The Commons and the Climate –
Dynamising the one to stabilise the other

A keynote presentation by

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for

The 1st Global Thematic IASC Conference on the Knowledge Commons

Governing Pooled Knowledge Resources:

Building Institutions for Sustainable Scientific, Cultural and genetic Resources Commons

12-14th September 2012
Université catholique de Louvain, Louvain-la-Neuve, Belgium

Overview and Key Messages

The challenges of responding in an effective and timely way to the challenge posed by global climate change are manifold, multi-dimensional, complex and utterly unprecedented in human history.

The issue to be briefly raised here is whether the "commons movement" can be further energized and focused to play useful roles in the response, and how such and efforts might be most effectively be approached.

Climate stabilization and sustainable development will require halting the rise in the atmospheric concentration of CO2-*equiv(ppmv)* before warming of Earth's surface by the greenhouse effect not only imposes great damages to human welfare and well-being, but becomes uncontrollably self-reinforcing with catastrophic ecological and societal consequences.

Putting to one side the many frustratingly difficult problems of achieving timely national and international political commitments to action in this sphere, this presentation will highlight **key technological and resource mobilization challenges**, and the correlative **institutional and organizational challenges** – some that will be addressed by papers in the parallel sessions and other keynote speakers.

I will emphasize the continuing need for the commons movement to offer concrete solutions that help meet the demanding informational requirements for reliable, timely and effectively coordinated action in both the technological and institutional domains. My presentation will point out several opportunities to pursue specific novel fields for "bottom-up" initiatives in commons creation and governance that could make important contributions to extending and improving the effectiveness of the "knowledge commons".

‘The commons meets climate change’:

Track 6+ papers and other keynotes on the Conference Theme

Title	*Paper’s Presenter*
Towards a Knowledge Commons for Integrated Assessment Models of Climate Change	**Matthijs DEN BESTEN**
The Local Tragedies of Global Climate Policies	**Leticia MERINO**
Collective Action for the Production of Knowledge on the Commons	**Norma GUTIERREZ**
A new opportunity for delivering the commons: exploring the interface between different legal fields	**Abbe BROWN**
Patent Pools for Clean Energy Technologies	**Wei ZHUANG**
The Renewable Energy Commons: Global Public Goods, Governance Risk and International Energy	**Timothy MEYER**
The Talent Pool: Human Capital, Knowledge Creation, and the Reach of Intellectual Property	**Orly LOBEL**
KEYNOTE: **Innovative intellectual property strategies for pooling knowledge and technologies in addressing global challenges**	**Bronwyn HALL**

Where are we now?

Ongoing climate destabilization due to anthropogenic emissions of CO2 is real and poses an existential threat to the future of human society as we know it.

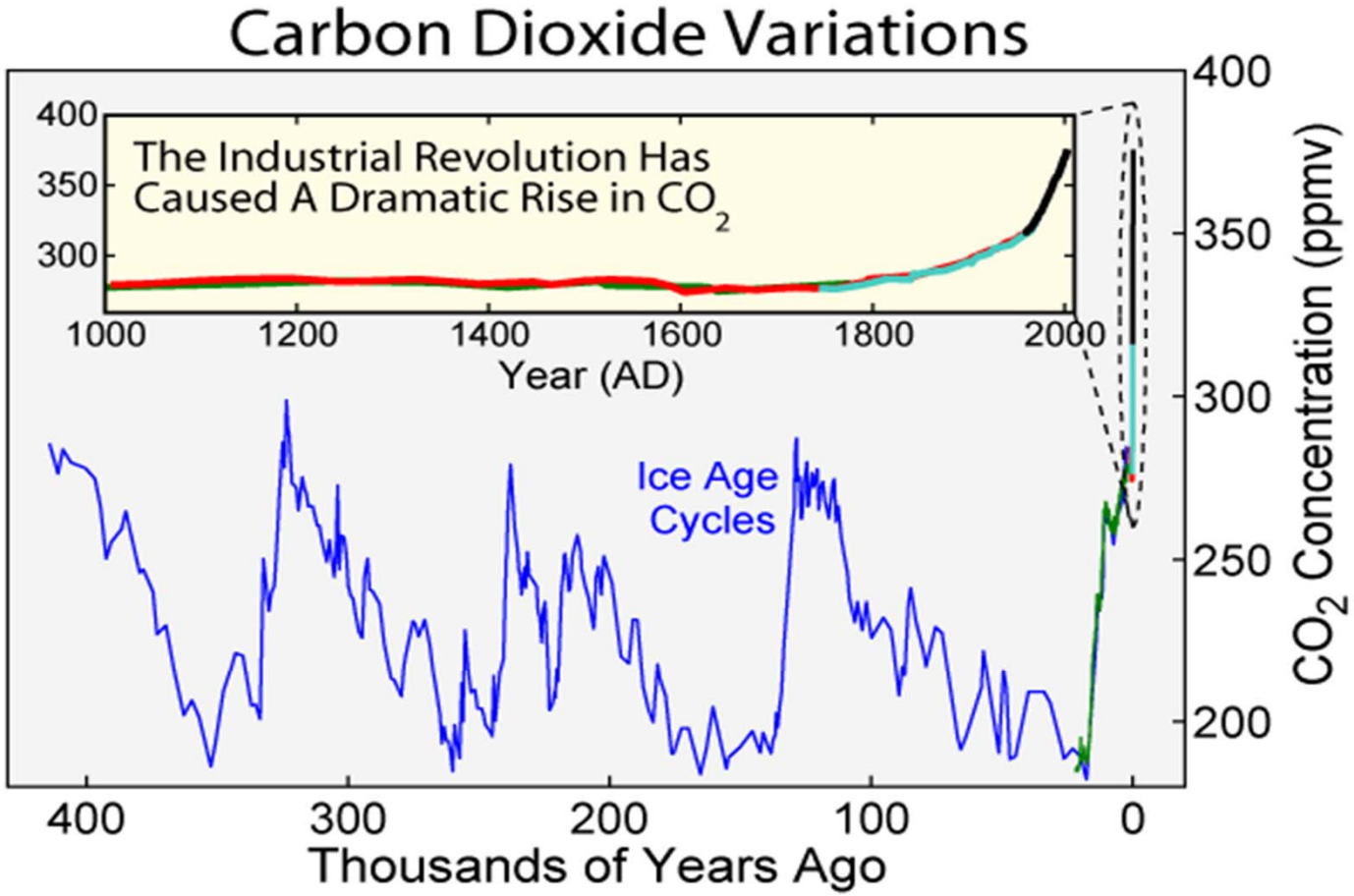
- **there is real potential for 'catastrophe" in a runaway rise of GHG concentration levels (ppmv), runaway warming and the onset of global climate instability (GCI)**

- **likely magnitudes and distribution of damages are uncertain, hard to estimate, but potentially enormous and unequally distributed**

- **with CO_2 concentration at 390 ppmv, required measures for stabilization at precautionary levels under 450 ppmv – by reduced emissions, abatement and rapid transition a "zero carbon production regime" will be very costly**

GLOBAL CLIMATE: From "Warming" and "Change" to Instability"

Secular Trend and Cycles in Atmospheric Concentration Level of GHG (ppmv)

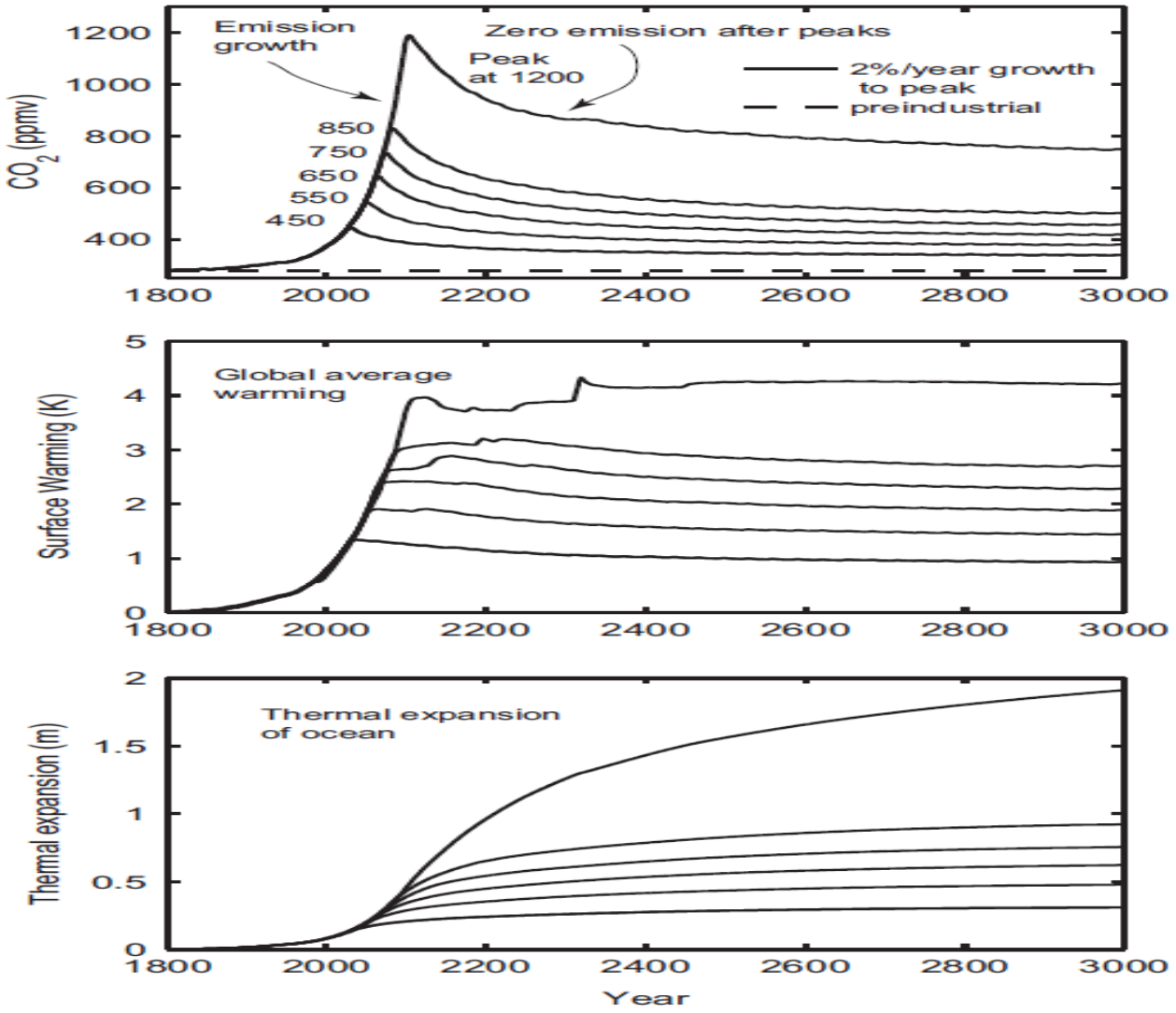


Source: **http://en.wikipedia.org/wiki/File:Carbon_Dioxide_400kyr.png**

Global Warming's *Millennium-long* "Irreversibility" – due to persistence of atmospheric CO_2

Climate system responses are shown for a ramp of CO_2 emissions at a rate of 2%/year to peak CO_2 values of 450, 550, 650, 750, 850, and 1200 ppmv, followed by zero emissions. The rate of global fossil fuel CO_2 emission grew at ≈1%/year from 1980 to 2000 and >3%/year in the period from 2000 to 2005

Source: Solomon et al., PNAS (10 Feb.) 2009 :p.1705.



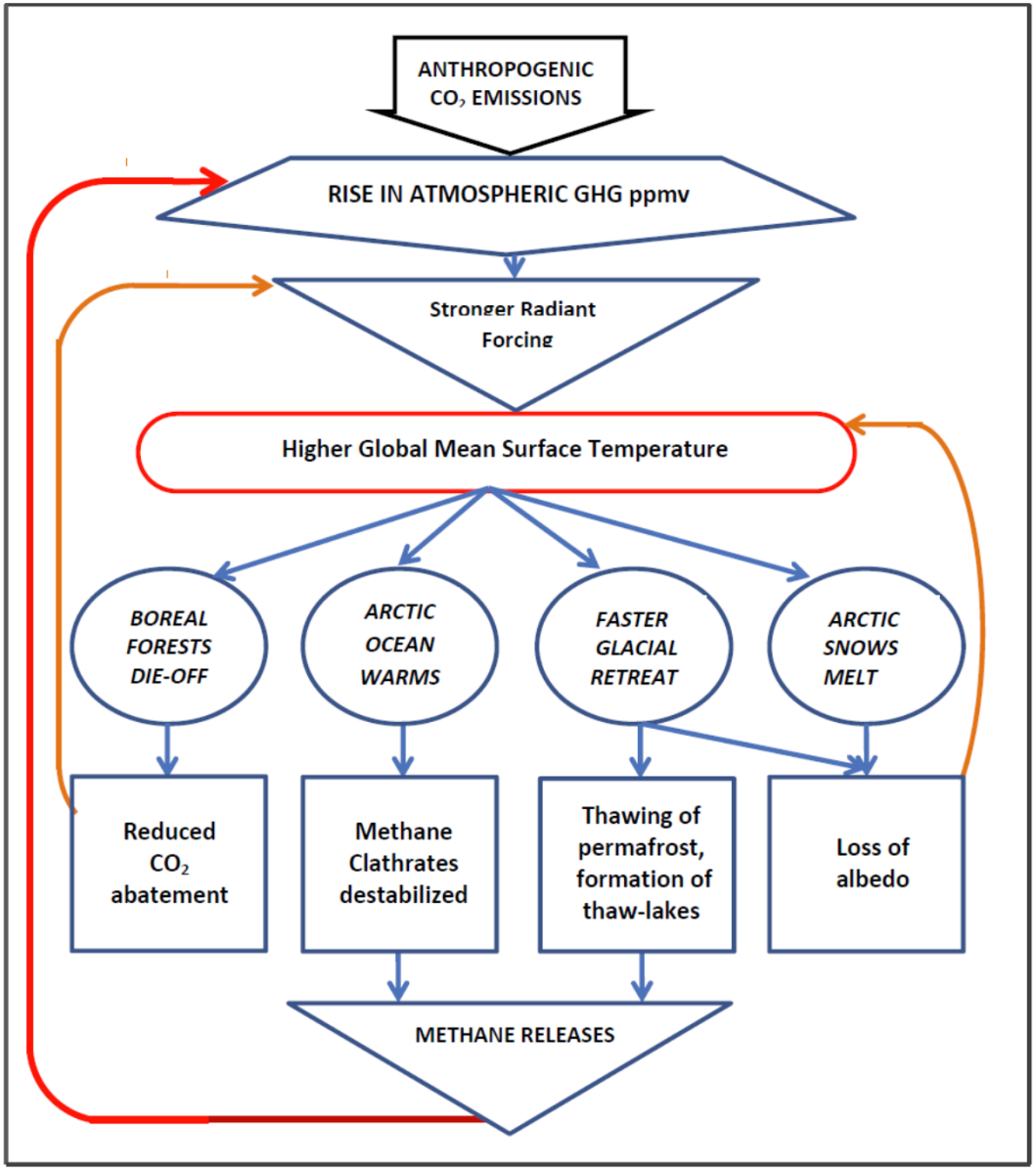
RUNAWAY GLOBAL WARMING AND CLIMATE INSTABILITY

The generic positive feedback mechanism driving climate dynamics and attendant environmental changes that entail ecological damage and human welfare losses include sequences such as this:

elevated GHG concentration → increased temperature → environmental change → increased heat absorption due to, e.g. glacier retreat → reduced reflective cover (albedo) and release of sequestered GHG (CO_2 and Methane) due to increased ocean temperature and disruption of oceanic convexion cycles → increased GHG concentration level → ……

Some of the intervening steps of the dynamic process are thought to be cascade-like in their sub-structure, which would accelerate the feedback process, and could trigger the onset of irreversible ***"climate instability."***

Figure 1: Geophysical system feedbacks drive climate destabilization

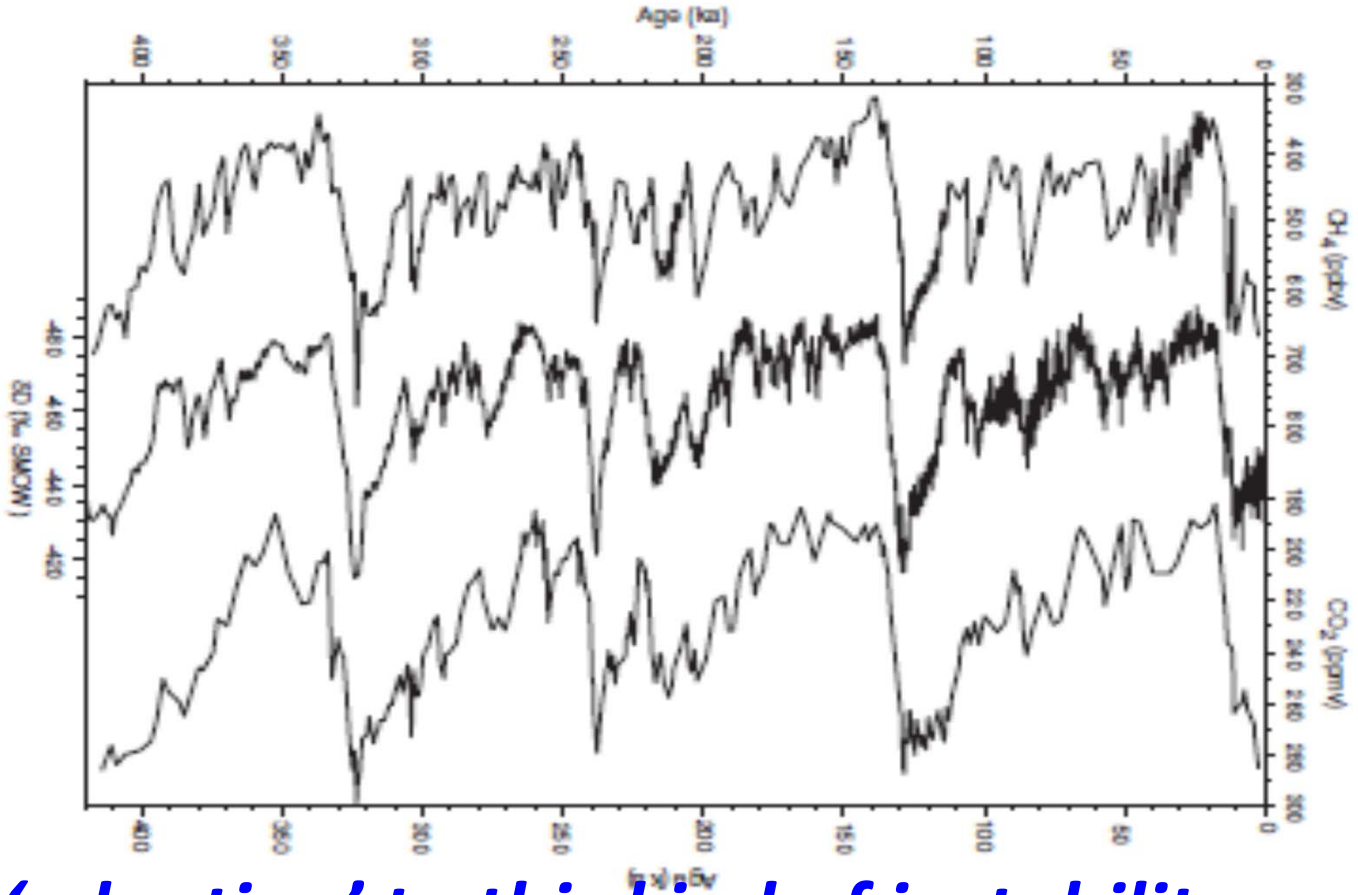


***Source*: P.A. David and A. van Zon, "Optimal Multi-Phase Transition Paths toward a Stabilized Global Climate," (June 2012)**

CLIMATE FLICKERING: Evidence from the Vostok ice core (Antartica) last 423 ky.

δD: *hydrogen isotope ratios measure atmospheric temperature*

CO_2 and CH_4: *greenhouse gas concentrations*



Try 'adapting' to this kind of instability.... .

Source: Reproduced from Petit et al, Antartica Nature,339,1999, in D.C. Hall, R.J. Behl / Ecological Economics 57 (2006) 442–465

A "Quick check on Economic and Political Realities

The 'climate destabilization crisis' is "fixable" in principle, but practical progress to date has not been encouraging

- **International negotiations of agreements on cap-and-trade, or coordinated carbon tax mechanisms that would curtail CO_2 emissions by "pricing carbon," are mired in 'public goods' problems and intractable conflicts of interests between the rich and the poorer but rapidly industrializing nations.**

- **Progress in North-South negotiations will not become easier until the BRICKS see lower transition costs for them, but the future costs of necessary technologies and the terms on which they might be transferred are uncertain. There is only a comparatively brief "window" for precautionary actions that can lower the capital costs of emissions reduction and make the transition more affordable for the BRICKS and compatible with future sustainable development.**

- **The required international action cannot focus on achieving agreed climate targets, because the externality problem disconnects individual country actions from global outcomes, and the links are in any case lagged and uncertain: in place of Kyoto and Copenhagen the political goal should goal should be coordination and commitments on completing specific (monitor-able) actions to be taken in each successive phases of the transition to climate stabilization.**

- **Mobilization of necessary knowledge and material resources for a 'tech fix' to stabilize CO_2-*e* (*ppmv*) should be prioritized, as we are running out of time and the transition will pose enormous problems of coordination, and require organizational innovation and new institutional solutions for political economy problems of international resource transfers.**

The portfolio of "tech fix" options for climate stabilizing action

- subsidize public private partnership investments in carbon-capture and storage (ccs) technologies for coal-fired electricity power plants improvement

- subsidize "greening" of carbon-base infrastructure and production facilities using available core engineering knowledge: manufacturing processes, transport vehicles and building design and insulation

- subsidize investment in applied R&D directed to yield less costly techniques of "renewable" (zero-carbon) energy production – including safer nuclear power – and radioactive waste storage

- long-term public R&D projects on alternative "climate engineering" solutions: solar radiation management techniques, and atmospheric carbon capture and sequestration

- public-private partnership investments in development of cost-reducing methods of damage mitigation

Climate & Commons – tackling the problem of two externalities

The core institutional-building challenges in responding to global warming entail creating organizational incentives and regulatory mechanisms that address the "dual externalities" that bedevil easy economic solutions to the problem:

Firstly, the social costs of GHG emissions are not "priced" in the markets that affect the decisions of private producers and consumers, although the consequences of their choices adversely affects others.

Secondly, scientific and technical information and data are peculiar 'goods' that competitive markets cannot be relied upon to allocate in socially efficient ways.

Therefore, some publically created compensatory incentives are required not only offset private tendencies to underinvest in the generation of new reliable knowledge, and also to direct applied research to inventing and developing technologies needed to transition to a "low carbon" global economy and a stabilized climate.

Understanding the source of "the second externality: the trouble with information as a commodity

Information is the key input as well as the output of research, and it has public good properties:

a) infinite expansibilty, i.e., negligible marginal transfer costs and *non-rival* use

b) indivisibility (i.e., information is integral and heterogenous) and it has substantial fixed costs of creation

c) *significant costs of exclusion* from access and possession

Thomas Jefferson recognized the "public goods" properties of ideas and information…back in 1813:

"If nature has made any one thing less susceptible than all others of exclusive property, it is the action of the thinking power called an idea, which an individual may exclusively possess as long as he keeps it to himself; but the moment it is divulged, it forces itself into the possession of every one, and the receiver cannot dispossess himself of it. Its peculiar character, too, is that no one possesses the less, because every other possesses the whole of it. ***He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me.***"

Economic implications of public goods for the organization of scientific research activities:

- Competitive markets fail to allocate 'public goods' efficiently, due to
  - 'transactions externalities' – try to sell a secret for its full information value
  - possibilities for 'free-riding' – full demand isn't revealed
- Competitive pricing (at incremental cost) leaves most (fixed) costs uncovered, even at large scale
- external use benefits (from 'spillovers') not properly valued by private willingness-to-pay

Understanding 'the second externality' and its remedies:

Classic economic analysis in "public finance" identifies three solutions for the problem of providing services involving *tangible* "public goods" (e.g., water and lighting utilities)

- tax-financed subsidies
- monopoly
- direct public provision financed by general taxation

Correspondingly, in the case of *intangible* resources we have:

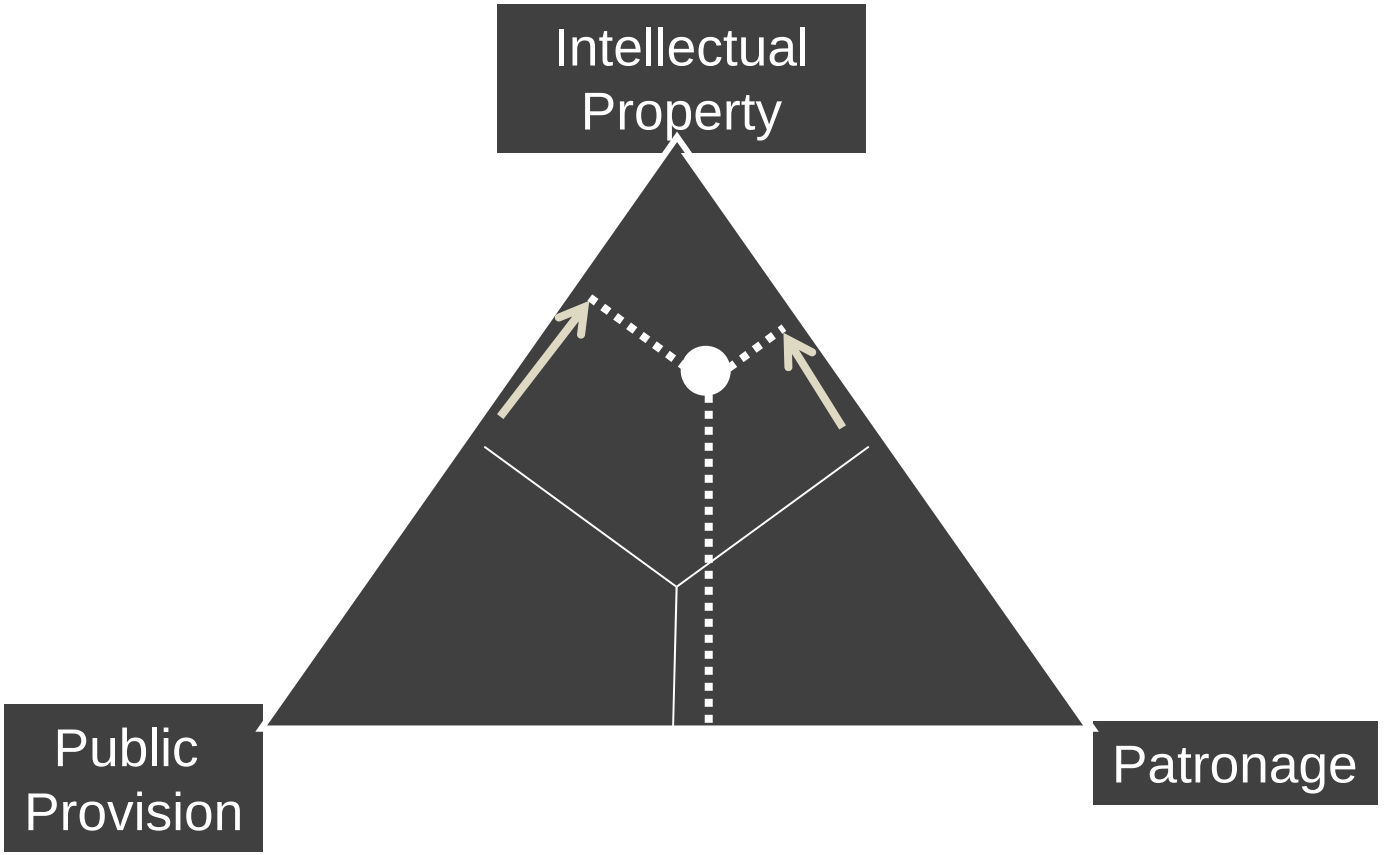
- ***"The 3 P's"*** -- co-existing institutionalized solutions for the problems posed by information-goods:
  - ***Patronage*** — and the 'open science' reward system
  - ***Property*** — IPR monopoly rights
  - ***Procurement*** — government production or contracting

None of the three solutions is perfect, but the monopoly solutions is particularly *socially inefficient* for information-goods:

Granting IPR monopolies to reward the winners of invention and publication races (i) induces duplicative private efforts, (ii) creates potential means of raising the cost of downstream inventions, and (iii) restricts the benefits from utilizing existing inventions by allowing the IPR holder to raise the price for access to the content – the marginal reproduction cost of which is very low, and being lowered rapidly by IT innovation.

The Present & Future of Open Science

The optimum mix of institutional solutions is not clearly identified, but one can see that changes in the last quarter century have been are pushing the system out of balance.



Fiscal pressures to "privatization" government informaiton production, reinforced by stronger and more comprehensive IPR protections, have put the public patronage of open science under pressure.

Climate & Commons – *tackling the problems of relying on IPR to solve the problem of information externalities*

In addition to knowledge-sharing commons organizations role in limiting the further extension of IPR "fences" that can perversely restrict knowledge creation and application while offering the prospect very big future economic rewards to a few patent or copyright holders in one or another specific technical field, the possibility of constructing commons by common use licensing of existing IRP can remove patent thickets that block further exploratory and applied research.

These two forms of the scientific and technological research resource commons, one based on codified knowledge placed in the public domain (and secured there as "prior art'), the other based on collaborative licensing of existing IPR and legally protected under IP statutes and contract law, are not the only ways in which the commons can be used as a mechanism to elicit and disseminate knowledge.

In addition to the contractual commons being used in conjunction with other incentive mechanisms (e.g., prize competitions), the organization of commons among members of "communities of practise" can be an important step in codifying informal and tacit knowledge, rendering it both more readily transferable and sustainable.

Pushing back against encroachment of IP into the public domain of information:

A "bottom up approach to forming "research commons" --*by licensing intellectual property on terms that protect common-use rights*:

Familiar working exemplars now are established in the in the copyright domain:

- **Open access journal publishing**
- **The Creative Commons ("some rights reserved" licensing– attribution only, no commercial use, no-derivative works)** http://creativecommons.org
- **Copy-left licensing of open source software (esp., GPL)**

Using the variety of commons for the 'tech fix'

--**The core of the CC technological challenges** require developing new technical knowledge and tools, and implementing available techniques in order to "green" carbon-using production facilities by lowering their CO2 emissions-output ratios rate, and to lower the resource cost of eventually switching production to carbon-free processes and infrastructures.

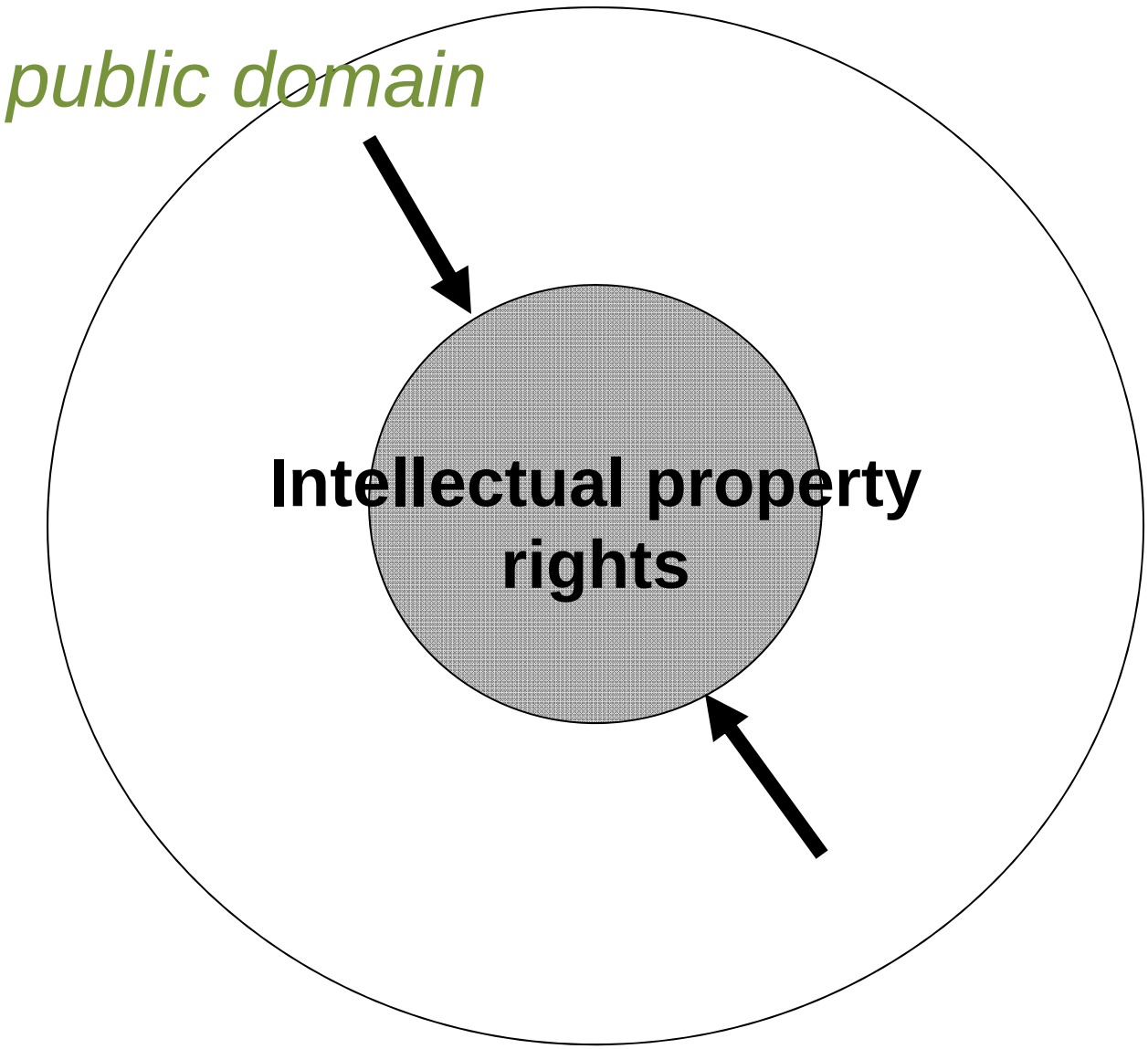
-- Creating new information and data commons to facilitate access to emerging research results and especially new research tools, and to support communication, coordination and collaboration among researchers can proceed in two ways – as **research resource commons**, or **"quasi-commons."** Such arrangements emerge are likely to emerge voluntarily when a limited set of academic science researchers or scientists and/or engineers engaged a particular field recognize that there would be mutual benefits from minimizing the distorting impediments to their work that are being created by the existence of IRP protections on research tools and data sets.

Key Message: Commons' forms and functions

The most familiar commitments by groups of researchers taken at the outset of a project to forego claiming any intellectual property rights on their discoveries and inventions. These e*x ante*, anticipatory agreements typically are found among distributed researchers in specific frontier areas who create platforms and open access repositories for anticipated flows of information and data-streams that are to be shared freely among the members of teams and projects affiliated with different academic and business entities, including those not in the original group – because the latter have left the content in the public domain, and publicized its status so that it cannot be made intellectual property.

By contrast , the "quasi-commons" form emerges e*x post* among an organizationally closed "club" of researchers, or research teams that hold intellectual property rights (based upon their previous discoveries and inventions). Rather than exploiting those proprietary rights for commercial ends, the enter what are in effect open cross-licensing arrangements among the voluntary members of the "commons club" and set rules for the governance of their quasi-commons – restricting future membership and stipulating what can and cannot be done with future legally protectable research findings, as well as how to allocate among themselves such revenues as are obtained from licensing the IP that they contribute to the common pool.

The "contractual construction" of epistemic commons to mitigate the obstacles to R&D created by existing IPR protection research tools and databases can avoid being proscribed as anti-competitive, abusive cartel arrangements when the pooled IP is seen to be complementary, but that the fragmented and distributed structure of its ownership would give rise to a "patent thicket", or to multiple marginalization (or royalty stacking) that is inimical to socially productive utilization of underlying knowledge. Voluntary cross-licensing contracts in such situations can create 'efficient cartels pools" of patents and other "protected" content, providing mutually beneficial sharing and reuse among the pool's participants.


public domain
Intellectual property rights

Ex Ante Organization of Scientific Research Commons … Biomedical Paradigms

Sage Bionetworks Commons Principles -- *San Francisco, California, April 2011*

http://sagebase.org/WP/com/

1. The purpose of the Commons is to expedite the pathway to knowledge, treatment, and prevention of disease.

2. We will promote collaborative discovery through the creation and support of a broadly accessible digital Commons consisting of curated data and methodological tools in which analytical results are shared in a transparent, open fashion.

3. The Commons will respect the rights and interests of all contributors including individuals from whom data are derived, researchers who collect and analyze data, and scientists and physicians who develop and implement healthcare advances. Those not respecting these rights will be excluded from the Commons.

4. Contributions to the Commons shall be appropriately acknowledged and attributed.

5. The Commons will promote data and tool sharing and distribution using standards that enable efficient reuse, compilation and comparison.

6. The Commons will hold no intellectual property rights in, and will not permit encumbrances on, data and other elements within the Commons. This will not, however, preclude individuals from protecting new goods and services developed using data and other elements from the Commons.

Approved and endorsed by: **Craig Alexander** Howard Hughes Medical Inst. **Brandon Allgood** Numerate, Inc **Misha Angrist** Duke University **Linda Avey** Brainstorm Res. Foundation **Myles Axton** Nature Genetics **Mukesh Bansal** Columbia University **Douglas Bassett** Ingenuity **Greg Biggers** Genomera **Hans Bitter** Roche **Robi Blumenstein** CHDI Foundation **Jason Bobe** Personal Genome Project **Barry Bunin** Collaborative Drug Discovery **Atul Butte** Stanford University **Carlos Caldas** Cambridge Research Institute **Andrea Califano** Columbia University **Richard Cave** Public Library of Science **Robert Cook-Deegan** Duke University **Maureen Cronin** Foundation Medicine, Inc **Jim Davies** Oxford University **…and many others.** *Note: Endorsements are individual and not institutional; signatories do not necessarily represent the policies or opinions of their institutions.*

Ex Post Organization of Scientific Research Commons … Biomedical Paradigms

Creative Commons' *Neurocommons Project*

http://sciencecommons.org/projects/data/background-briefing/

The NeuroCommons is a proving ground for the ideas behind Science Commons' Data Project. It is built on the legal opportunities created by Open Access to the scientific literature and the technical capabilities of the Semantic Web.

Executive Summary

The Neurocommons project, a collaboration between Science Commons and the Teranode Corporation, is building on Open Access scientific knowledge to build a Semantic Web for neuroscience research. The project has three distinct goals.

To demonstrate that scientific impact is directly related to the freedom to legally reuse and technically transform scientific information – that Open Access is an essential foundation for innovation.

To establish a framework that increases the impact of investment in neuroscience research in a public and clearly measurable manner.

To develop an open community of neuroscientists, funders of neuroscience research, technologists, physicians, and patients to extend the Neurocommons work in an open, collaborative, distributed manner.

Background

Let data speak to data **"Upload and share your raw data, and have a high impact factor for your blog - or perish? That day has not yet come, but Web technologies, from the personal publishing tools such as blogs to electronic laboratory notebooks, are pushing the character of the Web from that of a large library towards providing a user-driven collaborative workspace."** -- *Nature* vol 438 December 2005

public domain

The case of the "Eco-Patent Commons"

– a promising paradigm for voluntary private provision of free access to carbon-free technologies?

or

-- an experiment in getting corporate reputational credit for discarding IP that no longer was central (if it ever was) in the firms' competitive strategies?

From Hall and Helmers' (2010) study we have some preliminary answers:

Innovation in clean/green technology: Can patent commons help?

Bronwyn H. Hall

U of Maastricht and UC Berkeley

Christian Helmers

Oxford University and LSE

June 2010

What is the eco-patents commons?

- **Created January 2008 by IBM at World Business Council For Sustainable Development (WBCSD)**
- **First and only green patent commons**
- **Firms can pledge patents related to green technology**
  - **11 firms have done so (triad)**
- **Green defined by a classification listing IPC subclasses – some flexibility**
- **Pledge - available for use by third parties for climate-change related activities with auto royalty-free license; ownership remains with firm**
  - **Not a donation, and not tax deductable**
  - **Defensive termination right if user enforces another patent against pledging firm**

Hall and Helmers' 2010 conclusions on the Eco-Patents

- Green patents by OECD definition are indeed more likely to be pledged
- Pledged patents are more valuable than the typical patent in a firm's portfolio, controlling for priority year and 1-digit IPC
- They are slightly less likely to match the IPC pattern of the firm, suggesting that they are not central to firm strategy

We may learn more on this from Prof. Hall's keynote in the Conference's opening session this Friday morning!

Radical S&T policy innovations are likely to be needed:

Voluntary private pooling of complementary patents on green technologies, reducing the risks of barriers to downstream invention and innovation, might be encouraged by competition. But the "Eco-Patent Commons" experience to date doesn't support that expectation, because firms with key patents for the industry are likely not to give them away.

Some "new departures" in public policy tools may be needed to stimulate climate change-relevant private R&D investments:

- **Coordination of public agency procurement of the array of GHG emissions reducing systems can generate spillovers to the private sector.**
- **Public and Private Funds can award prizes on the basis of contributions to GHG emissions reductions in specified sectors and energy uses**
- **Public R&D grants and contracts should reserve government "march in" rights on patented inventions, require non-exclusive licensing – both to promote tech transfers and diffusion.**

Three novel, climate policy relevant roles for the commons

(1) It appears there is scope for **introducing commons to increase the effectiveness of prize competitions as incentives for directing invention and organization design innovations toward climate policy goals**. Agencies of western government agencies that are experimenting with so-called "prize sourcing" for directed technical advances do not seem to be preparing to make full use of the ideas that are submitted, and are giving the winners of the competition (along with all the submitters) the IPR rights.

In other words, they are perversely replicating the economic inefficiencies of the patent system, whereas prize competitions have been advocated by economists as **an alternative incentive mechanism to the granting of patents,** because the winning submission can disclosed and licensed freely, thereby increasing the benefits of its application.

(An historical footnote that you can't find in Dava Sobel's popular book, *Longitude:*

The British "Longitude Board," set up in 1714, understood the desirability of just that sort of arrangement; they supported the long research effort by Harrison, but refused to give him the announced £20,000 prize for his invention of a marine chronometer, in large part because he remained unwillingness to disclose the details of his invention, and insisted that he had the right to have a patent on it as well as receiving the prize money.)

Why not then use a contractual commons approach to increase the effectiveness of governments' and charitable foundations' uses of prize competitions to stimulate "green" invention and innovation?

CHALLENGES.gov

Implementation of Federal Prize Authority: Progress Report

A March 2012 Report from the Office of Science and Technology Policy
In Response to the Requirements of the America COMPETES Reauthorization Act of 2010

EXECUTIVE SUMMARY

On January 4, 2011, President Obama signed into the law the America COMPETES Reauthorization Act, granting all agencies broad authority to conduct prize competitions to spur innovation, solve tough problems, and advance their core missions.

Prizes have a good track record of spurring innovation in the private and philanthropic sectors. Early adopters in the public sector have already begun to reap the rewards of well-designed prizes integrated into a broader innovation strategy. Section 1 provides tangible examples of how prizes have enabled the National Aeronautics and Space Administration (NASA), the Department of Defense (DOD), and the Department of Energy to:

- **Establish an ambitious goal without having to predict which team or approach is most likely to succeed**
- **Benefit from novel approaches without bearing high levels of risk**
- **Reach beyond the "usual suspects" to increase the number of minds tackling a problem**
- **Bring out-of-discipline perspectives to bear**
- **Increase cost-effectiveness to maximize the return on taxpayer dollars**
- **Pay only for success.**

But, instead of letting the winners and all the contestants keep the IP on their submissions – as the U.S. and U.K. governments are doing, it would be more effective to have the contest rules require the donating of all submissions to an independently managed common-use "pool" that was set up for each competition.

The pool-managing "foundation" would license all the IP freely to the contest's competitors and grant licenses to "outsiders" on non-exclusive RAND terms, for a royalty fees. Licensing revenues would be divided so as to give larger, graduated shares to the first place contest winner, second place, third place, etc., perhaps down to the top 7 contestants, with the remaining royalty stream divided equally among the rest.

Novel, climate policy relevant roles for the commons, *cont'd*

(2) There also may be a potential role for **bottom-up initiatives that would introduce information and data commons organizations to bring together local expertise and indigenous community interests in order to inform and shape the design and implementation of corporate biodiversity and ecosystems policies and operational planning.**

In recent years ecosystem services reviews, and biodiversity maintenance plans have been undertaken on a broader scale by leading international business corporations, using sophisticated analysis and planning tools provided feely under a program organized under the auspices of the World Business Council for Sustainable Development (WBCSD).

But this is being done in a top-down fashion, centrally managed by each company and planned for its global operations, apparently without organized contacts with local agronomic, water resource and forestry experts, or consultation with people in the affected ecological settings who not only have a take in the design of such programs, but also possess specialized (albeit informal) knowledge t based on long experience knowledge.

Novel, climate policy relevant roles for the K-commons, *cont'd*

(3) Still another suggested innovative role for the commons, would be as a focused organizational mechanism to mitigate the perverse effect of the increasingly widespread business practice whereby business firms are restricting the mobility of employed scientific and technical personnel, and operations managers of specialized facilities -- by forcing them to sign contracts that have so-called "non-compete clauses" as a condition of employment.

This attempt to capture what is referred to as "employee intellectual property" (EIP), ostensibly to protect the firm's competitive possible based on innovation programs, actually may be harming their own innovative efforts in an effort to prevent rival enterprises from hiring those employees,. The legal system in many jurisdictions unfortunate enforces such mobility restricting contracts, by there is no reason why contractually constructed commons could not be promoted to mutually benefit firms in lines of business that would derive greater gains from the circulation of expert workers with varied experience, and the positive effects on effort and cognitive performance that are likely to result from better "job matching" between employees and employing companies.

Can the K-commons improve responses to disasters?

Another aspect of the climate change challenge where the formation of specialized knowledge commons may find a valuable role concerns the preventive and remedial tasks of mitigating material damages and alleviating human suffering from the consequences of from warming-driven "extreme weather," and localized losses of particular ecosystem services upon which the affected populations were dependent.

While there are obvious needs for open access to reliable technical and logistical information and data required for the planning and execution of work in those fields, need the parallel those in scientific research and engineering, the situation in regard to damage mitigation and disaster relief action has one aspects that appears (to this "un-expert" observer) to be rather different: critically important expert knowledge and information about effective techniques and organizational procedures is made available through a mixture of public regulations and mandatory standards, on the one hand, and on the other hand by private commercial services in which there may be strong incentives to restrict information flowing beyond the bounds of the client-contractor relationship. The balance been science and craft in this field may be tipped more towards the latter end, but students of the commons should not neglect the problems of information and sharing when secrecy, or tacitness resulting in high codification cost is a problem – different from the restraints imposed by IPR.

We may look forward the hearing more on this subject during the closing panel discussoin from Prof. Jacob Rhyner -- the Director of the UNU_EHS in Zurich, an institution focused on Environmental and Human Safety. Perhaps he will identify some ways in which new commons initiatives can contribute to enhancing the capabilities of communities to cope with the environmental stresses and outright natural disasters that warming is likely to bring in many of the developing economies.

Summary messages

My purpose in this presentation is not to dismay and discourage you by indicating the multiplicity and complexity of social and economic and technological changes that will be required for the world's societies to adequately respond to the challenges posed by the catastrophic threat of unchecked global warming.

Rather, it is to encourage you to become an active part of the necessary response:

- **To take stock of what you already know, and what you will need to learn to effectively focus your knowledge about the potentialities of the commons as a flexible instrumentality that will enable you to play an important contributing role;.**
- **To begin to seek to identify one or another of the variety of ways in a "bottom up" initiative in constructing and governing a commons or quasi-commons arrangement can facilitate the extensive and timely sharing of**

  --new and existing scientific and technical information and data that is relevant to "greening" carbon-based production activities, or advances in renewable energy technologies, or

  -- social and behavioral knowledge that can find practical application in identifying and informing l ocal communities about opportunities that couple the motivation derived from private concerns for health, or economic security or business profit with actions that also serve to mitigate the emission of CO2 and other GHGs;
- **To use the organizational structure of a managed commons in order to discover and tap the pertinent , experience-based knowledge of individuals and indigenous communities of practice in geographically and ecologically differentiated regions that will be so vital for the effective design and implementation of specific actions promoting climate stabilization and sustainable welfare in the world's developing economies;**
- **To inform and assist people in particularly vulnerable locales to become better prepared to cope with the heavier incidence of climate change-driven ecological and human welfare damages, to the life-threatening and socially disruptive consequences of more extensive droughts and flooding, and losses of vital ecosystem services that are likely to fall upon the those regions during what will be for many at best a long and arduous transition to a sustainable future in a low-carbon global economy.**