Institutions for the Anthropocene:

Governance in a Changing Earth System

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ABSTRACT

The unusually stable Earth system of the Holocene epoch of the past 10,000 years, in which human civilization arose, is yielding to a more dynamic and unstable Anthropocene driven by human practices. The consequences for key institutions such as states, markets, and global governance, are profound. Path dependency in institutions complicit in destabilizing the Earth system constrains response to this emerging epoch. Institutional analysis can highlight reflexivity as the antidote to problematic path dependency. A more ecological discourse stresses resilience, foresight and state shifts in the Earth system. Ecosystemic reflexivity can be located as the first virtue of political institutions in the Anthropocene. Undermining all

normative institutional models, this analysis enables re-thinking of political institutions in dynamic social-ecological terms.

INTRODUCTION: FROM THE HOLOCENE TO THE ANTHROPOCENE

The Holocene epoch of the last 10,000 years or so is defined by highly unusual stability in the Earth system. In particular, the climate system shows little variability compared to the preceding late Pleistocene.[1] The Holocene is now giving way to the Anthropocene, in which human influences introduce instability in the Earth system of a degree unprecedented in human history – but common in geological time. This paper addresses the profound consequences for all political institutions, not just those parts of government normally classified as environmental.

The International Commission on Stratigraphy is due to report in 2016 on whether the Anthropocene should be recognized formally as an epoch (in geological time), though the concept is already being deployed by scientists in many disciplines. The idea was popularized by Nobel Prize-winning chemist Paul Crutzen, for whom the Anthropocene is first intimated in rising carbon dioxide and methane levels in the atmosphere in the mid-18th century.[2] So we have been living in the Anthropocene for 250 years (without knowing it). But the departure from the Holocene only really takes off in the 1950s, in what Steffen et al refer to as 'the great acceleration'.[3] For example, by 1945 atmospheric carbon dioxide concentration was only about 25ppm above its preindustrial level of 280 ppm; by 2013 it was 120 ppm

[1] Steffen et al 2011, 747.
[2] Crutzen and Stoermer 2000.
[3] Steffen et al 2007, 616-17.

above the preindustrial level. Similar stories can be told for many other indicators, such as nitrous oxide and methane concentrations, ozone depletion, forest loss, land conversion, and biodiversity loss. The net result is 'an unintended experiment of humankind on its own life support system',[4] such that humans 'are not just spreading over the planet, but are changing the way it works.'[5] The possibility arises of catastrophic tipping points in the Earth system, perhaps precipitated by melting of the Greenland ice cap, or wholesale tropical deforestation.[6]

In light of the absence of fixed reference points in ever-unfolding social-ecological systems, I will argue that institutions for the Anthropocene are better analyzed not in light of static criteria (such as efficiency, coordination, robustness, or even respecting global ecological limits), but rather in dynamic terms. A dynamic approach can be found in historical institutionalism, which therefore provides an appropriate starting point. The persistence of dysfunctional institutions can be understood as a result of their path dependency. Problematic path dependencies established in the late Holocene point to the need for institutions capable of anticipating ecological state shifts and transforming themselves accordingly. Reflexivity, the ability of a structure, process or set of ideas to change itself in light of reflection on its performance, is the opposite of path dependency. But reflexivity as generally conceptualized does not recognize the active influence of the Earth system itself. A discourse of resilience, now prominent in global environmental change intellectual circles, can render reflexivity more truly ecological. Ecosystemic

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[4] Steffen et al 2007, 614.
[5] *Economist*, 2011.
[6] Lenton et al 2008.

reflexivity proves to be the primary requirement for institutions in the Anthropocene.

I begin with a brief look at how environmental concern has fared in institutions developed under perceived Holocoene conditions. I then expand on the challenge of the Anthropocene, and in particular the problematic institutional path dependencies it reveals. Next I introduce reflexivity as the antidote to path dependency, and add some ecological content through reference to resilience. The possibility of catastrophic ecological state shifts is then linked to the historical institutionalist idea of critical junctures, though the primary need here is foresight in order to prevent such shifts. I then explore the discursive aspects of institutional practice and the promise that can be found therein, before turning to the implications of the argument for institutional analysis and design, with a view to identifying practical possibilities for the advancement of ecosystemic reflexivity.

INSTITUTIONS IN THE HOLOCENE

It is during the Holocene that civilization – and its political institutions – arose, and so this epoch represents 'the only state of the Earth system that we know for sure can support contemporary society'.[7] This unusual stability meant that political and economic institutions could often take for granted the presence of the nonhuman world and the ecological systems in which human societies are embedded - though local ecological collapses did spell the end of some societies.[8] Of course the nonhuman world was vital for human existence, and resource-dependent

[7] Steffen et al 2011, 739.
[8] Diamond 2005.

communities often created institutions to prevent the abuse of commons resources.[9] But even in these cases, institutional success came most straightforwardly in the form of rules or informal arrangements to control access, rather than in adaptation to ecological dynamism of the sort that could be expected were stable Holocene conditions to change. And once we move beyond the local level, Holocene institutions eventually proved adept at simply ignoring ecological constraints because they were decoupled from local resource limitations.

Above the local level, the main political institution of the modern (late Holocene) era is the state. As Skocpol points out, early modern states had to do three things: keep order internally, respond to external threats, and raise the finance necessary for the first two tasks.[10] As states took on more functions – notably for ensuring economic growth and providing social welfare – the nonhuman world was still ignored. This world was suppressed by an implicit 'ecological contract' that parallels the 'sexual contract' portrayed by Pateman and the 'racial contract' described by Mills.[11] Pateman and Mills point out that the association of some individuals into the state for their mutual benefit was made possible by repression of others on the basis of (respectively) sex and race. Similarly, the implicit ecological contract in liberal societies involves creation of mutual benefit for humans requiring domination of nonhuman nature. In each case – sex, race, and ecology – domination long went unproblematized by political thinkers in the Western tradition and taken for granted in dominant institutions.

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[9] Ostrom 1990.
[10] Skocpol 1979.
[11] Pateman 1988; Mills 1997.

Liberal democracies eventually came to do a better job in recognizing ecological concerns. Recognition of the ecological challenge to the political economy first peaked in the 1970s with the publication of *The Limits to Growth*, which tried to show that if existing global trends in population and economic growth continued, the world faced a future of economic and social collapse once global carrying capacity was exceeded.[12] The *Limits to Growth* did contain some policy prescriptions – notably, an endorsement of John Stuart Mill's old idea of a 'stationary state'[13] - but said little about how political institutions would need to change.

Before the 1970s states had of course begun to take on responsibility for natural resource management and (eventually) environmental protection, and the scope of such concerns did see some expansion around this time, which has continued incrementally (along with a few setbacks). However, ecological concerns remained subordinate to the core economic, security, and welfare priorities of states.[14] States engage with each other in attempts to negotiate global environmental agreements but to date they fall far short of the sort of action that the *Limits to Growth* implied was necessary. The 1987 Montreal Protocol for protection of the ozone layer remains the only unambiguous successful effective collective response to a potentially catastrophic problem.

Existing institutions did not, then, rise to the challenge encapsulated in *Limits.* The limits concept has fluctuated in its prominence in global environmental affairs since the 1970s, but it never quite went away. The concept lingers in the

[12] Meadows et al 1972.
[13] Meadows et al 1972, 175.
[14] Dryzek et al 2003.

background of the sustainable development discourse so prominent in these affairs since the publication in 1987 of the Brundtland report to the United Nations, *Our Common Future*, while treated in ambiguous fashion.[15] It provides a sense of urgency to more radical sorts of green politics.[16] Limits thinking also informs the idea of 'planetary boundaries'. While dispensing with the idea of global carrying capacity and careful to frame their efforts in terms of complex systems (enabling greater sophistication than the 1970s *Limits* efforts), Rockström et al identify nine boundaries which together define a "safe operating space for humanity" in the Earth system.[17] Three of these boundaries have already been transgressed: the carbon dioxide concentration in the atmosphere is at 400 parts per million (and rising), compared to a boundary of 350 ppm. Interference with the nitrogen cycle and the rate of biodiversity loss (as indicated by species extinctions) are also judged by Rockström et al to have exceeded their associated boundaries.

ENTERING THE ANTHROPOCENE

Recognition of the Anthropocene means that ecological limits or even boundaries no longer provide a sufficient frame for thinking about global environmental affairs. As we will now see, the Anthropocene provides a more profound challenge to human institutions than the idea of ecological limits. The Anthropocene means the nonhuman world has a much greater claim upon us and our institutions and

[15] World Commission on Environment and Development 1987, 45.
[16] Dobson 1990, 73.
[17] Rockström et al 2009.

practices than before – because that world is so thoroughly inflected with human forces inducing potentially catastrophic instability.

In the Anthropocene, ecosystems are not just external constraints on human activity. We are not just in the system; we also help drive its parameters. So what makes the Anthropocene different is the lack of fixed reference points for collective action given by the desirable state of key systems, and that includes planetary boundaries (even though some of the scientists prominent in advancing the Anthropocene concept also helped formulate the planetary boundaries idea). Boundaries lose precision in the face of the dynamic and unstable character of the Earth system. Just as for limits, the imagery of planetary boundaries is static. So for example 350 ppm as the boundary for carbon dioxide in the atmosphere is fixed, no matter what further change is introduced in the Earth system by human actions. Consider two extremes: successful geoengineering to block solar radiation would stretch the 350ppm boundary; catastrophic loss of biodiversity would suggest the boundary should be tightened. The prescription to stay within planetary boundaries is actually a plea to maintain (or return to) the conditions of the Holocene, and prevent humanity entering the Anthropocene.[18] Yet if we have already entered the Anthropocene in a serious way, that is not enough.

Planetary boundaries can however still perform a vital heuristic function by identifying the aspects of the earth system requiring the most urgent governance attention. If Rockström et al are right then these are climate change, biodiversity,

[18] Dryzek, Norgaard, and Schlosberg 2013, 117.

and the nitrogen cycle.[19] Assuming stable Holocene conditions for governance in other areas has less immediately catastrophic consequences. Yet even here caution is in order, because the interconnected nature of complex systems means particular areas of governance should not be sealed off from one another, so at a minimum should come under common meta-governance. In addition, good governance should also anticipate potential long term problems, rather than simply respond to imminent disaster in particular areas.

The Anthropocene does, then, not just amplify existing ecological concerns: it changes their *content* by putting humans at the center of causal processes in the Earth system. In highlighting the vulnerability of the character of the system on which we depend to human action, it also confirms that this system is not something out there demanding limited and occasional attention. Rather, human-induced instability means this system is a key player in how human history will unfold.

Before proceeding to the implications for institutions, it is important to avoid the pitfall of using the Anthropocene concept simply to legitimate a more interventionist and controlling approach to the non-human world. Here some recent debates in conservation biology are instructive. In the United States, the Nature Conservancy in particular is now associated with an interventionist position that treats nonhuman nature as a repository of 'natural capital' that can be cultivated to provide 'ecosystem services' quantifiable in monetary terms, amenable to being traded off against more conventional monetary benefits from resource extraction. This approach appalls conservation biologists led by Michael Soulé, who believes

[19] Rockström et al 2009.

this kind of thinking facilitates attacks on biodiversity and so 'will hasten ecological collapse globally'.[20]

How then might we think productively about institutions appropriate to the Anthropocene?

PROBLEMATIC INSTITUTIONAL PATH DEPENDENCY

Most definitions of 'institution' assume continuity over time. So Goodin refers to 'the stable, recurring, repetitive, patterned nature of the behavior that occurs within institutions, and because of them.'[21] Of course the degree of continuity can vary, and as we enter the Anthropocene, strong continuity looks problematic. The persistence of sub-optimal institutions (the classic illustration is the inefficient QWERTY keyboard, originally designed to inhibit typewriter keys jamming) has been illuminated by historical institutionalists, who point out that institutions are path-dependent.[22] Path dependency means that early decisions constrain later ones, as the costs of changing course become high, actors develop material stakes in stable institutions, and institutions arrange feedback that reinforces their own necessity (consider for example how market institutions punish policy deviations from market orthodoxy). The ideas and norms generated by an institution's operation can further solidify the path. What all this means is that an established institution may constrain possibilities for future choice across institutions by its mere presence. So

[20] Soulé 2013, 896.
[21] Goodin 1996a, 22.
[22] Pierson 2004; Sanders 2006.

even institutions that fail in the face of changing conditions may persist.[23] Truly powerful institutions may be able to change their social environment in order to perpetuate themselves and drive out alternatives. Think for example of the institutions of global finance, which despite their failure as revealed by the global financial crisis of 2008, positioned themselves as essential ('too big to fail') and so foreclosed alternatives, meaning that after a few bailouts the post-2008 system looked very much like the pre-2008 one. The United Nations Framework Convention on Climate Change (UNFCCC) established in 1992 fails to produce a comprehensive global treaty on greenhouse gas emission limitation – but nevertheless that aspiration remains the focus for efforts by governments, civil society, and corporations concerned with climate change.

Historical institutionalists generally confine themselves to explanation of 'the construction, maintenance, and adaptation of institutions':[24] they have little interest in institutional evaluation and prescription.[25] However, their insights can be drawn upon to illuminate common institutional characteristics that look pervasive in the Holocene, but become problematic in the Anthropocene. Foremost among these characteristics is path dependency. Now, if an institution has manifestly good consequences, then strong path dependency associated with it would not be a problem. But many of the institutions that developed in the Holocene, such as sovereign states and capitalist markets, were complicit in generation of the unstable Earth system that now characterizes the Anthropocene. States have a priority for

[23] Young 2010.
[24] Sanders 2006, 42.
[25] For an argument that they should, see Kuyper 2013.

economic growth that subordinates ecological concerns, and a preoccupation with sovereignty that impedes global collective action. Capitalist markets for their part are equally addicted to material growth, and only recognize ecological constraints when forced to do so by non-market forces (such as government regulators).

High path dependency in institutions for environmental governance (such as a wildlife protection authority) may be fine if preservation or conservation (of species, ecosystems, or the capacity of the environment to absorb wastes) are at issue. But in the Anthropocene, co-evolution may often be a more appropriate metaphor than preservation or conservation. Co-evolution implies a dynamic relationship in which human influences on the character of a social-ecological system are unavoidable but should strive to respect non-human interests.[26] Preservation and conservation problematically imply that there is a fixed target ecological state given by non-human nature.

If Holocene institutions are now problematic to the degree they feature path dependency by generating feedback loops that avoid ever-changing ecological systems, how might we think of arrangements in human society more appropriate to the Anthropocene? We might begin by noting that institutions can vary in their degree of path dependency, such that we can envisage institutions for the Anthropocene that are able to adapt to a rapidly changing (and potentially catastrophic) social-ecological context. For example, markets can adapt to constitute what Newell and Paterson call 'climate capitalism' by being stretched to encompass

[26] Norgaard 1988.

trade in emissions permits, offsets, and efficient clean technologies, with money to be made by corporations participating in this new economy.[27]

Adaptive capacity may not however go far enough, for even institutions that do adapt can remain significant sources of instability in the Earth system. For example, the (limited) adaptation of markets to climate change has been accompanied by a host of problems: the dirtiest polluters may also be those with the power to secure exemption from emissions trading schemes;[28] offsets may simply enable high-polluting activities to continue, while proving ecologically destructive to (say) the tropical ecosystems where fast-growing tree species are introduced; and even without such problems of implementation, such schemes may simply render the material growth imperative of the political economy (encompassing governments as well as markets) more secure. Even if greater energy efficiency is secured by and in a market economy, the resulting increase in disposable income might lead to further stress on ecological systems. In this light, adaptiveness does not necessarily mean that institutions have freed themselves from the path dependency secured by their effective response to imperatives generated (and which, in responding, they help solidify) in social systems that behave as though the ecological dimension did not exist. It may simply mean that they can perpetuate themselves in a more unstable social-ecological context – yet in the end do little to reduce that instability, and indeed continue to contribute to the production of instability.

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[27] Newell and Paterson 2010.
[28] Spash 2010.

REFLEXIVITY

The opposite of path dependency is actually reflexivity, not adaptiveness. Reflexivity in a social context means the self-critical capacity of a structure or process or set of ideas to change itself after scrutiny of its own failures (or successes).[29] Reflexivity entails a capacity to *be* something different rather than just *do* something different, which distinguishes it from adaptive management and governance. Adaptive management is a response to uncertainty, involving willingness to learn from success and failure.[30] Adaptive governance has larger ambitions for the reorientation of government agencies (or sets of agencies). Both take the structure of government and the goals of policy as given, and so work within an administrative logic. So for example Folke et al's exemplar is a new system for wetlands management in Sweden, which 'took place within the existing institutional framework'.[31] Camacho's exemplars from US environmental policy (the Climate Ready Estuaries and Interagency Climate Change Science programs) were limited by their inability to find a way to engender the required learning capacity in government.[32]

At the global level, the most successful example of adaptive governance may be found following the 1987 Montreal Protocol for the protection of the ozone layer, involving 'broad stakeholder participation, revisability of goals, and continuous learning from the monitoring of performance'.[33] Yet ozone presents a relatively easy

[29] Beck, Giddens, and Lash 1994.
[30] National Research Council 2010.
[31] Folke et al 2005, 457
[32] Camacho 2009, 59-64.
[33] de Búrca, Keohane, and Sabel 2013, 268.

case where the benefits of action massively exceed the costs, and only a few non-essential chemicals need regulating, thus easily resolved within the dominant institutional order. More substantial capacity for institutional self-transformation may be required for tougher issues like climate change. So the United Nations Framework Convention on Climate Change (UNFCCC) makes some sense in the context of an international system whose dominant actors are sovereign states, and where legitimate collective global action must rest on agreement among sovereign states. The UNFCCC serves some legitimation needs of that particular social system. But its efforts to produce a comprehensive global treaty have led to prolonged impasse. A reflexive institution would recognize and learn from this failure, and try to be something different. In the case of the UNFCCC, that might for example mean questioning the aspiration to produce a comprehensive global treaty, and seeing the UNFCCC instead as an institution that oversees and coordinates numerous (polycentric) emerging governance initiatives on climate change, while still attending to global targets for climate change mitigation.[34] None of these initiatives need be comprehensive in its membership (ie, would not require participation of all the world's states), and they might involve many different configurations of actors, be they national, regional, or local governments, international organizations, corporations, or civil society activists and organizations. And if this new role proved inadequate, the UNFCCC would need to change further.

Reflexivity implies that thinking in terms of institutional models is of limited utility insofar as a model connotes something fixed and static, rather than reflexive

[34] Stevenson and Dryzek 2014, 194-5.

and dynamic. So the comparative statics of institutions is going to be less helpful than thinking about open-ended processes of reconstruction. Comparative statics in social-ecological analysis of institutions appears, for example, in chapter 1 of Ostrom's *Governing the Commons*, where she lays out three normative institutional models, featuring respectively central control of the commons, dividing the commons into chunks of private property, and cooperation among commoners, with a view to deciding which of the three is more likely to maintain the quality of the commons.[35] Reflexivity means the reference point for processes of reconstruction is where we are now in real situations.

RESILIENCE DISCOURSE AND ECOSYSTEMIC REFLEXIVITY

Reflexivity is normally portrayed as an attribute of human social systems such as institutions (or of individuals). But in the Anthropocene, consistent with the idea that the Earth system itself becomes recognized as a key player, the crucial entities are social-ecological systems, rather than social systems per se. The human components of social-ecological systems can then respond not just to human voices, but also to the non-human components of social-ecological systems that have no voice – but to which we can try to listen better.[36] Listening means first recognizing the existence and importance of these systems, and then organizing information on their condition and trajectory into decision making. Here, social-ecological systems can be illuminated by the idea of resilience (which can also apply to ecological

[35] See also Dryzek 1987, part II, comparing markets, administered systems, and polyarchy in terms of a common set of criteria. Ostrom 1990, 184 and 214 and Dryzek 1987, 244-5 eventually proceed to recognize the limits of models.
[36] Schlosberg 2007, 190-2; Dobson 2010.

systems without human elements). While providing an essential ecological corrective, resilience proves to have its own ambiguities, especially when it comes to social institutions, eventually pointing to an enhanced notion of ecosystemic reflexivity as the main institutional desideratum.

According to the Resilience Alliance, a large global network of natural and social scientists, resilience is 'the ability to absorb disturbances, to be changed and then to re-organise and still have the same identity (retain the same basic structure and ways of functioning)'.[37] This definition would seem to rest on the notion that there is some core structure that provides fixed reference points: the idea of resilience is to return to these reference points from a situation of disequilibrium caused by shocks to the system. That is why, for historical institutionalists, resilience is actually one of the *causes* of path dependency,[38] rather than a solution to problems created by path dependency. So in the Anthropocene we would want social-ecological systems to be resilient, but not want institutions that generate feedback avoiding ecological systems to be resilient. We can find examples of long-lived social-ecological systems that are resilient (in the terms of the Resilience Alliance definition) existing in humanity's past (for example, agro-ecosystems that have flourished for hundreds of years) – but not in industrial society.

Resilience was originally conceptualized in terms of a capacity to return to equilibrium after disturbance.[39] Multiple equilibria might also be recognized, where flipping from one equilibrium to another means that resilience has been stretched

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[37] http://www.resalliance.org/index.php/key_concepts.
[38] Pierson 2004.
[39] Folke 2006, 256.

beyond breaking point, and the new equilibrium is a degraded system.[40] An example of the latter might be when catastrophic fires destroy a forest (possibly because natural small fires have not been allowed to burn). However, if there are no clear equilibrium states, but rather evolving dynamism in social-ecological systems, then resilience needs to involve action that is constructive and dynamic, not preservative. In this light, resilience does not just imply the capacity to absorb stress and return to some status quo ante, as feared by for example Catney and Doyle, who see it as a way to suppress human betterment.[41] Folke et al treat 'transformability' as a subcategory of resilience,[42] though that conceptual stretching introduces a tension with the basic Resilience Alliance definition quoted earlier because it is not clear whether 'basic structure' is to be preserved.

Resilience might also seek to preserve some core values (e.g., basic needs and capabilities, biodiversity) while accepting that the structure of social-ecological systems can change. However, holding on to core values can itself cause social collapse if they do not adjust to changes in the world. Diamond argues that societies can cling to core values that eventually contribute to their demise.[43] For example, the Greenland Norse clung to European values and ways of life while resisting Inuit sensibilities and practices that would have facilitated survival. Thus core values should not be immune to reflexive scrutiny, though in Diamond's analysis the key core value of societal survival appears non-negotiable. When it comes to the core

[40] See for example Ostrom and Janssen 2004, 247.
[41] Catney and Doyle 2011, 190.
[42] Folke et al 2010.
[43] Diamond 2005.

value of justice, some theorists have begun to re-think what justice can mean in light of ecological concerns.[44]

In light of its multiple and stretched definitions and concomitant reasonable disagreement over its meaning, it is better to treat resilience as a discourse rather than a concept (just as 'sustainable development' and 'democracy' can be treated as discourses rather than concepts that can be defined with any precision). The discourse of resilience sharpens the concept of reflexivity by stressing that the Earth system can be an active participant in how history unfolds. Institutional reflexivity therefore needs to encompass the Earth system in a co-evolutionary relationship.[45] The resulting *ecosystemic reflexivity* (it could be called socio-ecosystemic reflexivity, but that is too much of a mouthful) differs from simple reflexivity in at least two ways I have discussed: the incorporation into human institutions of better ways to listen to ecological systems that have no voice; and an ability to re-think what core values such as justice mean in the context of an active and unstable Earth system (so Mulgan analyses how justice would look in a 'broken world' of insufficient resources and chaotic environment).[46]

This capacity to re-think social values does not mean that ecosystemic reflexivity lacks ethical content. For reflexivity implies an inquiring society that is not the prisoner of historical forces, whose members are autonomous, capable of critical questioning and jointly able to chart a developmental path. Ecosystemic reflexivity adds a dynamic twist to Holland's idea that 'sustainable ecological

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[44] Schlosberg 2007.
[45] On the basic idea of co-evolution, see Norgaard 1988.
[46] Mulgan 2011.

capacity' is a meta-capability necessary for pursuit of all the other capabilities that constitute social justice.[47] This dynamic twist also fits well with Amartya Sen's ethics of 'development as freedom', given that Sen insists that the capabilities that constitute justice should not be treated as a fixed list (such as health, bodily integrity, affiliation with others), but rather subject to continual rethinking in participatory processes of public reason.[48] So while the famous assertion of leading Holocene political theorist John Rawls that 'justice is the first virtue of social institutions' is hard to sustain, justice can nevertheless remain central to the ethics of reflexivity in the Anthropocene.[49]

Another key idea from resilience discourse further illuminates ecosystemic reflexivity – that of state shifts, which can be linked to historical institutionalist thinking about critical junctures.

STATE SHIFTS AND CRITICAL JUNCTURES IN THE EARTH SYSTEM

The dynamism and instability of social-ecological systems in the Anthropocene is revealed most dramatically in the renewed possibility of state shifts in the Earth system, where apparent stability yields suddenly to a qualitatively different system. Gunderson and Holling suggest that social and ecological systems alike generally feature slow change with occasional bursts of reorganization.[50] The Holocene was a period of unusual stability in which ecological state shifts were relatively rare, and did not occur at the global level, in contrast to the preceding Pleistocene, which

[47] Holland 2008.
[48] Sen 1999.
[49] Rawls 1971, 3.
[50] Gunderson and Holling 2002.

featured frequent rapid global warmings.[51] So such shifts have occurred in Earth's deeper history, each attended by mass extinctions of species.[52]

Might such a state shift provide the occasion for a reworking of institutional orders? After all, in purely human affairs, the extreme pressure of what historical institutionalists call critical junctures can induce institutional transformation. The basic institutions of the international system have transformed themselves in the wake of total war, at the Treaty of Westphalia in 1648, the Congress of Vienna in 1815, The Treaty of Versailles in 1919, Bretton Woods followed by the establishment of the United Nations system after 1945. World War II also demonstrated how quickly states could transform their economies from consumer-oriented markets to centrally-planned systems with broad provisions for social welfare to serve war making. These sorts of precedents lead Biermann et al to call for a "constitutional moment" in global environmental governance as we enter the Anthropocene.[53] Referring more explicitly to state shifts, Young concludes by recommending 'that well-crafted options are available when crises open up windows of opportunity for the introduction of substantial institutional changes.'[54] There are several issues here.

First, there is no guarantee that a state shift will receive any response at all – witness again Diamond's argument about societies that collapsed in the face of local or regional state shifts.[55] The possibility that there will be no effective response is

[51] Steffen et al 2011, 752.
[52] Barnosky et al 2012.
[53] Biermann et al 2012a.
[54] Young 2010, 384.
[55] Diamond 2005.

increased by the fact that while some ecological state shifts may look sudden in geological time, in human time they will seem prolonged, and so not yield the same sort of immediacy as (for example) reconstruction after total war. Climate change exemplifies this problem (more local cases such as collapse of a fishery can be sudden in human time).

A second problem is that reworking in the context of crisis may be inadequate if the product is stable institutions embodying path dependency then contributing to further social-ecological instability. Consider, in this light, the raft of environmental laws and agencies established around 1970 in the United States. Created in response to a legitimation crisis rather than an ecological state shift (the Nixon administration successfully pulled environmentalists out of the counterculture and into the political mainstream through its actions), this burst of institutional innovation made the United States an environmental leader among the countries of the world.[56] However, this moment of institutional reconstruction also established the terms of a standoff between environmental and development interests that continues to this day, preventing subsequent reforms. Stuck in this standoff, the US found it hard even to explore, let alone institutionalize, ideas about sustainable development and ecological modernization that gained currency and influenced policy practice elsewhere in the world.[57] The United States turned from leader to laggard in environmental affairs, and eventually one of the primary impediments to effective global action (its last exemplary global contribution was in 1987 with the Montreal Protocol).

[56] Dryzek et al 2003, 59-60.
[57] Bryner 2000, 277.

These two problems suggest that critical junctures of the sort an ecological state shift connotes do not guarantee positive institutional response. Moreover, if response does come, it does not necessarily connote impetus for continuing transformation, as opposed to renewed and problematic path dependency. Thus recognition of the opportunities provided by state shifts and critical junctures does not obviate the need for more permanent institutional reflexivity.

FORESIGHT AND THE ANTICIPATION OF STATE SHIFTS

A further reason why institutional transformation needs to be more than just something possible in response to a great crisis such as an ecological state shift stems from the possibility that (dysfunctional) institutions may be complicit in the production of catastrophic state shifts in social-ecological systems. Relying on institutional transformation in response to such shifts is therefore not enough. An ecological state shift is one thing institutions should be trying to avoid or at least ameliorate, given that historically such state shifts have often been accompanied by catastrophe (such as mass extinctions). Required therefore is a measure of *foresight*, which is more than concern for the future effects of current actions and a recognition that what worked in the past will not necessarily work in the future. Foresight also has to involve a capacity to anticipate anthropogenic state shifts and act before the shift occurs. This is a demanding criterion: it suggests embodiment of responsiveness to early warnings of the sort that at the moment only science seems capable of providing. We see today that early warnings of the sort given by climate science can meet with a storm of political opposition, as those who believe their

material interests will be hurt by anticipatory action mobilize against not just the action, but also against the science that makes action necessary.

A substantial body of work in communicating climate change can be drawn upon here to inform institutional design that would receive – and possibly respond – to such early warnings more effectively. To summarize radically, most people (including politicians) accord low priority to climate change. Those who do care (at least in the more problematic Anglo-American countries) process scientific claims about climate change through ideological filters, and certainly not through dispassionate assessment of the science.[58] This means that communicators such as Al Gore, who received a Nobel Peace Prize for his efforts, can reach those ideologically disposed to act upon climate change, but not those ideologically opposed. We also know that more knowledge does not necessarily lead to change in behavior or political action, that frightening people with disastrous scenarios is generally counterproductive, and that asserting the authority of science has no effect.[59] Based on studies that show what does not work in communicating climate change, and what does work in public health, Moser and Dilling conclude that 'people in a democratic society are best served by actively engaging with an issue, making their voices and values heard, and contributing to the formulation of societal responses' as opposed to being seen as the target of mass media messages.[60] Of course the science as such will continue to be produced by the scientists, but broader participation involving ordinary people in face-to-face communication

[58] McCright and Dunlap 2011.
[59] Moser and Dilling 2011, 164-5.
[60] Moser and Dilling 2011, 169.

about climate change with experts and advocates could help establish the agenda of questions for scientists that need answering, prioritize problems that need to be addressed, interpret the importance of scientific findings, and reconcile scientific findings with lay knowledge. In short, this agenda would involve the deliberative democratization of climate science. While there are plenty of examples from around the world of citizen deliberations that hear from experts (especially on climate change; most ambitiously, the Alberta Climate Dialogue, running from 2010 to 2015), they have all been oriented to public policy rather than science. But many scientists themselves recognize the need to engage more effectively about the science with citizen deliberators.[61] The more general point is that ecosystemic reflexivity requires a capacity to seek, receive, interpret and act upon early warnings as provided by science.

DISCURSIVE CONTRIBUTIONS TO ECOSYSTEMIC REFLEXIVITY

This invocation of deliberation in the context of foresight points to the relevance of discursive institutionalism,[62] which allows human agency to disrupt structural historical forces. Now, the discursive realm is not entirely immune from such forces; as Hay argues, ideas that underpin institutions too can be subject to path dependency, as actors in institutions benefit from the persistence of those ideas.[63] However, recognition of this realm can help identify points of leverage that can be

[61] Dietz 2013.
[62] Schmidt 2008.
[63] Hay 2006, 65.

put in the service of reflexivity, especially if 'path-shaping institutional change is not merely seen as a more-or-less functional response to exogenous shocks'.[64]

Deliberation is one of those points of leverage. Some very large claims have been made for the efficacy of deliberation in social-ecological contexts,[65] with some empirical support. So for example World Wide Views ran citizen deliberations on climate policy in 38 countries on the same day in 2009 using the same model; in just about every country participants favored stronger action than their governments were prepared to undertake.[66] The claims include deliberation's ability to integrate the interests and perspectives of diverse actors (scientists, public officials, activists, and others) concerned with different aspects of complex issues, promote public goods and generalizable interests, enlarge the perspectives of participants by bringing to mind those not physically present – such as future generations and nonhuman nature,[67] and organizing feedback on the state of social-ecological systems into political processes. While earlier I pointed to the danger of relying on transformation amid crisis, deliberation does increase the likelihood of positive response to (e.g.) legitimation crisis of the sort that occurred in the United States around 1970, or even something like an ecological state shift. Ackerman's analysis of three transformative moments in the history of the United States provides some clues.[68] These occasions were the Constitutional Founding, the civil war amendments to the constitution, and the New Deal. What characterized all three

[64] Hay 2006, 65.
[65] Smith 2003; Baber and Bartlett 2007.
[66] Rask, Worthington, and Lammi 2012.
[67] Goodin 1996b.
[68] Ackerman 1991.

moments was intense deliberation encompassing all the institutions of government – and much of civil society – simultaneously, in response to a great crisis of the state. This kind of intense engagement, featuring deep reflection about what constitutes the common good (though nothing like unanimity in how that good should be defined), was on Ackerman's account very different from politics as usual.

Institutions are in large measure discursive constructions: they work because of a convergence of expectations and understandings, not just formal rules.[69] So for example market liberal globalization is so powerful in large measure because it permeates the understandings of actors in the political economy.[70] Policy deviations from its orthodoxy are punished not just by impersonal market forces, but because people in key positions in financial and economic institutions believe those deviations will have negative economic consequences, and so (for example) disinvest in the deviant state. In global financial affairs, this set of understandings has so far been largely impervious to being shifted by deliberative scrutiny, rhetorical interventions, or anything else, but that is not necessarily the case in other areas. For example, the invocation of the idea of sustainable development by Brundtland was an attempt to show that environmental concern (and social justice) did not have to challenge conventional material growth;[71] Brundtland did not prove or really even argue that such reconciliation was possible, but rather asserted it with great force. Thus was the rise of the discourse of sustainable development on the world stage secured. The net environmental effects of its rise to global

[69] Schmidt 2008.
[70] Hay and Rosamond 2002.
[71] World Commission on Environment and Development 1987.

prominence remain debatable, as the years since Brundtland have seen sustainable development become ever more reconciled to conventional ideas about economic growth.[72] A less ambiguous success story can be found in connection with the 1987 Montreal Protocol. Litfin demonstrates the rhetorical force that the idea of an 'ozone hole' in the Southern hemisphere advanced by scientists and environmental activists had on negotiations, dramatically raising the standing of what she calls a 'precautionary' discourse and so making agreement on effective global action possible.[73] The Montreal Protocol eventually yielded a good example of what de Búrca, Keohane, and Sabel call 'experimental global governance', featuring 'deliberative, joint rule making'.[74]

At an extreme, the importance of the discursive realm in social-ecological affairs has been highlighted by those who speak of the 'end of nature' as an unproblematic reference point. According to Cronon, environmentalists and so environmental policy had often erred in their identification of what was to be preserved, conserved, or restored.[75] In particular, their images of pristine wilderness either picked one point from the past, or did not actually correspond to any historical state. The historical role of indigenous peoples in constituting ecosystems often went unrecognized. Postmodernists could run with this kind of thinking to argue that ecology is *only* a social construction, one that serves the power of some (scientists and administrators) against others.[76] There is indeed a

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[72] Parr 2009.
[73] Litfin 1994.
[74] de Búrca, Keohane, and Sabel 2013, 780.
[75] Cronon 1995.
[76] Latour, long associated with this view, eventually retreated; see Latour 2004.

sense in which the Earth system in the Anthropocene is a human construction; but that sense is material as well as symbolic, as human activity strongly affects the workings of the Earth system, not just the way we interpret its workings. But as the 'end of nature' argument makes clear, such interpretations (whether or not they are of 'nature') have major implications for what institutions do.

EVALUATING AND DESIGNING INSTITUTIONS FOR THE ANTHROPOCENE

The idea of ecosystemic reflexivity can shed light on existing approaches to the evaluation and design of institutions for the Anthropocene, and indicate how we might do better. Folke et al, key figures in the Resilience Alliance, suggest that 'The attributes of transformability have much in common with those of general resilience, including high levels of all forms of capital, diversity in landscapes and seascapes and of institutions, actor groups, and networks, learning platforms, collective action, and support from higher scales in the governance structure.'[77] Yet such generalities actually tell us very little; exactly what kinds of 'diverse institutions' should enter into the mix? If it is a diversity of (say) capitalist markets, low-visibility financial networks, and sovereign states, subject individually and jointly to problematic path dependencies, the mix may well be worse than any of its components. 'All forms of capital' require scrutiny rather than endorsement: social capital[78] may actually impede reflexivity if it is solidified by avoidance of contemplation of controversial

[77] Folke et al 2010.
[78] Further stressed by Folke, Hahn, Olsson and Norberg 2005, 449-52.

issues that threaten social cohesion (as suggested by Eliasoph in her studies of political culture in the United States[79]).

A very different institutional prescription for the Anthropocene was published in *Science* by Biermann et al, members of the Earth System Governance Project.[80] This Project was established in 2008, and constitutes the world's biggest network of environmental political scientists. Essentially Biermann et al recommend stronger and more coordinated institutions of global governance. But there is no real argument in this piece that this is what the Anthropocene truly requires; indeed, though 'Navigating the Anthropocene' is the title of the article, the word 'Anthropocene' does not appear in its text. We might for example ask why something with a modest record – central management of environmental affairs – should be picked out from the repertoire of available collective human responses and given a task far harder than it has shown itself capable of accomplishing so far.[81] The real significance of the Biermann et al article lies not in the content of its argument, but in the fact of its publication by 32 social (mostly political) scientists in the world's highest-profile scientific journal (this short article does not do justice to the richness of the work undertaken by members of the Earth System Governance project). Biermann elsewhere develops a more nuanced argument to the effect that the global institutional problem is 'lack of integration of economic and environmental policies', along with 'institutional fragmentation and weakness of the

[79] Eliasoph 1998.
[80] Biermann et al 2012a.
[81] On the shortcomings of environmental management and administration, see Ostrom and Janssen 2004, 243-5; Paehlke and Torgerson 2005.

environmental pillar of sustainable development'.[82] If that is the problem then more integration and institutional centralization are indeed obvious answers. But Keohane and Victor argue that the devolution of the global climate regime into a more fragmented regime complex is actually positive because at least it moves the world beyond impasse in the multilateral UN negotiations.[83] Moreover, the discursive dimension stressed in the previous section suggests that the core problem might not be incoherence and fragmentation in formal institutions, but rather the relative weight of different discourses: notably, subordination of sustainability discourse to economic discourse (market liberalism in particular). As noted earlier, sustainability discourse has been progressively de-radicalized in ways that make it more business friendly, such that development comes to look a lot like conventional material growth.[84]

Folke et al and Biermann et al come from the two most prominent scholarly networks that have contemplated governance in the Anthropocene, respectively the Resilience Alliance and Earth System Governance Project, and their positions appear quite different. Rather than rush to conclusions about appropriate institutional configurations for the Anthropocene, the prior task is surely to establish more secure foundations for institutional analysis, design, and experimentation. Particular experiments could though be informed by ideas of the sort generated in the Resilience Alliance and Earth System Governance Project, and much could be learned from how they played out in practice.

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[82] Biermann 2012b.
[83] Keohane and Victor 2011.
[84] Parr 2009.

In this paper I have explored path dependency, reflexivity, resilience, and foresight, enabling identification of ecosystemic reflexivity as the primary desideratum for institutions in the Anthropocene. I have also argued that it is not possible to reach conclusions based on the comparative statics of institutional models: be it markets versus hierarchies versus networks versus cooperative arrangements, polycentric versus centralized governance, or consensual versus adversarial politics. So while (for example) the debate between decentralists such as Ostrom and Hoffman,[85] critics of fragmentation such as Biermann et al,[86] and those such as Abbott who stake out some middle ground[87] can be instructive, it does not yet operate in quite the right territory. Instead, it is more productive to start from where we are now and think in terms of the dynamics of institutional change and available opportunities for overcoming problematic path dependency and enhancing ecosystemic reflexivity. This in turn requires context-sensitive empirical analysis and evaluation of existing institutions and practices before thinking about prescription.

The preceding sections of this paper offer examples of what is possible in these terms. There I argued (among other things) that the adaptive capacity of capitalist markets in unstable social-ecological contexts such as that presented by climate change may actually reinforce path dependency and inhibit reflexivity, that there are ways to think about particular multilateral institutions (such as the UNFCCC) responding to their own failure through reflexive contemplation of a

[85] Ostrom 2009; Hoffman 2011.
[86] Biermann et al 2009.
[87] Abbott 2012.

different kind of role, that we should be wary of particular transformational opportunities (such as that which occurred in US environmental affairs around 1970) yielding strong and undesirable renewed path dependency, that foresight could be enhanced through deliberative democratization of earth science, that discursive moves (such as that accompanying the 1987 Montreal Protocol) can have transformational consequences when it comes to the discursive aspects of institutions. Together these examples do not provide comprehensive institutional analysis, evaluation, and redesign; but they do suggest what is possible in these terms.

This framework can also be deployed in scrutinizing institutional proposals. For example, if indeed a 'constitutional moment' as envisaged by Biermann et al did come to pass in global environmental affairs,[88] we might ask of any centralized response directed at global institutional coherence whether or not it would embody strong path dependency of the sort we see in the Bretton Woods and United Nations institutions established after 1945. Or we could ask of the components of the 'polycentric' approach to global climate governance advocated by Ostrom[89] whether they contributed, either individually or jointly, to global ecosystemic reflexivity beyond local contributions to (say) reduction of greenhouse gas emissions in cities or states such as California. A partial answer can be gleaned from Hoffman. In treating multiple new forms of climate governance (such as voluntary emissions trading schemes, or networks of global cities) as an 'experimental system', Hoffman hopes that new material interests (for example, carbon traders) will become

[88] Biermann et al 2012a.
[89] Ostrom 2009.

increasingly powerful constituencies, and different actors will be socialized by their experience in the new forms.[90] Countervailing material interests to powerful fossil fuel corporations would surely be beneficial. At the same time we should be wary of renewed path dependency based on either material interest or ideas impeding future transformative capacity, however much this new path might seem to solidify more effective response to climate change in the short term.

There are other ways in which this framework can be deployed, notably in technology assessment. The failure of the world to curb greenhouse gas emissions has led to serious exploration of geoengineering technologies.[91] Among the many possibilities, the most popular proposal currently involves injecting sulfate aerosols or fine titanium dioxide particles into the upper atmosphere to help block solar radiation. Once this technology has been chosen, there is no going back: given the aerosols or particles eventually return to earth, the machines must keep running in perpetuity. If they were ever switched off, that would mean catastrophic rapid global temperature increase. The required institutions of geoengineering governance would need to be global, paramount and permanent: meaning the efficacy of the institutions and so the technology rests on a path dependency of a scope and strength unprecedented in human history, foreclosing other institutional options, and shutting down reflexivity.

Contemplation of the draconian politics that would have to accompany geoengineering drives home the intensity of the political challenge of the Anthropocene. The bitter politics of climate change that we see in the Anglo-

[90] Hoffmann 2011.
[91] See for example Lomborg 2010.

American countries (capable of blocking global progress) offers but a foretaste. Getting the requisite qualities embedded in existing dominant institutions (such as states and international organizations) is going to be a struggle. So the proponents of polycentric, pluralistic, and experimental governance may be right about at least one thing: it is easier to start with sites of politics at some distance from these established centers of power (and their associated path dependencies).

Existing dominant institutions are, then, highly problematic in the terms I have established. Yet haste to institutional prescription is also problematic, threatening to short-circuit the kind of learning process necessary in the novel and complex conditions accompanying the challenge of the Anthropocene. One solution to this conundrum lies in the experimental exploration of discursive structures and processes embodying the listening, learning, and anticipation that help constitute ecosystemic reflexivity. We can find intimations in existing institutions and practices, such as the experimental governance associated with ozone layer protection mentioned earlier.

If these developments are on issues that potentially challenge the core of the political economy, the more deliberative among them are at present often confined to scientists and professionals – for example, the Millennium Ecosystems Assessment whose deliberative qualities are celebrated by Norgaard,[92] or the Intergovernmental Panel on Climate Change. These scientific endeavors generally diagnose problems and make recommendations for targets and timetables (such as ecosystem conservation, or reductions in greenhouse gas emissions), without

[92] Norgaard 2008.

contemplating the policies that might enable those targets to be met. However, these exercises could be extended to collective decision by being linked more effectively and deliberatively to the efforts of non-governmental organizations representing a variety of relevant discourses (such as sustainability and environmental justice), corporations who seek to flourish in a 'green economy', and sympathetic governments and international organizations. There is an emerging literature on deliberative systems which can be put to good use here in identifying deliberative pathologies and blockages, and pointing to the sorts of initiatives that can promote transmission, accountability, and learning.[93]

There have also been some targeted efforts to involve participation in governance on the part of ordinary citizens, such as in the World Wide Views processes run on climate change in 2009 and biodiversity in 2012.[94] While the numbers of people involved in such processes are tiny, they do involve a critical and questioning input into existing governance processes – largely ignored by governmental negotiators in the case of climate change, accepted in principle in the case of biodiversity.

Discursive institutional innovation need not of course be confined to the global level. There are many local initiatives such as the transition towns movement, which explicitly bills itself as a response to the failure of higher levels of government to confront resource constraints and climate change. Networks across localities – such as the International Council for Local Environmental Initiatives cities network

[93] Parkinson and Mansbridge 2012.
[94] Rask, Worthington and Lammi 2012.

– also provide sites for deliberation.[95] Burgeoning networked environmental governance is however often a low-visibility affair, and dominated by moderate discourses such as 'green economy' or a technocratic version of 'ecological modernization.' Reflexivity in networks could benefit from more contestatory and critical voices (from science, citizens' forums, or social movements).

In networks and elsewhere, the institutional challenge can be captured in terms of the need for more productive deliberative systems combining moments of decision and moments of contestation, which in turn ought to contribute to the capacity of such systems for productive self-transformation. In short, while there are no easy recipes for institutional innovators, there are plenty of instructive initiatives from which to learn and ways to think about their connection.

CONCLUSION

Recognition of the Anthropocene connotes a powerful challenge to human institutions, as the non-human world becomes impossible to ignore as a central player in human history. This challenge merits more than response from environmental governance conceived as a niche area to be consigned to a government department or an academic sub-discipline, or even the 'mainstreaming' of ecological concerns into all areas of government. By confirming the causal force of human social processes in driving the character of the Earth system, whose instability in turn becomes a larger force, the Anthropocene forces a re-think of social-ecological systems and the place of political institutions therein (along with

[95] Bulkeley, Broto, Hodson and Marvin 2010.

deep commitments about what constitutes rationality in these institutions and beyond). The depth, novelty, dynamism, and complexity of the challenge call into question the rush to prescription of the (few) existing institutional analyses of the Anthropocene. I have identified ecosystemic reflexivity as the first virtue for political institutions in the Anthropocene. The ecosystemic dimension of reflexivity involves listening more effectively to an active Earth system, capacity to reconsider core values such as justice in this light, and ability to seek, receive, and respond to early warnings about potential ecological state shifts. I have shown how this framework can be applied in institutional analysis, evaluation, and design in a way that is true to the dynamic nature of the Anthropocene, and so avoids the temptation to think in terms of static institutional models. Taking the Anthropocene seriously suggests an evolving institutionalism joining inquiry and practice, in the face of existing dominant institutions that fall so far short of the requirements of this emerging epoch.

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