Canadian Society for Ecological Economics & Economics for the Anthropocene Conference

ECONOMIES IN AN AGE OF LIMITS: A TIME FOR (R)EVOLUTION!
(R)ÉVOLUTION ÉCONOMIQUE DANS UNE ÈRE DE RESSOURCES LIMITÉES

Abstract Book / Livre de résumés

SPECIAL SESSIONS / SESSION SPÉCIALES

THEME 1: BIOPHYSICAL LIMITS (OCT 21, 10:30 – 12:00)

An introduction to Ecological Economics: Biophysical Foundations

Chair: Farley, J. University of Vermont

Presentations

- Farley, J. University of Vermont. *Overview: Economics for a Finite Planet*
- Adams, A. University of Vermont. *Ecosystem Goods and Services: Core Concepts and Controversies*
- Dube,B. University of Vermont. *Energy and the laws of thermodynamics*
- Heese-Boutin, C.-H. York University. *Sustainable Scale: Weak vs. Strong Sustainability*
- Horen Greenford, D. Concordia University. *Ethics and climate change*

This symposium will present some of core concepts in ecological economics with a focus on its biophysical foundations. A second session will focus on the human subsystem. The intended audience is people interested in the field, but who have not studied it in depth. Specifically, this session will present the pre-analytical paradigm of the economy as a physical subsystem embedded in an evolving society which in turn is embedded in a complex, evolving and finite planetary ecosystem subject to the laws of physics and ecology. Low entropy energy is an essential input into all economic activity. The dominant source of energy in the modern economy is fossil fuels, which economic activities transform into high entropy heat, greenhouse gases and particulate matter. The global ecosystem is the source of raw materials, which the economic process transforms into economic products and ultimately low entropy waste, only some of which can be recycled. Ecosystems are formed from a particular configuration of raw materials and energy, and are capable of creating a flux of ecosystem services at a given rate over time. The extraction of raw materials and energy and the return of waste to the global ecosystem degrades global ecosystems and their capacity to generate life sustaining ecosystem services. A core concept in ecological economics is therefore sustainable scale, where scale is defined as the physical size of the economic subsystem relative to the ecosystem that contains and sustains it. The presenters are participants in the McGill-UVM-York graduate program in Economics for Anthropocene.

THEME 2: EQUITY, SOCIAL JUSTICE AND THE COMMONS (OCT 20, 13:30 – 14:45)

An Introduction to Ecological Economics: The Human Subsystem

Chair: Farley, J. University of Vermont

Presentations

- Farley, J. University of Vermont. *Brief Introduction to the Human Subsystem*
- Damiano, A. McGill University. *Economics, Ethics and Human Behavior*
- Bliss, S. UVM: Degrowth
- Ament,J. UVM: *The emerging field of ecological macroeconomics*
- Mallery, D. McGill University. *Transdisciplinarity, methodological pluralism and core concepts*
- Karim, A.*The role of other heterodox theories in ecological economics*

This symposium will present some of the core concepts in ecological economics with a focus on the human subsystem. Two of these presentations will take place in an earlier session that otherwise focuses on biophysical foundations. The intended audience is people interested in the field, but who have not studied it in depth. Presentations will cover the complex, evolutionary nature of the human subsystem, ethics and human behavior; the desirable ends of economic activities; achieving sustainable scale through growth; the role of democracy in an ecological economy; the role of other heterodox economic theories in ecological economics; the emerging field of ecological macro-economics, with a focus on monetary systems; and finally, transdisciplinarity and methodological pluralism compatible with the field's core assumptions. These presentations do not cover all core concepts in ecological economics, nor even all the most important ones. These sessions will be filmed and posted on-line. We will host similar sessions in future EE conferences, gradually building a video library that does include most of the core concepts in the field. The presenters are participants in the McGill-UVM-York graduate program in Economics for Anthropocene, and will present in the following order

Agriculture Nature and Communities (1) Managing Ecological and Economic complexity

Président : Dupras, J. Département des sciences naturelles, Institut des sciences de la forêt tempérée, Université du Québec en Outaouais

Présentateurs :

- Wood, S. Université du Québec en Outaouais. *One solution doesn't fit all: mapping ecosystem services for economically and ecologically efficient agro-environmental solutions.*
- Beaumont, M. Université du Québec en Outaouais. *Connectivité écologique des aménagements agro-fauniques : analyse de leur efficacité à maintenir la biodiversité animale dans l'agro-écosystème*
- Simard, C. Université du Québec en Outaouais. *Coûts privés et bénéfices sociaux des bandes riveraines boisées en milieu agricole: une solution efficace à la pollution de l'eau?*

L'intensification de l'agriculture dans le sud du Québec a entraîné plusieurs problèmes environnementaux tels que l'augmentation de la pollution de sources diffuses, l'eutrophisation des cours d'eau, la perte de couvert forestier et de biodiversité. Davantage, les conséquences environnementales de l'agriculture intensive, comme les bénéfices économiques qu'elle a pu entraîner, ont été répartis de façon inégale entre les utilisateurs des ressources en milieu agricole. Des programmes et des politiques ont été mis en place pour favoriser l'adoption de pratiques agro-environnementales qui améliorent la prestation de services écologiques envers la collectivité, mais avec des degrés de succès divers selon les contextes locaux.

Le programme de recherche ANCRAGE a pour but de mieux comprendre les pratiques agro-environnementales actuelles chez les agriculteurs du sud du Québec, et comment favoriser leur amélioration. Faisant usage du cadre des systèmes socio-écologiques, ce projet de recherche multidisciplinaire considère pleinement les caractéristiques locales des territoires où prennent place les activités agricoles intensives. L'objectif est d'analyser les pratiques agroenvironnementales et le contexte institutionnel qui les sous-tend, d'identifier les lacunes et les opportunités qui y sont liées et de proposer des solutions appropriées. De la sorte, ce projet de recherche vise une meilleure compréhension de la façon dont les ressources et les responsabilités devraient être distribuées dans les régions de production agricole intensive pour maximiser les pratiques agro-environnementales bénéfiques pour l'adaptation aux changements climatiques, le maintien de la biodiversité et la qualité de l'eau.

Cette session examine la performance socioéconomique et écologique de certaines pratiques agro-environnementales existantes et potentielles au Québec. Les questions abordées sont les suivantes : 1) comment mesurer les conséquences de la pollution

agricole et évaluer les bénéfices des infrastructures vertes comme les bandes riveraines en contexte d'agriculture intensive ? et 2) comment évaluer le potentiel des agriculteurs à adopter ces pratiques ? Lors de cette session, nous présenterons des outils afin de modéliser le potentiel d'adoption de divers scénarios de paiements pours services écosystémiques (PSE) basés sur des aménagements agro-environnementaux locaux. De plus, des évaluations écologiques d'un ensemble d'aménagements agro-environnementaux seront abordées, afin de mesurer la précision des modèles de distribution des espèces animales qui évoluent en milieu agricole. Finalement, nous présenterons des outils pour calculer les coûts de la mise en œuvre des systèmes agroforestiers comme les haies brise-vent selon certains paramètres clés comme les coûts de gestion.

THEME 2: EQUITY, SOCIAL JUSTICE AND THE COMMONS (OCT 20, 15:15 – 16:45)

Agriculture, Nature and Communities (2): An institutional analysis of agri-environmental programs in Eastern Canada

Chair : Bissonnette, J.F. Université du Québec en Outaouais.

Présentations :

- Kolinjivadi, V. Dr. Université du Québec en Outaouais. *Institutional analysis of the ALUS (Alternative Land Use Services) initiative on Prince Edward Island: Lessons for payments for ecosystem Services in Québec.*
- Zaga Mendez, A. Université du Québec en Outaouais. *Institutional and socioecological analysis of environmental schemes in Quebec: Focusing on Prime Vert Program.*
- Ouellet, F ; Mundler P. and Dupras, J. Faculté des Sciences de l'agriculture et de l'alimentation, Université Laval. *Réhabiliter les agroécosystèmes au-delà des politiques agricoles et environnementales ? Le cas des programmes ALUS en Ontario*.

Plusieurs acteurs gouvernementaux et non-gouvernementaux tentent d'induire des changements dans les pratiques agro-environnementales parmi les agriculteurs du sud du Québec. Certaines initiatives règlementaires adoptent une approche coercitive alors que d'autres cherchent plutôt à mobiliser les producteurs afin de les inciter à adopter de nouvelles pratiques volontairement, notamment par des programmes de PSE ou de compensation. Néanmoins, toutes ces initiatives tentent de favoriser les transformations institutionnelles, les institutions étant « des régularités durables de l'action humaine dans

des situations structurées par des règles, des normes et des stratégies partagées » (Crawford et Ostrom 1995: 582). Des facteurs institutionnels jouent un rôle important dans le succès de ces initiatives. Cette session aborde la question suivante : comment les initiatives qui cherchent à améliorer les pratiques agro-environnementales interagissent-elles avec les systèmes socio-écologiques locaux et les institutions qui les gouvernent ? Pour répondre à cette question, les participants se penchent sur le programme ALUS (Altenative Land Use Services) à l'Île-du-Prince-Edouard, en Ontario et le programme Prime-Vert au Québec.

Au Canada, l'adoption des Pratiques de Gestion Bénéfiques (PGB) au-delà de la mise aux normes est encouragée par des programmes appuyant des démarches volontaires, avec partage des coûts, impliquant une trentaine de PGB reconnues pour leur efficacité et leur popularité. Pourtant, globalement, les effets de ces mesures n'ont pas montré d'effets significatifs sur l'environnement (Kleijn & al., 2011) même s'il est admis qu'elles ont des effets positifs sur la biodiversité en matière de limitation des pertes (OCDE, 2011). Le taux d'adoption des PGB demeure relativement bas au pays, spécialement en ce qui concerne les milieux humides et la biodiversité (Sparling & Brethour, 2007). S'appuyant sur plusieurs auteurs, Ruiz (& al. 2014) observent que la participation se résume souvent aux agriculteurs déjà convaincus, que les agriculteurs n'adoptent pas les pratiques pour l'ensemble de leurs activités, et que la pérennité des engagements n'est pas assurée une fois le support financier terminé.

Basées sur le dialogue, la négociation et la concertation entre les parties prenantes, les approches collaboratives et participatives suscitent un intérêt grandissant dans le domaine de la gestion intégrée des ressources naturelles et de l'environnement (Conley et Moote, 2003 ; Red et al., 2008). Cet intérêt relève notamment du fait qu'elles sont perçues comme offrant la possibilité de renforcer à long terme les valeurs de protection de l'environnement dans la culture professionnelle agricole à travers l'engagement des agriculteurs dans un projet commun (Burton et Paragahawewa, 2011).

C'est dans ce contexte que sont apparues au Canada les initiatives Alternative Land Use Service (ALUS), d'abord au Manitoba en 2007, puis en Ontario en 2008, d'où le programme connaîtra un véritable succès, tant en matière d'adoption que de pérennité de l'engagement. Ce programme retient depuis de plus en plus l'intérêt des gestionnaires de l'environnement et des ressources naturelles par le changement de paradigme qu'il propose : démarche volontaire et gérée par les agriculteurs d'un même territoire, accompagnée d'un incitatif financier récurrent, visant à reconnaitre et valoriser le rôle actif et positif de l'agriculteur sur l'environnement, en opposition avec le modèle conventionnel de gestion centralisée et rigide, aux objectifs et aux solutions souvent mal adaptés aux réalités locales (MacRea et Abergel, 2012). La démarche ALUS est participative au sens où l'agriculteur est central dans l'élaboration de l'aménagement qui sera réalisé sur sa propriété ; elle est aussi collaborative au sens de la gouvernance du programme par la diversité des parties prenantes qui collaborent au sein de l'organe de gestion, le Partnership Advisory Committee (PAC), lequel est d'ailleurs contrôlé à majorité

par des agriculteurs. Le financement de ce programme requiert d'une part une participation gouvernementale par le biais des programmes environnementaux existants permettant d'implanter les aménagements sur les terres, et d'autre part, dans une plus grande proportion, le financement privé qui permet d'assurer la rétribution annuelle.

Notre communication visera à comprendre en quoi les spécificités du programme pourraient contribuer à l'adhésion pérenne des agriculteurs. En plus d'une analyse documentaire et d'une monographie locale, une quarantaine d'entrevues semi-dirigées avec des agriculteurs et des gestionnaires du programme ont été effectuée sur quatre des cinq communautés ALUS présentes en Ontario, permettant d'analyser la gouvernance du programme, les parties prenantes impliquées, les caractéristiques des participants, leurs motivations et la pérennité de leur engagement.

Academics as activists? Scientists' and the academy's role in social transformation.

Chair: Gobby, J. McGill University. Wironen, M. University of Vermont

Presenters:

- Temper, L. Autonomous University of Barcelona
- Brewer, R. University of Minnesota
- Erickson, J. University of Vermont
- Mendez, E. University of Vermont

Many academics dedicate their careers to understanding complex socio-ecological problems, although not all researchers see themselves or their colleagues as part of the solution or as agents of change. The past year has seen the election of President Trump, a politician who denies the scientific consensus on climate change, as well as the global March for Science. The engagement of scientists with policy and politics is receiving prominent media coverage and spurring heated debate within the scientific community about the role of scientists and researchers in advocating for social change. What is the role of academics in creating social change? How can and should academics engage? What are the risks of engaging?

Interventions range from public-oriented communication (e.g. journalism, documentary filmmaking), advocating for policy change, protest, action research, stakeholder forums, inspiring and mentoring a new generation of experts, collaboration and creative ventures with those outside of the academy, efforts to change the culture of the academy itself, as well as traditional academic work such as developing new technologies, methods, and

ideas. In this session, we ask participants to critically investigate their own role in enacting change in society. What are their different typologies of 'activist academics' and what are the benefits and drawbacks? What are concrete actions that we can take as experts to create positive change?

This session is designed specifically to address the last theme of the conference: *Pathways to Change: Tools and Strategies.* We propose this session for Sunday so as to draw on the 'problems and solutions' focus of previous days of the conference and really think about how to turn this work into real transformative change. We will do this by explicitly thinking through the role of scholars and researchers in making change.

Moderated 'Flash talk' Session (45 Minutes): During this first session in the workshop, 5 or 6 scholars who are actively working to make change in the world will present a "flash talk" presenting their approach. They will each be asked to speak for 4-5 minutes and then the moderator will ask the speakers questions designed to critically and collaboratively investigate the theme of the workshop: what is the role of scholars and researchers in making change? What are the risks and benefits of a given approach?

Break-out and Report Back session (45 minutes): This second session in the workshop will invite all present to participate in this discussion. We will form the participants into breakout groups (if attendance allows). Each group will be asked to focus on one of the approaches to change presented during the 'Flash Talk' session and each group will examine the impacts and barriers associated with that approach. At the end of the breakout session, group leaders will report back and the moderator will synthesize the key take-aways. In the end, we hope to have illuminated ways that scholars are actively making change in the world as well as having provided a space to critically reflect on how we can do this better.

From environmental law to ecological law

Panelists

- Garver, G. McGill University and Concordia University
- Burdon, P. Associate Professor at the Adelaide Law School.
- Derani, C. Federal University of Santa Catarina in Brazil.
- Maloney, M. Co-Founder/National Convenor of the Australian Earth Laws Alliance.

Just as ecological economics responds to shortcoming of environmental economics, ecological law seeks to overcome shortcomings of environmental law—both, with more rigorous incorporation of systems-based science. This session on the needed shift from environmental to ecological law is relevant to all of the themes of the 2017 CANSEE

conference, especially the themes of equity and justice and the commons, alternative movements and discources, and pathways to change. In the session, we will seek highlight outcomes from a workshop in Montreal, October 17-18, 2017, on the theme "From environmental to ecological law: An Anthropocene challenge." The workshop will bring together global leaders, emerging scholars and civil society representatives in ecological law and governance to consider what ecological law and governance means and how it builds on environmental law and governance to better respond to challenges in the Anthropocene, from the local to the global scale. These challenges are due primarily to humanity's failure to develop and implement normative regimes, such as law and governance, that keep ecological impacts of human use of material and energy within science-based ecological limits for long-term prosperity for humans and a broad diversity of other life.

The pre-CANSEE workshop is sponsored by the Law and Governance Initiative of the Economics for the Anthropocene (E4A) partnership (e4a-net.org) and the Ecological Law and Governance Association (ELGA – elga. world). Since 2014, E4A has engaged not only its 25 partners and more than 60 collaborators, but also a growing global community of interest around its core objectives. How law and governance can and should evolve to help keep ecological impacts of human use of material and energy within ecological limits is a key question within this community. ELGA was established in 2016 as a new global network of environmental law institutions, scholars and practitioners promoting the shift from environmental law to ecological law. ELGA has identified 180 organizations and 700 individuals globally with interests connected to

ELGA's vision and mission. Drawing on these E4A and ELGA connections, the October 2017 workshop and its follow-up will bring together many of the most influential actors in the field of ecological law. The workshop will be organized around 3 themes :

1) The Problem: The need to move from environmental to ecological law
2) The Solution: A deep dive into the meaning of ecological law
3) Getting There: The challenge of the transition from environmental to ecological law.

It will close with a participatory session in which participants will develop and launch an ongoing initiative intended to put the concepts of ecological law and governance into practice.

The proposed special session will be a first step toward building on the results of the workshop by bringing the CANSEE community into the ongoing discussion of the role of law and governance in advancing core principles of ecological economics. Participants from the E4A-ELGA workshop will briefly highlight key points that emerged in regard to the three workshop themes and the participatory discussion, and then engage session participants in discussion of how to build on outcomes of the workshop.

The session will begin with 30 minutes of brief summaries of the pre-CANSEE law and governance workshop by four panellists, all of whom are on the Steering Committee of ELGA and also actively engaged in the E4A Law and Governance Research Initiative. Then, the panellists will engage session participants in a 60-minute discussion on how to build on results of the workshop.

THEME 3: ALTERNATIVE MOVEMENTS AND DISCOURSE (OCT 21, 9:45- 11:00)

Handbook on Growth and Sustainability Book Launch

Chair : Victor. P. York University

Presenters

- Dolter, B. & Victor P. *Introduction to the Handbook on Growth and Sustainability*
- Meadowcroft, J. *Sustainable development, limits and growth: Reflections on the conundrum*
- Haberl, H. *Land as a planetary boundary – a socioecological perspective*
- Fischer-Kowalski, M. *Growth and Sustainability in a Material World: The self-reinforcing Cycle of Population*
- Paez-Victor, M. *Questioning Sustainability in Latin America*

The Handbook on Growth and Sustainability assembles original contributions from influential authors who have helped to define our understanding of growth and sustainability. The Handbook also presents new contributions on topics such as degrowth, the debt-based financial system, cultural change, energy return on investment, shorter working hours and employment, and innovation and technology. This panel serve as the official book launch of the Handbook and will feature six contributors to the Handbook on Growth and Sustainability

The purpose of the Handbook is to contribute to the debate over whether economic growth is compatible with sustainability, and, if it is not, to recommend what can be done to achieve sustainability. The Handbook contains twenty-two chapters divided into five sections. In the first section, entitled 'What is Growth? What is Sustainability' contributors clarify terms and explore some of the history of the growth and sustainability debate. In the second section, 'Is Growth Sustainable?' contributors present a range of perspectives on this important question. Some contributors answer yes, some answer no, and some say we focus too much on this question and should adopt an agnostic perspective. The third section, 'Is the End of Growth Nigh? Sustainability Constraints on Growth' features

contributors writing about the serious issues that threaten to constrain growth. These include issues such as energy scarcity, food system environmental impacts, and uncertain technological development. Contributors in section four, 'Are There Imperatives for Growth', outline the difficulty of moving away from a growth based economic system. Growth promises to alleviate unemployment and inequality. Our contributors explore whether these can be alleviated without growth. Our debt-based monetary system appears to depend on growth. Contributors explore whether debt-based money creates a monetary imperative for growth. In the final section, 'Is it Possible to Move Beyond Growth Culture?' our contributors ask what it would take for us to move away from a growth-based economic system. How would employment change? How would culture change? Would we make more of the products we use? Is it possible for humanity to plot a new course, or are we hamstrung by our biological inheritance and incapable of changing quickly enough to avoid calamity?

"Sustainable development, limits and growth: Reflections on the conundrum"- This chapter explores the linkages among sustainable development, limits and growth. It argues that sustainable development requires a shift in the societal development trajectory to pay attention both to environmental limits and to global equity. Only by appreciating the intimate linkages between environment and development will it be possible to open a pathway towards continued social advance while respecting the boundaries of local, regional and global ecosystems. Economic growth can contribute to sustainable development, but all 'growth' does not represent real social advance. In particular growth in physical pressures threatening global biodiversity and climate change must be brought under control.

"Land as a planetary boundary – a socioecological perspective"- Land is indispensable for crucial socioeconomic functions, including food and energy supply or infrastructure, as well as for biodiversity, carbon sequestration and many other vital ecosystem services. Even though the global land area is well known, the role of land as a planetary boundary is difficult to grasp. This chapter discusses how a focus on net primary production can help to better understand possible limitations resulting from the finiteness of productive land. Based on data and modelling related to the human appropriation of net primary production we demonstrate how human societies have managed to raise supply of land-based products by (1) taking more from ecosystems and (2) raising efficiency in converting plant growth into products and services. The chapter concludes that planetary boundaries related to the net primary production may be expanded by investing more work, energy, or human ingenuity, but doing so is not without limitations and usually involves tradeoffs and costs such as higher environmental impacts that may increase the risk of transgressing other boundaries such as those of nitrogen, phosphorous, water or biodiversity.

"Growth and Sustainability in a Material World: The self-reinforcing Cycle of Population, GDP and Resource Use" - The goal of our chapter is a macro-scale discussion of growth: human, economic and material, and the positive feedback links between these macro

elements. A sustainability transition, we argue, must address the full spectrum of these macro forces, and do so with the awareness of the historical forces that have shaped them. We represent human society as feedback loops between economic activity (as measured by GDP), human population, and social metabolism (measured as physical flows). The nodes of this triangle are mutually reinforcing: economic growth is in part driven by population growth, larger populations require more resources, more resource use enables greater economic investment and activity. We analyse these feedbacks quantitatively, globally and on regional levels. We find that the self-reinforcing power of these relations has gradually become weaker. If the system is not as self-amplifying any more, it equally might not be as self-diminishing. Thus, for high income countries, no/low economic growth may no longer represent a systemic threat. But for them, the issue at stake is higher: the departure from their high fossil fuel use, as well as a reduction in the use of material resources, is not a matter of no/low growth, but of substantial degrowth, at least biophysically.

"Questioning Sustainability in Latin America"- The issues pertinent to climate change, environmental degradation and sustainability, have a global reach, however, the discourse surrounding it does not. There is a particular cultural and linguistic divide among the discourse of English-speaking environmentalists, scholars and activists and those that are Spanish- speaking, residing mostly in Latin America. The purpose of this chapter is to try to bridge this divide, by highlighting the many Latin American writers in this field who are in agreement in points of view of those in the North, but as well, demonstrate salient differences in the appraisal of key issues such as development, sustainability, progress, social justice, resource extraction and climate change.

THEME 3: ALTERNATIVE MOVEMENTS AND DISCOURSE (OCT 21, 11:15 -12:30)

Quel est l'avenir de la foresterie communautaire au Canada? Réflexion sur les modèles de gestion des ressources collectives.

Chair : Bissonnette, J.F. Université du Québec en Outaouais

Présentations

- Teitelbaum, S. Département de sociologie, Université de Montréal. *Foresterie communautaire et gouvernance autochtone au Québec: rapports historiques* et contemporains
- Blouin, D. Département des sciences du bois et de la forêt, Université Laval. *La forêt Hereford : une gouvernance forestière inspirée des forêts communautaires de la Yankee Forest*

- Bissonnette, J.F. Département des sciences sociales, Université du Québec en Outaouais. *Le modèle des forêts communautaires de la Nouvelle-Angleterre : Analyse du caractère polycentrique de la gouvernance*

Les chercheurs ont noté au cours des dernières années un regain d'intérêt pour la foresterie communautaire au sein de la société civile du Canada, ainsi qu'ailleurs dans le monde. Bien que le concept de foresterie communautaire désigne une grande diversité de modèles de gestion, il fait néanmoins référence à des initiatives dont l'objectif est de maximiser les bénéfices écologiques et socio-économiques des pratiques forestières pour les communautés locales. L'atteinte de cet objectif repose généralement sur le principe de la gouvernance participative, qui confère un rôle important aux membres d'une communauté, lesquels se voient en mesure d'influencer les normes de gestion, en fonction de leurs valeurs et de leurs besoins. À cet égard, la foresterie communautaire semble être à l'image des tentatives de démocratisation de la gestion des ressources naturelles de tenures publique et privée. Les modèles qui y sont associés connaissent des évolutions distinctes, mais ils nous renseignent sur les possibilités de la gestion de ressources forestières collectives, selon des approches territorialisées, qui visent à valoriser la multifonctionnalité et l'établissement d'un lien de confiance entre gestionnaires et utilisateurs des ressources.

Les initiatives de foresterie communautaire donnent lieu à un ensemble de pratiques et d'institutions que l'on peut conceptualiser comme des systèmes socio-écologiques, dans une perspective d'économie institutionnelle. Les études démontrent que les modes de participation, les cadres règlementaires et légaux, ainsi que les capacités locales sont déterminants pour développer une gouvernance adaptative qui puisse répondre adéquatement aux changements socioéconomiques ou écologiques dans les régions forestières. En considérant différentes expériences de gestion forestière au Canada et en faisant des comparaisons avec d'autrej juridictions, cette session a pour objectif d'analyser les contextes et les facteurs qui permettent le développement des initiatives de foresterie communautaire.

Certaines des questions auxquelles les participant(e)s tenteront de répondre sont les suivantes : quels sont les modèles de gestion qui permettent l'adaptabilité de la gouvernance et la résilience des systèmes socio-écologiques dans la gestion de ressources forestières collectives ? Comment concilier les objectifs de développement socioéconomique et la conservation des écosystèmes forestiers en contexte de foresterie communautaire ? Des débats persistent en ce qui a trait aux types de gouvernance qui donnent les meilleurs résultats dans la gestion des ressources forestières collectives, ou encore aux finalités qui devraient être poursuivies à travers de telles initiatives. En somme, les participant(e)s à cette session visent à faire le point sur différents projets de foresterie communautaire, ainsi que sur les typologies et les cadres d'analyse ou d'interprétation déployés pour dégager une compréhension générale de cas particuliers.

THEME 4: FINANCE, MARKETS AND ECOLOGICAL MACROECONOMICS (OCT 21, 13:45 – 15:15)

Reflections on Ecological Economics

Chair: Muller, F. Department of Economics Concordia University

Presenters:

- Brown, P.G. McGill University.
- Timmerman, P. York University.
- Victor, P. York University.
- Muller, F.G. Concordia University.

The publication of "Limits to Growth" (1972), focusing on various socio-economic issues, such as population growth, scale of production, pollution and resource constraints, gave a new impetus to "environmental economics", an appendix of mainstream neoclassical economics. However, in mainstream economics, ecological problems were considered as "market failures" to the "other-wise – allegedly – efficient market exchanges, which only require that the "prices have to be set correctly".

The various profound criticisms and frustrations with mainstream neoclassical economics gave rise to a new vision, namely "Ecological Economics (EE)". Most ecological economists view the emerging field of EE as an interdisciplinary and pluralistic discipline, which conceptionally could include all disciplines, reaching from philosophical to pure scientific concepts.

With the acceptance of ecological sustainable economic development as the overall goal, EE forced the academic community to address and revisit the "distributive question" and the "no-growth" issue. For several decades, it seems, that distributive and growth issues were suppressed within mainstream economics. Distribution, equity, fairness and growth-scale considerations take a high priority in the hierarchy of issues in EE. However, a reality check of conceptional contributions written by ecological economists about these topics reveals surprisingly that only a few and limited analytical treaties exist. The lack of investigative endeavor of these areas by ecological economists can be criticized.

The occupation with monetary evaluation of ecosystem and biodiversity services – another area of concern – lead to some reservations among ecological economists, because they could be considered as return to mainstream neoclassical economics.

In sum, EE is in many respects a very impressive success story about establishing a new paradigm of our socio-economic order. However, this "temporary" success is precarious and fragile, because our present capitalistic society is disintegrating due to internal contradictions: low growth, grotesque income inequality and weakening democratic institutions by replacing them with oligarchic neo-feudalism. All these factors together can and will challenge the implementation of national and international agenda. It seems, that sustainability can only be implemented and succeed, when – finally- EE also addresses the question of our future socio-economic order. We are too silent on this issue!

Écosystèmes et biodiversité : vers une intégration systématique de leur valeur dans les évaluations économiques

Présidente: Pineault, K. Économiste, Ouranos

Panélistes :

- He, J. Professeur, Département d'économie, Université de Sherbrooke
- Bertrand, C. Département des sciences naturelles, Université du Québec en Outaouais
- Nolet, J. Président, Coop Carbone, Montréal
- Scemama, P. IFREMER, France

En février dernier se tenait une réunion des ministres fédéraux, provinciaux et territoriaux responsables de la conservation, la faune et la biodiversité du Canada. À l'issue de cette réunion, ceux-ci ont reconnu par voie de communiqué l'importance de protéger les espèces menacées, la biodiversité et les écosystèmes. Le document fait état de leur volonté à intégrer les efforts de lutte aux changements climatiques et à la perte de biodiversité, et souligne la contribution des écosystèmes à la résilience climatique. La reconnaissance de la contribution essentielle du capital naturel semble gagner du terrain et le développement durable est sur toutes les lèvres. Cette contribution du capital naturel n'est toutefois pas considérée systématiquement dans les décisions qui l'affectent. Des outils méthodologiques permettent de quantifier les biens et services écosystémiques ainsi que leur valeur socio-économique. Ils évaluent la contribution des écosystèmes au bien-être et aux activités humaines. Connaître la valeur de cette contribution permet entre autres de l'intégrer dans les décisions qui affectent la pérennité des écosystèmes : projets publics et privés, décisions d'aménagement territorial, utilisation des ressources naturelles, lois et réglementations, etc.

Ces outils sont-ils suffisamment reconnus et utilisés dans l'évaluation de projets de la sphère publique et privée ? Quels sont les défis à leur intégration à plus large échelle ? Comment les résultats sont-ils compris et intégrés dans les décisions publiques ? Comment leur utilisation par les décideurs peut mener à une meilleure résilience climatique ? Quelles décisions de gouvernance pourraient contribuer à l'intégration plus large de la valeur des BSE? Dans un contexte mondialisé, comment intégrer les bénéfices globaux des écosystèmes dans la prise de décisions locales ? Un panel d'experts du domaine vous invitera à réfléchir avec eux à ces questions.

THEME 5 : PATHWAYS TO CHANGE : TOOLS AND STRATEGIES (OCT 22, 9:30– 10:45)

Reports from Participants in the Sustainability Network Environment & Economy Fellowship Program (SNEEF)

Chair: Bubelis, P Executive Director, Sustainability Network

Presenters:
SNEEF Fellows who are graduate students from the Faculty of Environmental Studies at York University and affiliated with an environmental NGO.

- Meikle. B. Freshwater Future. *Lake Erie Algae: Is Agricultural Policy Aligned with Government Policy?*
- Pathan, S. Friends of the Greenbelt Foundation. *Stormwater Management: The Battle Between Grey and Green Infrastructure in Mount Albert Ontario*
- Dusek, W. Toronto Region Conservation Authority. *Ecosystem Services, Natural Capital Valuation and TRCA Infrastructure Projects*
- Mackie, E. Toronto Region Conservation Authority. *Watershed Protection Through Ecosystem Services Assessments*

SNEEF is part of Sustainability Network's efforts to strengthen the economic literacy of environmental NGOs. During the summer of 2017, six York University FES graduate students from the Faculty for Environmental Studies at York University were matched with five Toronto area environmental NGOs for field placement research projects. Four of the six Fellows present their reflection here.

Lake Erie Algae: Is Agricultural Policy Aligned with Government Policy? - Algal blooms in Lake Erie basin have negative economic, social, recreational and ecological impacts including temporary lost access to drinking water sources. While much has been done so far to reduce agriculture's impact on water, this research looked at the alignment of agricultural policies with other Canadian and Ontario government policies that have reduced to some extent phosphorous loading. The research identified the acts and action

plans whereby Ontario and Canada have committed to protecting the Great Lakes, the concerns surrounding algal blooms and the ways in which agriculture contribute to them. A review the economic policy and financial incentive programs that farmers benefit from was also undertaken as there is concern that the impact of these funds is not being properly monitored. More engaging economic analysis of related payments to farmers and the monitoring of the environmental impact of these was hampered by an inability to access government and farm data. The research points to a need for greater cohesion between agricultural and environmental policies if commitments and targets to restoring Lake Erie are to be fulfilled.

Stormwater Management: The Battle Between Grey and Green Infrastructure in Mount Albert Ontario - The Town of East Gwillimbury wants to improve its stormwater management system and related infrastructure. The research focused on an economic feasibility analysis that compared the life-cycle cost of a stormwater management system that is built with the green infrastructure (e.g. rain gardens) and a conventional system (i.e. grey infrastructure/retention ponds) in Mount Albert, Ontario. The research also considered the feasibility of building a model for a specific community in the GTA Greenbelt but concluded that data is lacking. When data from other communities was examined, it was found that either green infrastructure or grey infrastructure can be cost effective based on the number of rain gardens and the low, medium, and high cost assumptions for both grey and green infrastructures. With high number of rain gardens and low-cost assumption, grey infrastructure is more economically feasible option for storm water management system and with medium and high cost assumption green infrastructure is the more economically feasible option. With low number of rain gardens, green infrastructure is more economically feasible option for all low, medium, and high cost assumptions.

Ecosystem Services, Natural Capital Valuation and TRCA Infrastructure Projects - Literature within the last five years was examined and an overview of the current theory was created including sections on translating theory into practice, valuation methods, decision-support tools, compensation protocols and models and recommendations specific to the TRCA. Valuation is unavoidable but it does not need to occur solely in economic terms and other methods of valuation can supplement economic valuation methods, or in certain cases, supplant it. Problems with the current theory include scale, scope and phase of the ecosystems service, relying on individual's perceptions and feedback to value services and translating valuation theory into practice. Several valuation approaches (revealed-preference, stated-preference, cost-based and benefit transfer) and their resultant methodologies were examined to demonstrate several ways that ecosystem services can be economically valued. The research also considered the decision-support tools and models (InVEST, ARIES, and LUCI) that aid ecosystem service and natural capital valuation.

Watershed Protection Through Ecosystem Services Assessments- TRCA is looking to incorporate Ecosystem Service (ES) assessments into an emerging watershed

management framework. The research examined various ES assessments and demonstrated that the protection and restoration of green space is economically beneficial, and thus supported the move by cities towards sustainable development and green infrastructure. In a few cases, ES assessments indicated their research helped protect and restore green space during urban development. When ES assessments faltered, stakeholders often failed to understand the value of the local ecosystem goods and services and thus did not necessarily link natural areas and their personal well-being. A few times, development incorporating green infrastructure occurred in part due to the findings of an ES assessment. ES assessments often consider the value of green infrastructure over grey infrastructure for flood mitigation (eg. constructed wetlands or bioswales) though sometimes in combination with grey infrastructure. Although ES assessments are commonplace in many regions, few are utilized in the larger realm of city planning to help protect and restore natural areas which provide essential goods and services.

Uprooting Our Path by Way of Discourse

Chair: Kish, K. University of Waterloo, School of Environment, Resources, and Sustainability

Panelists:
All panelists are from the University of Waterloo, School of Environment, Resources, and Sustainability

- Davy. K.
- Kish, K.
- McCarthy, D.
- Quilley, S.
- Ruttonsha, P.
- Zywert, K.

Enabling new social commitments for sustainability will entail translating ideas into action, at both local and global levels. But ideas, in and of themselves, are neither politically neutral, nor detached from the contexts in which they emerge. These ideas come to inform political, social, and activist discourses. A discourse is “a shared way of apprehending the world. Embedded in language, it enables those who subscribe to it to interpret bits of information and put them together into coherent stories” (Dryzek 2005, 9). In this workshop, we will explore a range of alternative discourses that can lead us towards sustainable futures (such as forms of ecological consciousness, techno-efficiency solutions, and de-growth approaches), as they are evoked by various counter-cultural movements, grassroots community initiatives, eco-spiritual practices, currents of socio-eco-technological innovation, environmental policies, and systems theories. In doing so, we will ask the question, *what kinds of futures do each of these discourses inform and*

oblige, and are these options complementary or disconnected? Specifically, we are interested in how each discourse can take effect in different contexts, and at varying scales, and what this means for pathways of systems change.

We will begin the workshop by presenting a discourse map, which examines each of their origins, evolution over time, and points of intersection. Participants will engage in a facilitated discussion about how these, or other discourses they may have encountered, resonate with their own work, and play out at different types and levels of action. To follow, attendees will gather in small groups to apply these discourses in problem solving around specific contemporary Canadian environmental and social justice issues. For example, these might include consideration of how to address economic development in the context of unemployment, anthropogenic climate change, environmental justice, or health at community and municipal scales. To conclude, groups will come together to contemplate the opportunities and barriers that emerge when discourses intersect within the hypothetical scenarios examined.

THEME 5: PATHWAYS TO CHANGE : TOOLS AND STRATEGIES (OCT 22, 11:00– 12:15)

Exploring Political Rigour in Transformations Research

Chair:

- Temper, L. Institute of Environmental Sciences and Technology, Autonomous. University of Barcelona,
- Weber, L. McGill University, Department of History and Classical Studies

The role of science and knowledge production itself is at a cross-roads, as societal transformation calls for challenging dominant forms of knowledge production and the established protocols and discourses that have contributed to marginalizing other ways of knowing. This has led to a questioning of our scientific roles and the tools of scientific enquiry available to meet societal challenges and increased interest in engaged, post-normal, activist and transgressive approaches to science. This session explores what an emerging transformative knowledge paradigm may look like and how such an approach can combine both academic and what we term “political rigour”. It engages participants to firstly reflect on their own roles as researchers/activists/social actors and to enlist their input into what a ‘political rigour’ framework could entail, including identifying key methodological and theoretical recommendations, through art-based methods, creative role-playing and group discussions.

After a short introduction from the facilitators to explain the session aims and format, with some background on the concept ‘political rigour’ and the ‘tarot deck of transformative and transgressive researchers’ developed in a recent paper, participants

will creatively design their own tarot researcher character through a reflexive process, elaborating a description and key values they believe this researcher would bring to a politically rigorous research process. We will then divide the participants into small groups, in which they will use their tarot character along with characters already developed by the presenters to role-play and troubleshoot within one area of the research process while taking notes on large note boards. Relevant areas to explore may include: processes of consent, security implications, philosophy of science informing research, position and relations with co-researchers and participants, dissemination of results, alternative metrics for assessing research impact, etc. We will then have a quick report back to discuss points raised by each group.

Participants will be able to take home their designed tarot card, if they wish, and results will help inform the development of a potential political rigour assessment tool and framework for transformations research.

This session draws from collaborative work between the ACKnowl-EJ (Academic-Activist Co-Production of Knowledge for Environmental Justice) and the T- Learning Network (Transgressive Social Learning for Social-Ecological Sustainability in Times of Climate Change) on the development of a 'tarot deck' of transformative and transgressive research. This session aims to integrate perspectives from feminist scholarship, indigenous and decolonizing methodologies, queer theory and anti-oppressive research, as well as personal experiences of participants, to further examine what transformations research attendant to power relations and change-making can look like in practice and how it can inform ecological economics.

Comment éviter une perte de milieux humides au Québec? Une analyse des enjeux économiques, écologiques et légaux.

Présidente :
Charlène Kermagoret, Département des sciences naturelles, Université du Québec en Outaouais

Présentateurs :

* Pierre Scemama, IFREMER – UMR AMURE
* Charles-Hubert Born, Faculté de droit et de criminologie, Université catholique de Louvain
* Caroline Roberge, Faculté de droit, Université Laval
* Jie He, Département d'économique, Université de Sherbrooke

Ces dernières années, les pertes de milieux humides (MH) et des nombreux services écosystémiques (SE) qu'ils nous rendent suscitent une grande attention dans plusieurs pays. À l'échelle locale, les MH fournissent des SE tels que la protection contre les tempêtes et les inondations, l'approvisionnement en eau, les activités de chasse, de pêche et de loisir. À l'échelle globale, certains de ces milieux sont importants pour la régulation du climat, en raison de leur importante capacité de stockage du carbone. La littérature révèle que la valeur économique des SE des MH intacts dépasse les profits générés par l'exploitation de leurs ressources ou leur conversion. En outre, les coûts de remplacement des SE perdus, au profit d'infrastructures humaines, peuvent être beaucoup plus élevés que ceux que nécessite la protection des MH naturels.

De nombreuses juridictions utilisent la séquence d'atténuation (éviter, minimiser, compenser) pour protéger les MH et compenser les impacts négatifs résiduels des projets réalisés dans ces milieux, en exigeant la conservation, la création ou la restauration d'un milieu jugé «équivalent», en vertu de certains critères. Il existe toutefois un large consensus parmi les chercheurs, décideurs, ONG et promoteurs, selon lequel la première et la plus importante étape de la séquence d'atténuation, l'évitement, est souvent ignorée, avec peu ou pas de conséquences. De plus, plusieurs études ont montré que les lois et politiques n'étaient la plupart du temps pas efficaces pour assurer le retour des fonctions écologiques et de la biodiversité dans les MH créés ou restaurés pour compenser des pertes. La littérature révèle que cette situation est due, soit à l'absence de règles claires pour déterminer le type de compensation nécessaire, soit à l'inexistence de méthodes de suivi suffisantes et d'un contrôle adéquat des actions de compensation par les agences gouvernementales. Les études montrent que l'encadrement des systèmes de compensation, notamment des banques de compensation, est aussi à parfaire et que souvent, les mesures compensatoires entreprises ne répondent pas aux conditions des permis obtenus.

Au Canada, bien qu'une politique fédérale sur la conservation des terres humides existe depuis 1991, celle-ci n'est qu'un guide à l'intention des décideurs et ne s'applique qu'aux terres de la Couronne fédérale. Certaines provinces exigent l'application de la séquence d'atténuation, mais des résultats infructueux ont été rapportés, notamment en Alberta en Ontario. Au Québec, depuis 1988, les promoteurs doivent obtenir un certificat d'autorisation pour leurs projets dans un milieu humide (LQ, 1988, c 49). Depuis 2006, avant de délivrer un tel certificat, les autorités exigent le respect de la séquence d'atténuation. Elles l'ont d'abord requis en se fondant sur une directive ministérielle dont les dispositions sur la compensation ont été jugées illégales par les tribunaux pour le motif que seule une loi peut limiter l'exercice du droit de propriété. Une loi a par la suite été adoptée pour légaliser l'exigence de compensation mais prévoit qu'elle cessera d'être en vigueur dès que le législateur aura adopté une législation d'ensemble sur les MH dans la province (Loi 71; Loi 32).

La session spéciale s'inscrit dans un contexte où de nombreuses juridictions se sont données pour objectif de n'accepter aucune perte nette de MH et de biodiversité,

notamment l'Union européenne avec sa *Stratégie en matière de biodiversité à l'horizon 2020* et où des régimes juridiques étrangers et canadiens encadrant la séquence d'atténuation sont à parfaire. Dans le cadre de cette session, nous identifierons les raisons pour lesquelles l'évitement est souvent négligé dans le processus d'autorisation environnementale et pour quelles raisons l'application de certains mécanismes juridiques a échoué dans l'objectif d'aucune perte nette, alors que d'autres ont bien fonctionné. Nous aborderons cette question sous l'angle de la valeur économique des différents SE des MH, et les conditions de leur internalisation dans les outils de prise de décisions, de leur intégrité écologique et des perspectives légales associées. Nous comparerons aussi avec des études de cas de France et de Belgique.

Perspectives on Natural Capital and Ecosystem Services Valuation

Chair: Wironen, M.

Panelists:

- G Brown, P.
- Miller, E.
- Link, A.

The use of the concepts of Natural Capital and Ecosystems Services is widespread within this community of Ecological Economi**cs,** yet is not without controversy. While some consider these concepts extraordinarily useful in communicating with decision-makers and with mainstream society about the profound value of nature**,** others consider the evocation of these concepts to be reinforcing the problematic anthropocentric worldview which undergirds the very crises we face and thus may be counter-productive to our shared goals This debate within our community calls for us to address important questions about the technical and philosophical challenges around ecosystem valuation and this is what we seek to do in this special session. In this moderated panel discussion, we will bring together varying perspectives on these questions and will ask panelists and the audience to discuss the benefits and drawbacks of these concepts and reflect on their application in the spheres of academia, civil society, government and corporation. It is our hope that this dialogue will generate new insight in to how, we as a community of thinkers and change makers, to navigate the tensions inherent in these, promising yet problematic, concepts at the heart of ecological economics theory and practice.

PARALLEL SESSIONS/ SESSIONS PARALLÈLES

1. THEME 1: BIOPHYSICAL LIMITS (OCT 20, 10:30 – 12:00)

1.1. Matter and Energy flows

1.1.1. Biomass and Energy Metabolism of Canada, 1990 to 2011.

Toseef, A. University of Waterloo.
Singh, S. University of Waterloo.

Canada is ranked eighth, both as one of world's leading producer of food as well as consumer of world's total primary energy supply (TPES) i.e. 2%. In order to understand Canada's role in sustainable food production and energy security, it is important to analyze production, consumption and trade related to these flows. This research presents results from biomass and energy metabolism of Canada from 1990 – 2011 using the Material and Energy Flow Analysis (MEFA) approach consistent with Eurostat guidelines and methodology. For a full energy metabolism, we combine technical energy and biomass used as food and feed. We ask: i) how has the characteristic metabolic profile of Canada changed over time, ii) How does Canada compare to other nations such as US and EU-15 in terms of biomass and energy use? iii) Where are potentials for a sustainability transition in food and energy sector, and the role of a circular economy? Derived indicators calculated are: DE (Domestic Extraction), Imports, Exports, PTB (Physical Trade Balance), DEC for biomass (Domestic Energy Consumption), TPES for Technical Energy (Total Primary Energy Supply), DEC Intensity (DEC/Capita) and TPES Intensity (TPES/Capita). The study outlines relationship amongst the indicators and their importance towards the policy building in Canada for sustainable growth. Preliminary results indicate that Canada's biomass production (in tons) has not changed but imports and exports have grown by 150% and 40 % respectively between 1990 and 2011. Also Canada's food & feed energy and technical energy production has increased by 35% whereas imports and exports have doubled during the study period. However the per capita domestic energy consumption (DEC) has remained fairly constant.

1.1.2. Material and Energy Flow Analysis for the Region of Waterloo, Canada.

Senthilnayagam, A. University of Waterloo.
Singh, S. J. University of Waterloo.

To address global environmental challenges, resource use patterns at local and sub national scales can provide relevant insights into drivers and how these link to local policy and decision making. The Region of Waterloo is often referred to as "Canada's Silicon Valley" consists of the townships of Wellesley, Woolwich, Wilmot, and North Dumfries and the tri-cities of Kitchener, Cambridge and Waterloo. In close proximity to Toronto, and reputation of being the tech hub, Waterloo's

population (mainly from immigration) is on the rise and region is under rapid transition from a rural to an increasingly urban system being connected by rapid transit systems. To better understand the region from a systems perspective and to provide input into sustainability policies of the region, the concept of social metabolism is applied. Society's metabolism measures pressures on the environment where increasing throughput can have negative impacts on ecosystem and human health in the short and long term. Material and Energy Flow Analysis (MEFA) is conducted to calculate derived indicators of biomass and energy use for the Region of Waterloo in accordance with established conventions. Using a number of MEFA indicators, the paper will outline some of the major sustainability challenges in resource use patterns in the region since 2006. This study is the first to conduct a material and energy flow analysis for the Region of Waterloo in three points in time. Data on extraction, consumption, imports and exports of various biomass and energy flow indicators will be presented. Preliminary results suggest a slight reduction in per capita domestic extraction (DE) of biomass, from 2.42 tons/per capita in 2006 to 1.91 tons/per capita in 2016, the per capita domestic material consumption (DMC) is on the rise from 1.72 tons/ per capita in 2006 to 1.93 tons/capita indicating high import dependency of the region of Waterloo. Similar trends are observed for Energy Flow Analysis. It is envisaged that this study will encourage discussions around food and energy security in the region.

1.1.3. Industrial transformation pathways of China and India and their implications

Fischer-Kowalski, M. Institute of Social Ecology. Alpen Adria University Vienna

In this contribution, we will make an effort to compare India and China, the two most populated countries of the world that may be expected to mold global future, in the long run. We utilize data bases built up in the course of our efforts at Long-Term Socioecological Research (LTSER), our analyses of the global course of energy transitions, and our more recent interest in the interrelation between energy transitions and social revolutions. We observe these two countries, given very different political and cultural traditions, to have taken an astonishingly similar course during the past three centuries in terms of their macro socio-ecological features. This time frame, depending on interpretation, covers two major socioecological transitions: the transition from biomass based, agrarian economies to fossil fuel based, industrial capitalist economies. It also covers, in essence, a transition beyond the fossil fuel based regime.
In 1700, as agrarian societies, the metabolic profile of China and India have been very similar (population size, urban share, standard of living): China had 140, India 165 million inhabitants, the urban share was 5-6%, and annual incomes were estimated at about 600 GK$.

- Up to the end of WWII, all of this remains largely unchanged, except for population growth: China grew slightly stronger, to a population of 530 million, while India has grown to 410 million.
- In both countries during that period, the standard of living has been declining, income not keeping up with population.
- But from about 1947 on, the development trajectories of India and China look very different. Why is this so, and what does that tell about the future?

Up to the mid-20th century, both countries had been trapped in the systemic link of land and labour characteristic for the agrarian socio-metabolic regime. What makes up this trap?

- Land is the principal source of energy. The EROEI of biomass is relatively low.

- Human labour is the principal source of mechanical work. From low EROEI follows high workloads and low surplus (low net energy returns beyond feeding the worker).
- A vicious cycle has evolved: high workloads in agriculture require children to help > high fertility > higher food demand > intensification of land use, more work/ha > even higher workload per person.
- Small elites / colonial masters (< 5% of the population) control the land, keep the workers on the land in personal dependency (servanthood, slavery) and use the surplus for their consumption.

In order to leave this trap and to take off towards an industrial transformation, three interlinked conditions must be fulfilled: (1) A new energy source with a higher EROEI than biomass: fossil fuels. This, in principle, frees human labour power from food production. (2) A liberation of people from personal dependence (servanthood, slavery…) on land and landlords, to be able to use their labour power on other activities. (3) A re-investment of the surplus generated into infrastructure development and further production (and not into elite or colonialist consumption). Conditions (2) and (3) usually require the political disempowerment of feudal and/or colonial masters. We will shortly describe how in India and China, such a political disempowerment has actually taken place in the late 1940s, in different radicality and with different development programmes – and different consequences for the future pathway.

1.1.4. The examination of Cuba form economy ecology

Lopez Bastida, E. Cienfuegos University. Cuba;
García Lorenzo, D. Cienfuegos University;
Cabello Eras Juan José Costa University Colombia

The Worldwide Fund for Nature (WWF) evaluate the progress of the countries toward Sustainable development (SD) using a combination of the Human Development Index (HDI) as a social indicator and the Ecological Footprint (EF). Your recent Live Planet report (2016) situated at Cuba inside the little countries near the sustainable quadrant with low ecological footprint with high Human Development Index. This researcher tries to give a clarification of the situation by analyzing economic, ecological, social and technological indicators during several years. It exposes the main concepts of the Economic and Social Model and the main transformations based in six axes: efficacious and socialist government and social integration; productive transformation and international insertion; Infrastructure; human potential, science, technology and invention; natural resources and environment, human development, justice and equity. Also the reports examines the sectors and variables keys for coming up the sustainable development and principles challenges and difficulties

1.1.5. The stock-flow-service nexus: new directions for Ecological Economics?

Haberl, H. Institute of Social Ecology. Alpen Adria University Vienna

Fundamental changes in the societal use of biophysical resources are required for a sustainability transformation. This includes, among others, zero carbon emissions from fossil fuels in the next decades, strategies for coping with limited deposits of exhaustible mineral resources such as

metals or phosphorous, and the establishment of a viable balance between the use of renewable resources and the maintenance of healthy, carbon-rich and biodiverse ecosystems. At the same time, goals such as eradicating poverty and hunger and establishing good education, sanitation, housing and health-care are key socioeconomic sustainability goals (e.g., the Sustainable Development Goals). Many scholars agree that a fundamental socioecological transformation encompassing far-reaching changes in socioeconomic and institutional structures is required to enable fundamental alterations of society's biophysical resource base while pursuing such development goals. Analyzing the stock-flow-service nexus will allow researchers to develop highly innovative indicators of eco-efficiency and open new research directions that will help to better understand biophysical foundations of transformations towards sustainability. Including material stocks will help to better understand the long-term drivers of resource use, including lock-in situations created by spatial structures (e.g. infrastructures, settlement patterns, or urban form), production capacities, or technologies, as it highlights both the resource requirements of building up the stocks, as well as the resource needs created by their usage (e.g. think of transportation infrastructures). Including services derived from certain stock/flow combinations will allow for a non-monetary representation of economic output, welfare and societal wellbeing. Hence we believe that the stock-flow-service nexus approach has the potential for inspiring new research directions for Ecological Economics. The presentation will be largely conceptual but will include examples from recent empirical research at the Institute of Social Ecology in Vienna.

1.2. Water resource management

1.2.1. Low phosphorus buffering capacity and long legacies in watersheds threaten water quality

Goyette, J. O. Département des sciences biologiques, Université de Montréal.
Maranger, R. Département des sciences biologiques, Université de Montréal
Bennett, E. Department of Natural Resource Sciences, McGill University.

Phosphorus impairment of surface waters remains a concern worldwide. Given the urgency to better manage landscapes for food production and water quality, it is crucial to increase our understanding of the long term dynamics of P storage and fate in watersheds. Here, we examine the capacity of watersheds to buffer P transfers to surface water and quantify the timescales involved with P legacies. To achieve this, we reconstructed 110 years of P fluxes in 23 watersheds that spanned a large gradient of P enrichment by synthesizing agricultural, urban and water quality datasets. Our analyses suggested that P was preferentially retained within watersheds until a threshold of 2.6 Tonnes P km-2 was reached. Beyond that point, P transfers to surface water increased drastically. This low threshold of watershed P buffering capacity was exceeded as early as in the 1920's in some of our watersheds. We also show that, with no more P surplus (balanced P inputs and outputs), ~1500-2000 years might be needed to deplete the anthropogenic P stocks that have built during the last century back to a level of low risk for P transfers to surface water. The study highlights the great influence of human activities on ecosystem functioning and provides important insights for the management of P at the watershed scale.

1.2.2. Circular Economy Perspective on the Water Footprint

Sauvé, S. Université de Montréal

The evaluation of the water footprint is a good step towards the evaluation of the circularity of water. The assessment of the whole life cycle of a product allows the quantification its actual consumption of water – including direct and indirect water usage as well as spoiled water through contamination. The circular economy seeks to conserve resources within loops that allow their conservation. The concepts of fractionation of water into blue (underground and surface water), green (rain water) and grey (contaminated water) need to integrate the circularity of the water to differentiate consumption that is in closed or closable loops from that which is open ended. For example, rain water should be renewable inasmuch as harvest does not cause negative impacts and prevent soil infiltration and plant growth. Surface water consumption should be acceptable if harvests maintain the water ecosystem and if the used water is returned to the water body without negative impacts. Underground water is expected to be for the most part non-circular, unless it is being replenished at a rate equal or higher than its withdrawal. The water footprint estimations must be adjusted to better integrate circular economy concepts and integrate qualitative concepts of whether it is circular and lessen the focus on quantitation of water consumption – it is not so much how many liters that matter but where does the water come from and wat happens afterwards.

1.2.3. Examination of the Environmental Kuznets Curve for water pollutants-A GMM based approach

Apra, S. University Grants Commission Research Scholar, Jamia Millia Islamia, India.
Shahid A. Dept of Economics ,Jamia Millia Islamia

This study examines the relationship between economic growth and water pollution in the context of India using the concept of Environmental Kuznets Curve (EKC) for India. Seemingly the inverted U-shaped Environmental Kuznets curve (EKC) demonstrates(pollution-income relationship) that initially the pollution and environmental degradation surpass the level of income per capita; however this trend reverses since at the higher income levels, economic growth initiates environmental upgrading. We have also examined the extended EKC model to analyse other factors leading to pollution of rivers in India. In this study, majorly five pollutants namely Biological oxygen demand(BOD),Chemical Oxygen Demand(COD),Dissolved Hydrogen Ions(pH), Total Coli form (TC) and Faecal Coli form (FC) were chosen to examine the state of rivers and to determine the relationship between economic growth and water quality.Most of the studies on EKC hypothesis use panel data technique for empirically estimating the results. The panel data technique is an improvement over simple regression of time series analysis or cross sectional analysis because we can control bias arising out of omission of variables without observing them and can have regression analysis with both spatial and inter -temporal dimension. Using a panel data set for 24 years (1990-2014) covering twelve major rivers passing through fifteen different states of India and one Union territory, Delhi we have applied both the Generalized Least Square (GLS) and Arellano-Bond Generalized Method of Moments (GMM A-B) econometric methods. The sixteen states out of twenty nine states were chosen because the study makes an attempt to have a cross sectional analysis from north to south with different socio-economic and biophysical characters. The reason why we have applied GMM because we aim at modeling individual dynamics. We are trying to look whether current pollution level can depend on past pollution level

because it might be the case that a state with higher level of pollution could be more polluted because of its previous or past years level of pollution. Another advantage of GMM estimator is that it tackles both cross sectional heterogeneity and endogenity in the data. The data for average value of BOD, COD, pH, TC,FC was calculated from the Water Quality Database- Monitoring of Indian National Aquatic Resources series (MINARS) published by Central Pollution Control Board (CPCB).The water quality data was taken from hundred of monitoring stations within a country. Following the study by Grossman and Krueger, 1995, logarithm of Total Coli form and Faecal Coli form was taken as these pollutants grow exponentially and the distribution is highly skewed. The study has also used the extended EKC model with explanatory variables like population density, literacy, consumption of fertilizer, livestock ,poverty, water temperature and environmental policy. We have introduced dummy for environmental policy variable most of the environmental policies were introduced after 1992.Hence the value 0 and 1 was used for pre 1992 and post 1992 respectively. We have modeled the water pollutants(each separately) as a function of net state domestic product at factor cost(NSDP), squared and cubic term of NSDP, other explanatory variables and lags of water pollutants for the extended model case.

1.2.4. The Long Shadow of Agricultural Commodity Production: Connecting Farm System, Nutrient Flows, Water Quality, and Regional Economic Contribution

Wironen, M. University of Vermont - Gund Institute for Ecological Economics .

Agriculture undergirds rural economies around the globe while also constituting one of the largest direct human impacts on nature. As international trade in agricultural goods expands, rural farms are integrating into global commodity markets and adopting modern production practices. The social, economic, and environmental impacts of this transformation are considerable and extend far beyond the farm. A case study from Vermont highlights the multi-level, multi-scale governance challenges that emerge when regions specialize in export-oriented agriculture, focusing specifically on the connection between farm system, nutrient flows, water pollution, and the regional economy.

We use material flow analysis to trace the movement of phosphorus through Vermont's agricultural economy, examining how the use of feed and fertilizer, animal technology, and crop production have evolved over a sixty-year period during which much of Vermont's agricultural output was exported. The research reveals the dependence of farmers on inputs produced outside Vermont, exposing farmers to volatility in both the cost of production and the price received for goods. It also demonstrates a mass-imbalance in phosphorus flows, with a net accumulation of phosphorus in Vermont's landscape due to trade. The imbalance is directly linked to acute water quality problems facing the state, which threaten livelihoods, property values, recreational assets, and the water supply for thousands of people residing in a transboundary watershed.

To improve water quality, the State of Vermont is mandated to reduce phosphorus losses from agriculture by more than 50%, which is difficult given phosphorus' role in agriculture. As a result, officials face a policy dilemma, perceiving acute tradeoffs between rural farm employment and environmental improvement. Due to the export-oriented nature of Vermont's agricultural sector, officials cannot internalize the environmental costs of food production without placing producers at a competitive disadvantage. This tradeoff – and the ensuing governance challenges – are mirrored in many agricultural exporting regions worldwide.

The material flow results are paired with a regional economic analysis to assess the comparative economic contribution and phosphorus balance of different dairy production systems. Vermont's dairy sector is dominated by high-input, high-output confinement systems that rely on imported feed as a major part of the herd's diet, representing an influx of phosphorus and an outflow of money from the regional economy. Conversely, the growing grass-based agroecological dairy sector relies less on imported feed as part of the herd's diet, producing less milk but receiving a higher price per unit.

An economic input-output model is adapted using farm-scale data to investigate the regional economic and phosphorus implications of a shift toward agroecological dairy. It is hypothesized that this shift could help reduce Vermont's phosphorus imbalance at no net cost to the regional economy, despite reducing milk production. This is due to the different spending patterns and multiplier effects associated with agroecological dairy compared with the conventional alternative. By pairing material flow and economic input-output analysis, this study points to new interventions to sustain rural economies, local food systems, and water quality.

1.3. Planetary boundaries and environmental thresholds

1.3.1. Relational Theory: A common theoretical framework for ecological economics and ecohealth practice

Mallery, D. York University

This paper discusses the strong affinity between ecological economics, ecohealth, and critical systems thinking in terms of methodological approaches and stated goals, and argues that the integration of these fields would improve robustness and relevance of analyses, as well as strengthening the scholarly community under within the broader realm of sustainability science. This paper proposes that relational theory, a branch of complex systems theory, offers a common theoretical framework that provides insights into: 1) the nature and limitations of analytical modelling, and; 2) the development of evolution of self-organizing, open systems, across hierarchical levels of scale. I discuss two central concepts from the mathematical biologist, Robert Rosen, central to relational theory: the modelling relation and the metabolism and repair (M-R) system.

The concept of the modelling relation concerns the ways in which living systems semiotically encode percepts of their environmental contexts into formal systems of inference necessary for anticipatory foresight. Due to Godel's Incompleteness Theorum, Rosen demonstrated that anticipatory models are necessarily subjective, and that complex systems cannot be understood within single descriptive domains (e.g. neoclassical economics or reductionist science). The concept establishes the limitations of objectivity in scientific analysis, and this paper discusses the implications of these ideas on both quantitative and qualitative analysis. The M-R system, by contrast, is an abstract, mathematical construct that illustrates Rosen's theory on the self-entailing nature of living systems. The relational view holds that living systems develop teleologically, informed by their particular semiotic models. The concept also challenges many theories of deterministic, successional development (e.g. Tainter's Collapse of Complex Societies

and Panarchy) and lends credence to possibility of steady state societies proposed by ecological economists.

This paper concluded by discussing how relational theory is already being applied explicitly within ecological economics through Giampietro and Mayumi's biophysical accounting methodology, Multi-scale Integrated Analysis of Societal and Ecosystem Metabolism, as well as implicitly through Bunch and Waltner-Toews' EcoHealth Approach for participatory action research. It is argued that the adoption of relational theory would enable new, holistic approaches for integrated quantitative and qualitative research within sustainability science.

1.3.2. The physical basis of service sector production: Examining the limits of decoupling

Crownshaw, T. McGill University, Department of Natural Resource Sciences
Greenford, D. Department of Geography, Planning and Environment, Concordia University

In this paper, we investigate the effect of including the factors of production — capital and labour — in the allocation of environmental impacts to economic sectors. We use Environmentally Extended-MultiRegional Input-Output (EE-MRIO) analysis, employed in the conventional demand-pull sense. We argue that this inclusion is necessary for a proper allocation methodology, due to the presence of induced effects, i.e. the direct and indirect effects of inputs that are conventionally deemed to be exogenous from the model. For labour, especially for industries where labour is highly paid, this is particularly important due to the predominance of household consumption in final demand. We utilize a process of closing the EE-MRIO model with respect to household final demand, in order to make labour endogenous. To our knowledge, closed environmentally-extended input-out models is not common practice, and our analysis therefore provides a novel account of the environmental burden of the global economy by industry. We employ the industry-by-industry EE-MRIO model from the EXIOBASE 2.0 project, which includes a global economy of 42 nations and 6 rest of world regions, 163 industries, and environmental extensions broken down into material (commoditized) inputs (46), natural (non-commodity) inputs (18), and environmental impacts (102). Wages by industry are also available in the EXIOBASE database. The study is conducted for a snapshot in time and all data is for the year 2007. Inclusion of dynamic capital formation is also discussed, but implementation is left to further inquiry. We also advance a holistic allocation method based on a shared responsibility model and an inclusive perspective of the ecological dimensions of economic sectors.

Our results reveal that the labour-intensive sectors are a significant hidden driver of ultimate environmental burdens. For selected environmental impacts relating to climate change, water consumption and land use, we find sectors involving administration and defense, social security, construction, education, health and social work, and manufacturing of heavy equipment to be major drivers of impacts. Similarly, we find the environmental burdens of agriculture, primary production and resource-intensive services to be largely overestimated by current methods. Finally, we carry out a brief case study of the technology industry in the United States to highlight flaws in the common narrative regarding expansion of the service sector as a response to today's economic-environmental problems via decoupling, i.e. economic growth without increasing environmental burden. Public administration and defense, and construction for example showed 20% and 19% increases in land use when labour is endogenous compared to when it is not; while forestry and logging, and cultivation of crops show reductions of 16% and 12%. Looking at

technology sector, we find that the computer-based technology industry accounts for 0.2% of contributions to global warming, and when labour is made endogenous, accounts for 1% — a five-fold increase.

1.3.3. Bringing planetary boundaries down to earth: biodiversity tipping points in Canada?

Morrisson, P. Ecoecoanalysis

Ecologists have recently raised the possibility of planetary thresholds that define a "safe operating space for humanity". If these thresholds are exceeded, the theory is that there is a risk of irreversible and abrupt environmental change. One of these nine boundaries relate to biodiversity loss. Originally framed in terms of rates of species extinctions, a set of alternative indicators for this threshold has been proposed emphasizing the loss of genetic diversity, the loss of functional diversity, and the conditions which push biomes over "tipping points". In order for such thresholds and indicators to be useful to management of human activities, an approach is needed to bring them down to a regional and local level and to make the risks more specific. In this paper, I examine the relationship between the planetary biodiversity boundary and the circumstances of biodiversity loss in Canada. Specifically, I address four questions:

1. What is the magnitude and distribution of biodiversity loss in Canada? This analysis draws on publicly available data and reports.
2. What are the risks associated with biodiversity loss in Canada? Given the focus on the biophysical aspects of the "safe operating space", I base this analysis on the provision of ecosystem goods and services flowing from other species. The risk assessment considers the ecological systems, the socio-economic systems, and the linkages between them.
3. Where are the risks associated with biodiversity loss greatest? I assess these risks in geographic terms, and in terms of the causal sequence leading to the supply of ecosystem goods and services.
4. Is there evidence for possible "tipping points" in the delivery of ecosystem goods and services resulting from biodiversity loss?

1.3.4. Assessing the environmental efficiencies of North-South e-waste trade: Lessons from the Israeli-Palestinian cross-border e-waste industry

Davis, JM. Memorial University of Newfoundland, Grenfell Campus

This article contrasts dominant themes in the e-waste literature that focus on the environmental harm of North-South e-waste trade to demonstrate the potential environmental efficiencies such as increased reuse, refurbishment and materials recovery. To do so, I draw on a systematic analysis of an informal e-waste hub in the West Bank that has built a local economy collecting and processing the bulk of Israeli e-waste. This analysis details information on the fate of Israeli e-waste (e.g. % of e-waste items refurbished vs. dismantled, valuable vs. non-valuable components) and compares how e-waste is managed in Israel vs. the West Bank to challenge conceptions of environmentally responsible e-waste management.

1.3.5. Conceptualizing the discourse on E-Waste

Fevrier, K. York UNIVERSITY

In industrialized societies where resource intensive mass production and high consumption are the norms, waste generation exceeds the ability of the physical environment and institutional structures to manage it safely, cheaply and equitably. This poses serious threats to the natural environment and the social fabric of society. Electronic waste which typically includes, obsolete computers, cellular phones, televisions, and many other outdated electronic devices is today one of the fastest growing waste streams globally. The production of electrical and electronic equipment (EEE) and its disposal as electronic waste (e-waste) or techno-trash is a value chain marked by extremes: oppressive and precarious working conditions, political unrest, human rights abuses as well as environmental and elevated health risks linked to exposure to highly toxic substances and other heavy metals. These extremes are experienced at the initial extractive and end-of-life recycling and disposal stages. The externalization of the social, economic, environmental and health costs of this global value chain is disproportionately carried by racialized bodies while substantive corporate financial benefits and consumptive value is accrued by western investors, consumers, and their governments and the rich working classes in the metropolitan centres in the Global North and South – a classic case of environmental racism which targets individuals of lower socioeconomic, racial, and political status. Apart from the immediate health and environmental risks, the existence of informal e-waste recycling and disposal economies particularly, in the Global South makes visible the harsh underside of global capitalism that hides stark inequalities of wealth and power as well as class, race and gender across and within nation states. While the transnational flow of capital and labour has been the focus of much academic discourse, often unnoticed and less talked about is the fact that corporations within these industrialized nations also outsource waste. In this paper, I challenge the foregone conclusions and normative notions of e-waste to analyze the role of society and culture in definitions of, attitudes towards, behaviors around and the materialities of waste.

1.4. A reflection on growth

1.4.1. Humanity's Killer Apps and Resourceship, or Why Scientists Should Learn to Stop Worrying about the Population Bomb and Love Economic Growth.

Desrochers, P. University of Toronto Mississauga
Szurmak, J. University of Toronto Mississauga

The fear that a growing population is rapidly depleting its finite store of natural resources while mercilessly wrecking its environment is probably as old as civilisation. Some scholars thus interpret the oldest surviving written story, The Epic of Gilgamesh, as a warning against the rapid deforestation of Mesopotamia nearly 5,000 years ago. More generally, concerns about demographic and economic growth-induced depletion of soils, minerals, and biomass resources; optimum population; decreasing returns; ecological balance and steady-state economics can be traced back at least as far thinkers such as Confucius, Plato and Aristotle.

Critics of this perspective have similarly come from various ideological backgrounds, be they followers of Marx and Engels who believed that scientific advances would overcome natural limits,

Catholics who opposed population control on (mostly, but not only) theological grounds, and free-market economists who, while believing in the virtues of scientific advances, believed that these should be guided by the price system rather than central planning. Common to most, however, was the notion that resources are created by the always renewable resource of the human intellect; that people don't buy resources, but services; and there are always new and better ways to do things.

It seems fair to say that the latter (perhaps best described as "resourceship") perspective has been vindicated over the past two centuries. For instance, we now live in a world where every indicator of human wellbeing, from life expectancy, income per capita, hunger, and infant mortality to child labour and education, has improved dramatically. And, even more amazingly, despite the fact that there are now over seven times more (and much wealthier) people than two centuries ago, we live on a planet that is increasingly greener and cleaner; where in many if not most places, wildlife is much more abundant than in the recent and even more distant past.

The resourceship perspective, however, remains mind-boggling in light of the obvious finiteness of the Earth. This paper will attempt to reframe it in a way that might be more intuitively appealing to biologists and other scientists who are skeptical of conventional economic arguments. Our key insight is that humans differ from other animal species in at least two significant ways that deliver both increased wealth and reduced environmental impact over time. First, humans have long engaged in "niche creation" through their mastery of fire and their continual (re)combination of existing technologies in new ways, in the process continually developing new technologies that created lesser problems than those that existed before. In other words, every new invention furnishes a new idea for potential combination with vast numbers of existing ideas, thus ensuring that humanity's capacity to generate new ideas is truly exponential. Second, humans are the only species that has elevated trading in physical goods to a way of life, thus ensuring an ever more efficient use of resources and lesser overall environmental impact through time and over geographical space. In other words, trade has long overcome local natural limits.

1.4.2. Care to wager again? An appraisal of Paul Ehrlich's counter-bet offer to Julian Simon and its implications for biophysical limits to economic growth

Szurmak, J. University of Toronto Mississauga.
Geloso, V. Free Market Institute, Texas Tech University.
Desrochers, P.Department of Geography, University of Toronto Mississauga.

What is the capacity of the Earth to support our economic activities? Are there ecological limits to human activity on our planet? Does the way in which humanity is facing these limits suggest its inability to curb its greed, even as it is being told the resources are finite, or does it, perhaps, reveal a certain unwillingness to give in to the pessimism of seeing its activity on Earth as part of a zero-sum game? Our presentation will grapple with these questions in depth as it examines the outcomes of the little-known second wager, proposed in 1995, by the population biologist Paul Ehrlich to the optimist economist Julian Simon.

While Paul Ehrlich may be best known for his 1968 book The Population Bomb, he is still active as a proponent of limits on human activities, be it in the reproductive sphere, or, more recently, in the productive sphere. His latest work has centered on advancing the hypothesis that species on Earth are entering a period of sixth extinction (Ceballos et al. 2015) caused by anthropogenic

climate change. Julian Simon, on the other hand, until his untimely death in 1998, had focused his work on proving and popularizing the idea that while physical resources may be finite on their own, their limits lose their significance when the dividends from human ingenuity, collaborative work and unfettered economic exchange are factored in (see Simon 1996, among others). In the arena of debating biophysical limits to growth, thus, Ehrlich and Simon have been the ideal opponents, highlighting the main points of the debate between the catastrophist approach and the optimistic approach to Earth's resources. Some of us may still, in fact, recall the focal point of their debate, the "first" 1980 Julian Simon – Paul Ehrlich bet. Since its conclusion in 1990, the Simon - Ehrlich bet on the relationship between resource availability and population/economic growth has inspired much interest in both the popular and scholarly literature. Less well known is the fact that in 1995 Ehrlich, along with climate scientist Stephen Schneider, offered Simon another wager on fifteen environmental indicators over the next decade. Simon refused this offer, arguing Ehrlich and Schneider's claims had no direct and objectively measurable connections to human welfare.

In this presentation, we will offer a comprehensive discussion and assessment of this little-known Ehrlich-Schneider proposal to Simon. Our main conclusion is that over the original ten years of the wager, the outcome is difficult to assess but long-term trends seem favourable to Simon's interpretation, thus shedding additional light on his rejection of biophysical limits to growth.

1.4.3. The impact of consumption on global warming in Brazil in the period 1995-2012: analysis of greenhouse gas emissions from the perspective of the vertically integrated sectors

Costa,L. Ministry of Planning, University of Brasilia and UniEuro - Centro Universitário Euro-Americano

One of the main consequences of economic activities is the emission of gases from both the burning of fossil fuels (such as carbon dioxide) and non-fossil processes (such as methane), which cause the greenhouse effect. In this paper we analyze the impact of consumption on the generation of greenhouse gases (GHG) in Brazil from 1995 to 2012 using the methodology of the vertically integrated sectors or subsystems proposed by Pasinetti (1973).This methodological choice was made because it allows not only to assign to each commodity the GHG generated by the necessary inputs for its production, but also the GHG generated in the production of the inputs necessary for the production of these inputs, and so on, accounting for the entire generation of GHG in the production of the commodity until consumption.

For the application of this methodology it was necessary to make compatible the inventories of GHG emissions and input-output matrices in Brazil for the period from 1995 to 2012. As a consequence, a series of GHG generation was obtained for each of the 14 sectors and subsystems for the 18 years of the series, in addition to the participation of each subsystem in each sector's GHG generation, as well as the participation of each sector in the GHG generation of each subsystem.

The results show that the sectors responsible for most of the GHG generation in Brazil in the period were the "Forestry", "Agriculture and livestock" and "Transport" sectors. These results suggest that policies to reduce the generation of GHGs directed at production should be prioritized in these sectors. On the other hand, the sub-systems responsible for most of the GHG generation were the subsystems "Food and beverage", "Commercial and other", "Forestry",

"Agriculture and livestock" and "Other industries". Policies to reduce GHG generation directed at consumption should be prioritized in these subsystems.

The results also show that GHG generation by the "Forestry" sector decreased significantly between 1995 and 2012. Meanwhile, GHG generation in the "Energy" and "Non-metallic" sectors increased significantly in the period.
On the other hand, the results also show that there was a significant reduction of GHG generation by the subsections "Forestry ", "Food and beverages", "Chemistry" and "Textile" between 1995 and 2012. In contrast, some subsystems had significant growth in generation of GHG in the period, in particular "Mineral" and "Energetic".The comparison between GHG generation by the sector and the corresponding subsystem provides a useful indication for the focus of public policy. Policies to reduce the generation of GHGs focused on production tend to be more effective for the "Metallurgy", "Transport", " Agriculture and livestock ", "Waste", "Forests" and, in particular, "Non metallic" sectors. Policies to reduce the generation of GHGs focused on consumption tend to be more effective for the subsystems: "Commercial and others", "Pulp and paper," "Other industries", "Textiles" and, mainly, "Food and beverages".

The article concludes by suggesting possible extensions to the research. The first suggestion is the deployment of the "Agriculture and livestock" sector or subsystem in "Agriculture" and "Livestock", given its significant participation of GHG generation, both in production and consumption, in the "Agriculture and livestock" sector or subsystem. The second suggestion is the analysis of some specific sectors or subsystems to analyze public policies for reduction in GHG generation. The third suggestion is the analysis of GHG generation using the methodology proposed in other countries and periods. Finally, the fourth suggestion is the application of the proposed methodology to analyze other inputs with environmental impact, such as the generation of energy or the use of water resources.

1.4.4. Managing without Growth 10 Years On

P. Victor. York University.

Managing without Growth: Slower by Design, not Disaster was published in 2007. In the tradition of numerous challenges to the growth paradigm, the book examined the emergence of economic growth as the primary economic policy objective, the limits to growth based on resource and environmental constraints, the dubious link between economic growth and happiness, the disappointments of economic growth, and the possibilities and policies for managing without growth in Canada. The book also explored related topics concerning the scale of the economy and the contribution of changes in the composition of GDP and choice of technology for reducing the environmental impacts of growth. It also looked at the increasingly inaccurate information conveyed by the prices generated and used by the economic system and on which its main performance measure, GDP, is based.
One of the distinguishing features of the book was the use of several system dynamics models. One of these, LowGrow a macroeconomic model of the Canadian economy, attracted considerable attention and was used and replicated by researchers in other countries. LowGrow was designed specifically to answer the question of whether it is possible to achieve and maintain full employment and an acceptable government debt to GDP ratio, and drastically reduce poverty and greenhouse gas emissions, in the absence of economic growth. A positive answer to this

question was welcome news to many who, for many different reasons, want to find an alternative to the growth paradigm.

Now, 10 years later, circumstances have changed. Economies were battered by the financial crisis of 2008 and are still in recovery. Growth rates have declined. Inequality has increased. Global environmental conditions have worsened and employment has become more precarious. Populations have continued to increase and migration has reached unprecedented levels. Degrowth, planetary boundaries, and the Anthropocene have entered the lexicon of ecological economics. It is time for a second edition of Managing without Growth and one is in preparation for publication in 2018. This presentation will provide a preview of the second edition, noting major changes from the first edition such as the inclusion of new information and the amplification of key arguments. In particular, I will describe LowGrow 2. While remaining true to its origins, this substantially revised and extended system dynamics model of Canada's macro economy provides further insights into the possibilities for managing without growth in advanced economies. Some preliminary scenarios derived from the model will be presented for discussion and feedback.

2. THEME 2: EQUITY, SOCIAL JUSTICE AND THE COMMONS (OCT 20, 13:30 – 14:45)

2.1. Intégrer le bien commun à la gestion des ressources.

2.1.1. Comptes des terres du Québec méridional

Uhde, S. Institut de la statistique du Québec
Maxime, K. Institut de la statistique du Québec

Présentement, aucune information officielle ne permet d'évaluer globalement et de façon cohérente l'évolution de la couverture terrestre dans le Québec méridional, afin de pouvoir apprécier des phénomènes tels que l'étalement urbain, « l'enfrichement » des terres agricoles ou l'enrésinement des forêts. Pourtant l'ampleur grandissante des changements subis par l'environnement met de plus en plus en évidence les liens d'interdépendance entre le capital naturel et le bien-être des populations humaines. Devant le resserrement des sphères environnementale et économique, la prise de décision éclairée devient tributaire d'une information environnementale et économique intégrée.

Le suivi de la couverture des terres selon un cadre de mesure compatible avec le Système de comptabilité nationale (SCN) est un premier pas vers l'obtention de statistiques environnementales et économiques intégrées. Les comptes des terres font partie du Système de comptabilité économique et environnementale (SCEE), ou comptes de l'environnement, qui offre un cadre statistique complet et cohérent pour la mesure du capital naturel en lien avec l'économie. L'objectif du projet qui sera présenté est de produire de la statistique pertinente, cohérente et intelligible sur les tendances récentes relatives à la couverture des terres en conformité avec les normes du SCEE.

Les comptes des terres du Québec méridional ont été construits à partir d'une méthodologie originale axée sur l'intégration de données spatiales existantes et sur l'analyse des changements de couverture terrestre. Les comptes des terres forment un système d'information géographique (SIG) basé sur les données du 3e et du 4e inventaire écoforestier, produites par la Direction des inventaires forestiers du Ministère des Forêts, de la Faune et des Parcs (MFFP). Un modèle décisionnel permet de classifier les données écoforestières selon la classification de la couverture terrestre du Québec, adaptée de la classification du SCEE, ce qui donne lieu à deux couches de couverture terrestre pour les années 1990 et les années 2000. Le croisement de ces deux couches permet de générer la couche des changements de couverture terrestre.

Or, l'évolution des définitions et des méthodes entre le 3e et le 4e inventaire écoforestier affecte la comparabilité des données. La couche des changements de couverture terrestre comprend des polygones de « faux changements » qui doivent être retranchés pour assurer la fiabilité des estimations de changement. L'approche adoptée consiste en l'application d'une série de méthodes pour valider si les polygones de la couche des changements représentent un changement réel de couverture terrestre. Ce traitement permet d'obtenir deux cartes cohérentes de couverture terrestre pour le sud du Québec à deux moments dans le temps.

Un système de grilles forme la structure spatiale et statistique des comptes des terres du Québec méridional. Les cellules d'une résolution de 50 m représentent les unités spatiales des comptes des terres. Le croisement de la grille et de chacune des deux couches de couverture terrestre permet de reporter l'information sous-jacente des couches à l'intérieur de chaque unité de la grille pour en extrapoler la couverture dominante. Ce sont les données de couverture dominante en début et en fin de période par unité de grille qui sont agrégées pour donner les superficies de couverture terrestre présentées dans les tableaux de résultats.

2.1.2. La monnaie locale, un cas biomimétique de la résilience économique

M. Angel. Université Externado de la Colombie

Le Zaquen est une monnaie sociale qui cherche à donner de la résilience économique à une région rurale de la Colombie. Les 2 prototypes de la monnaie ont intégré des principes de la nature pour guider son développement et constitue, en ce moment, un bel exemple de la rennaissance des valeurs amérindiens de l'Amérique du Sud dans les alternatives du développement économique pour les décenies à venir. À partir de la minga traditionnel, une communauté de paysants et de neo-rurales se sont lancé à essayer le premier prototype d'une monnaie locale au début de 2017 dans la région de Zaquenzipa, en Boyacá, Colombie, tout en ayant la nature comme guide pour créer un corps économicque commun: créer de la résilience, comprendre et appliquer la auto-regulation, croître à un rythme naturele de 4 à 7 %, grandir à partir de la base (from the bottom up), se auto-organiser et intégrer le développement à la croissance.

Dans un cadre de recherche-action où la chercheusse fait partie du processus, l'éxperience d'enregistrer le processus d'une communauté au même temps d'en faire partie, fait de cette raconte une clé pour comprendre un processus dès l'intérieur. Des requis clés et des contextes souhaitables doivent se prendre en compte pour faciliter telles processus économiques. Comment traiter les obstacles? comment écouter les movements de la communauté? comment garder les eaux engagés et courants? Des réflexions pour ceux qui veulent être des leaders dans la créations

des monnaies sociales et complémentaires. Le contexte latinoaméricain et des possibles pistes pour le contexte quebecois seront explorés également.
Donc, après une brève introduction aux monnaies sociales j'outiliserái cet exemple, pour comprendre la création des systèmes de vie durable dans ce moment de transitions et de décisions pour notre future. J'offrirai l'opportunité d'intéragir pendant la présentation pour rêver ensemble le monde économique qu'on veut sur la Terre. Voilà ce que je veux vous raconter.

2.1.3. Démarche volontaire de conservation sans mécanisme (direct) de compensation économique : le cas des baleines du Saint-Laurent et de l'industrie du transport maritime

Chion, C. Université du Québec en Outaouais (2) Michaud, R.GREMM; (3) Turgeon, S. Parcs Canada; (4) Ménard, N. Parcs Canada; (5) Parrott, L. UBC; (6) Lagrois, D. Université du Québec en Outaouais; (7) Dupras, J. Université du Québec en Outaouais.

Dans le contexte de la conservation des ressources naturelles, le choix d'approches volontaires est parfois considéré comme une alternative aux approches réglementaires. Les conditions de succès des approches volontaires en conservation, en l'absence de mécanismes de compensation monétaire, sont encore peu comprises. Cette présentation décrit d'abord la mise en place d'une démarche volontaire visant à rehausser la conservation des baleines dans le Saint-Laurent, les outils développés pour appuyer cette démarche, les résultats obtenus et finit avec une réflexion sur les facteurs de succès.

La pression exercée par la navigation marchande sur les baleines est un frein au rétablissement de plusieurs populations menacées à travers le monde, notamment dans l'estuaire du Saint-Laurent. Les interactions entre navires marchands et baleines sont susceptibles d'occasionner des collisions mortelles et de dégrader de façon critique la qualité de l'habitat acoustique, crucial pour la conduite d'activités vitales de plusieurs espèces. Dans le fleuve Saint-Laurent, ces menaces sont identifiées comme des limites au rétablissement de plusieurs espèces en péril telles que le rorqual bleu, le rorqual commun et le béluga du Saint-Laurent.

Dans le contexte de la réduction des risques de collisions mortelles entre navires marchands et baleines dans l'estuaire du Saint-Laurent, la démarche présentée s'est basée sur deux piliers : 1) le développement d'outils d'aide à la décision intégrant les meilleures données disponibles en lien avec la problématique des interactions entre navigation et baleines et 2) la constitution d'un groupe de travail multi-acteur disposé à collaborer sur la co-construction de scénarios réalistes de réduction des risques de collisions. Parmi les outils développés pour supporter ce processus multi-acteur, une équipe scientifique a mis sur pieds le modèle 3MTSim simulant les déplacements des mammifères marins et des navires marchands dans l'estuaire du Saint-Laurent. Cette plateforme a été conçue pour permettre d'évaluer des scénarios d'atténuation des risques de collisions co-construits par les membres du groupe de travail. Le groupe de travail a co-construit 10 scénarios qui ont été testés au moyen de 3MTSim sur la base des gains en conservation et des coûts pour l'industrie. Les recommandations émanant de ce processus itératif ont ainsi mené à la proposition d'un ensemble de mesures volontaires incluant une aire de ralentissement des navires, une zone à éviter ainsi qu'une route de navigation recommandée. Durant les 4 premières années de mise en œuvre des mesures volontaires, malgré leur caractère provisoire, la conformité a été très encourageante entraînant des gains significatifs en conservation. Le caractère volontaire des

mesures de conservation leur confère une flexibilité favorable à l'adoption d'un cadre de gestion adaptative par le groupe de travail. Cette flexibilité s'est matérialisée par plusieurs modifications des mesures de conservation au fil des ans, informées par des nouveaux résultats scientifiques et par des constats émanant du milieu maritime.

L'approche de concertation basée sur la participation active des parties prenantes à l'élaboration de mesures réalistes de rehaussement de la conservation a permis de bâtir un lieu d'échanges ouvert et transparent propice à la collaboration. Cette approche a permis d'intégrer dès le départ les contraintes opérationnelles et logistiques de l'industrie maritime dans les paramètres de recherche de solutions. Ces résultats encourageants ont été favorisés par l'implication active des pilotes experts de la Corporation du Saint-Laurent dont les services sont requis pour le transit dans une partie de la zone couverte par les mesures volontaires.

2.2. A transgenerational perspective on the commons

2.2.1. Rights on What is Left: An Axiomatic Discussion of Grandfathering

Laurent-Lucchetti, J. University of Geneva
Leroux, J. HEC Montreal

Allocating property rights on an open-access resource that has been freely exploited in the past is often problematic. In practice, involved agents typically rely on one of two competing principles to determine future allocation. The first principle, grandfathering, favors the status quo while the other one, historical accountability, is a corrective justice argument. Using a conceptual framework inspired from the axiomatic literature on claims problems, we examine formally the relationship between the two principle. In particular, we show that both principles are actually compatible as international climate negotiations make it sound. We then characterize allocation rules that correspond to extreme versions of the two principles. In particular, we show that sharing the remaining carbon budget in proportion to historical emissions---usually referred to as "the grandfathering rule"---is actually the most regressive sharing rule compatible with the grandfathering principle.

2.2.2. A liability approach to climate policy: A thought experiment

Billette de Villemeur, E. Université de Lille
Leroux, J. HEC Montreal

We observe that a Pigovian climate policy need not exact full payment of the social cost of carbon upon emission to yield optimal incentives. Following this insight, we propose the creation of a carbon liabilities market to address climate change. Each period, countries would be made liable for their share of responsibility in current climate damage. This yields first-best emissions patterns. Also, because liabilities could be traded like financial debt, it decentralizes the choice a discount rate as well as beliefs about the severity of the climate problem. From an informational standpoint, implementation relies only on realized harm and on the well documented emission history of countries, unlike a carbon tax or tradable permits scheme, which are based on a sum of discounted expected future marginal damage. We offer a discussion of the differences between a

liability scheme and a carbon tax along the dimensions of information, participation, commitment, intergenerational fairness, and exposure to risk.

2.2.3. Examining the missing feedback link in Environmental Kuznets Curve Hypothesis.

S. Apra, UGC Research Scholar, Jamia Millia Islamia,India
Prof. Shahid Ashraf, Prof Dept of Economics,Jamia Millia Islamia, New Delhi

In recent years various empirical studies have investigated and quantified the causal relationship between economic growth and environmental consumption and degradation through an empirical model so-called Environmental Kuznets Curve (EKC), currently applied to a range of pollutants. Seemingly the inverted U-shaped Environmental Kuznets curve (EKC) demonstrates(pollution-income relationship) that initially the pollution and environmental degradation surpass the level of income per capita; however this trend reverses since at the higher income levels, economic growth initiates environmental upgrading. There are few explanations for the inverted U shape of EKC;a)Scale Effect: Scale of production implies expanding production at given factor-input ratios, output mix, and state of technology. It is normally assumed that a 1% increase in scale results in a 1% increase in emissions. In short, as economy expands there is increase in environmental degradation. b)Composition Effect: Economies move from subsistence to more material and intensive patterns of agriculture towards industrialization and then to service sector. This development path is the result of capital accumulation and knowledge based economies. Study by (Ekins 1997) suggests that the i) composition effect adds to the scale effect that is it leads to environmental damage at a faster rate than income ii) the composition effect acts against but does not fully counteract the scale effect.c) Displacement effect: Economies undergo displacement effect in which there is an increased demand of environmental quality as a result of increased income.

However, what affect does increased environmental degradation has on growth is the missing feedback link which has not been addressed in the EKC hypothesis. This paper examines the missing feedback link in EKC hypothesis by examining the casual association between fossil fuel consumption, carbon dioxide emissions and economic growth for India. Fossil fuel consumption has been taken as a proxy of driver of economic growth here. The casual association between the aforementioned variables has been analyzed using six interventions namely 1) urban development for which urbanization has been taken proxy 2) industrial development for which industrial value added has been taken proxy 3) trade liberalization for which sum of exports and imports as a share of GDP has been taken as proxy 4)energy efficiency for which combustible energy waste has been taken as proxy and 5)financial development for which a)domestic credit to private sector and b)net foreign assets has been taken as proxies. The choice of interventions for this study has been done keeping in view the economic liberalization perspective of India. The main aim of the paper is to investigate the missing feedback link for Environmental Kuznets Curve Hypothesis after incorporating the intervening variables. The period of study is from 1971 to 2011 as it covers pre and post liberalization era in India. All the data has been taken from World Bank country level indicators.

Results and Implications: The results clearly show that without intervention, moving towards the short run, there exists unidirectional causal association from economic growth to Carbon emissions and carbon emissions to fossil fuel consumption(driver of economic growth). Since

fossil fuel consumption is also a driver of economic growth we can say that without intervention we can see the missing feedback link is being addressed in the EKC. However, with intervention, the missing feedback link is being addressed when financial development(domestic credit to private sector) and trade liberalization were taken as intervening variables.

2.2.4. The Economics of Essential Resources on a Finite and Unequal Planet

Farley, J. University of Vermont

If economics is to get one thing right, it must be the allocation of essential resources (ERs) such as food, energy, water, and ecosystem services, without which we cannot survive. Mainstream economics assumes that the price mechanism in a free market economy generates a general equilibrium in which the supply and demand for all market goods, services and factors of production are in balance. Economists claim that markets also maximize utility by allocating resources to those who value them most. But the price mechanism breaks down with ERs. Rising prices do little to reduce demand, unless expenditures on the ER account for a large share of budget. As we saw in the 2007-2008 and 2011-2012 food crises, doubling or tripling the price of staple grains had no measurable impact on consumption in the wealthy nations, while in poor countries where food expenditures often account for more than 50% of the household budget, it led to rioting, political turmoil, and an additional 40 million malnourished people. Markets weight preferences by purchasing power, and on an unequal planet, will allocate essential resources to those who need them least. Rising prices also do little to increase supply on a full planet, at least in the short run. Between 2005-2008, a 350% in increase in oil prices generated only a 4% in supply. It takes at least a growing season for food supply to respond to price increases, and increased food production comes with serious ecological costs. But people need food and energy every day. Even short disruptions in access can have profound and irreversible impacts for individuals and society.

Exacerbating the problem, inelastic demand and inelastic supply create perfect conditions for speculation, which contributed to the tripling of both grain and petroleum prices in the run up to the 2008 price crash. A small decrease in quantity or shift in demand for ERs, for example when the ethanol mandate increased demand for corn, leads to a large increase in price, which can attract speculators. If speculators hoard or otherwise withhold ERs from the market, prices will rise further, attracting more speculative demand in a positive feedback loop—the antithesis of market equilibrium. The resulting high prices will likely attract additional investments in supply, but with a time lag. American farmers in 2008 planted record amounts of corn, in many areas by plowing under conservation reserves, leading to a record dead zone in the Gulf of Mexico. The oil industry invested heavily in hydro-fracturing (fracking), with its accompanying ecological costs. As soon as they realize that new supplies are forthcoming, speculators will sell, driving prices rapidly downward, just as new supplies were about to do so anyway, causing prices to crash. Low prices may lead farmers to scale back production, paving the way for a food shortage and new price increase. Sunk fixed costs mean that the oil sector will keep producing even at a loss, which keeps costs low long enough for people to respond by purchasing energy intensive durables, such as large homes and gas guzzling cars, locking in future demand for energy even as their decreased investments decrease future supplies.

2.3. Contemporary Environmental Justice

2.3.1. Democracy, Redistribution, and Climate Justice

Perkins, E. Faculty of Environmental Studies, York University, Toronto, Canada

"Climate justice" researchers are developing indicators of vulnerability, surveying the extent of climate change-related inequities, and developing policy proposals to deal with them. Global and local economic inequality and poor income distribution underlie and drive the need for "climate justice". Climate change is thus motivating pressures for redistribution, within many countries and also globally. This paper discusses some of the forms such redistribution might take, such as using a carbon-tax-generated global climate fund to provide a basic income for all; building commons governance structures for air, water, intellectual property, energy, and other pillars of livelihoods and sustenance; and facilitating open labour markets to balance free flows of capital and allow humane migration as a "climate justice" response.

Participatory community-based programs for environmental education and climate change awareness, and climate justice organizing, can help lead to increased political engagement by socially-vulnerable people so that such changes are brought about democratically. This paper provides examples, relevant in both the global North and South, based on the author's work with NGOs and community groups in Mozambique, South Africa, Kenya, Brazil, and Canada. Watersheds and water management, indigenous traditions, and gender equity receive particular focus. While "climate justice" is a fairly recently-coined term and its definition is still under discussion, climate justice activists and theorists generally acknowledge that climate change builds on preexisting economic and social inequities to deliver a "double whammy" to the world's most vulnerable people. Already living in precarious circumstances due to a combination of factors – gender, ethnicity, geography, class, economic underdevelopment, global and local history, colonialism, etc. – the marginalized are also those most likely to bear the brunt of extreme weather events and the turbulence they cause, and to find themselves without the economic resources to buffer these shocks to their livelihoods. Climate justice activists are calling for global redistribution to address the "climate debt" owed by the rich. Statistics already show that women and the poor are disproportionately paying with their health and their lives due to climate change. Climate change, which is likely to increase income inequality, is thus exacerbating a long-standing global development crisis.

To the long history of economic development literature calling for financial redistribution to reduce poverty, on ethical and economic grounds, a new flurry of articles and books has recently added research on how inequity harms everyone – both rich and poor. Economic inequalities are in fact worsening, however, both within most nations and internationally; powerful interests are engaged in the perpetuation of inequality, and it is politically very difficult to counter these trends. The focus of this paper is on how climate change interacts with economic inequality, how climate justice requires economic redistribution, and how the politics of climate justice may help to build democratic movements for redistribution. Insofar as both climate change and worsening inequality are a function of global capitalism, redistribution may be seen as both reformist and revolutionary; my aim in this paper is to describe the relation between these two phenomena and to outline some practical political strategies which are emerging as part of movements toward redistribution and climate justice. These include a carbon tax-funded global basic income;

reinvigorated commons governance for subsistence needs; and open labour flows and humane migration.

2.3.2. Shaping Policy in the Anthropocene: Gender Justice as a Social, Economic & Ecological Challenge

Spencer, P. University of Vermont

Environmental pressures such as natural disasters, resource scarcity, and conflict related to climate change have emphasized the importance of considering social justice within its ecological context. Gender inequality is one type of injustice that has traditionally been addressed as a social matter, yet gendered divisions in bargaining power, mobility, and access to resources are exacerbated by environmental instability. One barrier to gender equity in the face of a changing climate is the mainstream economic paradigm, which promotes growth and individualism, often at the cost of environmental and social wellbeing. The issue of gender inequality in the Anthropocene, the proposed geological epoch highlighting human impact of earth systems, is explored here in three parts. The first section identifies opportunities for feminist and ecological economics to assimilate notions of justice in mainstream economic thought. The second considers dynamics of gender equality through an econometric analysis of macroeconomic effects of traditionally female-dominated unpaid care work. Finally, the third part investigates national progress toward the maternal mortality reduction target set in the United Nations' Millennium Development Goals and proposes a gendered perspective for the newly implemented Sustainable Development Goals. Finally, a conclusion is presented with a discussion of policy implications for national and international development institutions as they seek to improve gender equity in diverse social and ecological contexts.

2.3.3. Climate and capitalism: Indegenous and anti-capitalist struggles for climate justice

Karim, A. York University.

This presentation will review Indigenous struggles for self-determination influenced by recent social movements led by Indigenous Peoples in North America/Turtle Island (e.g. Standing Rock, Idle No More, land claims struggles, etc.). Indigenous scholars such as Glen Coulthard, Leanne Simpson, Lee Maracle, and Howard Adams have brought critical attention to dispossession as an ongoing feature of the reproduction of colonial and capitalist social relations that we must consider in our conceptualization(s) of climate justice. In addition, this presentation will briefly explore Indigenous, Marxist and ecological economist views on nature to think about the commonalities and tensions between these theoretical perspectives with the hope of seeing what 'Western' views can learn from Indigenous worldviews on the relations between land (and 'commons'), people, and all beings.

2.3.4. Unequal Natures: Unpacking environmental inequality and justice

Akbulut, B. Concordia University

Several lines of thought within ecological economics have long conceptualized and studied different forms of environmental inequality and justice. Issues that have been discussed within this context include the distribution of environmental goods and bads, various measures of environmental inequality (e.g. environmental gini), environmentally unequal exchange and ecological debt, and studies of environmental conflicts and justice.

Yet there are definite challenges and missing links within the study of inequality and justice within ecological economics. Mos environmental justice studies run into empirical challenges in delineating the structural relationship between socio-economic inequalities and environmental injustices. Empirical studies of environmental inequality indicators, on the other hand, suffer from setbacks due to the use of relatively narrow set of environmental inequality/justice definitions and concepts of environmental inequality that remain isolated from other dimensions of well-being. More broadly, there is an emerging awareness that we have a fairly good understanding of some forms of environmental inequality, but we know very little about others.

This presentation builds on the premise that environmental justice and inequality cannot easily be captured within single-measure frameworks and that they require a multi-dimensional approach. It thus aims to take a step towards nuancing the understanding of environmental inequality and justice, by focusing on four aspects in particular: (1) Collective action and environmental inequality: the role of expected justice in the distribution of costs and benefits of environmental collective action (2) Environmental movements: Contextual perceptions/assessments of justice as a (non)mobilizer and understandings of justice/inequality beyond material costs and benefits (3) Political economy of environmental inequality: Interaction of environmental inequality with structural forces (4) Labor, Time-Use and Gender: Inequality in contribution to regeneration/care/reproduction of environmental goods and services.

In doing so, the presentation makes use of both theoretical insights and empirical fieldwork findings from Turkey. It makes the case that nuancing environmental inequality/justice needs to build on a processual rather than an outcome-based perspective in order to better shed light on interacting inequalities and institutional mechanisms.

2.3.5. Anthropocentrism, Biocentrism and Ecocentrism: How does Inter-Species Justice relate to Inter- and Intra-Generational Justice?

G. Yahya-Haage. McGill University, Natural Resource Sciences department.

Ecological Justice is a vital component of Ecological Economics, usually separated into Intra-generational, Inter-generational and Inter-species justice. Much has been written on the first two aspects, but Inter-species justice remains largely unexplored. This paper explores three approaches in addressing Inter-species justice: An Anthropocentric Ecosystem Services (ES) framework, Biocentrism and Ecocentrism. All three, occasionally overlapping, worldviews strive to adequately protect nature and each addresses the three prongs of Ecological Justice.

The Anthropocentric ES approach remains the most conventional. Valuation categories like Existence Values are considered important in safeguarding ecosystems. Biocentrism and Ecocentrism, by extending value to nature beyond anthropocentric instrumental value, are potential 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 ecosystems, is a 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 links the three prongs of Ecological Justice.
First, by tackling the Convergence Hypothesis, this paper addresses the claim of the Anthropocentric ES 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 sentient 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 arguments put forth by Biocentrism on how to expand this individualistic framework to include Intra-generational and Inter-generational Ecological Justice. 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 when deciding the importance of different ecosystems. The implication of such thinking on biodiversity conservation is explored. The paper critiques various arguments outlining how value given to biotic collectives, like ecosystems, can be scaled down to the welfare of individual sentient beings, which are indirectly valued for supporting these collectives. In the end, by exploring Inter-species justice through case studies, this paper reveals the issues and controversies associated with attempts to link all three components of Ecological Justice.

THEME 2: EQUITY, SOCIAL JUSTICE AND THE COMMONS (OCT 20, 15:15 – 15:45)

2.4. The social distribution of positive and negative externalities

2.4.1. Individual preferences regarding environmental offset and welfare compensation: a choice experiment application to an offshore wind farm project

Kermagoret , C. Université du Québec en Outaouais, Institut des Sciences de la Forêt tempérée (2) LEVREL, Harold. Professor. UMR CIRED, AgroParisTech ; (3) CARLIER, Antoine. Researcher. DYNECO, Laboratoire d'Ecologie Benthique, IFREMER ; (4) DACHARY-BERNARD, Jeanne. Researcher. UR ADBX, IRSTEA.

Reconciling economic development and the protection of ecosystems is an important societal issue and, in this context, compensation appears as an important and useful public policy tool. Indeed, compensation principle aims to strike a very concrete balance between the different objectives of sustainable development. On the one hand, it would respect the objective of ecological no-net-loss, in accordance with the regulatory constraint; on the other hand, it would respect the principles of social and environmental justice for the impacted territory. Beyond these, it would allow the operator to increase the social acceptability of his project. An important scientific issue is the study of the mechanisms underlying the equivalence relationship between the losses inherent to the development project and the gains provided by the compensatory measures. This equivalence assumes the existence of commensurable values to define losses and gains. While the principle of compensation has strong theoretical frameworks for discussing this equivalence from both an economic and an ecological point of view, few empirical studies investigate how this equivalence is actually perceived by the stakeholders of the project.

This paper uses the choice experiment method to investigate the preferences of local communities with respect to various compensatory measures in connection with a development project. A survey was conducted among recreational users of the bay of Saint-Brieuc, where an offshore wind farm is currently planned. The goal is to identify the preferences of the bay's users with respect to various compensation possibilities: welfare compensation (monetary indemnification and investment in public assets) and environmental offset. Based on the existing literature, two assumptions are investigated: (i) the community's demand for compensation is expressed differently depending on the nature of the compensatory measures proposed, (ii) there is preference heterogeneity within the community, depending firstly on the cultural practice of individuals in the territory and secondly on the socioeconomic characteristics of the individuals concerned. Two multinomial logit (MNL) models and a latent class (LC) model are used to explore the preferences and some sources of heterogeneity within the community.

The results of this study show that form of compensation is an important determinant of preferences and has an effect on the acceptability towards the compensation principle. These results overpass the specific case study of the bay of Saint-Brieuc since they are consistent and enrich some assumptions already advanced in the literature. They provide general elements about the understanding of individual preferences and motivations in the context of a development project. More precisely, two strong results have been identified. The first concerns the acceptability of compensation if it obeys the principle of strong sustainability, which includes ecological restoration for the gain of the population as a whole and which excludes monetary transactions, associated with the bribe effect. The second concerns the naturalists' specific attitude towards the principle of compensation. For these respondents, compensation has to take the form of an ecological action. In the best way, these measures should be determined within a regulatory framework, one which imposes biodiversity offset related to objectively determined ecological impacts which could not otherwise have been avoided and/or minimised. Moreover, specific individual responses to follow-up questions indicate that the heritage value influences the respondents' attitudes.

2.4.2. Modern irrigation double edge: Farmers' vulnerability through the lens of legitimacy and equity

Albizua, A. Basque Centre for Climate Change (BC3) and McGill University. (2) Corbera, Esteve. Senior Researcher. Universitat Autònoma de Barcelona (Spain) (3) Pascual, Unai. Ikerbasque Research Professor. Basque Centre for Climate Change (BC3)

The Itoiz-Canal de Navarra modern irrigation project increases farmers' water consumption control at the expense of them becoming more dependent on nested enterprises that control irrigation water, which might be translated as an overall increase in farmers' vulnerability due to their decreases in adaptive capacity. In relation to the legitimacy of modern irrigation introduction in the area and the distribution of natural resources and project-related information, this chapter has demonstrated that small-landholders (elderly, retired or multi-income farmers) have been partially excluded from the decision-making process of introducing modern irrigation. Consequently, land is being transferred to larger-scale intensive farmers along with the privatisation of farmers' previous water-use rights, which is increasingly controlled by the state.

Intensive farmers' adaptive capacity to climate and market fluctuations, cannot therefore be characterised as successful because it is affecting the ability of other farmer typologies, i.e. it is increasing the vulnerability of small-scale diversified farmers. For this reason, modern irrigation may be interpreted as a mal-adaptation. This chapter has also shown that within the context of rapid economic growth and global economic integration, the current agricultural transformation pathways create new vulnerabilities in populations that are either excluded from such growth, or whose economic activities suffer as a consequence of such globalising trends.

2.4.3. Economics in ecosystem accounting: challenges and opportunities

Alam, M. The Betty and Gordon Moore Center for Science – Conservation International

Ecosystem accounting approach addresses gaps in the current System of Environmental-Economic Accounting (SEEA) framework to describe interactions between ecosystems and the economy by linking ecosystem service flows to beneficiaries. Experimental approaches were piloted to trial ecosystem accounting in Peru and Liberia to field-test state-of-the-art theories and methods on quantification and monetary valuation of service flows from natural ecosystems. Within a larger set of accounts, the "ecosystem services supply and use account" records ecosystem services flows from the ecosystem (i.e., its supply) to beneficiaries (i.e., its use). A significant amount of challenges remained in terms of methodology and application. Mitigating those challenges require a better understanding of the ecosystem structure–processes–services relationship, as well as development of new techniques consistent with national accounting systems.

2.4.4. Environmental and Social Impacts of Tin Mining and Oil Palm Development in Bangka Island of Indonesia.

Wada, Y . Doshisha University, Faculty of Economics
Fukumoto, T., Assistant Professor, Osaka University, Graduate School of Sciences

Bangka Island in Indonesia has the population of 1.4 million, and it been the centre of tin mining industry in Indonesia since the 18th century. The tin industry has provided economic benefits to

the local economy as well as to Indonesia as a whole. On the other hand, tin development has caused serious environmental and social impacts. For example, off-shore tin mining has been one of the main causes for decline in fishing industry. Tailing from tin smelters contains various toxic substances such as arsenic, and radioactive thorium and uranium. Strict control of the tailing is necessary in order to avoid health impacts to residents nearby the smelters and mining sites. Our findings suggest that the toxic substances regularly leak into the environment and that the law enforcement has to be tightened significantly.

Palm oil production in Indonesia has increased rapidly in recent years and its production has become the world largest since 2009 surpassing the production in Malaysia. Bangka Island is not an exception. Our findings shown that the soils in the palm oil plantations which are located adjacent to tin mines (and on granite) contain more toxic substances compared to plantations which are located away from tin mines. Our tentative health survey suggested that plantation workers and residents near palm oil plantations which are located on granite and close to tin mines are more likely to contract cancers and other diseases such as tumor caused by excessive exposure to radiation.

Our findings suggest that the policy to protect palm oil plantation workers and residents near tin mine sites and smelters should be tightened in order to reduce probability of contracting diseases caused by excessive exposure to radiation and heavy metals.

2.5. Conflicts and appropriation of natural resources

2.5.1. Water's fluidity: re-conceptualizing dynamics of accumulation in water grabbing

E. Belfer McGill University, Department of Geography. Kosoy, Nicolas. Dr. University of McGill, Department of Natural Resource Sciences

The vital importance of water – and its many competing uses – call for a critical examination of the intersections of capital, water, and the state. Renewed attention to large-scale transfers of water and water rights is closely linked to the resurgence of 'land grabbing' in academic literature. Drawing on a vast array of academic literature on water and capital, and looking beyond agriculture-driven water grabs, scholars have argued for the examination of 'water grabbing.' Accordingly, this paper aims to assess the conceptual similarities and distinctions between various forms of water grabbing, through the evaluation of six water grabs. Six different commercial uses of water are addressed in the case studies: privatized hydropower generation, gold mining, bottled water, commercial agriculture, water as a sink for pollution, and privatized water provision. By means of reviewing and systematizing these peer-reviewed case studies, the following characteristics will be assessed: the method of accumulation, the actors involved, dominant discourses about water, water rights regimes, the role of the state, responses undertaken, and the impact on local users and ecosystems.

A thorough examination of the six case studies reveals that the dialectic and material qualities of water are precisely what render the use of Marxist theory so powerful in analyzing water grabbing, but the difficulty of clearly distinguishing between forms of accumulation in the context of water grabbing underlines the need for greater conceptual clarity in the use of these terms. More

critically, there is urgency in distinguishing between the forms of accumulation occurring not only between water grabs, but within them as well; the fluid, active nature of water requires a careful application of concepts of accumulation, as disparate forms of accumulation can occur across one body of water. Theories of accumulation clearly explain the mechanism by which these moving parts interact; for instance, where water is 'rented,' it is the use of these theories which clearly reveals the underlying transformation embodied within these grabs, while simultaneously explaining the role of state discourse and force in supporting these processes.

Water grabbing is an ongoing and contested process. The vigor, strength, and impact of organized social movements in resisting water grabs is not to be underestimated; indeed, in all six cases, the fractured and contested nature of control over water opens legal and political spaces for actors to wage long-term struggles over access to potable water. A more thorough and intentional use of theories of accumulation in analyzing water grabs strengthens the understanding of the project at hand, both for scholars and for resistance movements.

2.5.2. Applications of Terror Management in the Ecological Crisis?

Sanniti, S. York University

Over three decades, the Intergovernmental Panel on Climate Change (IPCC) has published increasingly stern reports on the "unequivocal" changes in the planet's climate system and humanity's "clear" influence. Nearly 200 scientific organizations worldwide hold this position, including institutions from all G8 plus Five members. Though a significant majority of practicing climate scientists endorse this information, the efforts made towards addressing the challenges presented by climate change do not align with the severity and limited timescale these issues impose.

This paper proposes that the problems presented by our ecological crisis are not a scientific or technological issue – rather they are a cultural issue where competing worldviews engage in debate over the source of the problem and the necessity of solution; and the extremes of this debate are speaking fundamentally different languages. On one side, climate activists are speaking of solutions to a scientific debate they see as concluded. On the other, climate sceptics are discussing threats to freedom, scientific corruption, and distrust in our governmental institutions. These opposing views lead to an opposing sense of risk: the economic risks associated with climate action are too great to support for some, while the environmental and social risks of climate inaction are too great to ignore for others.

Andrew Hoffman, Professor at the University of Michigan and author of 'How Culture Shapes the Climate Change Debate', says that "we cannot recognize the environmental problems created by our way of life, nor can we develop solutions to address them, without first facing and changing the beliefs and values that have led to them". This paper explores these cultural conflicts, the origins of these opposing beliefs, and why they are so inflexible. My research draws upon cultural anthropology, social psychology, and psychoanalysis to explore the role of unconscious, "non-rational" drivers of human beliefs, motivations, and behaviours. More specifically, my research illustrates the insidious yet significant influence of existential concerns.

Inspired by the work of Otto Rank, Norman Brown, and Ernest Becker, Terror Management Theory (TMT) was developed within the field of social psychology to explore the human mind's relationship with death. TMT claims a juxtaposition persists between the uniquely human awareness of death and our biological predisposition for survival, which brings about a potentially overwhelming sense of anxiety. To manage these existential concerns, TMT proposes that cultural worldviews are psychological defense mechanisms that provide a reliable sense of meaning, structure, and permanence through a set of shared beliefs about reality. Moreover, they provide the ability to achieve immortality through literal or symbolic death transcendence via cultural narrative. This claim has potentially wide-ranging implications for the construct of human society, interpersonal and cross-cultural relationships, and human-nature relations. Through a TMT lens, the concepts of nature, gender, and the economy will be explored to understand how this existential psychodynamic perspective might assist in determining the unconscious, psychological motivations behind human-constructed beliefs, values, and consequent behaviours. Most important to note from a TMT perspective is that to the extent that our own beliefs about reality serve death-denying functions, to admit legitimacy of an alternative conception of reality (for example, human activity is now the main driver of global change) we necessarily undermine our own beliefs and expose ourselves to the very anxiety those beliefs are constructed to mitigate.

2.5.3. From Tragedy to Community: A Critical Inquiry on the Commons

Akbulut, B. Concordia University

Recent times have witnessed the resurgence of the term commons, invoked from various different, and often radically opposed, positions. Some relate commons to efficient use and governance of resources, in a rather sterilised fashion, de-contextualised from the broader processes of capital accumulation, spread of markets and power relations. International organisations, such as the World Bank,—in a move that (implicitly) acknowledges the destructive impact of the relentless spread of markets and market relations—have been emphasising the need for community-based management of the commons to ensure their efficient and sustainable use. Somewhat similarly, an increasingly popular approach posits the commons as a third way between the State and market, sitting side-by-side (peacefully) with them. This takes for granted that certain fields of the social economic landscape should be organised via the market (such as private production and consumption) and others by the State (such as public goods and services), but those arenas where the State-market duo is either ineffective or undesirable are commons to be governed by communities. On the other hand, social mobilisations all around the world, whether resistance movements, or concrete practices of alternatives, are increasingly framing their discourses with reference to the commons: defending, reclaiming and/or building them. These mobilisations often adopt the term as a conceptual tool, and a political mobilise, to imagine non-capitalist ways of organising material life and creating solidarity

In its contemporary reincarnations, commons can be found to refer to a resource to be exploited, a group of people cooperating for their interests or forms of social relationships that constitute a need-based organisation of social economic life. Such uses of the term are undoubtedly tied to different approaches to and conceptualisations of the commons, and different understandings of the physical and social reality in which they are embedded, that often remain implicit in the narratives surrounding the concept. Critically discussing different approaches to commons and conflicts over them emerges as a crucial necessity.

This presentation initiates such a discussion by critically reviewing the contributions of major schools of thought on the commons. While it starts with an exploration of the literatures inspired by two canonical figures, well-known to ecological economists, Garrett Hardin and Elinor Ostrom, it will then turn to a much older tradition, Marxian political economy and the more recent reformulations of the commons within that tradition. Within this context, the engagement of ecological economics with the commons literature is paid particular attention to highligh that the more structural conflict between the commons and the political-economic contexts within which they are embedded is rendered invisible in most ecological economics writing on the commons in the absence of a coherent analytical framework on the political economy of the commons. The presentation concludes with a brief consideration of potential ways to further the ecological economics agenda on the commons.

3. THEME 3: ALTERNATIVE MOVEMENTS AND DISCOURSES (OCT 21, 9:45 -11:00)

3.1. Agriculture in the 21st century

3.1.1. The new Green Revolution? Sustainable intensification by intercropping

Martin-Guay, M. O. Université du Québec en Outaouais (2) Paquette, A. Pr. Université du Québec à Montréal; (3) Dupras, J. Université du Québec en Outaouais; Rivest, D. Université du Québec en Outaouais

Current and future agricultural systems will shape, perhaps irreversibly, the surface of the Earth, including its biodiversity, biogeochemistry, and the ecosystem goods and the services that are supplied to society. An increasingly important challenge facing agricultural systems is the need to ensure global food security while providing other ecosystem services. Worldwide, intercropping systems, where multiple crops are simultaneously grown on the same area of land, are more and more viewed as an effective means to achieve this goal. However, a large-scale assessment of agricultural production in intercropping systems in different biomes is required to scientifically support their widespread adoption by farmers.

This study is the first global meta-analysis integrating energetic and economic benefits of intercropping systems to their land-sparing potentials. The results of our study are unequivocally important for humanity. From 1110 intercropping observations recorded since 1975, we showed that intercropping systems produced 36 % more gross energy and 31 % more gross incomes on average, whilst using 20 % less land, compared to sole cropping systems. Our results suggest that intercropping remains beneficial, both under water stressful (e.g. arid and semi-arid environments) and non-stressful (e.g. temperate environments) contexts. Although intercropping offers a great opportunity for intensification of existing agricultural lands, many challenges need to be tackled by experts from multiple disciplines to ensure its feasible implementation. These include: the development of specialised varieties for intercropping, the education of farmers with regard to these new practices, economic incentives for the transition from current practices, the

adaptation of the crop-processing chain, and improved knowledge regarding the underlying mechanisms.

3.1.2. Estimating and valuing Canadian wild meat production and harvesting

Warltier, D. Centre for Indigenous Peoples' Nutrition and Environment, McGill University. (2) Linton, E. Princeton University (3) Landry-Cuerrier, M. Centre for Indigenous Peoples' Nutrition and Environment, McGill University (4) Humphries, M. Dr. Centre for Indigenous Peoples' Nutrition and Environment, McGill University.

Canadian wildlife is an important food source for indigenous peoples across Canada's north. Wild foods play a vital role in the food security of Canada's indigenous peoples; in some cases, a majority reliance on wild foods eliminated cases of food insecurity. However, a knowledge gap exists as to the quantification of these provisioning ecosystem services. So how much wildlife does Canada have; how much wild food can the various landscapes produce? This projects aims to answer 2 main questions: how much "wild meat" can the landscapes of Canada produce, and what is the potential loss to Northern indigenous communities if wild meat is lost to the local diet? These two questions will guide the project towards producing an estimation of provisioning ecosystem services [wild meat] across Canada's northern ecosystems, and an estimation of the replacement cost of these foods based on current harvest surveys and market prices of food in Canada's north.

To produce a map estimating annual production of wild meat in Canada's north we are starting with a Canada scale map of net primary productivity (NPP), derived from remotely sensed satellite imagery. Next, a map of secondary productivity (SP) will be produced using ecosystem specific conversion rates from NPP to SP. Taking the kilogram per square kilometre map of secondary productivity, size class distributions will be developed, partitioning the total ecosystem secondary productivity into size classes: g*10^1 (ex. grasshoppers), g*10^2-g*10^3 (ex. Snowshoe hare) , g*10^4 (ex. muskrat), and g*10^5-g*10^6 (ex. moose). This yields the annual productivity of a square kilometre of Canadian landscape divided into body class size. These values are then multiplied by a size class specific edibility factors to yield productivity of wild meat. The edibility factor is used to estimate the difference between the mass of a carcass and the mass of the edible meat on that carcass; the edible fraction. This will yield an upper estimate on the mass of standing wild meat produced each year in Canada, at 1 square kilometre resolution. Using known nutritional values for wild meat, maps estimating the caloric and macronutrient values in Canada will also be produced.

To produce estimates of replacement value of wild meat to northern communities we are starting with community scale harvest surveys. The mass of wild meat consumed in each community can then be compared to modern prices in northern Canada. Modern prices will be taken from the food prices currently posted under the Nutrition North government nutrition program. Using the price estimate, costs to replace wild meat will be constructed on a per calorie and a per mass of macronutrients basis. This will produce two food prices per community: the modern price to replace calories from wild meat, and the modern price to replace macronutrients from wild meat. Wild meat is valued in calories as well as macronutrients in order to consider the differing health outcomes for diets with different proportions of macronutrients. While the caloric consideration is sufficient to ensure a community has enough quantity of food to eat, it is important to track

macronutrients as well to ensure a community has enough quality food to eat. Decrease in consumption of wild foods has been linked to an increase in total energy intake and total energy from carbohydrates in Canada's indigenous communities, increasing risk of metabolic diseases, such as diabetes.

3.1.3. Decommodifying food

Bliss, S. University of Vermont

Food is a commodity in most of the world today. According to commodity markets, wheat is wheat is wheat, and organic wheat is organic wheat is organic wheat. Wheat can be traded for money, which can buy just about anything else in the world. More money can buy more wheat, irrespective of effects to ecological systems whose goods and services are not traded in markets.

Commodity markets allocate commodities to their highest-value uses, as measured by money. Actors' preferences are thus weighted by their purchasing power. A properly functioning, efficient market system delivers food to overfed people, to biofuel production, to inefficient large livestock, even to incinerators and landfills, but not to undernourished people who have little purchasing power (Farley et al. 2015). Markets do not differentiate between luxury and sufficiency. Nor do they send signals about global environmental thresholds.

As a result, agri-food systems cover 40 percent of Earth's ice-free land, release about a quarter of anthropogenic greenhouse gas emissions, slurp up two-thirds of total freshwater withdrawals, and threaten biodiversity more than any other human activity (Foley et al. 2005, 2011; Vermeulen, Campbell, and Ingram 2012; Millennium Ecosystem Assessment 2005). Enough plant calories are produced to feed about 10 billion people, yet 45 percent of plant calories and 60 percent of plant protein produced worldwide feed livestock, biofuel refineries, and industrial processes instead of humans (Holt-Giménez et al. 2012; Cassidy et al. 2013). Food waste accounts for about a quarter of crop calories (Kummu et al. 2012), or one-third of total production by weight (Gustavsson et al. 2011). Worldwide, 800 million people are chronically undernourished and approximately 2 billion are deficient in at least one important micronutrient (FAO, IFAD, and WFP 2015)

Experts tend to suggest reducing inequality and commodifying global ecosystems as solutions to these problems caused by commodity markets. Historically, though, inequality in capitalist economies has only decreased in times of fast growth or highly destructive war (Piketty 2014), both scary prospects in the context of climate change – the former likely to exacerbate the crisis and the latter a possible result. And integrating ecosystem services into markets makes essential resources like food more expensive, thus worsening inequality.

Another option is to "decommodify" food. For many human societies, food is a commons, not private property. But how might a society in which food is almost fully a commodity move toward making it a shared abundance, or at least move away from allocating it according to market logic? The planned production and provisioning schemes of communist governments are rightly criticized for constraining local food sovereignty; they limit the power of individuals and communities to control their own food production and consumption. Plus, these systems are fragile – they fall apart when political regimes inevitably change. Is there a more democratic way to decommodify food? Networks of free food already exist, even in countries where food seems

fully commodified. I plan to study the free food network of Burlington, Vermont. Its participants do not yet even know it exists. I hypothesize that it feeds food insecure people, supplements the diets of those on the margin of food security, and plays a more symbolic, socio-cultural role for fully food secure populations.

3.2. Pensées et mouvements alternatifs

3.2.1. Développement durable: des discours antagonistes

Provençal, J. Université d'Ottawa

Transformer notre monde, voilà ce que l'agenda 2030 pour le développement durable vise, rien de moins. Le développement durable est un discours largement répandu, pour ne pas dire populaire. Si populaire qu'il a, en quelque sorte, colonisé l'imaginaire et est devenu quelque chose qui semble incontestable (Elgert 2010), pour ne pas dire naturel. Qu'est-ce qui se retrouve exactement derrière le déploiement du discours politique relatif au développement durable ? Lorsque l'on parle de développement durable, lui attribuons-nous la même signification? En 1987, le rapport Brundtland a mis à notre disposition une conceptualisation large du développement durable ce qui a eu pour impact, chez les divers acteurs concernés, de sélectionner les éléments correspondant à leur intérêt particulier. De sorte que Greenpeace, le gouvernement canadien et la compagnie pétrolière Shell attribuent au développement durable un sens qui diffère considérablement. Ainsi, comment est-il possible d'atteindre les Objectifs du développement durable (ODD) si nous ne parlons pas le même langage?

Le lien entre l'énergie, essentiellement fossile, et le développement n'est plus à faire. Cette étroite relation remonte à la révolution industrielle. Le caractère incontestablement physique de l'énergie est pour autant indissociable des diverses facettes de la vie en société. La capacité à exploiter de plus en plus d'énergie pour la production est à la base de l'évolution des sociétés (Rosa, Machlis et Keating 2012). Tel que l'énonçait le directeur général de l'Agence internationale de l'énergie atomique, Monsieur Yukiya Amano, lors du sommet sur les objectifs du développement durable en septembre 2015 : « L'énergie est indispensable au développement. » Alors, qu'en est-il pour le développement durable?

À la lumière de cette étroite relation entre l'énergie et le développement, cette communication analyse le rôle de l'énergie dans le cadrage du discours politique sur le développement durable, dans le cadre du sommet ayant eu lieu à l'ONU en septembre 2015. L'hypothèse veut que l'ambiguïté du sens donné au développement durable soit fortement liée au rôle joué par le lien énergie-développement. Cette ambiguïté du sens entraîne une lutte discursive et selon les partisans du post-développement certains éléments discursifs empêchent la fixation de ce discours. Je postule que l'hégémonie que constitue le concept de développement et la chaîne conceptuelle qui l'accompagne ont entraîné l'objectivation de son lien avec l'énergie engendrant, selon les partisans du post-développement, la perturbation de la signification du développement durable pouvant déstabiliser la signification même du discours.

Cette étude, qui s'appuie sur l'analyse du discours de Laclau et Mouffe, démontre clairement le caractère marginal de l'énergie au sein du discours sur le développement durable, en plus de

soulever les antagonismes qui émergent quant à la manière dont l'énergie est articulée au sein du même discours. En effet, seulement 20% des 245 discours évoquent l'énergie. Lorsqu'on y regarde de plus près, l'on observe que les pays les plus développés, ainsi que les nations productrices de pétrole mentionnent l'énergie dans une proportion similaire, alors que les pays du BRIC et les États les moins développés en font mention dans des proportions de 50% et 40%. Démontrer l'existence de discours divergeant au sein de la communauté internationale sur le rôle de l'énergie dans le développement durable peut donner un indice des complications que nous pourrions rencontrer dans la mise en œuvre du développement durable.

3.2.2. L'écoféminisme comme alternative pour penser la justice environnementale globale

Gagnon-Bouchard, L. Université du Québec à Montréal

La communication que je souhaite présenter s'articule autour de la problématique de la justice environnementale globale et des discours alternatifs provenant des écoféministes. D'abord, je présenterai les thèses générales soutenues par Alf Hornborg dans « The Power of the Machine ». Hornborg s'appuie sur la théorie de la dépendance et les concepts de centre et de périphérie. Il met de l'avant l'hypothèse qu'avec une analyse système monde, on doit conclure que le modèle actuel de croissance économique est un jeu à somme nulle. Le but de son ouvrage de manière générale, c'est de remettre en question le fétichisme de la machine et de la technologie. L'économie et la technologie ne doivent pas se concevoir comme deux entités séparées. Il argumente pour une vision plus organique du monde en démontrant que même la machine et la technologie font partie de ce monde organique et ne se présente pas comme quelque chose de supérieur. Il y a donc un impératif afin de concevoir le monde comme un système dans lequel, les problèmes environnementaux d'un pays sont le revers de la croissance d'un autre pays. L'analyse doit pouvoir saisir que la croissance et le développement technologique sont liés au sous-développement et la détérioration de l'environnement. À partir de cette analyse, on peut saisir que la technologie sert à exploiter le temps (le travail) et l'espace (la nature) de plusieurs aux bénéfices de quelques-uns. Bien qu'il soit intéressant de voir le monde de manière plus organique et que le jeu à somme nulle représente une théorie très intéressante pour appréhender les problèmes environnementaux liés au système économique global. Hornborg pose excessivement d'emphase sur les ressources naturelles qui fournissent de l'Énergie et reste dans un rapport utilitaire à la nature. De plus, il évacue complètement la question du travail reproductif non rémunéré des femmes et de la manière dont cette forme d'exploitation est intrinsèquement liée à l'exploitation de la nature.

Ensuite, l'article « Globalization of the Economy and women's work in a sustainable society » de Maria Mies sera mobilisé pour pallier aux angles morts de la théorie de Hornborg. Maria Mies critique le développement durable et la perpétuation du modèle de la croissance économique capitaliste et patriarcale comme étant incompatible avec une volonté de conservation des ressources, d'indépendance des femmes, et d'une société durable. Elle aborde dans le même sens que Hornborg et s'appuie sur la théorie du jeu à somme nulle qui affirme que la croissance de l'un se fait sur l'appauvrissement de l'autre. Mies questionne les élites occidentales qui arrivent à se réapproprier des termes comme le développement durable pour perpétuer ce système économique de croissance. Hornborg et Mies mobilisent la théorie de Rosa Luxembourg qui décrit l'impossibilité pour le capitalisme d'être un marché fermé et son besoin de toujours aller exploiter

des milieux externes. Pour Mies, ces milieux sont les colonies et la logique de l'accumulation capitaliste fait appel à la logique coloniale et la violence qu'elle implique. Selon elle, cette violence coloniale n'est pas neutre et se dirige principalement à l'encontre des femmes. La thèse selon laquelle le développement et la modernisation économiques permettent d'enrayer les injustices envers les femmes est incorrecte puisque ces violences se sont plutôt exacerbées.

3.2.3. La subjectivation néolibérale à travers les outils de l'économie de l'environnement

Hequet, C. Université du Québec à Montréal

La méthode d'évaluation contingente permet l'évaluation monétaire de biens environnementaux non marchands à des fins de planification environnementale. Elle repose sur un sondage dans lequel on demande à un échantillon d'individus la valeur monétaire qu'ils seraient prêts à payer pour protéger un bien environnemental d'intérêt. La valeur totale est ensuite intégrée à une analyse avantages-coûts, comme coût s'il s'agit d'un projet d'exploitation ou comme bénéfice s'il s'agit d'un projet de conservation.

On a largement critiqué la fiabilité de la méthode ainsi que ses fondements théoriques. Dans plusieurs études, les répondants se montrent peu sensibles aux prix et aux quantités proposés, ce qui amène des chercheurs à conclure que les résultats des questionnaires ne peuvent être utilisés dans des analyses avantages-coûts, mais devraient plutôt être interprétés comme ceux d'un pseudo-référendum. Or, face à ce constat, plutôt que de proposer l'abandon du cadre économique au profit de consultations ouvertement politiques, on suggère d'en multiplier l'utilisation afin d'habituer les répondants.

Un tel entêtement à utiliser la méthode nous a amené à la considérer comme un outil qui, loin d'être neutre, s'inscrit dans un projet politique beaucoup plus vaste. Ce projet, c'est celui du néolibéralisme. Et puisque ses politiques sont entièrement basées sur la rationalité utilitariste, il lui faut produire des sujets adaptés, soit des individus opérant des choix uniquement en fonction d'un calcul d'intérêt personnel, telles des entreprises. C'est pourquoi le néolibéralisme peut être appréhendé, à la façon de Michel Foucault, comme un mode de subjectivation.

En nous appuyant sur les réflexions de cet auteur dans Naissance de la biopolitique, de même que sur les écrits de plusieurs de ses héritiers, nous développons l'argument que la démultiplication des sondages d'évaluation monétaire participe à la mise en forme de sujets néolibéraux. Forcés de réfléchir les questions environnementales dans un cadre économique, ceux-ci n'entrevoient plus d'autre justice que ce qu'ils ont déclaré vouloir payer et les biens et services environnementaux qu'ils reçoivent en retour.

L'utilisation de la méthode a donc pour effet de dépolitiser le rapport État-citoyen. Afin de sortir de cette rationalité néolibérale a-démocratique, on peut avoir recours à d'autres outils de planification environnementale, tels que l'évaluation multicritères, qui permet de se départir de l'aspect monétaire des évaluations.

3.2.4. Le capitalisme représente-t-il un obstacle à la sortie des énergies fossiles ?

Theurillat-Cloutier, A. Université du Québec à Montréal.

Plusieurs auteurs (Malm, Huber, Altvater, Mitchell) avancent que le développement et la consolidation du capitalisme n'aurait pas été possible sans le recours au charbon, puis au pétrole, à tel point qu'il serait possible de défendre le concept d'un « capitalisme fossile », donc intrinsèquement dépendant de l'extraction des hydrocarbures. À l'heure des changements climatiques et de l'anthropocène, la question de la transition énergétique soulève le problème du passage vers des sources d'énergie renouvelable qui ne possèdent pas les caractéristiques du pétrole, du charbon et, dans un moindre mesure, du gaz. Ces dernières sources d'énergies semblent en effet être les plus adéquates aux exigences de l'économie capitaliste : en vertu de leur homogénéité, de leur mobilité, de leur divisibilité et de leur flexibilité, il est possible de les concevoir comme des énergies « abstraites » (Pineault, Lohmann et Hildyard). La question se pose alors de savoir si le mode de production capitaliste est compatible ou non avec une transition énergétique vers d'énergies « concrètes » comme le flux solaire. Au-delà de la « seconde contradiction » générale du capitalisme relativement à son ancrage dans la nature (O'Connor), nous défendrons l'idée qu'il existe une contradiction plus spécifique relative à la forme d'énergie requise par celui-ci.

Dans un premier temps, nous préciserons le lien historique fort qui unit le capitalisme aux énergies fossiles à partir de la transition du XIXe siècle d'un mode de production alimenté essentiellement par la biomasse et les cours d'eau à un mode de production reposant sur le charbon. Comme nous le savons, la grande industrie, forme la plus aboutie du capital aux yeux de Marx, n'aurait pas été possible sans le charbon. En plus de permettre l'émancipation complète des forces productives de la force humaine, les machines à vapeur alimentées au charbon ont permis aux entreprises capitalistes de jouir de la concentration de la population dans les villes. Nous expliciterons également les bouleversements dans la sphère de la production et de la circulation occasionnés par les énergies fossiles, soit leur contribution à la réalisation du « travail abstrait » (Postone), à la prolétarisation, autant qu'à la mise en place d'un espace-temps abstrait (Huber).

Dans un deuxième temps, à partir de cette transition énergétique, nous développerons les leçons pour la prochaine et nécessaire transition énergétique en dehors des hydrocarbures, en explicitant les obstacles proprement capitalistes à cette transition. Le caractère fluctuant des énergies renouvelables pourraient en effet constituer un problème pour le maintien de l'espace-temps globalisé intrinsèque au capitalisme avancé. Par ailleurs, selon Hermann Scheer, la difficulté à transporter et à stocker l'énergie solaire favoriserait la consommation locale, ce qui aurait le potentiel de contester l'emprise des grandes entreprises de l'énergie pour faire émerger un modèle décentralisé. Cette transition aurait donc le potentiel de bouleverser la nature monopolistique du capitalisme contemporain (Baran et Sweezy). Andreas Malm défend également que le développement des énergies renouvelables serait peu profitable en raison du coût déclinant des technologies de captage du flux solaire, mais aussi en raison de l'impossibilité de s'approprier le flux solaire lui-même, soit de procéder à une forme « d'accumulation primitive » (Marx).

3.3. New perspectives in agroecology

3.3.1. Agro-ecology as Adaptive Management: Is a "Bottom-Up" paradigm for Eco-Friendly Agriculture Feasible?

Dube, B. University of Vermont

Arguments for environmental benefits "alternative" agricultural practices and systems often position farmers as active natural resource managers, as opposed to components of socio-ecological systems to be managed. Farming is framed as an iterative, communicative engagement with natural systems in conditions that are uncertain and heterogeneous across both space and time. This suggests that policies based on "Best Management Practices" or "modeled performance" will be suboptimal or ineffective, as they are unable to harness farmer knowledge and experimentation. On the other hand, farmers have limited ability to directly measure, and therefore to manage for, the outcomes of greatest public concern, like nutrient runoff or greenhouse gas emissions. Due to this, farmers or policy-makers may target natural capital on farms or other intermediate outcomes that are believed to correlate with desired outcomes. Here, I present several potential "proxies" or intermediate goals that could be used for adaptive, farmer-driven approaches to climate friendly agriculture, theoretical problems related to their implementation, and future topics of research within this paradigm.

3.3.2. Protein for a Healthy Planet

Brown, E. Beyond Market

Removing the animal from the protein production chain simultaneously and powerfully has a positive impact in four arenas: human health, climate change, help restore the Earth's natural variety; and help regenerate degraded soils. 1) For humans, benefits of consuming a plant-only diet include reduction in incidence of heart disease and cancer. 2) Shifting away from industrial animal agriculture would result in significant reduction in the emission of greenhouse gases; 3) enhance the ability of the Earth to support complex life by allowing currently imperiled species to increase their habitat, and would result in significant decrease in animal suffering. And 4) enable the restoration of degraded agricultural lands thus reducing erosion and facilitating the replenishment of soils and the absorption of greenhouse gases.

3.3.3. The Good Earth: Leveraging Political Agroecology in Canada's National Food Strategy

M. Fremes. York University, Faculty of Environmental Studies

Prime Minister Justin Trudeau has put forward the motion to build a federal food policy, The National Food Strategy. If shaped properly, the Strategy could be a turning point in creating a Canadian food system that is equitable and ecologically just. However, there is concern that the Strategy will not be enough to overcome the complex relationships that currently benefit from today's conventional system. This research seeks to understand the pivotal role that political agroecology must play as a tool to shaping The National Food Strategy as a true pathway to the social, ecological and economic change that is required in the face of today's massive climate change.

Political agroecology, as framed by academics (Gonzalez de Molina, Stephen Gleissman, Miguel Altieri Victor Manuel Toledo, and Enesto Mendez) refers to a recognition that the social and political decision-making or impacts and the practice and science of agroecology cannot, and must not be separated. It combines ecological conversation (such as energy, water and soil health) with the knowledge of farmers, the experiences of the community and the momentum of social movements. Countries such as Cuba or Brazil have developed reputations for their leadership in agroecology, and their unique experiences present important lessons for Canada's own path. Cuba's historic circumstance in Cold War politics, combined with its governance structure and revolutionary spirit were pivotal to the country's rapid systemic change. Such a particular circumstance is unlikely to repeat itself in Canada, thus this research questions what the impetus for urgent food systems change in the Canadian context might be. Brazil might share more in common with Canada, given that both countries have export-led, monoculture agricultural policies. However, Brazil has developed a strong counter-culture of political agroecology that Canada has not, and this research is concerned with finding out why.

Because agroecology is a place-based approach, Canada can learn from countries such as Brazil or Cuba, but must ultimately build a systemic approach that takes into consideration those attributes unique to our social, ecological and economic circumstance. This must include an acknowledgement of the country's extreme privilege as a resource-rich state, and the responsibility that comes with such privilege to protect the world's largest fresh water reserves and sustain forest populations for carbon sequestration, amongst others. It involves recognizing the power dynamics that shape the food economy, including subsidies, lobbying power, and the interests of major energy and financial sectors. These structures will require a pro-active reflection of the status quo, and willingness for creative innovation. It must revere the wealth and variety of generational knowledge that the country has, starting with Indigenous land management, as well as commons structures and urban agriculture movements. It must grow its knowledge-sharing communication across these groups and others to better support the social and ecological goals they have in common. Political agroecology has been supported by groups such as Food Secure Canada, Community Food Centres Canada and the National Farmer's Union. Its influence must continue to grow so that it becomes a dominant shaper in building the National Food Strategy that Canada needs. Political agroecology as an academic topic is new to this researcher, however its practice in the field is not.

3.4. Different lens to look at ecological economics

3.4.1. From the homo economicus and his fellows to the homo socioecologicus and the homo Anthropocensis

Damiano, A. McGill University, Faculty of Agricultural and Environmental Sciences

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, insatiability, indifference and individualism (see, for example Siebenhüner, 2000 and Daly et al., 1994). Furthermore, the idea of homo economicus stimulates an excessive depletion of certain environmental goods, thus contributing to the environmental degradation (Siebenhüner, 2000).

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 ideated by Siebenhüner (2000), and the homo ecologicus constructed by Becker (2006).

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 interdisciplinary, 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.

3.4.2. What can Religious and Philosophical Affiliation Tell Us about Views on Climate Change and Other Environmental Issues? An Analysis and Coding of Relevant Religious/Philosophical Periodicals

Yahya Haage, G. McGill University, Natural Resource Sciences department.

As society confronts the challenges of the Anthropocene, it is important to consider the views of different segments of the population. Understanding the intersection between an individual's religious/philosophical affiliation and their positions on environmentalism can be an asset in this endeavor. While the holy texts and founding documents of many groups have been scrutinized for environmental themes, non-scholarly publications allow a greater insight into the views and opinions to which contemporary believers are exposed. To that end, a systematic review of 25

religious periodicals, spanning the year 2014, was performed and each was coded for references to climate change and other environmental issues. Specifically, articles were coded based on whether they agreed on the veracity and cause of climate change, as well as their perspectives on environmentalism and animal-related issues. The 25 periodicals fell into 8 broad religious or philosophical categories: Christianity, Judaism, Islam, Buddhism, Hinduism, naturalistic philosophies, New age/Neopagan, and UFO-religions. The naturalistic philosophies were taken from a range of political views to determine whether this plays a greater role than their views on the supernatural. After the articles were coded, categorical statistical tests (Pair-wise Fisher's Exact Test and Chi Square analysis) were used to test three commonly held views. The three views were chosen as they play substantial roles in the current rhetoric surrounding environmentalism and climate change mitigation. The first is the claim that so-called "Eastern" religions are more environmentally-minded than the so-called "Western" religions. The second is that naturalistic philosophies are less environmental than society's dominant religions. The third is that new religious/philosophical movements are more environmental than older groups.

The preliminary results are enlightening. The acceptance of climate change has been found in all religions/philosophies that discussed it, with only Objectivism holding a clear anti-environmentalist worldview. The often-claimed view that “Eastern” religions are more environmental than their “Western” counterparts appears untrue, although there appears to be a difference in the types of environmental issues discussed. Modern views on environmentalism did not generally vary in relation to when the religion or philosophical systems were founded. By exploring the founding conditions of some of these movements, however, a better understanding of their current positions can be elucidated. The New age and UFO-Religions are used as case studies in exploring this connection. The results also suggest that belief in the supernatural is not a prerequisite for environmentalism, with Secular Humanism being ranked quite high in pro-environmentalist views. More generally, the results suggest that movements holding anti-environmental views rely less on outright climate change denial, having instead shifted to advocating a technocratic and economic solution to the issue. In the end, research such as this is vital in order to properly frame and communicate the changes necessary in the Anthropocene.

3.4.3. Thinking like a designer through a lens of ecological economics

Dastgheib-Beheshti, S. York University, Faculty of Environmental Studies

Like many young disciplines, product design is struggling to identify itself. For years, many notable design thinkers and historians like Victor Papanek (1972), David Orr (2002), John Heskett (2005) and Tim Brown (2009) have been warning that the lack of moral and social responsibility of designers in society, is creating increasingly complex ecological and social issues. Many documents and manifestos published in recent years, prove that both design researchers and practitioners struggle with the “moral dilemmas” (Jones, 2009) of the ecological and social impact of their work as design increasingly moves away from “intelligent problem solving” to the “boutiquization” of products (Bonsiepe, 2006). Designers also recognize that modern technology has changed the context of responsibility for consequences of actions by creating great separation in time and location between actions and consequences, often making their linkage invisible or difficult to identify (Ehrenfeld, 2008, p.31) and assigning responsibility problematic. (ibid, p.60)

Renowned designer and design thinker Tim Brown has noted: “Designers can’t prevent people from doing what they want to with products they own, but that does not excuse them from ignoring the larger system. Often, in our enthusiasm for solving the problem in front of us, we fail to see the problems that we create. Designers, and people who aspire to think like designers, are in a position to make important decisions about what resources society uses and where they end up”. (Brown, 2009, p.104)

In referring to “people who aspire to think like designers”, Brown points a finger in the direction of the emerging field of design thinking, the problem solution methodology and abductive reasoning that utilizes the tools and mindsets of design practitioners (Kelley & Kelley, 2013) to envision the future. Design thinking has been recognized as one of the few methods suitable for tackling complex problems with high levels of uncertainty. The creation of various design thinking toolkits containing collections of design management, communication and other tools that can be applied individually or in conjunction with others, has resulted in great strides towards making this methodology more accessible to diverse fields. In my initial research, as I compared and classified existing design thinking toolkits within such diverse fields as design, management, information technology and technological innovation (Schindlholzer, 2014) (Ogilvie & Liedtka, 2011) (Martin, 2009) (IDEO, 2011), I have noted that they also fail to recognize, let alone address the same moral dilemmas that haunt design practitioners.

This has led me to question whether current definitions of the roles of designers and the design thinking methodologies they utilize in solving problems are sufficient in tackling questions of sustainability, ecological and social impact, as well as equitable distribution of costs and benefits of designs. One problem lies with the simplistic economic perceptions of the value of design, which as a public good impervious to efforts to make it rival or excludable (Heskett, 2017) has not allowed it to be conveniently added to the list of goods monetized within capitalist and market economies (Bonsiepe, 2006). Value itself, through an economic lens, effectively refers to monetization, while a design lens frames it as “a point of integrity and source of values in its own right”, concluding that a value of a product cannot simply be reduced to a monetary one (Heskett, 2017), but should be considered a source of both economic and cultural wealth.

3.4.4. Prioritizing Culture, Feminized Externalities, and Life

Kish, K. Canadian Society for Ecological Economics

The various approaches and methods within ecological economics, all have their benefits, limitations, and internal debates. In this paper, I focus on macro-social theoretical ecological economics which seeks to find large patterns of opportunity for dealing with the cycles of socio-ecological and socio-economic life over time. In doing so, I do broadly critique other areas of ecological economics, mainly in their lackluster attempts at including the social sphere in their analysis. While many are interested in ensuring that we have an economy that fits within the biosphere, they ignore the question of whether it will also fit within the social sphere. There tends to be very little focus on what a sustainable society might look like and how the economy might fit into that. It is much more common for a scholar to look at how society views nature, and to have the economy reflect that. It is a subtle but important difference. One puts society as a central tenant for shaping the economy and the other uses existing economic systems to measure how society values their environment. In my research, I argue that the economy needs to be seen as a

subsystem of an eco-social system, and thus we need to determine what a 'healthy' social system is, and how the economy should service that.

I present a reconfigured framework for ecological economics which explicates social and cultural dimensions for local economic change drawing on Polanyian disembedding and historical sociology. I provide a framework for ensuring future inclusion of, what I call, the ecological economic 'sociosphere'. This framework prioritizes the cultural subsystem, oft ignored, as a central tenant in the development of a realistic green economic vision. As an important tenant of this, I link ecological economic theory with ecofeminist theory to explore options for their coevolution, which is only possible with a more explicit cultural representation in ecological economic work.

Finally, I question if we can continue to have a progressive, high-tech, and diverse lifestyle while being environmentally and socially responsible. I explore the kinds of things we may need to leave behind (such as regular international vacationing). In doing so, I look for the kinds of trade-off's that individuals are willing to make if changing cultural dimensions to adhere to environmental limits to growth may have unintended consequences (can we have our cake, and eat it, too?).

I finish by applying these three theoretical areas of research to a case study of makers across Canada. I explore how they include the socio-ecological system into a new economic system, the role feminized externalities in the economy, and the kinds of tradeoff's the participants have been, and are willing to, make.

THEME 3: ALTERNATIVE MOVEMENTS AND DISCOURSES (OCT 21, 11:15 – 12:30)

3.5. Drivers for an economic transition

3.5.1. Redirecting the Anthropocene: New Productive Forces and the Economics of Abundance

Milani, B. Green Economics

The very concept of the "Anthropocene" hints at the solution to its problems. On the flip side of humanity's unprecedented destructive impact on the biosphere are emergent positive potentials for human development and ecological regeneration, making possible a new level of harmonious integration with natural process. The beginning of the Anthropocene coincided with the rise of new productive forces (NPFs) based in human creativity and culture that challenge the very existence of capitalism. These NPFs include capacities that are necessary to create both egalitarian and truly regenerative green economies, and yet have been systematically suppressed or destructively channeled by capitalism to (more or less) intentionally create scarcity. Capitalism's key tools to do this have been waste and enclosure, and the wholesale denial of real human need. This context means that alternative economic strategy must not be primarily be about imposing limits, but about unleashing the forces of Abundance through qualitative development. A de facto

Abundance movement is already growing, within movements for local living economies, natural building, free culture, genuine wealth indicators, permaculture, indigenous culture, feminist Gift economies, participatory democracy, appropriate technology, and more. This paper looks at three key dimensions of the economics of Abundance that can simultaneously stop the destruction and create regenerative alternatives.

Like all class societies, industrial capitalism has been based in scarcity, but unlike previous class societies, its open-ended economic growth was destined to eventually erode scarcity—and so undercut class structure, along with related forms of hierarchy & domination. This has both a material and a cultural dimension, since class society has been based as much on the elite's monopoly of "high" culture as on its control of scarce resources. The Great Depression can be seen as the first spontaneous system shutdown in response to the threat of Abundance, a result of massive productivity gains during the 20s that outran worker incomes, and thus worker ability to consume. A chronic crisis of "effective demand" has ensued, mitigated only by the vast expansion of waste production by postwar Fordism, including war production, suburbanization and planned obsolescence. Most analysis of the origins of the Anthropocene track to this period, featuring a basic shift, especially in N. America, from economic to uneconomic growth.

Industrial capitalism's key factors of production have been physical resources and cog-labour, and its definition of wealth have been money and matter. The system's survival has depended on keeping it this way, despite the emergence of NPFs in which human creativity & development can and should logically be both the economy's key means and end-goal. Despite the growing potential of human development to radically reduce resource use, the postwar Waste Economy did the reverse, using resource-intensity to artificially reproduce cog-labour. So did the rise of bureaucracy and many socially-useless kinds of enterprise. Growing creative potentials were channeled into narrow professions and a "creative class" of informational/cultural workers. The information revolution, post 1980, has presented a greater challenge to cultural scarcity. Instead of being used to eliminate cog-labour, expand creative work and save resources, information production has been used to financialize the economy and facilitate precarious labour and a global resource grab.

3.5.2. Territorial Partitions, the Production of Mining Territory and the Building of a (Post-)Neoliberal and Plurinational State in Ecuador

Vela-Almeida, D. McGill University

This paper studies the state-mechanisms to enact mining in the Cordillera del Condor. In doing so, it presents a territorially-based critique of the dependence of extractivism in transitioning towards a post-neoliberal state. It is argued that socio-political processes that advocate for mining, while aiming for a longer-term objective to transcend neoliberalism, collectively challenge the tendency towards anti-neoliberal struggles and jeopardize plural worldviews for the country. In this manner, I contribute to the literature on post-neoliberalism and plurinationality by attempting to link conceptions of state rationalities on mining with an analysis of territorialization, which advances objectives of national sovereignty. I argue that these processes are continuously dependent on the use of neoliberal practices on the ground and ultimately undermine the possibilities of building a plurinational state comprised of multiple embedded territories.

Specifically, this paper first examines the transformations in socio-spatial relations in the Cordillera del Condor, which have permitted the state to produce mining territories. In doing so, five main territorial partitions are highlighted in order to illustrate how mining territories are produced. These include the consolidation of institutional hierarchies, governance frameworks, social imaginaries, politico-cultural identities and productive schemes. It is argued that territorial partitions are a consequence of a national political context, which has increased the capacity of the state to develop a particular mining narrative and the consolidation of a unified sovereign state.

The territorial partitions explain the geographical demands of authority associated with the contemporary narratives of the Ecuadorian government. These narratives depict the Cordillera del Condor as a strategic space to incorporate within the national economy and to consolidate mining extraction as a national priority for the wellbeing of the nation. As such, territorial partitions are synergized into new progressive definitions for an extractive economy in the Cordillera del Condor. In doing so, the state exercises control in the territory by enacting institutional hierarchies that consolidate the prevalence of the central government as the decision-maker over natural resources and national planning. This creates a centralized governance structure from previous political dynamics in the region and reframes social imaginaries that embrace a socially just and environmentally responsible mining economy while shuffling particular political identities of Ecuadorian citizens and Shuar people. The resulting territorial transformations challenge the productive capacity of the region to align to the economic needs of the post-neoliberal agenda. However, this territorially-based critique highlights that mining policies in the Cordillera del Condor are far from contesting neoliberal practices on the ground.

Second, the paper analyses these territorial partitions to extend the discussion on post-neoliberal state-building to highlight the contradictory nature of these strategies in ultimately confronting neoliberalism and pursuing plurinationalism as advocated by the Ecuadorian constitution. A pertinent question raised is whether post-neoliberalism and plurinationality are themselves exclusionary concepts that depend upon the very uniform tendencies from which they attempt to transcend. The corollary lies in whether the creation of a unified sovereign state can truly welcome plurinational autonomy as espoused in Ecuador's constitution. In answering this question, this paper challenges the state's position of using mining as a strategic activity for a post-neoliberal agenda while limiting Ecuador's ability to transition towards a plurinational state.

3.5.3. Parameterization of Movement Patterns exploring Ecological and Economic trade-offs towards Effective Management Strategies

Udugama, M. University of Reading, UK
Holloway, G. University of Reading, UK

The spatial-dynamics of movement behavior and the spread process of species are still under studied and remains poorly understood. One of the reasons limiting the exploration of this phenomenon is the lack of powerful mathematical models and the practical difficulties of predicting and modelling movement. Therefore, despite the technological advances and the growing literature, questions still remain in terms of understanding the complexity of the species spread processes and integrating which into operational bio-economic models. Exploration of

these phenomena can have important natural-resource policy management implications. For example, understanding animal including human foraging and migratory patterns can support policies such as climate change adaptation, placement of habitat corridors and pest and disease control.

The paper employs an Approximate Bayesian Computation (ABC) framework to investigate the movement pattern of human foragers; Ju/'hoansi human hunter gatherers in Botswana and Namibia and Dutch fishermen. Bayesian "likelihood-free" techniques (often termed approximate Bayesian computation (ABC)) emerged as a powerful tool which is widely used in the field of ecology. We analysed 44 possible models (normal, uniform, exponential, pareto, weibull, extreme value, gamma, log transformed variants and bounded exponential and power-law variants) under different assumptions employing a Bayesian model selection approach.

The results revealed that the both the human hunter gatherer and fishermen follow a bounded exponential movement and a bounded power-law distribution respectively. These results overturn the widely and previously concluded unbounded power-law (Lèvy flight) pattern for both data sets. The selected movement distribution was simulated which gives the probability an individual or group reaching a specified target during a given time. We then apply these simulations of each of the movement patterns to illustrate how the findings can be extended to predicting migration patterns of humans, placement of cost effective habitat corridors for animals and physical barrier identification to control spread processes. The results discuss the economic trade-offs of resource allocation. Further, extensions of applications in this paper are generalized to other species and movement patterns and are proposed as a potentially fruitful avenue for further, related research in the field of ecological economics.

3.6. Ecological Economics Rethoric

3.6.1. "She had a voice full of money": Rhetoric and Language in Ecological Economic

Timmerman, P. Faculty of Environmental Studies, York University.

One of the least studied aspects of ecological economics is the rhetoric and language in which it expresses itself and influences/shapes its domain. Over the past twenty years, standard economics has been subjected to a variety of linguistic critiques, ranging from the way it is saturated in a variety of metaphors (borrowed from physics, evolutionary theory, and even animal symbols), to gendered terminology (Deirdre McCloskey) and the politics of 'the rhetoric of the right" (David George). This paper explores, among other topics, the often-dangerous appropriation of this standard rhetoric by ecological economics. It argues that adopting this language, its structures of meaning, metaphor, and so on, are conducive to forms of entrapment and misalignment of the goals of ecological economics. In addition, the paper reviews some of the historic roots that cast economic discourse in the forms that have become normative, including its commitment to various quasi-scientific and mathematical rhetorics and terminologies. and their place in contemporary practice -- a commitment that has been already subject to critique, both internally and externally within the discipline. This paper looks comparatively at some of the "touchstone" texts in ecological economics, including a sample of close readings, particularly of writings on the themes of "growth" and "limits". It is again indicated that these provide "hostages

to fortune" for the direction of ecological economics. In an extended conclusion, suggestions are made towards a recasting of the rhetoric of ecological economics towards an enriched and more "embedded" approach, drawing on the theories of both Karl and Michael Polanyi, as well as insights from Ludwig Wittgenstein.

3.6.2. Tracing the Theory, Placing the Frameworks

Barbieri, L. University of Vermont

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 (Spash, 2012) and thus no seawall to stand against the waves of orthodox economic values and methods.

In his 2013 paper 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, and 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 almost all circumstances and every 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 could risk catastrophic environmental change at 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 each 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, and how each could be placed within or compared to the three ideological positions in ecological economics as outlined by Spash in 2013: Social Ecological Economists, New Resource Economists and New Environmental Pragmatists.

3.6.3. Telling stories with models and making policy with stories: an exploration

Beck, M. University of Ottawa

Narrative research is in vogue in the social sciences. A current debate in philosophy of economics concerns the role of storytelling in economic modeling, and a growing research program in policy studies investigates the influence of stories on policy outcomes. These two streams of research have yet to be connected in an investigation of how scientific models, in addition to delivering numerical results, also shape policy through the stories that are told with them.

This paper addresses that gap. I argue that stories produced with integrated assessment models of global climate change are particular types of policy narratives. An appreciation of these modeled stories about climate change and climate policy is essential for a full understanding of the role of IAMs in climate governance. In particular, narrative analysis of modeled stories illuminates the often subtle values and beliefs that underpin the models, thus allowing for their explicit examination. To that end, I suggest an analytical framework for studying the composition and content of stories told with IAMs.

For illustration, I use the framework to analyze two variations of the Dynamic Integrated Climate Economy (DICE) model that are used to tell new stories about climate justice and policy. These two DICE studies were developed by modelers in 2015 and published in academic journals. I demonstrate that even small modifications in the formal model structure may enable significant changes in the range of stories that can be told with the model. In particular, the two alternative DICE narratives considered in this study introduce concerns about the asymmetric allocation of climate change damages to the poor that are not part of the standard DICE story. In fact, the two DICE stories introduce different victims and heroes, and they conclude with different morals and calls for action. In short, the two DICE variations reflect an alternative, value-driven perspective on the origins of and solutions to environmental degradation.

This paper lays the foundation for further research on the narrative analysis of policy-relevant climate-economy models, contributing to ongoing debates in the climate governance literature. Analysis of IAM narratives may help to illuminate the relationship between science and politics and clarify how IAMs mediate the interaction between these two spheres. It may also improve our understanding of power and politics in the policy process, explaining how some model stories gain more authority in policy than others. Finally, the findings of this paper also have implications for the practical use of models in the policy process. Recognizing the role of IAMs as storytelling devices rather than merely number-generating machines facilitates their deliberate use as venues

for public debate by making model analysis more accessible to stakeholders who are less familiar with the mathematics involved, and by making it easier for those who are engaged in debate to grasp where their understandings and interpretations may diverge in the first place.

3.7. Comptes des ecosystèmes et services écosystémiques

3.7.1. Évaluation expérimentale du carbone écosystémique dans le cadre du Système de comptabilité environnementale et économique pour le Québec meridional

Auclair, J. Université du Québec en Outaouais. (2) Dupras, J. Université du Québec en Outaouais ; (3) Babin, D. CIRAD

Les écosystèmes sont composés d'un capital naturel qui participe à la régulation des systèmes naturels, à la culture et aux systèmes économiques. Les bénéfices qu'ils fournissent, définis comme étant des services écosystémiques (SE), ne sont toutefois pas représentés dans les systèmes de comptabilité nationale traditionnels (e.g. PIB) et ne sont souvent pas considérés par les décideurs. Pourtant, l'analyse des SE peut donner des informations pertinentes pouvant aider à la prise de décisions en aménagement du territoire. De surcroit, le recours au concept de SE est d'actualité en ce qui a trait aux politiques publiques environnementales. Suivant cette tendance, le Gouvernement du Québec développe une approche d'évaluation des SE qui se base sur le Système de comptabilité environnementale et économique (SCEE) développé par la Commission de statistique de l'Organisation des Nations unies. Le SCEE vise plus précisément à faire un suivi temporel et spatial du capital naturel de façon à mieux outiller les décideurs afin qu'ils puissent mieux gérer les ressources de leur territoire. Ce système comptable établit ses bases sur un cadre central qui définit les principales lignes directrices. Toutefois, comme il y a un manque de consensus par rapport à la comptabilisation certains comptes, un second ouvrage, les Comptes expérimentaux des écosystèmes du SCEE (SCEE-CEE), a été écrit afin de compléter le cadre central en y apportant une synthèse des connaissances comptables susceptibles de permettre leur implémentation. C'est dans cette lignée que des recherches sont requises afin de permettre l'application des comptes expérimentaux du SCEE au Québec. En ce sens, l'objectif principal de ce projet consiste à mettre en place, dans un projet-pilote, un premier portrait de comptes expérimentaux du carbone écosystémique pour le Québec méridional. Pour y arriver, la méthodologie qui a été utilisée s'appuie sur la Trousse de démarrage rapide des Comptes Écosystémiques du Capital Naturel (TDR-CECN) du Secrétariat de la Convention sur la Diversité Biologique. Cet ouvrage vise à complémenter le SCEE-CEE en y amenant des détails techniques beaucoup plus précis. Ainsi, la TDR-CECN souhaite accélérer l'opérationnalisation du SCEE-CEE en permettant l'acquisition d'une expertise empirique que peut difficilement établir le SCEE-CEE à l'heure actuelle puisqu'il repose sur un large cadre conceptuel. Plus précisément, la structure comptable qui a été utilisée au cours du présent projet a permis de mesurer les différents stocks et flux de carbone écosystémique pour les différentes régions du Québec méridional au cours de la période 2000-2010, en plus de comptabiliser l'utilisation humaine de carbone et de définir des indices de soutenabilité et d'état de santé du carbone écosystémique. De façon plus spécifique, ce projet prend son importance du fait qu'il permet de dresser un premier portrait des comptes expérimentaux du carbone écosystémique au Québec en établissant une procédure permettant leur comptabilisation dans la province. Cette procédure pourra être réutilisée par la suite afin de produire les comptes pour de nouvelles périodes temporelles. Elle pourra également servir à cibler

les besoins en données ainsi qu'à peaufiner les méthodes de traitements de façon à améliorer la qualité des résultats produits.

3.7.2. La valeur économique des services écosystémiques de la Trame verte de la Commission de la capitale nationale

L'Ecuyer-Sauvageau, C. Université du Québec en Outaouais. Dupras, J. Université du Québec en Outaouais

Les infrastructures naturelles ont la capacité de produire de nombreux biens et services écosystémiques (SE), mais ces infrastructures subissent plusieurs pressions qui limitent leur capacité à fournir les SE. En 2005, le rapport de l'Évaluation des écosystèmes pour le millénaire avait avancé que 60% des services écosystémiques dans le monde étaient surexploités ou dégradés (ÉEM 2005). Cette situation a été expliquée en partie par le fait qu'une majorité de services ne sont pas pris en compte dans la prise de décision sur l'aménagement du territoire (Sandhu et Wratten 2013), car les SE sont mal compris et qu'ils n'ont pas de valeur économique qui pourrait permettre leur prise en compte dans plusieurs outils d'aide à la décision (TEEB 2010; Bateman et al. 2011). Dans la région de Gatineau-Ottawa, la Commission de la capitale nationale (CCN) gère plus de 55 000 hectares de milieux naturels composés de forêts et boisés, de milieux humides, de milieux aquatiques, de terres agricoles et de prairies et pâturages. Parmi ces milieux, formant une trame verte dont les principales composantes sont la Ceinture de verdure d'Ottawa, le parc de la Gatineau et des terrains naturels en milieu urbain, il existe plusieurs écosystèmes exceptionnels, dont le complexe de milieux humides Mer Bleue. L'intégrité physique et écologique de cette trame verte est toutefois menacée, entre autres, par la fragmentation, les changements climatiques et les espèces invasives (Del Degan Massé 2010; CCN 2013). De plus, le territoire géré par la CCN se trouve encastré dans plusieurs juridictions municipales qui ont la possibilité de déterminer leurs priorités de développement et de conservation des écosystèmes à l'intérieur de leurs juridictions.

Dans ce contexte, l'évaluation économique des SE permet de mettre en valeur la contribution des écosystèmes au bien-être humain, afin que ces services puissent être considérés de façon explicite dans les prises de décision sur l'aménagement du territoire. En utilisant des techniques de transfert de bénéfices et de prix de marché, la valeur annuelle de 13 SE a été estimée à 322 millions de dollars. Les services contribuant le plus fortement à cette valeur sont des services non marchands, soit les services d'habitat favorisant la biodiversité, de prévention des évènements extrêmes (ex. inondations), de régulation du climat global et de traitement des polluants. Les valeurs obtenues ne représentent toutefois qu'un minimum de la valeur totale de ces cinq écosystèmes, puisque l'approche adoptée dans cette étude n'a pas permis d'obtenir des valeurs pour tous les SE, en raison de la disponibilité des données. De plus, les valeurs obtenues sont ancrées dans une perspective anthropocentriste et donc ne représentent qu'une partie de la valeur totale de ces écosystèmes. Ces valeurs pourront toutefois être utilisées par les gestionnaires de la CCN pour démontrer la contribution des milieux naturels à la qualité de vie des citoyens et en tant qu'outil de décision sur l'aménagement du territoire.

3.7.3. L'évaluation économique de la forêt urbaine d'Ahuntsic-Cartierville en fonction de différents scénarios de gestion de l'agrile du frêne

Bertrand, C ; Dupras, J. ; Delagrange, S. Université du Québec en Outaouais

The 20th century was the century of urbanization (Konijnendijk, 2000). According to the United Nations figures, only 13% of the world's human inhabitants lived in cities around 1900. In 2014, more than 54% of the world's population was residing in urban areas (United Nations, 2015). Urbanization is used to refer both to the movement of people into cities and to the transformation of natural into urban land cover (Mills, 2007). This rapid growth in urban population accentuates the demand for natural resources, leads to change in land-use patterns, causes pollution and loss of biodiversity (Rajashekariah, 2011). Urbanization leads to fragmentation and deforestation and these are major factors contributing to the decline of biodiversity locally, regionally and globally (Zipperer et al, 2012). However, in the past 20 years, remarkable progress has been made towards understanding how the loss of biodiversity affects the functioning of ecosystems and thus affects society (Cardinale et al, 2012). In 2005, the Millennium Ecosystem Assessment defined ecosystem services (ES) as benefits people obtain from ecosystems and examined how changes in ecosystem services influence human well-being (MEA, 2005). This assessment determined that there were four groups of ES: supporting, provisioning, regulating and cultural.

Adding to the urbanization challenge, cities must deal with global changes that are impacting them now and will be impacting them in the future. Global changes encompass the effects of climate change but also multiple effects that includes insect pests and invasive species from other ecosystems. An example of this impact is the Emerald Ash Borer (EAB) which induced ash mortality in Southern Ontario and Southern Quebec causing millions of dollars in damages. Another example would be urban heat island (UHI). The UHI is a local phenomenon with negligible effect on global climate (Trenberth et al, 2007), but its magnitude and effects may represent harbingers of future climates, as already-observed temperature increases within cities exceed the predicted rise in global temperature for the next several decades (Grimm et al, 2008). In many cases, the EAB infestation could contribute the the UHI phenomenon.

In 2011, when the EAB was first discovered in Montreal, the urban forestry department had many options as to how they would deal with this insect pest in order to reduce the damage to the urban forest. At that time, it was decided that the SLAM methodology would be the best to control the impact of the EAB. However, the SLAM methodology was developed in the United States where the context is not the same. Indeed, in the US, the urban foresters or their contractors administer the TreeAge insecticide which is more efficient than the TreeAzin used in Canada.

The goal of this research is to quantify the current ES of the Ahuntsic-Cartierville borough of Montreal and, through multiple scenarios developed via experimental research, to evaluate the impact of the EAB infestation through different intensities of this insect pest management. As part of this research, we will be concentrating our efforts to quantify carbon storage, air pollution, oxygen production, energy savings and avoided precipitation runoff. This will be accomplished using the i-Tree Eco software.

3.7.4. Valeur économique de l'esthétique du paysage dans les régions de la Gaspésie et de Charlevoix

Fall, M. Université de Sherbrooke, (2) He, Jie. Université de Sherbrooke; (3) Gélinas, N. Université Laval

Le paysage est une ressource culturelle et économique, un capital nature qui a permis le développement économique de plusieurs régions du Québec. Plus particulièrement, les régions de la Gaspésie et de Charlevoix misent sur la beauté de leurs paysages pour assurer leur développement socio-économique. Ces paysages deviennent une marque de commerce qui doit être préservée car ils sont aussi un gage de la diversité des écosystèmes à conserver. Cependant, il y existe un arbitrage entre la collecte de bois nécessaire au développement économique de ses régions et la préservation de l'esthétique du paysage. Le but de notre étude, financée par le Ministère de la forêt, de la Faune et des Parcs et le Fonds de Recherche du Québec – Nature et Technologies (FRQNT), est d'évaluer la valeur économique liée à l'esthétique du paysage pour une intégration dans les processus de planification forestière dans les régions de Gaspésie et de Charlevoix. Nous visons à développer un outil d'aide à la décision spatialement explicite pour quantifier les services des écosystèmes sous différents scenarios d'aménagement dans les régions de la Gaspésie et de Charlevoix. Cet outil de décision va aider les planificateurs forestiers à considérer d'avantage l'esthétique du paysage dans leur processus de décision.

Notre projet exploite une approche interdisciplinaire pour représenter l'esthétique du paysage en terme économique afin de mieux appréhender la valeur du paysage et de ses composants. Notre étude se base sur la méthode des choix expérimentaux qui permet de connaître la valeur monétaire de chaque attribut de l'esthétique du paysage. De ce fait, nous avons d'abord identifié les attributs clés de l'esthétique du paysage spécifiques à ces régions en se basant sur des groupes de paroles. Ensuite, avec la méthode des choix expérimentaux, nous avons pu assigner des valeurs monétaires à chaque attribut du paysage.

Pour ce faire, nous avons procédé à la réalisation d'une enquête de ménages qui s'adresse à la fois à la population générale de la province du Québec et à la population des deux régions à l'étude. Nous avons collecté un échantillon 998 individus. Les données contiennent aussi les informations socio-démographiques sur les répondants (revenu, sexe, âge, etc.) sur leurs connaissances des paysages et leur attitude envers le paysage, ainsi que des réponses sur leur choix parmi différentes options de paysages forestiers qui se différencient par les niveaux attributs caractérisant un paysage.

Les résultats de notre étude nous ont permis de définir une valeur monétaire sans biais pour l'esthétique du paysage pour ces deux régions et d'identifier les attributs jugés importants par les utilisateurs. Notre approche montre que les répondants considèrent et placent une valeur monétaire élevée sur l'esthétique du paysage. Ainsi, les résultats de notre étude constituent un signal important sur comment et dans quelle proportion la société évalue la préservation et la valorisation de l'esthétique du paysage et de ses composants.

3.8. Rethinking currencies and development

3.8.1. Econodynamics: A Proposed Framework for Rebooting the Study of Economics

Boyle, G.H. Orrey Software

This presentation is the product of a personal search for answers to a number of difficult questions. How can economic growth solve today's global problems? What role does the diamond-water paradox play in resource extraction? In an economy in which money is conserved, where do interest and/or profit come from and how does the "time value of money" concept work? Why is there no formal "scientific method" suitable for economic research like those for physics, chemistry, or the health sciences? Why are economic theorists able to successfully promote ideas that are in contradiction to accepted principles of science, such as carrying capacity or biodiversity? Why do political scientists not see the obvious fallacies in such theories?

Globalization, a widening wealth gap, rust belts in former manufacturing strongholds, two-income families, temporary jobs without benefits, falling real income and immense sovereign debt loads – these are just some of the characteristics describing modern economies. Furthermore, famine and war have created a population of unprecedented proportions of both economic and displaced refugees. It would seem that national and global economies are being swept along in the grip of massively powerful dynamics that current economic theory does not recognize and cannot address. We desperately need a total reboot of economic theory that identifies these dynamics and looks at them from a new perspective. I argue that recent advances in systems theory in general and the study of complex adaptive systems in particular can provide that new perspective.

The remaining portion of this philosophical and somewhat hypothetical presentation will have three main parts: (a) How did we get into this mess; (b) Why have we not fixed it by now; and (c) What new perspective might we take? I will also present supporting evidence from five economic agent-based models (ABMs).

HOW: I start with the nature of truth, the sources of meaning in life, the role of evolution in shaping our belief systems, and the emergent role of science in separating truth from fallacy. I review the causes of the birth of the scientific method in Renaissance Europe as a means of divining the truth, its rise to dominance as a social force, and now its waning hold and gradual dethronement, as national and world leaders turn away from scientific theories towards economic theories.

WHY:An irresistible dynamic has driven the evolution of the biosphere, and within that, the evolution of human societies, and within that, human belief systems and human economies. An emergent characteristic of this dynamic is to suppress all purposes and plans to resist it. I propose that this phenomenon be called "teleological pruning". TpLab is a multi-generational ABM in which natural selection guides the evolution of not just the genes of citizens, but also the development of their social belief systems. Core unalterable personal beliefs and collective tribal wisdom within a society are shaped to align with and enhance the effects of the long-term dynamic physical trends. This implies, for example, that all green investments and environmental plans will wither and die, having been selected out of our society. It also implies that all economic theory that is incompatible with perpetual growth will find little long-term support. This is why pro-growth theories dominate economics.

3.8.2. Commons Currency: an econo-art project across the Great Lakes

Baines, P. Great Lakes Commons. Arruda, J. Great Lakes Commons

The first step for a paradigm shift is imagining new possibilities. Great Lakes Commons is a bioregional community founded by the need to re-imagine our relationship with these waters as a shared and sacred commons.During the past few decades, water threats have been met with various interest-groups who mitigate short-term damage within their orphaned political and cultural boundaries. Invasive species, industrial toxins, micro-plastics, pharmaceuticals, oil pipelines, and nuclear waste risk all life in the basin against the rewards of money. Even water diversions for new growth and new products (such as bottled water) are made to keep money flowing upstream to investors and tax collectors, rather than to keep water flowing freely and cleanly.

The optimistic binary we are being sold is growing the economy while creating a healthy environment. Our economy knows no limits because it is a debt-based system needing more at every turn. Democracy and human rights are less important than servicing debt and growth. All value collapses into exchange value. Security and identity are now unhinged from social, ancestral, and ecological relationships and can be bought and surrendered through contract, scarcity, and debt. Decisions for protecting the commons are forced to reckon with the quest of the market, the dollar, and the value of more. While having money is private affair, the value of money is a commons. Like many other commons, money is a social agreement on what we value and how that value is exchanged and passed on. Let's imagine for a moment.

Let's imagine that the value of money is tied to the quality and availability of water to serve life in the Great Lakes basin. Since we are water, the water's benefit is our benefit. We know economics is a sub-system of ecology and our money system needs to reflect this, not subvert it. Let's imagine that watersheds return as the de facto boundaries for trade and treaty making. Canada and the USA are not nations, but settler-states making claims and treaties on Indigenous lands. The Anishinabek and Haudenosaunee nations have been living with the Great Lakes for over 15,000 years. A commons-backed currency would promote common peace and prosperity.

Let's imagine that the people of the Great Lakes co-created their own currency to see and reproduce commons and ancestral values such as: gratitude, reciprocity, fairness, balance, mutualism, cooperation, trust, respect, reverence, and friendship. The GLC currency project is an econo-art intervention into the above problems and possibilities.In 2017, GLC is piloting a project to test people's imagination and commitment for not only a new relationship with water, but with the money system that spoils it. We are currently designing the look and the currency. One side of the note would be used to explain the need for re-imagining value and ways to connect with the Great Lakes Commons community. We will be mailing 10 notes to each of our 500 of our Great Lakes Commons Charter supporters. These people aspire to be good ancestors to the lakes and try to align their lives with the tenants of this Charter. The mail package will also include strategies for distributing the notes.

3.8.3. Eco-currency as a tool for promoting restoration of Brazil's Atlantic Forest

Farley, J. University of Vermont. Ament, J. University of Vermont.

Brazil's Atlantic Forest has been reduced to 15% of its original cover, while ecologists estimate that failure to achieve 30% forest cover will result in a catastrophic loss of biodiversity and the ecosystem services with which it is associated. Brazil's New Forestry Code (NFC) mandates forest

cover in in ecologically sensitive areas known as Areas of Permanent Preservation (APPs), and in a Legal Reserve (RL) that covers 20% of rural properties, and farmers are responsible for reforesting any of these areas that were previously cleared, even though many of the benefits this would generate are public goods. Reforestation requirements are more lenient for small family farmers, but restoration costs and the resulting loss of farmland could nonetheless plunge them into poverty. Furthermore, reforestation required by the NFC will be insufficient to bring forest cover above the 30% necessary to avoid ecological thresholds.

We propose an innovative eco-currency that could equitably distribute the costs of restoration, increase forest cover to the 30% threshold, and bolster the rural economy. Relatively few people understand how modern currencies work, but the basic principle is that governments demand taxes paid in the national currency. The fact that all citizens must pay taxes requires them to also accept national currency in exchange for goods and services. It is impossible to pay taxes in any national currency until the nation has created that currency, which governments do by spending it into existence through the purchase of goods and services. We propose that the national government create a new electronic currency, the Eco. The government would declare that at some time in the near future, say in five years, citizens will be required to pay a new tax in Ecos. The government would pay an Eco to landowners who restore a specified unit of forest, say one hectare, to a specified acceptable quality. Landowners could restore the forest on their own land, or be paid by someone to restore the land in exchange for the Ecos (or a fraction of the Ecos) it creates.

The geographical coordinates of the restored area would function as a serial number for the currency. Using blockchain technology, the same used by crypto-currencies such as bitcoin, it would be possible to prevent any counterfeiting. Using satellite photos or even Google Earth, it would be possible to verify that a given area remains in forest, with steep fines (greatly exceeding an Eco) for any subsequent deforestation. The amount of taxes collected would correspond to the desired level of reforestation (e.g. enough to bring forest cover up to 30%), and would be collected over a suitable time period. The tax could be an income tax, a tax on capital (hence primarily targeting the rich), or a tax on fossil fuels, as desired by the government to achieve other goals such as greater equality or reduced greenhouse gas emissions. Since almost everyone would need this currency to pay the tax, it would be as widely accepted as any other national currency. Furthermore, if environmental organizations, foreign governments or anyone else wanted Brazil to restore more forest, they would be able to purchase the currency and destroy it.

4. THEME 4: FINANCE, MARKETS AND ECOLOGICAL MACROECONOMICS (OCT 21, 13:45 – 15:15)

4.1. Getting away from the fossil fuel economy

4.1.1. Making America Great Again? Assessing the Greenhouse Gas Emissions of Trump's Budget Proposals using Environmentally Extended Input-Output Analysis

Bliss, S. University of Vermont. (2) Adams, A.University of Vermont; (3) Hamshaw, K. University of Vermont; (4) Telle, S. University of Vermont.

The 2016 election of Donald J. Trump as the 45th United States President promises to usher in sweeping changes to the federal government's policy priorities, largely at the expense of environmental and social safety. Climate change mitigation efforts will likely slow as a result of renewed federal support and an enabling regulatory environment for the fossil fuel industry, as well as diminished international cooperation. Yet the scientific community has yet to explicitly assess the direct and indirect greenhouse gas emissions impact of the Trump Administration's proposals to increase defense and homeland security spending by $90 billion and cut other non-defense spending by $63 billion over fiscal years 2017 and 2018. This paper uses environmentally extended input-output analysis to estimate how these budget changes would result in changes in emissions if implemented exactly as described in official documents from the executive branch of the U.S. government. Our results suggest an increase of more than 5 million metric tons of carbon dioxide-equivalent emissions over two years relative to a counterfactual scenario without the new budget proposals. We argue that these estimates grossly underestimate the complete, long-term climate impacts of the analyzed expenditure shifts because of several methodological limitations. Regardless quantitative uncertainties, the federal government budget changes proposed by the Trump Administration represent a momentous stride in a dangerous direction with respect to the future functioning of the global climate system.

4.1.2. The Macroeconomics of the Energy-Emissions Trap

Sers, M. York University

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. Such a transition implies the adoption of energy sources with lower energy return on investment (EROI). In this paper we posit the possibility of an energy-emissions trap, whereby economies in transition to renewables face simultaneous limits from dwindling emissions budgets and net energy constraints.

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, among others, imply the aforementioned energy-emissions trap, 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 many different time dependent processes at the level of the macroeconomy, including aggregate investment, economic growth, capital stock dynamics, energy demand, and the EROI of various energy sources.

In this paper we discuss how traditional macroeconomic analysis of energy and climate, as carried out in neoclassical integrated assessment modelling, may be overly optimistic and that any macroeconomic modelling of energy and emissions will be largely incomplete without the integration of ecological economics principles. Modelling work in both ecological macroeconomics and the field of biophysical economics have provided numerous tools for addressing both the problems posed by emissions and the problems of declining EROI, but rarely are they united within the framework of a single modelling approach. In this paper we combine recent advances in both ecological macroeconomics and biophysical economics into a single coherent framework. The resulting hybrid method, combining the difference equation approach with an input-output analysis, allows for simultaneous modelling of the problems associated with both energy and emissions, and provides a formal setting for examining the energy-emissions trap. Such an approach combines the usefulness of difference equations to model complex dynamic processes with the ability of input-output models to address the multi-sectoral nature of modern energy systems. Using this approach to macroeconomic modelling we show that successful energy transitions are critically dependent on the balance between the rate at which renewables can be substituted or fossil fuels and the initial increases in emissions associated with the production necessary to construct the renewable capacity.

4.1.3. The fossil intensive DNA of the financial system: feedback loops between socio-ecological and financial fragility – Data supporting an emerging theory

Svartzman, R. McGill University

The origin of the current economic downturn lies in the 2007-2008 global financial meltdown, the main financial crisis since 1929. The crisis started with the burst of a speculative bubble in the U.S. housing market, translated into a liquidity crisis in the interbank lending markets, and spread into the real economy where banks stopped lending and companies froze expansion plans. Beneath the mechanisms that triggered the crisis, its roots are increasingly recognized to be located in the the so-called financialization of the economy that started between the 1970s and 1980s. Financialization can be defined as “the increasing importance of financial markets, financial motives, financial institutions, and financial elites in the operation of the economy and its governing institutions, both at the national and international level” (Epstein 2001, 1).

In fact, growing evidence shows that the burst of the 2007-2008 financial crisis and the ensuing economic difficulties go beyond the ‘dis-embeddedness’ of the financial system from the economic sphere (i.e. financialization). More specifically, financial crashes would occur whenever the relative scarcity of natural resources increases the pressure on the supply or demand side of the economy, ultimately affecting the ability of some agents to repay their outstanding debts (Daly 2014; Martinez-Allier 2016). Hamilton (2012) points out that ten out of the eleven last U.S. recessions have been preceded by an oil price shock. In the case of the 2007-2008 crisis, it is argued that the price increase of oil and its effect on interest rates have contributed to weaken the poorer U.S.

households' ability to repay their mortgages (Tveberg 2012). The above considerations suggest that the study of biophysical dimensions can complement the traditional understanding of financial crises. Going one step further, Smith-Nonini (2016) argues that the financialization of the U.S. economy itself is a rather natural outcome of the Keynesian 'golden age' in a new context of national energy scarcity: disconnecting wealth from production – by increasing public and private debts – allowed the U.S. to maintain its global influence and corporate profits in spite of its loss of energy surpluses.

This disconnection between real and virtual wealth has led investors to expect minimum returns of about 15% per year (Grandjean and Martini 2016). Such expectations are disconnected from the return provided by traditional long-term investment in infrastructure – such as those needed to drive the ecological transition in both developed and developing economies – typically lower than 2%-3% per annum (ibid). In this context, the pursuit of financial return can increasingly come at the expense of the protection of the commons. For example, in his attempt to maximize financial performance in a low-carbon transition, Rubin (2015) recommends switching investments in fossil fuels for new opportunities such as food, water and land. In fact, when financial flows target the relatively inelastic supply of such life-supporting systems, financial bubbles can form and affect the world's most vulnerable populations (Farley et al. 2013; Masters and White 2008. Annex 12). For example, George Soros considered that by speculating on agricultural commodities during the food crisis in 2008, investors' behavior was comparable to "secretly hoarding food during a hunger crisis in order to make profits from increasing prices (cited in Wahl 2009)".

4.2. Finance, wealth and capitalization

4.2.1. Modeling the dynamics of modern money

Boyle, GH. Orrey Software

This paper explores some of the dynamics of monetary systems. Money is the life-blood of the modern global economy in which all nations must participate, and which they use to trade their raw resources, manufactured goods and marketable services. And yet money remains an enigma that raises many questions and engenders many answers, but knows little consensus. For some people "money" means banknotes and coins, or bank ledgers, or net worth statements. Theorists think of a medium of exchange of property rights, or a lien on future production. There are debates about metallism versus chartalism, U-shaped versus C-shaped, and more tax versus less tax. Economists, bankers, corporate financiers, and monetary analysts categorize it by its liquidity, its velocity, its multiplicative effects, its derivative nature, or its risk. Net worth becomes the standardized measure of all that a person holds, and utility in the service of profits is the measure of all that exists. However, with all of this attention, there still remain some troubling questions. What is the impact of the diamond-water paradox? What is the source of the "time value of money"? Where do profits and/or interest really come from?

Thomas Piketty recently completed an investigation of the historical distributions of wealth. In his graphs we see that something dramatic changed in the global economy in the 1970s as the utopian trend towards increased wealth in the middle class abruptly changed direction. We can, perhaps, do little more than speculate about the causes of this abrupt change, but consideration

of it leads to a curious hypothesis – the financial economies of the world broke free of the biophysical economies of the world and took flight, soaring higher even as the latter struggled and started to sink.

There is a type of economic model that is peculiarly suited to a study of the dynamics of just such a disembodied financial economy. We find the first example of this, to my knowledge, in the works of Benatti (1988), and Drăgulescu and Yakovenko (2000) in what is now called the BDY model. It is an agent-based economic model in which the biophysical components have simply been ignored, prices of goods and services play no role, and only the dynamic interactions of units of money are considered. Now termed a "capital exchange model," in this type of economic model, money flows through the logical financial system in a manner highly analogous to the flow of energy through a physical system, and this fact invites application of all of the well-known tools of statistical mechanics in its analysis. But first, we need to understand how to build better models.

In this paper, three such capital exchange models are presented and discussed. First, the simple design and profound implications of the BDY model are briefly reviewed, and its connection by analogy to the 2nd law of thermodynamics is described. The second model presented is a simple variation on the BDY model in which a single constraint is added causing a dramatic change in behaviour. This enables a study of economic entropy in an extremely simple isolated economic model.

4.2.2. Revisiting financialization through the corn commodity chain – A holistic analysis of debt, technology and land

Menegat, S. McGill University; Svartzman, R. Ph.D.McGill University.

The 2007-2008 world food crisis has been assessed as the consequence of a broader set of issues affecting the stability of the whole international agri-food system in the long run. Academic literature defines these issues in terms of ecological degradation, social burdens and economic inefficiencies. Much effort has been spent in searching for a causal relationship connecting energy, land use, financial trends and food prices. In particular, while a certain correlation between financial speculation and the 2007-2008 food price spikes has been proved, the underpinning mechanisms and causes are still largely unexplained.

In this context, this presentation will explore the connections between the financialization of the agricultural sector, the evolution of the sector's corporate profits due to technological improvements, and the cost of energy. In doing so, we intend to test the hypothesis recently made by several scholars, according to whom the process of financialization triggered in the 1970-1980 can be assessed through a new "energetic" lens. Rather than being the simple result of technological progress in financial markets (as claimed by orthodox economists) and while responding to a politically-motivated agenda (as claimed in heterodox circles), financialization also seems to be deeply connected to energy realities, in particular in the US. When this country passed its own peak oil in the 1970s (thereby becoming dependent upon foreign imported oil), corporate profits started to shrink; financialization therefore appeared as the 'optimal' strategy to maintain corporate profits in a world of declining energy availability (with lower energy return on investment – EROI – among other indicators).

While this link is increasingly clear – and will be the subject of a previous presentation in this conference – it is important to avoid deterministic outcomes. The causal relationship between energy and financialization is a clear example of complex interactions where precise and unidirectional causal loops cannot be established. A systemic analytical approach is therefore required. In this context, we follow Blair Fix's recommendations, arguing that the quality of energy analyses can be greatly improved by framing the problem within a theoretical framework based on ecological economics, world system theory and the differential accumulation hypothesis.

In short, our goal is to further improve the current understanding of financialization processes through energy analysis, while avoiding mechanistic, reductionist and deterministic assessments. In order to do so, we ask whether the financialization observed in the agricultural sector in the US can be better explained through a holistic framework including the linkage between the availability of sources of cheap fossil energy and the evolution of agricultural commodity markets By analyzing the case of US corn production, we provide a context to assess the role of finance in determining the linkages connecting land use, energy throughput, and trade dynamics. Our study aims to provide an important contribution to the current understanding of agri-food system dynamics, international trade patterns and current financial macro-trends. Such developments corroborate the latest developments in ecological economics theory and set the bases for the further investigation of the mechanisms governing socio-ecological systems.

4.2.3. Measuring Comprehensive Wealth in Canada

Smith, R. Midsummer Analytic; Bizikova, L. IISD; McDougal, K. IISD.

Comprehensive wealth measures the combined value of produced, natural, human and social capital. It is, in our view, a key measure that Canada should publish alongside GDP. It complements GDP's short-term focus with a longer-term view of the country's prospects. As such, it is essential to understanding the sustainability of development, an issue on which GDP is silent. More information is available at www.iisd.org/comprehensivewealth/en/. The study, which made use of the best available data, is one of only a handful of comprehensive wealth studies ever undertaken in Canada or elsewhere. Here is what was found:

- Overall, comprehensive wealth grew slowly (0.19% annually) between 1980 and 2013 in real per capita terms. This contrasts sharply with relatively robust (1.36%) growth in real per capita consumption of goods and services. This is a potential concern, as consumption growth in excess of capital growth may not be sustainable in the long run. Canada's productivity was too weak to account for the difference in the rates.

- Human capital, which represents 80% of comprehensive wealth, did not grow at all in real per capita terms, in spite of more Canadians graduating with diplomas. This is partly due to an ageing workforce, but also raises questions about the effectiveness of educational investments, innovation and others.

- Natural capital, a traditional driver of consumption growth, declined by 25% in real per capita terms. It has fallen much further since as a result of the drop in oil prices. This represents a major loss of wealth that may not be recovered.

- Produced capital, the relative bright spot, grew solidly over the period (1.68%), but its growth was concentrated in the oil and gas and housing sectors (70%). This leads to concerns about diversification, "stranded" assets, market corrections and other longer-term risks.

- Social capital, which could only be evaluated in qualitative terms, appears to be stable but not increasing.

Given the above, the report concludes that Canada's development remains sustainable but that it is not on a robust footing. It thus notes the need to:

- Recognize the long-term risk in a fossil-fuel dependent economy and ensure the current debate about resource projects includes a plan to support the transition to a low-carbon economy.

- Reverse the downward trend in natural capital, as the country cannot afford another 30 years of declines – especially with climate change impacts still mostly in front of us.

- Find ways to ensure the growth of human capital. Other countries are doing so and Canada cannot afford to fall behind.

- Diversify investment to reduce the dominance of the oil and gas and housing sectors. The recent discussions around infrastructure investment are, we find, encouraging in that regard.

- Finally, begin regularly measuring comprehensive wealth and using it to guide decision making.

4.3. Degrowth and steady-state

4.3.1. Degrowth, banks and ecological constraints to endogenous money theory

Pastoret, C. Laurentian University.

In Post-Keynesian theory, the money supply is endogenous, meaning that banks and the central bank could indefinitely accommodate the needs of a growing economy, with no ecological constraints to limit this process. In fact, endogenous money has made possible the transition from an "empty world" with rapid economic growth, overutilization of natural resources and increasing pollution to a "full world", in which the economic system is getting close to the planetary boundaries (Goodland R. and Daly H., 1992).

Post-Keynesian theory and Ecological economics seem irreconcilable, as they aim at reaching apparently incompatible objectives: economic growth and full employment versus degrowth and ecological constraints to economic growth and full-employment.

Because money endogeneity has contributed to bringing our economic system closer to the planetary boundaries, ecological economists advocate 100% reserve requirements for banks. However, this solution might not have the expected results in an endogenous money framework, with unnecessary high costs in terms of employment and wellbeing.

This paper starts with Keynes's refutation of the quantity theory of money, as he proposes to think in terms of flows of money and the motives for its creation and its uses, while banks are not presented as creators of artificial money. It is then argued that ecological constraints can be integrated into the Post-Keynesian theory of endogenous money and banks. At the same time, ecological economics, and more specifically degrowth economists, might benefit from alternatives to the neoclassical commodity-based monetary and banking theories.

4.3.2. Monetary Theory and Practice in the Age of Planetary Boundaries: an Institutional Overview for Ecological Economists

Svartzman, R. McGill University. Ament, J. University of Vermont

Until the last decade, the question of how to govern money and finance on a finite planet had been addressed only sporadically by a few renowned economists, monetary theorists and other scholars (e.g. Gesell 1958; Polanyi 1944; Soddy 1934). But the multiplication of interconnected financial, economic, social and biophysical crises and the systemic risk they pose have driven a renewed interest in such question. In this regard, two groups (and five categories) of positions can be identified in the literature, the so-called – for this purpose – 'reformist' (or 'evolutionary') and 'transformative' (or 'revolutionary') agendas:

- The 'reformist' approach, mostly found in post-Keynesian economics, acknowledges that money is not economically neutral and that its creation, circulation and destruction can be regulated. The financial sector can be nudged towards the funding of economically, socially and environmentally 'desirable' activities. Under a 'green post-Keynesian' agenda, government intervention and regulation would have the unique ability to both fight the effects of financialization and to catalyze a transition towards a more sustainable economy;

- A large range of 'transformative' approaches consider that at least one of the two following features of the current 'post-Bretton Woods' monetary system is at the root of the degradation of Earth's life support systems. First, the fact that the creation of money takes the form of interest-bearing debt: this would create an exponential growth of money supply and debt, which in turn creates the need for an exponential growth in real output – to repay an ever-growing debt – that goes beyond our bioregions' carrying capacity. Second, the rule of monopolistic national currencies – mainly enabled by taxes, regulations and central banks' operations – would sacrifice diversity and resilience, thus creating financial instability and preventing the burgeoning of local ecological, social and economic initiatives (Lietaer et al. 2012). This assessment gives rise to four different – and sometimes strongly opposed (e.g. Dittmer 2013; Fontana and Sawyer 2015) – avenues aimed at transforming money itself: (i) rebuilding the foundations of macroeconomics and monetary institutions through the Modern Money Theory (MMT. Lawn 2010); (ii) nationalizing money through full-reserve banking or sovereign money (Daly 2012; Jackson and Dyson 2012); (iii) multiplying ecological complementary currencies (Lietaer et al.

2012); and (iv) upscaling ecological crypto-currencies (Paiva Sobrinho and 2016; Greco 2016).

Each of the reformist and transformative approaches presented above relies on either a thorough macroeconomic or socio-ecological assessment of the problems and challenges ahead. However, when it comes to assessing whether money is inherently at odds with the governance of socio-ecological systems on a finite planet, these proposals often fall short of providing a comprehensive and transdisciplinary theory. In particular, most of the proposals presented above fail to address three overarching questions posed by the institution of money:

(i)The structural imbalances created by the international monetary system cannot be fully mitigated at the national or subnational scale, given the interconnectedness of monetary policies in an integrated world; (ii)The institutional nature of money makes reforms more complex than often assumed. Monetary and financial institutions are themselves the reflection of specific social and natural settings, including power structures and different concepts of sovereignty; and (iii)Many proposals – in particular in post-Keynesian economics – only aim to bring 'green investments'. While this is important, the quality and governance of the funding is also critical, as shown in the institutional economics literature on the commons.

4.3.3. Putting money in its right place: Money, the State and the transition to a steady-state Economy

Guay-Boutet, C. Université du Québec à Montréal.

This communication aim is to discuss the preliminary theoretical results of a research conducted on the integration of post-Keynesian and neo-Chartalist monetary economics to the literature on the transition to a steady-state economy in Ecological Economics. Divided in three logical moments, this communication wish to: 1) disambiguate the State origin of money and the definition of money as a debt 2) provide an overview of post-Keynesian monetary economics on the issue of how credit-based (horizontal) money fuels economic growth (pro-growth bias) as a logical consequence of our definition of money as a debt 3) illustrate the argument via the presentation of some works in Ecological Economics on how State's spending of credit-free (vertical) money could ease the transition to a steady-state economy.

Mainstream economics aside, most contemporary historical and social sciences inquiries on the origins of money points to a State origin of money. According to these studies, money historically appeared as debt which, as a unit of account, bounded peasantry and central powers in Ancient Middle East (Peacock, 2006: Foucault, 2004: Greaber, 2011). As such, money in contemporary capitalism is no different from this point of view (Wray, 2014): horizontal money, created as bank loans to the productive sector, is still predominantly debt-based, operating as book entries in bank accounts (Gnos, 2006). Debt-free, or vertical money spent by central banks, still has a very limited importance in our economy. State is not out of the picture: via central banks indirectly controlling interest rates and required reserves ratios on private bank accounts, State plays a central role in validating the hegemony of credit-based money (Lavoie, 1992: 2004: Smithin, 2000), namely providing the ultimate guarantee in the issuance of the unit of account that credit-based money is. Even though this point is not unanimous in heterodox monetary economics (Victor and Jackson, 2015), a large group of researchers agree on the relationship between horizontal, credit-based

money as created by bank loans and understood by post-Keynesian, and economic growth (Biswanger, 2009: Tutin, 2003). However, integrating post-Keynesian monetary economy in Ecological Economics is not as easy as it seems prima facie. Indeed, during its early decades of formation, Ecological Economics did not pay significant attention to the study of money and its relationship with growth (Ropke, 2005). Simultaneously, post-Keynesian monetary economics did study this issue at length, but set aside the problem of ecological sustainability in relation with economic growth (Sawyer and Fontana, 2016). The preliminary results of our work (Guay-Boutet, 2016) lead us to believe that these short-comings can be surpassed. From a very general epistemological and historical point of view, post-Keynesian monetary economics, its neo-Chartalist trend in particular, and Ecological Economics could eventually form a unified paradigm (Gowdy, 1991) able to propose concrete paths for the transition to a steady-state economy by minimizing the relative importance of credit-based money, gradually valorizing debt-free vertical money created by central bank and government spending in a (Dittmer, 2014).

4.3.4. Over the Horizon: rethinking assumptions for a post-growth world

Crownshaw, T. McGill University; Adams, A. University of Vermont.

Maintaining steady economic growth has been the central goal of macroeconomic policy throughout the post-WWII era, explicitly promoted by the dominant economic paradigm. The global economy has now reached a size that is endangering the integrity of the biosphere. Despite the preponderance of scientific evidence for the consequences of growth, warnings from prominent researchers and activists, and the acute risks of inaction, policymakers, industry, and the public have largely failed to respond. We argue that it is necessary to confront the likelihood that substantive change will only be possible following a turning point brought about by an end of growth. This requires a strategic shift within Ecological Economics discourse, away from primarily mitigating the problems of growth and towards preparing cohesive approaches for the context of a post-growth world.

A thorough re-examination of contextual assumptions is needed in many domains. We present cursory re-examinations for a selection of relevant fields. We also attempt to highlight the systemic nature of interactions among these fields and their implications. A post-growth scenario is likely to be highly spatially and temporally heterogeneous, and represent a significant departure from the socio-economic conditions of the 20th century.

The first section explores the conceptual difficulties regarding economic growth, and summarizes the various forces, biophysical and social, that may bring about the end of growth. We examine economic growth as it is commonly understood, discuss the prospects for dematerialisation of economies, and review several categories of biophysical constraints on aggregate economic activity: sources limitations on critical economic inputs; sink limitations concerning the assimilative capacity of ecological systems; and feedback limits concerning the response of the climate system to anthropogenic interference.

In the second section, we deal with possible drivers of ecological degradation associated with a post-growth scenario and related feedbacks between natural and human systems. Impacts on ecological systems and biodiversity are expected to stem from climate change and ecological stresses associated with large scale human migration. Poverty both aggravates ecological

degradation and is in turn caused by it. We argue that in a post-growth paradigm, economies will become more localized, relying on resources in their immediate vicinity. Given these conditions, we attempt to illustrate how a post growth scenario may affect biodiversity, water pollution, air pollution and human societies.

The third section investigates the possible impacts of the end of growth on the global climate system and climate policy. We explore atmospheric capacity as an ecosystem service, likely changes in the emissions of greenhouse gases, identified feedbacks in the climate system, and the new policy context for climate change mitigation. We find that a shrinking economy may not necessarily lead to a reduction in the pace of global warming, at least in the short-term. This together with the presence of relatively poorly understood and uncertain climate feedbacks renders key climate policy decisions both urgent and subject to extreme risk. The fourth section on governance explores the likely challenges faced at different levels of government after the end of growth. The most significant issue will be changes in employment given limits on material throughput in economies. This may induce a shift in societal values relating to productivity and income distribution.

5. THEME 5: PATHWAYS TO CHANGE: TOOLS AND STRATEGIES (OCT 22, 9:30 - 10:45)

5.1. Transforming Energy Systems

5.1.1. Deliberating Our Energy Future

Dolter, B. University of Ottawa.

Climate change requires a great energy transition. This transition promises to disrupt regions and communities dependent on fossil fuels, and requires a structural change of the Canadian economy. Pathways for Canada's energy future are varied and have been outlined in reports such as the Trottier Energy Futures Project and Deep Decarbonization Pathways for Canada report. Deliberative dialogue amongst affected stakeholders offers a method of reaching conciliatory agreement on our energy future. This paper outlines two case studies of deliberative dialogue in Saskatchewan, Canada. One dialogue asked stakeholders to design an electricity future for the province using an energy-economy-environment model. A second dialogue asked stakeholders to design programs that could support an expansion of solar energy in the province. In each deliberative session, participants were faced with trade-offs and asked to use their creativity in small groups to propose a consensus pathway or program. Conclusions reached and lessons learned from these dialogues will be presented.

5.1.2. Change in the Anthropocene: De-carbonizing and Decolonizing Canada

Gobby, J. McGill University.

There are multiple intersecting social-ecological crises currently faced in Canada. These include increasing impacts of anthropogenic climate change, growing economic inequality, and the disproportionate levels of poverty and suffering of First Nations communities across the country. While these crises persist, the Federal government is continuing to approve pipelines and other oil and gas infrastructure projects which will facilitate the expansion of the Alberta tar sands, one of the largest single green house gas emitting projects on the globe. These fossil fuel projects are exacerbating the aforementioned crises faced in Canada, while disproportionately impacting Indigenous communities who are on the front lines of both climate impacts and the impacts of the expansion of oil and gas industries. In response to this, grassroots groups, non-governmental organizations and Indigenous communities are leading the movement for Climate and Environmental Justice. They are resisting unwanted projects as well as developing and promoting alternatives while challenging the dominant narratives about Canada's economic and energy systems. This paper brings together several years of qualitative research developed and conducted in collaboration with diverse actors in this broad movement. Gathered through participant observation, over 60 in depth interviews, and more than 50 completed questionnaires, these research findings explore the Theories of Change held by these agents of change as well as the tactics and strategies being used to "Change the System, not the Climate". This work also explores the major barriers to change being faced by this movement, including internal tensions and external forces. Ultimately, this project is a collaborative brainstorm on what can be done to strategically overcome the barriers and increase the transformative power of the movement. It also offers a reflection on what the climate justice movement in Canada has to teach the ecological economics community about making large scale change, in a short time scale and about how it can contribute to scholarly theorizing about making change Anthropocene.

5.1.3. Decentralized democratic energy transition: Sharpening the vision for a just and ecological whole earth energy system

Burke, M. McGill University

In view of threats to human and nonhuman life posed by fossil energy use, this paper conceptualizes and sharpens a decentralized and democratic transition pathway for global renewable energy systems. The motivation for this work stems from the growing interest in a 100 percent renewable energy future worldwide. Extensive support for a transition from fossil fuels to renewable energy systems conceals a wide range of perspectives on the transformative potential of the energy transition. For many, the challenge of energy transition centers on the substitution of fuel types, while others find this conventional framing inadequate, seeing rather an opportunity for more fundamental social transformation through energy transition. As a leading example of this transformational perspective, the movement for energy democracy has emerged in North America over the past decade to advance a vision of a renewable energy future rooted in social and ecological values. Centralized visions of global renewable futures continue to gain prominence, yet 'bottom-up' transformations may prove better suited for achieving radical and possibly rapid sociotechnical change. Decentralized and democratic energy visions have not yet been sufficiently developed as a coherent vision for global renewable energy governance, despite an increasing recognition of the many benefits of a decentralized approach, particularly for the Global South but also among marginalized groups of the Global North.

To construct and explore a decentralized democratic model of global energy transition, this doctoral research follows the approach used by the authors of Right Relationship: Building a Whole Earth Economy (Brown & Garver, 2009), who pose five questions in search of an economy in right relationship with both human society and the broader community of life: What is the global energy system for? How does it work? How big is too big? What is fair? How should it be governed? These questions are directly relevant for energy systems because modern forms of energy serve as the foundation for modern economies. Centralized and decentralized renewable energy systems are not simply different physical energy systems. Rather, they present very different socio-economic models with different political economies. Drawing from the energy democracy movement as well as social-ecological fields of study, this research converts the vision and values of energy democracy and related fields of study into a tentative conceptual tool for guiding global energy futures.

A whole earth energy system shifts from an agenda of unlimited expansion toward the pursuit of social-ecological wellbeing. The Earth is awash in solar-based renewable energy, yet biophysical thresholds as well as limited human needs place constraints on the scale of future human energy systems, while fairness requires that due consideration be given to intra- and inter-generational justice and the needs of the biosphere as a whole. The key features of this vision include a reorientation of energy development toward meeting the needs of all within planetary limits as conceptualized in the energy life ring. As such, the energy transition prioritizes sharp reductions in demand among affluent communities coupled with equally dramatic increases in renewable energy technologies in underdeveloped communities under the direction of the communities themselves.

5.1.4. Contentious carbon: taking stock of social movement efforts to constrain Canadian fossil fuel extraction

Tucker, B. University of Oxford.

Canadian fossil fuel projects have increasingly faced resistance over the past decade from actors driven by concerns about Indigenous sovereignty, ecosystem and human health, and climate change. This paper begins to investigate the near-term climate change mitigation impacts of this resistance. Using data from a crowd-sourced map, it establishes the broad scope of social movement efforts to curtail Canadian fossil fuel extraction from 2005-2017, finding that X coal, X natural gas, and X tar sands projects representing X tonnes of extracted CO2e have been challenged, with up to X tonnes remaining unextracted due to this resistance. Next, with a focus on efforts to block tar sands pipelines, it uses a political risk model from Hoberg (2013), grey literature, and interviews with central actors from communities, NGOs, government, and industry to theorize how project outcomes and climate and energy policy discourse have been impacted

5.2. Energy Transitions

5.2.1. The equitable allocation of greenhouse gases

Greenford, D.H. Concordia University. Matthews, H. D. Concordia University

National Emissions Inventories (NEI) use Production-Based Accounting (PBA), which counts only Greenhouse Gas (GHG) emissions generated within national territories, referred to as "territorial emissions". Approximately a third of global GHG emissions are linked to production for export and are therefore not subject to domestic mitigation policies. Furthermore, GHG accounting conventions are often mistakenly conflated with responsibility for climate change. The following research aims to provide a way of reconciling accounting conventions with responsibility for — and to act on — climate change. Here I propose a weighting metric rooted in normative ethics to allocate Emissions Embodied in Trade (EET) between bilateral trading partners — Equity Weighted-Based Accounting (EWBA). The metric is constructed to weigh EET inversely to how vital a given trade is for each country involved. Each trade comprises of a transaction of income for the exporting country and products for the importer. Need to engage in trade is quantified using the use-value for income and products exchanged in a given trade. Use-value is empirically derived from the relation between human welfare and income, and its mapping onto products purchased with said income. In order to define and quantify use-value (in this sense, the relative usefulness) of products, a cardinal ranking of products was proposed and a corresponding hierarchy of emissions was quantified. Three broad emissions categories are defined: subsistence, luxury, and a middle category for emissions that result from neither subsistence nor luxury activities. National emissions are broken down into these three classifications and it is found, unsurprisingly, that developing countries have relatively higher proportions of subsistence emissions compared to wealthier developed countries.

It is found that EWBA emissions suggest higher abatement responsibility than PBA emissions for most affluent countries, though usually less than if EET were divided equally between producing and consuming parties. EWBA provides an alternative accounting convention to PBA that is arguably fairer, and hypothetically more effective, than Consumption-Based Accounting (CBA), which allocates all EET to the final consumer. If adopted as the convention in international climate policy, revised NEIs employing EWBA should better reflect both historic contributions to climate change and future national abatement responsibility (i.e. how much nations should contribute to the international efforts to curtail global GHG emissions), ideally yielding more equitable and effective climate policy. It was also found that dividing EET equally (i.e. 50/50) between bilateral partners provides a good first order approximation for EWBA and is proposed as an attractive policy-ready solution due to its simplicity and transparency. This metric is dubbed Equal Allocation-Based Accounting (EABA), and can be calculated by taking the mean of PBA and CBA emissions. EABA is also used a null hypothesis with which to compare the outcomes of EWBA-derived NEIs.

Perhaps the most substantial or interesting contribution of this research is the proof of concept it provides for more general applications. In attempting to build a weighting metric and accounting method to distribute GHG emissions between nations in an ethical manner, I have derived a methodology I now term "quantitative ethics" — a method that begins with an ethical premise and arrives at a quantifiable outcome that can be used in policy formulation.

5.2.2. Responsibility in a climate changed world: Exposing the role of fossil fuel producers

Greenford, D.H. Concordia University.

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.

Global leaders assert that they are aware of these implications, though no country has mapped out an end game for the fossil fuel industry. This disconnection between averting climate catastrophe and phasing out fossil fuel supply has led to policy inefficacy. The entirety of the discourse in policy has focused solely on demand-side measures, like disincentivizing the use of fossil fuels with a carbon tax, or incentivizing the adoption of renewable alternatives with subsidies, ignoring the vast potential of supply-side policies needed to ensure a safe transition including the phase out fossil fuel subsides. Here I present the case for supply-side policy from the perspective of responsibility in a climate-changed world.

This lack of focus on supply-side measures is no accident or oversight; indeed, it is fundamental in maintaining the dominance of the incumbent energy system. This leads to a needed explicit discussion of a glaring contradiction in international climate policy today. Developed nations who earn a significant amount of their revenues from fossil fuel exports — like Canada, Australia, and Norway — have also stepped forward on the international stage advocating and agreeing to ambitious climate action. The level of ambition required clearly implies the end of the fossil fuel era. How can these countries reconcile the paradox of decarbonizing their economies at home while refusing to halt increases in production and exports of fuels they no longer use themselves? These fuels are largely targeted for markets in the developing world. This inconsistency between domestic and foreign energy policy sets up a dangerous double standard, as well as neocolonial power dynamic between developed and developing countries. In practice these discordance results in the coercion of developing nations to follow the same fossil fuel development path trodden by industrialized developed countries, while climate science tells us there is neither time nor atmospheric capacity to allow for such a scenario.

Here I examine the basis for responsibility of fossil fuel producers in more depth, considering economic and political arguments through an ethical lens. Supply-side policies can take equity considerations explicitly into account. For example, the question of who should be allotted rights to extract the remaining burnable reserves is already being discussed. It is crucial that developed countries who are substantial fossil fuel extractors and pledge climate action take bold steps to show the developing world that their commitment to a post fossil fuel world is more than just rhetorical.

5.2.3. Energy Transitions in the Postal Sector: How national postal operators can be key drivers to a practical, achievable and sustainable transition to a low-carbon economy.

Doherty, J. York University.

Canada has an energy problem. It is not accessibility, fossil fuel dependence, or lack of clean energy sources, nor is it energy policy or energy poverty. The problem with Canada's energy landscape is that it is dependent on and persists in using existing infrastructure. Centralized energy systems, as is currently the norm, are costly, produce waste in distribution and transmission, and are innately inefficient over long distances (1). What has resulted is a fractured energy system that has created a domino effect giving rise to environmental degradation, inefficient generation and distribution, and energy poverty. In other words, Canada has carefully cultivated an energy landscape that is inflexible, inequitable, dependent, in varying degrees, on hazardous sources, and vulnerable to fluctuating markets and foreign economies.

Although Canada has made progress in lowering energy-induced greenhouse gas emissions, this progress has been slow and tedious and persists in trying to use more sustainable and efficient energy technologies and systems under existing inefficient infrastructure and pathways. If Canada is to truly transition to a low-carbon future and drive innovative and disruptive change, we need to re-think our existing energy landscapes. It was the purpose of this research to identify how the building and transportation sector, whose emissions account for 32% of global energy use and produce 19% of energy-related GHGs (2) can play a fundamental role in driving this change. More specifically, this paper examines how national postal operators, who often have the largest logistical reach and network, can be the starting point for challenging the status quo.

Centralized energy systems and the subsequent path dependency this has created is an issue that has been strengthened through years of political decisions and higher-level forces that have generated systematic barriers to the adoption of more sustainable and efficient technologies. Although postal operators are making strides in improving transport and building operations, the reliance on fossil fuels for energy and the subsequent lock-in to internal combustion engines remain key barriers to greening this industry. As such, there is still enormous potential for improvement (3). Luckily, these imperfections present an extraordinary opportunity to escape the lock-in of ageing energy infrastructure, inefficient methods of transportation and reliance on fossil fuels.

This paper focuses on how key partnerships between public postal operators and private logistics companies could play a vital role in realizing this change by challenging the status quo and how continued collaboration and environmental awareness will continue to drive the transportation sector past the tipping point needed to push the global economy into a carbon-free future.

By exploring these issues in further detail, this paper has generated case studies highlighting some key national postal operators in OECD countries (Canada Post, Deutsche Post DHL, Royal Mail, Australia Post, United States Postal Service) to identify industry best practices and explore the progress that has been to date. It concludes with recommendations and pathways that could be taken in the future to green the postal and logistics industry and help Canada ameliorate current approaches in order to be the agent of change needed to realize the commitments made at COP21 in Paris and become a more sustainable, resilient and independent Canada.

5.3. Governing Transformation

5.3.1. Setting Up an Ecological Economy

Derek, P. Independent.

To set up a fully ecological economy (EE) there are about sixteen parallel steps, depending on details of categories. First and most important is the replacement of the classical paradigm with one that is capable of promising a future not only for homo sapiens but all the many threatened species. The new paradigm puts the ecosphere and its state of health at the centre, and is what enables all of the other necessary changes to occur or fall into place. The role on money changes from a dominant one to one that assists in what must be accomplished, and the difference between wealth, especially natural wealth, and money must be understood. Normal investment will emphasize the desirability of corporate operations' environmental sustainability. An ecological economy will be one of full employment, because otherwise the unemployed, who form part of the ecological whole are neglected. The additional employment will be created in wealth-enhancing projects, where predominantly natural wealth has been lost through past neglect of the ecosphere. Several such projects will be discussed. Such projects must necessarily be financed through interest-free loans or grants that will be provided by a new institution or set of financial institutions not currently envisaged by the Bank of International Settlements (whose function may change considerably in the EE). Particular attention will be required in setting up such funding institution(s) in large single-currency areas. Addressing climate change will become feasible in the EE, given the new financial institutions, and governments that have ignored climate change can begin the work of reducing greenhouse gas emissions forthwith, and address the problems of reabsorbing excess CO2 already in the atmosphere. It will be important, in reducing emissions, to make deadlines for achievable goals, and not wait for carbon taxes to do their work; since it is already known that the carbon-tax route is too slow. Mining will become more rapidly eco-friendly, and the principles "Reduce, Re-use and Recycle" will come into full force much more easily. Industrial goals, already becoming more ecological, will more easily optimize that happy state, while such negatives as planned obsolescence will diminish, largely through a new attitude to production and quality of what is produced. Local production and trade will be favoured relatively to what we see now, though international trade will continue, its extent depending on conditions that cannot be predicted as yet, though diminution of transoceanic trade is inevitable because of the necessity to reduce burning of fossil fuels to zero. There will have to be major changes in advertising, so as to discourage consumerism. Benefit corporations will be encouraged to multiply, as also the number of jurisdictions in which a new corporation can register as such. Much attention will be paid to "the commons," especially restoration, as part of restoring/increasing natural wealth. There will be a strong focus on global population stabilization and decline, likely beginning with adequate funding of UNFPA. A strong focus on organic farming and a necessary shift in negative agribusiness practices will contribute to restoring the importance of family farms and other small farms. Because of the broad general focus on health, food quality will become important, including the reduction of junk food. Militarism must decline steeply, or we are all done for. Inequality will be reduced, likely starting with salary inequality; and there will be new ways of assessing wealth, perhaps including the Genuine Progress Indicator, which is now in force in at least 20 states of the USA. Resource accounting will become essential in the EE.

5.3.2. The Science of Global Sustainability. Its Role in Governance for Prosperity

Sabau, G. Memorial University of Newfoundland.

Sustainability science, as coined by the NAS (1999), is "a quest for basic knowledge that can be used in a very practical way" "in the hope of finding a balance between meeting human needs and preserving the natural way that the ecosystems providing for us work". It is the science at the intersection between two complex, dynamic, interacting systems, the natural system and the socio-economic system, a field characterised by emergent phenomena, non-linear relations and uncertain outcomes. Research has shown that the current policies based on exponential expansion of the size of the economy are exceeding the planetary limits (Wackernagel, 2010; Rockström et al. 2009; Steffen et al. 2015) and produce increased social inequality (Piketty, 2014). Can sustainability science inform new policies that prioritize sustainability as the overarching goal of economic development?

This paper argues that by defining sustainability science in light of critical realism theories (Bhaskar 1975, 2008; Sayer 1992, Maxwell 2012), the potential exists to make the science of sustainability operational. Critical realism states that the world exists objectively and is stratified in three distinct ontological layers, the "real" (potentials, tendencies), the "actual" (events) and the "empirical" (experiences and perceptions) (Bhaskar, 2008). While events and experiences can be known empirically, empirical observation is not sufficient for understanding the potentials, or tendencies that shape the behavior of the systems themselves. Theories need to be developed to explain the role potentials, such as values, play in behaviours, especially how they impact human decisions. According to critical realism, conceptualization in social sciences can create potential for social action, as concepts defining social structures, institutions and relations evolve and can be improved upon because "they are man-made" and "are open to reasoned critique about what is the better conceptualization, and the better things to do" (Vatn, 2015). The science of sustainability, by focusing on both nature and society and on their dynamic interactions, can create and apply knowledge useful to support decision-making for sustainability, defined as the capacity of human society to continue indefinitely within the limits of the global ecosystem (Sabau, 2010).

Thus understood, sustainability science becomes relevant for achieving the first goal of Ecological Economics, the optimal scale of economic activity. Guided by the ecological limits revealed/measured/calculated by natural sciences, social sciences can set the task of designing and implementing a new architecture of the economic system functioning within the planet's ecological limits. This might start with redefining the purpose of economic activity, "to stay alive and to keep a place under the social sun" (Georgescu-Roegen, 1971), not as goals in themselves but as means to achieving prosperity, defined as ability to flourish as human beings, in less materialistic ways, within the ecological limits of a finite planet (Jackson, 2017). It is difficult to envision how the new economy for long-lasting prosperity will look like, or function, that is why innovative thinking is needed concerning new patterns of production, consumption, investment, work, and leisure based not only on technologies but also on new values like thrift, frugality, responsibility, sharing and care.

5.3.3. The New Economy Network Australia (NENA): connecting and amplifying 'alternative' economics initiatives in Australia, to create systemic change

Maloney, M. Australian Earth Laws Alliance and Convenor.

Today's dominant economy is built on the foundations of a global industrial and financial system with immense productive capacity, but the extractive nature of which has created extreme income

disparity and social injustice and wrought devastation on the natural world. Around the world, networks and coalitions have been forming and growing for many years which challenge the destruction and injustices of consumer capitalism and aim to build new pathways forward. In Australia, there are tens of thousands of fantastic organisations and dozens of networks promoting different elements of the 'alternative economy'. In this paper, I'll provide an overview of a new network that's been created to connect all of these diverse organisations and existing networks, so that we can connect and amplify the work already being done, and strengthen our efforts to 'join up the dots' and create a new economic system in Australia. I'll provide an outline of why the network has been created, how we're 'growing' and building the movement and what our strategies for the future are. The 'New Economy Network Australia' (NENA) was created in an interim or 'skeletal' form at a conference in Sydney, Australia in August 2016 and will be officially launched at the second 'new economy' conference in Brisbane, in September 2017.

NENA currently brings together hundreds of people and organisations across Australia who are interested in moving beyond the current unsustainable and unjust economic system that currently dominates Australian society. The plan is to link up thousands of 'alternative' economy initiatives, and build even greater momentum for a new economy. NENA is attracting significant excitement and engagement around Australia, and already includes representatives from First Nations Peoples, commoning and cooperatives organisations, sustainable energy and community energy organisations, organic and sustainable food system networks, alternative currencies and trading groups, anti-mining/post-extractivist groups, makers, repairers and anti-advertising groups, academics and researchers, environmental and sustainable population groups and many more. In my paper, I'll also discuss why we've chosen to frame the network within the language of the 'new economy'. Many different movements have emerged around the world focused on the concept of a 'New Economy'. Although they use different labels, such as the Social Economy, Solidarity Economy, Sharing Economy, Collaborative Economy, Steady State Economy, Regenerative Economy and Community Economy, they all share two key goals: (i) to challenge the current dominant economic system, with its reliance on fossil fuels, large scale resource extraction and socially unjust structures and wealth distribution, and (ii) to create and strengthen economic systems that serve the needs of people in ways that are ecologically sustainable, socially just and culturally diverse.

5.4. Other ways forward

5.4.1. Public Management and the Limits to Economic Measures of Policy

Gordon, J. American University

The current literature on low or no growth economies addresses the need to effectively manage the transition from our current economic state to the steady state economies of tomorrow. And yet, while most discussions include policy suggestions on how to manage the transition in a way that protects or enhances social cohesion, very little consideration has been given to reconciling this to current trends in public management, nor to how future policy makers will evaluate the success of programs in achieving these outcomes. This paper attempts to bridge this gap by introducing concepts of ecological economic theory to public management research. First, it suggests that in a constrained growth economy, traditional techniques for evaluating public policy

may no longer be valid if the aim is to improve socially desirable outcomes. This is due to the labor market assumptions of those models under general equilibrium. Second, a review of the literature on trends in public management suggests that governments may be ill designed to respond to constrained growth, so long as they continue to pursue the neoclassical economics-inspired New Public Management reforms currently in vogue in the United States and elsewhere. Finally, this paper offers suggestions on what public policy evaluation will look like in the future, with special focus on the goal of reducing poverty and inequality without growth. The paper is a complete "survey-style" paper and I am looking for high quality feedback from conference participants.

5.4.2. Proposing quantitative targets and limits to urban sprawl using the measure of weighted urban proliferation (WUP)

Jaeger, J. Concordia University. (2) Schwick, C. WSL Eidgen. Forschungsanstalt für Wald, Schnee und Landschaft, Zentrum Landschaft.

Current trends in land uptake for built-up areas in many parts of the world clearly contradict the principles and the spirit of sustainability. Urban sprawl is an example of the tragedy of the commons. To address this increasing problem, there is an urgent need for the establishment of targets and limits to urban sprawl, similar to limits and standards in other environmental sectors such as noise limits and limits to water pollution. The novel method of Weighted Urban Proliferation (WUP) can serve this purpose. The WUP is a combination of the amount of built-up areas, their dispersion, and land-uptake per person. We applied this method to Montreal and Quebec City and to 32 countries in Europe to examine the current state of sprawl, for historical analysis, and as a baseline for future scenarios. We found considerable sprawl in Europe at three scales with highly affected regions in the centre and along the Mediterranean coast using recently available consistent data across Europe from the European Copernicus programme. Based on our results, we propose a European de-sprawling strategy, including the implementation of targets and limits, and a set of concrete measures to control urban sprawl and to use land sparingly.

Urban sprawl in Montreal and Quebec City has turned into a fast growing problem since the 1980s. In the last 25 years, urban sprawl has accelerated in these two cities: It has become worse than ever before and has done so faster than ever before. In Montreal, urban sprawl has increased exponentially since 1951. It appears to have gotten out of control. Without rigorous measures, scenarios of future urban sprawl for Switzerland for 2050 show that sprawl will continue to increase strongly, but a few examples demonstrate that sprawl can be reduced. For example, as a consequence of intense public discussion, the Swiss Spatial Planning Act was revised in March 2013 to make it tighter. The new WUP method has recently been implemented in Switzerland's landscape monitoring system. Banks can help avoid urban sprawl, such as the Alternative Bank of Switzerland (ABS) does, by not giving loans to projects that would strongly contribute to urban sprawl, i.e., a divestment from urban sprawl. The WUP method is highly suitable for performance control of targets and limits to urban sprawl once they will be implemented.

5.4.3. Eco-Political Discourse in Canada: Learning from History

Harvey, J. University of New Brunswick; St. Thomas University

Our interest is to interrogate the process by which an unsustainable political economy could give way to ecologically and socially-rational alternatives. A system changes when the system paradigm changes (Meadows, 2009). Paradigm change (at least) requires two connected but distinct discursive processes to occur. First, the hegemonic system must be problematized in the public sphere. Second, counter-hegemonic discourses that attempt to frame new arrangements must gain legitimacy in the public sphere, such that their alternative proposals are accepted as plausible and therefore possible (Gramsci, 1971).

This discursive struggle for legitimacy takes place within a contemporary-cultural context that both constrains what is 'possible' to be thought, and also masks the historical nature of contemporary discourse. To ignore the history of eco-political discourse is to decontextualize current struggles and therefore handicap the strategic potential of alternative discourse production. This paper uses critical discourse analysis to provide some historical context for contemporary counter-hegemonic strategies. It reports on a longitudinal study of eco-political discourse in Globe and Mail editorials, beginning in 1960 and ending in 2016. The Globe and Mail was selected as the 'paper of note' for political and intellectual elites in Canada, and therefore significant within circles of influence and power. Editorials as a genre were chosen because they represent fully-developed and articulated opinions, presented as 'common sense' prognostications on a wide range of public matters, and therefore are easily analyzed for ideological content. The objective of the research is not to make judgements on the agenda-setting influence of the Globe and Mail in political/policy realms, but to reveal the contours of what is considered 'legitimate' discourse relating to environmental politics over a 55-year time span.

The paper takes a discourse-historical approach to frame analysis in order to characterize the Globe's editorial discourse in four different periods: the 1960s; the 1970s; 1982-1992; and post-1992, for each of which a brief history of the political context (primarily federal) is provided. Editorials were sampled in five year intervals, and were screened for eco-political topics using keywords. Within each sample year, each eco-political editorial was analyzed for its presuppositions, assertions and propositions, identifying characteristic frames associated with specific eco-political discourses.

The results reveal a radical shift in Globe and Mail editorial discourse over 55 years. Contrary to expectation, during the 1960s, 1970s and up to 1987, the paper of the business and political class took an activist stance on environmental issues that was on the whole rooted in progressive ethical norms. Beginning in 1992, the year of the UN Earth Summit, and carrying through to 2016, eco-political editorial discourse changed quite dramatically. Ethical premises were replaced by economic rationalities. While there is some variation over this long period, at times reflecting changes in federal governments, overall the trajectory of eco-political discourse through this period holds. Analyzing this data through the lens of neo-Gramscian, post-structural discourse theory allows us to discuss the relationship between historical context and discourse legitimacy, which in turn, can inform contemporary counter-hegemonic discursive strategies as we try to change the unsustainable hegemonic paradigm.

5.4.4. Information Entropy: A New Perspective on Invasive Species Management

Tait, M. St Paul's University at the University of Waterloo, Larson, B.

Many conservation biologists and ecologists consider invasive species to be one of the greatest threats to biodiversity because their spread across biogeographic boundaries may endanger unique and localized expressions of biodiversity (whether species or communities). Consequently, they imagine a future, the 'Homogocene', where a small set of species dominates ecosystems around the world, and they promote policies and practices to lessen the spread of these species. Nevertheless, there is very little consensus among ecologists about the theoretical rationale for managing ecosystems against species invasion. In this presentation, we argue that there is no biophysical or ecological justification for invasive species management, although there may be compelling social and ethical arguments for such efforts. Managing species invasion in order to preserve biodiversity faces challenges already identified in the 19th century, in the apparently unrelated field of theoretical thermodynamics.

We employ James Clerk Maxwell's concept of information entropy to shed new light on recent attempts to provide a 'thermodynamic' or 'systems' basis for preserving biodiversity, arguing that many such attempts in the ecology literature misconstrue the importance of course-graining as a modeling tool for complex systems. Ecologists have often found it useful to borrow concepts from thermodynamics. Ecological systems are thermodynamic, since every biological system is constrained by the laws of physics. Some ecologists have attempted to shed new light on ecological processes by appropriating thermodynamic concepts. This idea has met with some skepticism on the grounds that ecological systems are not just thermodynamic. Living systems are complex, adaptive, and emergent, and their 'parts' are not homogenous, unlike the particles in an ideal gas. The laws of thermodynamics may constrain ecosystems, the argument goes, but their usefulness in explaining the behavior of such systems is easily exaggerated. Maxwell's 'Demon' thought experiment suggests that entropy is best thought of as information-relative rather than a 'law of nature'. Once it is understood that complex adaptive systems are systems about which we have incomplete knowledge, the conceptual tools developed in the context of thermodynamic systems can be shown to have relevance in a wide variety of systems contexts. Adopting this Maxwellian thermodynamic approach to managing complexity, we wish to explore an analogy between thermodynamically closed systems and isolated biogeographical provinces in ecology. Specifically, we consider the case of invasive species as sources of 'propagule pressure'. Managers concerned with invasive species must contend with 'ecosystem equilibrium' processes leading toward the 'Homogocene' or the 'New Pangaea', a time where biogeographical barriers have been broken down under the influence of human activity. The prevention of invasive species dispersion requires energy input on a scale to counteract global trade and concomitant dispersal of species.

As we will explore, removing barriers to species interaction through globalization is akin to allowing a previously isolated thermal system to interact with its environment: in both cases the system will tend toward equilibrium, and fighting this tendency is costly. Unless social and economic integration decrease, the energetic input required to lessen the spread of invasive species will grow. Policies designed around invasive species mitigation face significant social and technical challenges. Here we issue a novel conceptual challenge, inspired by Maxwell's Demon, to any attempt to characterize a species as 'invasive'.

THEM 5: PATHWAYS TO CHANGE: TOOLS AND STRATEGIES (OCT 22, 11:00- 12:15)

5.5. Communicating the changes

5.5.1. What makes local elected officials tick and how can we train them for social-ecological change?

Guertin, M.A. Université de Sherbrooke

Municipal planning is complex because it is linked to ecological and social issues. Socio-ecological problems are manifested at different scales and involves citizens and local, regional, provincial and federal elected representatives. In Quebec, local elected officials (municipal councillors and mayors) become protagonists in the decision-making process leading to land use planning and the preservation of ecosystems. The socio-ecological issues on which they must position themselves are numerous and complex (protection of wetlands, green belt projects, endangered species protection, access to waterways, energy transport projects, urban sprawl, etc.). In addition, there is little research on representations of local elected officials about socio-ecological issues as well as the training offered to improve their skills. What are their representation of ecological thresholds, ecological goods and services, ecological economics and Quebec's legal framework for land use planning? What are the skill sets required to be an elected official in Quebec? What are the mandatory training required of newly elected officials. Who offers training to elected officials and how are researchers approaching elected officials for better land use planning? Can training contribute to better knowledge transfer and mobilization?

This presentation will reveal a preliminary exploration of an interdisciplinary research about training of municipal elected officials to socio-ecological issues. The topics covered will be social-environmental training, environmental training, adult learners in a formal, informal and non-formal setting and qualitative research with elites such as elected officials.

The presentation will identify certain pitfalls that researchers, practitioners and activists may encounter while working with local elected officials. Theories of changes and learning will be discussed putting in perspective the contribution of interdisciplinary research and training programs involving elected officials. The purpose of this presentation is to introduce a « research and development » project that will lead to the elaboration of training strategies for municipal elected officials on socio-ecological issues and land use planning.

5.5.2. A role of social innovation in linking sustainability goals with rural development objectives in the Scottish uplands

Nijnik, M. The James Hutton Institute. (2) Barlagne, C. The James Hutton Institute; (3) Bryce, R. University of the Highlands and Islands; (4) Slee, B. Rural Development Company; (5) Price, M. University of the Highlands and Islands (6) Miller, D. The James Hutton Institute

Considerable changes have occurred in the Scottish uplands: social, including demographic (e.g. workers leaving, retired people moving in); economic (e.g. renewable energy, tourism development) and environmental (e.g. driven by climatic change). Some upland regions require

strategies for watershed management, risk prevention (e.g. alleviate floods, windfalls, soil erosion) and the preservation of biological, landscape and cultural diversity. For example, the decline of agriculture in some localities affects cultural landscapes via land abandonment. In other places, small private enterprises intensify wood production, e.g. for using biomass for energy. An expansion of small businesses (e.g. tourism, infrastructure or wind/hydro power), new social enterprises and social entrepreneurship (e.g. health care or renewable energy) and new activities (e.g. mountain biking or horse riding) may support sustainable economic growth. However, some changes may entail environmental and social challenges to upland ecosystems and may at times threaten the provision of their services.

The ecosystem services obtained from the uplands are diverse and distinctive. However, the provisioning services of ecosystems may be economically non-competitive in wider markets due to physical isolation of regions; while topographic difficulties increase timber harvesting and processing costs, especially in small-scale operations. Mountain regions (in this country and elsewhere) are often considered as 'marginalised'; and upland communities may have inadequate access to important decision-making fora. Still, there are good examples (e.g. of community forests and social innovations) that represent positive models of governance systems (including multi-level governance) that should be investigated and reinforced.

The most recent developments provide formidable challenges for scientists and practitioners: What are marginalised rural areas? How do people in Scotland see their future? What are the pathways to change? What are the dominant public attitudes concerning sustainable rural development and how can they be translated into policy designs and operationalised by using socially innovative tools, strategies and adaptive management practices?

This paper seeks to contribute to an improved inclusion of marginalised rural areas in rural space in the view of wider impacts that these areas can have for the environment and people. The research contributes to the development of a better understanding of: (i) human-environmental interactions pertaining to social-ecological systems (SES), which is considered to be crucial for the designing innovative responses to address contemporary challenges in the Scottish uplands and to enhance the systems' resilience; (ii) the perception of pathways to change by relevant stakeholders to suggest on tools and strategies to improve the SES and the well-being outcomes derived from these; (iii) diverse development trajectories of SES, with identification of management options, policies or institutional arrangements -- responses (e.g. social innovations) -- to assist in overcoming the challenges and achieving the SES sustainability at a local scale.

The pilot findings indicate that deliberative governance systems can enhance the collective agreement - hierarchically, inter-sectorally and spatially - on (i) how to attain desirable trade-offs between non-marketed and provisioning ecosystem services in each locality, and across the territory and (ii) which strategies, policy instruments and management tools to use in order to promote a more sustainable delivery of the ecosystem services. Participatory decision-making processes and collaborative networks, involving scientists and other relevant stakeholders, can assist in the development of a better understanding of the drivers of change, and of how these drivers may affect marginalised rural areas and local communities residing in these areas.

5.5.3. Talk the talk to walk the walk and move the movement

Davy, B.J. University of Waterloo.

Despite the findings and predictions of Limits to Growth, fifty years of environmental discourse has failed to shift our economic development into sustainable patterns. The approaches of "rational analysis, data gathering, systems thinking, computer modeling, and the clearest words we can find…. are useful, necessary, and they are not enough" (Meadows, Randers & Meadows 2004 271).

Mainstream approaches to promoting ecological economics typically assume that individuals will respond rationally to economic incentives, appropriately framed arguments, and/or scientific knowledge. Scientific understanding of ecology is crucial for understanding the nature, scope, and urgency of environmental problems, but such knowledge does not lead to ecologically responsible behavior in a straightforward way. Numerous studies have identified a persistent gap between knowledge and changes in behaviour (Geller 1981; Geller, Erickson & Buttram 1983; Finger 1994; Kennedy, Beckley, McFarlane & Nadeau 2009). Economic incentives can shift behaviour, but are often ineffective in the longer term because when economic incentives are removed behavior tends to revert, following unchanged underlying motivations (Dwyer, Leeming, Cobern, Porter, & Jackson, 1993; Katzev & Johnson 1987). Dual-process models in psychology acknowledge conscious and unconscious motivations to human behavior, and have led to some interesting research on the importance of message framing, and the removal of barriers to change (Cheng, Woon & Lynes 2011; Davis 1995; McKenzie-Mohr 2000; Pelletier & Sharp, 2008), but scant empirical research exists on unconscious value formation and how it relates to ecologically responsible behaviour.

Three important factors in unconscious motivations of human behaviour, effectively demonstrated in more than 300 studies in terror management theory, are self-esteem, world view, and mortality salience (Burke, Martens and Faucher 2010). Greenberg, Pyszczynski, and Solomon (1986) introduced the idea of terror management theory, based on Ernest Becker's The Denial of Death (1973), and The Birth and Death of Meaning (1962). Terror management theory, often referred to as "TMT" in the literature, explains how thoughts of death and challenges to one's world view create a sense of threat to one's self-esteem by threatening the system in which self-worth is vested.

Influencing a population requires identifying the values salient when people are making decisions about ecologically responsible behavior, to understand what the norms are that people try to act in alignment with to bolster their self-esteem. However, changing the salient norms is a different matter. Aiming at changing behaviour in the existing system requires attention to contextual factors as well as values, but also larger structural change in how people relate to the environment, such as required to shift perspective from relating with "the environment" to a more than human moral community. Behaviour change aims at getting people to choose to consume less of a specific resource, whereas a deeper shift in values would make overconsumption unthinkable because it would entail changes in ontology to produce ecological conscience. An effective way to pursue change at this level, indicated by studies in terror management theory, cognitive science, and anthropological studies of value formation in ritual, is to raise the salience of ecological values through repetition and public espousal. Avenues for this in Canada include civic ceremony, and nationally distributed public service announcements such as the short film series Hinterland Who's Who.

5.5.4. Wicked Opportunities: A Multi-Layered Methodology for Socio-Ecological Systems Transformation

Ruttonshaw, P. University of Waterloo.

Though integrated socio-ecological systems dynamics characterize sustainability and resilience problem spaces, human convictions, inventions, and actions occupy a unique position within related dilemmas. These human factors, nested within ecosystems, have exponentially magnified the emergence of complexity within the biosphere, over time, along with socio-ecological systems stresses. However, the latter may not always follow from the former, as the potential for novelty that accompanies complexity can present prospective solutions for transition along sustainability and resilience pathways. As much as the interconnections that exist within complex adaptive systems can generate uncertainty within transition initiatives, so too can they breed opportunity. In this presentation, we will discuss how to analyze and work with these critical points of intersection. Through a series of vignettes focused on human-environment interactions, we will examine the development of socio-ecological complexity in the hundred years leading up to the 'great acceleration', within industrialized societies, and with a view to the implications for sustainability and resilience planning.

This conversation will be informed by a relational framework that extends from systems thinking, strategic design, social innovation, resilience, and sustainability transition literature. In these various schools of thought, we are reminded that transformation within complex adaptive systems can be a multifaceted, multi-scaled, non-linear process. Here, I adopt the 'basin of attraction' metaphor, found in resilience thinking, to signify systems' starting conditions, and explore 'points of leverage', therein. Specifically, I postulate that human-coordinated phenomena, within these basins, are generally composed of three layers, around which we can manage inquiry and action, as follows: (1) Perspective, comprising systems of meaning and ways of knowing; (2) Practice, comprising socio-eco-technological ordering; and, (3) Power, comprising the means by which change is influenced, mobilized, and implemented. Analyzing the links, interplay, and feedbacks that occur between these layers may reveal how barriers or changes within one may have direct or inadvertent effects within another; how socio-ecological complexity may arise in one layer and not in others; or, how complexity might be defined through the nature of the interconnections between them.

5.5.5. Between materialism and idealism: the dynamics of belief systems and their role in deep structural change

Orr. C. McGill University

While there are numerous critiques of the dominant belief system – often called the growth paradigm – researchers are unable to adequately explain its persistence. Moreover, the dynamics of belief systems remain inadequately theorized and poorly understood, leading to a disconnect between empirical understanding of beliefs in the present and their persistence over the longue duree. As a result, a naive "paradigm shift" logic persists. This paper seeks to better understand the role of ideas in maintaining the

stability of society's deep structures, and their potential role in systemic change. First, it builds on a complex systems approach to belief systems, extending the complex embeddedness of belief systems to include the society-nature relationship. It navigates the chasm between materialism and idealism by combining a complex systems perspective with the sociology of knowledge to develop a theoretical framework that conceptualizes belief systems and helps to understand their dynamics. Second, this paper theorizes and explores the dynamics of how belief systems persist, change, and evolve as part of and in relation to the deep structures of social systems. It argues that belief systems are not "freely floating" ideas and values. Rather, they become embedded in social relations and committed to through material actions in the real world: belief systems and deep structures of society intersect through the ontological assumptions embedded in social relations and ontological commitments of material actions. In these ways, belief systems become embedded in very real social and material realities that confront individuals in daily life, in turn shaping their beliefs and constraining their actions. This framework challenges conventional assumptions about social paradigm shifts, with implications for their transformation and qualifications for how paradigms are treated as leverage points in system change. Third, the growth paradigm is used to illustrate how this framework can be operationalized to understand the historical processes and dynamics of belief systems. Understanding these dynamics can enable us to connect the longue duree of history to the present and implies a very different approach for how we attempt to change belief systems in relation to the society-nature relationship.

5.6. Vers des systèmes durables

5.6.1. Les entreprises de la transition écologique au Québec : caractéristiques et trajectoires

L'Allier, M.S. Université du Québec à Montréal

Les changements climatiques et la crise écologique prennent une envergure sans précédent. Devant l'ampleur des crises, il y a urgence d'agir afin de limiter le réchauffement climatique et de respecter les limites planétaires. Pour parvenir à de tels objectifs, des changements majeurs sont requis dans la façon dont se réalisent les grandes fonctions sociales que sont le transport, l'alimentation, l'habitation ou la production d'énergie. Ces changements dépassent les simples améliorations technologiques des systèmes existants – ils devront également toucher les infrastructures, la règlementation, les institutions ainsi que nos habitudes de vie et notre niveau de consommation. Ce sont donc une multitude de transformations profondes et simultanées qui doivent se réaliser avec le concours de tous les acteurs de la société : gouvernement, entreprises et société civile.

Dans le cadre de cette recherche, nous nous sommes demandé quel type d'entreprises avait le potentiel de réaliser et d'accélérer une telle transition. Une analyse et une synthèse d'études portant sur la transition écologique, l'entrepreneuriat soutenable et l'économie verte nous ont

permis de faire ressortir 5 grands critères qui permettent à une entreprise d'accélérer la transition écologique.

Critère 1 : Percevoir et comprendre la gravité des crises environnementales : les dirigeants de l'entreprise de la transition perçoivent la gravité des crises climatiques et écologiques, comprennent leurs liens avec les activités humaines ainsi que les risques de basculement des grands équilibres planétaires et des conséquences catastrophiques d'un tel scénario pour l'humanité.

Critère 2 : Contribuer à ramener les activités humaines à l'intérieur des limites planétaires : l'entreprise de la transition écologique offre des produits, services et processus qui permettent de réduire l'utilisation des énergies fossiles et le gaspillage, d'annuler ou de minimiser les externalités négatives de produits et services existants et de protéger la biodiversité, les espaces sauvages et des écosystèmes(i).

Critère 3 : Intégrer la responsabilité sociale au cœur de son modèle d'affaires : la mission même de l'entreprise de la transition écologique vise à contribuer à l'amélioration de la société. Elle ne se concentre pas seulement sur l'aspect environnemental de la transition, mais vise également une plus grande équité sociale. Par conséquent elle est en mesure d'identifier les gains non économiques des ses activités pour la société et les individus(ii).

Critère 4 : Adhérer une redéfinition de la croissance : l'entreprise de la transition écologique considère qu'il est nécessaire de prioriser le bien-être sociétal et écologique plutôt que la croissance sans contrainte de la consommation matérielle. Elle croit en la nécessité de désinvestir et de ralentir les activités économiques jugées néfastes pour l'environnement et le bien-être des communautés, et d'investir dans les activités économiques qui les protègent et les améliorent(iii).

Critère 5: Initier une transformation structurelle des régimes actuellement en place: l'entreprise de la transition écologique ne vise pas à « se verdir » elle-même, mais plutôt à verdir la société dans laquelle elle évolue. En suggérant de nouvelles façons de faire, elle est amenée à proposer des innovations radicales qui visent à transformer un système plus large, et ce, malgré les difficultés d'une telle stratégie(iv). Par conséquent, son succès ne se mesure pas seulement à sa performance financière, mais également à sa capacité à améliorer la soutenabilité de la société.

5.6.2. Corridors écologiques urbains : la gouvernance de la transition à Montréal

Beaudoin, A. Université du Québec en Outaouais

Parmi les problématiques occasionnant la perte de biodiversité, l'urbanisation est citée comme étant une cause importante, créant isolement et perte d'habitats (CMM, 2011 ; Campbell, 1996 ; Tratalos, 2007 ; Douglas, 1983 ; Bridgeman, et al, 1995, Thomas, et al. 2012 ; Suzuki, F.D. ; 2015, Snäll, 2015). Cette transformation des écosystèmes affecte entre autres le climat, l'hydrologie, la production et séquestration de carbone. Aujourd'hui, il existe une tendance où nous tentons de réduire ces impacts sur le milieu en proposant l'intégration d'infrastructure naturelle (IN) dont l'objectif est d'adapter nos villes aux changements globaux. Ces IN fournissent une panoplie de services écosytémiques (SE), que ce soit la réduction des ilots de chaleur à la gestion des eaux

pluviales, en passant par l'amélioration de la santé publique ou du cadre de vie des riverains par le verdissement, pour ne citer que ceux-là.

Les corridors écologiques représentent une forme de ces IN où la connectivité est mise de l'avant afin de favoriser le déplacement de la biodiversité en plus de profiter des co-bénéfices rendus par les aménagements adjacents. Mitchell et al. (2013), suggéraient d'ailleurs d'approfondir nos connaissances sur la manière dont cette connectivité influence l'accès et les bénéfices des SE chez l'humain.

Toutefois, bien que les corridors soient connus dans le monde scientifique pour augmenter la résilience des villes face aux facteurs de pression des changements globaux (Rayfield et al., 2015) et l'augmentation des SE (Mitchell, et al. 2013), nous notons un manque d'étude traitant de la gouvernance entourant ce type de développement. Étant un domaine relativement nouveau, dans un contexte où la gouvernance participative est en plein essor (Ostoic et Konijnendekj, 2015), cette recherche tentera d'analyser les acteurs clés et la gouvernance afin d'en faire ressortir les éléments clés qui assurent le succès et prévenir les obstacles dans la mise en place de corridors écologiques. Nous espérons ainsi être en mesure de recommander certains réseaux d'acteurs afin d'optimiser l'intégration de ces aménagements connectés les uns aux autres et ainsi apporter notre contribution à l'augmentation de la résilience de nos villes en encourageant la réussite de ce genre d'initiatives.

Ce faible nombre d'études sur le sujet de la gouvernance entourant les corridors écologiques urbains serait entre dû au faible nombre de projets concrets, ce qui est d'autant plus vrai dans le contexte montréalais. Cependant, la Communauté Métropolitaine de Montréal (CMM) est actuellement le chantier de 14 corridors écologiques, ceux-ci deviendront notre terrain d'exploration profitant de l'opportunité pour documenter l'évolution de la démarche à ses premiers balbutiements.

Pour y parvenir, nous avons identifié quatre sous-objectifs ; D'abord il nous faudra 1) identifier les facteurs de succès à la réalisation de corridors écologiques selon les acteurs. Par la suite, nous 2) caractériserons ces acteurs, le but étant que chaque catégorie, telle que suggérée dans la littérature, soit minimalement représentée. Suite à quoi il nous sera possible 3) d'identifier la relation entre les acteurs, ce qui nous permettra de préciser la stratégie actorielle mise en place dans chaque projet. Nous documenterons ces stratégies 3.1) à partir des entretiens semi-dirigés, et aussi 3.2) à partir de la littérature. Ces informations seront ensuite mises en relation avec le type de gouvernance (réseau d'acteurs et relations de pouvoir) entourant chacun d'eux. Autrement dit, cette étape consistera à 4) identifier le réseau associé à chaque projet et mettre ces résultats en perspectives par rapport aux critères de succès préalablement identifiés.

5.6.3. Vers une économie biosourcée au Québec : d'une vision à une stratégie de développement.

Fagoaga, N. Institut de Recherche en Économie Contemporaine

La dernière politique énergétique au Québec propose des cibles ambitieuses de réduction de la consommation de produits pétroliers de l'ordre de 40%. L'absence de feuille de route pour

atteindre les cibles énoncées marque le manque de vision et d'ambition nécessaire pour amorcer la rupture nécessaire dans les politiques industrielles de la province.

Dans le but d'amorcer cette rupture, l'IRÉC propose une voie pour le développement d'une économie qui permettrait de mettre à profit les secteurs en crise du territoire et de solliciter les régions à travers une stratégie de développement intégrée, capable de répondre aux enjeux de réduction de la consommation de produits pétroliers. C'est dans ce cadre que nous avons pu articuler une vision pour le développement d'une économie biosourcée au Québec.

En raison de la place qu'occupe la forêt et l'agriculture sur le territoire, le recours à la biomasse comme centre de gravité d'un système de production énergétique pourrait jouer un rôle stratégique. Pour la mise en œuvre d'une politique de transition vers un nouveau paradigme de développement économique, plus soutenable, la biomasse apparaît comme l'une des ressources renouvelables ouvrant la voie à de nouvelles manières de faire, de même qu'à la production de multiples produits industriels à plus faible émission carbone.

Dans une telle vision, la transition écologique de l'économie se déploie nécessairement dans un modèle de décentralisation et de régionalisation. Prenant appui, aux paliers local et régional, sur les infrastructures déjà présentes sur le territoire et sur les dynamiques industrielles et technologiques, la transition requiert une stratégie de reconversion des équipements, de même qu'une révision des chaînes d'approvisionnement (en matières premières) et de distribution (en produits transformés).

La diversité socio-écologique de chacun de ses territoires fournit au Québec les moyens d'une approche originale, adaptée au potentiel et au dynamisme des capacités productives de chaque région. Pour parvenir à la mise en œuvre d'une telle politique bioindustrielle globale et intégrée, il est nécessaire de pouvoir identifier les caractéristiques d'une éventuelle filière complète et de la chaîne de valeur qui devrait la structurer à travers :

- La mise à disposition ou l'exploitation de la matière première. Il faudra ici éviter la mainmise par quelques grands joueurs sur une partie significative de cette chaîne de valeur comme cela semble la tendance actuelle souhaitée par les grandes entreprises papetières ;
- Le déploiement d'une chaine logistique reliant les centres de valorisation et de préconditionnement de la biomasse à des bioraffineries régionales ou nationales ;
- La mise en place graduelle des grappes bioindustrielles nécessaires pour répondre à la demande en bioproduits ;
- Une politique de mise en valeur du territoire et d'optimisation du potentiel productif des sols. Cette politique de mise en valeur pourrait offrir des occasions de restructurer les économies locales et de fournir aux communautés dévitalisées de nouvelles vocations économiques.

Pour enclencher la transition vers ce nouveau paradigme, il faut cesser de considérer les projets en fonction des seuls critères technologiques ou de marché. Il faut délaisser les approches sectorielles et aborder de front plusieurs enjeux dans des réponses intégrées et complémentaires.

5.6.4. Mobiliser massivement la société en faveur de la transition écologique : un enjeu majeur à l'heure de l'Anthropocène

Born, C.H. Université Catholique de Louvain, SERES

Le concept d'Anthropocène cristallise le défi majeur que doit relever l'humanité en ce début du XXIe siècle : satisfaire, le plus équitablement possible, les besoins alimentaires, énergétiques, résidentiels, éducatifs et sanitaires de base de dix milliards d'êtres humains, ainsi que leur légitime aspiration à un minimum de sécurité et de confort, sans dépasser les limites planétaires « sûres », au-delà desquelles l'évolution de la biosphère et du climat présente des risques de déstabilisation majeure. Réduire les pressions considérables que fait peser sur les équilibres climatiques et les écosystèmes la diffusion à l'échelle mondiale du modèle consumériste suppose une transition extrêmement rapide – on parle de l'horizon 2030 – vers un modèle de développement réellement durable – fondé sur une économie bas-carbone, respectueuse de la biodiversité et moins inégalitaire. Ceci suppose à la fois un changement radical dans nos façons d'utiliser l'énergie, d'occuper et d'exploiter l'espace, de consommer les ressources et de produire des déchets et des innovations sociales et de gouvernance à même de susciter l'adhésion des sociétés à ce nouveau modèle. En un mot, il s'agit de transformer nos modes de vie en l'espace d'une ou deux générations.

La seule voie – démocratique – envisageable pour maintenir à temps le développement des sociétés humaines dans les limites planétaires serait de réussir à susciter en quelques années une mobilisation volontaire et massive d'une grande majorité de citoyens, d'entreprises et de groupes d'intérêt influents en faveur d'une durabilité « forte », se traduisant par un changement majeur des modes de consommation et de production. Par mobiliser, on entend l'ensemble des mesures visant à informer, conscientiser et responsabiliser le public et à modifier ses comportements en faveur d'une conception du développement compatible avec le respect des limites planétaires. Au-delà de la sensibilisation, la mobilisation appelle à l'action : il ne suffit pas de convaincre le public du bien-fondé d'une politique de durabilité forte, il faut surtout que chacun y contribue effectivement.

Un tel changement volontaire de comportement suppose une révolution psychologique, morale et culturelle : il nous faut prendre conscience des conséquences écologiques et sociales de notre mode de vie, revoir notre perception, nos valeurs, notre attitude face à la nature et aux risques environnementaux, réviser notre conception matérialiste du « bonheur », en un mot refonder notre relation à la nature.

Le constat est sans doute trivial, mais, paradoxalement, il reste encore insuffisamment compris par le législateur, qui tente d'infléchir les comportements par la contrainte ou par des incitants sans une véritable réflexion, ni sur ce qui les induit, ni sur les fondements éthiques qui justifient ses mesures. Or, le droit peut contribuer de façon décisive à la transformation de notre attitude face à la nature. Il peut, il doit la légitimer, l'encourager, l'imprimer au corps social par une stratégie globale et intégrée de communication, d'incitation, d'éducation et de sensibilisation à l'environnement. La présente contribution tente d'évoquer ce qui nous semble être l'un des défis majeurs pour le droit de l'environnement contemporain. À l'heure de l'Anthropocène, le législateur ne peut plus se contenter d'assurer un arbitrage entre protection de l'environnement et développement socio-économique, en limitant de façon « raisonnable » les conséquences environnementales de nos activités

5.7. Social innovation in Ecological Economics

5.7.1. Work Sharing from Different Angles

Ashta, A. Université Bourgogne Franche-Comté

Ecological Economics is dealing with a large number of problems, of which a just distribution within and across geographies and generations is one. This problem is evidently important if total work is not to increase, in the line of sustainable principles, assuming stable-state economics. Clearly, any political compromise requires redistribution from the rich to the poor. Most neo-classical and free market economists do not like redistribution schemes which entail giving charity either within their country or across borders. Indeed, there seems to be some reluctance to receiving charity which creates dependency. While many economists propose entrepreneurship as a way out of unemployment and inequality, with or without microcredit, clearly these solutions are still aiming at growing the total production rather than limit it.

One way to solve such unemployment problem would be through sharing work, rather than sharing the rewards from work. Although work sharing leads to happiness through a better work-life balance, ironically, high income inequality leads to demonstration effects which keeps us from sharing work. A review of work sharing shows that it has been effectively used in the US during the great depression and in Europe in times of great recessions, but the effectiveness often depends on the institutional arrangements in which it is implemented. Although a few politicians are asking for a shorter work week, mainstream economists, leaders as well as their conservative voters seem to be hesitant, insisting that it increases costs for the business. One reason could be that voters have anchored their thinking on work-sharing solely on solving unemployment. Since the majority of workers are employed and loss averse, they prefer not to reduce their own welfare, rather than share the work.

Perhaps, what is required is to present the results of research on work sharing as a solution to other problems and/ or other desirable outcomes. One such additional anchoring could be on sustainable development, anchoring the work sharing solution to the well-advertised problem of global warming with continued growth. Could work sharing solves the problems of unemployment, inequality and global warming, and yet produce a happier world?

This literature review takes a multidisciplinary view of the problem. Such a multidisciplinary view is now necessary because politicians and business leaders do not want to take paths which will lead to a crossing with no bridge. They want to know how to implement work sharing so that it results in effectively solving multiple problems, yet providing them a pleasurable living at an individual level to provide incentives, and they want to know the precise institutional framework to develop for this.
There are hundreds of papers on EBSCO alone on work sharing. As a result, we did not look at adjacent fields using similar words. Instead, we narrowed it down to "work sharing" in full text, peer reviewed academic papers in English. We still obtained 284 results, including "work-sharing" with a hyphen. We examined the first 30 in our list and found that the ones where "work sharing" did not feature in the title or the abstract were not pertinent. They had "work sharing" in the keywords and so appeared in the list of 284. We therefore modified the search for "work sharing"

in Title or "work sharing" in Abstract. After deleting the doubloons, we obtained 95 results of full text, peer reviewed, academic papers in English.

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5.7.2. Corporations in Resource Management: Working with Community Groups to Challenge Corporate Power

Hartley, E. McGill University

This research contributes to a deeper understanding of corporate power in natural resource extraction on Treaty 8 territories in north eastern British Columbia. Situated at a nexus of Indigenous self-determination, resource extraction, and ecological degradation, the Montney shale play offers an opportunity not only to study the corporate drivers of the Anthropocene, but also to apply that knowledge in service of Indigenous communities. A project originally proposed by Keepers of the Water, a non-governmental organization that works with First Nations in the Mackenzie and Peace River watersheds, I am developing a corporate map of the Montney Shale area.

Corporate Power Mapping is a method that was widely used by labour and civil rights movements during the 1960's and 70's (Noy 2008, Schiffer 2007). Corporate mapping focuses on the tools and ability of corporations to influence and shape the communities and environments they operate in. Specifically, I will be mapping strategic, allocative, and operational power, in conjunction with communicative agency to help Keepers of the Water build a plan for strategic engagement of various corporate actors operating on the Montney shale (Carroll 2016, Miller and Harkins 2010). Data collection is focused on a subset of resource industries, including water extraction, forestry, and natural gas extraction. The number of corporations operating, their preferred methods of financing, lobbying efforts, and their relationships with local First Nations will all form important parts of the analysis of ongoing accumulation and colonialism on Treaty 8 territories.
The Montney shale formation is an important nexus to be studying. About 60% of the shale gas being extracted through hydraulic fracturing on the Montney shale is being exported to Alberta and used in the extraction of bitumen from the Athabasca region. The site C damn, and several illegal water retention damns located on or near the Montney shale are also part of the regions contributions to Canada's corporate ecology. There are also important links between the natural gas extraction companies and a dramatic increase in deforestation locally. Keepers of the Water and other community groups have developed strong understandings of the linkages and cumulative impacts of these industries, and a corporate map can finally give them the edge they need to differentiate between corporate actors and increase their campaign power.

Lastly, this research can have important social and ecological implications. The Peace River valley is one of the most intensely industrialized regions of northern Canada. Regulatory oversight of industry in the region does not properly account for cumulative impacts and permits are being issued with little regard for the ever-expanding footprint of the Oil and Gas industry (Garvie et al 2014). Indigenous communities are suffering the brunt of the consequences of these cumulative impacts, including exposure to methyl-mercury due to the many hydro-damns in the region, wildlife such as the woodland Caribou disappearing, and health impacts from industrial emissions (Garvie et al 2014). Keepers of the Water aim to use the corporate map emerging from this research to influence the corporate actors driving the concerns addressed above.

5.7.3. Social Multi-Criteria Analysis for EcoHealth Assessment

Mallery, D. York University.

This paper discusses the strong affinity between ecological economics, ecohealth, and critical systems thinking in terms of methodological approaches and stated goals, and argues that the integration of these fields would improve robustness and relevance of analyses, as well as strengthening the scholarly community under within the broader realm of sustainability science. This paper proposes that relational theory, a branch of complex systems theory, offers a common theoretical framework that provides insights into: 1) the nature and limitations of analytical modelling, and; 2) the development of evolution of self-organizing, open systems, across hierarchical levels of scale. I discuss two central concepts from the mathematical biologist, Robert Rosen, central to relational theory: the modelling relation and the metabolism and repair (M-R) system.

The concept of the modelling relation concerns the ways in which living systems semiotically encode percepts of their environmental contexts into formal systems of inference necessary for anticipatory foresight. Due to Godel's Incompleteness Theorum, Rosen demonstrated that anticipatory models are necessarily subjective, and that complex systems cannot be understood within single descriptive domains (e.g. neoclassical economics or reductionist science). The concept establishes the limitations of objectivity in scientific analysis, and this paper discusses the implications of these ideas on both quantitative and qualitative analysis. The M-R system, by contrast, is an abstract, mathematical construct that illustrates Rosen's theory on the self-entailing nature of living systems. The relational view holds that living systems develop teleologically, informed by their particular semiotic models. The concept also challenges many theories of deterministic, successional development (e.g. Tainter's Collapse of Complex Societies and Panarchy) and lends credence to possibility of steady state societies proposed by ecological economists.

This paper concluded by discussing how relational theory is already being applied explicitly within ecological economics through Giampietro and Mayumi's biophysical accounting methodology, Multi-scale Integrated Analysis of Societal and Ecosystem Metabolism, as well as implicitly through Bunch and Waltner-Toews' EcoHealth Approach for participatory action research. It is argued that the adoption of relational theory would enable new, holistic approaches for integrated quantitative and qualitative research within sustainability science.

5.7.4. Transition towards an economy where human well-being is the ultimate goal: arguments and implications for UN's 2030 Agenda and the SDGs

Chapariha, M. University of Lisbon. Bina, O. University of Lisbon

Gross Domestic Product (GDP) as an indicator or growth, and 'thus' progress, has demonstrated exceptional resilience. Its persistent mis-use represents a fundamental threat to Earth's sustainability. Since Kuznets provided the first version of GDP in 1934, the indicator has become synonymous of economic growth, and has progressively transformed itself into the 'ultimate goal' (after Herman Daly) of governments from the late 1950s (Victor, 2008). Many scholars, organisations and multiple disciplines - notably ecological economics, have explored in depth the

adverse implications of this single-minded pursuit of growth that fails to consider the biophysical limits of our planet, as well as basic implications of increasing waste of resources and degradation of environment. Economic growth is arguably important for meeting basic needs, but will not necessarily improve psychological well-being beyond that (Easterlin et al., 2010). In essence, the current mainstream economic system is operating as if economic growth were its ultimate goal, and this is considered to be in conflict with strong sustainability perspectives, and with the need to address aspects of global environmental change, having a just society, and achieving lasting well-being beyond basic needs.

The United Nation's report 'Geo 5' is just one of the most recent analysis of such implications, offering a global coverage. Even the latest financial and economic crises have failed to shift governments' focus away from unlimited pursuit of growth, and this happened despite the increasing attention, analysis and arguments being put forward for a beyond-GDP agenda. We can therefore speak of a continued need for alternative discourses to be raised and presented convincingly, so as to achieve a paradigm shift in mainstream economic, thinking towards a socially and ecologically sustainable future.

This paper seeks to contribute to the alternative discourse that views human well-being as a critical dimension of such sustainable future, as explored –inter alia- in UNDESA's 2012 report ('Building a Sustainable and Desirable Economy-in-Society-in-Nature') and by subsequent work by Robert Costanza and other scholars. Central to our approach is the Means and Ends Continuum framework conceived by Daly, which provides a solid basis for arguing that human well-being (and ideally of all life) is the desirable ultimate goal. In particular, we consider the case of 2030 Agenda and the Sustainable Development Goals (SDGs) as an important arena for reflection about the (limited) extent of progress towards such future, and of the need to explore alternative interpretations of the new UN agenda in the years to come. First, we begin with a multi-disciplinary review of the evolving understanding of human well-being, and link this rich perspective to the notion of ultimate end; second, we critically review the engagement with human well-being by major strands of economics; finally, we explore the potential contribution of the new UN SDGs to human well-being and reflect on the possibility for it to be upheld as the ultimate goal of SDGs in the coming decade.

Amongst the many important contributions of the Means-Ends Continuum, which consists of is the 4 major parts: ultimate means, intermediate means, intermediate ends, and ultimate ends, is the emphasis on the need to explore, understand and acknowledge the interconnectedness and complex dynamics between means and ends in policy making. Comparing different economic models -Economic of happiness, mainstream economy, green economy and ecological economics- Ecological Economics takes a clear lead in clarifying and distinguishing between means and ends, as well as in proposing human well-being as ultimate goal.