome is likely to vary regionally and may partly depend on how REDD+ policy develops, and also on how different development paradigms (e.g. Nobre *et al.* 2008) are favoured in different regions. However, the process of matching the cultural, environmental and social determinants of human decision making over land use, to the supply of economic and ES resources will be central to any policy that successfully reduces poverty and/or vulnerability to ES loss in forest-dwelling communities, whilst also meeting international climate objectives.

CONCLUSIONS

Following the 2009 UN CoP-15 Climate Conference in Copenhagen, the REDD+ policy process is likely to develop rapidly. Although it is only one form of PES, the international financing associated with REDD+ means it has obvious potential for global influence on land use decision making in tropical rain forest regions.

In the context of South America, the scientific basis for justifying some form of PES is strong at both regional and local scales, partly because of recognition of the importance of at least one large-scale ES beyond carbon, namely water.

The risk of local and regional economic consequences resulting from substantial changes in rainfall patterns, especially those leading to drought, are widely acknowledged, together with the risk of positive feedbacks among 21st century climate, deforestation and vegetation functioning.

Although we highlight emerging understanding of these questions (Figs 1–3), there remain significant research gaps needed to support policy in relation to PES. As for the most appropriate structure of PES mechanisms designed to reduce poverty or reduce vulnerability of forest-dwelling communities to the loss of ES, the emerging picture is one of flexibility, whereby:

1 the metrics of ES should refer to a bundle of services rather than single metrics such as carbon storage; and
2 compensation for the maintenance of these ES should result in increased resilience of the people-forest relationship.

The appropriate mode of compensation in any PES

1 'Serviços ambientais reduzirão emissões de carbono no Acre'. *www.amazonia.org.br/noticias/noticia.cfm?id=323169.* Accessed 14.11.09

mechanism must be sensitive to the cultural and economic circumstances of any individual community. However, the provision of resources that first increase social capital and strengthen sustainable economic resilience represents a global common denominator to which all PES mechanisms are likely to need to adhere.

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14 Conclusions

The purpose of this project was to build capacity across disciplines in order to begin to examine the potential for alignment between the economy and the resources provided by the forests of Amazonia. That work has resulted in successful international team-building led from South America (*PRISMA Amazonia* consortium 2011: PI, Prof. Carlos A. Llerena, Lima, Peru). The synergisms arising thus far from this work have also led to the draft-stage or peer-reviewed publications listed in this report.

In terms of the physical resources, while there remains uncertainty, observations and climate model analyses suggest that the interaction of the forest and the atmosphere can affect both regional and global rainfall and temperature. Substantial loss of forest would impact that interaction and also lead to the emission of carbon stored in vegetation and soil, with potentially large climatic feedbacks. We cannot yet quantify to what extent the climate and hydrological regulating functions of Amazonian forests underpin Latin America's economy, which in turn provides goods and services regionally and to the world. Answering this question would constitute a principal step towards understanding the components of a new 'green' economy.

Although there is uncertainty, were deforestation to exceed 40% of the original forest extent or if global warming were to exceed 3–4°C, Amazonia – especially the south and south-east – could be tipped into a new climate-forest equilibrium, experiencing lower rainfall and forest cover (Nobre and Borma, 2009: *Current Opinion in Environmental Sustainability*, 1: 28–36). However, few studies have looked at the effects of projected deforestation and climate change acting in combination. Since these two pressures interact to impact the forest, an emerging question is: *how will Amazonia respond to the interacting pressures of deforestation and climate change and how resilient are its biodiversity and ecosystem services?*

Previous studies have attempted to quantify the economic value of the climate-regulating ecosystem services of Amazonia. These efforts and the exploratory study in Chapter 9 indicate the forest is potentially worth US$ billions to the agriculture and hydropower sectors, which are a key part of the Latin American economy, plus there is potential for the discovery and innovation by sovereign host nations of new pharmacological and/or biotechnological products related to natural forest resources. A conundrum of sustainable development arises here: continued economic growth (business-as-usual) *appears* to depend simultaneously on conversion of Amazonian forests to agricultural uses *and* conservation of the forest. This dichotomy can be resolved through careful analysis of regional needs for agricultural production, Amazonia's climate and hydrological regulation services, identification of the beneficiaries of the services and assessment of the impacts on the regional economy of possible changes in those services resulting from forest loss. In other words, *can regional economic growth and poverty alleviation be sustained over the long-term if Amazonia's natural capital shrinks? If not, what mode of economic development can be sustained within the limits of the biosphere?*

This also raises the issue of how 'poverty' and 'poverty alleviation' are understood and measured. The complexity and multi-dimensionality of the concept of 'poverty' was raised several times during the course of the project, both by researchers and by local community representatives (Chapters 1 and 2). The capacity-building discussions helped to define the meaning *in the Amazonian context* of terms such as 'poverty reduction'. The planned consortium research project will enable a more systematic analysis of this issue, especially with regards to indigenous peoples, who are in some ways the most marginalised members of society in the region. One of the challenges facing economists, as highlighted in Chapter 2, is that conventional valuation techniques cannot adequately deal with non-linear (eco)system functions that provide essential services that are hard to replace. In addition, conventional valuation also underestimates the impacts of changes in ecosystem service provision on the poor, since they are the most reliant on ecosystems to provide their basic needs and have little ability to buy substitutes. Hence there is a need to apply novel valuation techniques.

Drought in Amazonia can have a significant impact on transport, health, freshwater and food supplies, as illustrated in the preliminary analysis of the 2005 Amazonian drought discussed in Chapter 6. The Andean Amazon workshop (Chapter 5) made a strong case for more detailed assessments of the vulnerability of poor and marginalised groups to changes in climate and ecosystems that could be induced both by global climate change and deforestation. An emerging question is: what groups within and beyond Amazonia are most vulnerable to changes in Amazonian climate and ecosystem services. And how are they vulnerable? Going beyond vulnerability assessments, it is crucial to design strategies in conjunction with local populations and grassroots organizations to foster local resilience. The Permaculture Demonstration Unit in Manaus,

which hosted the Amazonian community leaders' workshop (Chapter 3), provided an example of one successful approach. Not only are the permaculture centre's organic techniques productive, they efficiently manage and recycle wastes (nutrients) and water, while supporting a carbon-rich and diverse agro-forest system.

'Community-based' and 'ecosystem-based' climate adaptation strategies, including activities such as agroforestry, are being tested in poor communities throughout the world. What is missing from many such exercises is the integration of climate change adaptation and mitigation into a single (resilience) framework. Given the key role of Amazonia's local communities in maintaining forest carbon stores, there is an opportunity to bridge these two – historically separate – areas of our climate response. As emphasized by Amazonian community leaders (Chapter 3) and discussed in Chapter 13, the focus of efforts to conserve tropical forests and mitigate climate change needs to be broadened from its current singular focus on carbon towards maintaining a bundle of services that can reduce poverty/vulnerability and support the resilience of the people-forest relationship. There is a need to explore the range of existing strategies that are currently being developed across Amazonia and ask: *which ecosystem management strategies are most likely to foster poverty alleviation and local resilience and be able to be scaled-up across the region?*

Community-based approaches to forest conservation and sustainable development cannot be scaled-up without financing. As discussed in Chapter 11, Latin American nations have a great deal of experience with distributing money to poor families. In general, nations have been able to finance such conditional cash transfer programmes (CTPs) based on revenues generated through natural resource extraction activities such as mining. In Amazonia, however, some CTPs have depended for their funding on international finance organizations such as the World Bank.

There is both optimism and scepticism among nations that a deal on REDD+ can be reached within the UN's Framework Convention on Climate Change (FCCC). REDD+ could enable a shift towards financing of Amazonian CTPs through international carbon finance mechanisms. In addition, the removal of perverse subsidies from activities that contribute to deforestation could also generate large sums for this purpose (Chapter 12). The potential for such a step change in financing requires closer scrutiny and attention by both social scientists and policymakers. However, as strongly emphasized by the Amazonian community leaders in this project (Chapter 3), cash transfers on their own may not be the most appropriate means to reduce poverty and protect ecosystem services such as forest carbon storage. Hence, the question arises: *what delivery mechanisms are appropriate for sharing resources and benefits to promote local self-sufficiency, poverty reduction and continued forest stewardship?*

Social programmes to alleviate poverty, such as CTPs, are often designed and targeted across national territories based on the spatial distribution of measures of household poverty such as the Human Development Index. If a new form of CTP is to emerge, including natural capital assets/vulnerability, such poverty measures will need to be expanded or complemented using an understanding of how standard poverty measures and ecosystem services intersect (and potentially interact) to influence wellbeing. Multi-dimensional Poverty Indices (MPIs) – that look at a range of factors such as education, housing, income, employment and empowerment and are therefore useful for addressing the complex and varied nature of poverty and inequality across Amazonia — could be expanded to include additional dimensions such as access to clean water and other indicators of the Millennium Development Goals.

As illustrated in Chapter 10, high resolution, spatially extensive datasets on ecosystem services have recently become available for Amazonia, although not so for its Andean headwaters. These could be coupled with new social and economic data to create spatially-explicit MPI maps that can help to target socio-environmental programmes at multiple levels. The Millennium Ecosystem Assessment emphasised that human wellbeing depends on ecosystems – and vice versa – but we currently lack tools that can enable policymakers to unlock the potential of natural capital to address poverty. Thus, *the challenge is to develop policy-relevant tools that integrate poverty and ecosystem services in order to help inform the design of socio-environmental programmes.*

Although the direction of policy could be turning towards environmental services in Latin America, as discussed in Chapter 12, economic and political forces in some parts of the region threaten to undermine the progress that has been achieved. Robust analyses of the trade-offs between water, food, energy and climate security that would result from different policy options are difficult to carry out, but are needed to

provide information that can aid the creation of sound policies in the short-term that will promote sustainable development over the long-term. It is also important to acknowledge that decision-making is often not only based on rational analysis of different options, but also on values and political realities. *The challenge is to work with policy-makers to understand their perspectives and knowledge needs and provide them with evidence that can aid in the near-term, political decision-making process*. The ESPA programme espouses an urgent need to deliver evidence and tools on ecosystem services for poverty alleviation. If developed successfully these new tools could provide a new lens — or prism — through which to view development policy-making. The preceding questions in italics have emerged from the work of the participants during this project and form the basis of the recent (January 2011) research proposal led by Prof. Carlos A. Llerena (La Molina, Peru) that has emerged from this capacity-building project and that could provide a new policy prism aimed at focussing understanding on *Poverty Reduction through Incentives for Sustainable Ecosystem Management across Amazonia*.

Appendix 1 — Publications

Papers (published, in review and unpublished) written by members of the team and related to the collaboration-building carried out during this ESPA project:

Araújo, G. and Strapasson, A. 2011. **Climate change policy and governance in Brazil**. Unpublished report.

Arraut, J.M., Nobre, C., Barbosa, H.M.J., Obregon, G. and Marengo, J. **Amazonia's aerial rivers and lakes: looking at large scale moisture transport, its relation to Amazonia and subtropical rainfall in South America**. Journal of Climate. Accepted.

Betts R.A., Kay, G., Marengo J.A. *et al.* 2010. **Future Climate Change in Brazil: GHGs, deforestation and impacts**. Met Office and INPE joint publication. Marengo J.A., Ambrizzi T., da Rocha R.P., Alves L.M., Cuadra S.V., Valverde M.C., Torres R.R., Santos D.C., Ferraz S.E.T. 2009. Future change of climate in South America in the late twenty-first century: intercomparison of scenarios from three regional climate models. Climate Dynamics, Volume 35, 1089–1113.

Cranford, M., Trivedi, M. and Queiroz, J. 2011. **Exploring the Value of the Amazonian 'Water Pump'**. Submitted for review to UNDP and In Ecosystem Services and Poverty in Amazonia (2011) Final report of an ESPA capacity-building project. University of Edinburgh and Global Canopy Programme, UK.

Grace, J.; Meir, P. 2009. **Tropical Rain Forests as Old-Growth Forests**. In Editor(s): Wirth, C; Gleixner, G; Heimann, M. Old-Growth Forests: Function, Fate and Value. Pages: 391–408

Hall, A. 2011. **Turning the tide in Amazonia? From perverse incentives to environmental services**. In review for World Development. Also In Ecosystem Services and Poverty in Amazonia (2011) Final report of an ESPA capacity-building project. University of Edinburgh and Global Canopy Programme, UK.

Mattei, L. 2011. **Panorama dos Programas de Transferencia de renda Emphasis Latino-Americanos Localizados na Redião Amazônica**. In Ecosystem Services and Poverty in Amazonia (2011) Final report of an ESPA capacity-building project. University of Edinburgh and Global Canopy Programme, UK.

Meir, P. *et al.* 2010. **Beyond carbon: realising the value and continued stewardship of tropical forest ecosystem services in a changing climate**. Accepted paper presented at the Commonwealth Forestry Conference, Edinburgh, 2010. In review (International Forestry Review); and In Ecosystem Services and Poverty in Amazonia (2011) Final report of an ESPA capacity-building project. University of Edinburgh and Global Canopy Programme, UK.

Meir, P.; Woodward, F.I. 2010. **Amazonian rain forests and drought: response and vulnerability**. New Phytologist, Volume: 187 Issue: 3 Pages: 553–557.

Mulligan, M. and Burke, S. 2011. **Mapping the Benefits and Costs of Amazonia's Ecosystem Services**. In Ecosystem Services and Poverty in Amazonia (2011) Final report of an ESPA capacity-building project. University of Edinburgh and Global Canopy Programme, UK.

Phillips, O.L.; Aragao, L.E.O.C.; Lewis, S.L.; *et al.* 2009. **Drought Sensitivity of the Amazon Rainforest**. Science, Volume: 323 Issue: 5919 Pages: 1344–1347

Trivedi M.R. *et al.* 2009. **REDD and PINC: A new policy framework to fund tropical forests as global 'eco-utilities'**. IOP Conf. Ser.: Earth Environ. Sci. 8 012005

Trivedi, M., Anderson, L. *et al.* 2011. **Counting the costs of the 2005 Amazon drought: a preliminary assessment**. In Ecosystem Services and Poverty in Amazonia (2011) Final report of an ESPA capacity-building project. University of Edinburgh and Global Canopy Programme, UK.

Appendix 2 — Outreach and end-user engagement

The long-term aim of the capacity-building project was to create an interdisciplinary team and research agenda capable of delivering the evidence base needed by decision makers to help foster a shift from Business as Usual towards Sustainable Ecosystem Management across Amazonia. The key to the success of such a research programme will hinge on its ability to meet the knowledge needs of decision-makers.

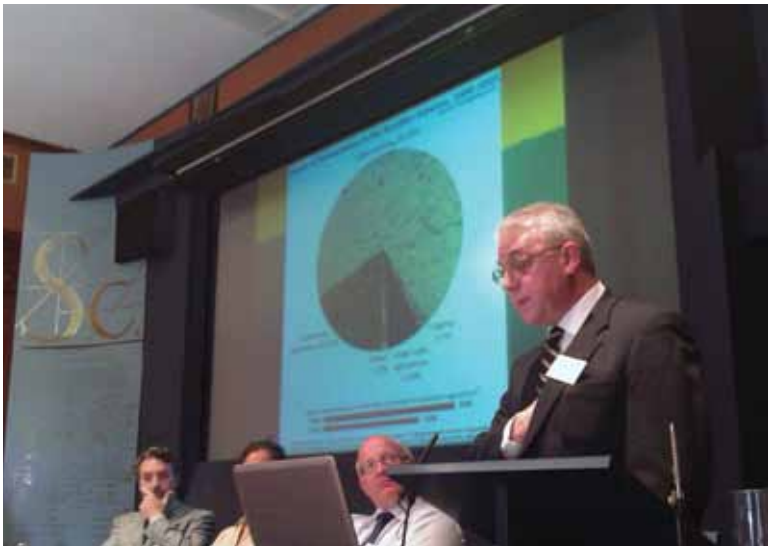
Three key end-user groups were identified during the course of the project: local communities, policymakers and the private sector. Community leaders from across Amazonia were engaged in the capacity-building activities, with a specific workshop convened in order to better understand their perspectives and needs (Chapter 3).

Two outreach events were also organised towards the end of the project, aimed at engaging and informing government and private sector end-users.

Teaming up with TEEB

Salão de Atos do Parque Barigui, Curitiba, Brazil
9–10th September 2010

The Global Canopy Programme and the AVINA Foundation teamed up with the UNDP, TEEB (The Economics of Ecosystems and Biodiversity) and Curitiba Mayor's office to hold a workshop for local and regional policymakers from across Latin America to launch the *TEEB for local and regional policymakers* report. Representatives of the ESPA-funded project, including Professors Carlos Nobre (INPE) and Carlos Young (UFRJ) presented their findings to key Amazonian political leaders, including the mayors of Alta Floresta, Brazil, and Cobija, Bolivia. The policymakers expressed their desire for information on the importance and value of ecosystem services at local and regional levels that could be used to construct policies to maintain natural capital and support local development. They also focused on the need to improve governance across scales (local-national-international) in order to stimulate a shift to a new economic development paradigm.



Peak Soya?

The Royal Society, London, UK
9th May 2011

The project teamed up with The Royal Society to bring together leading researchers with companies and their investors involved in 'forest risk commodities' such as soy to explore how current and potential future trends in South American climate, land use and policy could affect commodity supply chains.

The private sector participants were drawn from the companies involved in the Forest Footprint Disclosure (FFD) project, which is funded primarily by DFID. FFD is backed by 58 financial institutions with over $5 trillion in collective assets under management. It was created to help investors identify how a company's activities and supply chains contribute to deforestation, and link this 'forest footprint' to their value. Participating companies such as André Maggi Group, Carrefour, Sainsbury's, Body Shop, Nestlé and Unilever depend on commodities that may be sourced from formerly forested regions. Hence, the private sector actors attending the meeting were particularly interested to hear how environmental and policy changes in the Amazon region could affect their businesses.

Researchers from the UK and Latin America explained how tropical forests and savannas such as Amazonia and the Brazilian Cerrado help to regulate South American climate and buffer the region from climate change. The mounting scientific evidence of looming food, energy, water and climate risks provides private sector actors with a rationale for shifting towards more sustainable operations and investments in order to manage such risks.

The knowledge needs of the private sector participants were gathered in order to help inform the design of future research.

↑ Dr Anthony Hall, London School of Economics, addressing corporate stakeholders at the *Peak Soya?* event convened with The Royal Society, London.

www.globalcanopy.org
www.ed.ac.uk/schools-departments/geosciences/