

# Real-world-economics-outline

*Thursday, April 30, 2015*

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## 1 INTRO

### 1.0.0.1 Importance of economic dynamics for the earth system and global sustainability

- Human economic activity has a deciding role for the future of our planet. Yet some may argue that economics out of the three pillars of sustainability development - the social, the economic and the environmental - is the pillar least integrated in current approach to sustainability science.
- The human economy is a driving factor of biodiversity loss and climate change. At the same time, global economic inequalities themselves can be viewed as one of the greatest barriers for addressing global environmental and socio-economic challenges.

- At the same time Growth in human population and the economy are two trends that epitomizes the current environmental challenges of biodiversity loss and climate change and improvements in living standards in many countries that have undergone economic growth in the 20th and 21st century. Associated with these trends is the dilemmas of global equity on a finite planet, including the question of whether countries with large economic prosperity need to consume less to allow the developing countries to achieve similar living standards.
- In this context, understanding how the economy is linked to the environment and to social aspects of society is of foundational importance for the science of global sustainability.
- It is therefore concerning that scientific fields of the three pillars of sustainability are still only connected to a very limited extent. In particular, the field of economics and finance remains the pillar most poorly addressed by sustainability science [REF]. This is of great concern for the prospects of sustainable development guided by sound advice from the scientific community.
- To address the need to integrate economics and finance better with sustainability science, in this Sustainability Science perspective we highlight two areas of importance:
  - 1) recent advances in integrating economics into sustainability-oriented sciences.
  - 2) major gaps for integrating economic into sustainability-oriented sciences.

#### 1.0.0.2 A brief history of sustainability science - what concepts has been important for SS

- Sustainability science emerged as a unified discipline in the beginning of the 21st century (Bettencourt and Kaur 2011). Before and after its unification, contributions to sustainability science has mainly come from three broad fields, the social sciences, engineering and the biological sciences (Bettencourt and Kaur 2011).
- Contributions from these fields have mainly come from a small number of disciplinary clusters. For example, contributions from engineering has mainly come from systems and complex engineering and research. Contributions from the biological sciences have mainly come from the field of ecology with contributions to biodiversity and ecosystem services. Similarly in the social sciences, contributions have not been evenly distributed across the field.
- *Maybe describe more here some of the important concepts of sustainability science - but may be too redundant for the type of article.*
- The contribution of the social sciences has remained fairly constant over time, but increased slightly since the unification in 2003 (Bettencourt and Kaur 2011).
- *Key papers* \* Future challenges, Charles Perrings PNAS 2007 \* “Although both economics and ecology are still full of examples of disciplinary myopia, the integration of the disciplines through such ventures has generated more flexible and adaptive solution to both the management and the science of common-pool environmental resources (12, 13).” \* Evolution of sustainability science \* Beyond panaceas \* Science Magazine, Introduction, Sustainability Science paper, Kates and ... \* William C. Clark and Nancy M. Dickson - Sustainability science: The emerging research program -PNAS 2003

#### 1.0.0.3 History of economics and sustainability science - what generally characterizes the research questions that have been taken up?

- Sustainability science has been successful in addressing a number of economic issues. These include the interactions between the natural resource base and human income, such as Sub-Saharan African exceptionalism in world poverty and the role of deprived natural resources, ethnic diversity, inequality and institutions in keeping many people caught in a “poverty trap” (Kates and Dasgupta 2007). Another area of economics that have been advanced by sustainability science is the operationalization of

ecosystem services (or natural capital) valuation (Daily and Matson 2008), both through national statistical accounting schemes [Mäler, Aniyar, and Jansson (2008)}, now mandated by the OECD under the terminology of green accounts, and, through on-the-ground ecosystem service based governance through actions spanning from the community level (Cowling et al. 2008) to the national level (Liu et al. 2008).

- The above two examples serve to illustrate that sustainability science' occupation with economics has mainly followed **two** pathways. (1) The role of disparity and central mode of human income and its interactions with the environmental system and the social effects it brings with though complex feed-back loops. (2) Valuation of earths natural capital and operationalizing local and national governance schemes of these assets.

#### **1.0.0.4 History of economic and sustainability science - what generally characterizes some of the research questions that hasn't been taken up?**

- Other economics-related research questions have barely been addressed by sustainability science (\*at least when judging by the content published in the xxx number of articles under the sustainability science label in PNAS). Some of the most notable areas of omission appears to be the role of international licit and illicit financial capital flows and trade for sustainable development, and the role of financing and key-financial players in ensuring democractic or other political sustainability transitions.
- Is this because sustainability science is naive to the role of money in decision making?
  - We can not rule out this explanation, however sustainability science has dealt with issues of corruption in e.g. developing countries.
- Is this because these branches of research are less well developed in economics and finance?
  - Doesn't seem likely since sustainability science has taken on other areas of research that have only recently emerged or been limited to small communities.

#### **1.0.0.5 Recent history of decreasing diveristy of economics and relations to other disciplines in terms of sustainability related questions**

- The fields of economics and finance research have changed over time. In particular, recent contributions document how the economical sciences during the 20th century underwent a continuing decrease in the diversity of research questions and methods being used (Colander 2005).
- *What about the recent history of finance research? Find some references to document this.*
- Recently, and partially fuelled by the financial crises of the 21st century. There has been a concerted effort to re-energize the field of economics with a return to a more diverse set of approaches and questions. It remains to be shown, however, if the recent changing dynamics of economics research will also lead to an uptake of sustainability related questions.
- In recent decades many of the economical questions most pertinent for global sustainability have been addressed in communities that are only tangentially connected to the core fo economics research and in some cases arguably more closely connected to sustainability science. These include, the investigation of the material foundation and material limits to economic growth (club of rome ref, Brown et al. 2014; Burger et al. 2012; Burnside et al. 2012), the valuation of natural capital [Costanza and Daily refs], the global structure of the economy (M. Lenzen et al. 2012), the impact of economic activies, such as trade, on the environment and vice versa [natural resources refs],xxx, xxx, xxx.
- In the meantime, sustainability science must actively seek to integrate with those communities that address questions of economics and finance most pertinent to global sustainability.

- \*Mention somewhere that the economical sciences have gone through a phase of decreasing diversity. A diversity that is now returning following the prolonged financial crises of the United States and Europe. Sustainability science can play an important role in maintaining this diversity by more fully integrating with some of the emerging branches of research.

#### 1.0.0.6 Summarizing intro and outlining content and purpose of the main body of the paper

- In the following we ... , ...

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## 2 RECENT ADVANCES

### 2.1 Two advances in integrating the earth system in economic accounting

#### 2.1.1 Greener economic accounting for natural capital

##### 2.1.1.1 History of the ecosystem services and natural capital concept

- The ecosystem services and natural capital concepts evolved out of other related concepts in the 1980's linked to the "land economy" and were mainstreamed in particular through the Millennium Ecosystem Assessment published in 2005 (Millennium Ecosystem Assessment 2005). From a historical perspective (Gómez-Baggethun et al. 2010) "the trend towards monetization and commodification of ecosystem services is partly the result of a slow move from the original economic conception of nature's benefits as use values in Classical economics to their conceptualization in terms of exchange values in Neoclassical economics". This trend has led to debate over whether the use of the concept in its current form would stall aims of conservationists (Norgaard 2010; Norgaard 2008). The contrary argument sees the benefit of co-existence and exchange between a diversity of concepts and approaches, including both traditional biodiversity conservationist and newer ecosystem service or natural capital based approaches (Tallis et al. 2008; Reyers, Polasky, Tallis, and Mooney 2012; Reyers, Polasky, Tallis, Mooney, et al. 2012). The main feature of the inclusivity argument is that the diversity of concepts are needed to interact with as many stakeholders as possible for the parallel pursuit of conservation and environmentally sustainable economic development (Tallis and Lubchenco 2014).

Gomez-Baggethun (Gómez-Baggethun et al. 2010) in his review concludes that the focus on monetary valuation and payment schemes related to the ecosystem services and natural capital communities has indeed contributed to attract political support for conservation. At the same time "*a growing number of ecosystem services may have been commodified and the Neoclassical economics paradigm and the market logic to tackle environmental problems*" amplified.

- Payments for ecosystem services [e.g. Kelsey Jack et al. 2008 PNAS]

##### 2.1.1.2 Global economic dynamics in natural capital and ecosystem services

- In 2014 (Costanza, Groot, et al. 2014) estimated the annual monetary loss of ecosystem services from land use change between 1997 and 2011 to range between 4.3 to 20.2 trillion USD.

### 2.1.1.3 Recent impact of the ecosystem services and natural capital concept

- A lot of progress has been made since the inception of ecosystem services valuation in the XXXX. Notable progress, includes the inception of the Intergovernmental Platform on Biodiversity and Ecosystem Services (Díaz et al. 2015). Political attention to global sustainability and the unsustainable dynamics of current measurements of economic growth has facilitated international research progress on integrated measures of growth, such as the Genuine Progress Indicator (Costanza, Kubiszewski, et al. 2014). Such integrated indicators of social, environmental and economic progress are now being suggested as indicators for the UN Sustainable Development Goals (Costanza, Kubiszewski, et al. 2014). In 2015 all OECD countries will adopt mandated green accounting systems (**REF**). The InVest tool developed to incorporate natural capital into decisions, is now *GIVE EXAMPLES OF NOTABLE USE*.

### 2.1.2 Global trade and the telecoupling of socio-environmental dynamics

- Leontief 1970 envisioned national accounting as a way of measuring the impact of economic activities and human consumption on the environment. With recent progress in accounting for resource use in globalized production and consumption chains using global multi-regional input-output models (MRIOs) to link together resource extraction, import, consumption and exports in national accounts (Manfred Lenzen et al. 2012, Lenzen et al. (2013), Lenzen et al. (2014)). Early phases of that vision is now being implemented in a number of ways. By associating the MRIO with environmental and social variables (so-called satellite variables), environmentally and socially extended MRIOs are produced that allow to assess the environmental and social interlinked impacts of global economic activity (e.g. Wiedmann et al. 2013, M. Lenzen et al. (2012); Marques et al. 2012).
- Early assessments of long-standing economic hypotheses such as the Environmental Kuznets Curve and the paradigm of relative and absolute decoupling have been compromised by not accounting for resources used in foreign countries in the production of commodities consumed domestically. Still challenged a need to interpolate large amounts of missing data, the model provides a significant advancement in order for sustainability scientists to assess the degree to which relative and absolute decoupling is being reached in the globalized economy Wiedmann 2012, whether an Environmental Kuznets Curve really does exist, assess the domestic economic, environmental and health impact of pollution attributed to commodities that are being consumed in foreign countries (Marques et al. 2012), and similar how global trade drives biodiversity threats in the developing countries (M. Lenzen et al. 2012). One of the latest applications of this methodological advance will be a dataset on the value added to national economies by trade to be released by the United Nations Conference on Trade and Development (<http://unctad.org/>). The dataset provides a new opportunity to assess and evaluate ...XXX. These assessments have fundamental value for sustainability science as they answer basic questions about future paths for human development and the sustainability of current economic paradigms.

#### – References

- \* (Lambin and Meyfroidt 2011) Globalized trade have increased pressure to convert forest to cropland. Some countries have managed to circumvent this pressure and increased forest area and agricultural production simultaneously.
- \* Leontief, W.; Ford, D. Environmental repercussions and the economic structure: An input-output approach. *Rev. Econ. Stat.* 1970, 52 (3), 262???271
- \* Leontief, W. An information system for policy decisions in a modern economy. In *Input-Output Economics*; Oxford University Press: New York, 1986; pp 418???428.
- \* Leontief, W. Structure of the world economy. *Am. Econ. Rev.* 1974, LXIV (6), 823???834.
- \* Local impacts of trade and financial markets: Economic change effects on land use change (“, a recent doubling in commodity prices has created incentives for landowners to convert grassland to corn and soybean cropping”) [Wright and Wimberley, PNAS 2013] and (Lybert et al. 2011 PNAS - booming markets for Moroccan argan benefits some rural households but threatens endemic forests)

- \* Trade and emissions [e.g. China's international trade and air pollution in the United States, Lin et al. 2014 PNAS] and Lenzen and Wiedmann studies. [i.e. consumption based accounting of official trade statistics]

## 2.2 Implications of economic inequality globally, nationally and locally

Economic inequality has steadily risen to the top of political agenda fuelled by financial crises in North America and Europe. Most recently it was nominated by the World Economic Forum as one of the greatest challenges of the century (World Economic Forum 2014). During the past decade(s) inequality research has helped show how social and environmental sustainability is tightly linked to this phenomenon from the global level of earth system governance down to the level of the mental well-being of the individual.

### 2.2.0.1 Consequences of global inequality dynamics

- The world is heterogeneous in terms of its natural resources, biophysical conditions as well as history of human colonization and colonial history. From those first principles global inequality in terms of economic wealth, is in and by itself not surprising.
- The history of how global inequality has come to be is too rich a literature to cover in any detail here. However, the implications for global sustainability should be obvious to anyone who have followed global negotiations on any environmental, social or economic topic.
- The effort to combat climate change serves as an important lesson for all, including sustainability science, on how important historical inequalities are to take into account in any attempt of global stewardship.
- Thus, historically unequal contributions to global climate change together with global economic inequality largely explains the deadlock in climate change negotiations and the global south's insistence on their rights to develop (Roberts 2001; Blaxekjær and Nielsen 2014), known in UN-jargon as "common, but differentiated responsibility".
- A special issue on the African poverty trap in PNAS (Kates and Dasgupta 2007) highlighted the complex interplay between ethnic diversity, natural resource endowments and the global trade system in keeping some countries seemingly trapped in poverty (Collier 2007). Such research highlights the potential need for special regulatory interventions in the global economy (Hyden 2007) to re-level the global economic playing field. In the end, such interventions, may be crucial to speed up progress in tackling global threats such as climate change.
- **Notes to integrate**
  - Global inequality - Historical political ecology - is colonial history a blind spot in sustainability science?
    - \* Henrik on Soviet Union and regime shifts
    - \* Mark Davis - late Victorian-holocausts
      - El-Nino, famines, and the making of the third world
    - \* India: Climate shocks used to be normal in India - colonialism blocked institutional adaptation
      - Raj - modern society -
    - \* Luis et al. - mass die-offs of native americans to European settlement - onset of the Anthropocene
    - \* Shock doctrine and the socio-ecological as well as macroeconomic consequences today - Naomi Klein

- \* Can also add regional examples of grid-lock such as inequality within the European Union and challenges for the sustainability transition. With large inequality the poorer nations will have an incentive to stall transition policies for which they would be at a disadvantage. EMU crises and inequality paper (Bitros, Batavia, and Nandakumar 2014).
- \* Progress in reaching MDGs is less in lower-income countries in particular countries with high burdens of HIV and Non-communicable diseases (???)

### 2.2.0.2 National dynamics and impacts of inequality

- Just as global outcomes are highly influenced by global inequality, research is increasingly demonstrating how economic, social and environmental outcomes within nations are influenced by how wealth is distributed in society. For example, sustainability science research has focused on the need for more tightly regulating wealth in Africa to bring the country out of poverty (Kates and Dasgupta 2007). **Median voter theorem** However, a study from 2014 (Gilens and Page 2014) raises the question about the influence of concentration of wealth on democracy and potential sustainability transitions also in Western democracies. Thus, Gilens (Gilens and Page 2014) showed that “economic elites and organized groups representing business interests have substantial independent impacts on US government policy while average citizens have little or no impact”, the latter observation contrary to the prediction of the median voter theorem. *The degree to which these findings can be transferred to most developed nations or in some way can be explained by macroeconomic indicators such as the concentration of wealth will have important implications for sustainability science in particular with regard to the role of democracy in models of how to achieve transitions to for global sustainability.*
- **Regulatory capture** In public administration, “regulatory capture” describes the situation where regulatory institutions act in favor of the entities they are supposed to regulate instead of the public interest they have been instituted to enact (Zinn 2002, Livermore and Revesz (2012)). Although the origins of capture-like regulatory behavior can be hard to identify (Shapiro 2012), regulated entities often have more financial resources available than the regulator and the job security of the regulator might in the end depend on the economic activity of the regulated. This economic inequality may present some moral challenges for sound regulatory decision-making (Ferguson and Johnson 2010). Cases where capture has been proposed to influence decision making on environmental sustainability include the implementations of federal regulations such as the Endangered Species Act (Botello-Samson 2010a) and Surface Mining Act (Botello-Samson 2010b) in the United States and off-shore drilling in Israel (Portman 2014) and the US (in Alaska and the Mexican Gulf Unger 2008; Shapiro 2012). Further the regulation of Genetically Modified Organisms in the United States (Hiatt and Park 2010; Hosmer 2013) is often contrasted with the public scepticism reflected in regulatory hesitance of GMO’s and biotechnology in the EU (Ostrovsky 2007), which may partially be related to a great risk of capture in the US. A recent cross-national study found that “regulatory regimes have similar developmental patterns over time, although the time spent at each stage in the process can vary significantly according to unique domestic factor” (Newman and Howlett 2014). *Implications for sustainability / socio-ecological models?*
- **Media control** The degree to which sustainability transitions have public support may depend on the degree to which the public is informed about the grand challenges of sustainability. An interesting question for sustainability science in the context of national inequality can look into the influence of the economic concentration of multimedia ownership structures and the degree to which communities locally and nationally are aware about specific and general sustainability grand challenges. (**PERFORM LITERATURE SEARCH**) The results of this line of research will in turn influence the models that sustainability science will propose for viable sustainable transitions.
- Media coverage influences public behavior and vice versa. If media coverage is influenced by the owner of a given media, high concentration of media ownership can lead to over or underreporting of a given issue, lack of diversity or disinformation (also from vested interest). For example, newspaper coverage of climate change in Japan from 1998 and 2007 correlated with increased public awareness (Sampei and

Aoyagi-Usui 2009) (Global Environmental Change study). *Mass media have been critical to highlight environmental concerns in the past* (Boykoff 2009).

- \*\*Two general issues seem to dominate in the research literature: (1) How organizations brand themselves through media. (2) Influence on public awareness and concern of media coverage.

- **Quality of reporting**

- (Boykoff, Frame, and Randalls 2010) found a need to increase the diversity of media framings related to how to tackle climate change beyond “climate stabilization”, but did not relate this lack of diversity back to ownership structure or concentration.
- (Boykoff and Boykoff 2007) \*On the role of journalistic norms in decreasing information content about anthropogenic climate change in US mass media. “consistent adherence to interacting journalistic norms has contributed to impediments in the coverage of anthropogenic climate change science. Through analysis of US newspaper and television coverage of human contributions to climate change from 1988 through 2004, this paper finds that adherence to first-order journalistic norms - personalization, dramatization, and novelty - significantly influence the employment of second-order norms - authority-order and balance - and that this has led to informationally deficient mass-media coverage of this crucial issue. By critically scrutinizing US print and television media as a ‘public arena,’ we improve understanding of how journalistic activities have shaped interactions at the interface with climate science, policy and the public.” **Question - are these journalistic norms tied to ownership structure?**
- *Climate contrarians* (Boykoff and Olson 2013) in *Celebrity Studies*: illustrate the growth pathways of climate change contrarians in US media (i.e. decrease in quality) one of which is hypothesized to be relation to the carbon-based industry: “threefold analysis: of the motivations that prop up these contrarian stances, such as ideological or evidentiary disagreement to the orthodox views of science (also known as scientific consensus); **the drive to fulfil the perceived desires of special interests (for example, carbon-based industry)**; and the exhilaration from self-perceived academic martyrdom and the more general desire for notoriety. In these ways, celebrity is a vehicle for influence, and influence is vital to decision-making within the dynamic architectures of contemporary climate science, politics and policy”
- *Balanced reporting on consensus issues* (Boykoff and Boykoff 2004) GEC “the prestige press’s adherence to balance actually leads to biased coverage of both anthropogenic contributions to global warming and resultant action”.
- *Political economy* (Boykoff and Yulsman 2013) Wired “This paper addresses contemporary political economics-from greater workloads and reductions in specialist science journalism to digital innovations and new media organizational forms-as they relate to media coverage of climate change.” *decline in climate change reporting* (Boykoff and Yulsman 2013) Wired “In the face of many ongoing climate science and climate-related weather events to report on, we must look for explanations for this decline in the realm of political economy.” On covering global environmental issues - (Boykoff 2009) “Meanwhile, political economic forces have contributed to tremendous pressures on and within the news industry, where these issues have become more, not less, challenging to cover.”
- *Some short-term improvements combined with persistent long-term challenges* (Boykoff 2009) “there is empirical evidence to suggest that there have been short-term improvements in media representations of environmental issues, such as more accurate coverage of anthropogenic climate change. However, over the long-term scale, many institutional challenges persist for enhanced media reporting on the environment.”

- **Concentration**

- Germano shows through mathematical modelling that ownership concentration influences the tendency of media to underreport or censor issues that may influence their advertisers negatively. “Given that over half the revenues of global newspaper publishing come from advertising (80% in



the US and 57% in OECD countries, OECD, 2010), we study how media firms internalize the effect of their own coverage on advertisers' sales and hence on their own advertising revenues. We show, within a framework of non-localized, Hotelling-type competition among arbitrary numbers of media firms and outlets, that (i) **\*topics sensitive to advertisers can be underreported by all outlets in the market, (ii) underreporting tends to increase with the concentration of ownership, and (iii) adding outlets, while keeping the number of owners fixed, can further increase the bias.** We argue that self-censorship can potentially cover a wide range of topics and generate empirically large externalities" (Germano and Meier 2013)

- While media over the long-term have undergone a process of ownership “unconcentration”, media is currently undergoing a recent trend of increasing concentration (Vizcarrondo 2013).
- (George 2007) A study of US newspaper coverage and reporter assignment in 1993, 1994 and 2004 found that the repositioning of products during mergers and resulting concentration of ownership led to increasing variety and differentiation in coverage. The study did not address the variety and diversification in relation to topics of sustainability or topics of interest to the ownership. The owner's need to differentiate its increasing number of products may therefore be the largest counter acting force to decrease in diversity or bias in reporting during increasing concentration of media ownership.
- *Increasing concentration of ownership in Pakistan despite political and regulatory intentions of the opposite* (Rasul and Proffitt 2013). There is also a study on concentration from Latvia after becoming member of the EU which does not cite the results. Also increasing concentration in Taiwan (Chen 2002)
- (Nash and Bacon 2006) in a review of pacific media coverage on environmental sustainability in relation to ownership structure found little effect. Instead environment reporting had a “motherhood” status, which also however ruled out making any assumptions about the quality of reporting.
- Swedish case studies: “corporate voices make substantial use of environmental and ecological arguments in their strategic communication, but they provide little useful information about the company's impact and do not usually foster forms of dialogic stakeholder engagement” (Lischinsky and Sjölander 2014). (Tjernström 2007) investigated a case study of political intention to decrease ownership of TV media with the opposite outcome for Swedish TV4
- Fortune 100 companies need to manage the information sources that their employees use to get information about their sustainability. Note: Negative implications of employer control of employee knowledge, framed as a management issue. (Craig and Allen 2013)
- *Digitalization as a driver of concentration?* (Compaine 2010) “One of Noam's final and most useful insights, coming in Chapter 19, ‘The Findings and the Model,’ is that any trend to concentration is largely the result of declining prices for media consumers. This is primarily the outcome of the digital revolution. For example, the music industry has found it hard to maintain prices and the online newspaper business is still struggling with a model for user payment. Telephone calls can be made for close to nothing using Voice over IP services. Yet the high fixed cost and low marginal costs of most information products has been a strong incentive for players to meet the price deflation challenge first by reducing costs, by attempts at product differentiation, but eventually by seeking merger or acquisition by a competitor to be able to maintain some control over prices.”
- *Number of media vs. number of source media* (Winseck 2008) *The State of Media Ownership and Media Markets: Competition or Concentration and Why Should We Care?* “This article presents a global overview of the state of communications media ownership and markets. The primary issue at stake is whether or not markets and ownership are becoming more or less concentrated. After reviewing contrasting views on this issue, I suggest that the question turns on whether or not we consider ‘numerical diversity’ (the number of channels available in any given area) versus ‘source diversity’ (a measure of the number of media owners in any given area). Drawing on recent data I suggest that while there is undoubtedly greater ‘numerical diversity’, we are seeing - within countries, regionally and globally - greater concentration at the level of ‘source diversity’. While new media, especially the Internet, open up unprecedented opportunities for people to

access and distribute information, the emergence of a powerful nexus between both ‘old’ and ‘new’ media means that the character of media ownership and markets still matters greatly. This nexus of ownership and market power spans different segments of the media and is qualitatively different from previous times. These factors have an important influence on the evolution of media technologies and markets, the work of media professionals and the character of information and media content”

- **General importance for sustainability science** Such questions are of clear interest to sustainability science and research on global sustainability. For example, what are the implications for the likelihood of sustainability transitions? If decision makers make choice in the interest of their financiers instead of in the interest of their electorate, may this either increase or decrease the likelihood and speed of sustainability transitions wanted by the electorate? Relevant cross-country questions for sustainability science ask whether vested interests have a larger influence on the trajectory of publicly supported pathways for sustainability transitions in more unequal nations or whether these phenomena are rare unique cases or nearly universal. These recent research advances offer important specific questions for sustainability science to integrate with and more generally identifies economics research on the concentration of wealth and the research on political economy as priorities for integration. *The worst case scenario for sustainability science is if inferred conclusions and proposed models are naïve to the importance of these areas of economics in law, public administration, political science and communication.*
- **Implications for society, well-being, health and environment** The final line of research highlighted here relating to national inequality relates to the social and environmental impacts of differences in equality. Highlight here recent findings on whether more equal societies have better public health, are more happy, and better environmental protection. This relates back to the mechanisms of concentration of wealth, one person one vote, regulatory capture and media ownership structures.
- Health impacts of inequality from national to local level
  - **NATIONAL**
  - **Regulatory capture and health** - case - the tobacco industry in middle and low income countries (Gilmore et al. 2015)
  - *Influence of regulatory capture in trade agreements and implications for health inequality* If states do not find ways to increase their capacities then PTAs are likely to become much greater drivers of health inequities (Walls, Smith, and Drahos 2015).
  - Persistent inverse relation between socioeconomic status and mortality in the USA in 1960 and 1986 (???). While the overall death rate decreased in the period, the inverse association with income increased.
  - (???) Lower ratio of dentist per population in more unequal countries could be a sign of divestment in health care in unequal countries. “This study shows an inverse relationship between income inequality and use of dental services. Of the two indicators of disinvestment in health care assessed, only dentist-to-population ratio was associated with income inequality and use of dental services.”
  - **Political will as a barrier to implementing generated knowledge** Relate back to median voter theorem Cite coming of age review.
  - **Which type of public health interventions generate inequalities - downstream (yes) - upstream (no)** ‘downstream’ preventive interventions are more likely to increase health inequalities than ‘upstream’ interventions. More consistent reporting of differential intervention effectiveness is required to help build the evidence base on IGIs (???)
  - **Effective public health stroke interventions and socioeconomic status** “Those with a lower socioeconomic status have more severe deficits and are less likely to receive evidence-based stroke services, although the results are inconsistent. Poorer people within a population and poorer countries globally are most affected in terms of incidence and poor outcomes of stroke. Innovative prevention strategies targeting people in low socioeconomic groups are required along

with effective measures to promote access to effective stroke interventions worldwide. (Stroke. 2012;43:1186-1191.)” (???)

- **Non-communicable diseases and socioeconomic inequality** (???) (1) “In most countries, people who have a low socioeconomic status and those who live in poor or marginalised communities have a higher risk of dying from non-communicable diseases (NCDs) than do more advantaged groups and communities.” “Effective actions to reduce NCD inequalities include equitable early childhood development programmes and education; removal of barriers to secure employment in disadvantaged groups; comprehensive strategies for tobacco and alcohol control and for dietary salt reduction that target low socioeconomic status groups; universal, financially and physically accessible, high-quality primary care for delivery of preventive interventions and for early detection and treatment of NCDs; and universal insurance and other mechanisms to remove financial barriers to health care.”

#### – LOCAL

- **Whitehall study I and II** (???) “The Whitehall study of British civil servants begun in 1967, showed a steep inverse association between social class, as assessed by grade of employment, and mortality from a wide range of diseases.” The same pattern was consistently found 20 years later.

#### – (???)

- The evidence for modest neighbourhood effects on health is fairly consistent despite heterogeneity of study designs, substitution of local area measures for neighbourhood measures and probable measurement error. By drawing public health attention to the health risks associated with the social structure and ecology of neighbourhoods, innovative approaches to community level interventions may ensue.
- The Haves, the Have-Nots, and the Health of Everyone: The Relationship Between Social Inequality and Environmental Quality Annual Review of Public Health, 2014 [@]

#### \* SUMMARY POINTS

- \* 1. Evidence supporting the equality/sustainability hypothesis suggests that social inequality is bad for the environment, which may in turn explain why societies with more inequality appear to be less healthy.
- \* 2. Social inequality may degrade the environment through asymmetries in political power that affect who experiences the benefits and harms of pollution.
- \* 3. Social inequality may also worsen environmental quality by increasing the environmental intensity of a society’s consumption or decreasing social cohesion and the willingness to cooperate to protect common resources.
- \* 4. Evidence of a negative association between social inequality and environmental quality appears strongest for localized air pollutants and markers of access to safe water and sanitation, and weaker for more dispersed pollutants, such as CO<sub>2</sub>, and other measures of water quality.
- \* 5. The evidence linking inequality with worse environmental quality is more consistent in within-country studies from the United States than in between-country studies, perhaps because the former benefit from a greater consistency in data and the fact that the larger political and development contexts are held fixed.
- \* 6. Challenges to conducting this research include the fact that inequality changes slowly over time so that longitudinal effects are hard to estimate and the fact that nonlinear effects and effect modifiers appear to play a part.
- \* 7. Although the evidence remains somewhat mixed and more research is needed, there are intriguing indications that reducing social inequality may not only help those who are most exposed to health-damaging pollutants but may also improve environmental conditions for all.

#### • *Research agenda:*

- Media ownership structures - is disinformation and public awareness about sustainability issues smaller in nations with higher concentration of wealth in media (or is it ownership structure?)
  - \* Australia - media owned by coal ownership
  - \* Employment in PR industry versus journalism
  - \* Role of large media corporations in democratic sustainable transitions
  - \* Communication of information about non-empowering information/news
- Societal health and happiness - government investments smaller public health investments?
- Research question - to what degree are sustainability dynamics in nations with high concentration of wealth different nations with less concentration of wealth?
- “Rising wealth concentration contributed to the crisis because the increasing asset demand from the rich played a key role in the rise of the structured credit market and enabled poor and middle-income households to accumulate increasing amounts of debt. To tame the inherent instability of the current mode of capitalism it is necessary to reduce inequality.” - Sabalini 2014/2015
- Also cite contrary view from Chicago School - the economic elite wants democracy and would strike a deal if they had the chance, because dictators tries to wipe out the economic elite Capital - in the Twenty-First Century - In the Rest of the World - Michael Albertus - University of Chicago.

- **Internal conflict - poverty and income inequality**

- Poverty, i.e. global inequality is a better predictor of internal conflict and insurgency than domestic inequality. (???) “after controlling for per capita income, more ethnically or religiously diverse countries have been no more likely to experience significant civil violence in this period. We argue for understanding civil war in this period in terms of insurgency or rural guerrilla warfare, a particular form of military practice that can be harnessed to diverse political agendas. The factors that explain which countries have been at risk for civil war are not their ethnic or religious characteristics but rather the conditions that favor insurgency. These include poverty-which marks financially and bureaucratically weak states and also favors rebel recruitment-political instability, rough terrain, and large populations.”

### 2.2.0.3 Local dynamics and impacts of inequality

- Local hotspots of economic inequality is correlated with loss of biodiversity (Mikkelsen, Gonzalez, and Peterson 2007; Holland, Peterson, and Gonzalez 2009) and poverty hotspots exhibit poorer environmental quality and hence opportunities for improving public health (Cushing et al. 2015)
- Economic inequality leads to mental stresses and loss of social capital which results in largely unsustainable economic growth based on short-sighted compensatory consumer behavior (Bartolini 2014).
- Income inequality and health - (Pickett and Wilkinson 2015)
  - There is a very large literature examining income inequality in relation to health. Early reviews came to different interpretations of the evidence, though a large majority of studies reported that health tended to be worse in more unequal societies. More recent studies, not included in those reviews, provide substantial new evidence.
  - Key points
  - Evidence that income inequality is associated with worse health is reviewed.
  - It meets established epidemiological and other scientific criteria for causality.
  - The causal processes may extend to violence and other problems with social gradients.
  - Reducing income inequality will improve population health and wellbeing.
  - *References*

- \* The Haves, the Have-Nots, and the Health of Everyone: The Relationship Between Social Inequality and Environmental Quality Annual Review of Public Health, 2014
  - SUMMARY POINTS
  - 1. Evidence supporting the equality/sustainability hypothesis suggests that social inequality is bad for the environment, which may in turn explain why societies with more inequality appear to be less healthy.
  - 2. Social inequality may degrade the environment through asymmetries in political power that affect who experiences the benefits and harms of pollution.
  - 3. Social inequality may also worsen environmental quality by increasing the environmental intensity of a society's consumption or decreasing social cohesion and the willingness to cooperate to protect common resources.
  - 4. Evidence of a negative association between social inequality and environmental quality appears strongest for localized air pollutants and markers of access to safe water and sanitation, and weaker for more dispersed pollutants, such as CO<sub>2</sub>, and other measures of water quality.
  - 5. The evidence linking inequality with worse environmental quality is more consistent in within-country studies from the United States than in between-country studies, perhaps because the former benefit from a greater consistency in data and the fact that the larger political and development contexts are held fixed.
- \* Cost-effectiveness of conservation actions (e.g. Jonathan Hoekstra, PNAS piece, 2012)
- \* A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence

– **Notes to integrate**

- \* Unequal localities - mental health and stress for rising in the social hierarchy
- \* Tim Jackson - social hierarchy
- \* Spirit level - book - Wilkinson, R.G., Pickett, K., 2010b. The Spirit Level: Why Equality Is Better for Everyone. Penguin, London.
- \* *Conspicuous consumption* - Consuming to be seen and get status.
  - Thorstein Veblen
  - Veblen goods

### 3 AREAS THAT NEED ATTENTION

#### 3.0.1 A framework for structuring research questions on the global dynamics of the formal and informal economy

Global economic dynamics are influenced by actors at different levels of organization and occur in both the formalized and informal global economy.

##### 3.0.1.1 Table 1 - globalization framework Economic phenomena linked to the formal and informal economies at various spatial scales.

actors	white (licit)	grey	black (illicit)
finance	banks, bonds		money laundering
global actors	direct land investment		drugs / arms / mafias / ??range??
individual agents	remittances		illegal migrants & “evaders of the state”

### 3.0.2 Finance in politics and key financial players

**3.0.2.1 Role of finance in preventing democracy and implications sustainable transitions - is only the case in more unequal nations?** \*A study from 2014 have documented how the role of campaign financing in US politics may lead to in-validation of long held theories of political science, such as the median voter theorem (Gilens and Page 2014). Similar ongoing studies are documenting how the probability of getting elected is correlated with the amount of campaign funds raised [**Cite Tom Ferguson research**]. The regulated earns more than the regulator and this financial inequality may present some moral challenges for sound decision-making in regulators (Ferguson and Johnson 2010).

\*Such questions are of clear interest to sustainability science and research on global sustainability. For example, what are the implications for the likelihood of sustainability transitions? If decision makers make choice in the interest of their financiers instead of in the interest of their electorate, may this either increase or decrease the likelihood and speed of sustainability transitions wanted by the electorate?

#### 3.0.2.2 Impact of ownership structures and financial corporations on global sustainability (key players)

- A recent study have documented that a small number of financial institutions play an important role in linking the global economy together (Vitali and Battiston 2013). What are the implications for global sustainability of such hyper connectivity?. Can the concepts of key-stone species, for example, be transferred to financial capital holders, and does this concept also apply to the socio-environmental effects of actions taking by the financial actors. Ongoing research are just starting to investigate such questions in the marine realm [*get Calle, JB and other SRC folks to fill in here*]. Similar research could be taken on in the agricultural and silvicultural realms with regard to land-use change etc.
- **Fertilizer prices** is one case where prices may be controlled by a cartel-like ownership structure and could be a terrestrial model for the key-financial actors model (**Christopher Gilbert GEDB seminar 150424**). (**Ott 2012**) “Torero (2011) examines the market structure and shows that the fertilizer industry is a global one with a high level of concentration.” **\*\***(Hernandez and Torero 2011): “The results of the study indicate that the fertilizer industry is a global market with high levels of concentration and increasing trade. The top five countries control more than 50 percent of the world’s production capacity for all major fertilizer products. There is also a high level of concentration at the country level among the major producing countries, except for China. The high and increasing levels of trade in the industry are evident from the higher dependence of several regions on imported fertilizer.” *“It appears that despite the high levels of concentration in the industry, prices are even higher in further concentrated markets due to the apparent greater market power enjoyed by a couple of firms.”*

### 3.0.3 The global impact of investments and market dynamics

- The great recession of 2008 and the prolonged recession in Europe have been two of the most influential events on western hemisphere policy in the 21st century. Both recessions were partially caused by the influence of increasingly complex financial system on commodity prices such as housing prices and even national savings (Greece) [find articles on investment in the national savings of Greece, Italy and Spain **REFS**]. The impact of the following economic downturn on important environmental policies such as energy investments can be seen e.g. in many nations decision to explore options for liquified shale oil and natural gas and lowered ambitions in national and supra-national plans of transitioning to renewable energy sources [**REF**].
- Increasing investment in food commodities from index investors in 2007 may have exacerbated the spikes in food prices in 2008 and 2011 and consequently had a role in the social unrest that these price rises helped unleash (**Christopher Gilbert GEDB seminar 150424 - Index investor activity increased before price spikes**).

- The integration of financial market dynamics and complexity with sustainability science seems an important agenda to ensure a more resilient and holistic response to such events.
- Examples of remaining research questions with regard to the financial crisis are:
  - What have socio-environmental impacts been of the financial crisis on other continents?
  - Can key trends in environmental and social degradation or improvement be traced to events relating to the financial crisis.
  - How do other actors respond to financial crisis. Do they e.g. learn to anticipate negative impacts from prolonged recessions caused by financial market complexity?
- **notes for integration**
  - Market dynamics
    - \* Socio-ecological consequences of financial and market dynamics
      - The principal agent problem
      - What are employees evaluated for and what is the goal of the institution
  - National bankruptcies - socio-ecological consequences of economic shocks
    - \* Asian financial crisis
    - \* Latin American crises -
      - Argentina - rangelands
      - Brazil - forest dynamics
    - \* Somalia - cautionary tale of socio-ecological drivers of piracy in a economically and democratically collapsed state
    - \* Greece

### 3.0.4 International financial transactions and flows

#### 3.0.4.1 Social and environmental impact of financial transactions

- With increasing complexity of financial markets, impacts of capital flows are in a manner similar to impacts of production and consumption in globalized supply chains becoming harder to track. Are international financial transactions playing important roles in determining social and environmental outcomes in regions where they flow from, through and end-up. Are these outcomes positive or negative for global sustainability?

#### 3.0.4.2 Social and environmental impact of illicit financial transactions

- While capital flows of the financial market may prove an important factor influencing the likelihood of sustainable transitions, much of international trade happens outside the market. For example, the international market for wildlife medicine largely occurs through illicit financial transactions. Such markets and transactions may in some cases have more immediately obvious impact on socio-environmental sustainability. For example, the negative impact of such trading on threatened species, sometimes appearing on the brink of extinction, is well-documented through declines in e.g. elephants and rhinos in Africa. Tragically, from trophy hunting it has been shown that increasing rarity of hunted species may only increase the exclusiveness, price and demand for their derived products - potentially leading to a self-reinforcing feedback loop toward further decline (Palazy et al. 2011; Palazy et al. 2012). In other cases, the effect of illicit international capital flows are much less well documented. **give examples** Thus, whether licit or illicit, untangling the teleconnected socio-environmental effects of international capital flows should be of priority to sustainability science.

- **Notes for integration**

- **Estimate size of flows**
- **Find good cases**
  - \* Illicit flows from China (to Garry's hometown)
    - Partially off the books businesses moving capital out of country to obscure tracking.
    - Main investors in China are global tax havens.
- **Global Financial Integrity**
  - \* [Global Illicit Financial Flows Reports](#)
- *drugs*
  - \* Cocaine production World Bank report - What Do We Know
  - \* "Narko states" - e.g. Colombia, Mexico
    - Effects on land use change dynamiscs
    - E.g. Colombia, spraying fields will generate new areas with deforestation for coca plantations.
- *human trafficking* (probably treat separate from drugs)
  - \* immigration as a problem and a solution (not sure this fits under the header of trafficking - maybe need separate chapter on economic consequences of migration (human flows))
    - new people in countries as source of conflict
    - *ethnic diversity as a source of conflict or a sign of different cultures*
    - new people in countries as a source of innovation (*REFS from economic geography*)
    - *new economic ventures started up by immigrants*
    - immigrants in canadian households earning more than native-born canadians
    - interlinked-chains of skilled migrants between coupled bilateral systems (source-sink dynamics)
- *family financial networks*
  - \* Hawala
  - \* Informal Transfer Systems - IMF report on Hawala
  - \* framed under a telecoupled financial
  - \* **References**
    - ***Do international migration and remittances reduce poverty in developing countries***
    - Remittances, financial development and growth - **Highly cited paper**
    - Evaluating the Economic Impact of International Remittances on Developing Countries
  - \* possible structuring
    - global markets and on the ground effects - financial flows
    - local networks and the global impact and context - most illicit flows

- **Online resources on fincial flows for integration**

- <http://www.afdb.org/en/blogs/integrating-africa/post/african-regional-integration-and-the-fight-against-illicit-fi>
- [http://www.gfintegrity.org/storage/gfip/documents/reports/gfi\\_aficareport\\_web.pdf](http://www.gfintegrity.org/storage/gfip/documents/reports/gfi_aficareport_web.pdf)
- [http://www.unodc.org/documents/data-and-analysis/Studies/Illicit\\_financial\\_flows\\_2011\\_web.pdf](http://www.unodc.org/documents/data-and-analysis/Studies/Illicit_financial_flows_2011_web.pdf)
- <https://openknowledge.worldbank.org/bitstream/handle/10986/6719/wps4618.pdf?sequence=1>
- <http://www.gfintegrity.org/reports/>



- <http://www.gfintegrity.org/>
- <https://books.google.se/books?hl=en&lr=&id=CCwqWOvf9dQC&oi=fnd&pg=PR5&dq=human+trafficking+ill>
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- [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2528587](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2528587)
- <http://www.jstor.org/discover/10.2307/1123280?uid=3738984&uid=2&uid=4&sid=21106131267781>
- [http://scholarship.law.gwu.edu/cgi/viewcontent.cgi?article=1928&context=faculty\\_publications](http://scholarship.law.gwu.edu/cgi/viewcontent.cgi?article=1928&context=faculty_publications)
- [http://faculty.haas.berkeley.edu/Dalbo/Regulatory\\_Capture\\_Published.pdf](http://faculty.haas.berkeley.edu/Dalbo/Regulatory_Capture_Published.pdf)

### 3.0.5 Financial innovation for sustainability

#### 3.0.5.1 Innovation of investments for sustainability

- Non-governmental financial investments are playing an increasing role in addressing concerns related to social and environmental sustainability, in the developing as well as the developed world [REF]. Philanthropy has played a role in ensuring environmental, social and economic sustainability for centuries. Associated with the increase in the role of private investments has been an increasing diversification of types of investments for sustainability [REF]. From the well-known micro-financing strategies [REF] to green bond markets and other types of investment for impact [REF].
- Sustainability science needs to embrace these recent developments by asking a number of research and solution-oriented questions: (1) How effective are private financial investments in ensuring positive sustainability-related outcomes, compared to, for example, governmental investments?; (2) Which types of private financial investments are most effective in various geographical areas and in solving different sustainability-challenges.
- **notes for integration**
  - the positive perspective - see notes from finance and the biosphere seminar
  - the critical perspective - a roving bandits strategy??
    - \* is financial innovation a strategy for escaping regulation
    - \* black and grey markets
      - money laundering - tax havens
    - \* “black/deviant globalization (book)”
      - using globalization to evade prosecution
      - *cross-border crime as a business to benefit from administrative conflicts and inefficiencies*
      - illegal waste dumping in Italy, starting out as legal waste exports in Germany
      - Gomorrah movie

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## 4 FUTURE PERSPECTIVES AND CONCLUSION

*Text to be added here.*

- **notes for integration**
  - Integrating with the core of the socio-economic sciences

- \* Deeper integration with economic and social sciences
- Going away from individualism, having a more rich view of how societies function - corruption - brutality - goodness - norms - war & conflict (blind spots - myopias - cognitive dissonance - understand the world and see the seeds of good) - decision making / participatory stuff
- Advanced economic modelling (maybe not for this paper)
  - \* Game theory - Chaos - Buzz Braug -
- *How can sustainability science go on from here in interacting with a broad set of large real world (socio-)economic and financial issues*
- Co-production - what happens when scientists collaborate
  - \* Challenges of co-production
  - \* How do you think about having socially good processes, without being over-normative.
- Key guideline for what may be considered more controversial bits - looking at the empirical side of things and value diversity



## 5 Supporting notes

### 5.0.5.2 Notes on integration

- Emphasis on need to fully integrate economics and finance into sustainability science.
- The current state of sustainability science or (environmental, social and economic sciences) is ripe with example of lack of integration.
  - Examples of lack of integration between ecological, social and economic perspectives:
  - Lack of integration of an explicitly ecological perspective into social sciences and socio-economic policy (Brown et al. 2014, Burnside et al. (2012))
    - \* With the implication of overlooking natural resource exploitation as an underlying trend for the “great recession” (Brown et al. 2014)



### 5.0.6 Older snippets

**5.0.6.1 INTRO** The concept of capital is important to sustainability science and environmental conservation

- The concept of capital, a term borrowed from economics, is foundational for sustainability science. Natural, social and financial capital distinguishes between the assets possess in currencies of environmental, societal and monetary value. This is one example of an important interplay between sustainability science and economics where sustainability science has adopted central concepts of economics. Sustainability science is addressing some research areas of economics
- Sustainability science has begun to address the interplay between economic dynamics/sustainability and socio-environmental sustainability. Examples include, (1) the influence of economic inequality on environmental sustainability, (2) the measurement of economic growth integrating measures of financial capital with social and natural capital.

Sustainability science has been slower to pick up other central lines of economic research \* However, many central areas of economics has yet to make into integrated sustainability research. These include, (1) the influence of money in politics and how they influence democratic transitions toward sustainability, (2) how international monetary transactions and illicit capital flows influence social and environmental outcomes at their destinations and to what extent this tele-couples econo-socio-environmental dynamics in areas fare apart.

### 5.0.6.2 Main body

- Green accounting (progress, next steps)
- Inequality and environmental, social and financial sustainability
- The role of money in facilitating or slowing down democratic transformations toward sustainability

Perspective \* From green accounting to national accounts revisions

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### 5.0.7 Even older snippets

**5.0.7.1 Title:** *Blind spots: Gaps and recent progress in linking real world economics and sustainability science*

**5.0.7.2 Tenet:** Sustainability science has made good progress in showing the environmental and social effects and limits to current resource use. Yet, the field has had what can best be described as a “blind spot” to the impacts of capital and so-called real world economics on the environmental and social aspects of sustainability.

**5.0.7.3 Format suggestions:** A comment or perspective piece, e.g. for PNAS sustainability science section, or some more realistic target journal. The piece would comment on and highlight recent progress and future potential for stronger integration of real world economics into sustainability science.

Four topics to highlight as gaps or areas of recent progress Remaining gaps

- The influence of capital in governance on environmental issues
- International financial flows and consequences for democracy and the environment Areas of recent progress?
- The environmental and social sustainability of income distributions (an area of progress?)
- Macroeconomic indicators (an area of progress?)

### The influence of finance in environmental decision making

Main argument: Democracy as a cornerstone in a future Anthropocene that is just, fair and sustainable.

Research questions: Do elected representatives represent the electorate and the environment? What is the role of vested interest in environmental policy?

Research needs: Studies looking at voting behaviour of elected representatives on environmental issues in relation to campaign financing and total amounts of raised capital and public opinion etc.

### Illicit financial flows - hidden connections to democracy and the environment?

Research questions: What is the role of financial flows in and out of countries in affecting foundational aspects of a sustainable future?

- 1) Do international investment/money laundering affect aspects of democracy and thus opportunities for sustainability?
- 2) What are the direct and indirect impacts of international financial flows? Are they captured by analysis of commodity flows and supply chain/life cycle analysis?

*Resources:*

- Biocapacity exports and imports (Lenzen, political ecology)
- Lenzen, M., Moran, D., Kanemoto, K., Foran, B., Lobefaro, L., & Geschke, A. (2012). International trade drives biodiversity threats in developing nations. *Nature*, 486(7401), 109-112. [doi:10.1038/nature11145](https://doi.org/10.1038/nature11145)
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- Datasets on financial flows (illicit financial flows report/database, Garry has database )

**Sustainable income distributions (an area of recent progress?)**

*Research question:*

Which (post-transfer) income distributions are most sustainable in terms of environment (and other aspects of human wellbeing)?

Recent progress:

Happiness and inequality studies?

GDP growth and inequality studies (does GDP growth increase inequality while decreasing ecosystem and human well-being?)

What are unaddressed gaps here?

*Resources:*

Garry Peterson publications in PLoS One and Conservation Biology.

What are other important resources Garry?

**The sustainability of macroeconomic indicators (an area of progress?)**

Aim of section: Highlighting progress in reforming macroeconomic indicators of growth to include ecosystem services and human well-being. Research question: I'm not sure what the area for sustainability science is here

Basically I guess this section could be a description of the many known undesirable environmental and societal effects of a pure GDP growth based focus and an analysis of science' role in current progress in changing the policy agenda.

*Resources:*

Costanza, R., Kubiszewski, I., Giovannini, E., Lovins, H., McGlade, J., Pickett, K. E., . Wilkinson, R. (2014). Time to leave GDP behind. *Nature*, 505, 283-285.

And Ida's ecological economics paper and global environmental change paper

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