

Future Earth Young Scientist Networking Conference on Integrated Science

Ecosystems and human well-being in the green
economy

May 25 - 31, 2014, Villa Vigoni, Italy

futurearth
research for global sustainability



A key theme of the Rio+20 United Nations Conference on Sustainable Development, held in June 2012, was the promotion of a “green economy”. Future Earth, launched during Rio+20, is an ambitious new 10-year research programme which will provide the knowledge we need to tackle the most urgent challenges of the 21st century related to global sustainability, and that includes issues relating to transformations towards green economies.

The International Social Science Council (ISSC) and the International Council for Science (ICSU), in collaboration with the International Network of Next Generation Ecologists (INNGE) and Institute for New Economic Thinking’s Young Scholars Initiative (INET YSI), assembled a group of early career researchers with diverse backgrounds and research perspectives to reflect on ecosystems and human wellbeing in the transition towards green economies and debate relevant issues as part of a series of conferences on Integrated Science that are funded by the German Research Foundation (DFG).

The aim is to bring together creative multidimensional, interdisciplinary and trans-disciplinary perspectives to address the complex topic of how future societies deal with ecosystems and human wellbeing. Young scientists debated issues relating to the topic, questioning key assumptions, theories and models underlying the current research on ecosystems, human wellbeing, and the transformation towards green economies; dynamics of governance, justice, authority at global and local levels; and the development of research methodologies to assess change in the transformations towards sustainability.

What is Future Earth by Frans Berkhout

In a session that laid out Future Earth's *raison-d'être*, Frans Berkhout, Interim Executive Director, elaborated on Future Earth's two key aims – integrating science and producing useful knowledge. Integrating science and young scholars that can work in that way is needed because the challenge of global sustainability cannot be understood one discipline at a time. Innovation in science comes through the interactions between disciplines.

Future Earth is a community more than anything, and in that community it seeks to harness the points of view from all stakeholders. Frans Berkhout posed key questions for the talented group of early career scientists.

Questions for the group:

1. What is the greatest obstacle to integration in science? How could Future Earth help?
2. What is the greatest opportunity for knowledge co-production? How could Future Earth help?

Discussions centred on the very nature of the institutionalisation of science (including how that acts on the concept of “publish or perish”) and if that hinders what is considered science?

Barriers for integrative science

- Cultural barriers for integration
- Acknowledging that science is not the only means of knowledge production
- Be realistic about science's role in societal transformation/transition
- Natural scientists have the misconception of going to social scientists when they want to work on something of societal relevance
- Issues of different barriers in different disciplines (disciplines have different fundamental sets of simplifying assumptions)
- Hiring processes often focus on purely disciplinary scientific track record

Opportunities for co-production

- Focus on changing training cultures.
- Make students fluent in communicating across disciplinary boundaries ab ovo and throughout university and beyond
- Funding models with realistic time frames to support research-practice teams to develop productive working relationships

Tipping Points by Tim Lenton

Professor Tim Lenton, Chair in Climate Change/Earth Systems Science, University of Exeter, discussed tipping points from global and regional climate systems to local socio-ecological systems perspectives. Preventing tipping points can be hard and relies on rapid measures of implementing mitigating measures. Delaying tipping points may be the second best opportunity.

Detection involves early warning systems and methods for detecting early-warning signals of tipping points – ones that include slowing down of dynamics (i.e. today will be more like yesterday). The scales of systems where early warning methods are applied are at population and ecosystems level.

Tim Lenton posed the question; can we identify “positive” tipping points for societal progress and recovery? Tipping points and their aspects in worldviews – when worldviews change, they change abruptly.

1. How do tipping points interact? Across scales? Where are early warning signals feasible? Where are they not?
2. What are our best options to avoid or delay unmanageable tipping points and manage unavoidable tipping points?
3. Can we identify positive tipping points toward a more sustainable and state of human ecological well-being?

One key realization was that tipping points are not always identified as such in the language of various disciplines. Collective knowledge is broader than we think it is, particularly since we are stuck within our own fields. (Transitions as a tipping point-like metaphor in the social sciences). Frans Berkhout put the notion of tipping points and transitions in a perspective from evolutionary theory. Highlighting the importance of positive feedbacks for creating tipping points.

Discussions from the group centered around creating frameworks for managing tipping points. And frameworks that moves beyond understanding and towards action. One that captures the different understandings from across the fields and disciplines.

Framework

- for thinking
- to inform action
- join dynamical, systems evolution, human agency

Knowledge Capture

- same concepts in different disciplines
- evolutionary theory
- social movement theory
- paradigm shifts
- socio-technical transitions

Management in reality

- manage (adapt) to unavoidable
- complex systems - is it too complex? Is this what actors need?
- political economy, previous cases – late lessons from early warnings
- case studies: carbon taxes, ozone hole mitigation (Montreal), successful mitigation of societal conflicts (violent conflicts, labour conflicts etc, mainly negative tipping points), tipping points in public health (change in smoking behaviour – positive tipping point)
- governance frameworks to deal with complexity – connecting social tipping points to decision-making
- reassembly of ecological systems – decisions and planning to preserve ecosystem services rather than the current ecosystem assembly (e.g. planning of landscapes in anticipation of tipping points)
- if tipping points create opportunity for adaptation then what are the capacities to bring about change?

Reflections that were unable to be discussed

- better metaphors for tipping point – beyond the ball and cup
- assuming we are in the anthropocene can we identify novel regimes that have happened in the past?
- not quite clear whether tipping points apply homogenous implication across actions, individuals, distribution of costs in approaching a tipping point
- look to resilience and its application in policy – is it just another buzz word, do they know what resilience is?

Visualisation & Science Communication by Sebastian Meier

Research is there not just to talk to scientists, but also policy and society. With that researchers need to think about the model of communication as well as the research. Visualisation has its place. We cannot change the world with beautiful visualisation, but it can help to create an audience and get people engaged. Visualisations are a way to break down barriers to engaging with complex ideas to envisage alternative futures.

For communication: propose/research/publish – visualize. Researchers can't come at visualisation from the end. It has to be thought of right from the beginning. Sebastian Meier highlighted how to use data visualisation to communicate across disciplinary boundaries and within the global research community.

Investing in communication is an important concept – research is important for future of planet but needs to be understood by policy makers and public. Visualisation is a means and an approach do this.

What are the skills to look for when wanting to include visualisation in your work?

- having open mind and being able to work in interdisciplinary teams, understanding how communication works
- communication is most important point of this - how to communicate complex ideas

The presentation put forward the fact that information and communication literacy are an important part of understanding the ethics of visualization. The group threw up questions about the intersection between power of visualisation and the cost of them – are we creating possibility for powerful actors to use these tools to questionable ends?

There is often a tension between narrative (story telling) with visualisation and actually getting people to engage with the data in a meaningful way.

Questions from the group centred on if there much evidence that better visualisation has bigger change or impact? Do we have data we can point to to show that it works?

We don't have good enough knowledge yet. We know it can optimise visual cognition but don't have proof that connects it to long term change

Reference

Andrew Gelman & Antony Unwin (2013) Infovis and Statistical Graphics: Different Goals, Different Looks, *Journal of Computational and Graphical Statistics*, 22:1, 2-28, DOI: 10.1080/10618600.2012.761137

The state of research for early career scientists by INNGE, INET YSI, Global Young Academy, and NESSE (Peter Søgaard, Jay Pocklington, Irene Friesenhahn, Jennie Dodson)

Presentations from four invited early career research networks were about ways to build networks beyond the conference. And providing examples of regional networks of participants, webinars and other webtechnologies that foster such networking. It is important that these networks need to be low commitment, and they often find ways to remain connected.

What could a "Good" anthropocene be? by Garry Peterson

Garry Peterson of the Stockholm Resilience Centre talked about the challenge of the anthropocene – putting it in some historical context, from the “great acceleration” to modern day human activities, before laying out the criteria for a possible “good” Anthropocene.

With all the alternative imaginary anthropocenes, it is possible to ask the question: what are the possible futures? Criteria for justice, prosperity, sustainability. And what are the possible challenges for the future? Ecological challenges (pests and pathogens evolve resistance to human biocides, toxins, emergence of diseases, removing top predators). Challenges to inequality. (Human Development Index is increasing for almost all countries, with a few exceptions. However, fairness (i.e. poverty reduction) has leveled out in several continents). What are the barriers to a “good” Anthropocene and what are some strategies for reduction?

There is a big overlap between possible response strategies to address pathological dynamics in the Anthropocene. Institutional dynamics are often more important than more science or conservation strategies.

The essence of the talk was to set the scene: we’re outside the planetary boundaries and we can’t go back in them in a reasonable timeframe – we need to figure out how to live in good Anthropocene.

The group focused on the research frontiers for new sustainability science. Asking the question and giving definitions for an expanded criteria for a good Anthropocene (including notions of fairness, resilience, prosperous, and fun!).

However, questions led to aspects of inequality, and if a certain level of inequality is needed for the system in general. Discussions of inequality become question of politics rather than science. Is the phrase good Anthropocene internally conflicting?

Abstract theoretical discussions on is part of the problem choosing which path when the reality is that the worst of worst has already happened – not about choosing but how to make the worst better off, not about pathways but acknowledging that these multiple futures are possible at the same time. What are the seeds of “good” Anthropocenes that need to flourish and grow?

Group Discussion Report Back:

Group 1 - Kate Brauman

- governance, tension between global governance versus bottom up, who defines what we're governing for?
- problem with top down is is only effective when fair amount of consensus from bottom up
- indicators and problems with current indicators – limiting, misleading, not leading towards right interventions – not just about what the indicators for measuring the economy but maybe thinking about health - not just about better indicators but different indicators
- need to understand decision-making cultures and the real use of these things

Group 2 - Rachelle Gould

- overall global footprint – reducing consumption in wealthy countries to support more equitable distribution
- locally relevant indicators - should there be one vision of what success is?
- what are we measuring and how do we define what a good life is – defining what well-being is?
- social relationships, trying to convey impact of actions both socially and environmentally and the challenges of doing this – globally interconnected social and ecological impacts

Group 3 - Carina Wyborn

- Easier to discuss how scientists can inform the future instead of deciding how the future should be
- Researchers can try to define a good process, a good Anthropocene will be locally defined
- Research question: What are the metric to define what a good process looks like?

Governance Mechanisms by Jennifer Clapp

Jennifer Clapp's presentation was one that took stock of the discussion up until that point, with a presentation on environmental governance discussing the norms, rules-systems and institutions to guide practice toward sustainability.

There has been lots of research on environment and social problems, visions for sustainability – but the arrow to get from one to the other “black box of governance” as big question mark.

She posed the question of is it linear line between problem, governance, sustainable future and is linear really the right way to draw it?

What are the key ingredients for successful sustainability initiatives? What components are essential? What are the biggest challenges for global environmental governance? Why is it so hard to 'get it right'?

She presented 8 layers of complexity.

Layer 1: different ways to frame environmental problems

Layer 2: Need different kinds of information needed to govern problems

Layer 3: different kinds of tools to govern economy-environment linkages

Layer 4: different spatial scales of governance/decision-making

Layer 5: different actors involved in governance processes

Layer 6: Different goals for processes and outcomes

Layer 7: Different worldviews (ideas) of the interface of economy and environment

Layer 8: different ways power and exclusion affect governance

Navigating these 8 layers of complexity mean that the relations between science and governance is not a piece of cake.

Political Economy of Sustainable Systems by Thomas Ferguson

Thomas Ferguson, Institute for New Economic Thinking's Director of Research Projects, Professor of Political Science at the University of Massachusetts, Boston, gave a presentation on the political economy of an unsustainable society – the one we have. And posed the question – why have we had stalemate politics with environmental policies for so long?

Carbon pricing efforts started in US and Europe but frontiers of now many more in scandinavian and asian countries. Entirely state run economies and entirely private don't run well – oligopoly is the dominant form shaping these economies.

The choice, he argues, is not state over market. You have to have both. The challenge is to find a way to keep producers from dominating the market.

Taking the example of the carbon tax; to put a price on carbon requires you to find way to price externalities;

- not question of generational equity, big beneficiaries of immediate pollution control those who are currently suffering from use of coal - claims of cost of fixing this are not true
- two ways to do this: (tax and emissions control through permits – emissions trading)
- who gets the money?
 - tax: government, question is who gets the money? Kleptocracy in much of the world so is this a problem.
 - permits: becomes property right that wasn't there before – that is very valuable – how to distribute them? Giving them to the polluters – is that fair? If not careful with these systems the polluters can make more money than before;

Discussions from the group

Q: becoming increasingly less democratic, so how can our research engage with the real world political economy?

- got to be interested in democracy to deal with this – must have democratic input into climate negotiations

Q: emissions trading schemes, will they ever work?

- problems in the system design – European system never considered possibility of the 2008 crash

Q: bring it back to question of money, 'the economics stupid', connections between big banks, big money, and government

- http://ineteconomics.org/sites/inet.civicaactions.net/files/BWpaper_Ferguson_040811.pdf

Q: can research influence policy – whole point of the transdisciplinary agenda? The question of researchers and future earth – it is all about democracy, social movements, and participation.

- digging into the literature on political economy of environment – international regimes etc – there is not enough good being done on economics and politics – but need to be selective about which economists
- environmental science has to keep scientific credentials 'clean' and have to approach questions analytically without obvious bias or big politics around that.

How can we incorporate political economy into environmental research when economists miss the political part and politics misses the economy – how do we bring this into our research in real places to understand the real world?

Ecosystems, Poverty, and Resilient Economics by Jacob Park

Jacob Park, Associate Professor of Business Strategy & Sustainability, Green Mountain College, highlighted the drivers, trends, and outlook of the important nexus between ecosystems services, poverty, market resiliency, and the base of the pyramid.

Themes and topics revolved around:

- Unprecedented changes in structure and function of ecosystems
- Increasing food and resource insecurity
- Increasing energy demand from emerging & developing economies
- Rising economic footprint of China & India, among others
- More than 20 of the world's top 50 cities ranked by GDP will be located in Asia by the year 2025
- African economic and technological renaissance
- Global technology 'revolution'
- Africa Mobile Phone Case Study: Market Resilient Example
- What is the role of the market (or constitute "market resiliency") in terms of the climate change, water, energy, and food nexus

With greater than 70% of the world's poor live in rural areas of developing countries, sustainability and innovation is becoming all the more important. Can we create business models that yield high value to business and high value to society? What are or should be the new models of community-driven ecosystem enterprises at the base of the pyramid?

Key Takeaways and Guiding Questions

- There is a need to strike a balance between ecosystem stewardship, poverty reduction, and market resiliency at the base of the pyramid?
- Is the way that the business community addresses issues other than profit (social, environmental, cultural issues)?
- There is a distinct lack of transparency in business R&D. How can the Future Earth/general research community engage with business R&D?

Overarching question: How does and should initiatives like Future Earth engage with sustainability initiatives in business?

Group Discussions

Are sustainable businesses willing to be exposed to sustainability science research? For example can the business models that yield profit for business and profit for society question be informed by research.

Ecosystems and Human Well Being by Chris Gordon

Prof Chris Gordon, University of Ghana, made the point quite clear – that poverty should be our key focus. Talking directly to the young scientists about the need to question and contest everything. He spoke about the linkages between climate, health, ecology and human wellbeing – eg from malaria transmissibility.

He used the example of Ghana, where there is agreement on green growth pathway official policy as “climate compatible development” – not going to mitigation or adaptation until development is addressed – as far as possible look for ‘triple win’ but must confront tradeoffs.

He posed the question of what are related (research policy) processes and structures that shape knowledge sharing between science and practice and what is the governance behind these?

Group Discussions

Group 1

- Is the concept of transformational change really applicable to “ecosystems and well being?”
- focused more on defining the terminology – what is transformational change? Are social movements a good place to look? Scientific paradigms? Publishing structures of interdisciplinarity and global change?
- challenge in testable research question – to what degree is transformational change when linking ecosystem and wellbeing – hard to find examples that document connections between ecosystem and human wellbeing
 - there are literatures to look for these connections – integrated conservation and development and food networks
- can we cure ecosystems?

Group 2

- Are there new and innovative ways of identifying or predicting situations where impacts exceed the capacity of ecosystems to adapt through incremental and/or transformational change?
- How possible is it to predict transformational change? is it better to focus on how to prepare systems for transformational change rather than predicting when they are going to happen?

- problems of working across scales and disciplines – solutions have to be scale specific what framework can be used to identify which scales solutions to be identified at?
- how can we have direct transformations across scales and disciplines? What analogies can we identify across different systems to correlate or transfer systems identified across systems?
- long term time series data to identify transformational changes – is why science of predictions is lacking – not just long term data but scenarios to test before and after situations to understand what transformations are happening?
- how to bring evolution and models of physiology into climate impacts?
- always focusing on what we want to do for the future but the future is always too far away – somethings to learn from current actions to take action for now – and how do we connect long term and short term changes
- new remote sensing techniques changing the way people are thinking – has thus far been ecologists maybe needs to be broader

Group 3

- Can we use the ‘green economy’ as a way to change how decision-makers respond to situations where current ‘best practice’ no longer works and more radical responses are required?
- bogged down in term green economy – mostly still based in growth so inherently not radical – “nixing the whole term”
- what is the goal – is it human well being? if it is what are the metrics to say if it is or not working – but this is already there, many metrics are there but not using them
- what do we need to do to get decision-makers to use these metrics?
- campaign finance reform in political system?
- nationalised industry what does that do?
- can you actually use science to use voting preferences?
- is there a pathway to using science to affect politics?
- does changing the metric lead to radical change?
 - if we are changing what we value and how we measure it are we getting a different response?
- if you are stuck in elevator with Obama what would you tell him about ecosystem and well being that would make him do something?
- what would it take for decision makers to make more radical decisions? If growth is the norm and that is the dominant paradigm then you’re trapped already? What is it going to take to move outside that paradigm? And in what context have decision-makers made radical changes and what can we learn from them?

Environmental Politics and Social Movements by Thomas Ferguson, Jacob Park, Jennifer Clapp, and Chris Gordon

Jennifer Clapp

Thoughts on engaging civil society

- important engage to ensure relevance of questions
- highlights importance of transcending disciplinary boundaries
- shows where contribution can be made
- two way learning

Challenges

- not an easy relationship – need to maintain role as academic and degree of independence, perspective, don't get 'sucked in' – can work, just have to manage carefully
- as academic can be critiqued for being too close to stakeholders; can be difficult for tenure
- find ways to keep engagement while publishing independent thinking - writing about the experiences is exciting research

Example

- external evaluator on EU project 'science and society' theme
- online course to support two way learning between academics and activist
- Journal of Political Ecology paper on concepts that have come from activism that are now used in academia to push conversations forward - good eg of co-production

Jacob Park

Research agenda

- want both stakeholder relevance and rigour (data, methodology) but sometimes you have to pick – sometimes hard to do both, so depends on context; start with rigour early on to find time to be relevant
- be realistic about time limitations of being everywhere – take risks and go where you feel drawn to

- pick and choose your battles

Professional development

- what does that mean in academic context?
- find a mentor, but understand how to become a good mentee
- intangible qualities - more than networking - has negative connotations - do what is comfortable but understand the norms of the context - appreciate that networking has nuance in different contexts
- learn the rules and norms of your context, don't forget the power dynamics

Tom Ferguson

Question of mass movements, knowledge and societies

- production of knowledge is not a matter of indifference - understand parts of science that hit politically sensitive topics
- close relationships between science, committees and vested interests
- not a simple role re production of knowledge and decision-making and not about good intentions - need to focus on democracy and civil liberties
- not that everything is political – that is pathological view of the world
- be critical ask two things 1) Is it true? 2) Why am I hearing this?

Chris Gordon

Two messages from working with civil society – “choose who you go to bed with carefully, and use protection”

- watch the vested interests and the use and abuse of your career for their credence
- make sure your scientific integrity is paramount
- protection: institutional review process to check methodologies are appropriate, valid, look for legal protections where necessary
- watch the relationship with journalists - be aware they may misrepresent you
- always ask why you are getting involved - what are the reasons - be wary of being sympathetic to the cause “chicken that laid the egg was involved the pig that gave us the ham was committed” - know why and know where the money is coming from
- be wary of red herrings - when attention is being used to detract from main game
- be wary of ‘one man NGOs’ - ensure that the folks you work with are legitimate within the communities they are seeking to represent

New Communications Media by Paul Lussier & Myanna Lahsen

Myanna Lahsen, Senior Researcher II in the Earth System Science Center at the Brazilian Institute for Space Research (INPE), opened up the session with a presentation on what are the current information structures in place, and with what consequences?

There are deeper questions to be asked – such as how do we know what we know? Asking these questions helps us to look at daunting questions and deep structure of the political economy of media – how to integrate science in a smarter way through new technologies?

The Case Study/Key points

- Brazilian media obstruct public understanding of underlying science
- United States – Six companies control over 80% of US news (Robert McChesney - Digital Disconnect)
- Brazil
 - 6 families own 70% of major media outlets; media bosses occupy 1/10 seats in HoR and 1/3 in Senate
 - agricultural lobby strongest force in government
- media study found profound misfit between national emissions profile and problem framing/solutions in national climate discussions as reflected in media
 - 80% of emissions from land use; 15% energy sector 3% industry 2% waste
 - meat production being main driver behind deforestation and largest source of national emissions
 - Brazil is the world's largest meat exporter & major consumer (not per capita though)

Climate skepticism has different forms in different places. The media is never really addressing the driving trends of things like deforestation or what we should do about it. There are few links between critical media research and global environmental change science.

Paul Lussier, via skype, spoke and eluded to a new media landscape emerging.

- Media lab devoted to considering new media models to make an impact – bringing scientists, journalists and media producers together
- despite focus on science communication and public understanding of science, little work on how scientists talk about communicating their research to the public – much work is on how scientist approach controversial issues
- need more work on more general rather than controversy focused research – how they address public in general – to point to new media model and strategy in science communication
- more work on norms and values that scientists hold re communication with public
- calls for changing forms of communication to replace deficit model of public understanding of science – migration from one way to two way communication is insufficient
- despite much media concern about climate change remains low
- declining media on climate change connected to lack of interest in viewing public and users – media entities shutting down environment desks
- consolidation of media interest does not allow for issues that do not make money
- increasing calls for scientists to engage in public debate through advocacy
- media messages main vehicle through which society accesses science – compels us to find better ways to engage
- different norms of communication delivery and rigor in journalism and science
- framing matters, but it is also not a panacea
- is social media the solution?
 - aids conduits to social movements
 - coverage shifts to polemics
 - mores space for contrarians
 - further framgments in discourse
 - ‘echo chamber’
- all more unified approach is needed - to unite traditional and social media
 - member portals
 - marketing on the fly email
 - social media
 - personal URL campaigns
 - text messaging
 - online newsletters
- communication ‘sweet spot’ in between passion, symbols and facts
- data based communications center for climate change: interdisciplinary science.com
 - data
 - journalists networks
 - personalities: celebrities, influences, scientists
 - media: formats, distribution
- making the mistake that the finding or the data is the story - that has to be constructed around other media formats - lead with opportunity that speaks to social and traditional media formats

Products & Reflections

Participants, over the course of the five days, had begun to work in groups, and had identified key themes and research topics that would be worth pursuing – from the talks already given and given their academic backgrounds.

Group 1 – Ecosystem services and poverty reduction

- developed a conceptual framework to look at relationships between poverty and ecosystem services looked at pathways to study linkages between the two
- looking at poverty from multidimensional - beyond income - bringing poverty reduction and ecosystem services together with livelihood development as the linkage
- review of theoretical ideas, possible multidimensional indicators of poverty - from linear and circular point of view
- using cases from individual group members to do comparative analysis

Group 2 – Meat

- paper - FAO data, animal production, cereal and grain, meat at center how has meat consumption/production driven land use change

Group 3 – Worldviews

- have two papers in mind but want to combine this into one
- looking at SDGs to analyse inputs into the process - content analysis of different worldviews and how they are being represented in the end products
- but this misses the point of why this is important - so review of theory around worldviews (drawing on Jennifer Clapp's and other typologies) apply to cases or examples where worldview played significant role to show how or in what ways not paying attention to different worldviews - what is missing from them, whose perspectives are not being represented
- target in two groups - those who know about it but also for those who don't know exactly what it is about - infographic based op ed and journal article

Group 4 – Making change in the world

- looking at tools and approaches, assumptions that each of those tools are able to achieve - ie law will work, science will make change, etc across range of different disciplines what the assumptions are, limitations of each tools and linkages between them
- possible exploration through water
- will pull together concept note to see if there is enough interest

Group 5 – Indicators

- testing what is the use of indicators - strong emphasis on producing them - but when are they useful, when are they not and why?
- study of Finnish decision-makers suggesting that indicators are not used because of policy emphasis on economic growth
- pick an indicator/context - study in international context case studies/interviews with national level decision makers, possibility of integrating things link international or constitutional rights within this to provide guidance to where leverage points might be
- looking for participants

Group 6 – Climate change adaptation models

- doing models across different backgrounds decided too hard
- brainstorm of issues about thinking across climate change adaptation, proposed 3-4 possible modelling strategies that could be used/considered in climate adaptation
- two different products
 - one extension/education product, webpage word cloud for voting on insights to consider most important issues to look at how variables interact to build conceptual model for each modeling strategy
 - also manuscript to consider social, ecological, climate, economic issues associated with modelling

Group 7 – Tipping points and resilience

- paper: case studies to highlight short term ecological responses to environmental shocks to produce long term resilience
- looking at a number of case studies and synthesis, how can we use this knowledge, looking for governance piece, how to resolve various scales of thought and action in responses
- diverse case studies across geographies - looking for input on possible cases

Group 8 – Uncertainty in Knowledge Co-production

- paper based on case studies from different disciplinary perspectives that looks across how uncertainty is addressed and the implications in working across science decision-making
- trying to unpack the conditions and ways in which uncertainty will present challenges and opportunities to co-production

Final discussions centered on the future work of all the groups and how to keep the networks alive. Suggestions included webinar series, special issue in journal/book, facebook group, twitter, newsletters, wiki, and also keeping in

contact for broader related issues (calls, job offers... etc) and planning further meetings – guidance on how to do that, resources, funding to make it happen.