

FRONTIERS IN ECOLOGICAL ECONOMICS

Online Conference | 9:00 am – 5:00 pm EST | May 3, 2017

Economics for the Anthropocene
University of Vermont Gund Institute for Environment

Join by Zoom at: <https://yorku.zoom.us/j/330839806>

Graduate students from the [Economics for the Anthropocene](#) graduate research and training partnership and the [University of Vermont Gund Institute for Environment](#) are hosting a one-day online conference on “Frontiers of Ecological Economics”. Students have developed fifty-minute sessions with three to four ten-minute presentations based on bibliographical research conducted in a joint graduate course in ecological economic theory. Session overviews and presentation abstracts are below. Students will present from one of three linked classrooms at UVM, McGill & York universities. You are welcome to enter or leave the conference at any time throughout the day through the [Zoom web link](#) and ask questions to moderators through an online chat box. We hope to see you virtually on Wednesday.

9:00 am **Session 1 | Responsibility and Vulnerability in the Age of Ecological Limits**

Moderator: Svenja Telle | UVM

- 1.1 *The Responsibility of Fossil Fuel Producers* | Daniel Greenford | McGill
- 1.2 *Grappling with Vulnerability and Climate Justice: What Can Local Communities Do?* | Kelly Hamshaw | UVM
- 1.3 *Communicating Ecological Economics* | Holden Sparacino | UVM

10:00 am **Session 2 | Humans, Nature and Values: Towards a Holistic Approach**

Moderator: Laura Gilbert | McGill

- 2.1 *From the Homo Economicus and his Fellows to the Homo Socioecologicus and the Homo Anthropocensis* | Alice Damiano | McGill
- 2.2 *Beyond Monetary Valuation: Nature's Multiple Value Dimensions*
Natália Britto dos Santos | York
- 2.3 *Anthropocentrism, Biocentrism and Ecocentrism: How does Inter-Species Justice Relate to Inter- and Intra-Generational Justice?*
Gabriel Yahya Haage | McGill

11:00 am **Session 3 | Theory and the Future of Agriculture**

Moderator: Sam Bliss | UVM

- 3.1 *Tracing the Theory, Placing the Frameworks* | Lindsay Barbieri | UVM
- 3.2 *From Sector to System: The Economic Embeddedness of U.S. Agriculture and the Need for a New Path Forward* | Catherine Horner | UVM
- 3.3 *Stepping off the Treadmill: Human-Powered Agriculture and the Pressure to Produce* | Rachel Mason | UVM

- 12:00 pm** **Session 4 | Theoretical and Practical Challenges of the Energy Transition**
Moderator: Daniel Horen Greenford | Concordia
- 4.1 *Net Energy and Society* | Tim Crownshaw | McGill
 - 4.2 *The Macroeconomics of the Energy-Emissions Dilemma*
Martin Sers | York
 - 4.3 *Refrigeration Alternatives and Jevons' Paradox* | Josh Taylor | UVM
 - 4.4 *Is Nuclear Energy a Replacement for Fossil Fuels?* | Sam Bliss | UVM
- 1:00 pm** **BREAK**
- 2:00 pm** **Session 5 | Well Being in the Anthropocene: Perspectives from the North & South**
Moderator: Rachel Mason | UVM
- 5.1 *The Southern Transition: International Development in the Anthropocene*
Alicia Richins | York
 - 5.2 *Achieving Sustainable Livelihood in a Full World – Macroeconomic and Cultural Implications* | Laura Gilbert | McGill
 - 5.3 *Just Distribution and Ecological Economics: The Role of Universal Basic Income* |
Karan Kumar | McGill
- 3:00 pm** **Session 6 | Creating Space: Spiritual and Cultural Diversity in Ecological Economics**
Moderator: Alice Damiano | McGill
- 6.1 *Decolonize your Mind: The Role of Spirituality and Science in Ecological Economics* | Svenja Telle | UVM
 - 6.2 *Dismantling Colonialism: Ecological Economics as a Method of Decolonization* |
Alayna Howard | UVM
 - 6.3 *Disrupting the Monoculture: Reverence for Traditional Knowledge in Ecological Economics* | Molly Fremes | York
- 4:00 pm** **Session 7 | Synchronous Failure and Applied Responses**
Moderator: Catherine Horner | UVM
- 7.1 *Social Multi-Criteria Evaluation for EcoHealth Assessment*
David Mallery | York
 - 7.2 *Hot Money, Speculation, and Food Security: Case Studies from Indonesia and Thailand* | Sean Morris | UVM
 - 7.3 *Changing Regulations and Green Business Practices* | Doug Baxter | York
 - 7.4 *Evaluating Indicators to Assess Progress of Ecological Financial Planning Strategies for Sustainable Household Consumption* | Claire-Helene Hesse-Boutin | York

ABSTRACTS

1.1 *The Responsibility of Fossil Fuel Producers* | Daniel Greenford | McGill

Climate change poses one of the gravest existential threats humanity has ever faced. In order to avert climate catastrophe, anthropogenic emissions must reach zero as soon as possible. Without a complete phase out of the combustion of fossil fuels, there will be no way to meet this challenge. The implication is clear — fossil fuels will become unusable in a world with a safe climate and similarly, the production of fuels will become obsolete. The challenge presented is no less than transitioning the entire industrial human economy to a post-combustion energy system, walking away from the energy that facilitated the birth of modern civilization and towards a world that can safely sustain humanity for the indefinite future.

So who is responsible for rising to this challenge, if anyone at all? Is this responsibility equally distributed or does it reside disproportionately in the hands of a few political and economic actors? I argue the case is the latter. Fossil fuel producers, particularly fossil fuel corporations and the nations that aid and abet them, hold a disproportionate amount of wealth and power relative to other actors in the energy-climate scene. This power is derived from a number of aspects of their privileged position stemming from wealth and socioeconomic dominance, which manifests as political influence as well as technological and institutional control. For starters, these companies and countries hold the most capital for funding research to develop and scale the technology needed for the transition. Furthermore, fossil fuel producers — simply by inputting marginal resources into the market — depress prices and consequently incentivize consumption. This net increase in consumption caused by an increase in supply of a marginal resource forms the microeconomic basis for the responsibility of producers of harmful goods generally, and is now a particularly pressing matter in a world where burnable fuels are dwarfed by viable reserves. The equity implications of who — which countries or corporations — will get to extract remaining burnable resources has begun to be explored. The flipside to this conversation is who will be unable to extract their remaining reserves and has been explored using climate-economy coupled models. Further considerations of market dynamics in the explicit light of agency and responsibility associated with privileged positions in the global economy warrants a closer and more thorough examination if there is to be a lucid discussion about the role of fossil fuel producers in a decarbonizing economy. I put forward that without such a discussion, nations will be unable to overcome the current intractability inherent in climate policy.

1.2 *Grappling with Vulnerability and Climate Justice: What Can Local Communities Do?* Kelly Hamshaw | UVM

Climate change is a global phenomenon yet its impacts are borne most acutely at the local scale by vulnerable communities and individuals alike. Considerable research demonstrates that disasters commonly related to climate change such as floods, severe storm events, or wildfires have disproportionate impacts on communities of color, low-income households, and individuals with compromised health conditions due to structural social inequities existing prior to the disaster. Climate justice recognizes that communities and community members experience the impacts of climate change differently based upon their socio-economic, political, and cultural characteristics. The role local communities can play in addressing climate change impacts is particularly salient in the current political atmosphere. Efforts to increase community resilience through climate adaptation strategies have proliferated within the United States and beyond. Ensuring that such climate adaptation efforts address the equity dimension is critical to building resilient and just communities. Without careful consideration and planning, it is possible that adaptation and mitigation activities could reinforce or exacerbate existing socio-economic vulnerabilities or even create new ones.

This review investigates three primary questions within the scholarly literature: 1) how is vulnerability manifested within communities at the local level, 2) what types of local adaptation strategies can effectively address vulnerabilities to climate change impacts, and 3) what challenges do marginalized communities face in building resilience. The review concludes with articulating a call to action for local communities to lead the way in addressing climate change through transformative change in a climate justice framework based upon ecological economic principles.

1.3 *Communicating Ecological Economics* | Holden Sparacino | UVM

Climate change issues are becoming more pressing and time frames for actions have shortened, and the growing field of ecological economics continues to examine alternative paths forward through research and policies. This talk will examine how ecological economics is communicated to decision makers and to the public, and look at how communication can be improved to accelerate ecological economic policy adoption and increase understanding. Under the current contentious political climate, decision makers have not commonly adopted ecological economic policy. Ecological economics is not widely seen as viable, and the projected consequences of inaction not seen as inevitable. Effectively communicating the consequences of resisting a paradigm shift away from neoclassical economics towards a more holistic approach is becoming increasingly important. Barriers to adoption are numerous, including lacking of awareness of ecological economic principles, precautionary or unpredictable outcomes, ineffective communication of policy proposals and research, and a polarizing political climate. This speed talk will look at the methods and communication that ecological economists have used in the past, and compare them to best practices for policy adoption in the field of ecological economics and through interdisciplinary work. By examining past projects and their communication practices, the talk aims to indicate how ecological economics can be more effectively communicated to the public and decision makers, resulting in better interdisciplinary collaborations, public awareness, and the adoption of more holistic policies.

2.1 *From the Homo Economicus and his Fellows to the Homo Socioecologicus and the Homo Anthropocensis* Alice Damiano | McGill

The mainstream economics is tightly related to the idea that human beings act according to the abstract model of *homo economicus*. However, this model is receiving increasing criticism, both for its assumptions and for its consequences. Indeed, human behavior often does not comply with key characteristics of the *homo economicus* such as rationality, self-interestedness, isolation, insatiability, indifference and individualism. Furthermore, the idea of *homo economicus* stimulates an excessive depletion of the environmental goods, thus contributing to the environmental degradation. Hence, from an ecological economics perspective the idea of *homo economicus* clearly needs to be revised and substituted with a new model of homo that takes into account the limitedness of human rationality, as well as the limits posed by the society and the environment.

Several authors have already produced alternatives to the *homo economicus*, such as the *homo sustinens* and the *homo ecologicus*. In this paper, I present a review of the many kinds of *homo* and their main characteristics, and then I propose two new models of *homo* that are conceived as an ecological economics response to the *homo economicus* and its hegemony. The first one is the *homo socioecologicus*, i.e. a model of *homo* with characteristics that allow him to have a sane relationship both with the society and with the environment. This model is conceived as not time-specific, and it represents a general paradigm of how humans—with all their imperfections—can live together in the environment without dramatic consequences. The second model is the *homo Anthropocensis*, which is time-specific and tailored for the current era, the Anthropocene. Indeed, the Anthropocene is a very particular age that poses new, serious problems in terms of environmental and social crises (e.g., climate change,

wars), and this raises the need for a *homo* that is able to cope with them. The two models are tightly related to each other, but they have several differences, especially in their values and priorities.

These models are constructed starting from the characteristics of the *homo economicus* and of the other models of *homo* that have been created in various contexts and disciplines, such as the *homo politicus*, the *homo scientificus*, the *homo sociologicus*, the *homo reciprocans*, the *homo consumens*, the *homo efficens*, and of course the *homo sustinens* and the *homo ecologicus*. In addition, these models are characterized also by some new, emergent properties. The assumption behind this method is that each model of *homo* is likely to bring some piece of reality and truth, and thus they are all considered as potential contributors to the new models of *homo*. Also, the ecological economics approach encourages interdisciplinarity, and considering the models of *homo* that belong to the other disciplines is a way to construct a model without neglecting the various sides of human personality.

2.2 *Beyond Monetary Valuation: Nature's Multiple Value Dimensions* | Natália Britto dos Santos | York

Nature is essential to human well-being, providing material and non-material benefits. Ecosystem valuation interest has increased steadily, initially focused on providing monetary valuation of nature and its services, raising debates regarding the appropriateness of these measures in different conditions. However, monetary valuation alone cannot capture the whole variety of nature benefits, and relying only on monetary values can lead to underestimation as well as environmental and social injustice. As we face the Anthropocene, the planetary crisis calls for urgent changes in how we perceive and value nature.

Drawing from a literature review, this paper will explore that nature values are realized by people not only as instrumental (people's satisfaction) or intrinsic (nature per se), but also through relational values arising from nontangible relationships. Further, I will discuss the need to incorporate a plurality of valuation languages and knowledge sources to better understand ecological, socio-cultural and monetary values, considering specific conditions under which approaches may or may not be appropriate. Otherwise, we might disregard important values, especially those less tangible and difficult to measure. This conversation is of utmost importance since all values are equally relevant to understand human-nature relationships and then make wise, social and environmentally just decisions regarding urgent planetary challenges

2.3 *Anthropocentrism, Biocentrism and Ecocentrism: How does Inter-Species Justice relate to Inter- and Intra-Generational Justice?* | Gabriel Yahya Haage | McGill

Justice is a vital component of ecological economics. Such ecological justice is usually separated into three components: intra-generational, inter-generational and inter-species justice. Much has been written on the first two aspects, but inter-species justice remains largely unexplored. Even less has been written about the connections between justice for entire systems, like ecosystems, and justice for individual non-human organisms. This paper seeks to explore three approaches in addressing Inter-species ecological justice: an anthropocentric ecosystem services framework, biocentrism and ecocentrism. All three, occasionally overlapping, worldviews strive to adequately protect nature and all address the three prongs of ecological justice.

The anthropocentric ecosystem services approach remains the most conventional. The inclusion of valuation categories like option and existence values are considered important in safeguarding ecosystems and species. Biocentrism and ecocentrism, by extending value to nature beyond anthropocentric instrumental value, have been offered as alternatives. Biocentrism, focusing on the intrinsic value of individual human and non-human sentient beings, remains a strong component in animal rights theories. Ecocentrism, which offers value to collectives within nature, including species and ecosystems, is a far more common alternative. By considering

case studies related to biodiversity and animal welfare, this paper draws out the benefits and drawbacks of each perspective and the effectiveness with which each one links the three prongs of ecological economics.

First, by tackling the convergence hypothesis, this paper addresses the claim of the anthropocentric ecosystem services framework that protecting Inter-generational and Intra-generational human interests leads inexorably to preserving nature, thereby achieving Inter-species justice. The idea that human-based valuation methods, including benefit transfers, are adaptable to individual non-human beings is also addressed. The controversial concepts of species substitutability and option value are used to highlight the possible failings of this perspective. Market-based attempts at dealing with animal welfare are also explored.

Then, by considering biocentric movements like compassionate conservation, this paper explores the arguments put forth by this second worldview on how to expand this individualistic framework to include Intra-generational and Inter-generational ecological justice. According to advocates, this is possible through a change in mentality and substantial reductions of harm to the environment and the underprivileged. Using the impact of invasive species on biodiversity as a case study, the potential successes and failures of such views are discussed. Similarly, the implications of this view on wild animal welfare are explored.

Finally, the ecocentric arguments for connecting the three prongs of Ecological Justice are critiqued. This worldview claims to effectively address both Inter-generational and Intra-generational injustice, the former by preserving nature for future generations and the latter due to links between habitat destruction and developing areas. A touted benefit of ecocentrism is its ability, unlike biocentrism, of offering different levels of importance to different systems, with greater value given to rare species and habitats. This paper explores how this relates to social power structures, particularly regarding who decides the importance of different biotic collectives. The implication of such thinking on biodiversity conservation is explored. The paper also critiques the various arguments outlining how the value given to biotic collectives, like ecosystems, can be scaled down to the welfare of individual non-human sentient beings, which are indirectly valued for helping support these collectives.

In the end, by exploring the infrequently addressed concept of Inter-species justice, this paper reveals the issues and controversies associated with attempting to link all three components of ecological justice. Species biodiversity and animal welfare are two key issues in which these perspectives diverge and so they serve as case studies of the implications of each worldview.

3.1 *Tracing the Theory, Placing the Frameworks* | Lindsay Barbieri | UVM

Founded on the pillars of sustainable scale, just distribution, and efficient allocation, ecological economics as a discipline stands in answer to fundamental critiques of existing economic orthodoxy. However, the intentional pre-analytic embracing of value and methodological pluralism has now, ~40 years later, resulted in the discipline shifting from its early radical stance towards a more traditional, neoclassical research agenda (Spash, 2013). This has been documented with the increased use of neoclassical methodologies for ecological economics research pertaining to climate change (Blake et al., 2012), and indeed the entire academic discourse within the journal of *Ecological Economics* has become increasingly similar to the orthodox discourse found within environmental economics (Plumecocq, 2014). This shift, arguably a sign of ecological economics struggling to maintain its founding identity, has been attributed to the lack of a strong disciplinary focus with no cohesive epistemology or subsequent methodologies and thus no seawall to stand against the waves of orthodox economic values and methods.

In his 2013 paper in *Ecological Economics*, Spash “explores and explains what is deep and what is shallow in the ecological economics movement at a time when [...] there are crucial crossroads to be negotiated and a path to be chosen.” This compelling exploration shows ecological economics as comprised of three main groups divided by epistemological, methodological and ideological positions: social ecological economists, new resource economists, and new environmental pragmatists. Here I focus on this final group. The new environmental pragmatists use concepts and methods such as ecosystem service valuation to commodify, quantify and define the price of nature within socio-environmental (S-E) systems.

Certainly not without criticism for monetizing environmental values in “virtually every circumstance and context” (Norton and Noonan, 2007), ecosystem services is arguably a useful framework for addressing complex S-E challenges (e.g. environmental degradation and resource overexploitation) that push against the thresholds of our planet. Understanding and managing environmental resources within planetary boundaries is critical; for if we surpass these limits, humanity will risk “deleterious or even catastrophic environmental change at continental to global scales” (Rockström et al., 2009). Despite the importance, S-E research remains challenging, and it may be that the valuation of ecosystem services is a pragmatic and effective method for framing resource management under current political and economic systems.

However, ecosystem services is just one of a variety of frameworks that have been developed and used to synthesize and analyze S-E data to help manage resources in these complex systems. I use a recent comparison of 10 frameworks that are most prominent for analyzing S-E Systems. All 10 frameworks “vary significantly as to their theoretical and disciplinary origin, their purpose, and the way they conceptualize the social and the ecological systems, their interaction and dynamics” (Binder et al., 2013), thus other frameworks may be better aligned with different ideological positions within ecological economics. To place these frameworks, I do three things. **First**, I give a brief review of the disciplinary backgrounds, underlying epistemologies, and explicit methodologies for framework. **Second**, I compare how each framework is explicitly used within ecological economics by analyzing published research within the journal of *Ecological Economics*. **Third**, I discuss the alignment of each framework with the three ideological positions in ecological economics as outlined by Spash 2013, social ecological economists, new resource economists and new environmental pragmatists.

3.2 *From Sector to System: The Economic Embeddedness of U.S. Agriculture and the Need for a New Path Forward* | Katie Horner | UVM

Historically, agricultural policies in the United States have favored large-scale and highly specialized agricultural operations. This policy approach has given rise to agribusinesses that dominate national agricultural and food systems. Driven by a cultural imperative of constant economic growth, these agribusinesses have become increasingly detached from natural ecological systems, embedded instead in the global economic system. Thus, in place of agricultural systems, there is an agri-sector situated within the bounds of economic markets and technological innovation. This sector degrades the natural resources upon which it depends, as well as the health of the people it feeds. While these consequences have been identified and acknowledged, the role of economic systems as a contributing factor has been largely ignored by national policies. In fact, a majority of policies aimed at addressing agri-environmental degradation have further embedded agriculture within economic systems. Policy schemes like payment for ecosystem services and conservation incentives continue the tradition of an agri-sector driven primarily by financial incentives and disincentives.

Most recently, there is growing discussion of financially valuing the restoration and maintenance of ecosystem services as a means of fostering a more sustainable agriculture. This policy direction is underpinned by the premise that farmers do not provide enough of a public good (in this case, ecosystem services or, more simply, healthy agroecosystems) because they do not receive payment for doing so. This premise leads to the traditional economic

conclusion that, if farmers were paid for this provisioning, they would be motivated to provide greater amounts of these goods. Such proposals, however, fail to address the underlying ways in which an agri-sector will inevitably degrade ecological systems due to the inability of conservation to out-compete other more economically efficient profit-producing practices.

Looking at existing literature within ecological economics, I show how policies that continue to rely on economic tools and metrics will not only fail to reverse or prevent environmental and human health externalities but also, further embed the agri-sector within economic systems. Following this, I explore the literature on crowding out theory and the possibility that introducing price schemes into agroecological and conservation practices may limit the extent to which farmers are able to intrinsically value nature. This intrinsic valuation may be a necessary step towards establishing farming practices that are grounded by the limitations of natural systems. Finally, this speed talk makes the case that to achieve a truly sustainable *agriculture*, policy must promote the intrinsic and non-monetary valuation of ecological systems. If policy fails to resituate agriculture within ecological systems, the damage to our environment and public health will continue.

3.3 *Stepping off the treadmill: Human-powered Agriculture and the Pressure to Produce* Rachel Mason | UVM

The environmental, public health, and other problems of industrial agriculture are well-known. Definitions of sustainable agriculture vary, but one broad theme involves low-input systems that depend upon natural biogeochemical mechanisms to provide the services that are required by agriculture, while conserving the ecosystems upon which they rely. In these systems synthetic inputs are partially replaced by in-depth knowledge and intensive management, requiring more human work.

High labor requirements run counter to the long-term trend in agriculture – and, indeed, the wider economy – of constantly increasing labor productivity. Farmers wishing to implement environmentally-friendly yet labor-intensive practices are often faced with the unattractive options of continuing to compete on price with other farmers, potentially by resorting to abusive labor practices, or selling food only to affluent consumers at high prices. Neither of these options will establish sustainable practices as the default in the US food system.

The economics of labor is currently lacking from discussions of agricultural sustainability, but issues of labor productivity have become prominent in the ecological economics literature, especially among those who advocate zero or negative economic growth. Two paths are generally suggested: reducing working hours, and – more relevant to sustainable agriculture – shifting to lower-labor productivity sectors. This raises the questions of: (1) What policies could induce such a shift?; and (2) How would the resulting economy function?

Policies to encourage a transition to lower labor productivity industries aim to: emphasize resource productivity over labor productivity; measure and prioritize goals other than productivity; and subsidize or even guarantee employment. Many counterintuitive effects are possible, and the emerging field of ecological macroeconomics seeks to explore some of those issues. The models are currently incomplete and in need of more empirical evidence, but are highlighting some important questions, particularly about income inequality in a low growth, low labor productivity economy. I will briefly review ecological economics policies and models that deal with labor productivity issues, and relate those to the problem of fostering human-powered agriculture.

4.1 *Net Energy and Society* | Tim Crownshaw | McGill

Energy surpluses have always been central to human societies and underpin their formation, growth, transformation and complexity. Surpluses can be examined in absolute terms, but for the purpose of technological differentiation are more usefully represented as the ratio of output to input energy of any energy production process, or Energy Return on Investment (EROI). The EROI of our dominant fuels has been declining steadily throughout the modern era while it remains a critical aspect of the sustainability and long-term prospects of our present energy-dependent society. In particular, the EROI of most renewable energy technologies is significantly lower than that of the non-renewable fossil fuels, which implies a significant reduction in aggregate EROI as the world transitions away from climate change causing fossil fuel resources. It is essential to understand the implications of this change, by characterising the constraints facing our potential responses to it.

Most analyses of EROI within the context of human society and macroeconomic scale tend to look for direct links between EROI and environmental or socio-economic effects; that is, to discern a direct causation. However, this practice sidesteps the most common technological-optimist response to the challenges of declining EROI: that any decline can be offset simply via an increase in the scale of energy production activities to yield the required net energy. In practical terms this type of response is subject to available resources, labour and capital; and diverts these away from other crucial sectors of the economy. Maintaining a constant energy surplus with declining EROI implies a larger proportion of the overall economy must be devoted to energy production.

This study will investigate approximate bounds on the increased scale response, by modelling the time-dependent evolution of energy sector scale with projected EROI trends. For this, we will employ a high-level system dynamics model including energy sector scale, EROI and net energy demand (as exogenous). As net energy demand is the greatest source of future uncertainty in this analysis due to unknown changes in end use efficiency, several scenarios are used to represent a range of outcomes. Relative response feasibility is established by a comparison of model output to historic energy sector scale and growth. As these simplified models are necessarily highly aggregated, I qualitatively discuss implications of the changing composition of the energy surplus for substitutability, and examine the utility of alternative energetic measures for this purpose, such as exergy and emergy.

We anticipate the results of this study to show that increased scale is unlikely to be the primary mode of adaption to expected declines in future EROI. Increasing the size of the energy sector is only a partial solution at best to the problem of declining thermodynamic quality of our energy sources as we move away from fossil fuels. The balance of the adaption response will likely have to come from changes in energy consumption behaviour. Furthermore, careful attention must be given to the energy forms provided by the future energy system and dominant modes of energy consumption. This is critical, as our globalized economy now exhibits intractable dependencies on energy dense, transportable fuels for its ongoing maintenance and operation. Ultimately, declining EROI doesn't have to spell disaster, but does present serious societal challenges and the need for transformative change. Our collective response to the end of the high-EROI fossil fuel era will determine our success or failure in the 21st century.

4.2 *The Macroeconomics of the Energy-Emissions Dilemma* | Martin Sers | York

The growing possibility of catastrophic climate change necessitates that economies shift away from using fossil fuels as the dominant source of primary energy. There exist well-established figures for the total emissions permissible such that there is a reasonable probability of remaining below target temperatures such as 1.5 or 2.0 degrees Celsius by 2050 derived by the Intergovernmental Panel on Climate Change. In order to remain within emissions limits, economies must transition from primarily fossil fuel based energy systems to renewable and

other alternative energy systems. A successful transition will require very large and targeted investments to be made in order to replace and retrofit existing energy infrastructure and capital stocks; however, the transition is complicated substantially by several key factors. First, renewable and alternative energy sources do not behave in the same manner as fossil fuels and substantial complexity is introduced when attempting to have renewable energy types approximate the behavior of traditional energy systems. Second, the time dynamics of the transition, introduced by the existence of an emissions ceiling and the steady decline of the EROI of fossil fuels, present significant constraints on the set of possible “successful” transition pathways. These factors imply the possibility of a so-called energy-emissions dilemma whereby the increased short-term energy consumption and economic growth necessary to facilitate the fairly complex transition to renewables cannot be undertaken or completed without transgressing exogenously determined emissions targets. As such a successful transition requires the balancing of several different time dependent processes at the level of the macroeconomy (aggregate investment, economic growth, capital stock dynamics, energy demand, EROI, etc). We posit that traditional macroeconomic analysis of energy and climate may be rather overly optimistic concerning energy transitions and emissions if it does not take into account the substantial complexity and urgency suggested by the energy-emissions dilemma.

4.3 *Refrigeration Alternatives and Jevons’ Paradox* | Josh Taylor | UVM

How can alternative ecological refrigeration systems at both small and large scales offer viable means to significantly reduce energy demands and greenhouse gases (GHGs)? Currently, where adequate refrigeration exists, inefficient cooling technologies produce significant levels of GHGs; in parts of the world where refrigeration technologies are not widespread, vast quantities of food spoil adding to waste and high-levels of GHGs from food production, processing, and transportation for food that never gets eaten.

With high climate and energy impacts from refrigeration and cold chains in the global food system, refrigeration systems can be a significant leverage point for climate change mitigation. Cold storage demands are increasing globally as food systems develop and intensify.

Historically there have been diverse efficient and ecological means of food refrigeration, including root cellars, icehouses, and spring water-cooled systems. With the rise of financially inexpensive but ecologically costly conventional refrigeration many of these techniques experienced declines in usage. Recently there has been a nascent resurgence of ecological cold storage systems, including subterranean storage and hybrid ecological/electric systems that use natural (outside) cold air intakes to incorporate existing cold winter air. These systems can represent an additional wedge toward reducing GHGs and mitigating climate change through using existing green technologies. This presentation reviews contemporary uses and benefits of alternative ecological refrigeration systems, including current examples, challenges, and future possibilities. This all is viewed within the lens of Jevons’ Paradox, because as efficiency is increasing, so too is overall refrigeration related energy consumption and greenhouse gas emissions, questioning the significance of the efficiency gains.

4.4 *Is Nuclear Energy a Replacement for Fossil Fuels?* | Sam Bliss | UVM

Burning fossil fuels for energy production is pushing global average temperatures toward thresholds that scientists predict will cause mayhem for the Earth system, including human societies. Can nuclear replace coal, oil, and gas?

Nuclear currently supplies about 2 percent of global energy consumption. Most projections, even from industry groups, foresee only modest growth in nuclear’s share of total energy use. The growth that would be required to displace fossil fuel energy substantially would involve enormous material costs and uncertain but estimable risks of disaster and weaponization. Nuclear was only ever economically feasible because it produced militarily useful byproducts for constructing bombs, according to some analyses. Long-lasting high-level radioactive waste and

decommissioning reactors present unforeseeable challenges and dangers as well. Uranium availability could also limit the scale of nuclear energy. Nuclear fission energy cannot easily power transportation and industry, the energy uses that are most dependent on fossil fuels. Even as a supplement to intermittent renewable energy, nuclear provides less utility than is often assumed in debates about decarbonizing energy supply. In practice, nuclear reactors are risky and difficult to shut on and off, and doing so lowers their net energy even further below that of fossil fuels. Whether through renewables, nuclear, or some combination of the two, transitioning away from fossil fuels makes a high-energy future less likely and more costly.

Luckily, huge co-benefits could come with reduced global energy use: slowed climate change, reduced pollution, progress toward escaping the unwinnable race for endless growth. The dream of cheap, limitless, “clean” energy may not be so desirable even if it were achievable. Humans increasing their power over nature has coincided with greater, not lesser, environmental damage, social hierarchy, and violence.

5.1 *The Southern Transition: International Development in the Anthropocene* | Alicia Richins | York

Situating ourselves in the Anthropocene, we as a global community are tasked with the still seemingly gargantuan feat of constraining and reconceiving of human systems to better fit the very real biophysical limits of the greater Earth system in which we live, alongside numerous other living and non-living species. Many have called this the Great Transition, from neoclassical economics to ecological economics, from self-centred individualism to care for community, from historical systems of oppression and inequality to those of justice and reconciliation. There has been a decades-long debate in the rich “developed” countries over the limits to growth and how it might be managed, as nature’s capacities to contain our physical and ethical wastes and sustain our untenable consumption of natural resources are persistently overshot. The argument has been that this self-constraint in the North is particularly needed to leave room for those countries systematically left behind in the quest for progress and development, to be able to grow and provide for the material well-being of their societies (i.e. catching up) before they too have to more seriously contend with the global situation of limits to growth. Now, however, we must face the fact that the space for leaving room has already been taken up in our failure as a global community to face the reality of a changing climate. Now the developing world must find a way to “develop”—to pull people out of poverty, to provide for the material wellbeing people, (not to mention their happiness and fulfillment), outside of the traditional development paths, and without the catalyst of growth that the North has had at their disposal since the Industrial Revolution.

Using the Greenhouse Development Rights (GDR) framework, I consider the implications of a right to development in the South in an increasingly climate constrained world. This literature review further explores alternative, anti- and post-development discourses arising out of these sites of previous colonization, including examples of emerging paradigms such as “Buen Vivir” in South America. The efficacy of “leapfrogging” innovations as a path through industrial development is assessed, especially with its implications for an ecological transition. It is my argument that both “the good life” and “development” need to be redefined by those themselves in pursuit of good lives, taking into account the right to improved livelihoods, and the existence of home-grown alternatives to the traditional development paradigm. Furthermore, it is observed that autonomous self-determination that seeks to break from the Western neoliberal framework overwhelmingly tends to be inherently ecological.

5.2 *Achieving Sustainable Livelihood in a Full World – Macroeconomic and Cultural Implications* Laura Gilbert | McGill

Neoclassical economics and capitalism require individuals to have steady paid employment to ensure their personal livelihood. One of the promises neoclassical economics and the growth paradigm is the eradication of unemployment. Even with the ever-increasing throughput and scale of the economy, growth has failed to provide full employment. Research shows that high unemployment in a population is correlated to increased mental distress, crime, mortality, and poor health. Unemployment is therefore an economic and a social problem. As we approach the limits to growth and we are forced to decrease energy and material throughput of the economy to fit within biophysical limits, we will no longer be able to push the growth agenda in an attempt to reach full employment. Also, the rise of mechanization and technological advances is decreasing the opportunities for low-skilled labor.

Given these constraints, this literature review will explore three themes to help achieve sustainable livelihood in developed nations. To begin, the concept of work sharing will be explored. This can be described as the reduction of the length of the average workweek and lowering the age for retirement to create more employment opportunities. This solution suggests that lowering the average workweek in developed nations by a few hours could increase productivity of the workers, and provide more employment opportunities. Although true in theory, small to medium enterprises could find it difficult to cover the fixed costs of hiring new employees and to provide enough working-hours for hiring more full-time employees. Furthermore, cultural and ethical norms in certain regions could make this transition difficult. Secondly, the macroeconomic implications of the implementation of a governmental Job Guarantee Program will be explored. In this scenario, the role of government, taxes, and money must be completely rethought. Government spending is financed through printing money instead of taxes and loans. Taxes are used to reduce the spending power of businesses and individuals. The Job Guarantee Program would provide transposable training and only produce real goods. Special measures would be taken to control inflation. This measure is unlikely to happen in the near future given the shift in economic thinking and planning required. Thirdly, ending the commodification of leisure time and relationships will help achieve sustainable livelihood in ways that employment alone cannot. The push in the early 20th century in the U.S. to make leisure time more good intensive and less time intensive continues today. This leads to less satisfying leisure that is overall less creative, active and personal. Ending the commodification of leisure will help maintain a low material and energy throughput of the economy, while ending the commodification of relationships will help built rebuild a sense of community.

To conclude, this literature review summarizes three tools to help achieve sustainable livelihood in developed nations. Although macroeconomic considerations are important, more research is needed to identify cultural and normative impediments to changes in current methods for securing livelihood.

5.3 *Just Distribution and Ecological Economics: The Role of Universal Basic Income* | Karan Kumar | McGill

Since the economic system cannot grow forever on a finite planet, the present generation must limit economic growth to ensure the well-being of the future generations. The problem is one cannot ethically tell poor people they must continue to suffer deprivation to ensure that the future generations do not suffer. If the pie must cease to grow, then we are ethically obliged to redistribute it.

Ecological Economics is based on three fundamental tenets: sustainable scale, just distribution and efficient allocation. In this literature review, the just distribution theme is taken up and the different approaches in achieving it are stated. In particular, there is discussion on Universal Basic Income(UBI) as a catalyst in achieving just distribution. Arguments in favor and against UBI are discussed as well in the review.

A chapter from India's most recent Economic Survey (2017-18) is reviewed as part of the summary. The survey discusses UBI from a social and economic perspective. However, the main contribution of the review is to highlight

UBI as a supplementary policy tool to address ecologically degrading activities. The core idea is how UBI can be an alternate to India's highly inefficient subsidy program addressing not only social and economic but also ecological concerns. To address these concerns, the complementary role of Pigouvian taxes/subsidies and a progressive income taxation is acknowledged. The summary concludes by discussing different roles of government, and emphasizing on its role as a trustee for future generations.

6.1 *Decolonize your Mind: The Role of Spirituality and Science in Ecological Economics* | Svenja Telle | UVM

Across cultures throughout the world for most of human history, "natural disasters", as they became known in English only during the latter part of the nineteenth century, were interpreted differently: namely, as a response to human wrongdoing on part of a supernatural powers. In this hermeneutic worldview, morality and materiality, social relations and natural phenomena, were understood to be interrelated, as described in indigenous traditions. Eventually, the emerge of natural science and classical economics changed this understanding, according to which the merely material realm of nature followed its own mechanistic principles that were entirely separate from human morality and social relations.

By the turn of the twenties century, these principals had become fully rationalized as natural disasters, which can be predicted and modeled through science. Today, science studies the history of everything, offering a way of making sense of our world and our role within it, purely based on western rational thinking. The cumulative result of scientific research is remarkable— a grand narrative of rational knowledge. But, can we create a new narrative that honors Nature as part of ourselves without any method to define the sacred, the myth and the spiritual dimension? Is it enough to rationalize humans interconnectedness or does it go beyond rational comprehension and needs to be experienced through rituals and ceremonies rather than through science alone? As Native Americans call it: ceremonies are the way we "remember to remember".

Surely, it is a challenge to define the worth of spiritual value of Nature without economic benefit and monetary value. The essential importance of a healthy spiritual connection to nature, place, community and culture is fundamental to the healthy function and well-being of both individual and society. Ecological economists have been grappling with how environmental problems require both new ways of understanding science and new ways of joining knowledge that is concerned with spiritual questions, beyond the realms of institutionalized religions. Therefore, it is essential to understand the role of ecological economics as a discipline in existing literature to serve as a linkage between the "spiritual" and "rational" approach to nature. As climate change continues to alter our planet, how can we use this monumental change as an opportunity for societal and spiritual transformation and which role does ecological economics play in this shift and how can EE help include spirituality in the western scientific narrative?

6.2 *Dismantling Colonialism: Ecological Economics as a Method of Decolonization* | Alayna Howard | UVM

This paper examines the intersection between colonialism and economics. Through literature review it provides insight into the colonial nature of the Western economic system and its role in the exploitation and displacement of indigenous peoples in North America. In recent decades, small steps toward decolonization have begun through reparations and the formal recognition of a select number of indigenous tribes. However, these efforts to make amends for acts of colonialism remain embedded in the neoclassical economic model, which is incompatible with decolonization.

Neoclassical economics is rooted in the concepts of individualism and materialism - these values are at odds with most indigenous cultures, which center around communal and sustainable living. Focusing on relationships to

land, the concept of property, and the treatment and use of natural resources, this paper considers some of the ways in which the values and cultures of indigenous peoples are incompatible with the neoclassical economic model. In contrast with the neoclassical economic model, there is much alignment between the ecological economic model and traditional indigenous ways of life. Ecological economics is built upon the principles of ecological sustainability, just distribution, and social equity. Through the pursuit of these principles, ecological economics has the potential to serve as an effective method for decolonization. However, these principles cannot flourish within the colonial systems that continue to dominate Western society. This paper considers the possibility that ecological economics could be a driving force for decolonization efforts in North America, and the barriers and challenges that stand in the way of that potential.

6.3 *Disrupting the Monoculture: Reverence for Traditional Knowledge in Ecological Economics* Molly Femes | York

This presentation will delve into narratives of traditional ecological knowledge (TEK) and its intersection with ecological economics. It will examine how these ways of thought overlap, where they diverge, and ultimately, what relationship they are able to have without threatening the sovereignty of non-dominant knowledge.

One way to secure a dominant paradigm is the denial of the “other”, the strong establishment of a monoculture. Western cultural dominance, through various mechanisms of oppression throughout history has enforced a monoculture that celebrates the dominance and mastery of humankind over its natural world in the name of progress. It has been supported by doctrines of private property, individuality, and modernity, and it denies those cultures that did not and do not support this value system.

As a formalized discipline, ecological economics emerged as a criticism within this system, an urgent call to act upon the disconnect between modern economics and the non-negotiable reality of thermodynamic laws and biospheric capacities. But it is still deeply entrenched within the dominant world from which it emerged. There have been calls to bring TEK or indigenous knowledge “into” the realm of ecological economics. Yet to do so falls into the same pattern of hundreds of years of colonial theft of knowledge, culture, language, land and labour. It becomes a process of legitimizing the “other’s” value system into the monoculture, distorting, warping, twisting and polishing it so that it fits into a more valid, acceptable framework.

The question then becomes one that rejects the dominant dualism (science vs. nature, win vs. lose) and makes the conscious decision to champion plurality. The diverse “other” TEK does not need to be recognized, validated, or developed. It is a science, a relationship, a way of living which exists in various forms all over the world, and will continue in strength and in truth whether it is acknowledged by the dominant paradigm or not. Yet the urgency of our Earth’s situation demands drastic action towards the end of the monoculture, and an awakening to these voices. In the context of this conference, as we dare to map out the future of ecological economics, how will we respond to such urgency?

7.1 *Social Multi-Criteria Evaluation for EcoHealth Assessment* | David Mallery | York

Ecological economists have long criticized the economic paradigm of value monism that privileges cost-benefit analysis (CBA) as the predominant approach to policy making and decision support. Issues relating to land-use planning, environmental management and sustainability are inherently complex, meaning that single descriptive domains (such as market performance) are insufficient to assess the desirability of proposed socioeconomic and/or socioecological configurations. Researchers within the fields of ecological economics, critical systems thinking, and ecohealth alike have argued that holistic, flexible approaches to policy analysis vis-a-vis multiple dimensions and criteria are required as alternatives or compliments to traditional cost-benefit analysis. Social multi-criteria evaluation (a form of multi-criteria decision analysis) has emerged as a promising alternative valuation scheme that is currently used within all three fields.

A common theme within the EE and ecohealth literature is the relevance of multiple criteria necessary to assess human health and wellbeing apart from traditional economic utility and welfare. Both fields are concerned with social and environmental determinants of health and wellbeing while stressing the human cost of economic growth and development. Given these common goals, one might ask why ecohealth and ecological economics research is not more thoroughly integrated. Doing so, I argue, would create an opportunity to promote transdisciplinary research while contributing to the robustness of analyses. To that end, this study provides a social multi-criteria evaluation (SMCE) and integrated analysis, based within the broader framework of the ecohealth approach, that assesses land-use scenarios within the Credit Valley Watershed in Ontario, Canada.

This study uses four criteria-categories within which performance indicators are selected: (1) Ecosystem Health, i.e. measures of structural and functional integrity derived through remote sensing and GIS data; (2) Ecosystem Services, i.e. provisional, regulating, supporting and cultural goods and services provided by ecosystems; (3) Human Health, i.e. ecosystem indicators of human health (e.g. PM 2.5, Ozone) compared against desirable benchmarks; and (4) Valuation, i.e. economic and social values of human health benefits of ecosystem services derived through benefit transfer methods and PROMETHEE II preference outranking methods.

Scenarios are illustrated and compared using a MOIR (multi-objective integrated representation) graphic tool similar to an amoeba diagram. However, by employing a post-normal science framework, this case study does not determine “optimal” scenarios, per se. Rather, the goal is to “sketch the anatomy of environmental conflict” (Silva-Macher & Farrell, 2014, p. 748) by revealing how preferences for specific scenarios are spatially or demographically distributed. In this way, the need for compromise between conflicting groups can be anticipated in the planning process.

7.2 *Hot Money, Speculation, and Food Security: Case Studies from Indonesia and Thailand* Sean Morris | UVM

Climate change and natural resource constraints pose a significant threat to the world agricultural productivity. Concern about the effects of these issues on commodity agricultural products (wheat, soy, cocoa, oats, corn) is especially merited in countries of the global south, where food represents a larger portion of expenditures and demand is less inelastic. While the issue of commodity food price volatility has traditionally been analyzed through equilibrium-based models, this presentation will discuss the role played by the increasingly consolidated international financial system in contributing to these market distortions. This presentation offers three case studies from late 1990's-era exchange rate crises in Thailand and Indonesia to examine the relationship between international capital flows, currency speculation, and food insecurity. Implications for domestic and international agricultural and monetary policies are discussed.

7.3 *Changing Regulations and Green Business Practices* | Doug Baxter | York

As suggested by Capra and Pauli (1995) changes towards a more sustainable future begin with changes to industry practices. The profit maximizing framework governing most firms in the current market economy can be explicitly linked to the degradation of the biosphere. As concern grows for future ecological stability we are beginning to see a focus on the implementation of increasingly strict policy regulations disincentivizing resource intensive activities, excessive waste, and pollution.

Environmental regulation is a method internalizing otherwise external costs, such as carbon emissions and resource waste, associated with the production of goods and services in firms. It typically does so by monetizing the associated environmental impact, or imposing restrictions which limit the number of externalities a firm can produce. While regulation is largely seen as beneficial for achieving sustainability goals, it is often criticized for having negative economic implications.

Formulated by Michael Porter in 1995, the 'Porter hypothesis' suggests that strict regulation, if implemented correctly, can benefit both economic and environmental goals. Porter hypothesizes that externalities represent lost opportunities for profit, and are primarily a bi-product of sub-optimal operating frameworks and business management practices. He suggests that the introduction of environmental regulation can provide incentive to firms to optimize their practices and processes to gain previously forgone financial benefits. This creates an environmental-economic 'win-win' scenario whereby impact on the environment is reduced and profits are increased simultaneously.

By conducting a literature review, this paper will explore the use of environmental regulation as a tactic for reducing industry contribution to the climate crisis. It will examine various test cases for the Porter hypothesis to elaborate on the effects of strict environmental regulations on firms. Finally, it will explore the concept of an environmental-economic 'win-win', achievable using environmental regulation.

7.4 *Evaluating Indicators to Assess Progress of Ecological Financial Planning Strategies for Sustainable Household Consumption* | Claire-Helene Hesse-Boutin | York

Household consumption expenditure represented 58% of global GDP in 2015, and has hovered between 40% and 70% of global and national GDPs since the 1960s. Households are also arguably the driver of private and public economic activity – the end consumer of firm activity are households and public and private organizations, at least rhetorically, serve households. As "ultimate beneficiary" of economic activity, this paper prioritizes the household as loci of consumption, driver of demand, and primary location of values formation. This paper will review the literature on methods of measuring household impacts on environmental degradation as well as reviewing indicators of how households influence distributive justice and macro-economic efficiency, within an ecological economics framework.

The objective of this review is to identify and select a methodology(ies) by which to evaluate the progress of utilizing the personal financial advisory relationship to influence more sustainable household consumption. This could also lead to bringing household lifestyles into alignment with the environmental, social and economic constraints of ecological economics. This paper will develop an evaluation matrix of impact methodologies and suggest an operationalization strategy for the collection, analysis and communication of data in the financial advisory relationship.