



JPI CLIMATE Future Research Leaders Forum

Position Papers

Sustainable Transformations of Society
in the Face of Climate Change:

Promising Research Directions

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Contributions

Introduction: Shaping the European Research Agenda

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Introduction

Shaping the European Research Agenda

Given the multiple interrelations between societal responses to climate change, other global change processes as well as additional societal and environmental mega-trends, research on sustainable transformations of society is an inherently interdisciplinary endeavour. Given the normative underpinnings of the formulated need for sustainable transformations, transdisciplinary research and action is needed to understand, develop and implement social and economic responses to climate change.

Setting a European Research Agenda for better understanding societal transformations under a changing climate calls for the active participation of decision-makers and knowledge-users in society, international research leaders and in particular the *research leaders of tomorrow* in order to contribute their insights, visions and promising ideas. The European Joint Programming Initiative JPI CLIMATE is doing exactly that.

The 25 position papers have been prepared by promising researchers, working in the interface of transformation studies and climate change research and who, as future research leaders, are expected to shape and build the research activities of tomorrow. The open space event – the **JPI CLIMATE Future Research Leaders' Forum** – on which the contributors shared and discussed their ideas and positions was part of a series of agenda-setting workshops organized by the European Joint Programming Initiative 'Connecting Climate Knowledge for Europe' (JPI CLIMATE), which aims at supporting European research to tackle the grand societal challenge of climate change through collaborative, trans-national research funding. As network of European research funders, JPI CLIMATE brings together national funding institutions of currently 15 member and observer countries, as well as several observer institutions and the European Commission. In particular, the JPI CLIMATE Future Research Leaders' Forum contributed

- to **define research priorities** at the interface of Social Sciences and Humanities (SSH) and climate change research, including views of researchers working on the interface of natural sciences and SSH;
- to **identify innovative and promising research directions**, including ideas and approaches, and
- to **facilitate networking and community building** among the research leaders of tomorrow.

By connecting science and decision making processes, JPI CLIMATE helps to meet the challenge of making European development both climate-friendly and climate-proof. JPI CLIMATE is based upon

a Strategic Research Agenda (SRA)¹ consisting of four inter-connected thematic modules (and associated working groups):

- Moving towards decadal climate predictions (WG1)
- Research for climate service development (WG2)
- **Understanding sustainable transformations of societies under climate change (WG3)**
- Climate change decision support methods and tools (WG4)

The position papers, prepared for the JPI CLIMATE Future Research Leaders' Forum provide important contributions to the identification of research priorities and pathways for implementing the SRA of JPI CLIMATE and therefore for transformation research in Europe and beyond.

¹ see www.jpi-climate.eu

Evaluating the evaluation process on quality: what do we value in inter- and transdisciplinary climate change knowledge?

Introduction

One pertinent issue for social sciences and humanities (SSH) in climate research hinges on how best to assess and evaluate climate-related knowledge for effective policy-making. This issue is particularly relevant when multiple and distinct perspectives are involved, as is the case with climate research. Given how perspectives are uniquely embedded within implicit frames of reference, values and world-views, they inevitably yield multiple versions of what counts as important from any given epistemic position (Brunner, 2001; Hirsch Hadorn, 2013; O'Brien et al., 2013). The glaring gap and need for empirical evidence on how perspectives influence decisions on quality is particularly relevant and timely given how the climate and global environmental change (GEC) scientific communities are now mobilising on initiatives such as 'Future Earth' and 'Earth League'. These initiatives seek to deliver scientific knowledge through effective collaborations across natural and social sciences, and so a focus on assessing and evaluating this effectiveness is imperative and necessary for the legitimacy and acceptance of use-inspired interdisciplinary knowledge in its own right. I suggest that an inherent diversity in quality criteria may be unique (and necessary) for inter- and transdisciplinarity to flourish and provide SSH research the platform it deserves to influence that research. There are three key and closely linked sub-themes that I would like to outline as 'propositions' for consideration.

First, is on the need to prioritise research on quality criteria used by 'knowledge producers' (i.e. scientists and other actors that participate in research) and 'knowledge enablers' (i.e. funders, reviewers, science program managers) in their assessments of knowledge for effective policy. Examining quality is particularly important for knowledge that integrates natural and social sciences, where inconsistent evaluation is a pertinent problem for knowledge producers and enablers who may not explicitly be aware of or share similar understandings of quality (Holm et al., 2013; Palsson, et al., 2013). There are calls for more critical examinations of knowledge within intricate climate policy process (McNie, 2007), a proposition that should also examine how knowledge is deemed acceptable for its purpose from the 'knowledge producer and enabler' perspective. This could potentially be relevant also in the European context, where funding schemes such as Horizon 2020 aim specifically at promoting SSH on human dimensions of climate research.

Second, is to consider implications of quality and impact criteria for transdisciplinary research where knowledge co-production beyond academia is expected. A critical and reflective discussion on this topic took place at a conference held in Berne, Switzerland in 2011². Those discussions revealed that whilst some progress has been made on means for effective, consistent and robust evaluation of quality in transdisciplinary research, it is still early days and closer empirical examination of current assessment and evaluation processes on both quality and impact of transdisciplinarity is still needed. This would help to critically ascertain the appropriateness, relevance and effectiveness of current evaluation practices in recognising the uniquely distinct characteristics of transdisciplinarity, particularly when considering 'other ways of knowing' such as Indigenous and traditional knowledge (Adler, et al., 2012). Given how transdisciplinarity is one of the stated goals for the type of research that Future Earth seeks to promote, then evaluating procedural and epistemic aspects of quality and impact assessment need attention.

Finally, my third proposition centres on a more critical reflection on the practice of inter- and transdisciplinarity research itself, whereby we as a community take the opportunity to critically reflect on our own assumptions, biases and world views and how these shape our own notions of what it means to be true "inter- and transdisciplinarians". Research on transitions and transformations towards more climate resilient and sustainable societies appear to be gaining ground, but these efforts also appear fragmented within fields and lack connections for learning 'across' fields³ (Cornell, et al., 2013). Methods, frameworks and approaches have been developed and applied to numerous case studies within future studies, sustainability science, systemic learning, action research, transdisciplinary research, transition management, policy sciences, and science and technology studies⁴. One way to begin connecting these existing efforts could involve a more engaged exchange with respect to evaluating quality and impact, potentially facilitating a stronger epistemic 'community of practice' (Wenger, 1998). This connection, based on effective learning across fields, could also support the type of education 'revolution' that would underpin the necessary training for this type of research (O'Brien, et al., 2013), where SSH play a fundamental role.

Propositions

In summary, the common thread that weaves through and brings together the three propositions raised in the previous section, centre on the issue of assessing and evaluating quality and impact. The three propositions are as follows:

² "Evaluation of Inter- and Transdisciplinary Research: Experiences and reflections on best practice", Berne, Switzerland, 14-16 September 2011, <http://www.transdisciplinarity.ch/e/Network/international/2011/index.php>

³ C. Pohl 2012, pers. comm., 27 July

⁴ C. Pohl 2012, pers. comm., 27 July

- **A critical assessment of quality criteria applied by knowledge producers and enablers in evaluating interdisciplinary (natural and social sciences) knowledge;**
- **A critical assessment of criteria applied to evaluate both quality and impact of transdisciplinarity, especially as it pertains to integrating Indigenous and traditional knowledge;**
- **Enabling an inclusive and reflexive ‘community of practice’ that not only facilitates research links between fields but also critically assesses this research practice on its own quality and impact.**

All three propositions could potentially play a very crucial role in better promoting SSH research on climate and GEC. The current tendency is to apply assessment and evaluation criteria that has traditionally evolved to meet the needs of basic disciplinary research, yet this tendency may not be adequate for assessing knowledge that has use-inspired application (Hirsch Hadorn, 2013). Empirically validating these propositions may present new insights and inspire congruent opportunities for better recognition of SSH research and its role in promoting the knowledge required to face climate and GEC challenges.

Conclusions

Potential research avenues that might deliver on some of the information needs outlined in the three propositions may include evaluation of quality criteria applied in:

- Scientific assessments that synthesise knowledge for policy use at different scales, i.e. global assessments, regional assessments, national ‘country-level’ assessments;
- Assessments of inter- and transdisciplinary research proposals, that are often difficult to assess through conventional ‘disciplinary’ structures of review processes; and
- Evaluation of journals’ quality criteria applied in the assessment and review of inter- and transdisciplinary research papers submitted for peer-review.

In considering research activities to address these propositions, as well as their interdisciplinary and reflexive nature, it is also important to include ‘philosophy of science’ as a field that offers important conceptual advances on epistemology and ontology that would be highly relevant for a more substantial and richer analysis. Funding opportunities that may facilitate these proposed initiatives may include Horizon 2020, for example through European Research Council (ERC) grants that specifically seek to support and promote the research efforts and ideas from young researchers as ‘future research leaders’.

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Beyond cost-efficiency and time schedules - a transformational approach towards climate protection

Climate change is one of the most complex problems that the humanity has ever faced so far. It will influence and require substantial changes in almost all domains including our lifestyles. Furthermore, its magnitude is too large to be stopped by the emission reductions achieved within any single sector, country or local community. In order to curb emissions of CO₂, which the IPCC called "the most important anthropogenic GHG" (IPCC, WG 1, 2007), many different stakeholders on the international arena including politicians, companies, NGOs, communities and single consumers will have to obey an unwritten "social contract on sustainability" with the final aim of climate protection in three key transformation fields – energy usage, urbanization and land use⁵. This in sum will require significant changes in a way of thinking and performing daily operations that can be defined as a societal transformation. Turning on the climate transformation path will be certainly not an easy task, however its benefits could be plentiful. Beside climate protection, green transformation could significantly support dealing with acute global issues like: poverty, food and water supply security, fossil fuel dependence or maintenance of natural biodiversity. It could also bring tangible co-benefits to industry, e.g. by decreasing waste and process inefficiencies and thus leading to higher profits. In other words, the common effort to decrease emissions could increase the welfare of the humankind.

Current literature focuses mostly on the "hard" economic aspects of climate change protection such as cost-efficiency of mitigation measures, GHG reduction timelines, or burden-sharing schemes. Although all these features are important to the ultimate success of the global mitigation efforts, they are not sufficient. In order to effectively counteract global warming we need take into account not only economic, but also social factors in deciding upon future climate policies. The social factors including preferences, values, norms and behavioral traits are often underestimated, although they do possess a large transformational potential. Thus, it is important to investigate both economic and social dimensions of climate protection, analyze the relationships between them and search for the possible synergies and conflicts by means of institutional and societal interaction analysis^{6,7}. The

⁵ WBGU (2011)

⁶ Ibid.

⁷ <http://www.ecologic.eu/1658>

below presented position statements indicate the areas of particular importance to the climate change transformation (and other societal goals) where the use of social sciences perfectly complements and boosts the performance of the underlying economic concepts.

1. Climate-friendly changes in the lifestyle and consumption patterns

Allcott H., and Mullainathan S. (2010) showed that the implementation of behavioral approaches can evoke an incentive to reduce emissions comparable to a large price discount, but without any additional costs. They examined the example of the American company OPOWER, that managed to achieve an average energy reduction of 2% per household by making use of the concept of social comparisons. The company was sending the energy use specifications to the final energy users with a comparison to other similar households and a few energy saving hints. Finally, the authors estimated that if a comparable program was implemented in the whole USA, it could reduce national emissions by about 0.5% and thus generate a negative abatement cost of \$165 US per metric ton of CO₂⁸.

Further environmental, social and economic advantages could be achieved in a similar manner by changing customers' habits and preferences for other products and services (the behavioral methods could be additionally enhanced by the educational programs and social learning process). In a globalized world economy producers are facing tough competition. This make them listen to the customers' wishes particularly carefully. Therefore, customers demanding clean and sustainable goods are very likely to make companies produce goods with lower carbon intensity and longer durability. Such improvements should not be a big challenge to the industry since the necessary technological solutions are mostly already available on the market. E.g. Pascala R. and Socolow S. (2004) named 15 well-known low-carbon technologies called wedges, each with the capacity of decreasing carbon dioxide emissions by 1 billion ton of carbon emissions per year until 2055⁹. The mix of only 7 wedges could result in stabilizing carbon emissions at that time, however in 2011 the number of the necessary wedges increased up to 9 due to increase in emissions¹⁰. Obviously, in that case the emission decrease would happen at the expense of higher prices due to investment in the new clean technology and lower production volumes, if products were designed to last longer. However, it should be acceptable for the final user to pay that additional charge in exchange for a better environmental quality, longer product life but also reduced communal costs from recycling and garbage disposal. Last but not least, conscious and sustainable use of resources could lead to a more efficient allocation of the public spending, e.g. through a decrease in fossil fuel/energy subsidies.

⁸ Allcott H., Mullainathan S. (2010)

⁹ Pascala R., Socolow S. (2004)

¹⁰ Socolow R. (2011)

2. Sustainable production processes – assuring long-term competitive advantage by protecting the environment

Herman E. Daly noticed that from certain point on increased production volumes will not generate any additional utility. This phenomenon, known as uneconomic growth, happens when the production abuses finite natural resources. In that situation the scarcity of the resources constitutes the bottleneck that cannot be overcome by any technological improvements or higher production capacity¹¹.

Unfortunately, most of the companies act myopic pushing the environmental system to the limits. The marketing campaigns aim at creating artificial needs and thus overconsumption. Furthermore, most companies are not very interested in producing robust and durable products that could last many years due to an obvious drop in the sale volumes and thus profits¹². Luckily, early signs of a positive change towards “sustainable revolution” are emerging. In the Vision 2050 paper (WBCSD 2010) developed by a bottom-up initiative of 29 global companies, the CEOs explain why the sustainability became an important part of their future growth strategy. These market leaders have already recognized that population growth will not bring them any advantage in sales due to restricted and diminishing production resources. Therefore, they perceive the expenses needed for the technology and process adjustments as the necessary investment to sustain the leader position on the future markets¹³. Porter M. E. and Van der Linde C. (1995) showed that such environment-friendly investments often result in the financial advantage e.g. cost savings due to more efficient use of the raw material, energy etc.

Drawing on these early findings, the bottom-up initiative of WBCSD enterprises estimate that sustainable consumption products will rise to a three percent share of global GNP or 6.2 trillion USDollar in 2050¹⁴. However, the expected positive sustainability gains can be spoiled by the so-called re-bounce effect. This well-known macroeconomic phenomenon leads to higher consumption volumes due to more efficient production and thus lower prices of goods. Profound changes in the societal mentality and consumption habits described in the previous paragraph should be however capable of controlling the Jevons paradox effect¹⁵.

¹¹ Daly H. E. (2005)

¹² Van Nes N., Cramer. J (2005)

¹³ World Business Council for Sustainable Development (2010)

¹⁴ World Business Council for Sustainable Development (2010)

¹⁵ Alcott B. (2010)

3. Robust climate change policy architecture as a key to success of the climate protection

Stopping climate change will be undoubtedly a long-lasting process. Thus, it is important to ensure that common efforts to mitigate GHG will continue despite changing political moods, economic conditions etc. This goal can be achieved by creating a stable but at the same time flexible climate architecture that would serve as a framework for future actions. It would indicate the right direction to move forward rather than define unrealistic rigid emission reduction goals, budgets and time schedules. The stability of the architecture would be assured by the institutions that are proven to shape and constrain the policy making and social behavior, although they are a creation of the politicians (society)¹⁶.

The persistent deadlock in the climate negotiations let us expect that substantial emission reductions are very unlikely to occur in the near future. Appropriate climate policy architecture could however effectively use that time in order to create appropriate regulatory options, build institutional network and encourage participation in the environmental agreements. In other words, it would prepare institutional foundations which are needed for substantial emission cuts in the long-run¹⁷. As a result, countries would be able to start immediately with radical emission decreases, when they become ready for that. An important function of the climate architecture would be also the management of conflicts that are likely to occur between different stakeholders¹⁸.

Edenhofer O. et al. (2008) stress on the other hand the importance of the global policy architecture in an effective removal of the obstacles on the path to sustainable development that concern mostly new clean technologies. This would include reducing the cost of low-carbon solutions relative to accustomed carbon technology e.g. through subsidies, R&D grants, low interest loans etc. Future climate policy architecture should also create appropriate legacy to decrease the risk for green investors e.g. by defining long-term plans for clean technologies. Last but not least, robust policy architecture must support economic growth in the developing countries by means of clean solutions in order to prevent economic dependence from the fossil fuels observable in the developed countries¹⁹. However, it should be noted that even the best policy cannot guarantee diffusion of the new technologies which requires overcoming the resistance to change. The study of the socio-technical systems responsible for accepting innovations supported by the sociological information could be very helpful in this respect. Geels F. (2005) showed that due to commonly accepted social norms, rules, and values innovations can primarily establish only in the protected

¹⁶ O’Riordan T., Jordan A. (1999)

¹⁷ Schmalensee R. et al. (1998)

¹⁸ Jacoby H. D. et al. (1999)

¹⁹ Edenhofer O. et al. (2008)

niches. However, this can be changed, if the system becomes instable e.g. due to the social pressure or negative externalities like climate change.

In conclusion, effective climate protection will demand profound societal changes that span most of the human activities from consumption and manufacturing to governance systems. Luckily, these changes can be combined with pursuing other urgent societal and political goals which greatly increases their implementation potential. Thus, an important task for the scientists is to identify all the linkages between climate protection and other life domains and to look for the possible synergies (cobenefits) as well as impeding factors conflicting climate protection. Such results would be particularly valuable to the design of any managed transition or transformational policy. Finally, climate change research should also pay more attention to the societal side of emission reduction policy since it may considerably lower the costs of particular mitigation measures and increase its environmental effectiveness.

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The role of political processes in the governance of sustainable innovations

Introduction

It is increasingly becoming clear that a sustainable future requires more than simply embracing principles of 'Corporate Social Responsibility' or adopting new norms and regulations. Rather, it requires more fundamental changes that includes a wide range of societal dimensions, including production practices, consumer preferences, democratic values, institutional arrangements, and the financial system; and entails a reconfiguration of established roles of governmental, market, and civil society actors. Given the broad range of changes that are needed for societies to transform in a sustainable manner in the face of climate change, it is surprising – if not disconcerting - how little attention is placed on the role of political processes within academic debates on sustainable transformations.

Although in recent years a sizable body of literature has emerged on transition management, sustainable innovations, and sustainable practices (e.g. Rothmans et al. 2001, Spaargaren 2003), in most instances these contributions fail to take into account that the transformative processes that they seek to describe have important political implications and are the result of political processes (although notable exceptions include Shove (2010) and Smith and Stirling (2010). Sustainable transformations will entail the reconfiguration of roles of almost all groups in society, therefore having a strong impact on already changing political identities.

Moreover, as new, sustainable values are introduced, these will compete with other market values: for instance when access to (clean, fresh) water is simultaneously considered to be a human right and a commercial product. In addition, new modes of production and consumption will inevitably lead to winners and losers, raising issues of distributive justice and political accountability. Sustainable transformations - if and when they happen - also result from political processes. As scholars on sustainable issues tend to focus primarily on issues of governance and management (e.g. Schout and Jordan 2008), they are prone to overlook the importance of political dynamics in processes of decision-making.

Propositions

Given the above-described omission to include the political impacts and drivers of sustainable transformations, I wish to introduce three propositions for innovations of future SSH climate change research:

1. SSH climate change research should move beyond current approaches to climate governance, environmental management, and disaster risk reduction management.

When addressing climate change, too often policy makers and academics alike express a belief that we can initiate sustainable transformations by adopting principles from pre-existing approaches. For example, principles of measuring and reporting that are derived from the New Public Management literature are adopted with little critique in the principle of Monitoring, Reporting, and Verification (MRV). What is overlooked is that the application of these principles in various domains have shown very uncertain results and are also associated with perverse effects where 'only what is counted counts' (Bowker 2000). Other examples include the promulgation of principles of 'good' or 'fair' governance in the climate governance debate that are mostly derived from common pool resources management and are frequently either too generic or too much subordinated to hierarchical modes of government to affect any substantial change. Principles from disaster risk reduction, such as resilience, are problematic for similar reasons, as they tend to incentivise the maintaining of the status quo, lack urgency, or only promote shallow change after disaster events.

2. The politics of sustainable transformations should be viewed as being continually on-going and taking place in a multitude of societal processes, rather than only at specific moments in specific arenas.

Most political analyses of sustainability or climate change tend to focus either on the global level, or only on local policies and/or regulations. What results are fragmented images of how political leaders at the global scale fail to take on the challenge of climate change in a 'race to the bottom'; of local case studies that present stories both of success and failure; and of powerful elites that operate outside the view of the public. As a result, we can hear advocates of a 'bottom-up' approach where 'top-down' decisionmaking is failing; calls for deliberative and participatory processes to replace interest-based decision-making; and ideas of horizontal or 'peer' accountability to counter the loss of hierarchical accountability (e.g. Papadopoulos and Warin 2007). In reality however, different types of political processes are going on side by side, sometimes conflict with each other, and other times complement each other.

3. Understanding the politics of sustainable transformations requires an analytical perspective that can capture the multiple political discourses and practices these processes entail.

The politics of sustainable development can include conventional interest-based decision-making in representative politics and discursive struggles in societal debate. They can equally include processes of politicization and depoliticization of climate knowledge and science, struggles between top-down and bottom-up decision-making, conflicts between instrumental/managerial and participatory/deliberative rationalities of decision-making, and competing modes of accountability.

To avoid fragmentation, such a taxonomy of where the political can be found and how it is expressed in different arenas and how it progresses over time should be supplemented with an integrated perspective of how politics are given shape in the interaction of different modes of politics. This perspective can be found in the theoretical concepts of discourse and practice.

Conclusion

In order to bring an integrated perspective to assist the understanding of the politics of sustainable transformations, I propose an analytical framework of discourse and practice, as I have developed in my PhD-thesis (Behagel 2012). Although discursive approaches in this field are not new, they have so far been mostly employed to describe policy change in terms of discourse (Hajer and Versteeg 2005). However, they can also provide insight into struggles between representative and participatory politics by describing processes of articulation (Behagel and Turnhout 2011), what political rationalities actors follow, or how dominant discourses are performative and thereby lead to disciplinary effects or invite resistance. By supplementing a discursive approach with a practice approach, additional insights can be offered into the day-to-day politics that actors engage in: how they make political decisions - for instance whether to join a participatory process or not - based on an established logic of practice (Behagel and van der Arend 2012), or how they pursue their goals within the situated contexts in which they work.

As a postdoc, I am currently pursuing funds to apply these ideas to the climate change context. For instance, I am writing a proposal to fund a PhD to research political issues in the governance of climate adaptation in commercial seaports areas. I have also recently submitted a postdoc proposal to acquire a scholarship to fund my own future research that will focus on sustainable transformations in the domains of water, ecosystems, and energy in Brazil. I am also preparing this proposal to submit for a Marie Curie action this summer. Finally, I joined the JPI workshop in Brussels as a rapporteur, co-authored a JPI paper on SSH research priorities in the face of climate change, and take part in the LEDSGP (Low Emission Development Strategies Global Program) network.

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Propositions

- “Could be possible to identify some educational components involved in the process of building adaptation strategies to climate adversities?”
- “There are important specificities in the social actor’s perceptions and phenomenon representation. It is necessary to understand the possible motivations as a way for adaptation strategies development that are more consistent regarding social participation and learning process”
- “In the development process of adaptation strategies is important to consider significant problems of the communities, even when they are not directly related to climate issues”
- “The motivational problems may serve as stimulus and causative agent of reflections on the conditions of vulnerability to climate change, in the community, from its demands together with researchers and agencies ones”

Introduction section

Communities were revealed as climate vulnerable not only due to their biophysical situation, but also to their socio-cultural conditions, lack of collective action and social capital to build climate adaptation strategies (Adger, 2003). As it was pointed out by Crozier (1990), the collective action does not occur as a natural and spontaneous human interaction, nor neither is a logical consequence of the problems to be solved. For this author, one’s intentions, goals and historical consciousness do not provide the success of one’s projects as much as the media to be use (mediation between the "ends" and pursuing the "means"). There is mediation, a way to be built, with existing knowledge gaps in research. Therefore, this is precisely what educators and policymakers should encourage. As the intensification of extreme climatic events is relatively new, including the problematic situation of climate refugees, there is lack of information about the following question: “Could be possible to identify some educational components involved in the process of building climate adaptation strategies for climate adversities?”.

Although significant efforts were made in the development of participatory methodologies, such as the *Agence de l'Environnement et de la Maîtrise de l'Energie* (Plan Climat, 2009), there is still information gap about the understanding of educational elements (and pedagogical ones) or that accompany this social process, which is the adaptation to climate. Learning how to educate future

generations so that they can be capable of dealing with uncertainties (such as the climate ones) is knowledge already indicated by the thinker Edgar Morin (2000). The paths to follow in order to make these teachings become popular and towards a sustainable society are the aim of this investigation and the core of the presented proposal.

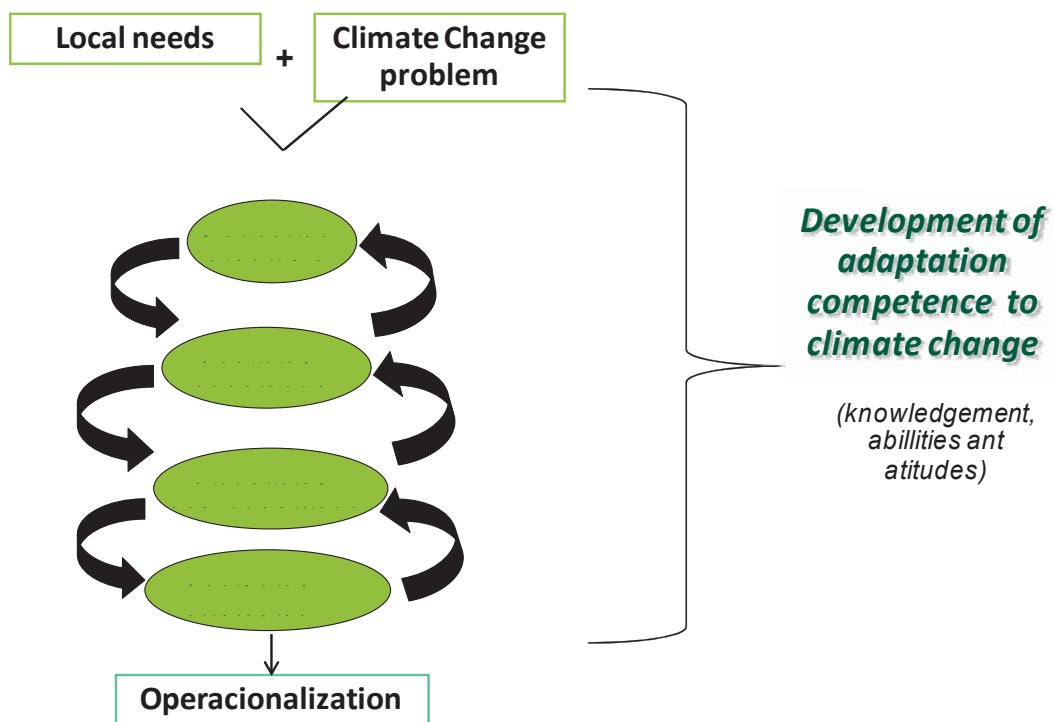
Conclusion section

The adaptive capacity to climate change, as well as other human capacities, can be improved by an educational process. For that, it is assumed Freire's perspective about adaptation strategies development in which effective and consciousness communication between an external agent and the community (or target public) is extremely vital (Freire, 1977; Habermas, 1992). For these authors, educators must firstly be effective communicators in order to build a relationship of collective knowledge development. It is a dialogic process of knowledge development and not only a transfer of knowledge or techniques.

However, in an educational perspective, what are the principles and effective tools in communicating climate adaptation and climate change? According to Freire, effective communication requires that the interlocutors establish "ad-miration" of the same object. A zone of common universe of signs is developed; thus, they can understand the object of communication in the same way. Knowledge generated through a collaborative process is significant because it is essentially related to the material and symbolic universe of the participants, in a center -people approach. For Kolb (1982), the meaning is a need to capture new information and transform it into something tangible and usable to solve the own quotidian problems.

The development of adaptation strategies, as part of a large educational process, is the object of a complex research because it involves an analysis of human aspects, and it is not precisely tangible. Evaluations on the effectiveness of the used methods are not entirely precise because there is a continuous learning process that takes place beyond the moment of interaction in workshops or projects, for example. In this sense it is important considering in project objects and management, time to return and asses the learning built over time (it also means to plan financial support to do that). By the way, as Freire (1977) points out, there are essential specificities in the social actor's perceptions and phenomenon representation. It is necessary to understand the possible motivations as a way for the development of adaptation strategies that are more consistent regarding the social participation and learning process. The development of a reflection process on the state of vulnerability is the guideline for building adaptation strategies, which in turn, must be integrated into a meaningful universe for actors. Under the light of Freire ideas and based on different studies (Bonatti et al 2013 and D'Agostini 2010), it was possible to present an idea on Motivational problems.

This model (see below) suggests that in the process of developing adaptation strategies is necessary to consider significant problems of communities, even when they are not directly related to climate issues. The manner these actors perceive their reality or how they mean and represent this reality is private, and, in many cases, with no relation to the strategies proposed to help the communities by external agents (Bonatti et al, 2013). Thence, the problems might serve as a motivating stimulus, a causative agent of reflections on the current conditions of vulnerability to the climate changes, in the community. The adaptation strategies emerge from their own demands together with the proposals of external agents (as suggested in the first and second spheres of the Figure 1). The other spheres are inspired on the idea of *unperceived viability* (Freire 1977).



The ideas of modal were preliminarily experimented in the center-people approach of CLARIS LPB (The Europe-South America Network for Climate Change Assessment and Impact Studies in La Plata’s Basin) and SINERGIA (International Systems of Studies on Water Resources and Management Impacts Due to Global Warming, in Paraguay’s Basin) workshops²⁰. In these two workshops the goals were:

- 1) To develop a collaborative discussion about the impacts of climate change considering the participants’ understandings about climate change phenomenon.

²⁰ Workshops headed by Michelle Bonatti

2) To develop primary scenarios and design adaptation strategies according to a context (local needs) created by the participants.

The methodological tools were the Compound Stimulus, Forum Theatre, and Soft Systems Methodology (Somers, 1996, Boal, 2005, Checkland, 1981). Especially, the Compound Stimulus is a drama methodology that allows to investigate and build scenarios through few given elements and collective actions. Somers (1996) pointed that the process to imagine, describe and understand stories allows three basic human creative capacities to the learning process: organize momentary experiences; predict individual and collective futures and live hypothetical stories.

Through these workshops' experience, it was possible to develop primary scenarios and adaptation strategies among the participants. Despite the construction of detailed scenarios require further elaboration, the workshops could initiate this process. The group discussions and participative tools were effective to the understanding of climate impacts in the participant's social reality.

Finally, the other side of this learning process is the educator's learning (workshop educator), which is related to understand how to promote educational experiences. In the education for freedom, it is fundamental that the educator shows himself opened to rethink and permanently change peoples' conduct. This underlying goal was also experimented in these workshops

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Position statements

Rather than looking at the past or envisioning the future, though these steps are fundamental, I propose a greater focus in present time assessment of transformative societal change.

I suggest three research principles for future SSH climate research:

- **an integral understanding of ongoing social impacts and responses to adaptation;**
- **action-research as a driver for transformative change, and**
- **a creative and effective dissemination of scientific knowledge that inspires sustainable pathways.**

Following these principles, one research theme is an in-depth understanding of ongoing changes in cultures and practices, amongst case studies of adaptation, exploring possible correlations with sustainable business, with successes and failures of measures and policies involved, moreover assessing and understanding causes for existing gaps between perceptions, values, motivations and actual commitments towards transformative change.

Another theme is to explore links between changing practices and cultures and creative and efficient forms of communicating science, as well as correlations between different levels of transformative societal change and action-research.

Introduction

The idea of societal transformation is at the core of sustainability science, particularly in sustainable transitions research. Within a multi-level perspective of socio-technical systems, transitions have been defined by several authors [8; 9], as “profound changes in various or all aspects of a societal system’s functioning”. Transitions have also been characterized as “transformative change” at the dominant societal regime level [4; 10;]. Recent approaches put forward new forms of governance and go beyond two conventional models – a top-down approach to decision making centered in the State, and a liberal market-based approach wherein change is geared by the market’s “invisible hand”. While the first model implies regulation instruments as well as ‘weak sustainability’ measures, the second relies on market dynamics, such as ‘cap and trade’ instruments. Both modes of governance pay little attention to social transformations and essentially have failed to set forward sustainable pathways. Alternative approaches such as strategic niche management,

technological innovation systems approach and transition management, offer new modes of governance. But they still do not fully consider societal transformation and its interdependencies with governance, as well as alternatives to the dominant neoclassical economic system. How are sustainable businesses and alternative economic models driving transformation in cultures and practices? How are alternative modes of governance influencing societal practices in the present moment? Or rather, how social transformation is happening today and why.

Is a changing climate the driver for societal transformative change or are there other more important drivers? Should adaptation research be interconnected with other topics – such as social, cultural and structural changes within a dominant regime, or the effects of an economic crisis that, to a certain extent, seems to be a symptom of a collapsing fossil fuel and resource intensive production system? An offshoot of this question is the topic of social justice. Is it possible to look at social justice in climate adaptation without considering aggravations imposed by the economic crisis, such as increasing poverty and social exclusion, the fragility of the social welfare state or enduring unemployment in Europe?

In line with these reflections, the first research theme suggested in the initial statements, is concerned with how social practices, consumption habits and deeply ingrained attachments to ways of being, of acting, of consuming, as well as personal aspirations for prosperity (5), may represent lock-ins within the regime subsystem that may need to be broken down in order for new socio-technical, cultural and economic paradigms to emerge.

Related to this, the triplet “structure, cultures and practices” proposed by Rotmans and Loorbach in 2006 [4], derived from Giddens’ structuration theory, has been used in transition theory as a set of parameters to describe transformative change in the functioning of the social system.

Structures are seen as both a product of and an influence on agency. They are physical, economical and institutional infrastructures. Haan [5] points out that the concept of cultures is very specific in the transition context. They are “collective sets of values, norms, perspectives and paradigm”. Finally, practices are defined as a set of forms and habits of production, behaviors, and individual ways of use, self-reflection and reflexive dialogue. Transition authors [4, 9, 10, 12] suggest that, along a period of time, a process of change occurs in the current aspects of culture, structure and practices, which represent barriers for structural change. This triplet of concepts is useful to describe functioning, provides instrumental concepts for narrative approaches, and could be used in an in-depth assessment of different levels of transformative change.

Both retrospective and prospective analysis can help co-design sustainable pathways, and define desired outcomes and processes of change in the medium and long term. However, lesser attention has been given to the now - what are the narratives of today? What stories are unraveling moment-

to-moment, as we research pathways towards a sustainable future? The subject of socio-ecological resilience (1) and how the latter interconnects with social transformation is also correlated to this.

Regarding the last theme I suggested (communicating science), transdisciplinary sustainability research entails building a scientific metanarrative, but it's vital to recognize, as Hulme [6] points out, that what appears as a fact is not communicated unfiltered to people. A mediating and selective action shapes discourse around facts. Messages are organized hierarchically within the media discourse, according to 'news value' and 'agenda-settings'. As a result, often the most important fact to a scientist may be the less valued in the journalistic piece. Further research should not neglect how to communicate climate adaptation, overcome filtering processes and disseminate scientific knowledge in a way that mobilizes action, and influences transformation in cultures and practices within the development of sustainable pathways.

Conclusion

SSH Climate research seems to be very much focused in understanding and characterizing change at the level of structures (institutions, legislation, policies, infrastructures, technologies), but not as much at the level of cultures and practices. What are the drivers for societal transformative change? – New modes of governance? Alternative economic models? Sustainable livelihoods businesses? Action-research? How can practices, such as habits of comfort and consumption, change? I find these are important research questions. SSH Climate research should also be concerned with a wider and deeper understanding of changes throughout time and space. Not only designing future scenarios, but also finding connections, differences and similarities between future visions of communities across the world, and how these are affecting present-day collective values, ways of viewing the world, behaviors, routines, habits and motivate collective action towards real and effective change. In short, finding the social drivers of transitions.

Since transformative research has been developing participatory and deliberative tools used within an action-research context, it is fundamental to understand how such tools influence change within current social practices and cultures. Moreover, sustainability studies often resort to a methodology framework that is mostly concerned with either understanding or assessing what has been done or with future visions of communities and individuals (such as future workshops, scenario methods or backcasting). Linked to this issue, it seems important to better systematize the selection and implementation of this type of methods and tools, by developing a system that allows for greater comparability between processes and results. This requires a more thorough assessment of their efficiency, strengths and weaknesses, as well as a testing ground that can be approached using the same set of tools in similar contexts, within a group of action-researchers resorting to similar models to interpret both qualitative and quantitative data.

BASE - Bottom-Up Climate Adaptation Strategies towards a Sustainable Europe - is a 7th Framework Program, still in its first year. I am researcher for the full duration of the project (you can see my profile here). I'm also developing my PhD research within BASE and the topic is to understand drivers for transformative change in cultures and practices. Moreover, I'm involved in a proposal just submitted to the EC last February: TREE – Transition, Reporting, Evaluation and Engagement. To illustrate our proposal we've prepared a 6 minute Simple Show that you may watch following this link: <http://www.treeproject.eu/>

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Understanding transformational adaptation – decision-making under uncertainty

Climate variability and future climate change impacts will increase the vulnerability of societies around the world. Understanding climate change and the different responses to climate change requires cooperation between all key players, the scientific community, the decision-makers, the stakeholders and the practitioners. Methods and tools have been developed to assess mitigation and adaptation options. However, to further understand, plan for and manage adaptation to climate change (Moser and Ekstrom, 2010), it is important to comprehend the decision-making processes which influence transformations of societies under climate change. A distinction between incremental adaptation and transformational adaptation (Stafford Smith et al., 2011, Kates et al., 2012) is relevant in this context as to increase our understanding of the shift from incremental adaptation towards transformational adaptation and provide support to decision-makers responsible for adaptation to climate change to make this transition.

In addition, as future projections of climate change effects are uncertain, this requires decision-makers to make decisions about adaptation to climate change under uncertainty. Uncertainties of climate change pose new challenges for decision-makers assessing policy options (Hallegatte, 2009) and complicate decision-making tools. Furthermore, insight into the costs and benefits for society helps decision-makers to assess the effectiveness of adaptation options; however knowledge gaps exist on the quantification of costs and benefits of adaptation to climate change.

Thus, future research requires not only improving models and tools to assess adaptation options under uncertainty but also entails enhancing our understanding of the decision-making process and how the models and tools can be embedded into the decision frames of all key players.

The following propositions state needed advances in social science climate research to deal with current climate variability and future climate change.

1. Improved understanding of decision-making under uncertainty in the context of climate change will enhance transformational adaptation to climate change.

As climate variability and future climate change will increase the vulnerability of societies around the world, especially the impacts in developing countries will be severe. For example in the Hindu-

Kush-Himalayan (HKH) region, where the increase in global temperature is expected to affect water supply and lead to more extreme events (i.e. increasing magnitude and frequency of flood events due to excessive rainfall events in combination with snowmelt). It is important to investigate how local adaptation to climate change through the implementation of protection measures against flooding reduces the vulnerability of local communities. Uncertainty about the real extent of the impact of climate change on flood risks calls for flexibility regarding the implementation of protection measures. A decision-maker should avoid over-investments in case risks increase less than expected while at the same time facilitating sufficient protection also if the risks become higher than expected. To characterise the flexibility of alternative measures a distinction can be made between incremental and transformational adaptation measures, where incremental measures refer to already existing measures which are climate-proofed, while transformational adaptation measures relate to integrated combinations of measures including innovative approaches (following the definition of Kates, et al. 2012).

I propose a research idea aimed at analysing how climate change, economic and policy uncertainties affect the decision to invest in flood protection measures when local costs and benefits are taken into account. An investment model developed by De Bruin and Ansink (2011) is to be further extended, as it currently incorporates flexible timing of investment decisions and scientific uncertainty on the extent of climate change impacts related to flood risks to derive the optimal investment combination of incremental and transformational flood protection measures. The model allows decision-makers to cope with the uncertain impacts of climate change on the probability of a flood event and its associated flood damage. The presence of both irreversibility and flexibility links this decision problem to the theory of investment under uncertainty (Dixit and Pindyck, 1994). The model can be applied to evaluate integrated flood management in the river basins or coastal areas in developed and developing countries. Currently the model is applied to a case study on incremental adaptation within the research programme on climate change adaptation in the HKH region (HICAP) on the Eastern Brahmaputra Plains, Assam, India.

2. Decision-making on incremental and transformational adaptation requires insight into the costs and benefits of the adaptation measures.

Knowledge on the economic impacts of climate change, associated costs and benefits of adaptation options and the applicability of decision support tools is increasing (Narain et al. 2011, Zhu and Van Ierland 2011, Watkiss, 2011) through several research studies and EU projects such as MEDIATION and ClimateCost. However, there remains a need to gain further insight into the economic effects of the implementation of adaptation options through case studies that contribute to the knowledge base on the economic aspects of adaptation (Agrawala and Fankhauser, 2008; IPCC, 2012). Insight into the costs and benefits for society helps decision-makers to assess the effectiveness, efficiency and feasibility of adaptation options and allocate scarce resources.

I conclude that more research is needed to further understand climate change and to plan for and manage the implementation of transformational adaptation. One way forward is to put more emphasis on economic analysis of transformational adaptation to climate change under uncertainty within a transdisciplinary setting.

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“Reality does not exist on its own, in and for itself, but only in an historical relationship with the men who modify it.” (Antonio Gramsci 1971, p.346)

SSH research on climate change has mostly focused on governance questions and in this context often worked with ideal types for institutional design that were constructed either from a hypothetical-deductive view where rational actors calculate their interests or from a normative-inductive view where rational actors would agree the most appropriate solution for joint progress if the setting was done right.

Most of the time these approaches do not further dissect the socio-structural drivers of interest formation or apparently inappropriate behaviour in their research design and risk to fall into tautological traps: since the actor motivation concepts are rather universal (either calculating individual utility maximization or seeking to identify which might be the most appropriate solution), the lens of interpretation is not very sensitive to contextual particularities of the historical situations individuals decide in.

Adding such a deconstructivist point of view promises a more differentiated lens for assessments why climate change policies and institutions may or may not evolve and be effective or not. Understanding the genealogy of the current, historically specific way that humans organise their individual and collective reproduction provides good insights into which ideas and proposals for change resonate, which do not, and why.

Historical-materialist research designs in the tradition of Antonio Gramsci, for example, start the analysis with an assessment of a “framework for action“ that comprises the economic mode of value creation, its regulatory expression in policy and institutions, the normative and informal practices and procedures as well as the mental models and scientific backing that inform and legitimize these solutions. The latter provide the explanations of why things are done the way they are, the glue linking observed world with individual sense-making. This provides for a systematic connection between agent and structure and instead of reifying states or political organizations explains their nature as a complexity of state-civil society relations.

Taken together, these frameworks for action (see graph below) form “limits to the possible“ and shed a light on where drivers and lock-ins of a current development path lie and in which worldviews and ideas or interests, social-political institutions and economic-technological structures they are rooted. Central units for analysing change are “social forces“ or agent networks whose

“collective action” or “collective will” seeks to further particular ideas and interests within these frameworks. These are enjoying different degrees of power potentials for doing so, depending not only on the amount of control over capital and influence in central regulatory organs but also on how much their particular programme is adaptable to the status quo and resonates with the common sense view on what a desirable way forward may be.

Thus, such frameworks for action are at once triggering political activity, limiting the success of these activities and still are changed by them; they are continually changing over time and therefore a historical conjuncture. For Gramsci, the heart of this process is the “philosophy of praxis” of humans: competing ideas, ideological hypotheses or theoretical as well as practical projects are interacting and transforming the order of societies as well as the way it is interpreted and explained: “Man knows objectivity insofar as knowledge is real for the whole human race historically unified in a single unitary cultural system” (ibid. p.455).

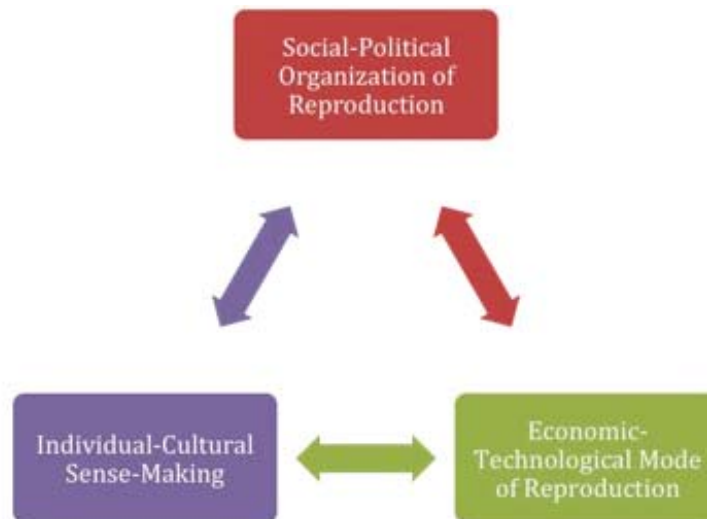


Figure 2: Framework for Action

The unification of the system lies at the heart of the concept of “hegemony” which refers to times where the three dimensions of a social system are rather aligned and little conflict is visible; the given arrangement of modes of reproduction, socio-political organization and worldviews rather smoothly organise a development path that the majority of the people in this society perceive as acceptable. As a leadership concept, hegemony describes the art to lead with least resistance, which involves calibrating compromises and finding persuasive explanations why these would be of general interest. Part of the persuasive explanations are of course theoretical approaches and scientific expertise, which is why Gramscian approaches see the process of intellectual production in dialectical relation to the process of historical change: theory is always for someone and for some purpose.

This agential concept of societal change provides transformation concepts like the Multi-Level-Perspective with a coherent reasoning for origins of niche initiatives, strategies of coalition building for regime change or defence, and the role that landscape narratives or worldviews play in this context. It therefore dynamically links the 3 levels in their interplay and particularly helps shedding light on why, where and how pilots lead to system change and where they are merely co-opted by the "old" regime.

The framework analysis is also very helpful for understanding the moving from one phase of transformation to another, in particular when the window of opportunity emerges where a process breaks from the preparation phase into the navigation phase. Dissecting the reinforcing interrelationships between the three dimensions of the framework for action in the given context as well as the interests and compositions of the social forces that are seeking to amend will highlight the degree of hegemony or conflict and crisis in the given "historical bloc". It may be that the mode of reproduction is not running as smoothly out of emerging technological or economic constraints due to resource shortages, or that disagreements with the socio-political organization of the reproduction processes is mounting because of rising inequality or decreasing quality of life, either of which being triggered by new information from science or changes in values due to observation of the consequences of the current order. Usually this will be mutually reinforcing and the ruling actors will seek to accommodate the frictions through small changes.

In some analyses such amendments may already count as transformations, but in line with the Stockholm Resilience Centre definition, these should rather qualify as a resilient accommodating on the side of the old system or as an adaptation to a new compromise within the same development path. From a Gramscian political point of view the former would qualify as co-optation into the ruling parties and the latter as a war of position in through which a new composition of ruling parties emerges. Yet, transformation of a system involves a re-design of the development trajectories, a different kind of socio-ecological system with a changed mode of reproduction and new institutional expressions and worldviews that moderate structure and agent relations.

Thus, for real transformations to take off, the window of opportunity is widest when wide-spread disagreement around the persuading worldviews will provide for many fissures even into the regime level. Such an "organic crisis" is a highly political period where many formerly suppressed ideas and "collective wills" find an opening to bring their view forward and powerful players feel the urge to engage in a reorganization of the development ordering if they do not wish to resolve to violent imposition measures.

This also means that deconstructing the programmatic goals of different social forces or "collective wills" involved in a particular situation or case will give an early idea about how radical change may become and who will be working in which direction in the navigation and re-stabilization phases of

transformation processes. This gives insights regarding promising interventions, coalition-building and strategic knowledge provision that a transformative research agenda could provide.

Innovative research policies for sub-national or national levels could therefore combine a Gramscian historical-materialist framework analysis with transdisciplinary Transition Cycle research designs. The latter divide transformative research into 4 different phases that are always labelled similarly but differ in the methods of analysis and concrete research implementation according to each scholar's approach. The following graph shows the Wuppertal Institute's cycle as one example.

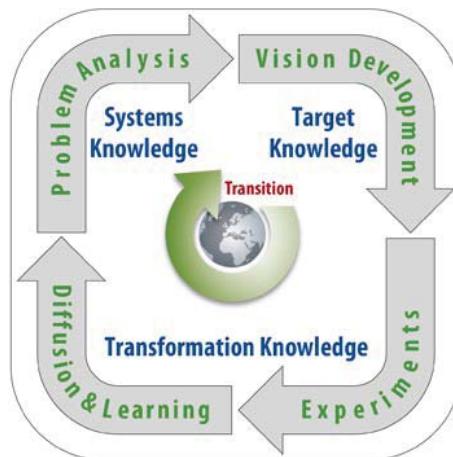


Figure 3: Transition Cycle Research Design

Equipped with a hegemony framework as the backdrop the problem analysis also involves a description of the material and capital flows as much as the technological and infrastructure systems and a mapping of core actor groups.

The following transdisciplinary multi-stakeholder processes strategically invite actors that would be able to shift antagonistic positions and are likely to constructively engage in verifying and co-identifying the presumed regime lock-ins that block the envisioned climate protection change.

The resulting mapping informs systematic coalition-building activities for the conduct of experiments around technology, business, policy- and regime change in the form of prototypes, either as niches or as time-bound trials that do not create the "normal" opposition of full-size changes and whose negative consequences in case of failure are relatively low.

A systematic evaluation of the results, the diffusion of the learning and a reassessment of the premises of the analysis of the system at the outset should complete the cycle and may lead to more experiments and/or an upscaling of the solutions. Alternatively, the trial could lead to a failure, which should be documented and communicated as rigorously, so that new research designs will differ.

For most committed participation by the actors, ensured government action upon research results or even government participation in the project would be highly beneficial. It would also enhance chances for actual regulatory change in the aftermath of experiments. In all cases, the framework for action in the analysed setting will be changed: information and actor constellations have been amended and form the new “limiting conditions” for all future endeavours.

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Critical Transdisciplinary Research for Social Transition to Sustainability

Propositions

- The challenges Climate Change Research face are similar to other global long-term problems society is confronted with and fits under the umbrella of Sustainability Research.
- Experiences, methodologies and theories from other research fields such as Transition Studies, Natural Resource Management, Adaptation Management, Science and Technology Studies, (Soft and Critical) System Thinking, (Reflexive, Participatory, Regional, and Multi-Level) Governance, (Interpretative) Policy Analysis, and (Critical) Discourse Analysis (to name only a few) have to be integrated into Transdisciplinary Climate Research.
- On the one hand current Climate Research (such as regional climate adaptation research) isn't willing to include non-science knowledge into the whole research process and on the other hand it leans towards a positivistic approach and isn't prepared to deal with powerful actors or strategic behaviour in political arenas.
- We need climate research to be critical (but non-ideological) and evidence based, yet practical so to include non-science knowledge and avoid naive positivism at the science-society, science-stakeholder, and science-policy interface.

Empirical Background

My contribution is based on the results of a sub-project Governance of the KLIMZUG-NORD project. The overall objective of KLIMZUG-NORD is to develop strategies to cope with the consequences of climate change in the metropolitan area of Hamburg, Germany (www.klimzug-nord.de). It is mainly a natural science based and somewhat action oriented project. More than 100 scientists are being funded from 2009 to 2014 by the German Federal Ministry of Education and Research. Within our work package (Climate Adaptation Governance, Regional and Reflexive Governance, stakeholder workshops) we have conducted about 50 qualitative interviews, some ego-centred qualitative Social Network Analyses, more than ten stakeholder workshops, and several interdisciplinary workshops.

Social Transition to Sustainability

One core element of my research perspective is the focus on Transition Studies²¹, especially the mid-range theory Multi-Level Perspective (MLP). MLP was first formulated by Rip and Kemp (1998) and aims at analysing, describing and understanding societal long-term transitions towards sustainability. It is one of the most prominent approaches in sustainable transitions studies (Markard et al. 2012: 955). Other relevant approaches are transition management (c.f. Lorbach 2010), strategic niche management (c.f. Kemp et al. 1998), and technological innovation system (c.f. Jacobsson und Johnson 2000). MLP conceptualises overall dynamic patterns in socio-technical transitions. It combines concepts from evolutionary economics (trajectories, regimes, niches, specification, path dependence, routines), science and technology studies (sense making, social networks, innovation as a social process shaped by broader societal contexts), and structuration theory and neo-institutional theory (rules and institutions as deep structures which serve as a foundation for knowledgeable actors and their actions, duality of structure, i.e. structures are both context and outcome of actions, rules of the game that structure action) (Geels 2011: 26).

Open research questions in Transition Studies as well as for MLP are how to integrate micro politics (power struggle and tactical games of actors), meso politics (actor constellations and power struggles in established domains), and macro politics (patterns of power and conflict within the particular political system) in a systematical way (Vound Bornemann 2011). Furthermore social-innovations have to be embedded based on the theory of institutional change (Gottschick 2013, in review-a).

Transdisciplinary Research

Including non-science knowledge is on key aspect of sustainability science. Transdisciplinary Research is one suggested approach to address both real-world problems and the goals of sustainable science as a transformational scientific field (Lang et al. 2012).

The creation of knowledge and handling uncertainty is an important topic for transdisciplinary research. But many times there is an unverified and uncritical assumption that uncertainty is always handled in a rational manner. Therefore I developed an analysis framework of four conceptualisations on how actors handle uncertainties (Gottschick 2013, in review-b). This framework includes rational, no-regret, blissful and formative conceptualisations of handling uncertainty. It is applied to analyse and interpret qualitative interviews of diverse actors of a local Governance Adaptation Network (Discourse Analysis). These findings show how and why there are misunderstandings between scientists and stakeholders in discussions about uncertain knowledge and scientific controversies. This example illustrates just how important critical approaches to discourse and qualitative data in the field of Transdisciplinary and Climate Research are.

²¹ I am a member of the Sustainability Transition Research Network, STRN, www.transitionsnetwork.org.

This is demonstrated also by the next case study. In the field of participation research and stakeholder workshops our basic assumption follows Habermas' theory of communicative knowledge and the ideal of authority free communication (Feindt et al. ; Schaper et al.). This is complemented with our Conflict-Oriented Cooperative Understanding approach (Feindt et al. 2008; Gottschick 2013, in review-a). With colleagues I organised a conference about Participation Research and Participation Procedures in Social Science Climate Research (2012). While there are still open research questions the discussions show that procedures of participation are available and already critically discussed (Newig und Fritsch 2009; Knierim et al. 2013, im Erscheinen). However, our empirical data that consists of interviews and workshops demonstrates that both strategic communication and the subtle exercise of power are formative for some stakeholder involvement in research. Critical research would have revealed these results quicker and more precise.

Critical Research

Critical Research and Critical Discourse Analysis (CDA) has spread out in many schools of social science and humanities (SHH), reaching even natural science disciplines (Jäger 2008). My favoured Critical approach is however in distance to the ideological notion of CDA (e.g. van Dijk 1993) and in line with the critical thoughts about Critical Research from Bruno Latour (2004). My aspired Critical Research direction is close to what Keller (2011) calls the Sociology of Knowledge Approach to Discourse (SKAD). Keller speaks of interpretative analytics to emphasize that SKAD analysis is based on the relation of various data and interpretation steps. It does not focus on one particular document of discourse (e.g. one interview) rather it breaks up the material surface of utterances (Keller 2011: 62). Hermeneutic sociology of knowledge provides the context of SKAD and refers to the necessity of reflexive interpretation to understand the discursive world-making (Keller 2011: 60). This interpretative approach to analyze qualitative data is also mirrored by the growing research field of Interpretative Policy Analysis²² which is also relevant for Climate Research and my proposal.

The aim of my research is to find a way how Critical Research and Transdisciplinary Transition Research can mutually strengthen each other.

Conclusion and Outlook

Research is needed in order to understand and support social transition in current times of climate change and requires more than improved participation procedures, optimised uncertainty communication, risk perception analysis, knowledge brokering instruments, and science-induced stakeholder scenario workshops. What we need is no less than a program that enables SHH to simultaneously do descriptive and prescriptive research. We need research that brings together

²² See e.g. the program of the 8th International Interpretive Policy Analysis Conference (IPA) 2013 (www.ipa2013.univie.ac.at).

positivism and deconstructivism, critical research and action research, social science and natural science, scientific knowledge and citizen knowledge.

What we need is a Critical Transdisciplinary Research for Social Transition to Sustainability.

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Propositions

- The transformation towards a lowcarbon society is comprehensive, a process encompassing all social areas with a dedicated goal in which in which specific actors and actor constellations play an important role
- Research should face the – at first glance apparently paradoxical – challenge of increasing the probability of nondeterminable processes, namely the shaping and acceleration of the transformation
- This requires the establishment of a whole new approach to research which might be termed Transformation Research
- Transformation Research aims, in its widest sense, at a better understanding of transformations within the planetary boundaries. Looked at in more detail, transformation research requires historical analysis and thinking about the future in a systemic and interdisciplinary manner that yet does not exist.

Introduction

The German Advisory Council in Global Change (WBGU) has developed the notion of "Transformation Research" in its latest flagship report. Although the notion has resonated widely within civil society and science policy, it has (due to the political nature of the WBGU) hardly been discussed in the academic world. The subject of the new, reflexive research field 'transformation research' should be the global transformation towards a lowcarbon society under consideration of the sustainability guard rails and the tight timeframe (decarbonisation by 2050). Historical analysis will aim to identify central drivers and framework conditions, the interaction of past transformations with the natural environment and the role technology played within such transformation. It will also include an understanding of the preconditions required for their political shaping, how transformation might be accelerated and to what extent societies already meet these requirements. Existing research approaches such as the transition management approach or historical transformation or innovation research, can be developed further for this purpose.

The new research field should also be tasked with the exploration and vivid illustration of what future societies which respect the planetary boundaries might look like. Possible social development paths and their respective implications on other elements of the bio and sociosphere

require crossdisciplinary elaboration under consideration of future limits. This research particularly calls for the integration, expansion and redirection of future research, and its close cooperation with various disciplinary research institutions, and modelbased scenario development, to determine the modification or further development of existing models for possible new paths towards a sustainable global society.

Conclusion

In terms of the preconditions and possibilities for a global transformation towards a lowcarbon society, this research can refer to the extensive knowledge stock of contributions by the established research traditions with regard to some aspects of the transformation process. This knowledge should be examined for transformationrelevant issues, and be made available. To date, socio-scientific transformation research delivers important details and analyses regarding the influenceability and social embeddedness of transformation processes. The new research field can therefore consolidate and combine methods and various different theories from a multitude of already existing research directions. This includes the socio scientific research on the transformation of political systems, the systemically oriented innovation research, historical research, and fresh approaches, such as transition management, future studies can also deliver some approaches, as can the rather qualitatively carried out model and scenario research.

In this respect, the inclusion of expertise from the engineering sciences is also important, as it can provide a thorough assessment of the respective technological potentials and implications. Equally, the natural sciences can deliver the knowledge needed to analyse the interactions of various social development paths with the biosphere.

The new research field 'transformation research' is necessary as the present research approaches towards the integrated exploration of (global) transformation processes with a view to the imminent issues of sustain ability and limited natural resources must be expanded. Inter and transdisciplinary research approaches which have set themselves the task of overcoming social problems are just the beginning. However, they must also be developed further, in particular with regard to the proposed comprehensive perspective. Although there is some rudimentary knowledge about decisive transformation factors, little is known about the interaction of the influencing factors, especially in a globalised world. The new research field should also pursue a global, culture comparing perspective whilst accommodating local characteristics. A central issue here, as in all research for the transformation, is the communication and relaying of research results to policy-makers, as they have to make the decisions required to shape the transformation, and to society as a whole, as, ultimately, society will have to assist implementing these transformation process relevant decisions.

Apart from defining the social preconditions for a successfully structuring, or the influenceability of transformation processes, this theme should also examine what the options for accelerating such a process are.

Particular focus should be on the examination of social tipping points and central starting points, as identified in the first key research theme. Beyond a historical understanding, technical expertise is as relevant here as it is in insights into intercultural processes, not least in terms of the global dimensions and legitimacy.

The transformation towards a lowcarbon society is inevitably also a global process which must be supported by the appropriate institutions and global governance mechanisms. In this context, the as yet to be developed field of transformation research must examine whether and how global governance can support the processes investigated. This means that transformation research should examine the role of global governance and global cooperation in historical transformation processes and times of major upheaval to learn from the past in order to shape the future. Moreover, it should investigate whether and in which form global governance can support the structuring of future development paths towards climatefriendliness and sustainability. Transformation research would also have to explore how global governance processes, which are extremely timeconsuming due to the great number of actors and the complexity of interest structures, can be accelerated.

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Introduction

In my view, there are four crucial issues that need to be tackled by SSH research in relation to climate change and the socio-ecological transformations required to limit its devastating consequences. The first three issues listed below are connected in that they ask the big (and largely unanswered) questions about institutions for change: how to speed up and scale up change within capitalist democracies? Do we need new modes of decision-making and a new model of democracy specifically for the challenges that will define the 21st century? The fourth issue laid out below is important to understand the tasks such transformative institutions would have to fulfil and thus their 'conditions of possibility': these include tasks of facilitating a democratic process of societal transformation, where transformation is understood as shifts between the (politically) 'possible' and 'impossible', that is, as re-configurations of the social imaginary and the legitimating mechanisms of the polity. The conditions of possibility of these shifts are not yet understood; nor are the means to deliberately facilitate them in a democratic manner.

1) Bridging the gap between 'ecological modernisation' and radical decarbonisation

The paradigm of 'ecological modernisation' which characterised the environmental reforms in industrialised countries over the past 40 years has run out of steam: while it earned undeniable merits in cleaning up hazardous sources of pollution and therefore in improving considerably the quality of life in industrialised countries, it is not at all clear whether the technology-based approach employed in ecological modernisation can resolve the fundamental challenge of decarbonisation (alone). It seems that the changes required to meet the most basic climate goals are far more fundamental and reach much more deeply into the very structures of economy and society than a mere 'modernising' approach can handle (Haberl *et al.* 2011). The dominant strategies for change envisioned to bridge that gap – like 'Transition Management' (TM) (Grin *et al.* 2010) and 'Earth System Governance' (ESG) (Biermann *et al.* 2010) – offer interesting new perspectives but appear unable to answer the question how to change the entire economic system fast enough to escape a 'four degree scenario' (Schellnhuber *et al.* 2012). More radical alternatives like the 'degrowth' discourse (Martinez-Alier *et al.* 2010) are side-lined as they seem too radical to influence the political, societal and academic mainstream. What is thus required is an approach to socio-economic change that focusses on the attainability of the climate goal and offers more radical

mechanisms and instruments of social change than TM and ESG while remaining more agnostic or open with regard to the resulting socio-economic order (van den Bergh 2011). While it seems obvious that by the end of this century capitalism will have changed beyond recognition it is impossible to know today what it will look like. Thus it is more important to focus on the radical intermediate steps of transformation than on the design of a new societal blueprint.

2) Coming to terms with agency: designing the institutions for transformative decision-making

Institutions for socio-economic change today are either based within the representative structure of liberal democracies or 'outsourced' into the market and to social 'entrepreneurs'. Both institutional environments (liberal democracy and the market) provide less-than-ideal conditions for radical change. The liberal democratic order is dependent on economic growth as its prime functional imperative and is unlikely to facilitate forms of change that undermine this foremost objective (Hausknot 2012). Hence there is a structural lock-in to the growth paradigm that cannot be broken within liberal-democratic forms of will-formation. The market and civil society as arenas for radical (social and technical) innovation are the typical alternatives mentioned in the literature. While undeniably important, they crucially lack mechanisms of up-scaling and decision-making to arrive at binding and pervasive forms of change. Instead, they rely on the market-specific mechanisms of diffusion which rely on 'individual utility', commodification and self-regarding choice-making (van den Bergh 2012). Without institutions for the up-scaling of and collective decision-making on radical social innovations, civil society, too, is restricted to a relatively toothless discursive arena where creating niches like 'eco-villages' and so on is the only way to enact radical change.

Here, SSH research is urgently required to explore the possibilities of transformative political agency and decision-making between the liberal-democratic state, the market and civil society. Each of these spheres could be the locus of new institutions to facilitate and enact more radical forms of transformative change. Surprisingly, very little research has gone into the possibilities of institutional change so far (for democratic innovations, a good starting point is Smith 2009).

3) Is a 'transformative democracy' required and if yes, what would it look like?

Closely related to the previous point (2), this research area addresses the question of transformative political agency in a more systematic manner and links it explicitly to the democratic framework and to questions of legitimation and regime stability. If the institutions and instruments for transformative change identified in research programme (2) are to be implemented within a democratic framework, they need to answer to important questions of legitimation and institutional stability. The democratic regime resulting from these institutional innovations could differ significantly from contemporary liberal-democratic systems and function under novel mechanisms

of legitimation and stabilisation. This might be required to break the functional lock-in to the economic growth paradigm and to enable the emergence of a new social imaginary and a form of democracy that functions stably in a steady-state or even a physically shrinking economy (Kerschner 2010).

4) Building a theory of transformation that is based on the discursive economy of the 'possible/impossible' and on the 'social grammar' that coordinates and executes this distinction politically: what is required to make the necessary forms of change 'possible' in socio-political terms?

In order to understand the preconditions for societal change and the transformative requirements new democratic institutions need to address, research is needed to understand what delineates the 'possible' from the 'impossible' and how the boundaries between these realms of the political imaginary are constructed. What is the 'economy' that reproduces and controls these boundaries? How is it institutionalised (formally and informally) and what forms of (institutional) change are required to interfere into this economy? In more concrete terms: how can propositions that are discursively accepted as 'intelligible' (radical forms of change that 'make sense' but contradict some underlying conditions of political 'possibility') also be rendered 'possible'? How can the realms of the 'intelligible' and the 'possible' be linked in a more consistent way (Hausknot 2012)? Having a better understanding of these questions will help bring underway the institutional innovations required to facilitate and speed up societal transitions towards sustainability.

Conclusion

In sum, I propose to focus at least some of the funding of JPI Climate on questions of transformative political agency and its institutional conditions. The core questions here are:

- (1) Are the existing institutions of political decision-making sufficient to rise to the challenge of radical decarbonisation?
- (2) If not, what are the specific requirements for institutional design and innovation to make transformative agency more effective?
- (3) How can these newly to-be-developed institutions answer to questions of democratic legitimation?

Research should focus on (a) the theoretical foundations of and linkages between agency/institutions/radical change; (b) institutional design and experimentation; (c) empirical (experimental) testing of proposed institutions.

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Understanding and shaping societal transformations under a changing climate through joint knowledge production (JKP) – merits, pitfalls and research directions

INTRODUCTION

It is increasingly argued, amongst others by JPI CLIMATE that societal transformations under climate change require scientific research to be participatory and socially accountable. This is due, amongst others, to the presence of value pluralities, high decision stakes, large uncertainties and sometimes also the urgency with which decisions should be taken. This plea resonates with a broader shift that is addressed in academic literature on joint knowledge production (JKP) [3;7]; Mode-2 research [6], Post Normal Science [5] and transdisciplinary research [9]. All these approaches seem to endorse the claim that "science needs to be seen as more than a set of rules and practices organized for understanding the world, but rather as being part of a chain of reasoning, interaction and action within knowledge systems" [2,P.7].

Social scientists who wish to contribute to the understanding and shaping of societal transformations under climate change should analyse this shift critically as well as constructively. Is this shift towards more participatory user-inspired research actually occurring, or do actors only pay lip service to it for strategic or symbolic reasons? If the shift is occurring, what is in it both for science and society? And what lessons can social scientists contribute on how to do JKP between science and society? And how should social scientists dealing with climate change issues conduct their work? Based on my own research and experience, I have derived three propositions on these issues.

PROPOSITION 1: JOINT KNOWLEDGE PRODUCTION BY SCIENTISTS AND OTHER SOCIETAL ACTORS HAS THE POTENTIAL TO ENHANCE THE QUALITY OF CLIMATE-RELATED RESEARCH AS WELL AS ITS SOCIETAL RELEVANCE

JKP projects have been shown to provide added value in terms of societal relevance [7;8;10;13]. In my own research, I found examples of actors who were able to give examples of policy-relevant knowledge providing action perspectives for dealing with wicked problems, including agenda setting knowledge, translation of climate scenarios to the regional scale, designs for adaptive buildings and

societal cost-benefit analyses of adaptation measures, amongst others. More importantly, actors pointed out that such knowledge would be much more difficult, or even impossible, to develop without science policy collaboration.

JKP may lead to better climate-related research as well. Transdisciplinary settings:

- provide researchers with a broader knowledge base (network contacts, empirical data) [4;8];
- may enhance reflexivity of researchers [2];
- promote the development of 'T-shaped skills' [2];
- lead to motivation and gratification derived from interaction with 'society' [4];
- lead to the development of creativity and intuition through the confrontation with paradoxes inherent in transdisciplinary research [14];
- stimulate research practices complementing 'Mode 1' research (more outspoken action orientation, use of 'responsive methodologies') [14].

PROPOSITION 2: WITH FORMATIVE EVALUATIONS OF JOINT KNOWLEDGE PRODUCTION PROCESSES, SOCIAL SCIENTISTS CAN CONTRIBUTE TO A SOCIETY THAT CAN BETTER COME TO TERMS WITH CLIMATE CHANGE

A start has been made with empirical analyses of JKP projects [3;8;10]. I want to make a case for an analysis of the quality of the knowledge production processes by analysing the credibility and salience of the project outcomes and the legitimacy of the knowledge production processes as perceived by the actors involved [1]. Researchers, policy makers and other actors in JKP projects have certain interests in terms of the credibility (scientific adequacy) of the knowledge produced, its salience (perceived relevance) as well as the perceived legitimacy of the knowledge production process. More insights are needed into the question how these interests can be met. After all, for JKP processes to lead to beneficial societal outcomes, sustained commitment of actors is needed and this requires that their interests are taken into account.

I want to stress the need for formative rather than summative evaluations. Evaluations of knowledge production processes are inherently subjective. Furthermore, one can question the effectiveness of, for instance, financial sanctions for promoting effective knowledge production processes. Also, I deem it essential that space is created for making and learning from mistakes. Actors should feel free to be open and transparent, not only about their successes but also about their failures.

PROPOSITION 3: REWARD STRUCTURES FOR RESEARCHERS SHOULD REWARD BOTH 'BLUE SKIES' AND PARTICIPATORY USER-INSPIRED RESEARCH

The widely shared wish for highly contextualised research is not mirrored with an equal shift in reward structures for researchers. They often see themselves confronted with Mode 1 reward structures and institutions [2;7]. More specifically, combining transdisciplinary projects with a PhD trajectory can be challenging [4]. The real world focus of transdisciplinary project creates new dependencies for the researcher, which can be difficult to reconcile with current practice in which PhD research should often be finalized within a fixed term. It has been shown that researchers' experiences with combining PhD research and JKP projects vary [8].

A research agenda that takes the notion of JKP seriously should look for ways to alter existing reward structures. An example would be to start looking for flexible, more practice and less publication-oriented career paths for transdisciplinary researchers. Social scientists can play a role by thoroughly scrutinising the merits and pitfalls of such alternative routes. At the same time, it is also up to social scientists to distinguish the 'genuine' from the more 'strategic' and 'symbolic' efforts to jointly produce knowledge and to lay bare the conditions and factors that bring them about.

Finally, while being in favour of JKP efforts, I want to stress the importance of 'blue skies' research next to participatory user-inspired research. Both types of research are needed and social scientists can contribute to the question which type of research is appropriate under what circumstances. In the context of climate science, potential trade-offs between 'usefulness' and 'academic reflection' have been documented [12]. At the same time, in various fields blue skies research has led to tremendous unexpected societal benefits. As these benefits are often hard to predict, funding for blue skies research may come under pressure in times of economic crisis. It is up to social scientists to warn research funders for 'penny wise pound foolish' decisions.

CONCLUSION

With my three propositions, I want to make a case for carrying out JKP projects and for evaluating them and learning from the evaluations. At the same time, I want to stress that blue skies research is still needed. We should look for coexistence of and fruitful connections between both forms of research. Implicit in my third proposition is the warning that scientists should not be predominantly rewarded for their number of publications and citations in high impact academic journals. Although good articles are of profound value for the quality of the academic enterprise, we should not forget that their primary aim should be to communicate research findings rather than to evaluate researchers. As Scopus and Web of Science make it easy to 'objectively' measure someone's publication record, research funders may easily be tempted to under-expose other, more subjective, 'performance indicators'.

Finally, there is a huge amount of literature available on knowledge production processes. We do not lack concepts for describing, analysing and explaining them. We need integration between what is available: theoretical integration between concepts, but also profound practical experience with and empirical knowledge on how JKP works out in practice. One good integrated contribution may help us more than one hundred fragmented ones. Such a contribution requires 'slow and steady' rather than 'quick and dirty' research.

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Introduction

As the concept of climate change has matured, increasing focus has been placed on the interconnections between its economic, political, cultural and social aspects. However the urgency of the issue is not reflected in action where there is a lack of concrete decision making where awareness and intention to act on the issue rarely result in climate action. Where understanding is high and intentions to engage and act are stated, a re-alignment of these intentions and actual decision making is needed (Hulme, 2009).

While much has been written on the well-known “gap” between attitudes and action (Ajzen, 1991), it is imperative that we find a way to ‘crack the code’ on bridging human intention and behaviour with implementation and practice. A better understanding is needed of how (and if) communication about climate change in itself enables transformations in society and the factors that influence how the communication itself is interpreted.

Proposition: understanding how climate change communication can influence sustainable transformations in society should be at the centre of future climate change and social science research

The need for climate communications

Sustainable transformation in society and caution around engaging on the issue of climate change can be addressed through robust communications to make climate change easy to relate to (spatially and temporarily), increase understanding of uncertainty and risk around scientific conclusions and increase trust in scientific claims. A clear understanding is also needed of the impact climate change communications have on societal changes and how they are received as well as interact within different cultural contexts (Kahan *et al.*, 2011).

Climate change communication methods primarily rely on the premise, defined by the Deficit Model, that providing people with more information will automatically lead to changes and transformations in behaviour. However people and society are made up of a web of values, beliefs, attitudes, norms, cultures, perceptions and habits, all of which affect the communication of climate change, its interpretation and resulting action (Whitmarsh *et al.*, 2011; Ockwell *et al.*, 2009).

Climate communications must therefore adopt a multi-disciplinary approach, incorporating key elements from sociology and psychological theory, psycho-analysis, as well as behavioural

economics, to facilitate transformations in society under a changing climate. In so doing, specific behaviours (such as energy, water, food, waste, travel related), perceived barriers to behaviour change as well as beliefs and behavioural intentions can be addressed to limit the challenges that are born from changes in societal practices.

Combining social research theory with climate communication

In order for climate change communication to incite and support societal transformations under a changing climate, research has shown that certain elements must be the focal point of its design: motivation, medium, content, messenger, audience, location, timing and consideration for the context under which decisions are made. Whilst communications can facilitate societal changes, society's need for reparation as a pre-requisite for change demands an alignment of support at the systems level with the desired behaviour.

A multi-disciplinary approach combining climate science (e.g. causes, impacts, adaptation, mitigation, economics, resources depletion etc), social and psychological theory (e.g. the Deficit Model's tailored information, Rational Choice Theory's utility maximisation, the Norm Activation and Values-Beliefs-Norms Theories'), behavioural economics (e.g. 'nudge' theory), psycho-analysis (e.g. denial, anxiety, apathy, uncertainty, feelings etc) is needed (Crompton, 2010; PIRC, 2012).

Complexities in climate communications

Climate communications can facilitate and encourage long term climate action across society through sharing of lessons, barriers and successes in adaptation and mitigation of climate change. But multiple dimensions of the climate communication process must be understood in order to maximise the impact they have on societal transformations. Reception and interpretations of climate communications is unique and often subject to different cultural systems (both individually and collectively, as well as across a society and within it) highlighting the role of cultural values, beliefs and influences at the individual and systems levels in influencing decision making and leadership on climate (Weintrobe, 2013).

Communication itself should increase knowledge and understanding of the science of climate change, causes, impacts, adaptation, mitigation, solutions, costs, benefits and risks. The content of communications must be adapted according to the identified needs of target groups as well as ensuring the identified behaviour change is well supported at the systems level. The quality of the information disseminated is crucial. It must be both specific and general in nature whilst informing, educating and reminding of personal impacts in a comparative way (to other behaviours, individuals, household appliances, etc), available alternative options (and the benefits of adopting these) and in a simplistic yet approachable format.

Key elements required to ensure the success of climate communications are positivity of messages, understanding of the context within which decisions are made, the language used, justifications for the need for societal transformations combined with a series of incentives and rewards. The use of cognitive dissonance tools to increase awareness on inconsistent attitudes and behaviours and guide towards sustainable choices will enhance 'feel good' effects increasing the likelihood of repeated and long term changes. Culture and climate change, for example, are intertwined both in the interpretation of the problem and the framing of the solution creating a role for culture as the basis for incorporating and applying sustainability in societal transformations. Intra-cultural dialogue is at the heart of climate action and culture influences the development and communication of climate solutions as well as their interpretation. Cross-cultural communication therefore provides a means for acquiring and transferring knowledge and is therefore necessary to share ideas, values, historical adaptation and provide contextual justifications for implementing climate solutions.

Conclusion: ideas for future research

A better understanding is needed of how (and if) communication about climate change in itself enables transformations in society and the factors that influence how the communication itself is interpreted. To ensure maximum impact from climate communications, specific requirements must be met surrounding the messenger (i.e. decision maker, academia, scientist, business, media,), the format, the flexibility and transferability of messages and the evaluation of information packages to ensure they are constantly updated reflecting societal transformations.

Behavioural, attitudinal, awareness and demographic characteristics have been found to play a crucial role in influencing key components of the attitude-behaviour cycle. Transferability, flexibility and applicability of messages to more than one audience mean that multiple issues can be addressed and numerous behaviour changes can be achieved simultaneously.

A multi-disciplinary and integrated approach is needed to encourage collaboration, networking and sharing of ideas in the fields of social science, humanities, policy and climate science. A rigorous and robust evaluation process should also be carried out, collating evidence on a global scale, alongside all future communication of climate change and social science research to ensure high and meaningful impact, scalability, replicability and sustainability.

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Zooming in on sustainability assessment: acknowledging the role of plural climate change discourses in societal transitions

Introduction

In a context of global anthropogenic climate change, the international development cooperation sector cannot escape from the challenge of reinventing itself (Gupta, 2009), as it not only needs to 'climate-proof' its activities, it also needs to position itself in an increasingly complex global system with new players generating negative climate externalities on an unparalleled scope and pace (IPCC, 2007). There is a global consensus on the use of sustainable development/sustainability as an action-guiding principle to cope with the multidimensional challenge of climate change, yet somewhat paradoxically, the dynamic and ever-changing sustainability 'goal' encompasses many interpretations. In other words, the socio-ecological climate crisis is a reality, but the meaning of the concept to respond to that crisis remains contested. The array of interpretations of sustainable development reflects particular perceptions, which, when shared amongst a group of people and/or organizations, become discourses. A 'discourse' is then a shared, structured way of apprehending the world (Dryzek, 2005). Discourses dominate decision-making by providing a bias in conceptualizing a policy issue (such as climate change) and in conceiving solutions to those problems. This growing recognition of the role of discourse in devising solutions to cope with climate change (Hilden, 2011) is not –yet– matched by a parallel interest in the role of discourse in some of the most visible climate action initiatives on the ground: the widely used climate adaptation tools inspired by sustainability assessment approaches (Bond et al., 2013); and community-based adaptation initiatives (IIED, 2013).

Moreover, research on the effectiveness and dynamics of micro-level initiatives (such as the climate-screening and –proofing of particular development initiatives; as well as on the setup of community-based climate adaptation schemes) is not linked to the climate change discourse(s) at the macro-level (e.g. the international climate negotiations under the UNFCCC). However the interactions between the micro- and macro-level could yield interesting insights into the factors determining the current changes in the development cooperation sector, mirroring broader societal change in the face of climate change. For example, these micro-level initiatives (applying sustainability assessments, designing community-based adaptation schemes) could potentially be

the ‘seeds’ of a broader systemic change; or discourses at macro-level might prove very influential at micro-level in certain sectors but not in others.

In summary, the role played by discursive dynamics in shaping societal change in the face of climate change, as well as the multi-level dynamics of societal change in the face of climate change, are still not well understood. In order to understand these dynamics, and in order to generate targeted and socially robust policy recommendations, we make two major propositions outlined in Section 2 (Proposition 1 and 2).

However, we would like to make two complementary suggestions:

- a reflection on discursive dynamics is closely linked to the actors shaping and disseminating the discourses; and scientists (Pielke, 2007), among others, play a key role in the climate change debate (cf. the role of the Intergovernmental Panel on Climate Change) – a reflection on their role in sustainability assessment seems pertinent (Proposition 1 bis).
- a reflection on the replication of information patterns throughout society seems pertinent given the importance of information and perception in driving behavioural change in the face of climate change (Proposition 2 bis).

Propositions

- Proposition 1: Apply a discourse-analytical lens on the development and use of sustainability assessment approaches in international development cooperation, so as to move beyond one-sided interpretations of climate change challenges and so as to diversify the scope of options for climate action;
 - Proposition 1 bis: Focus on the analysis of sustainability assessment as a forum for honest brokering (Pielke, 2007) of scientists in climate policy choices, whereby scientists clarify and expand the scope of choice available to the public and to the public decision makers.
- Proposition 2: Focus on the understanding of mechanisms underpinning climate policy change by analyzing opportunities for fruitful interaction between niche-practices (such as community-based adaptation and sustainability assessment) and climate policy regimes at higher (national & international) decision-making levels, by applying multi-level transition research frameworks (such as developed by Grin et al., 2010).
 - Proposition 2 bis: Focus on the emergence and diffusion of ‘climate-proof memes’ (information patterns) in different actor coalitions influencing decision-making.

Conclusions

The ‘translation’ of the abovementioned position statements/propositions into research policies and associated funding requires an epistemological openness as well as a profound commitment to inter-disciplinarity. Indeed, knowledge in support of societal transformation in the face of climate change calls for an analysis of a system’s deeper-lying structure (diagnostic and explanatory knowledge), it needs to project into the future (orientation knowledge), it needs to assess the impact of decisions (explanatory, orientation and action knowledge), and it has to lead to the design of new strategies for solutions (knowledge for action). Adaptability, defined as the capability to develop appropriate reactions in the face of uncertainties or surprises, is a key cross cutting principle in designing research policies – meaning that any funding scheme should be highly flexible to respond to changing research needs.

In summary, this means our propositions would be fostered by:

- Acknowledging the pertinence of alternative problem framings as an essential element of solutions-oriented research in the face climate-change. Hence there is need to focus on the inclusion of a wide range of stakeholders both in the coproduction of knowledge (citizen science & inter-disciplinary ‘expert’ science) and in the assessment and evaluation of research output.
- Acknowledging subjectivity awareness so as to make careful and transparent knowledge claims which do not specify absolute closure, but which do expand the scope of possible actions. Two rapidly emerging research fields are particularly promising in sustainability- and solutions-oriented research policy and funding:
- Sustainability assessment research, as exemplified by projects such as LIAISE – Linking Impact Assessment Instruments to Sustainability Expertise (<http://www.liaise-noe.eu/>), and by the network & forum function of organizations such as the IAIA – International Association for Impact Assessment (www.iaia.org).
- Transitions research, as exemplified by networks such as the STRN – Sustainability Transitions Research Network (www.transitionsnetwork.org). Both research fields are especially suited to translate the two proposed original approaches to sustainability assessment research (discourse analysis & multi-level transition) into tangible and socially robust recommendations fostering policy and societal change – especially in combination with an open-minded reflection on the role of the scientists in facilitating societal transition to sustainability in the face of climate change.

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Climate change transformation – what is holding us back?

Position statements

- There is a need for greater understanding of the social foundations for change and theoretical mechanisms that hinder and/or lead to transformational change, such as lock-in effects and regulations that facilitate change.
- In particular the energy sector is in need of radical change, both to more sustainable and low emission generation, as well as in order to relate to changes in consumer behaviour.
- Steps to develop the understanding of change can be taken by picking and analysing cases of successful transitions of deep structures, both across sectors and in sectors likely to generate such knowledge, such as the energy sector.
- Setting up research programmes with long-term funding aiming at providing general knowledge about barriers to change and how to overcome them is important in order to bring transdisciplinary understanding

Introduction

While the changing climate is calling for substantial changes in practices and thinking, there is an apparent lack of according action towards this goal. This paradox is very evident for example in the national and EU-level electricity sectors, and there is a need for developing the understanding of barriers to necessary transformations and in the identification of necessary and contributing factors for change (Inderberg 2011, 2012). By no means, however, these factors are limited to the energy sectors, although these sectors do represent a pivotal socio-economic system where transformation to a low or zero emission operation is vital. While there are several examples of different but significant change in and causes thereof, the analysis of these cases have often used institutional organization theory such as historical institutionalist and path dependency theory, explaining stability, rather than causes of change (Mahoney 2000; Pierson 2000, 2004; Pierson and Skocpol 2002). Often, when change have been in focus, it has been explained retrospectively without sufficient attention to what critical junctures are, how to identify them, as well as how interaction between factors such as agent and structural influences produce barriers by 'locking in' systems and what it takes to overcome such barriers (van der Vleuten and Raven 2006).

This knowledge gap should be addressed in order to develop more knowledge about what factors lead to inertia and lock in, to the end of understanding what factors are barriers for system transformation and change, and how these may be overcome (Eikeland and Inderberg Forthcoming 2013). A central sector for climate change and in the midst of transformational pressure, the EU and national energy sectors represents ideal cases for studying such factors and the interplay between structural factors and opportunities for institutional entrepreneurship (Fligstein 2001). By picking particular and critical cases for intensive study over time it will be possible to identify such mechanisms at work, and in this way develop theory on barriers to and opportunities for change (George and Bennett 2005). Also, theoretical innovations, for example by combining organizational virus theory which is aimed at explaining change (Røvik 2011), to the more traditional historical institutionalism and path dependency perspectives, could bring fruitful theoretical contributions for understanding systemic change that is necessary for climate change transformation.

Ideas and design for research programmes

The Norwegian Research Council is seeking to catch these needs through calling for 'new concepts' in energy research (ENERGIX-call), and for climate change research (the NORKLIMA programme). However, these efforts have some clear limitations, both in terms of the risk for being too specific, and in terms of requirements for direct applicability. While research on change often is limited to specific research programmes tied to sectors, such as the energy sector or transport, important research on social and systemic transformation tend to not recognize important and general lessons across fields. After all, climate change is a 'wicked problem' demanding a 'sectorless' response and while there is a need for a high number of responses in a large number of areas, piecemeal solutions are not necessarily the answer here and they need to be coordinated in practice (Rittel and Webber 1973).

Also research programmes can run the risk of putting too strict requirements on direct applicability of results, in the short term. While this is an admirable goal and rightfully set requirements for wide dissemination of knowledge, research results from the social sciences and humanities (SSH) are sometimes of general value, at least in the immediate turn and in terms of economic measures such as competitive advantages. Still, SSH findings have proven important in the past, and may be of great value for society. Organization studies, for example, have progressed far in terms of public organization and benefits and drawbacks of various models and principles – often without the immediate value of individual projects being fully recognized.

Therefore, appreciating these challenges within SSH, funding for research programmes should ideally aim at facilitating long-term research projects with the goal of understanding transformation, barriers for change and how to address such barriers. Opportunities for change and the interaction between large structures and individual or collective actors such as organizations or

institutional entrepreneurs should be emphasized. Projects would ideally be large and long-term in order to facilitate capacity-building and build-up of competence over time. Research programmes should focus not on specific sectors, but should still be limited in scope. This can be achieved by requiring research projects to aim for developing knowledge of general mechanisms, for example about what factors in socio-technical systems lead to lock-in and inertia. Such factors should emphasise generalizability across cases and sectors, through a variety of methodological approaches, while reasoned and representative cases can still be selected within individual sectors (Gerring 2007).

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Transformation in Sub-Saharan Africa in a changing climate: Tapping the potential of water harvesting technologies for rainfed agriculture

Introduction

In the next 30-50 years more water will need to be allocated to food production, demanding higher production and productivity in agriculture while requirements for water increase for other sectors and users (Beddington et.al, 2012). In Sub-Saharan Africa the onset of climate change combined with highly variable rainfall, frequent droughts and low water productivity is likely to pose added risks for food production in the region (Thornton et.al, 2011). Water harvesting technologies (WHTs) may offer an alternative pathway for enabling transformation in the direction of greater resilience and food security (Barry et.al, 2008; Rockström et.al, 2002). WHT comprises of small-scale water technology innovations that induce, collect, store and make use of local surface runoff for agriculture (Reij et.al, 1996). If well integrated in small-holder farm systems, WHTs can help transform low-yielding farms into productive ones, with observable yield increases, ranging between 30-60% (in semi-arid and subhumid areas) (Critchley & Gowing, 2012).

We do know some of the intrinsic and extrinsic challenges limiting adoption of WHTs in SSA countries. They often remain small-scale and fail to grow because of a lack of institutional support and long-term funds, whereas established technological innovations (such as large scale irrigation infrastructure and dam building projects) have an established infrastructure of support (Movik & Mehta, 2009; Lankford, 2009). There is a tendency to treat WHTs as marginal to conventional water systems (e.g. large scale irrigation and dams). Instead of exploring how mutual adaptations can contribute to the growth of new more sustainable water management alternatives (Getnet & Macalister, 2012). Additionally, WHT promoters themselves can often be the cause for non-adoption, through poorly designed and executed strategies that do not fit the needs of farmers, their circumstances, and their diversity. Non-governmental organisations (NGOs) for instance, controlling a large number of WHT implementation projects in SSA countries, can make technology adoption more evasive as a result of poor coordination with farmers (Sumberg & Thomson, 2012). Tapping into the transformative potential of WHTs is likely to involve a paradigm shift. It also demands a better understanding of the role of community-based innovations, and the enabling conditions for their wide scale diffusion (Leach et.al, 2012; Westley et.al, 2011).

Propositions

A future research agenda for WHT transformations for the future:

- The integration of sustainable transformation research with new research frontiers on WHT adoption and diffusion, as a potentially powerful conceptual, methodological and policy experiment, for understanding how radical change in rainfed agriculture can be realised on the basis of small-scale, decentralized forms of innovation.
- Development of conceptual clarity on the multiple drivers of change at a global, regional (i.e. the SSA region), and national scale that can accelerate or slow down a transformation of rainfed agriculture on the basis of wide-scale diffusion of WHTs.
- Identification of novel platforms for dialogue, learning and sourcing of investments on WHTs that operate across traditionally divided sectors (e.g. public and private, donor organisations and governments).
- Development of suitable quantitative and qualitative indicators of WHT spread and diffusion that have the potential to be co-aligned with conventional innovation indicators within industry and agricultural development institutions.

Conclusion

This research is benefiting from its timing. The urgency of targeting investments in sustainable water management technologies can be inferred from the recent World Bank report on climate change, outlining the devastating effects a 4 degrees Celsius warming will bring (especially for the tropics) under a business as usual scenario (Schellnhuber et.al, 2012). The research and policy community therefore recognizes today, perhaps more than ever before, that the potential in small-scale decentralized technologies for climate change adaptation has to be taken more seriously. Several parallel initiatives are already taking place in this vibrant and rapidly emerging field.

Particularly in SSA, an increasing number of international research networks and policy consortiums are following WHT research with great interest. Deeper collaborative engagement with these research consortiums can act as a first step for launching this timely research agenda on sustainable transformations in SSA countries. It is only recently for instance, that the International Fund for Agricultural Development (IFAD) has provided the RAIN Foundation a large grant to execute a global program on 'Rainwater Harvesting for Food Security' that focuses entirely on developing global, regional and national inter-institutional learning systems for scaling-up WHTs (<http://www.rainfoundation.org/>). Platforms for collaboration and seeking funding can be aligned with activities of several other prestigious international and regional research consortiums. The Future Agriculture Consortium (<http://www.future-agricultures.org>), the European Union 'Water Harvesting Technologies Revisited' (WHaTeR) (<http://whater.eu>), and the Southern and Eastern

Africa Rainwater Network (SearNet), (<http://worldagroforestry.org/projects/searnet>) all have a shared interest in sustainable transformation pathways and processes of scaling-up decentralised innovations and where this research agenda can be of added value. Outside the sphere of water and agriculture research new spaces for collaborative engagement on transformation are also unfolding. Future Earth (FE), the new 10-year international research initiative on transformation towards global sustainability (<http://www.icsu.org/future-earth>), recognises that achieving food security in a changing climate poses a key challenge for human societies in the coming decades. Specifically, the Food Futures theme of FE that is dedicated to the issue of global food security, offers an important 'window of opportunity' that should not be missed for linking up WHT research with a dynamic global research network on transformation research for global sustainability.

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Introduction

The evolution of climate change from a scientific theory to a threatening problem of society, has led to the acknowledgement of social science as the link between basic research and action. This seems to grow since the third climate change assessment report of the IPCC. Due to the continuing failures of mitigation and the already occurrent consequences of climate change, adaptation has become the main concept in dealing with this global threat. Almost simultaneously social science has become more important in climate change literature and as Agrawal et al. (2012) pointed out there have been major contributions of social scientists in this topic.

As a geographer, scales, spaces and borders are main topics. Looking at current efforts on climate change issues reminded me of general concepts in planning. These efforts are typically based on the concept of space as a container, each large container filled with smaller ones. But political, administrative or research spaces don't always suit to the scales of planning which would be necessary, including disciplinary spaces. Therefore my suggestions like to direct future research perspectives towards cross-border or intervening spaces.

PROPOSITION 1: CLIMATE CHANGE RESEARCH (CCR) AND SOCIAL SCIENCE HAVE TO INTEGRATE BY DEVELOPING JOINT METATHEORIES AND CONCEPTS.

First of all I would like to discuss a topic which is very popular in geography as well, the difficulty of developing Human-Environmental-Science. The main argument shown by Weichhart (2008) is that most questions in human and physical geography don't have the same objects of knowledge and metatheory, you could say they don't speak the same language. As a consequence it is difficult to face hybrid elements of knowledge which help us to understand the connection between impacts and societal response. The same arguments could be put forward concerning CCR. It is a very young scientific theme which so far has predominantly been researched by meteorologists, oceanographers or geophysicists (Latif 2012). So the topic is dominated by physical aspects. Even nowadays we mainly focus on discussion if there will be 2.5 or 2.8 degrees Celsius of warming and how we optimize our data instead of methods how to accelerate the transformation.

In order to make CC research more socially important social science is hopping on the train. What hasn't been taken into consideration is that these two traditions don't share a joint history in CC

research and therefore don't have the shared philosophical basis and language games, epistemology and metatheory. In order to solve our epistemological gap we have to ask ourselves

- a. What is our knowledge?
- b. From where do we get our knowledge?
- c. How are our beliefs justified?

A way to shrink the gap between these two ways of science would be to translate the big discussions that already took place in sustainability research or earlier geography studies into the climate change context.

I think there is a need to discuss this in order to understand and to be able to transform society. Within European CCR there should be time – and money – to do this.

PROPOSITION 2: SUBJECTIVE REALITIES OF CLIMATE CHANGE POLICY MAKERS

Currently adaptation strategies are being developed on supra-national (e.g. EU), national, sub-national and local scale. Given the fact that the perceptions and perspectives on climate change are important for decision making on all scales and claiming a power shift between governmental and non-governmental actors an interesting research would be to show

- What remains of adaptation policies which have been developed on a global or European level when it comes to place-based or regional reality? Assuming that some aspects simply disappear: why is that?

This could result into local governmentality-studies of adaptation strategies, to investigate different rationalities and a possible relocation of power. Main questions occurring are:

- a. What kind of timeframes, knowledge and unspeakables (values and concepts which are not even discussed, e.g. the invisible hand of the market or tourism in general) are involved?
- b. Which actors or actor groups are influencing these strategies? How important is the superior scale strategy?
- c. Why are they (not) adapting? Do people see CC as a chance or a threat?

Adopting the methodology of Reckien et al. (2011) and combining it with the governmentality-framework by Dean (2003) to go deeper into the drivers of governance could result into a better understanding of basic patterns and constraints of local decision-making.

PROPOSITION 3: SPACE IS USUALLY NOT A CONTAINER – THE EXAMPLE OF IMPACTS OF CC ON AN INNOVATION BASED SERVICE SOCIETY

Europe has rapidly developed into a service society in most (urban) regions. In the context of sustainability in general and in particular in climate change adaptation – in my experience of course – this resulted in a strong demand for more regionalism. So the main focus of adaptation is the endogenous potential of a region, again based on the concept of *space as a container*. What is factored out is that most products of everyday life which are consumed in a region are produced outside of this region. Therefore the quality of life in a region is also depending on the circumstances outside this region, sometimes in areas far away. So in order to develop adjusted adaptation strategies this factor has to be taken into account (of course this depends on the definition of the size regions). The following research questions and actions can be derived from this:

1. Identification of what goods are produced and what is consumed in a certain region. How much space is used for this production and where are the products from if not from this region (value chains!)?
2. What are the spatial and resource capacities to produce goods? What kind of expertise and knowledge are endogenous?
3. How much space is needed to provide the people with the basic functions of existing?
4. How have and can service society regions respond to rapid changes? What does this mean for our understanding of given borders, regionalism and identity in a relational space which is built by social-economic practice?

An outcome of this could be a new way of adaptation which recognizes the relational space and its global linkages.

Conclusion

My personal experience – which is focused on alpine regions – a deliberate transformation (O'BRIEN 2012) e.g. a societal one is not discussed. This is not really surprising. Mitigation and Adaptation are far easier to implement and are often reduced to technological aspects, CC tourism or natural hazards.

In these short propositions I tried to point out that one reason for this could be our understanding of space as a territory with given boundaries (container), in research disciplines, governance, development of strategies and decision making as well. We have to reconsider our understanding in this context in research and climate change action as well to create transformation capacity in order to implement deliberate transformations in times of post-normal science. I believe the research

questions posed in the previous chapter can contribute to a broader understanding and thus to a shift in climate change research.

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Propositions

- **SSH research needs to focus more on marine environments**
- **Environmental and digital humanities can be combined to develop new approaches to climate change research**
- **Humanities scholars can contribute more to research on transformation processes**
- **Humanities researchers need to improve communication of their research results and relevance to researchers from other fields as well as to society**

Research on marine environments

Research in the humanities and social sciences seems so far to have focused more on terrestrial than on marine environments. This is certainly the case in ecocriticism (literature and environment) and environmental history, the two fields that I am most familiar with. With some notable exceptions (Jue 2011), ecocritical studies predominantly address environments and subjects that humans easily interact with, such as forests, cultural landscapes, so called wilderness areas and large mammals. Comparatively little corresponding work concern marine environments or organisms such as bacteria, plankton, or algae, even though these often play crucial roles for maintaining healthy ecosystems. The case is similar in historical studies; while the terrestrial dimensions of the history of science and environmental history are well developed, this is much less the case with the oceans (exceptions include Lajus 2007, Rozwadowski and Van Keuren 2004). A promising future research direction would speak to these gaps in the existing knowledge by developing current research so that it covers all parts of the globe. Unique research problems related to marine environments would also challenge and provoke scholars from the humanities and social sciences to develop innovative approaches and methodologies that could contribute to the broader field of climate change research.

Research that focuses on the oceans is of particular importance in relation to climate change for two reasons. First, changes in the ocean are possibly the most visible effects of climate change so far, including rising sea levels, flooding, melting sea ice and bleaching of coral reefs. It has been argued that if corresponding effects had been seen on land, popular attitudes towards and political efforts to mitigate or stop climate change would be significantly more forceful and decisive than they are today (Roberts, 2012). Second, while we can see some effects of climate change on marine

environments, most concerns and changes in the ocean are not readily observed or experienced by us, such as acidification, changing currents, warmer waters, and sometimes eutrophication. These are mostly known through scientific analyses and reports. The same is true for climate change. By researching marine environments, scholars can begin to develop a better understanding of the earth as a system made up of components and processes not readily appreciated by human senses, and what that means to our perception of problems and our willingness to change.

Environmental and digital humanities can be combined to develop methods for innovative interdisciplinary research.

For studies of marine and other environments, perspectives from environmental and digital humanities can be combined in order to examine how digital tools and technologies influence and perhaps even shape climate change research (Edwards 2010, Nicholson-Cole 2005). What presumptions and conceptualisations do climate models rely on? What values and worldviews do they exhibit? What kind of knowledge do they exhibit and promote, and what kinds of knowledge do they leave out? Which perspectives are not included in the model, and therefore also assigned a backseat in ensuing policy discussions? From a different perspective, what kinds of new knowledge is enabled by digital technologies but not yet utilised or implemented in humanities research? How can digital tools help humanities scholars develop new types of projects and research questions?

Humanities research on transformation processes

Humanities scholars could contribute more to the understanding of societal transformation processes and thus to the broader research question of how societies can adapt to climate change and develop more sustainable policies and practices. For example, historians could contribute with more research on past transformation processes, comparing successful transformations with failed attempts and relating the challenges of climate change adaptation to some of the most comprehensive societal changes in the past, such as the Copernican or Industrial revolutions.

Research results from the humanities need to be better communicated to other researchers as well as to the public.

Humanities scholars in particular need to increase their visibility both in media and in popular debates (Ekström and Sörlin 2012). Humanists as well as social scientists also need to have a stronger voice in contexts that define climate research and expertise, an area that at the moment is dominated by natural scientists. This is seen for instance in the JPI Climate Research Strategy Agenda, where the social sciences are categorised as only one of four modules, and humanities not included at all, a surprising categorisation of a problem that is fundamentally about human behaviour. A stronger presence of humanities perspectives and scholars in what has so far been the realms of the natural sciences could lead to innovative cross-disciplinary projects and approaches. A

recent example of such a successful collaboration between the natural sciences and the humanities is Libby Robin and Will Steffen's article from 2007, 'History for the Anthropocene' (*History Compass*, 5:5, 1694-1719), in which Steffen, an earth system scientist, and Robin, an environmental historian, show that "[g]lobal history has become the business of more than just historians". Similar projects that cross modern institutional boundaries will be crucial for research pertaining to climate change in the future and for that research to result in successful policies and real societal change.

Higher visibility of humanistic research in public and political discourses would also increase the possibilities for successful funding applications. By being more explicit regarding the implications of their research for policy and other research fields the importance of contributions from the humanities and social sciences to climate change research can become more evident and widely recognized than it is today.

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In the last decade more attention has been given in climate change research to integrating the social and natural sciences. Examples of this include research investigating the psychological dimensions of climate change (Hulm, 2009; Gifford, 2011; Kahan et al., 2010), including climate change denial (Norgaard, 2011), as well research into the cultural values underlying different perspectives on climate change (Leiserowitz et al., 2011), and how understanding public attitudes and responses from cultural and psychological perspectives may open up new possibilities for public engagement. This movement towards integrating the social and natural sciences is critical for moving forward collectively with public discourse and policy creation.

An area of research that has yet to be significantly explored is the application and integration of constructive-development theory (a branch of psychology focusing on adult development) to climate change work. There are at least two ways that research in this area could be valuable:

- 1. Developing a thorough understanding of the underlying psychological structures (mindsets or worldviews) that generate and inform the spectrum of opinions and values about climate change, is likely to inform the development of more effective and inclusive communication strategies and initiative and policy designs.**
- 2. Understanding and recognizing developmental differences among climate change leaders (change agents, decision makers etc) and how these differences influence their work, can be used to inform leadership development, to better match leaders with their role and responsibilities, and to increase leader's self-awareness, which can again support more effective communication and decision-making.**

Researching the impact of introducing a developmental perspective (knowledge, awareness and experience) to climate change leaders, would help the larger field of climate change researchers better understand the role that constructive development theory can play in catalyzing transformative climate change leadership.

The very limited research that has been conducted on the application of adult development theory to sustainability and climate change leadership is primarily theoretical. Boiral et al. (2009) conducted a theoretical study of the application of adult development theory to environmental leadership. Hargens and Zimmerman (2009) also conducted a theoretical study where they propose a model of eight "ecological selves" which represent different ecological worldviews, abstracted from constructive-developmental research. The only research that included a developmental

assessment is Barret Brown's empirical study of how developmentally mature sustainability leaders design and engage in complex change initiatives (2011).

Adult developmental psychology research reveals that there are fundamentally different ways of making meaning of our world, and that these ways of making meaning develop in consistent ways over time and across cultures (Cook-Grueter 1999, 2004, Kegan 2002, Torbert 2004). Some of the patterns to this development relate directly to how people perceive, make sense of and the opinions they are likely to form about complex issues such as climate change. Taking this into account when analyzing the polarization of public discourse, creating communication strategies and crafting climate change policies can have a profound effect on understanding and the success of initiatives.

Constructive-development theory views human development as a sequence of integrated and increasingly complex meaning-making stages or systems, each potentially more effective at addressing the complexities of life. This is a nested hierarchical process, where each development to a new stage results in a transformation of the previous way of making meaning, while also including the previous stages (Cook-Greuter, 1999). Some of the cross cultural patterns that developmental researchers find are increasing capacities to engage with complexity, to recognize, take and value multiple perspectives, engage with uncertainty and the widening or deepening of someone's scope of care and responsibility. Constructive-developmental theory shares the following summarized assumptions (Cook Greuter, 2004, McCauley, et al. 2006, p. 636):

- People actively construct their understanding and way of making sense of themselves and the world.
- Growth occurs in a logical progression of stages, evolving from less to more complex and from static to dynamic.
- Later stages are reached only by journeying through earlier stages—each stage transcends and includes previous stages. The movement is often likened to an ever-widening spiral of development.
- Each later stage is more differentiated, inclusive, and integrated—and capable of more optimal functioning in a complex and changing world. However, later stages are not better in any absolute sense, but may be better (i.e., more adequate) in a relative sense.
- As development unfolds, tolerance for difference and ambiguity increases, while defenses decrease.
- Development occurs through interplay between the person and the environment, not just one or the other.

- A person's stage of development influences what someone notices or can become aware of, and therefore, what they can describe, articulate, reflect on, influence and change.

Specifically regarding climate change, development informs how someone perceives the issues, what their concerns are, who they take to be an authority on the issues (whose opinions and what kinds of opinions are likely to be more valued), and what might motivate (as well as de-motivate) them to participate in dialogues and work to effect change around the issues (Boiral et al. 2009; Torbert et al., 2004). Understanding these developmental differences can help change agents navigate values-based conflicts, communicate in ways that transcend the differences of the worldviews while including what is valued by the different worldviews and design solutions or initiatives that address the needs of different communities.

Of the two prospective areas of research applying adult development theory to climate change leadership mentioned earlier, all would benefit from the inclusion of a developmental assessment. Torbert and Cook-Greuter's Leadership Development Framework (LDF) is one of the more finely tuned and validated assessment tools in the field, with over 7000 database profiles. Studies could be conducted to look at the climate change perspectives, values and behaviors of individuals (and groups) assessed at different developmental stages. Additionally, the behavior of climate change leaders at different developmental stages, could also be studied, including developmentally mature leaders, which may have direct bearing on leadership development within the larger field. And finally, studies could be conducted to assess the impact of introducing a developmental perspective (including an assessment) to climate change leaders.

Further research on the application of constructive-development theory to climate change leadership could contribute significantly towards catalyzing sustainable transformations within society and compliment other research that integrates the social and natural sciences within the larger field of climate change. It also offers insight into the process of transformation itself – of both groups and individuals.

The supplementary table below offers an example of adult development theory applied to sustainability and climate change perspectives and worldviews. It draws on developmental research by Rooke and Torbert (2005), Cook Greuter (2004), and O'Fallon (2011), and includes theoretical research on the development of sustainability and climate change perspectives and worldviews by Brown (2005, 2011), Boiral et al. (2009), Esbjorn-Hargens and Zimmerman (2009), Brown and Riedy (2006), McEwen and Schmidt (2007), and Obrien and Hochachka (2010).

| Action Logic | Main Focus | Space Frame | Leadership Methods | Time Frame | Systems | Orientation to Climate Change |
|-----------------------|---|--|---|----------------------------------|--------------------------------|---|
| Diplomat 12% | Socially expected behavior, approval, "one right way", avoids conflict, loyalty to chosen group. "Wants to belong" (Norms rule needs) | Ethnocentric "WE" Our circle, our beliefs | Enforces social norms, encourages, cajoles, requires conformity. Feedback received as disapproval, upholds allegiance, social glue | Past and Today | Limited feedback closed system | CC, when recognized, can be a moral & spiritual obligation. Nature is a garden to steward, legacy for children, concerns for security. CC may not be recognized at all – depending on cultural or political orientation. Concern for personal rights and freedom. |
| Expert 37% | Expertise, procedure and efficiency, error free tasks, what's logical and effective, interiors arise "Knows the answer" (Craft logic rules norms) | Early Worldcentric All of us | Seeks perfection, argues own position, efficiency and improvement. Tactical ideas and solutions. Dismisses feedback from non-experts. | Months | Early linear systems | May disagree that CC exists or is human caused. When recognized, CC is seen as a technical issue that requires proven technological solutions. CC can be managed by limiting temp rise to x degrees, based on expert predictions |
| Achiever 30% | Delivery of results, effectiveness, goals, success within system, "What's successful", science analysis, thinking about thinking (System effectiveness rule craft logic) | Worldcentric All of us | Provides logical arguments, data, makes task goal contractual agreements, Accepts feedback if it supports goals, optimizes strategic outcomes. | 1-5 years | Linear cybernetic system | CC is the ultimate technical & social challenge, replete with profit & opportunity. CC is the most serious problem companies are facing. The climate will remain safe within broad limits. We will develop ne technologies and strategies to keep it that way. |
| Individualist 12% | Self in relation to system; interaction with system, context of thoughts & feelings, limits to science/analysis "All ways equally valid" (Relativism rule single system effectiveness) | Planetcentric, Sentientcentric | Adapts or ignores rules when needed, or invents new ones, discusses issues, airs differences, welcomes feedback for authenticity. Original, creative solutions. | 1-10 years | Complex adaptive system | Addressing CC is our responsibility to the Planet. Must avoid tragedy of the commons. Intrinsic rights of Nature. The only safe climate is the one we had prior to Industrial revolution. Must include diverse stakeholders. |
| Strategist 5% | Linking theory and principles with practice, dynamic systems interaction, paradox. Development "Actualization of self and others" (Most valuable principle rule relativism) | Planetcentric All, Developmentally us | Leads in reframing, situation so decisions support overall principles, strategy, integrity, catalyses breakthrough shifts, Invites feedback | Multi-generational | Developmental system | CC requires holistic, complex approach integrating culture, justice & nature. Visions of a safe climate are plural and acceptable risk needs to be negotiated through public debate. Make decisions based on greatest good for humanity & nature. |
| Construct Aware 2% | Interplay of awareness, thought, action and effects; transforming self and others. Complexity of meaning making. Constructs. (Deep processes & intersystemic evolution rule principles) | Early Kosmiccentric | Reframes, turns inside-out, adaptive, dynamic steering. Feedback part of natural system, essential & held lightly. Generates social transformation | Historic Cosmic Time-frame | Early evolutionary systems | Recognizes the plethora of CC responses related to worldviews, & understands they are constructed & reified through belief systems. Integrate interiors and exteriors in assessment and responses. Transdisciplinary research and action. |

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Personal Transformations? Scholars, Climate Change, and Maladaptive Social Sciences and Humanities

Introduction

In the coming decades anthropogenic climate change will likely lead to catastrophic outcomes for humanity should we fail to transform in order to adapt to its impacts. As the institutional system and individuals responsible for both describing the physical and natural science of climate change, universities and scholars find themselves in a position comparable to those organisations and people tasked with the world wars of the last century. Within universities, the social sciences (SS) are the disciplines most able “to figure out how we bring about massive economic and social transformation on a tight deadline” (Schellnhuber, quoted in Barnett 2009). The humanities (H) as the disciplines tasked with meditating on the human condition and that most ancient form of scholarship, stories (Gottschall 2012), are at least as important. Fassbinder et al. (2012), in keeping with this thinking, make a passionate call for a radical ecological transformation within SSH disciplines as well as the university as a whole, which they consider presently maladapted to the task.

While the SSH (mostly SS) succeed in producing the research that describes environmental crises and society’s reactions, they still largely remain apart from society, trapped in what are now widely criticised as institutional systems neoliberalising around business models stressing grant dollars, limited performance metrics, and individual productivity, with correspondingly adverse impacts on scholars’ own health and well-being (Rosalind Gill 2009; Jubas & Kawalilak 2012; Kelsky 2011). This situation limits the ability of the academy fully ‘green’ itself in both research and practice and accomplish the task of helping society radically transform in order to limit the worst effects environmental crises (Fassbinder et al. 2012). In particular, Greenwood (2012, p.218) sceptically ponders the “the role traditional liberal arts discipline...in responding to diverse communities, species, and nations living on a planet in the throes of converging socio-political-ecological crises rooted in centuries of colonization, genocide, and ecocide” in the context of a constrained neoliberal academy.

This question of how we most effectively harness and change the SSH to address environmental crisis, compels another question about what such a shift means for individual people within the academy, especially those of us just now entering these ‘ivory towers.’ To study social

transformation in the face of climate change, for me at least, is to confront deep questions about my own existence and expectations from life and in turn how these influence my engagement with my profession. These questions are at least as philosophical, spiritual, and psychological as they are practical.

Drawing in part on my own experiences coming to terms with climate change and participating the academy, I make two broad propositions about the implications for new and experienced scholars in the era of climate change and use these to frame some urgent concluding questions.

1. The emergency of climate change transforms the motivational context and expectations of Social Sciences and Humanities scholars.

Climate change is a universal human crisis. Its impacts transcend and often render moot social boundaries, such as state borders, cultures, classes, and political ideologies at a scale in the human experience comparable in scale to few tasks but global war. Unlike war where there might be clear winners and losers determined first by horrific violence, the rapid onset and Earth-scale of climate change calls into question the sustainability of all of civilisation, defined perhaps not by militaries, but the advent of inhospitable geographies. Scholars with a career-oriented mind-set, subscribing however reluctantly to the neoliberalisation of the academy risk placing short-term economic security and long-term career goals ahead of the Earth. Practically speaking, contemporary concerns with higher education's neoliberalisation are difficult to reconcile against the given the long-term catastrophic implications of climate change. This state of affairs ought to have deep implications for how scholars think about themselves and their practice.

2. The SSH scholar of climate change must be the change that the academy lacks

I have a fantasy that all of my university colleagues start taking such a question seriously, and that my workplace becomes a space of spirited deliberation about its fundamental purposes in our changing times—with interdisciplinary study groups reading *Greening the Academy* and planning and enacting meaningful transformative actions. (Greenwood 2012, p.218)

While there are movements toward open access publishing (Collins & Milloy 2012), knowledge exchange (I. Fazey et al. 2012), interdisciplinary environmental studies units in universities, and older pushes for more liberating pedagogies (e.g. Friere, Illich), these types of change remain drops in the bucket, subservient to the broader neoliberal institutional cultures described by Fassbinder et al. (2012) and others. Greenwood's wish could be realised if individual SSH scholars took it upon themselves to act and think the transformation of "fundamental purpose" necessary to transform their disciplines and institutions to effectively approach climate change.

A willingness to engage in difficult but potentially liberating reflection on their own role in the world as change agents may allow scholars to transcend in some way the immediate problems of the neoliberal academy. In doing this, they may find the courage to meaningfully speak, write, and reach out. However, what that means for each individual may be different and very difficult.

For me, it means the on-going process of coming to terms with the idea that my future and yours is likely to be bleak if society does not transform. It has meant orienting myself outlook in such a way as to forgo alternative and perhaps easier but ethically untenable life paths. One cannot unlearn something as deeply solastalgic, the impending sense of a loss of place and planet (Albrecht et al. 2007; Albrecht 2005), as climate change.

Conclusion

The gap I discuss here has much less to do with finding underresearched areas related to social transformation – that part seems easy enough. It is perhaps a much more difficult task to question what it means to be a member of the social sciences or humanities in the era of climate change and neoliberal university systems. What does it mean for the life and expectations of individual scholar today to engage with environmental crisis? What does it mean for how one approaches their work and private lives? What personal transformation must one undergo to in order to liberate themselves from the academic and non-academic structures that inhibit the push for social engagement and transformation? And perhaps most importantly, how does this reflect back upon and transform our institutions?

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Historical analogies of social transformation: Indigenous peoples and global change

Climate change is widely recognised as a global problem, which requires coordinated and concerted efforts from nations, communities and individuals. Furthermore there is mounting evidence that climate change will disproportionately affect poor and marginalised populations, including indigenous peoples, and reinforced current social inequalities. Within Oceania, for instance, inequalities exist between ethnicities, tribal groups, classes, males and females, age groups and places (Barnett and Campbell 2010). In Australia, in particular, inequalities between indigenous and non-indigenous peoples are amongst the worst in the developed world. For many Australian Aboriginal and Torres Strait Islanders access to and opportunities for employment and educational advancement is limited, the provision of social services, community infrastructure and healthcare remains deficient, and social problems are endemic (Veland et al. 2012). The impacts of climate change threaten to exacerbate the existing social, economic, institutional and health problems faced by indigenous and tribal peoples worldwide and create new challenges and opportunities for societies. For both practical and ethical reasons, it is critical that we understand the nature of current inequalities, the ways in which climate mitigation and adaptation actions can allow for more equitable and just outcomes for indigenous peoples, and the possibilities for purposeful social transformations that recognise indigenous values and rights. The purpose of this paper, therefore, is to consider existing knowledge of climate change adaptation and social transformation, and identify critical gaps in our understanding of the social, economic and institutional dimensions of climate change adaptation as it pertains to the indigenous peoples, and suggest areas of future research.

Indigenous and tribal peoples are widely considered to be amongst the most vulnerable to the negative impacts of climate change. However this depiction, of indigenous and tribal peoples as vulnerable, has more recently be challenged by scholars (Cameron 2012; Veland et al. 2012; Howitt et al. 2011). In the context of the islands of Oceania, Barnett and Campbell have questioned the widespread application of the concept of vulnerability to natural hazard reduction and climate change adaptation studies. They argue that the discursive nature of the term vulnerable (and vulnerability) is such that its usage is accompanied by various other connotations (weakness, passivity, insecurity, marginality). By labelling island communities as vulnerable their resilience and capacity to adapt to changing environmental and social conditions become invisible and the

vulnerable entity becomes identified as the problem (Barnett and Campbell 2010). Such an approach to vulnerability emphasises the need to protect indigenous and tribal peoples from climate-related harm, while adopting western solutions designed by outside experts that often increase risks to local communities by failing to incorporate local knowledges, cultural values and practices, and empower local people. Kinship, for instance, is an organising principle on which Australian indigenous societies and connects people, places and environmental phenomena together. Despite these links, the Australian federal government continues to favour policies that seek to move Aboriginal people away from their traditional lands to larger townships where social connections are typically strained but government service delivery is easier (Howitt et al. 2011) and indigenous knowledge and adaptive management strategies are frequently overlooked (Veland et al. 2012). In Northern Australia, Veland et al. (2012) has demonstrated, Aboriginal perceptions of and responses to climate variability and change is influenced by their cosmological framings which located the environment as sentient and responding to human behaviour. Extreme weather events are therefore related to people's interactions with and cultural (including spiritual) relationships to flora and fauna, as well as biophysical processes, and it is difficult (and perhaps culturally inappropriate) to seek to separate climate risks off from broader culturally-situated notions of risk. Veland et al. (2012) suggest the current failure of scholars, policy-makers, and practitioners to acknowledge the different ways in which indigenous peoples understand and conceptualise climate change, as well as the spiritual dimensions of global environmental change, may result in inappropriate top-down interventions which renew social inequalities. Some scholars go so far as to argue that climate change adaptation interventions (designed to "protect" indigenous people) are in fact a greater risk to indigenous societies than the impacts of climate change and represent a renewed belief in environmental determinism (Howitt et al. 2011; Veland et al. 2012). In my view such an argument fails to appreciate the speed, magnitude, and complexity, and inter-generational nature of global environmental change, as well as the large amount of literature that frames climate change as a social rather than biophysical phenomenon (thereby avoiding charges of environmental determinism). The fact remains that the impacts of climate change, in interaction with other global change processes, is and will continue to affect indigenous peoples around the world, and the key focus for researchers should be on how to ensure that mitigation and adaptation responses do not perpetuate existing inequalities and marginalisation, and allow indigenous groups some 'locus of control over their own destinies as part of a recognition of identity and place' (Adger et al. 2011, 21). Part of thinking about how transformation can guide climate change adaptation planning, policy making, and practice therefore should involve understanding and questioning how underlying existing social values and relationships influence who gets access to what resources, why, when and how.

In this paper I argue that historical geographies of the indigenous peoples can enrich current knowledge of the processes of vulnerability and resilience, the circumstances under which transformational change occurs, and build recognition of the paradigms and structural constraints that impede widespread and deep social reform amongst indigenous groups. In order to understand transformation, I argue it is first necessary to understand what contributes to both individual and collective processes of change, which includes change within social practices, and examine exemplars of social transformation (Hackmann and St Clair 2012). Accordingly we need to identify what are the characteristics of successful change, what capacities are needed for such change to occur, and most importantly what are the limitations and pitfalls of deliberate change (Hackmann and St Clair 2012 18). At present many researchers, policy-makers, and practitioners fail to situate vulnerability assessments of indigenous groups within their historical and contextual groundings, which not only serves to limit understanding of the social dimensions of climate change adaptation for indigenous peoples but also results in adaptation dialogue, plans, and practices rearticulating colonial-era policies and imaginings of indigenous people as passive victims (the so-called “doomed races”) of external stimuli (in this instance global warming) who require outside intervention to save them. Accordingly I argue that increased scholarly attention should be devoted to the recognition and examination of the ways in which processes of change are mediated by local historical and cultural patterns and modes of living. Discussions of global change, and by extension adaptation, far too often position the biophysical from the economic, the political from the social, the contemporary from the historic, and in doing so treat the political, social, and cultural consequences as inevitable ‘externalities’ (as economists put it) which lead to a disembodied and disembedded understanding of both global change and human responses to change. Alternative approaches are needed that bring together diverse knowledges (natural and social sciences, western and indigenous, expert and local) to examine both the effects of and responses to global environmental change, and to better understand societal transformations under changing climate conditions. For indigenous and tribal peoples, questions of justice and indigenous rights lie at the heart of discussions of adaptation and transformation, and it is necessary not only to consider historical and contextual factors, but also how notions of fairness and justice are incorporated into the processes, policies, and practices of adaptation.

Climate Change Adaptation and Social Transformation

There is no one universally accepted definition of adaptation; however adaptation is often described as a goal, outcome or process undertaken by individuals, households, institutions and systems (both social and ecological) in response to climate variability, extremes, and change (IPCC 2012). Recent understandings and definitions, for instance, by Pelling (2011) conceive of adaptation as a state of reflection where people contemplate their circumstances and make about what the goals and outcomes of adaptation should or could be. Pelling conceptualises adaptation in terms of

three pathways or layers of analysis: resilience (maintaining the status quo), transition (incremental change), and transformation (radical change). Adaptation, Pelling suggests, presents opportunities for social reform, for questioning the values that underpin current inequalities in development and our unsustainable relations with the wider environment (Pelling 2011). However this outcome is by no means assured and mounting evidence indicates that far too frequently adaptation is imagined as a technological solution enacted for defensive rather progressive purposes (Adger et al. 2011). For instance, the construction of sea walls and other “hard” adaptations are often presented by adaptation consultants, government officials and community members as the only viable adaptation option for coastal and island communities, and limited consideration is given to other (often more long-term) adaptation options. From this perspective, adaptation involves decision-making about what is worth preserving and what is deemed expendable. Such decisions are typically grounded in economic calculations of costs and benefits and underpinned by dominant discourses that position the economy as the first priority, above ecological health or cultural flourishing (Adger et al. 2011; Pelling 2011). There is a danger that climate change adaptation (both in theory and in practice) will be reduced to simply another form of risk management designed to re-articulate and preserve the economic core, rather than a process that heralds broader societal changes (O’Brien 2012a).

For many scholars, the reliance on risk assessment and incremental adaptation in response to global environmental change is highly problematic because climate change is ultimately a problem of values not biophysical processes or technological efficiency (Pelling 2011; O’Brien 2012b). It is fundamentally a question about how we as individuals and collectives ought to live, what kinds of societies we want to be part of, and how we should relate to the broader natural world (Schlosberg 2012). Climate change not only raises the question of whose values, lifestyles and worldviews are given pre-eminence in planning and decision-making, but also raises the issues of whether our existing values and institutional arrangements are appropriate to the task.

Scholars and environmental activists are increasingly advocating transformation as the “solution” to global environmental change, distinct from or coupled with mitigation and adaptation (O’Brien 2012a). Definitions of transformation vary and mean different things to different people (O’Brien 2012a and 2012b; Pelling 2011). Some define it as large-scale changes to the form, structures, and values of socio-ecological systems. Others consider it a psycho-social process that involves engendering human beings to commit to changing their behaviour to produce a better life for all. For some, the concept of transformation suggests new opportunities for technological, economic and social innovation such as the creation of green economies, the development of renewable materials, and low-carbon lifestyles. For others, it suggests constraints to freedom, trade-offs and conflicts between different groups, and the creation of real or imagined winners and losers. For the purpose of this paper, transformation is understood to be a process of altering the fundamental

attributes of a system, including institutions, structures, regulatory systems, financial regimes, as well as lifestyles, practices, attitudes, policies, and power relations (Hackmann and St Clair 2012 16; Field et al. 2012).

Transformation, Pelling observes, implies an irreversible regime change to achieve a specific goal or outcome (Pelling 2011). Social transformation involves a fundamental shift in the way a society, institution, social group, or community is organised and goes beyond the incremental social changes always at work within societies, as well as the transitional adaptations advocated by many working in the field of climate change adaptation. It implies a 'step-change' in which all existing social values and patterns are questioned, and many are reconfigured (Castles 2010). Social transformations therefore are closely related to major shifts in dominant political, economic, and cultural relationships. Questions arise as to the purpose, form, function and outcomes of deliberate transformation. Not only how do we facilitate social transformation, but also how do we ensure that such changes are inclusive and bring together duties, obligations and responsibilities to the poor, vulnerable, and future generations, and more broadly how do we ensure justice in transformational change.

What lessons can be learnt from historical case studies?

In order to understand the full complexities of the transformation or transformative adaptation I argue it is necessary to consider the ways in which change emerges and operates in modern societies. Here the work of social science can illuminate the ways in which processes of environmental change, including but not limited to climate, interact with and relate to the multitude of other processes at work in societies across scales (both temporal and spatial). In particular work is needed to analyse global environmental change through a historical lens. This could involve examining of the historical drivers which have contributed to high carbon lifestyles and economic models, or track the influence of neoliberal thought on governance and institutional arrangements. Hackmann and St. Clair (2012) suggest that lessons can be learnt from environmental history case studies. I would go further and argue that historical case studies of social transformations can enrich our understanding of the contemporary differences across geographical, cultural, and economic contexts and identities, and the ways in which social transformations were facilitated in the past.

The process of adaptation is not new in itself. Human societies have always been at risk of climatic hazards and this vulnerability can contribute towards the development of adaptive management and risk reduction strategies. In tropical savannas of Australia, for instance, Aboriginal clans developed a complex system of fire management over tens of thousands of years, which involved burning specific areas of the land in a patchwork pattern at certain times of the year to reduce the risks of larger uncontrollable wild fires, ensure easy access to game and water sources, and regulate

species diversity. Similarly irrigated agriculture emerged in multiple locations Oceania in response to irregular rainfall (Barnett and Campbell 2010). Case studies and historical analogues, wherein past experiences and responses to climatic extremes, variability, and change are examined in a defined area, are frequently used by scholars as a means to assess social vulnerability at a local-level. Such studies often seek to explore what makes specific communities, institutions and systems vulnerable to climatic hazards and change, and what capacities or features of those communities, institutions or systems allow them to successfully adapt to changing conditions. The analogue approach allow scholars to explore how societies' perceive, experience, and manage climatic risks; how social and biophysical processes shape social vulnerability over generations; what conditions and processes influence both the form, function, and effectiveness of adaptations in the past; and what range of possible actions can (and should) communities, institutions, and systems take in response to future climate change. Temporal analogues, in particular, can assist us to identify strengths and weaknesses in societal responses to climatic risks and how these responses change over time, document potential conflicts within groups, and the ascertain opportunities for policy interventions. However this approach is based on the premise that human societies in the future will continue to conduct their activities in ways similar to those of societies in the recent past, and some scholars have argued that this premise is fundamentally flawed because the impacts of anthropogenic climate change are likely to exceed any climatic changes experienced previously and therefore it is unlikely that future societies will operate like those of the past (Ford et al. 2010). Yet I argue that historical antecedents of adaptation and transformation in human societies offer important insights for understanding processes of social change, despite the unprecedented speed and magnitude of global warming, because the social and ecological contours we encountered today are frequently the result of complex historical processes and trajectories. Accordingly I argue that planned adaptation, representing deliberative responses across scales (from local to global), needs to consider historical contexts and experiences in the design, implementation and evaluation of adaptive and transformative actions. In particular the abilities of indigenous societies to adapt to climate change are often conditional on the political and socio-economic environment, all of which is underpinned by the historical legacies of colonialism. For indigenous peoples colonial issues continue to set the backdrop for new encounters, including their experiences of and responses to global environmental change.

Historical analogies of environmental change and stress are a well-established method of examining vulnerability to the impacts of climate change. In my view historical analogies of social transformations can similarly illuminate what factors are conducive to transformation in the context of global environmental change. Diverse historical examples, from the environmental transformation of New Zealand from predominately woodlands into farmlands, to the social transformation of Pacific Island cultures following the introduction of Christianity, highlight how

both incidental and purposeful transformations can be instigated by small groups of committed individuals working in formal or informal networks, but can also be imposed by outside experts who instituted widespread changes under notions of progress and improvement without local support or consent. Such transformations involved widespread changes to indigenous governance regimes, agricultural systems, production and consumption patterns, lifestyles, values and worldviews, and inevitably involved both beneficial and negative outcomes for local peoples. Such case studies provide an opportunity to assess the processes that shape both vulnerability and resilience, and the circumstances under which transformational change occurs, as well as the potential dangers of irreversible changes.

For indigenous peoples the process of colonisation, which involved irreversible regime changes around the world, fundamentally altered indigenous societies, economies, lifestyles, social structures and cosmologies, and was associated with widespread environmental changes as non-indigenous groups sought to “civilise” and “remake” colonial spaces in the image of their metropole. In Australia, for instance, the British colonialism involved numerous transformations, both planned and endogenous, of Australia’s socio-ecological systems. For much of the nineteenth and twentieth century British colonial and later white Australian governments deliberately removed Aboriginal people from their traditional lands and incarcerated them in institutions for the specific purpose of remaking and transforming them into suitable workers and subjects. This process often involved separating them from their lands, family members, and traditional practices, and remaking them to accord to white norms of dress, diet, housing, hygiene, and lifestyles. The removal of Aboriginal peoples from their traditional lands, accompanied by the expansion of white agricultural activities, caused widespread environmental changes to the Australian continent. Wild fires, for instance, are now a common feature of the Australian hazard landscape in part because Aboriginal people were removed from their lands and their traditional fire management practices were no longer systematically applied to the Australian terrestrial landscapes. The unsustainable modes of living, high carbon lifestyles, economic arrangements, and development paradigms that are now features of contemporary Australian society are a result of complex historic processes and trajectories of progress which followed on from British colonisation in 1788. An appreciation of the historical drivers that led Australian society, and other societies, to lead such high carbon systems and lifestyles may offer insight into how to transform those societies, as well as allow us to unpack the successes and failures of broad-scale environmental and social transformations.

For some scholars history is quite literally in the past and of limited value to climate change adaptation. Yet this undervalues the importance of historical experiences and memories play in shaping cultural values and practices, creating the physical landscapes we traverse, live and work in on daily basis, and the laws, policies, and institutions that structure our lives. For settler societies, such as Australia, New Zealand, Canada, and the United States, colonial experiences continue to

define and influence the relationship between indigenous and non-indigenous groups, and inform indigenous perceptions of and responses to global environmental change (Cameron 2012). In New Zealand, for example, the Treaty of Waitangi (signed in 1840 between Māori rangatira (hereditary leaders) and representatives of the British government) is considered a “living” document which provides the parameters of the relationship between Māori and the New Zealand government both now and in the future. This historic document, which has no legal status in itself, guides government policies and institutional arrangements (to varying degrees of success) including mitigation and adaptation policies and practices. The New Zealand emissions trading scheme, for instance, includes specific exemptions for Māori groups to develop their tribal lands and for Māori forestry interests. In the future it seems likely that the Treaty of Waitangi will remain an important cornerstone on which Māori interact with and negotiate climate change adaptation options with the New Zealand government. So what does all this discussion of history and contextualisation mean for sustainable transformation under changing climate conditions? First it suggests that we need to consider how historical processes shape and underpin contemporary realities of living with global change, especially for marginalised populations and communities in both developing and developed societies. Second historical analogues can provide us with insight into potential measures to evaluate adaptation policies and practices to ensure that the desired goals are attained (resilience, adaptation, sustainability, transformation, social justice). And lastly, as I will discuss below, analogues and temporal case studies provide us with further knowledge of the risks or unintended consequences of policies, programs and practices, and remind us of the inherent need to ensure fairness (and more broadly social justice) in both mitigation and adaptation approaches.

How do we ensure fairness in social transformation?

Questions of justice lie at the centre of discussions of how we adapt to changing environmental conditions (Schlosberg 2012). This is because there are unavoidable justice dimensions associated with climate adaptation, which determines the winners and losers of decisions about how, when, and where to adapt. For instance, who decides and benefits from the relocation and resettlement of low-lying island populations, whose interests are represented in adaptation policy-making and implementation, and who ultimately decides what constitutes “good” and “sustainable” adaptation as opposed to “bad” and “maladaptive” adaptation. A number of international treaties provide formal definitions of climate justice based on the concept of universal human rights. The United Nations Declaration on the Rights of Indigenous Peoples maintains that:

Indigenous peoples have the right to maintain and develop their political, economic and social systems or institutions, to be secure in the enjoyment of their own means of subsistence and development, and to engage freely in all their traditional and other economic activities (UNDRIP 2007 8).

Accordingly governments must take ‘appropriate actions’ to mitigate any adverse environmental, social, economic, or cultural impacts on Indigenous groups (UNDRIP 2007 12). However the question of what constitutes “appropriate” adaptation or social transformation for indigenous peoples remains largely undefined in international agreements.

What principles should we then consider when we make decisions about how to distribute the benefits and burdens of adaptation and broader social transformation? For theorists, this is fundamentally a question of justice. In particular, it is about the nature of justice and why it requires people to interact with the environment in one way rather than others (Sen 2009; Schlosberg 2012). For many indigenous societies calls for climate justice as embedded within broader struggles to protect and preserve their cultural identities, languages, communities, and ways of life, as well as reduce poverty and social disadvantage, and go beyond simplistic notions of justice as distributional equity and incorporates demands for recognition, and self-determination. This reflects, in part, indigenous cosmologies which typically position people as part of nature (as opposed to Cartesian binaries which dominant western thought), and recent historical experiences of social exclusion and marginalisation. Yet existing scholarship on climate justice and adaptation does not address what capacities (or capabilities in the words of Sen) people require to allow them to lead the kind of life they value, and fails to consider questions of cultural diversity and difference (Sen 2009). Even environmental rights approaches only briefly discuss the importance of a stable climate to people’s ability to function and flourish (Schlosberg 2012).

The double injustice created by global environmental change on already poor and marginalised populations requires us to consider what it takes to enable just outcomes across scales and generations. It cannot simply be assumed that all responses to climate change are or will be “just” interventions for all peoples across temporal and spatial scales. Thus while social transformation is heralded as the “solution” to global environmental change by some, I worry of the potential that large-scale transformations will simply re-inscribe existing power relations and economic structures, fail to reduce greenhouse gas emissions, and exacerbate current patterns of social, economic and political exclusion in the future. Research is needed to examine interpretations of and responses to global environmental change, be they technological, economic, social, political, or discursive in nature, through an ethical lens. This may require an expansion of current conceptions of justice to incorporate the ways in which ecosystems are directly linked to our capacities to live, function and flourish as individuals and collectives, as well as further refinement of the notions of partial ordering aimed at comparisons of justice (Sen 2009). Any assessment of justice, which I believe should be at the centre of discussions of social transformation, demands that we engage with what Sen terms the ‘eyes of mankind’ and think both locally and globally. We should do this for three reasons: first because we may identify with others elsewhere not just with people in our local community or nation-state; second because our decisions and actions can impact on the lives of others both near

and far; and finally because what others may see from their respective perspectives (shaped by their histories and geographies) may assist us to overcome parochialism (Sen 2011 156).

Conclusion

Anthropogenic climate change can be seen as a symptom or outcome of the dominant patterns of economic development over the last two centuries, development that is underpinned by particular worldviews that position human cultures as separate from and above nature, and position western social norms as superior to local and indigenous traditions. Any transformation that focuses solely on climate change as the problem, and avoids consideration of the political, economic, social, cultural and historical factors that underpin and drive the subordination of the environment for both political and economic goals and interests, is unlikely to achieve anything. Indeed at times the diverse goals, interests, and complexities surrounding all aspects of global environmental change suggest that our responses (be it mitigation, adaptation or transformation) is quite simply an untenable and unworkable. Yet the wider body of literature on global change and social transformation suggest that change does and can happen within and across societies. Some of the most revered social transformations in modern times, such as the abolition of slavery, female suffrage, and indigenous land rights, were founded on notions of justice and involved fundamental shifts in the way society saw itself and others. The legislative reforms that heralded the abolishment of slavery in Britain, for instance, followed decades of campaigning by antislavery movements that mobilised public opinion and involved questioning widely held assumptions about the nature of race and work, and challenging established economic models. Similarly the recognition of Māori rights to land and resources (as enshrined in the Treaty of Waitangi) only emerged in the 1970s after more than a century of campaigning by Maori activists. Such historical analogues of social transformations highlight how transformations often require widespread changes to entrenched systems, which are frequently underpinned by power interests, involve acts of civil disobedience and open conflict, and occur over generations. Questions, therefore, remain about the form, function and outcomes of social transformation under changing climate conditions, most notably what role governments (and other powerful interest groups) can or should play in social transformation, and at what point does transformation become an act of social engineering.

To meet such large challenges I believe that it is necessary for scholars to think more widely about what concepts, knowledges, and theories can enrich our understanding of global change. Much of our recent thinking, research agendas, and policies have been set or defined by the contours of natural science, the separation of the social from the ecological, and the construction of climate change as a biophysical rather than social problem. This has meant that we frequently consider global environmental change as distinct from other processes of change, and examine historical case studies only as they relate to changing climate conditions. Yet historical studies can illuminate

and extend our knowledge of the human dimensions of global change, and offer new insights into how social learning occurs across societies and generations, and how people's actions, both an individual and collective level, are shaped by dictates of material benefit, economic survival, political contingency, and particular patterns of cultural consciousness as well as environmental factors. Similarly historical and contextual understandings allow us to consider notions of fairness and justice in policies, practices, and transformations, through temporal as well as spatial scales. Indeed a research project that sought to synthesise existing knowledge on social transformations from across the social sciences to identify commonalities, including what institutional arrangements, social values, and behaviours contributed to the radical change, as well as the long-term consequences of those changes would be particularly worthwhile. Such a project would be able to access funding from a range of international and national funding agencies due to its broad scope, interdisciplinary nature, and general focus on sustainable transformation and social justice.

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Proposition

Efforts to address climate change in the United States frequently break down due to deep and persistent division in attitudes about climate change, including support for or against policies to reduce greenhouse gas emissions. While an increasing number of Americans are concerned about the risks presented by climate change, most remain disengaged (Leiserowitz et al., 2013) and a vocal minority actively dismisses the data and obstructs policies designed to reduce greenhouse gas emissions. Societal transformation for North Americans will require creating new public spaces that foster sustained, productive dialogue on how to create alternatives that avoid the worst climate change predictions.

Background and Significance

Engaging North American citizens and decision-makers in discussion about climate change and how to deliberately change society's course is one of the greatest challenges our nation faces. According to a recent Nature paper, most of the uncertainty about the future of our planet has less to do with a lack of understanding about the geophysics of the Earth system, and its response to greenhouse gas emissions, and more to do with if humans will act or not to reduce emissions (Rogelj et al., 2013). Societal and political polarization and resulting inaction on climate change is well documented in the United States. Several political, cultural, and psychological factors negatively influence our capacity to engage people on the issue. Political special interests work strategically to promote doubt about the problem of anthropogenic climate change and, thus, delay the crafting of meaningful solutions (Oreskes & Conway, 2010); cultural worldviews held by citizens of the United States strongly shape persistent disbelief in climate change (Kahan et al., 2011); and psychological and cognitive factors further make responding meaningfully to climate change difficult for most people (Kahneman, 2011).

Advocates for public deliberation frequently espouse it as an effective method for overcoming some of these political, cultural and psychological hurdles. The process, generally speaking, brings together people who reflect different views, to share ideas, learn the positions of others, and work towards possible solutions. The deliberative process has been found to help people move beyond first and often hasty reactionary perspectives to develop more informed, reflective and considered opinions (Barker, et al., 2012). The deliberative process can help individuals address complex issues more systematically (Ross, 2006) and move toward greater cooperation (Ostrom, 1998).

Participants with openness, in theory, may be in a better position to embrace new perspectives and develop, what Michael Thompson (2003) calls, “clumsy solutions” that reflect diverse worldviews and policy solutions.

While an abundant literature exists on the theory and practice of public deliberation and its purported benefits; few empirical studies have been conducted (Carpini et al., 2004; Barker et al., 2012), especially on deliberations about climate change. More research is needed to understand those factors that lead to particular outcomes regarding both individual and institutional change, and the potential limitations and pitfalls along the way. Experimental research on small group discussions suggests that resulting collective opinion tends to move in the direction of the preexisting views of the majority rather than to converge (Schkade et al., 2000). While minority opinion can lead majorities to consider new alternatives and perspectives (Mendelberg, 2002), this outcome is less likely when minorities are perceived as dogmatic. In a study about how deliberation affects climate change beliefs, Hobson and Niemeyer (2011) found climate deniers became increasingly “dogmatic” and “belligerent” through the deliberative process. Further research is, therefore, required to fully understand how to manage the tensions inherent in climate change deliberations. Because any solution to substantially reduce emissions carries with it tensions across value-systems, we need to better understand these value-systems and how to address their cultural and psychological needs. Thus the questions emerge:

- What capacities do participants and moderators need to possess in order to effectively deliberate on the issue of climate change mitigation within the United States?
- How can ideas generated through deliberation influence and link to large-scale institutional decision-making?

Research Innovation

Exciting, albeit challenging, opportunities exist for expanding practice and research on deliberation toward transforming society in the face of climate change. An emerging number of deliberative forums already exist including the Alberta Climate Dialogue project, Campus Conversations on climate change at several Universities in the U.S., and Living Room Conversation. I convened a team of faculty, staff, and students to build new deliberative processes at the University of Montana. Last October, 2012, we gathered 90 undergraduate students and an expert resource panel to take part in a three-hour deliberation to discuss strategies for becoming a carbon neutral campus. Participants shared their views with one another as well as with available experts. Moderators for each table were carefully selected and trained in facilitating small-group discussions designed to encourage open-minded, conscientious, creative and active engagement. Data were gathered from pre- and post-survey questionnaires to measure student engagement, knowledge, perceived efficacy, motivation, trust and open-mindedness, among other metrics. A note-taker at each tables

captured student ideas for individual and collective action. Additional observations made by the note-takers and moderators revealed the heterogeneity of the groups, the nature of the conversations, and how groups addressed conflict, if at all. Based on those quantitative and qualitative findings, we planned a second deliberation for April 16, 2013. This deliberation will mix 90 students, faculty, and staff in small group discussion. The focus is twofold: first, to identify ways to strengthen connections between education, operations and decision-making to advance sustainability at the University; and second, to identify points of access for students, staff and faculty to influence decision-making at the University. A third deliberative event is planned for July 2013 to engage 90 Missoula, Montana residents in discussion about county-wide climate action planning. Moderators and note-takers trained from the campus deliberations will facilitate subsequent deliberations in the community. In addition, pending funding, our team plans to bring together 75 state legislators from across the nation to discuss state-level energy, transportation, building and climate change policies or initiatives.

The late Nobel Prize winning economist Elinor Ostrom argued that dealing with the unprecedented global commons problem of climate change calls for action across all scales and sectors. Because we cannot hope to guess which kind of responses will end up being most effective in transforming the U.S. electorate, we need to consciously experiment with many different modes of social change. Public deliberation offers an opportunity to engage students, general citizens, and decision-makers in facilitated conversation about ways to move forward on climate change. Thus, a focus on public deliberation does not negate the need for strategic and persuasive campaigns to shape policy and decisions on critical issues. The risks are sufficiently high that we must address the issue from both the bottom-up and from the top-down simultaneously. Our work attempts to propose insight related to the bottom-up component of this timely concern.

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Propositions

1. In order to create sustainable transformation of society, one has to understand how institutions evolve over time and how they adapt to the environment they are embedded in.
2. Social norms are the source of many global environmental problems and also a potential key for solving these problems.
3. There is a strong need for formal models that look at the human-environmental interaction as a complex adaptive system, rather than one that is in equilibrium.
4. Solving the climate change problem requires models that do not only look at efficiency of different policies, but also at its equity and fairness implication over space and time.

Introduction

In spite of remaining challenges, we understand much better the problem of climate change than decades ago. First of all, concerning the natural sciences, the fact that climate change is largely human-induced is clearly established, even though it is still somewhat unclear how anthropogenic and natural forces interact. Also, climate models have been improved considerably, making projections into the future more reliable. There is, however, still major uncertainty about critical tipping points and non-linearities in the natural system (Lenton et al. 2008). It is also still unclear how climate change acts on different scales, as the aggregate effects may be very different than the local effects, which need to be investigated more thoroughly in order to successfully adapt. After all, climate change mitigation will only have global effects, while adaptation can only happen on a local scale.

Concerning the economic sciences, the normative implications of climate change and its policy implications are well understood by now: we should cut CO₂ emissions drastically. While one could of course investigate somewhat more rigorously the tradeoffs involved, (e.g. adaptation vs. mitigation or cheap energy vs. larger emissions), research activity could be better devoted to other questions than giving “optimal” policies. Clearly, it has been apparent that simple “one-size fits all” fixes have not proven to be very successful, largely because there is a gap between what works in theory and how this can be realized in practice. We also understand know much better why climate change is such a challenging problem – largely due to the fact that it is a global common pool resource with slow feedbacks and currently 7 billion users involved. While we cannot change the

properties of the problem itself, we can change the institutional constraints to transform the nature of the problem from one that has no cooperative solution into one that has one (Tavoni et al. 2011). We also understand very little why equity and fairness – both between and within generations – seem to be so important obstacles in policy obstacles, largely because most economic models (especially game-theoretical ones) tend to overemphasize the role of efficiency. A lot can be learned from sociology and psychology here.

What is generally very poorly understood is how institutional change occurs and how it can be steered. This is especially true for informal institutions, such as social norms, identity considerations, and cultural values. It is well known that most people are willing to undertake voluntary activity to reconcile a common problem, while humans shed away from being the only “sucker” contributing to a public good. It is also clear that individuals take their own adaptive actions, which may be substituted or complemented by governmental policy undertaken. What is also lacking, are integrated bio-economic models that that may offer guidance on understanding how individuals who are embedded in a social-ecological system are affected by climate change.

Conclusions

A promising starting point for future research is the observation that climate change will bring along cascading changes and adaptations – often unintended or unanticipated – that will involve the environment to adapt, people to adapt, and regulations to adapt. Seen in this light, it seems instrumental to develop modeling frameworks that look at system dynamics and changes, rather than steady states of systems, a good example is the notion of complex adaptive systems (Levin et al. 2012). This holds especially true for understanding institutional transformations in itself (North 2005). Some of these models will be verbal, but it is also clear that mathematical models will remain the workhorse for evaluating different climate policies. It is hard to persuade policy makers that you understand the dynamics of your system if you cannot put them into equations.

Interdisciplinary work will be even more important, both between and within the social and natural sciences. It seems relevant to build bio-economic models that closely analyze how the environment responds to changes and which economic consequences this may have, especially for systems that tend to be important for food security, such as fisheries or agricultural systems. Such detailed models could also show the winners and the losers of climate change, providing an important “what if” benchmark that could be tested against alternative policies. It is also clear that human adaptation may have negative effects, for example if one group adapts at the expense of others (Berkes et al. 2006) creating dangerous conflict potential. It seems essential to take a closer look at risk and uncertainty, especially taking the different scales into account to distinguish “individual” from “systemic” risk (Beale et al. 2011).

In economics, normative models will probably step somewhat away from optimization routines that have formed the corner stone of environmental economics for so long. While optimal solutions remain an important benchmark, one will also look closer at management advice that is not necessarily optimal but perhaps more useful. Figuratively speaking, we will spend less time on the peak of the hill and look more often down the cliff, to understand when the environment reaches a state that is prohibitively costly, or even approach irreversible tipping points, perhaps using early warning signals (Scheffer et al. 2012). Seen in this light, there is absolutely no doubt about that the concept of resilience will become an even more important tool, also because it leans itself easily towards quantification. Policy recommendations would largely benefit from the development of simple rules and heuristics that are not necessarily optimal, but very robust and tend to work in practice (Gigerenzer and Gaissmaier 2011).

Perhaps even more important than the normative questions, is to gain a better understanding on societal transformations and how environmental social norms and values can change over time. It is well established that individuals tend to pursue pro-social behavior and take voluntary action to mitigate environmental problems (Richter and van Soest 2012), while most economic models tend to rely on the stereotypical homo economicus who maximizes his self-interest. It is essential to understand better how individuals are embedded in a social environment (Brekke et al. 2011).

Formal models should be developed that go beyond the rational actor model that show how cultural values, identity, and (environmental) social norms change over time (Bulte and Horan 2010, Richter et al. 2012). These new models will then provide good grist for the empirical mills to understand the plausibility and applicability of competing model explanations (Barrett and Dannenberg 2012). An obvious next step is to link these new insights with implications for policy design, as regulatory policy may crowd-out the willingness to take actions voluntarily (Bowles 2008, Gneezy et al. 2011). The main challenge is to design governmental policy that crowd-in or support pro-environmental social norms (Richter and van Soest 2012).

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The role of recurrent situations and scale inter-linkages in analysing societal transformations in the face of climate variability and change

Introduction

Managing the complex inter-linkages between societies and climate in a sustainable way requires a better understanding of the relation between the socio-ecological systems and the climate system. Recognising the pronounced diversity in research and development concerns, this position paper particularly endeavours to establish an efficient and policy-relevant approach to assessing climate related transformations in societies and related adaptation options. It outlines two propositions focusing on (1) a meaningful generalisation of heterogeneous societal transformations and (2) a more systematic integration of micro- and macro-scale approaches.

Proposition 1: Structures of societal transformations: Identification of recurrent patterns in transformation pathways supports our understanding of core mechanisms and management options

Specific processes that shape societal development and transformations locally derive from complex causal networks with diverse context conditions and dynamics. However, the recurrence of distinct processes has inspired interdisciplinary research on patterns of socioecological development. For example, meta-analytical approaches characterise patterns in important processes including deforestation and agricultural intensification (e.g. Geist & Lambin 2004, Keys & McConnell 2005, Rudel 2008). Yet, these analyses are only based on selected areas for which case study knowledge is available. Advancing pattern approaches, an emerging line of research has explored core problems of sustainable development with an emphasis on vulnerability and adaptation (e.g. Sietz et al. 2006, Jäger et al. 2007, Sietz et al. 2011, Sietz et al. 2012). This line of research has revealed vulnerability patterns in socioecological systems. Applications include assessments of agricultural livelihoods in dryland areas, for example, which are based on spatially explicit quantitative indicators covering the entirety of regions investigated (Sietz et al. 2006, Sietz et al. 2011).

Proposition 1 aims at directing attention to pattern analysis as a suitable approach to support the understanding of the causal mechanisms of society-climate interactions. In pattern analysis,

individual cases submit to a meaningful generalisation of mechanisms as opposed to an unachievable description of every unique case. Key research questions include:

- What recurrent patterns in the properties of socio-ecological systems determine their transformation in face of climate variability and change?
- What are typical ways in which adaptive pathways feed back to societal and climate development?
- How do we validate the patterns identified in societal transformation?

Methodological approaches based on data mining, modelling and comparative analysis (e.g. Sietz et al. 2006, Jäger et al. 2007, Sietz et al. 2011, Janssen et al. 2012, Sietz et al. 2012) are well suited to the task of revealing the potentially non-linear characteristics of societal transformations including emergent and path-dependent characteristics and critical thresholds. They can be applied in a range of contexts, at any resolution and to different frameworks used.

Overall, the identification of a limited number of typical patterns presents an efficient approach to improving our understanding of transformation pathways. Decision-making for sustainable transformations can be significantly enhanced by pattern-specific entry points combined with insights into changing criticality.

A research policy is needed which explicitly facilitates the integration of climate and land use sciences with other relevant domains such as institutional analysis, innovation systems, transition management and governing of complexity (e.g. Assefa et al. 2009, Loorbach 2010, Teisman et al. 2010) to create space for collaborative and integrative approaches.

Proposition 2: Integrating micro- and macro-scales: Research on societal transformations should be inherently linked to the analysis of multidimensional processes and their dynamics on local to global scales

Climate conditions enforce broad-scale processes that manifest themselves at local scales. In describing local particularities, micro-scale studies facilitate the comprehension of specific mechanisms which determine climate impacts on societies. However, these analyses are often too detailed for directly feeding into the policy and decision-making spheres due to the multitude of frameworks and methods employed.

On the other hand, climate as an intrinsically global phenomenon necessitates integrated assessment models at global scales to investigate the relevance and spatial distribution of underlying processes and climate impacts. Global models focus inevitably on aggregate assumptions. This aggregation is useful to understand similarities and differences from a broadscale, global perspective. Nevertheless, it faces the challenge of adequately depicting the heterogeneity of local situations and feedbacks in underlying processes.

Against this background, Proposition 2 seeks to promote a more elaborate integration between micro- and macro-scale approaches addressing the following research questions:

- How can we achieve a more systematic integration of the rich knowledge base at microscales with macro-scale analyses?
- Which overarching mechanisms revealed by global models require more detailed investigation at local scales to foster their refinement?
- How can locally derived insights into adaptive transformations be up-scaled and applied to locations elsewhere?

A stakeholder-guided selection of indicators and discussion of measurements and thresholds as used in the Advanced Terrestrial Ecosystem Analysis and Modelling (Schröter et al. 2005), for example, is necessary both to enhance the analysis of relevant processes and to produce results that are relevant and useful in managing the societal transformations. This should include the perception of local populations about current climate variability and expected future change should be integrated more thoroughly in research activities to allow an improved understanding of local realities.

Importantly, the validation of research results constitutes a crucial step in establishing the credibility of micro- and macro-scale assessments and hence their suitability for informing decision-making processes. Validation approaches should take into account newer assessments in the fields of vulnerability and disaster research that test the consistency of vulnerability indices and model results against independently reported damages caused by specific climate exposure (e.g. Alcamo et al. 2008, Fekete 2009, Sietz et al. 2012). To further enhance validation efforts on the global scale, improved observational data on climate variability are required which reflect appropriately the spatial and temporal differences of mechanisms that determine societal transformations.

Overall, strengthened interdisciplinary research will increase the connectivity to and opportunities for participation in collaborative international research programmes such as the Global Land Project (International Geosphere-Biosphere Programme and International Human Dimensions Programme).

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Establishing an ‘Observatory of the New Human Condition’: Proposals and Prospects

Introduction

The philosopher Hannah Arendt published *The Human Condition* in 1958, a text in which she observed the historical development of human existence. The work was deeply influenced by her experience of the Second World War and the emergence of the nuclear age. Since Arendt’s time, issues of environmental, climatic and demographic global changes have surmounted the concerns of Arendt’s period and caused a radical transformation in terms of human awareness of and responsibility for our vulnerable earth. In the twenty-first century these concerns have inaugurated a ‘new human condition’ which coincides with our age of ‘Global Change.’ In nearly all domains of Global Change research the role of humans is seen as a driving force. As humans will be both the subjects of impacts and agents in mitigating such impacts, the anthropogenic factor will be the key in adapting to change. Consequently human and social sciences benefit from embedding anthropogenic research questions to better understand environmental forces and issues.

However, it has been established that intellectual and cultural enlightenment rarely contributes to changes in human behaviour. It is also extremely difficult for humans to change harmful habits, repetitive actions or unhealthy preferences even when cognizant of the negative consequences of not changing their behaviours. Cultures of alarmism and denial go hand in hand with the ‘new human condition’ of the twenty-first century.

Therefore in the age of ‘Global Change,’ societies are confronted with the Prisoner’s Dilemma Game: all would benefit from collaborating towards the common good, but with unstable open free market systems, anaemic global politics, cultural distrust, and imperfect and dysfunctional communication between agents, any defector pursuing the option of self-interest is more than likely to get away with cheating on a global social compact. Indeed, the probability of avoiding catastrophe becomes smaller when uncertainties and lack of knowledge about anthropogenic links to environmental change and problems cause less cooperation, instead of facilitating mutually beneficial collaborations between agents, states and polities over such issues.

In light of this we need to define and understand how and why humans in the face of non-imminent, but slowly coalescing dangers choose to act as we do. Then we need to innovatively explore how we may be able to change the direction of our collective behaviours.

Questions and Propositions

Within the context of the Prisoner's Dilemma our research questions are aimed at individual, institutional, and social levels: firstly, how do individuals respond to calls for change in their individual behaviours? What types of inducements and resistances come into play? Secondly, how can social innovations help redress institutionally ingrained patterns. How do institutional models hinder or facilitate such innovations? Thirdly, how do societies develop resilient responses to threats of crisis and collapse? What are the precedents and prospects for developing such resiliencies? To address and better understand these questions we need to go beyond the premises held by rational choice and behavioural decision theories. We need to think outside the box of conventional approaches to such issues. We therefore propose exploring the four following themes:

- Different attitudes towards nature, technology, and risk;
- Different conceptualizations of time and differential discounting of future outcomes;
- Different strategies for arriving at "rational" decisions; and
- Different rates of pro-social behaviour in common-property resource dilemmas.

By exploring these themes we hope to come to a better understanding of how and when environmental problems have been addressed, mitigated or solved by individual and common action.

Conclusion

Addressing Global Change in the twenty-first century and formulating strategies to foster environmental awareness, knowledge and action which will facilitate change in behaviours is a daunting task. Whether viewed as Quixotic or not, it is a nettle which must be grasped; we ignore human-environmental relations and issues at our peril.

We feel that by addressing such issues on the individual, institutional and social levels, multiple perspectives and various scales of awareness and understanding will be promoted. By establishing a figurative 'Observatory of the New Human Condition' through our proposed questions and themes, we hope to instigate and provoke wide reaching discussions which will act as portals to illuminate the human and environmental relationships transforming the age of Global Change. It has been maintained in some quarters that the only solution to overcome the Prisoner's Dilemma is to develop mutual trust and understanding of these issues at hand, yet polities due to internal political, cultural and economic factors, are rarely in positions to be able to make such clear cut

choices on such a basis. However, in the long run, societies have proven resilient and in the future are likely to prove so again in adapting to change. The question, however, is not if change will occur -but more importantly how and when. It is from the perspective of our figurative observatory that we hope to monitor how successful the 'new human condition' will be in responding to the global challenges of our age.

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Innovations in SSH climate research

Introduction

Based on my conceptual and empirical work, and my long-standing interest as a trained geographer in bridging the gap between social and environment sustainability assessments, I have developed a special interest in scientific tools and methods designed at dealing with adaptation processes in resource dependent production systems, which are exposed to different climate change impacts (e.g. Luthe et al. 2012, Wyss 2013). Following a complexity approach, regional production systems can be understood as a network of interrelated actors (as e.g. described in Liu et al. 2007, Bodin and Crona 2009). Even if certain adaptation processes to climate change impacts can be traced back to individual actions, they do not follow a summary logic in a systemic context, resulting in important consequences for initiatives aimed at enhancing the resilience of human-environment systems. The uncertainty about the future development of key global change indicators and the resulting concrete effects on social and natural systems, a priori preclude in my eyes the application of theoretical concepts which are based on the assumption of full information and full rationality of economic or social actors, and the methodological frameworks derived from them. In this context, complementing the existing framework with evolutionary and behavioral components for a deeper understanding of the adaptive capacities of social agents embedded within complex human-environment systems, which take into account a) the factor time, and therefore the inherent path-dependencies and b) the regional institutions and traditions which affect the action potential of the individual agents, should yield interesting results.

Propositions

This can be translated into the following three overarching research propositions on innovations in social science climate research:

1. **Complement structural interdependency analysis, e.g. social-ecological networks, with action related experiments under changing climatic conditions.**
2. **Integrate both social and environmental variables into system-analytical frameworks, in order to unravel climate related leverage points which affect the functioning of human-environment systems on a regional, national or sub-national scale.**

3. Strengthen the theoretical and empirical understanding of the action potential of individual actors within different human-environment systems in the face of climate change, for example community initiatives versus market-based transactions, and complement the concepts of resilience, (social) transformation and vulnerability with these insights.

Following these rationales, a combination of methods which allow to analyse structural and action-related variables under one unified methodological framework – e.g. by means of a combination of structure-based network analysis with action-related behavioural experiments – would help unravel the dynamics of adaptation processes in resource dependent human-environment systems, while allowing to identify possible barriers to sustainable adaptation paths. Even if many funding possibilities for interand trans-disciplinary research between social and environmental scientist exist (e.g. SNF Sinergia and The Swiss Network for Interantional Studie SNIS in Switzerland, the DACH and CH-AT Alliance for the Alpine countries, or the LINNEAUS grantscheme in Sweden), only if we manage to integrate socio-economic and environmental factors into one unified methodological research framework, and therefore bridge the gap between social and natural science approaches not only on a conceptual, but also an empirical level of analysis, will true trans-disciplinary research be possible.

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Conclusions and Outlook

The diversity of propositions discloses a fundamental tension, or axis, which needs to be covered in its entirety by any credible research agenda on societal transformation in light of climate change: On the one hand, there is transformation as building resilience in order to avoid societal disruption as a result of climate change. Such research propositions often address sector-specific, concrete or smaller-scale challenges. It seeks solutions and is easily perceived as useful to stakeholders – often it will seek to engage stakeholders in the research and take their preferences as given.

On the other hand, there is transformation as disruptive change. Such research propositions typically address fundamental drivers in society such as the functioning of democracy or the pervasiveness of neo-liberal thinking. It is critical and thus often perceived as annoying rather than useful to most interest groups holding a stake in the current modes of production and consumption.. This line of research will typically not take preferences of these prevailing stakeholders at face value but look at what shapes these. It is recurrently in favour of a transdisciplinary research mode, including a knowledge co-production of researchers and relevant stakeholders/change agents interested in a comprehensive societal transformation in line with sustainable development.

Daniel Hausknost sums up how neither end of this research axis currently meets the scale and urgency of addressing climate change: ‘What is thus required is an approach to socio-economic change that focusses on the attainability of the climate goal and offers more radical mechanisms and instruments of social change than “Transition Management” and “Earth System Governance” while remaining agnostic or open with regard to the resulting socio-economic order (...) Thus it is more important to focus on the radical intermediate steps of transformation than on the design of a new societal blueprint.’

Across the board of research propositions, there is a striking frequency of questions on how people’s and society’s values and norms are determined and change. Most contributors would probably agree with Meg Parsons’ analysis that ‘Any transformation that focuses solely on climate change as the problem, and avoids consideration of the political, economic, social, cultural and historical factors that underpin and drive the subordination of the environment for both political and economic goals and interests, is unlikely to achieve anything.’ This might be linked to the notion of a sustainability science, mentioned by Gottschick and others.

An overwhelming number of research propositions stress that in order to understand transformation we need to better understand the interrelationships between different levels of societal change – spatially from the individual to the global and temporally from the short term to

the long term. The integration of different disciplines, including between natural sciences and social sciences/humanities, is a necessary but challenging tool for doing that.

Another methodological message from many research propositions is that we need more comparative case studies, whether of contemporary pilot projects or historical analogues of transformation. Theory helps make sense of the world, but societal transformation in light of climate change ultimately will only succeed if based on empirical knowledge.

Future research funding activities in JPI CLIMATE and elsewhere should take these messages from the future research leaders serious.

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