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Investing in human and natural capital: An alternative paradigm for sustainable development in Awassa, Ethiopia

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ABSTRACT

Ethiopia remains underdeveloped due to limitations in natural, human, social and built capital. A 2006 scientific atelier conducted in the city of Awassa, Ethiopia investigated investments in human and natural capital as a sustainable development strategy. Local stakeholders identified firewood shortages, degradation of croplands, rising lake levels encroaching on croplands and poor water quality as major impediments to development. They further identified ecological degradation as a key component of these problems, and they acknowledged multiple vicious cycles compounding the environmental and economic threats to the Awassa community. Proposed solutions included investment in natural capital in the form of reforestation activities, investment in human capital in the form of promoting more efficient wood stoves along with increasing public awareness of environmental threats, and investments in social capital in the form of inter-institutional coordination to address environmental problems. All recommended investments rely primarily on national resources, in distinct contrast to the extensive imports required for most built capital investments. Unfortunately, Awassa lacks the surplus necessary for major capital investments of any kind. The atelier therefore helped local participants identify potential funders and write grant proposals for various projects, though none have been funded so far. Reversing the ecological degradation on the scale necessary for sustained economic development in Ethiopia however will require a steady flow of substantial investments, and cannot rely solely on the short term generosity of funders. International payments for carbon sequestration and other ecosystem services could help provide the necessary resources.

1. Introduction

With a per capita Gross Domestic Product (GDP) of under $100 per year and ranking 170 out of 177 ranked countries on the United Nations Human Development Index (UNDP, 2004), Ethiopia is one of the least developed countries on the planet. Human life is impossible without adequate food, water and energy, yet Ethiopia consistently lacks secure supplies of these essential resources. Frequent drought and famine contribute to food insecurity, and almost 60% of the population—including 89% of the rural population—lacks access to potable drinking water (Hilton Foundation, 2006). Meanwhile the dominant source of energy is biomass, largely obtained from wood. However, forest resources in Ethiopia are dwindling so rapidly that charcoal, the favored cooking fuel, has recently been made illegal.

A key component of food, water, and energy shortages is the massive ecological degradation the country has suffered over many centuries—in particular the loss of forest cover. Population pressures, land-intensive agricultural practices, and economic distress—especially among poor farmers and pastoralists—have interacted to generate vicious cycles of land exploitation, ecological degradation, and poverty. In addition to these rapidly compounding disinvestments in natural capital, low human and social capital—as evidenced by high illiteracy (especially among women), high unemployment, and an unstable political situation—have further exacerbated negative feedback cycles. Lack of capital is the central limiting factor in the development of the country. However, the current development paradigm focuses almost exclusively on investments in built capital, funded by overseas investors, and largely ignores the importance of natural, human, and social capital in development efforts. And yet it may be the case that the latter forms of capital offer far more promise for policymakers and development practitioners seeking to break vicious cycles and promote virtuous ones in developing countries. This paper uses the results of a 2006 atelier to investigate the potential for investments in human and natural capital, as a

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supplement to built capital investments, to promote sustainable development in the city of Awassa, Ethiopia.

2. Current development paradigm

Underdevelopment in Africa is generally attributed to a lack of industry, poor quality roads, and weak overall infrastructure. In Ethiopia all industries together, including food processing, beverages, textiles, leather, chemicals, and metals processing constitute less than 10% of total GDP. Agriculture is the main contributor to the Ethiopian economy; however, an underdeveloped infrastructure, including a lack of transportation and communication systems, seriously constrains agricultural markets (World Bank, 2006; Ehui and Pender, 2005). This lack of infrastructure also constrains outreach attempts by government and civil society aimed at educating Ethiopians in improved agricultural management practices, further retarding economic growth. Under the current dominant paradigm, overcoming underdevelopment in Ethiopia requires massive foreign investments in built capital for export-oriented growth: *foreign investment* because domestic capital supply is inadequate, and *export-oriented* because domestic consumption demand is inadequate. This neoclassical macroeconomic worldview has distinctly shaped Ethiopian and international development activities and outcomes.

And yet the record of overseas financial capital investment in Ethiopia is poor. Capitalists demand profit on their investments, and the rate of profit they seek is proportional to the degree of risk they perceive. Ethiopia is a high risk country, yet returns on investments are among the lowest in sub-Saharan Africa, which in large part explains the paucity of investments (Eifert et al., 2005). Ethiopia is currently encouraging foreign countries to invest in the mineral sector, which can yield large short term revenues necessary to attract foreign investment, most recently from countries including China and India (Jenkins and Edwards, 2006). However, mineral reserves are non-renewable capital stocks that, once exhausted, are gone forever. Moreover, mining is notorious for its negative and long-term environmental impacts (Boocock, 2002). Since foreign investors in Ethiopia are currently free to remit all profits, and capital gains taxes were recently slashed from 40% to 10% (Ethiopian Reporter, 2006), it is not at all clear that conventional financial investments will significantly or sustainably benefit the country.

The export-led model of development poses other problems as well. While comparative advantage theory claims that all countries will benefit from free trade, this is only true when factors of production such as financial capital cannot flow across international boundaries (Daly, 2002; Daly and Cobb, 1994). Ethiopians with financial capital to invest will look for an absolute advantage, investing their money wherever it generates the greatest risk-adjusted returns. Ethiopia's absolute advantage is in low wage labor, and most of the labor force is in agriculture (Ehui and Pender, 2005; MoFED, 2004). Higher wages would eliminate this advantage. Consequently, though increased agricultural exports may "look good" in terms of increased GDP, few benefits accrue to the small producers and agricultural workers who make up the vast majority of Ethiopia's population.

An additional weakness of agricultural export-led development schemes stems from the simple fact that farmers producing crops for export still have to eat. In Ethiopia in particular, with inadequate transportation systems to distribute imported food, domestic food security demands domestic production. Increasing total agricultural production typically requires increasing land under cultivation—and in Ethiopia, the only way to increase land under cultivation is to cut down more of the near-exhausted forest, or to engage in other undesirable practices such as removing lands from fallow or farming steep slopes. Studies in the Ivory Coast (Ehui et al., 1990) and Thailand (Panayatou and Parasuk, 1990) suggest that beyond a certain point, the result of increasing land under cultivation can actually be a decline in net agricultural production. In Ethiopia, agricultural expansion has served to promote wind and water erosion as well as desertification, ultimately lowering the productivity of existing farmland while destroying what little forest remains (Bishaw, 2001).

An obvious alternative to expanding land under cultivation is increasing productivity on existing farm lands. Historically the approach to agricultural intensification in Ethiopia has been to invest in built capital: "modernizing" agriculture by introducing fertilizers, pesticides, farm machinery, and irrigation systems (Ehui and Pender, 2005). Unfortunately, such modernization is heavily reliant on imports as well as fossil fuels, which are required not only to make, maintain and power machinery, but also to produce fertilizers and pesticides. Ethiopia has few fossil fuel reserves of its own, and fossil fuel prices are increasing rapidly as new discoveries have lagged behind production (Heinberg, 2005; Campbell and Laherrère, 1998). If the price of agricultural commodity exports fails to keep up with that of fossil fuels, then conventional modernization threatens to become a losing investment. Add to this the inherent difficulties in competing in global markets for agricultural products due to wildly fluctuating commodity prices and trade subsidies in many countries, and it becomes clear that export-led development based on industrial agriculture is not a promising path for Ethiopia either.

3. An alternative paradigm: investing in human and natural capital

Ultimately, though the lack of built capital is important, it is clearly but one factor among many resulting in the underdevelopment of the country. In fact, upon reflection it is difficult to determine to what degree lagging built capital levels in Ethiopia are actually a "cause"—as opposed to an effect—of underdevelopment. A more holistic consideration of the range of contributors to Ethiopia's present situation, including natural and human capital factors, might reveal points of greater leverage for policymakers and development practitioners seeking to help push the country out of the present cycles of underdevelopment and poverty.

3.1. Natural capital disinvestments

First, like much of East Africa, Ethiopia is currently witnessing massive disinvestments in natural capital. High forest cover in Ethiopia fell from 16.0% in the 1950s to only 2.7% by the early 1990s, and continues to decline by nearly 1% per year as woodlands are converted to fuel wood, farmland and building materials (Shiferaw and Holden, 2001). The negative feedback loops generated and strengthened by this process are readily apparent. Deforestation in the steeply mountainous regions of the country leads to extensive erosion, with estimated soil losses of up to 41,000 tons/km^2/year in some areas (Mahamed and Ram, 1987). The soil erosion problem in Ethiopia is particularly severe due to the erosive and bimodal nature of rainfall, and the fragility of the light volcanic soil (Berry 2003; Alemu 1999). Nationally, Ethiopia experiences total topsoil losses of over 1 billion tons/year (Brown, 2006), leading to the irreversible degradation of over 5 million acres of former cropland (Dregne, 1990), and to the widespread 'jest' that Ethiopia's most valuable export is its topsoil. Forest loss may also be triggering regional climate change, including a reduction in annual rainfall, while deforestation combined with overgrazing leads to soil compaction, exacerbating periods of violent flooding and widespread droughts. The net result is a dramatic decline in agricultural production (Bekele, 2001). This, in turn, provokes the further expansion of agricultural lands into ever more marginal lands, often including highly ecologically sensitive parcels—and important sources of ecosystem

services—such as mountaintops, steep hillsides, and riparian and gallery forests.

This simple negative feedback cycle meanwhile spurs on others. The loss of riparian and gallery forests, which play an important role in water purification, aggravates the already serious lack of potable water. Rural families, especially women and children, may spend hours daily traveling to gather water for drinking and other household uses. Forest clearing is similarly diminishing the supply of firewood on which rural Ethiopians depend. In Awassa Town, as in most of Ethiopia, women and children are responsible for fuel wood collection. On average, children make two 50 minute trips per week to search for fuel, while women make at least one 100 minute trip per week (Achalu, 2006). Continued deforestation will only increase the time spent searching for fuel wood in coming years. Fuel wood shortages are also forcing many to burn the animal dung, leaves and twigs which might otherwise fertilize their fields. All of these examples illustrate direct negative impacts of deforestation, but their full impact is cyclical in nature. Shortages of water and fuel supplies reduce household productivity (as more time and effort is expended to meet basic subsistence needs), which in turn increases the need for agricultural production (to supplement household incomes to maintain a given standard of living). But agricultural expansion directly undermines the soil's capacity to produce those much-needed crops, necessitating further expansion of agricultural lands and thus exacerbating the original water and fuel wood challenges (Dessie and Klemen, 2007; Ehui and Pender, 2005).

3.2. Human capital barriers

At the same time, an adult literacy rate of 41.5% (only 33.8% among adult women), and a net primary school enrollment level of 51.0% attest to the lack of human capital in Ethiopia (World Bank, 2006). The vast majority of the population is engaged in subsistence agriculture, in rural areas where there is often little access to education or health care (Kloos et al., 2007; Shibeshi, 2005). AIDS currently infects 3 million Ethiopians and has left an estimated 1.2 million orphans (WHO, 2006). As of 1998 the disease had reduced Ethiopian life expectancy by10 years, and researchers expect an additional 16 year reduction by 2010. In spite of disease and recurrent food and water shortages, however, Ethiopia's population has doubled since 1980, and is expected to surpass 106 million by 2020 (Kurian and Thomas, 2004), further straining already inadequate health care and educational facilities. Meanwhile, persistent cultural beliefs undermine the educational and economic opportunities of women and, consequently, Ethiopia's development potential (Kloos et al., 2007).

Here too the concept of the feedback loop is useful. Are illiteracy, AIDS, and the suppression of women causes of underdevelopment in Ethiopia, or are they effects of something else? Most likely the answer is both—all are both causes and effects in complex and compounding cycles of poverty and low human capital (e.g., *poverty and low human capital → low educational attainment → poverty and low human capital → poor health practices → poverty and low human capital*, and so forth). The question thus becomes not only how to overcome disease and illiteracy, but how best to break these cycles. The construction of hospitals and schools is clearly one appropriate response to many of the challenges faced by Ethiopians today; however, such massive built capital investments require resources that Ethiopia simply does not have.

3.3. Human and natural capital investments

The alternative approach is to increase both agricultural yields and socioeconomic outcomes by investing in human and natural capital. Human capital, including education and job skills, has long been recognized as a critical factor in sustainable development (Beine et al., 2008). Efforts at increasing levels of human capital, particularly through the education of children and women, have enjoyed a great deal of success in developing countries across the globe (Brown, 2006). Such efforts have been associated with such positive trends—or "virtuous cycles"—as increased productivity and declining birth rates. Meanwhile natural capital has received increasing attention in the academic literature (Aronson et al., 2007; Costanza et al., 2000; Costanza and Daly, 1992), if not necessarily among most development practitioners. Agrarian societies depend on stable climates, adequate rainfall, and fertile soils. Forests help stabilize local climates, promote rainfall (depending on the regional ecology), recycle nutrients, regulate water flows, create new soils, and prevent erosion (Myers, 1997).

The work of Nobel Prize winner Wangari Maathai (2002) in particular has shown that reforestation projects can lead to dramatic improvements in the quality of life of adjacent communities. Maathai's now-famous Green Belt Movement saw more than 100,000 rural Africans—mostly women—plant 30 million trees, including fruit trees to improve nutrition and supplement incomes, as well as native species and fuel wood species used to reforest thousands of hectares of degraded land in Kenya and beyond (Maathai, 2007). Her organization further showed that investments in human and natural capital are possible even when financial resources are scarce: her rural force of so-called "foresters-without-diplomas" eschewed modern capital-intensive tree propagation techniques, and they spread knowledge without formal training or certification in forestry. They instead built upon their own skills and knowledge, and worked within the resource opportunities and constraints at hand to transform negative cycles of poverty and resource degradation into positive cycles of knowledge expansion and forest re-growth (Maathai, 2007).

Such investments in natural and human capital require no imports, they create no foreign debt, and they provide a proportionally greater share of direct and indirect benefits for the poor when compared to built capital investments. Perhaps even more importantly, the natural capital investments of the Green Belt Movement work by utilizing and augmenting locally available resources and knowledge—such problem solutions might thus resonate strongly with local understandings of complex, often cyclical problems.

The following sections present the results of a 2006 atelier conducted in the city of Awassa, in the Southern Nations Nationalities and Peoples Region (SNNPR). This atelier investigated the potential for investments in human and natural capital, as a supplement to traditional built capital investments, to promote sustainable development in Ethiopia.

4. The "Green Awassa" Atelier

With partial support from the Fund for Sustainable Futures, the "Green Awassa Atelier" was hosted by the Awassa Children's Center, a local social service and educational non-governmental organization (NGO), in June of 2006. The atelier integrated the expertise of faculty and students from the University of Vermont's Gund Institute for Ecological Economics and Department of Community Development and Applied Economics, faculty from Addis Ababa University, the Wondo Genet College of Forestry, and the University of Pretoria, and the local knowledge and expertise of government leaders, regional environmental experts, local NGO and community-based organization members, and local businesses. The city of Awassa was selected as an appropriate venue for the atelier because of its importance as a regional capital, its proximity to a number of stakeholders (including regional government offices, and Ethiopia's only college of forestry), and the serious and immediate ecological threats the city currently faces.

Box 1
Awassa, Ethiopia

Forty years ago the Lake Awassa watershed was totally covered by forests and woodlands. Rich tropical gallery forests surrounded the lake, merging into acacia savanna woodlands covering a fertile flat plain, which, in turn, merged into densely forested steep mountain slopes. These ecosystems harbored abundant wildlife, including a number of species endemic to the region. Some 30 years ago the fertile flatlands were cleared with heavy machinery and converted to mono-crop farms of corn and sisal. As populations grew, demand for fuel wood, building materials and additional farmland led to the clearing of surrounding mountain slopes and gallery forests. Without forest canopies and roots to protect and hold soils in place, frequent tropical storms soon washed away the fragile topsoil on the hillsides. Overgrazing further intensified the problem, and soon massive erosion gullies formed on the fertile farmlands. Hundreds of tons of sediment – along with human, animal, industrial, and agricultural wastes - were washed into Lake Awassa every year, drastically decreasing the productivity of upland soils while contaminating the main source of drinking water for much of the local population. Finally, as a result of extensive sedimentation the lake level actually began to rise, flooding the fertile farmlands along its shores. In response to this devastation, the government outlawed charcoal production and the selling of certain tree species, but illegal markets in both commodities quickly developed and thrived.

Seeking effective solutions to these pressing issues, board members of the Awassa Children's Center asked the Gund Institute for Ecological Economics at the University of Vermont to facilitate a project that would link the children at the Center with the larger community by focusing on the environmental and economic problems of the city. Specifically, the Center expressed concern over a cooking fuel shortage in the area, and sought local involvement to address this growing problem. The Mayor of Awassa voiced similar concerns, emphasizing the link between deforestation, cooking fuel shortages, the degradation of Lake Awassa, and poverty, and expressed his desire to achieve a "Green Awassa," where all stakeholders could cooperate to create and maintain a more environmentally conscious and economically sound community.

In this context, forty participants engaged in workshops, presentations and field visits around the Lake Awassa watershed (Table 1). The goal of the atelier was to assess the critical problems facing Awassa, develop a shared vision of a sustainable and desirable future, develop project proposals for local partners to realize this vision, write grants to fund the projects and, in the process, train participants in grant-writing skills.

Table 1
Atelier participants: organizations represented in the atelier.

Organization	Type	Description
Awassa Children's Center	NGO	Local NGO specializing in the care of AIDS orphans
Awassa Youth Campus	NGO	Local NGO, home of the One Love Theater
Concern for the Environment	NGO	Local environmental NGO
Awassa Municipal Government	Government	Local government offices
Wondo Genet Forestry College	Academia	The only forestry college in Ethiopia; offering a detailed background to problems
SNNPR[a] Bureau of Agriculture and Natural Resources	Government	Regional government natural resources and forestry experts
Sidama Zonal Bureau of Natural Resources	Government	Zonal (~District) natural resources and forestry experts
Awassa Women's Affairs Office	Government/ women	Local women's organization; promoting role of women in atelier projects
Regional Technical Training College	Academia	Awassa-based vocational school
Van Der Lief Foundation	NGO/ business	Principal funding agency for the No Charcoal campaign
University of Addis Ababa	Academia	Providing organizational and writing skills; communicating atelier results

[a] Southern Nations, Nationalities, and Peoples Region.

5. Atelier results: identification of serious needs and a shared vision for the future

After a brief introduction to the goals and methods of the atelier, presentations by local and international experts were mixed with open discussion among local stakeholders as atelier participants strove to identify the most serious issues facing the Awassa community.

Table 2 summarizes the principal problems identified by atelier participants. Although this is not an exhaustive list of the many concerns that arose over the course of the atelier, the following list includes all of those issues that received repeated attention in discussions among stakeholders in the Awassa community. Issues in the table are first broken down by which form of capital is affected (built, natural, human, or social), and what stakeholders felt to be the general problem. The third and fourth columns then offer a more detailed description of the problem, including its immediate or proximate impacts, as well as second-order impacts: for example, deforestation was cited as a direct cause of fuel shortages (proximate impact of deforestation), and fuel shortages was cited as a direct cause of increased workloads for women (secondary impact of deforestation). The fourth column presents the principal stakeholders affected by each problem.

Disinvestments in natural capital were by far the most cited problem among atelier participants. Deforestation and the consequent soil erosion worsen rural livelihoods, while the exhaustion of fuel wood stocks places an additional burden on both rural and urban inhabitants, especially women and children. Moreover, as Table 2 and Figs. 1–3 indicate, atelier participants also recognized vicious cycles at work. For example: *Deforestation → Soil erosion → Reductions in agricultural productivity → Agricultural expansion onto marginal lands → Deforestation* (Fig. 1).

Some of these negative cycles were relatively straightforward, and were directly mentioned by atelier participants, for example: *Lack of inter-sectoral coordination between stakeholders → Competition between political parties/levels of government → Lack of inter-sectoral coordination* (*in addition to expanded deforestation*) (Fig. 2).

Meanwhile other feedback loops were more complex, and only discernable in retrospect, as illustrated in Fig. 3 below, where the different elipses indicate relationships that were explicitly identified by atelier participants. For example *Deforestation → Fuel shortages → Increased women's workload* was mentioned by some participants, while *Women's workload → Human health concerns* was identified by others. This implies the larger causal chain: *Deforestation → Fuel shortages → Increased women's workload → Human health concerns* and so forth.

Under such feedback conditions, isolating the "most important problem" is difficult. According to participants, of all problems discussed, the most serious, all interrelated, were: *fuel and construction wood shortages*; *deforestation on hillsides and resulting soil erosion*; *encroachment into gallery forests* for agricultural as well as fuel wood purposes; and *overgrazing*. However this extended exercise in problem definition clearly revealed participants' appreciation of the complexity and self-reinforcing nature of the many problems Awassa currently faces.

6. A shared vision of the future

Once participants had identified the problems, local stakeholders were asked to lay out their visions of a sustainable and desirable future

Table 2
Atelier results: most serious needs for the community of Awassa, Ethiopia.

Area (form of capital)	General problem	Proximate impacts *caused by general problem*	Secondary impacts *caused by proximate impacts*	Stakeholders[a]
Natural	Deforestation	→ Fuel shortages → Loss of biodiversity → Soil erosion	→ Increased women's workload → Lack of jobs (tourism) → Poor soil quality → Poor water quality	Villagers, women, farmers, Awassa Town, local regional government
Natural	Fuel shortages	→ Increased women's workload	→ Reductions in agricultural and household productivity → Human health concerns	Villagers, women, farmers
		→ Burning of dung	→ Poor soil quality	
Natural	Loss of biodiversity	→ Lack of jobs (tourism) → Loss of food/medicine stocks	→ Lack of economic opportunities → Reductions in food security → Human health concerns	Villagers, local and regional government
Natural	Soil erosion	→ Poor soil quality	→ Reductions in agricultural productivity → Reductions in food security → Agricultural expansion onto marginal lands	Villagers, farmers, Awassa Town, local government, regional commerce (loss of roads)
		→ Poor water quality (contamination/siltation of Lake Awassa) → Lack of infrastructure (flooded villages/roads)	→ Human health concerns → Loss of biodiversity → Lack of economic opportunities	
Natural	Poor soil quality	→ Unstable water supply (lack of water infiltration and holding capacity) → Reductions in agricultural productivity	→ Reductions in agricultural productivity → Desertification → Agricultural expansion onto marginal lands	Villagers, national government
		→ Agricultural expansion onto marginal lands	→ Deforestation → Overgrazing	
Natural	Poor water quality	→ Reductions in water security → Human health concerns	→ Increased women's work load → Reductions in agricultural and household productivity	Awassa Town, lakeside communities, local government
		→ Loss of biodiversity (threats to aquatic life)	→ Lack of jobs (tourism) → Loss of food/medicine stocks	
Natural	Unstable water supply	→ Reductions in agricultural productivity	→ Reductions in food security → Agricultural expansion onto marginal lands → Deforestation → Overgrazing	Villagers, farmers, Awassa Town, local and regional government
		→ Drought and flooding	→ Reductions in agricultural productivity → Lack of infrastructure (flooded villages/roads)	
Natural	Overgrazing	→ Soil erosion → Poor soil quality (e.g. compaction) → Deforestation	→ Reductions in agricultural productivity → Fuel shortages → Loss of biodiversity → Soil erosion	Villagers, herders, Awassa Town
Built	Lack of infrastructure/ jobs	→ Lack of economic opportunities	→ Agricultural expansion onto marginal lands → Deforestation → Overgrazing → Further marginalizes women, youth	Women, youth, villagers, local, regional, and national government
Human	Lack of education	→ Lack of appropriate agricultural knowledge → Lack of health education	→ Reduced agricultural productivity → Overgrazing → Human health concerns → Overpopulation	Women, youth, villagers
		→ Lack of environmental education → Lack of skills/training	→ Deforestation → Lack of jobs	
Human	Human health concerns (e.g., HIV/AIDS and prenatal care)	→ Reduced agricultural and household productivity	→ Reductions in food, energy and water security → Agricultural expansion onto marginal lands	Awassa Town, villagers, women, local/regional/national government
		→ Lack of prenatal care	→ Further marginalizes women	
Human/social	Overpopulation	→ Scarcity of resources	→ Reductions in food, energy and water security → Lack of education → Human health concerns → Deforestation → Overgrazing	Awassa Town, villagers, women, local/regional/national government
Social	Lack of inter-sectoral coordination	→ Competition between political parties/levels of government	→ Deforestation → Lack of inter-sectoral coordination	Local government, NGO community

[a] Note that this is not a comprehensive list of stakeholders—the NGO community, for example, is a potential stakeholder in all of the stated problems. This list only includes stakeholders specifically implicated in the "Green Awassa" atelier process.

for Awassa, with dialogue continuing until a consensus emerged on a vision of a "Green Awassa." Participants determined that a "Green Awassa" would be characterized by the implementation of environmental efforts, particularly reforestation, to ensure: (1) *fuel security*, including reforestation to increase supply, and the adoption of fuel-efficient stoves to decrease demand and ease burdens on women; (2)

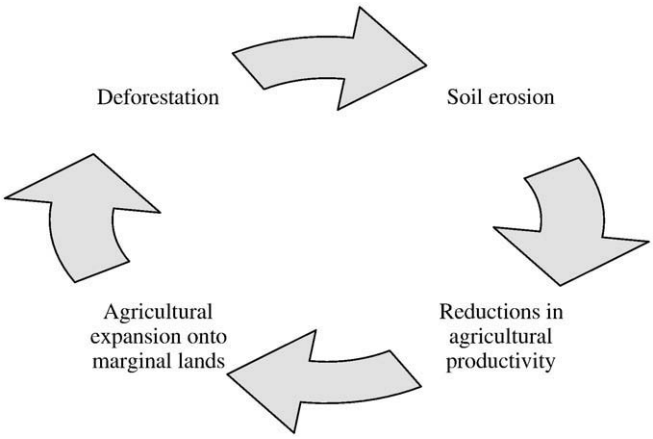

Fig. 1. Simple deforestation feedback loop.

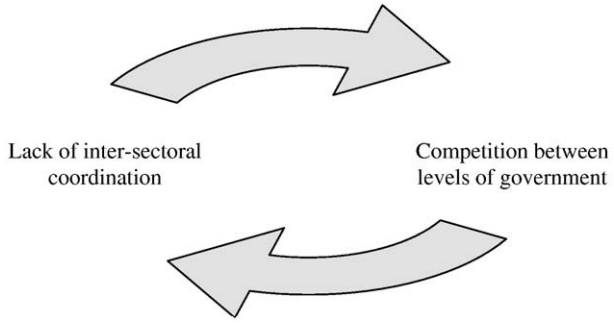

Fig. 2. Simple coordination/cooperation feedback loop.

food security, including greater agricultural yields and improved nutrition to improve health; (3) *water quality*, including the availability of drinking water for human health and improvements in the health of Lake Awassa; (4) *sustained economic activity*, with an emphasis on increased opportunities for women and youth; and (5) *increased awareness of environmental issues*, including an increased understanding of and respect for the role of forests in sustaining human life in the community of Awassa.

Historically, decision makers have frequently seen some of these goals as conflicting: for example, government programs long sought to increase food security through land clearing, mechanization and agro-toxin applications, threatening water quality and the environment. However, atelier participants concluded that education and environmental initiatives (i.e. investing in human and natural capital) can promote all five of these goals simultaneously. In fact, in the case of Awassa it appears that investing in human and natural capital may be a prerequisite for achieving the core goals of the community.

7. Proposed solutions

Based on their shared vision of a more desirable future, stakeholders worked together to design four complementary projects believed to contribute substantially to the achievement of the desired objectives. The four projects are summarized below.

7.1. Reforestation

In some form or another, deforestation figured prominently in many of the problem definitions presented in Table 2 above. The main causes of deforestation around the Awassa community include the expansion of agricultural land for annual crop production; the extraction of fuel and construction wood from the forest; the growth of Awassa Town and other villages; and illegal settlement within protected natural forests in the region. Compounded by a high rate of

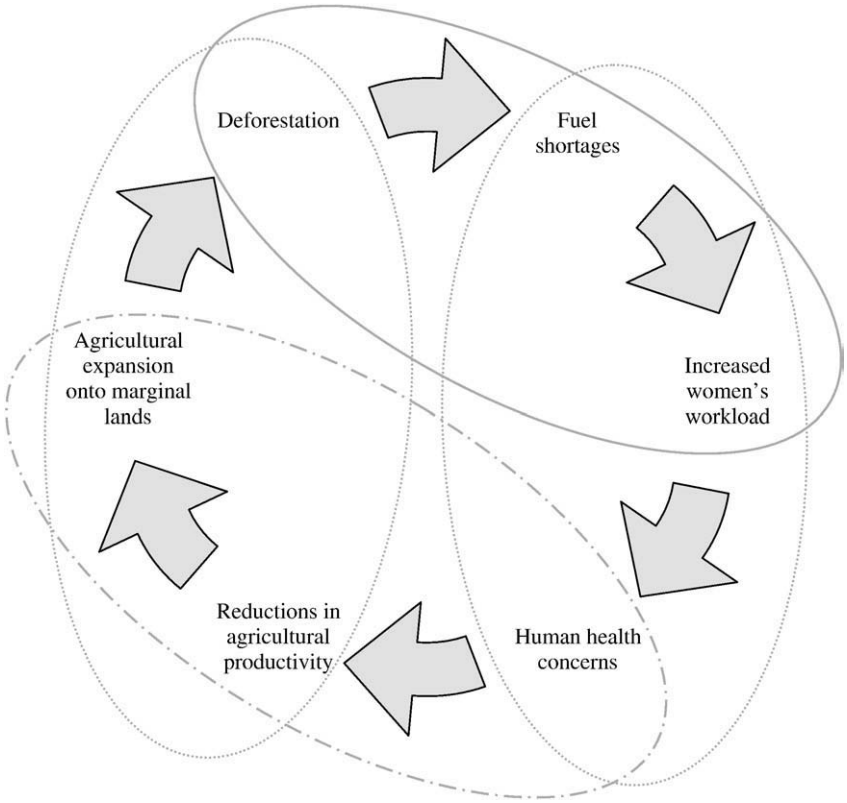

Fig. 3. Extended deforestation feedback loop. Ovals indicate relationships that were explicitly identified by one or more stakeholders. Severals such "extended" feedback loops can be identified from the problems and perceived casual pathways summarized in Table 2.

population growth, these factors have continued to aggravate soil erosion and siltation, biodiversity loss and overall land degradation (Dessie and Klemen, 2007). The current trend is towards decreasing productivity and the irreversible degradation of the interconnected and interdependent ecosystems in the Lake Awassa watershed.

Under this context, the proposed reforestation program has two phases. In the first phase, 1 million seedlings will be planted, including a mix of exotic fruit and fast growing species (e.g., Eucalyptus *globulus*) and slower-growing local species (e.g., Acacia spp., *Podocarpus facutus*, *Olea africana*, *Cordia africana*), with an emphasis on indigenous species in ecologically sensitive areas (e.g. gallery forests). Propagation will primarily occur through Farmer Managed Natural Regeneration (FMNR): this low-input practice entails providing incentives to farmers (usually a small monetary payment) to prevent grazing and to practice careful cultivation on degraded lands to permit natural regeneration of native species. The technique has been successfully employed in Niger, Chad, Burkina Faso, and Ethiopia over the past 2 decades (World Bank, 2008), and has the significant benefit of actively engaging land owners and land users in the management of naturally regenerating trees and seedlings on their farmland. Unfortunately, due to irreversible land degradation in some areas along with the impacts of global climate change (Harris et al., 2006), natural regeneration will not be possible for many sites in and around Awassa. Such areas will thus require more intensive tree propagation and management efforts, including the establishment of seedling nurseries and private and community woodlots and orchards.

This pilot project will ultimately provide the expertise for the ambitious second phase: reforestation of the 15,000 ha watershed surrounding Lake Awassa. This larger project will be undertaken through the cooperative efforts of local government, the local NGO Concern for the Environment, and the Wondo Genet College of Forestry. Local farmers and women's groups will implement the reforestation activities, under the direction of foresters and other professionals with abundant knowledge of species and plantation techniques appropriate to different terrains, soil types, and local management skills and capabilities. Marginalized populations including poor farmers and especially women will be targeted to participate in the program based on input from community leaders, tribal elders and government representatives at the grassroots level. Thus reforestation efforts will not only help address shortages of food, fuel, and construction materials, but they will also supplement household incomes and provide access to skills training for those in greatest need.

It should be emphasized that although atelier participants expressed interest in *restoring* natural ecosystems in the Awassa area, particularly in the biodiversity-rich gallery forest, the principal objective of the reforestation project is not *restoration*, but *reforestation*. Restoration seeks to restore ecosystems to as close as their original condition as possible, given environmental realities including permanent soil degradation and global climate change (Harris et al., 2006). Reforestation meanwhile, in this context, focuses on using trees, woodlots, orchards and forests to satisfy urgent human needs for fuel, construction materials, and other forest goods and ecosystem services. While the former emphasizes planting trees primarily for ecological benefits, the latter emphasizes planting trees as *a development strategy*: the proposed reforestation efforts aim to provide food and fuel wood to satisfy immediate needs, while generating much-needed income and increasing knowledge and skills among program participants to foster future economic development.

7.2. Alternatives to wood use

Complementing the proposed reforestation efforts, the Alternatives to Wood Use project will attempt to address the demand side of wood consumption. In Awassa as in most of Ethiopia, there are as of yet no affordable alternatives to burning wood as cooking fuel. Used ubiquitously for cooking and building—but with deleterious effects on both soil and hydrology (Bewket and Sterk 2004)—the Eucalyptus tree (*E. camaldulensis*, *E. globulus*), is cut as fast as it grows. Eighty-four percent of all fuel consumed in Awassa Town is wood—per capita fuel wood consumption is roughly 198 kg/year—and as a result, native trees have been almost totally used up: only 2.6% of the Awassa region remains forested (Achalu, 2006). Those forests that remain are threatened by extensive illegal logging, forest fires, increasing wood demand, and encroaching agricultural practices.

The main objective of the Alternatives to Wood Use project is to extend an environmentally beneficial technology (wood stoves that reduce firewood consumption) to the Southern Ethiopia region, while simultaneously fostering entrepreneurial activity among local women and youth. Youth from the Awassa Children's Centre, an orphanage in the city of Awasaa, will learn to build and sell fuel-efficient stoves in collaboration with the Awassa-based Van Der Lief Foundation. In a similar project developed by the local NGO Concern for Environment, rural Ethiopian women will undertake trainings in fuel-efficient woodstove construction, marketing, and use. These women will not only learn valuable stove construction and marketing skills (human capital investments), but they will also capture the benefits of reduced fuel use in their own households. At the same time, additional trainings will provide participating households instructions in the planting and management of small-scale woodlots (natural capital investments) to provide long-term supplies of fuel and further supplement household incomes.

Atelier participants asserted their belief that income generated from the sale of seedlings, fuel wood, and fuel-efficient stoves will foster entrepreneurial activity among youth, and will enable rural women to supplement their incomes and satisfy household needs. Education in marketing and money-management may also provide rural women the opportunity to exercise some degree of financial independence in a traditionally male-dominated society. Taken together, these initiatives will help to increase food security, decrease human pressure on the environment, and raise the economic and social status of women and youth in Southern Ethiopia.

7.3. Public awareness

Turning to the broader population, a general lack of education, including a lack of appropriate agricultural knowledge and a lack of environmental education were identified by atelier participants as undermining economic development and exacerbating ecological crises in the Awassa region. In order to promote public awareness of environmental problems and to encourage the citizens of Awassa and surrounding areas to mitigate ecological degradation, the Awassa Youth Campus (AYC) proposed a public awareness campaign. The AYC is a small local NGO dedicated to developing and maintaining a self-sufficient centre for education, vocational training and the arts among orphaned children in the Awassa region. The AYC houses the One Love Theatre, a troupe of Ethiopian children and teens that combine acrobatics and theatre to communicate information regarding HIV/AIDS prevention and other important social messages to audiences throughout East Africa. The circus is well known in the markets of Southern Ethiopia, and has performed for hundreds of thousands of people in markets and refugee camps in Ethiopia and along the Sudanese border over the last 6 years.

The One Love Theatre identified their capacity to expand the educational circus they currently run on AIDS awareness to also teach an environmental theme based on the outcomes of the “Green Awassa” atelier. The AYC began designing a program to communicate crucial environmental messages while the atelier was taking place, and the circus has already engaged in several public performances demonstrating the links between agricultural expansion, deforestation, fuel wood shortages, and drought. More generally, the One Love Theatre can also play a role in communicating project outcomes to other communities. Such communications efforts—about project successes as well as project failings—will be crucial for encouraging intelligent, informed natural and human capital investments in other districts. Moreover, these

communications channels might ultimately foster expanded inter-sectoral and inter-regional coordination (much-needed forms of social capital), that will be needed for larger scale forest management activities.

7.4. Coordination/steering committee

Finally, to more directly address the widely acknowledged problem of non-cooperation between levels of government and between the private, government, and NGO sectors, a final output of the atelier process was the formation of the Green Awassa Collaborative Alliance (GACA). The GACA represents a coalition of stakeholders in the Awassa region, including members from the NGO and business communities, as well as from academia and from local, zonal, and regional government. The GACA was established with a directive to facilitate and implement environmental and social initiatives to ensure (1) food security, (2) a clean and healthy water supply, (3) sustained economic activity, and (4) increased awareness of ecological issues in the Lake Awassa watershed.

The GACA is governed by a Steering Committee comprised of the Awassa City Government, the SNNPR Regional Bureau of Agriculture and Natural Resources, Wondo Genet Forestry College, the Sidama Zonal Natural Resource Office and the Awassa Children's Centre. The composition of the Steering Committee was intended to demonstrate government officials' and NGOs' commitment to cooperation and to the vision and implementation of the "Green Awassa" projects. Such a coordinating body is crucial for administrative and financial purposes—namely it legitimizes projects in the eyes of both national and international funding sources. At the same time, a far-reaching oversight body can help prevent the "leakage" that plagues many reforestation initiatives—whereby protecting forests in one area leads to increased deforestation elsewhere. Finally, the presence of such an inter-organizational coalition can help ensure the diverse projects in and around Awassa complement one another—coordination that is pivotal for generating virtuous cycles within and across development efforts.

In sum, the four projects strive to use investments in natural, human, and social capital as a means of achieving the self-stated goals of the Awassa community. Each project responds explicitly to one or more locally-identified needs, and each is based primarily upon local resources and abilities. Finally, and perhaps most importantly, none of the projects are seen as an ends in themselves, but rather as a means to an ends: the objective of the projects are not only to plant trees, build stoves, spread environmental awareness and foster inter-sectoral collaboration, but to break vicious cycles of human poverty through strategic investments in human, natural and social capital.

8. Challenges to project implementation

If adequately funded and implemented, the four proposed solutions above would help address all of the problems identified by atelier participants. However there remain a number of impediments to the realization of these projects, and the achievement of the goals outlined in the "Green Awassa" atelier.

8.1. Human and social capital challenges: stakeholder engagement

Past efforts at environmental protection, including reforestation, in Ethiopia have been stymied in part due to a lack of community involvement in the decision making process. This lack of participation quickly translated into a lack of ownership on the part of local stakeholders. The Derg regime, for example, saw a number of extensive "forced reforestation" programs, whereby peasants were obligated to plant trees on large tracts of land in response to "top-down, authoritarian, and politicized" demands from the national government (Gebremedhin et al., 2003, p. 132). Extensive deforestation did occur under the Derg, followed by rapid deforestation when those same peasants overexploited the forest that they had planted—but over which they had no ownership (Newmarch and Cadwell, 2008; Holden et al., 2003). Similarly, previous projects to extend fuel-efficient stove technologies have taken place in Ethiopia, but many of these have focused on the promotion of inappropriate technologies (e.g. solar cookers which are largely ineffective for cooking *Injera*, Ethiopia's staple food). Where appropriate technologies have been developed, most have required prohibitively high up-front investments.

To be successful, atelier participants recognized that the projects arising from the "Green Awassa" atelier would have to be founded upon local input and involvement at all stages. This will not, however, be easy. High rates of illiteracy throughout Ethiopia (evidence of low levels of human capital) make it especially difficult to communicate project goals and solicit public input. At the same time even some of the most educated Ethiopians in the Awassa region—including those in government and civil institutions—are simply not used to working together. Atelier participants described a number of bureaucratic obstacles for NGOs; government institutions were perceived as inherently corrupt (evidence of low social capital) and the personal ambitions of politicians were believed to interfere with the duties of civil servants. On top of this, a long history of unsuccessful development projects has resulted in a lack of trust across sectors (Gebremedhin et al., 2003). These divisions will need to be resolved in order for a successful collaborative effort to restore and maintain natural capital at a large scale to take place.

8.2. Natural capital challenges: institutional and financial support

Beyond challenges regarding human and social capital, a number of the challenges to the proposed projects are directly related to innate characteristics of natural capital, and the inability of existing policies in Ethiopia to sufficiently accommodate these unique attributes. For starters, there is the problem of ownership. Land in Ethiopia is owned by the government, and most land available for reforestation is characterized by communal use rights. Forests on such lands are therefore common pool resources, and as such are subject to underinvestment and overexploitation by individuals—the individual retains all the benefits of resource harvest, but shares the costs with the broader community (Hardin, 1968). While many cultures have developed institutions for the effective management of such resources (Ostrom, 1990), traditional management institutions in Ethiopia have been disrupted over the past several decades by changes in land tenure rights and by population growth. Numerous changes in land tenure laws resulting from changes in political regimes mean that land tenure and even land use rights remain insecure (Deininger et al., 2003). Neither communities nor individuals are likely to invest in natural capital if others will capture the benefits of those investments. And though under certain circumstances transforming common pool resources into private property can lead to more efficient management, in Ethiopia traditional and recent land tenure systems have emphasized the need for "land access for all"—a goal which may be incompatible with strict private property rights (Gavian and Ehui, 1999). Meanwhile high rates of population growth mean that there is increasing pressure on land resources—the only way to provide farm land to growing populations is to redistribute land already being farmed by others, or to convert communal lands to private use. Either approach is a deterrent to long-term investments in natural capital (Kebede, 2002).

Another inherent difficulty with natural capital investments is that most of the services generated by forests—such as water regulation, erosion control and climate regulation—are public goods. As such, these services are subject to overexploitation and free-riding: individuals at the bottom of a forested slope derive significant benefit from improved water quality and reduced erosion due to the presence of the trees, while the majority of costs (in terms of forgone short term agricultural production, and costs associated with maintaining and protecting the trees themselves) are absorbed by individuals living on the hillsides. Similarly, microclimate regulation from intact forests benefits a broader regional community, and services such as carbon sequestration and biodiversity conservation benefit the global community. In spite of such

widespread benefits, however, few mechanisms exist to channel payments from the beneficiaries of such services (the regional and global communities) to the local rural providers (see e.g. Turpie et al., 2008; Pagiola et al., 2002; or Landell-Mills and Porras, 2002). Unlike common pool resources, private property rights are not a potentially viable solution to the production of public goods from forests, as there is no possible mechanism by which such benefits can be targeted solely to individuals who voluntarily pay for them (Daly and Farley, 2003). For resources that provide such benefits, community-level provision is generally desirable, but this also requires environmental governance structures that do not appear to exist in Ethiopia at the present time.[2] Rural Ethiopians are thus left with little incentive to sustain natural capital levels: at least in the short term, the cost to individual peasants of preserving forests is probably greater than their share of the benefits.

Finally, and perhaps most importantly, although natural capital has the potential to be self-sustaining once established (i.e., once an investment in reforestation is made, and institutions are created to sustainably manage that resource, the natural capital stock will not require further money investments to continue providing benefits streams), returns on the initial investment may be extremely slow. A tree that is planted today may yield almost no benefits for years—no matter how much effort is invested in planting, watering, and protecting it. Meanwhile intact forests which provide a stream of ecosystem services at a fixed rate over time (e.g. food, fuel, water regulation, erosion control, etc.) may be converted to financial capital as fast as we choose (e.g. forests cut and sold for timber and firewood). Even though the long-term benefits from an investment in natural capital (e.g. planting new trees or protecting existing forests) may far outweigh those from sacrificing natural capital stocks for short term gains, communities living at the margin of subsistence often cannot sacrifice consumption today for greater consumption in the future, no matter how high the rate of return.

Unless stakeholders believe the short term local benefits of intact ecosystems to be greater than the short term local costs, it will be exceptionally difficult to overcome such natural, institutional, and economic barriers to reforestation. In the Awassa area, the good news is that for the lands on which reforestation offers the greatest ecological benefits—barren slopes and buffer zones around the lake—opportunity costs for changing land use are *lowest*. The denuded hillsides produce almost nothing, and rising lake levels are inundating the marginal land at the water's edge—farmers lose almost nothing by converting these lands to forest, suggesting that the payment required to convince farmers to plant trees will be very low. Unfortunately, short term benefits are also low. While successful grant proposals can provide the resources necessary to undertake reforestation projects and enhance short term benefits, it is an incomplete solution. Without sustained commitment from a wide range of stakeholders over a long period of time, trees will not be able to grow, and it will be impossible to reforest enough land to significantly improve food, water and energy security. The current grant system strongly favors shorter projects—it is presumed that after 2–5 years a "good project" should be self-sustained. In Ethiopia, with millions living at the edge of subsistence and population pressures on the environment increasing every day, it is simply not possible to assume that, at the end of a 5-year project, local stakeholders will have the capacity to invest their time and effort in the continuance and expansion of reforestation efforts without some form of external support. In other words, there is a need for a larger scale, more sustainable funding mechanism, beyond a simple "grant-and leave" approach, to ensure that the long-term natural capital investments necessary to fully capture the benefits of reforestation are achieved.

8.3. Overcoming the challenges: PES and carbon sequestration credits

One possibility for generating the long-term financial support needed for a successful reforestation program is payments for ecosystem services (PES). PES is an arrangement whereby external beneficiaries of ecosystem services make direct, contractual and conditional payments to local landholders and users in return for adopting practices that secure ecosystem conservation and restoration (Wunder, 2005). In Ethiopia, the most likely service for generating substantial payments is carbon sequestration. The global community is growing more and more concerned with the issue of climate change, driven primarily by anthropogenic carbon dioxide (CO_2) emissions. Carbon sequestration is one ecosystem service, provided by growing forests, which can generate payments from industrialized countries to developing countries through several emerging institutions, including the Clean Development Mechanism (CDM) under the Kyoto Protocol. Deforestation and similar changes in forest land use are significant sources of CO_2, representing up to about 20% of current emissions (FAO, 2005). By removing carbon from the atmosphere and durably storing it in trees planted and maintained by a rural community and in well-managed agricultural soils, carbon sequestration averts potential increases in atmospheric CO_2 while simultaneously providing a new means of livelihood to the rural poor in developing countries (Katoomba Group, 2005).

In spite of the uncertainties surrounding certain types of carbon offsets—in particular land use change offsets—more than 150 bilateral carbon offset schemes were already underway by 2004, including more than 30 based on forestry activities and options related to land use designed to conserve and/or sequester carbon (FAO, 2004). A recent study by Jindal et al. (2008) summarizes the progress of 23 such projects underway in Africa; it also stresses that Africa's sequestration capacity is seriously underutilized. Although many projects in Africa have only recently been implemented or are in the development stages, making outcomes hard to measure, a number of carbon sequestration projects have already fulfilled their initial goals. One example from Ethiopia in particular is the *Humbo Assisted Regeneration* Program (Newmarch and Cadwell, 2008; World Bank Carbon Finance Unit, 2008; Jindal et al., 2008). This CDM project, funded by World Vision Australia in conjunction with the World Bank Biocarbon Fund, bears some resemblance to the proposed reforestation project in Awassa.

Box 2
Ethiopia Humbo Assisted Regeneration

Humbo, a region in southwestern Ethiopia, like many regions has fallen victim to overgrazing and land clearing for fuel wood collection. Much of the area is now barren and subject to erosion and flooding. The Humbo Assisted Regeneration Project brings together World Vision Australia, the Ethiopian Agriculture, Rural Development & Forestry Coordination Office, and 7 local community cooperative societies to manage degraded lands for carbon, biodiversity and sustainable income-producing activities through reforestation. Communities have been trained in techniques to propagate native species (including farmer managed natural regeneration); and the project area currently covers over 2,500 hectares. The forested lands provide habitat for local species and enrich biodiversity, while at the same time reducing soil erosion and flooding (problems similar to those faced in Awassa). Income from the sale of carbon sequestration services – in the form of Certified Emissions Reductions (CERs) sold by World Vision to the World Bank over the next 3 decades - will be reinvested in project activities and in local infrastructure and food security efforts. Over 3,000 households will ultimately benefit from the project through employment and training opportunities as well as through access to sustainable food and fuel sources, and cleaner and more reliable water sources in and around the project area due to the reforestation effort.

Source: World Bank Carbon Finance Unit, 2008

[2] For a noteworthy exception, see (Gebremedhin et al., 2003).

Another project which exemplifies a carbon sequestration program that could be applied in Ethiopia is the *Village-Based Management of Woody Savannah and the Establishment of Woodlots for Carbon Sequestration* project in Benin (GEF, 2008). This project built upon the Government of Benin's self-proclaimed commitment to strengthening global ecosystems and promoting sustainable development by supplying the Government the financial and technical resources needed to address deforestation. In addition to working to educate target groups of farmers, herders and others on the social, economic, and ecological roles of trees in woody savannahs, project activities included training women to build improved, energy-saving stoves, engaging local people in the development of rules and institutions for the sustainable multipurpose use of forest resources, and empowering them to implement their own forest management plans (GEF, 2008).

Both the Beninese and Ethiopian carbon sequestration projects involve extensive cooperation between local and national organizations to coordinate project efforts and to devise plans to maintain a sustained yield of various forest products and services over the coming decades. Both also yield a vast array of corollary benefits beyond the sequestration of carbon alone—in the Beninese case, for example, in addition to the planting of over 600,000 seedlings with a survival rate of over 70%, results of the project include more herders growing leguminous trees to feed their animals, and increasing numbers of women using energy-saving cooking stoves (Jindal et al., 2008; GEF, 2008). Meanwhile, participation within the internationally established institutions of the CDM has helped to strengthen local institutions, encourage participation of the local population, and clarify the roles of various governmental units (GEF, 2008). At the most fundamental level, however, carbon sequestration payments allow local stakeholders in poor rural areas to rise above subsistence; it temporarily frees them from the overwhelming burden of satisfying daily food and fuel needs in exchange for their time and labor in planting and maintaining forests. These forests themselves will then eventually provide a steady flow of ecosystem services which, if used sustainably, will help obviate the need for future international aid.

Humbo and Benin are areas facing problems that are similar to those identified for the Awassa watershed. Based on the levels of carbon sequestered from these two projects a PES scheme for Awassa could potentially sequester 26.4 to 42.13 tons of carbon per hectare, yielding a total of 396,000–631,950 total tons of carbon for a 15,000 ha reforestation project. Based on the 2007 World Bank Biocarbon fund payment rate of USD$4 per ton of sequestered carbon, revenues for farmers in the Awassa watershed could reach between USD$1,584,000 and USD$2,527,800. Under alternative carbon credit exchange mechanisms, such as those through private organizations, revenues could exceed USD$5,000,000 (Jindal et al., 2006; FAO, 2004).

International payments for carbon sequestration are not a panacea for reforestation projects in developing countries.[3] However, carbon sequestration payments have the potential to provide the steady flow of funds necessary to permit stakeholders in a reforestation project to make the long-term investments in natural capital necessary to establish (or, where possible, restore) self-sustaining, and highly beneficial ecosystems. In essence, Ethiopia would fund reforestation schemes that help meet important existing needs—including food, energy and water security—by producing and exporting carbon credits. To diversify project income sources, the country might even consider more elaborate schemes to market and sell "umbrella services," which include biodiversity, carbon and water (Turpie et al., 2008; Pagiola and Platais, 2007). Existing Ethiopian export commodities include coffee, gold, leather, live animals and cut flowers. Almost all of these exports require imported inputs, contribute to erosion, pollute land and water, and require substantial transportation infrastructure to get the product to market. Carbon sequestration and other PES schemes in contrast require almost no imported inputs and no export infrastructure, and are probably justified based on their positive externalities alone. A case study by Balmford et al. (2002) found investments in natural capital and ecosystem services across a range of ecosystems offered returns of up to 10,000%.

9. Conclusions

The current development paradigm emphasizes investments in built capital, including infrastructure and industry, as the key to economic development. However, recent developments including the award to Wangari Maathai of the Nobel Peace Prize suggest that a new development paradigm—one centered on investments in human and natural capital—may constitute a viable alternative to this conventional approach. This paper used the results of a 2006 atelier in Awassa, Ethiopia to further investigate the potential for investments in human and natural capital to promote sustainable development.

The "Green Awassa" Atelier served to bring together key stakeholders to design, establish and implement locally-based development projects. By engaging participants to develop and articulate a shared vision, and helping to create an action plan for the implementation of the "Green Awassa" projects, the atelier set the stage for participants to translate their shared vision into funding proposals for the resources needed to undertake projects and make them self-sustaining. The projects themselves will invest in human and natural capital by training farmers, women and youth in forestry techniques and the construction of fuel-efficient stoves, and by using the existing One Love Circus and the newly formed Green Awassa Collaborative Alliance to communicate results and disseminate skills to other communities. Most importantly all of the projects look beyond individual "problems," and instead focus on the vicious cycles that generate them. The "solutions" themselves may also be represented as cyclical, for example: *Reforestation → Improved soil quality → Improvements in agricultural productivity → Increased food security and Reduced cultivation of marginal lands → Reforestation (through natural regeneration and perhaps expanded planting*). In this context reforestation is not done for ecological restoration's sake, but for the sake of economic development, and to introduce a positive and constructive feedback loop by breaking a destructive one.[4]

Although it is clear that the community's vision of a "Green Awassa" characterized by fuel security, food security, water quality, sustained economic activity, and awareness of environmental issues will not be easy to achieve, the grant-writing atelier was a step in the right direction. The use of international PES schemes, particularly payments for carbon sequestration, may provide the long-term funding needed to sustain the proposed projects, while simultaneously strengthening institutional supports in the form of local NGOs, civil society members and government offices working together to implement, manage, and evaluate project activities.

There is of course no guarantee that the "Green Awassa" atelier process will work, but current progress in grant requests (two grant proposals have been submitted) and in inter-sectoral collaboration on the ground in Awassa (the GACA has already met on several occasions) suggest that the chances of success may be greater than through other approaches. Ultimately there remains much to learn about natural capital investments and institution building, and as this learning process takes time, it must begin as soon as possible. The appropriate approach is to learn by doing. The loss of natural capital and the essential ecosystem services it provides in Ethiopia threatens food, water and energy security, with the threats most pronounced for

[3] Indeed, the time-consuming and costly work of developing a formal project proposal and verifying and marketing certified emissions reductions (CERs) will likely deter many smaller projects from seeking carbon payments, at least through the formal channels of the CDM (Newmarch and Cadwell, 2008).

[4] Many thanks to Dr. James Blignaut for encouraging us to expand upon this crucial theme.

farmers and pastoralists, generally the poorest of the poor. Targeted investments in human and natural capital together might allow rural Ethiopians to replace cycles of poverty, sickness, and environmental degradation with cycles of knowledge, health, and life.

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