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15. Climate as a Commons

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1. Introduction

New institutional economics or "new institutionalism" has informed a significant body of research on local common property arrangements and international environmental conventions (e.g. Ostrom, 1990, 2005; Ostrom et al., 1994; Young, 2002). This interdisciplinary research encompassing economics, political science, sociology and anthropology has shed light on the conditions in which voluntary collective action can attain sustainable governance and use of environmental resources, and has identified design principles that characterize successful governance solutions.

The new institutional research on environmental governance has been phenomenally successful in terms of its volume growth and policy impact. Yet its potential is far from exhausted. Understanding the challenges and solutions of governing large and complex environmental resources such as atmospheric sinks were identified as key future tasks (Ostrom et al., 1999: 278) and some progress towards understanding their adaptive governance has been made (e.g. Dietz et al, 2003). However, much of the literature has examined single-level or uniplanar governance solutions. The governance of global environmental resources, however, is increasingly based on multi-level solutions operating at the local, national, international and intermediate levels simultaneously. This calls for finding ways to accommodate and deal with institutional diversity as part of the solution for adaptive governance (Ostrom et al., 1999: 278; Ostrom, 2005). In particular, there is a need to be able to deal with traditional national policies based on the enforcement power of the state in conjunction with solutions based on voluntary cooperation.

The greatest obstacle for the extension of the new institutional approach to new areas of research lies in its mostly implicit definition of "governance". The literature distinguishes between "governance" and "government" by considering the absence of coercive state power as the hallmark of "governance". Yet governance is what governments do. Sometimes – as when resource users govern themselves under customary institutions – environmental governance does not involve the *state*. Yet customary resource users perform the governmental functions of legislation, administration and adjudication, and therefore the *government* is involved. Rather than a monolithic external actor, the government, and the state, should be understood as arenas and instruments of collective action which are often pertinent in environmental governance. The key implication of the involvement of the state is that it entails a different distribution of power than self-governance solutions. Otherwise, national environmental and natural resource use policies perform similar functions and rely on similar institutional solutions as customary common property arrangements, despite being formal, having larger jurisdictions, and relying on the enforcement power of the state. Often these complex governance arrangements are polycentric (Ostrom, 2010, 2012).

This chapter suggests a broader definition of environmental governance: as the establishment, reaffirmation or change of institutions to resolve conflicts over environmental resources (Bromley, 1989, 1991; Knight, 1992). In this definition, *conflict* refers to a conflict of interest, not necessarily to an open conflict, between involved parties. This broader definition is applicable to the governance of all *environmental resources* from conventional renewable and non-renewable natural resources to biodiversity and atmospheric sinks, as well as to environmental safety and the quality of air and water. The definition does not limit the type or scale of environmental governance problems and solutions that can be examined. In what follows, the heuristics of commons will be applied to the problem of climate change (see also Paavola, 2008, 2011).

2. Atmospheric sinks of greenhouse gases as common-pool resources

The atmospheric sinks for greenhouse gases (GHGs) can be conceptualised as a common-pool resource not unlike a pasture or an aquifer. These sinks are stock resources, which have a limited capacity to provide a flow of sink services. Conventional common-pool resources such as aquifers and fisheries have a physical regeneration rate and thus a relatively well-defined capacity to generate a flow of resource units. Similarly, watercourses, air basins and global atmospheric sinks have a capacity to absorb pollutants, and are replenished by natural processes at a certain pace. These sinks typically form a part of a larger resource system catering for multiple uses.

Therefore, the use of the units in the atmospheric GHG sink is always rival within the sink use (a unit of sink services used by one user is not available to others). It is possible that sink services can be jointly produced with other services. However, the sink service can become rival with other uses of the resource system if a threshold for multiple use is surpassed. Some resources have thresholds, which if surpassed, may lead to the collapse of the resource system. For example, the climate system may change its nature if the atmospheric CO_2 concentrations surpass 400-500 ppm.

The key challenge in governing atmospheric GHG sinks is the same as with all other common-pool resources: to constrain its use so as to prevent its destruction. A derivative task is to distribute the sustainable capacity of the atmospheric GHG sink to provide sink services among competing users. However, the challenges of governing the atmospheric GHG sink are also shaped by the difficulty of exclusion of potential users from the resource (Ostrom, 1990). The users of GHG sinks range from large coal and natural gas-powered electricity generation plants to families driving cars or keeping cattle. The size of the sink, the range and heterogeneity of activities that make use of it, and the large number of users make it difficult to monitor the use of sinks and to exclude unauthorized users. The absence of clear borderlines, and the perfect mixing of GHG emissions in the atmosphere contribute to the difficulty of exclusion.

Because of the difficulty of exclusion, enforcement of entitlements to sinks is complicated. Users also have incentives to use the units of the GHG sink before other users make the units unavailable for them. Private ownership is not a feasible governance alternative when exclusion is difficult, but collective ownership and agreements to constrain resource use, and widely shared values, could help overcome the challenge of difficult exclusion.

There are also still further resource attributes influencing the governance challenges of atmospheric sinks. A consensus has emerged that the climate system is non-linear (Steffen, et al. 2004). If the use of the sinks surpasses critical thresholds, the climate system may change towards a new equilibrium which may alter the conditions of life on Earth. There is uncertainty about what those thresholds are; the current estimates of safe CO_2 concentration levels vary between 400-500 ppm. There is also uncertainty regarding climate change impacts and their incidence. Therefore, governance solutions must facilitate the management of risks and uncertainty.

3. The challenges of governing the use of global greenhouse sinks

The challenges of governing atmospheric GHG sinks are also shaped by the attributes of their users. User attributes determine the starting point for collective action aimed at establishing or modifying governance institutions, shape the costs and prospects of acting collectively, and influence what governance solutions can be agreed upon.

Collective action is shaped by political-economic factors as well as current patterns in the use of atmospheric sinks for GHGs. The most important aspect of the global political-economic order is the role of nation states as collective actors representing populations within their territories. The law on international relations treats nation states as formally equal, sovereign actors in international affairs. This formal equality contrasts with unequal developmental attainments. Industrialised developed countries have achieved high levels of per capita income and have strong, capable states. In the developing world, states are weak and at times dysfunctional, and they have been unable to promote income growth and wellbeing among their citizens. This also means that developing country states lack capacity to advance their (and their citizens') interests in international negotiations on the governance of atmospheric GHG sinks.

The economies of nation states also exhibit different degrees of complexity, which affects their vulnerability to climate change impacts. Complex economies of the developed countries offer numerous sources of income with different risk attributes: they are more resilient during periods of shocks and stresses. Economies of developing countries depend on primary production, agriculture in particular, and they are exposed to substantial climatic and economic risks. Because of underdeveloped financial and insurance sectors, people in developing countries cannot insure their assets and stand to lose them when tropical storms, floods, or droughts occur (Paavola and Adger 2006).

There are significant differences in the vulnerability of economies to weather-related disasters. In developed countries, per capita income and growth are not affected noticeably by extreme weather events such as the European drought and heat wave of 2003, even though the lost assets still measured up to a significant percentage of GDP. In contrast, extreme weather events such as Hurricane Mitch can tax over 10 percent of the GDP of a low-income country (see Linnerooth-Bayer, Mechler, and Pflug 2005).

The differences in vulnerability between developed and developing countries are even more significant in terms of loss of life. Disasters of comparable magnitude claim a much higher magnitude of casualty in developing countries. For example, the magnitude 6.6-6.7 earthquakes in Northridge, California in 1994 and in Bam, Iran in 2003 killed 60 and 30,000 people, respectively. Hurricane Andrew killed 23 people in Florida in 1992 while a comparable typhoon killed over 100,000 people in Bangladesh in 1991 (see Adger, et al. 2005). Brooks, Adger, and Kelly (2005) have found that the level of educational attainment, level of health status, and the quality of governance are important factors explaining the differences between countries in mortality due to natural disasters, alongside differences in the volume and quality of infrastructure to do with energy, water, transport and health care.

There are also other sources of heterogeneity that influence the ability of nation-states to act collectively. These include political ideologies, such as beliefs in the ability of markets or states to generate desirable outcomes. They affect the range and assessment of governance alternatives which are perceived as feasible. Religious beliefs as well as secular beliefs in, for example, liberalism also situate nation states in international political arenas. Globalisation is unlikely to reduce these heterogeneities. It is more likely to increase them because it will introduce heterogeneity to previously homogeneous societies and increase heterogeneity where it has already been present (Paavola 2005b).

Thus, the global community is divided by heterogeneities that make agreeing on a solution for governing the use of atmospheric sinks difficult. Developed countries have invested in energy-intensive lifestyles, technologies, and infrastructure, which make GHG reductions both expensive and time-consuming. At the same time, developed countries have capacity to avoid adverse consequences of climate change, as well as to recover from them. Developed countries form a homogeneous and powerful negotiation block, which has significant experience from having acted collectively in other contexts. Developing countries – particularly the least developed countries – are in a different situation. They have contributed little to climate change because of their limited energy use and reliance of renewable sources of energy. But their economic development requires increasing the use of energy and emissions of GHGs. At the same time, developing countries are highly vulnerable to adverse climate change impacts. Finally, developing countries make up a large and heterogeneous negotiation block, with members from oil producing countries to small island states that are threatened with inundation by rising sea levels.

There are, of course, more coalitions in climate change negotiations than just developed and developing countries, and the contours between the groupings are more complex than the discussion above suggests. But even this limited account demonstrates that there are significant obstacles for acting collectively to govern atmospheric sinks. Actors start from uneven positions and their interests are different. Their views regarding feasible and acceptable solutions may also differ.

4. Progress in governing the use of global atmospheric sinks

The dominant view among scholars and policy makers has been that climate change governance should be based on international agreements, which involve most nations (see e.g. Hare et al. 2010). The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP) are cornerstones of this approach. These kinds of governance strategies face two key hurdles. First, wide participation has to be secured for any agreement to come into force. Second, all agreements need to be implemented through national policies. In light of the above discussed governance challenges, it is no surprise that a grand agreement on climate change involving the adoption of ambitious greenhouse gas mitigation commitments by a large number of states has been elusive.

One insight from the commons research is that collective action could more likely be successful if the number of involved actors could be reduced. In the case of atmospheric sinks, there are several ways to achieve this. For example, arguments have been made for the major polluters to negotiate their own agreement to overcome the large numbers dilemma and heterogeneity (Naim, 2009; Victor, 2009). However, there are serious problems with agreements that omit the involvement and representation of affected parties for the sake of expediency (see Eckersley, 2009). Another proposal has argued for "a building blocks" approach: a strategy where sectoral or other partial agreements are negotiated incrementally among the involved and affected parties, with the expectation that over time they will together amount to a comprehensive approach to tackling global climate change (Falkner et al, 2010).

The Paris agreement in 2015 in the end did not pursue a "mini-lateral" agreement or the building blocks approach. It instead avoided having to come up with a negotiated set of commitments by deferring it to the states to come up with their own "nationally determined contributions" (NDCs) to combat climate change. Recent analyses of the first round of these national pledges indicate that together they are not sufficient to limit global warming to below 2C, not to speak of below 1.5C warming (Robiou Du Pont et al, 2017). Most of the major polluters have pledged to reduce their emissions less than the alternative equitable and effective emission reduction strategies would entail (ibid).

But more importantly, commons research has demonstrated that top-down governance solutions relying on the central role of the state have been a false panacea in the governance of many resources (see Ostrom, Janssen, and Anderies et al. 2007). It has also highlighted the potential of polycentric governance arrangements to handle complex governance challenges. Polycentric order has been defined as "one where many elements are capable of making mutual adjustments for ordering their relationships with one another within a general system of rules where each element acts with independence of other elements" (V. Ostrom 1999, 57). Polycentric order may emerge in a bottom-up way when diverse actors around a phenomenon like climate change seek to realize diverse benefits (or to avoid diverse costs) that accrue on different scales (see Ostrom 2010): for example, mitigation actions do not only generate the global benefit of reduced greenhouse gas emissions and reduced rate of climate change, but they also create co-benefits such as better air quality, reduced reliance on fossil fuels, reduced exposure to their price fluctuations, and improved energy security. These benefits can be a sufficient motivation for mitigation actions, although perhaps not on a comprehensive scale.

A myriad of voluntary climate change initiatives already exist. For example, the Cities for Climate Protection (CCP) programme and the Sustainable Cement Sustainability Initiative (SCSI) represent attempts to address GHG emissions, comparable to those of major emitting states as will be discussed below in greater detail. These initiatives have been successful in reducing GHG emissions or slowing their growth compared with business as usual. However, evidence suggests that voluntary initiatives may be at their best in realizing cost-saving emission reductions. Therefore, state-based and hybrid governance solutions may be needed to complement voluntary ones in order to stabilise atmospheric concentrations of GHGs at a safe level.

5. Examples of polycentric arrangements for climate governance

Polycentric climate change governance can involve a variety of actors, such as local governments and communities, non-governmental and church-based organizations, businesses, and governmental organizations in different combinations and roles. Some of the solutions are limited to one area of activity, such as local governmental activities or industry, while others can be more general in nature. Many of these solutions are voluntarily adopted and have voluntary membership, although the act of joining can create responsibilities. The Cities for Climate Protection (CCP) programme and the Cement Sustainability Initiative (CSI) will be discussed below as examples.

Cities for Climate Protection (CCP) programme

Local governments have developed and implemented governance solutions for reducing the emissions of greenhouse gases from their jurisdictions. The pioneer in this area has been the International Council for Local Environmental Initiatives (ICLEI) with its Cities for Climate Protection (CCP) programme. Others include Climate Alliance, C40, and the U.S. Mayors' Climate Protection Agreement (see Gore 2010; Kern & Bulkeley 2009; Román 2010).

The ICLEI launched its Cities for Climate Protection (CCP) programme in 1993. It aimed to enlist one hundred municipalities worldwide with joint emissions of 1 one billion metric tonnes of CO_2 (ICLEI 1993). The programme also sought to strengthen local commitments to greenhouse gas emission reduction; to develop and disseminate planning and management tools; to research and develop best practices; and to enhance the national and international ties between among municipalities (ibid).

The CCP programme expects those joining it to develop a local action plan to reduce greenhouse gas emissions, to undertake measures to reduce emissions from municipal building stock and vehicle fleets, to institute public awareness campaigns on climate change, and to join procurement initiatives that seek to create demand for climate-friendly products and services. Those joining are also expected to link with local governments in developing country and emerging-economy countries' local governments to foster technological and financial transfers (see ICLEI 1993).

The CCP progress report published in 2006 (ICLEI Local Governments for Sustainability 2006) highlighted that 550 local governments had joined the programme since 1993. Their combined population was a quarter of a billion, or more than 4 percent of the global total. The combined GHG emissions from participating local governments were 1.85 billion tons of eCO_2, or more than 6 percent of the global total (excluding emissions from land use and land use change). That is, GHG emissions of the CCP members are comparable to those of large Annex 1 countries, such as Germany, Japan, and Russia. The participants reduced their joint emissions by 3% or 60 million tons of CO_2 between 1990 and 2006. These emission reductions brought substantial savings to participating cities amounting to about $35 per reduced ton of CO_2 emissions (ICLEI Local Governments for Sustainability 2006, 2).

Cement Sustainability Initiative (CSI)

Another example of climate change governance is provided by the Cement Sustainability Initiative (CSI), a programme of the World Business Council for Sustainable Development (CSI, 2002) that has been considered a model for the "sectoral" approach to climate change mitigation (Schmidt et al. 2008; Meckling and Chung 2009). The cement industry is a significant GHG emitter: its worldwide CO_2 emissions are about 5% percent of the global total, making them comparable to those of Germany, Japan, and Russia in 2004 (CSI 2002; UNDP 2007).

Ten large cement manufacturers formed the CSI in 2002. Its members represent nearly two-thirds of the global cement manufacturing capacity outside China (CSI 2009). The CSI aims to increase the cement industry's contribution to sustainable development and the public understanding of that contribution. The agenda for action adopted in 2002 contained six key areas of work which were 1) climate protection; (2) fuels and raw materials; (3) employee health and safety; (4) emissions reduction; (5) local impacts; and (6) international business processes (CSI 2002, 5). The agenda invited other cement producers to join and committed to reporting on the progress in three years' time (ibid.).

GHG emissions of the cement industry originate from the chemical reactions of the key raw material, limestone (50% of the total), fuel used in the manufacturing processes (40% of the total), and electricity consumption, transport, and other sources (10% of the total). Thus, the initiative encompasses raw material considerations (which influence half of emissions), fuel mix (the use of renewable sources of energy or energy derived from waste); process technology and its efficiency, product quality (which influences the use of cement per output unit), logistics, and other factors.

The CSI developed a CO_2 protocol for use in defining and making publicizing baseline emissions of involved companies. It facilitated the setting of targets by involved companies against their baseline emissions, and annual reporting of CO_2 emissions (CSI 2002, 19-20). The data suggests that CO_2 emissions per produced ton of clinker have decreased 6% between 1990 and 2006. Thermal energy efficiency has improved by 14% over the same period. But the emissions of CSI members increased by 35% because their output grew by 50% in the same period.

The CSI data suggests that operational optimization has limited scope to influence CO_2 emissions because it is tied to the technological design of plants. Industry performance improves through the addition of new, efficient plants and decommissioning of old, inefficient plants. Alternative fossil fuels, waste, and biomass contribute to the fuel mix in different ways in different regions (CSI 2009). Raw material and fuel mix and product choices have substantial potential to reduce sectoral CO_2 emissions over the long run.

Key observations from the examples

Climate change governance initiatives such as the CCP and the CSI can cover GHG emissions comparable to those of major Annex 1 countries. The CCP has also achieved GHG emission reductions comparable to those of major Annex 1 countries, and it has done so by providing cost savings to the participants. The CSI has improved performance compared with business as usual in a period when the cement industry's output grew by 50% (CSI 2009). But voluntary initiatives such as the CCP and the CSI are most likely to realize cost saving emission reductions. These are not insignificant – as Enkvist, Nauclér, and Rosander et al. (2007), suggest, nearly a third of the global emission reductions needed by 2030 would actually provide a net benefit.

New forms of climate change governance may also have other, less tangible implications. The CCP and the CSI have established processes for assessing current performance and for setting targets and planning for their attainment. These processes make performance transparent and can create stakeholder pressure to for further improvement. The CCP and the CSI have also identified and disseminated best practices and have pursued market creation for new climate friendly products and services. So, over time, they may help to bring down the marginal abatement costs of carbon and thus to create new cost-effective measures for reduction of GHG emissions.

But because two-thirds of the GHG emission reductions needed by 2030 entail economic sacrifices, there clearly remains a role for conventional state-based solutions as part of a wider polycentric governance strategy. This raises the question: what should the division of labour beamong state-based, hybrid, and voluntary governance solutions, and how do they interact? Voluntary industry initiatives such as the CSI are likely to benefit from the existence of political commitments because those commitments provide a basis for longer-term planning and investment. State-based governance solutions can also foster and facilitate the functioning of hybrid and voluntary climate change governance initiatives. For example, markets need backing by the states, such as legal recognition and enforceability of contracts in courts, to be credible and to function.

From the other viewpoint, hybrid and voluntary forms of climate change governance may play an important role in legitimizing and mainstreaming climate change to actors participating in them and to external political and economic decision-makers (see Gillard et al, 2017). They may lower the threshold of participating in mitigation activities and increase pressure to make progress in conventional state-based forms of climate change governance. At the same time, voluntary and hybrid forms of climate governance as part of a wider polycentric governance strategy offer a decentralized, flexible, and incentivized way of learning, innovating and experimenting with promising ways of reducing GHG emissions and targeting research and development investments (ibid).

Although the discussion here has focused on the potential and promises of hybrid and voluntary forms of climate change governance, they can also have problematic implications. Collaborative industry initiatives may not in reality be open to all and they may result in restraints on competition. Voluntary initiatives in general are not representative, and their accountability remains unclear. These issues are increasingly drawing attention in research (see Unerman and O'Dwyer 2006; Bäckstrand 2008).

6. Conclusions and future directions

The governance framework for climate change is still largely in the making, but both new institutional arguments about polycentricity and the emerging empirical evidence suggest that institutional diversity will characterize it. The governance framework will partly be based on the UN Framework Convention for Climate Change (UNFCCC) and the protocols and decisions of parties made under it. However, national policies and regulations, sub-national and local policies and plans, and a variety of hybrid and voluntary initiatives will also play a role in climate change governance. Together, these institutional responses will create a wider polycentric governance strategy for climate change that will disperse authority and responsibility.

Although the dynamics of different kinds of institutional solutions as part of a wider polycentric governance strategy largely remains to be studied, something can be said about it. Voluntary and hybrid governance initiatives can clearly be comparable to major Annex 1 countries in terms of GHG emissions and emission-reduction achievements. While these initiatives will be at their best in realizing emission reductions that save money, they can also help to create markets for carbon-friendly products and abatement technologies, and help to bring down the marginal abatement cost of carbon over time. However, climate stabilisation will also require emission reductions that will entail economic sacrifices. This means that state-based governance solutions will remain a part of the wider polycentric governance strategy.

The question is: how different governance solutions within the wider polycentric strategy will interact? Voluntary solutions may benefit from political commitment, which can provide a basis for longer-term planning and investment. State-based governance solutions can also foster hybrid solutions involving markets. Voluntary initiatives may in turn play a role in mainstreaming and legitimising climate change to actors participating in them and to external political and economic decision-makers. They can lower the threshold of participating in voluntary climate change measures and create pressure for making progress in state-based forms of climate change governance. Voluntary and hybrid forms of climate change governance also offer a decentralised, flexible and incentivised way of learning about low-cost and promising ways of reducing greenhouse gas emissions and targeting R&D investments effectively.

There clearly is a need to improve the evidence base on the performance of non-conventional forms of climate change governance and the interaction of different types of governance solutions that form parts of a wider polycentric governance strategy. The scholarship on common-pool resources and polycentricity is well placed to make a contribution because it can draw on both a conceptual apparatus and comparable empirical evidence to draw from.

But climate change is not only a problem of managing and reducing the level of greenhouse gas emissions to avoid dangerous climate change. The atmospheric concentration of greenhouse gases has already increased to a level that will entail long-lasting impacts on a variety of socio-ecological systems. Even ambitious reduction of greenhouse gas emissions in the near future cannot anymore prevent these climate change impacts that are already occurring and intensifying. In the short run, some of the impacts of climate change such as extended growing season in the far north may be beneficial, but in the long run many impacts of climate change will be adverse.

In high latitudes such as Northern Europe and Northern part of North America, mean annual temperatures will increase much more than elsewhere and annual rainfall increases in many places. At the same time, snow and ice cover will reduce in extent and duration. Seasons will change because of a longer growing season and shifts in ecological zones of flora and fauna may also occur. Flood risk will increase, as will the likelihood and impacts of extreme weather in general. At the lower latitudes, which already often experience water stress or scarcity, rainfall will further decrease, which will lead to challenges in agriculture, public water supply and ecosystem management. Yet more extreme weather patterns will still pose increased risk of flooding alongside droughts and increased risk of wildfires. Sea level rise will impact coastal communities everywhere, for example by increasing the impact of given level of sea surges alongside creeping coastal erosion.

Climate change adaptation can include public policies and plans, public or private investments, provision of new private or public goods or services, burden sharing arrangements, or changes in behaviours or practices. For example, national adaptation strategies and plans can establish adaptation priorities and identify the key structures and processes for adaptation. Investments for adaptation can include climate proofing of critical infrastructure for energy, communications or transport. Weather forecasts of different durations and advance warning systems are examples of climate services that can be provided publicly or privately. Insurance and compensation schemes are examples of burden sharing arrangements. Behavioural and practice changes include, for example, farmers altering their crop choices to better handle climate risks.

Many adaptation actions seek to provide either a common pool resource, or a public good. In particular, there is an interest in what is called ecosystem-based climate change adaptation, which can, for example, involve the use of land cover or wetlands to manage flood risks, or the use of urban blue and green infrastructure to alleviate the impacts of heat waves. The provision of these more localized benefits of ecosystems in terms of climate change adaptation is the traditional terrain of commons research, with perhaps a new twist. Ecosystem-based adaptation is also embraced by western developed countries within which provision will take place in the complex institutional setting involving both top-down and bottom-up processes as well as both state and non-state actors.

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