

What can agents do? Engaging with complexities of the post-Hardin commons*

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Pp. 125-156 in L. Freese (ed.), *Advances in Human Ecology*, Vol. 8. Greenwich, CT: JAI Press, 1999

ABSTRACT

Since the mid 1980s the institutions through which non-privatized, common resources are managed have been examined by a growing number of social-environmental researchers. Actual agents, it emerges, often do better than those envisaged in Garrett Hardin's influential 1968 paper on the "tragedy of the commons." Where commons research revolves around the question "What can agents do?," my interest in the complexities of both environmental and scientific change leads me to ask a complementary question, "What social change can researchers affect or facilitate with their various understandings?" The relevant understandings concern not only the situations that commons researchers study, but also the social situations in which the researchers are embedded. I contrast simple formulations of well-bounded systems with work that attends to "intersecting processes" or dynamics among particular, unequal agents whose actions implicate or span a range of social realms. "Critical heuristics" are introduced as a means to address tensions among these two poles. The resulting multi-part framework is intended to apply to environmental and scientific analyses and to analyses from social studies of science and technology. The ultimate goal of this essay is to stimulate further work on what agents can do—but not alone or through their accounts of the world alone—to contribute self-consciously to the ongoing restructuring of the intersecting processes in which particular knowledge-making and social changing agents are situated.

INTRODUCTION

Garrett Hardin's 1968 *Science* article on "tragedy of the commons" has been widely invoked in discussions of resource management. In his hypothetical common pasture each herder in the community follows the same logic: "I will receive the benefit in the short run from increasing my herd by one animal; everyone will share any eventual cost of diminished pasture per animal; therefore I will add another animal to my herd." Overstocking and degradation of the pasture are thus inevitable. The obvious remedy is private ownership of the land—or whatever resource is used in common—so that individual resource users factor the full costs into their decisions. Another remedy is "mutually agreed coercion," that is, legal and government controls to "restrain people who find it irrational to

restrain themselves" (McCay 1992, 189). Without privatization or mutually agreed coercion, agents pursuing their self-interest, which is what agents always do, will inevitably—"tragically"—overexploit and degrade resources held in common (Hardin 1968).

Since the mid 1980s the institutions through which non-privatized, common resources are managed have been examined by a growing number of social-environmental researchers, often coming together under the umbrella of the International Association for the Study of Common Property (IASCP). Actual agents, it appears, often do better than those in Hardin's thought experiment. People, working together in communities, overcome their short-term self-interest and build local institutions for managing a resource held in common (McCay and Jentoft 1997). In general, successful institutions are operated and monitored by a clearly defined group of those directly concerned with the resource. They are "externally accepted"—that is, the government, markets or industries tolerate, or even support jurisdiction over the resource by the community of users (Ostrom 1990).

Many kinds of agents are, in different ways, involved in the commons. There are the local community of users, and agents of the government, commerce, and industry, who either restrain outsiders from exploiting the resource in question, or who are themselves among those restrained. There are also social-environmental researchers providing accounts of successful resource and environmental management, and other scholars still invoking Hardin's idea. And there are observers and analysts of scientific change making sense of discourse on the commons since Hardin's 1968 contribution. This essay argues that all these agents affect—directly or indirectly, self-consciously or unwittingly—the use and future of common resources. Although they operate in different social realms, I want to problematize the conceptual, practical, political, and geographic separations that researchers make. I draw attention to the nature and significance, theoretical and practical, of intersections among those realms.

"Making accounts of" and "making sense" in the previous paragraph connote an emphasis on understanding the commons itself or research on the commons. Where commons research revolves around the question "What can agents do?," my interest in the complexities of both environmental and scientific change has led me to ask a complementary question, "What social change can researchers affect or facilitate with their various understandings?" The relevant understandings concern not only the situations that commons researchers study, but also the social situations in which the researchers are embedded. The "social change" may be as modest as stimulating change in the concepts used by members of the audience, as ambitious as stemming the resource degradation in some environmental situation, or somewhere in between. Yet, at all points on

this spectrum, the linkages between understanding and agency, between interpretation and politics, invite systematic examination.

I introduce here a multi-part framework for addressing the understanding and agency of researchers.¹ The practice of researchers can be considered from three angles:

Angle A. Researchers conduct a "dialogue," involving concepts and evidence, with the situations they study;

Angle B. They endeavor through interactions with other social agents to establish what counts as knowledge; and

Angle C. They address self-consciously the complexities of the situations they study and of their own social situatedness so as to affect social change.

For each angle, I consider formulations of three types:

Type 1. Simple formulations of well-bounded systems;

Type 2. Simple scenarios that open up issues, pointing to greater complexity and to further work needed in particular cases; and

Type 3. Work based on dynamics among particular, unequal agents whose actions implicate or span a range of social realms.

In the sections that follow—labeled A1 to denote angle A with a type 1 formulation, A2, and so forth—I illustrate each part of the 3x3 framework. I use mostly cases centered around the commons, but, in order to move through the full framework, the illustrations are abbreviated and I cannot engage deeply with specific debates about the commons. The primary goal of this essay is to draw more attention to the ways that different researchers attend to complexity so as to affect social change. The framework is intended to be applied fruitfully to environmental and scientific analyses other than commons research, and to analyses from studies of science, technology and society.²

ANGLE A. RESEARCHERS CONDUCT A DIALOGUE, INVOLVING CONCEPTS AND EVIDENCE, WITH THE SITUATIONS STUDIED

Researchers employ concepts and evidence in producing their accounts of common resources. When they call into question the accounts of others and seek to establish their account as knowledge about the commons, researchers also mobilize social resources—funding, authority and reputation, the interest of policy-makers or activists, and so on. Social resources, however, will emerge in angle B; for now I will focus on the concepts and evidence, as if the traditional image of science as a dialogue with reality were sufficient.

A1 (angle A, formulation type 1). The tragic and the locally managed commons: Two system-like formulations

The dynamics of Hardin's "tragic commons" are described in terms² of individuals who function in the same self-interested way, that is, the dynamics are undifferentiated. Evolutionary arguments are often invoked to reinforce that premise as follows. Suppose there happened at one time to be some individuals who restrained themselves from increasing their herds. They would have fewer resources than any individuals who did not, and so be buffered less in bad times or have fewer surviving offspring. Sooner or later this kind of individual and their restraint would go extinct (Picardi and Seifert 1976, Hardin 1968). Undifferentiated dynamics would then govern the system and the tragedy would unfold.

Unlike the a priori hypothetical dynamics of the tragic commons, the "locally managed commons" stems from a wealth of studies of actual institutions attempting to manage resources held in common (Ostrom 1990, Feeny et al. 1990). Ostrom (1993) summarized the conditions for the success of those institutions in a set of design rules, some of which were mentioned in the introduction (see also McKean and Ostrom 1995):

- i. Clearly defined boundaries of the resource, and of the community of users.
- ii. Benefits of resource use proportional to the costs imposed for its maintenance and management.
- iii. Users affected by rules of resource use are involved in deciding on any changes to those rules.
- iv. Infractions of rules are monitored; monitors are users or are accountable to them.
- v. Sanctions are graduated according to the severity of the offense.
- vi. Conflict resolution mechanisms are rapid, low-cost, and local.
- vii. External authorities and other interested persons accept jurisdiction over the resource by the resource users' institutions.
- viii. Institutions for managing large resources form nested layers of organization.

The locally managed commons differs dramatically from the unregulated, open access character of the tragic commons. In both cases, however, self-interest is the basis of people's rational actions, and the social and environmental phenomena of interest are system-like. That is, a clear boundary is drawn between what goes on inside the system and influences from the outside. The outside influences set the parameters within which the system operates, but the focus is on the dynamics inside (Taylor and García-Barrios 1995). The significance of this commonality will emerge in the sections to follow.

A2. A simple class simulation with complex implications

I use a simulation to introduce Hardin's idea and its implications in introductory environmental studies and "biology and society" classes. This

simulation is designed to encourage students not only to examine the implications of the "tragedy" idea and its shortcomings, but also to consider the ways people analyze ecological and social complexity more generally.

In the class simulation, each student begins with a herd of the same size and with some cash for buying more cattle. Each year they have an opportunity to add to their herd, and they receive income from the sale of milk and excess calves. The income per head of cattle declines once the combined herd on the common pasture exceeds some threshold and the pasture becomes overgrazed. I also participate as a herder and purchase as many cattle each year as allowed, which ensures that overgrazing will occur. As herders, we all tally our own individual accounts, while as teacher I sum up their purchases and then announce the income per cow that everyone earned during the year from milk and calves. The only other rule is that on my own I make no more rules. Therefore, as the simulation progresses and some students begin to express objections, they have to decide whether and how to attempt to mobilize fellow herders to add or change the rules.

Once overgrazing has become dire and annual income has dropped almost to zero, I stop the simulation and ask the class two questions to review the situation. What has happened? It is readily noted that differences in herd size and wealth have opened up and that production and income for the herd as a whole is lower than it could be. What could be done now overgrazing has occurred? On this question, herders who have the largest herds and greatest wealth can use their resources to exert disproportionate influence, not only on what propositions are accepted, but also on the procedures for making decisions. Students who purchased few or no cattle because they did not want to contribute to overgrazing are poor and less influential.³

Four levels can usually be discerned in the changes that the students seek during and after the simulation:

a) They want more realism or detail in the rules—to allow cattle to die, purchase prices to vary, herders to trade among themselves, income to vary with season, and so on. They seek such changes even though they do not prevent overstocking.

b) They have herders communicate about their actions, plans, and norms, e.g., "greedy herders should be shunned."

c) They allow exchanges with the outside world. For example, the simulation assumes that cattle can be bought from some unspecified place, and milk and calves can be sold. Cattle themselves, then, ought to be saleable. Some students even propose to leave the game to become agriculturalists, traders, or urban workers.

d) They get involved in the politics of collective governance, that is, in conflicts and negotiation among unequal parties. Proposals made

include halving every herd, setting an upper limit on all herds, taxing large herds, and privatizing pasture—Hardin's main policy conclusion. Actually instituting any proposal, however, turns out to be more difficult. The poor, conservationist-minded herders see the halving proposal as unfair to them, while the wealthy herders tend to use their muscle to resist proposals that tend to level holdings. If land is privatized, for example, the wealthy want it to be subdivided in proportion to current unequal herd sizes. Many students, faced with the stratification of wealth and influence, want to begin again with the pre-game conditions of equality. When, as the teacher, I insist it is too late for that, some students tend to invoke an outside government—another instance of c) above—with power to impose such changes over the objections of the wealthy herders.

Through their responses the students reinstate communication, exchanges with the outside world, and conflicts and negotiation among unequal parties. These considerations are central to the picture of the commons that IASCP institutional analysts have drawn. I do not, however, concentrate on establishing that picture. Instead, I interpret the students' responses as breaking open the fundamental assumption that the world is composed of systems. Each of the levels at which students sought change can be rephrased in terms that disturb Hardin's idea and simple models of systems more generally:

a) Instead of viewing the system as composed of individuals the nature of whose interactions are given at the outset, the system's dynamics are allowed to be mutable.

b) By thinking about the networks of social support in which "individuals" are raised and in which they then operate as adults, "sociality," not individuality, is made primary. There can be no atomized individuals in the form Hardin presented. Networks of social support make communication—even through people's silence—unavoidable. The networks give power to sanctions, in the form of withdrawal of social links, and thus also strengthen the threat of such sanctions.

c) Any boundaries defining a system are seen as permeable.

d) Inequality among individuals within the system colors the paths that they can pursue, including their responses to developments "outside" the system.

The significance of the last two levels will be clear if I return to the classroom simulation for a moment. Students tend not to go so far as dissolving the distinction between inside and outside; they want to appeal to some outside governing power to implement policies against overgrazing. Conservationist measures and egalitarian politics, however, tend to be resisted by wealthy herders. They may accept privatization, but usually insist that their land allocation matches their current herd size. What happens to proposed government policies is an example of outside influences refracted through internal features, such as inequality among

individuals, to impinge on processes inside the herding "system," including, in particular, the on-going differentiation among individuals. This lesson about the dynamics of unequal agents also comes through when I disallow requests to return to the pre-game equality; after all, that state exists nowhere in the known world.

The class simulation illustrates the character of the second kind of formulation, namely, simple scenarios that open up issues, pointing to greater complexity and to further work needed in particular cases. "Opening up" in this case can be summarized in terms of critical heuristics. Heuristics are propositions that stimulate, orient, or guide our inquiries, yet break down when applied too widely. Critical heuristics, as I define the term, place established facts, theories, and practices in tension with alternatives. The class simulation proposes that the analysis of causes and the implications of the analysis change qualitatively if systemness is viewed as problematic. More specifically, taking in turn each level a-d) above, the analysis and its implications change if:

- a) the system's dynamics are mutable;
- b) social situatedness is considered primary;
- c) boundaries are treated as permeable; and

d) the paths individuals can pursue are analyzed in terms of unequal individuals subject to further differentiation as a result of their linked economic, social and political dynamics.

Another critical heuristic can be derived from the class simulation. A corollary of viewing systems as problematic is to consider the special conditions necessary for a simple model to apply to a situation. If researchers find a situation in which individuals appear atomized and non-communicating, they should ask what history led up to that Hardin-like state of affairs. If communities are well-defined and externally accepted, what made that "loose embeddedness" of local institutions possible (Ostrom 1990)? In short, the analysis of causes and the implications of the analysis change if attention is given to the hidden complexity of apparently simple models.

A3. Differentiated agents situated in intersecting processes—Ecology meets political economy

The class simulation is one way to disturb the apparent simplicity of Hardin's tragic commons and, to some extent, of the locally managed commons. However, the simple scenario and the critical heuristics I derive from it point only to the political and social situatedness or embeddedness of commons. They do not specify how to analyze the complexity of politics, sociality, and environmental change involved in particular commons. Some of the kinds of considerations that might be involved can

be illustrated through a brief summary of research during the 1980s⁴ concerning nomadic pastoralists.

Nomadic pastoralists are herders living in semi-arid climates where rainfall is variable, unpredictable and spatially patchy, who spend at least part of their year roaming a common rangeland in search of patches of pasture.⁴ During the 1970s the dominant accounts of pastoralism had an environmental determinist outlook, in which range degradation and desertification were attributed to pastoralists allowing grazing beyond the environment's supposed carrying capacity. This picture was problematized by research during the 1980s on the on-going transformations of the economies and ecologies of nomadic pastoralist groups (Taylor and García Barrios 1995). The alternative picture highlights different factors that are implicated—to different degrees in different locations—in past transformations, e.g., taxation, establishment of military control, imposition of borders, and other aspects of colonial and post-colonial administration. Similar kinds of factors are implicated in more recent changes: further severe droughts, extension of agricultural areas, privatization of access to resources, regulation of conflict over resources, sedentarization, development projects sponsored by national governments and international agencies, and the changing economic conditions and terms of trade accompanying structural adjustment.

Some pastoralist societies have been rapidly restructuring with their boundaries becoming permeable. Pastoralists break their reciprocal relations with agriculturalists to become cultivators themselves; better off agriculturalists become absentee herd owners; and the poorer peasants and herders become their hired laborers. Squeezed for time to take their own herds out on the better rangeland, these herder-laborers allow their livestock to overgraze areas close to their settlements. As a result, environmental degradation, where apparent, lies close to population concentrations—not, contrary to Hardin's picture, out on the common rangeland (Little 1985, 1988; Taylor 1992).

This alternative picture of nomadic pastoralism exemplifies and suggests extensions of the non-system perspectives of the previous section. It emphasizes that:

- Structures are subject to restructuring, e.g., nomadic pastoralism becomes combined with and constrained by agricultural activities. "External" influences are usually implicated in the structuring of any "local" institutions (see a & d in section A2);
- Categories and the boundaries between them are problematic, e.g., pastoralism/ agriculture; herding/ laboring; climatic/ economic forces. Levels and scales are not clearly separable, e.g., local, national, and international practices, knowledge, and policies all enter the dynamics of the pastoral situation (see b, c & d);

• Control or generalization are difficult. For example, there may be plenty of degraded common property resources. However, once such situations are seen as transformations of existing complex and differentiated politics and not as the inevitable result of some fundamental, apolitical dynamic (see b & d), general policy solutions are not warranted. This applies equally to government imposed privatization or NGO promotion of traditional pastoral and agricultural practices. The alternative picture, instead of pointing to policies based on simple themes, exposes multiple possible engagements by various agents in a range of social positions. Moreover, this multiplicity opens up questions about the ways any particular engagement, when linked with others, will lead to desired and unintended restructurings.

I summarize these aspects of non-systemness in the term intersecting processes (Taylor and García Barrios 1995).⁵ That is, social and environmental change are analyzed as something produced by intersecting economic, social and ecological processes operating at different scales. These processes transgress boundaries and restructure "internal" dynamics, thus ensuring that socio-environmental situations do not have clearly defined boundaries and are not simply governed by coherent, internally-driven dynamics.⁶

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Let me reflect on angle A as a whole. Notice that in section A3 I have not presented any one particular case in detail nor exposed the locally-centered, but scale-spanning dynamics involved. The points about non-systemness are summarized in something like a type 2 formulation. This slippage speaks to a tension that is significant for my framework. Type 3 formulations, which involve dynamics among particular differentiated and differentiating agents, are difficult to convey in a lecture or an essay, and difficult for members of an audience to digest and make their own. In contrast, simple and system-like type 1 formulations are readily communicated—at least, until one pays attention to their hidden complexity. Addressing the tension between these two kinds of formulation is why I include type 2 formulations in my framework. Their scenarios and critical heuristics are intended to be easy for the audience to absorb and adapt. At the same time, they open up issues, pointing to greater complexity and to further work needed in particular cases.

However, to consider how readily an account can be conveyed and digested is to go beyond knowledge-making as a simple dialogue with the situation studied. Knowledge-makers become agents engaged with potential knowledge-users, who include other knowledge-makers supporting or disputing their accounts. Considering the social situatedness of knowledge-makers is what defines angle B. In what ways do people engage with knowledge—accept, question, modify, apply it—when they are in dialogue

with the situation studied at the same time as they are in dialogue with knowledge-users, all of whom operate in necessarily social situations?

ANGLE B. SOCIALLY SITUATED RESEARCHERS ESTABLISH WHAT COUNTS AS KNOWLEDGE IN THE EYES OF OTHER SOCIAL AGENTS

Researchers are unavoidably engaged with other social agents. When they produce their accounts they are not simply recording their own knowledge, but are trying to persuade others to publish, read, accept, or build on those accounts. In this section I focus on some ways to interpret the social situatedness of agents as they establish what counts as knowledge.

B1. Simple formulations: Society vs. Nature or Reality

Two contrasting formulations of how knowledge is established are that:

a) Different accounts persist of the same phenomena, for example, of the management of common resources (see A1-A3). Therefore, decisive aspects of knowledge-making must lie outside the dialogue with nature or reality, that is, in the realm of social influences; and

b) In order to establish knowledge, researchers have to persuade other people. But to do so, they focus on marshalling concepts and evidence and challenging those of others. Any effect of social influences is small and transient—eliminated by the time that a scientific community reaches a strong consensus about a theory.

B2. Rhetorical interpretations of tragic and locally managed commons

In the two different formulations above, knowledge reflects or corresponds to nature/reality, social influences, or—at least transiently—a mixture of the two. In contrast, the question of what researchers do to persuade others invites attention to the rhetorical effects of the researchers' accounts. One can examine ways an audience might be influenced by the framing of the case as much as by its substance—the evidence, logic, and conclusions. Such rhetorical effects, in turn, facilitate researchers in establishing what counts as knowledge.

Different effects that the framing of tragic and locally managed commons have include the following:

a) Simpling and reinforcing foundational assumptions

Commons discourse begins with sweeping claims for the general applicability of the simple model of Hardin. Postulates have then been

successively added to address the discrepancy between the model and observations. This process can be interpreted as "simpling":

Like sampling, "simpling" is a technique for reducing the complexity of reality to manageable size. Unlike sampling, "simpling" does not keep in view the relation between its own scope and the scope of the reality with which it deals... It then secures a sense of progress by progressively readmitting what it has first denied. "Simpling"... is unfortunately easily confused with genuine simplification by valid generalization. (Hymes 1974, 18; my emphasis)⁷

In the tragic commons, as in most of economics, selfishness is seen as a fundamental characteristic of humans, and this determines the dynamics of the system. The belief that the simple model's ideal-type dynamics are fundamental or foundational tends to be reinforced through simpling and the proliferation of versions for different situations generated by adding complexities to the basic model. Moreover, the idea that self-interest is human nature is reflected in the very name "tragedy"—classically a tragedy is something bad that happens to mortals despite their best intentions; only the intervention of the gods can prevent it. Ironically, the same reinforcing effect is achieved by theorists of the locally managed commons when they argue that use of non-privately held resources can be governed satisfactorily, provided appropriate social sanctions or regulations are in place to counteract individual selfishness (Feeny et al. 1990).

b) Privileging of worldviews and political positions, or, more generally, facilitation of certain social actions or interventions.

The assumption of undifferentiated individuals is central to the tragedy model. Given this assumption, the dynamics permit only a limited range of options. Hardin explicitly advocates two: i) Privatization of the resource; and ii) Mutually agreed coercion implemented as legal and government controls. Consider the other logical possibilities: iii) Individuals can leave the system—but this cannot be a solution for every case; iv) Individuals can all abandon their desire to accumulate in favor of conservation—but this is undermined by even one holdout or cheat and is never presented as very likely; and v) Individuals can drive the system to the inevitable degradation awaiting all non-privatized resources—and this is clearly undesirable. Coercion, even mutually agreed coercion, raises the specter of centralized State control. For most Western audiences, privatization is left as the rhetorically privileged option. This message stands, even when the actual record of development efforts casts doubt on the effectiveness of that policy.⁸

In the actual world, privatization often cements the current claims of unequal individuals—an observation Hardin overlooks. To speak of

common resources in terms of the tragic commons is to distract attention⁶ from the special interests of those with greater claims (Peters 1987). Hardin's model thus makes it easier for powerful interests to get their way. This result was evident in the concessions proposed to secure the United States' ratification of the Law of the Sea, after many years of opposition in which the tragedy of the commons was invoked. The concessions ensured that existing seabed claims of US corporations could not be reallocated to the world community (Broad 1994). Once property rights were accepted, discussions of the tragedy quietened. Over and above unequal property claims, negotiations and contestations among groups with different interests, wealth and power—the messy stuff of most politics—are omitted from Hardin's picture. The tragic commons thus naturalizes the liberalized economics of structural adjustment and obscures the politics through which structural adjustment is imposed and implemented in poor, indebted countries.

Discounting politics among unequal individuals is characteristic of two more general orientations towards social action: The enlightened guide instructs listeners how we—an undifferentiated "we"—must change to avoid the impending crisis in question. The technocrat, with an analysis of the scientifically justified or most efficient measures, argues that it would be in our best interest—again, an undifferentiated "our"—to submit to these measures.⁹ Moralistic or technocratic views of social action are particularly comfortable for those who imagine themselves as the guides and educators, or the planners and policy advisers. The privileged position these roles afford would be put at risk if researchers were to have long-term and necessarily partisan involvement in some particular situation. Moral and technocratic politics are in the interests of natural scientists especially; they can employ their status and skills without re-tooling in political-economic analysis.

Rhetorical privileging of certain political positions can also be seen in the emphasis on designing loosely embedded institutions for managing common resources. For example, officials of the United States Agency for International Development (USAID) invoked the superiority of local institutions to insist that the government in Cameroon adopt free market policies preferred by USAID and drop government-level subsidies and regulation (cited in Moke 1994). Without condemning the USAID policies, the irony should be noted; the position of the USAID officials—outsiders overruling the knowledge and institutions of Cameroon officials—was bolstered by the push for local management.

c) Substitution of exotic for the near-at-hand.

Over the last thirty years environmental degradation and preservation have become familiar issues in affluent countries. In those countries, atomized consumers find it difficult to organize institutions to ensure that private, corporate, or military property holders bear the full

environmental costs of their activities. Concerned consumer-citizens have reason then to be anxious about their capacity to unite and organize with the goal of influencing corporate and military decision-making. In this light, concern about irrationality of non-privatized resources in poor countries can be interpreted ironically, as a displacement from unspoken issues—issues other than what the tragic commons is literally about.¹⁰

A similar substitution of the exotic for concerns close to home is evident in the attention now given to the locally managed commons in poor countries. Over the last twenty years, dominant political-economic discourses in affluent countries have promoted deregulation, privatization, decentralization. As the authority of the central State is diminished and economies become more vulnerable to the dictates of globalization or transnationalization, counter discourses have arisen concerning community and civil society (Agrawal 1996, Burbridge 1997). These represent a search for a level of influence intermediate between atomized individuals and the all-powerful market. In this context, the attention given over the last fifteen years to the locally managed commons can be interpreted as a displacement to somewhere else of concerns in affluent countries about whether people can still influence social and environmental sustainability.

d) Rendering the special typical.

When illustrating the possibilities of managing resources held in common, researchers have often invoked special situations in which the resource and its users are somewhat autonomous from the influence of the government, markets or industries. This condition is summarized in Ostrom's (1993) principles of "external acceptance" and "clearly defined boundaries." As studies of such situations accumulate, however, they begin not to appear special, but to be employed to support more general claims. Inquiry is not directed towards defining how the situations arise as special cases of more general processes (perhaps non-system like or intersecting processes; see A3). When the exemplar becomes defined by such design conditions, several things follow:

"Design" connotes that what has to be done is set up a new institution from scratch. This constitutionalist impulse discounts previous history, as if that became irrelevant once a group decides to establish new institutions. As a corollary, little attention is given to the transition problem, that is, how to engage with on-going processes to produce the desired social and institutional change. This tendency is evident when discussions highlight "success stories," neglecting failures, as well as the processes leading to both successes and failures. The constitutionalist impulse also privileges a pure politics perspective in which decisions are seen as the result of people coming together to deliberate. This view detracts from the analysis of the political-economic conditions shaping social interactions.

According to the design principles, institutions work better if all the people know and understand each other well. If this is used to privilege homogeneous groups, it risks contributing to ethnicization of communities. Such design principles discount the ever-present heterogeneity and inequality within communities. More generally, the idea of an external-internal divide—even in the form of inquiring into how different institutions were undermined by "external" forces—discounts the ways unequal "internal" agents can mobilize and be mobilized by things happening and people operating in far distant places. As observed in angle A, a deep boundary between what goes on inside and influences from the outside has been a dominant part of work done on the tragic and locally managed commons.

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The interpretations of rhetoric above are, of course, over-generalizations. They are partial—neither necessary, nor sufficient—angles of illumination on commons discourses. More work would be needed to demonstrate the effects of a particular researcher's account on specific audiences. Nevertheless, the interpretations suggest a way to approach the production of detailed accounts of the social situatedness of particular knowledge-making agents. Let me elaborate.

The two "Society vs. Nature/Reality" formulations in section B1 treat researchers more or less as vehicles through which the reality of nature or social influences get into the knowledge. This image leaves vague what researchers actually have to do—over and above trying to expose the way things in the world really operate—when they produce and promote their accounts. Interpretation of the rhetorical effects of researchers' accounts assumes more active agents, people who use more than concepts and evidence to move their audiences. Yet, interpretation of the rhetorical effects still leaves unspecific what knowledge-makers do when engaging with potential knowledge-users. Nevertheless, from the rhetorical analysis emerges an emphasis on ways that accounts facilitate certain forms of social action. In this spirit, one can consider how certain courses of action are facilitated over others, not only in the use or misuse of scientific products, but also in the processes through which the science is formulated in the first place. Instead of examining or discounting the social influences on the making of scientific knowledge (see B1), one can expose the social actions built into knowledge as it is made.

B3. Heterogeneous construction of a tragic commons model

Let me pursue the idea of social situatedness conceived in terms of social actions built into knowledge-making, but shift now to a type 3 formulation concerning particular agents whose actions implicate or span a

range of social realms. To do so requires exposing the diverse practical choices—commitments to certain social actions over others—that particular researchers have to make when making knowledge. This project I call "heterogeneous construction," using construction to connote a process of agents building by combining a diversity or heterogeneity of components or resources, as in people building a house or a nation rebuilding its economy after a war.¹¹ I add the qualifier heterogeneous to establish some distance from standard views about social construction, which imply that scientists' accounts reflect or are determined by their social views (Taylor 1995).¹² The ways that diverse social actions are built into knowledge as it is made are illustrated by the following excerpts from my analysis of research undertaken at MIT in the mid-1970s on the future of nomadic livestock herding on common rangelands in sub-Saharan Africa (Taylor 1992).

The 1968-74 drought in sub-Saharan Africa resulted in decimation of the pastoralists' herds and famine. Western attention was drawn to the region, not only for relief efforts, but in subsequent studies of the ecological and social arrangements of pastoralists. One such study formed part of a \$1 million project at the Massachusetts Institute of Technology (MIT) funded by USAID during 1973-75 to examine the long-term future of the sub-Saharan region. After a three week visit to the region a graduate student at MIT, Anthony Picardi, with a background in systems analyses of population and ecological issues, constructed and reported on a sequence of three system dynamics models "for understanding the ecological and social dynamics of the pastoral system" (Picardi 1974, abstract, p.i). Picardi's system dynamics models of pastoralists included many factors and mathematical relationships, and allowed many scenarios to be investigated. Picardi saw a common pattern, which he summarized in terms of Hardin's tragedy of the commons.

Many social realms intersected in Picardi's making of science—those of different researchers at MIT, both in the USAID project and in the modelling and management fields more generally, in addition to the worlds of USAID, the US Congress, Africanists at the United Nations, and Africans, including the pastoralists themselves. I chose Picardi's modelling work as my entry point into these social realms, and so I reviewed applications and critiques of system dynamics, attended classes and conducted interviews with the System Dynamics Group at MIT, manipulated Picardi's model on a computer, and reviewed subsequent analyses of nomadic pastoralists in sub-Saharan Africa. From these different sources I distilled nine consistent aspects of system dynamics modelling, which can be summarized in the following terms: Fixed rules and system structure; History as a source of long-term values; Generic systems; Uniform individuals, which can be simply aggregated; Constant parameters; Temporal and spatial variability leaves system structure unchanged;

Systems decomposable into subsystems; External forces simply mediated;⁸ Responses to crises require overall policy changes. (Illustrations of two of these are given below; see Taylor (1992) for the full analysis).

I then characterized alternatives for each aspect, illustrating them using examples abbreviated from the literature on African pastoralism. The contrasts were not meant to be read as indicating technical limitations of Picardi's models. Instead, I asked what it would have meant practically to pursue the alternatives, given the many social realms intersecting in Picardi's making of system dynamics models? By exploring the implications of pursuing these counterfactuals, I aimed to expose the ways Picardi's work was facilitated by his staying with the conventional aspects of system dynamics. That is, my goal was to expose the practical choices or commitments to certain social actions over others that were resources for his knowledge-making.¹³ This counterfactual method is illustrated in the following two of the contrasts.

a) Rules and system structure: Fixed vs. Changing.

Picardi designed his models as an effort to understand "the ecological and social dynamics of the pastoral system" (Picardi 1974, p.i). For Picardi, as for other system dynamicists, it was unquestioned that the world—at whatever level of resolution examined—is composed of systems. In system dynamics a system connotes more than the orderly collection of interacting components subject to scientific management. A system in system dynamics is a bounded integrated entity, the behavior of which is primarily determined by internal interactions or rules (Picardi 1974, p.4,7,19ff; Forrester 1969, p.17ff.). External factors are simply mediated, like energy into an ecosystem or people migrating out of a pastoralist society (Picardi 1974, p.7,15).

In contrast to analyzing complex interactions as self-determining and enduring, modelers might analyze the changes in the structure of those interactions and rules governing them.¹⁴ To do so they would need to anticipate the restructuring that may result from crises, such as loss of livestock during the 1968-74 drought, or from external interventions, such as the administrative actions in colonial West Africa that progressively undermined Islamic systems of regulations (Turner 1993). With sources of restructuring in mind, the modeller then incorporates the range of system structures into the model from the outset and specifies transitions or switches among those structures. In practice, however, such prior specification is difficult. It is no trivial issue even for pastoralists to anticipate the new arrangements they will make when, say, they rebuild their herds after a drought or they react to encroachment. An outsider wanting to anticipate structural change might get drawn into detailed comparative study to see how other pastoralists had responded to similar situations. Or, the outsider might live with pastoralists long enough to

observe how they respond to change. Given the short study time dictated by USAID, Picardi did not follow either of these courses. He considered only a small number of switches within the model system, corresponding predominantly to policy changes such as initiation of taxation to enforce destocking (Picardi 1974, p.323ff).

Although USAID's short study time constrained Picardi's modelling, the time limit also facilitated his work. It relieved Picardi of any expectation of undertaking more detailed study or developing a sustained engagement with pastoralists. Furthermore, USAID had requested an evaluation of long-term strategies for the region, intending to use the results to advise the US Congress and the United Nations in assisting the region through international intervention. Picardi was well aware of the need to communicate his results to these clients (Picardi 1974, p.4, 6, 19, 216-7). If Picardi's evaluation of nomadic pastoralism had been replete with pathways branching according to possible restructuring of arrangements, then significant translation would have been expected of Picardi by the project's sponsors, USAID (or of USAID by their sponsors)—especially if the possible restructuring depended on future initiatives of the pastoralists themselves, and not the external interventions.

Of course, Picardi's actions were not determined by this one relationship with USAID. Other elements of the intersecting social realms were implicated in his emphasizing system-ness and de-emphasizing restructuring. Each element reinforced each other, rendering them harder to modify in practice. This cross-reinforcement will be evident if I consider another of the contrasts and examine the practical consequences.

b) Uniform units vs. Strata of differentiating individuals

In Picardi's models all individual households, livestock and plants behaved identically. In contrast, a modeller could consider the effects of differences, say, in the wealth and power of households. More detailed data would, of course, be needed. In addition, an alternative to system dynamics (or patience in its use) would be required because system dynamics's computer implementation was not designed for multiple variants (arrays) of each basic variable. The speed of computer operations and the clarity of diagrams used to illustrate the system drops rapidly as variables proliferate. Modelling the process of differentiation of strata would, however, have been more difficult. The characteristics of the strata change as they accumulate or become impoverished. In fact, the very structure of the system may change, e.g., herders become agriculturalists and wage laborers. As in the case of modelling a changing system structure, the modeller would have to anticipate these changes.

To model differentiation Picardi would also have had to work without exemplars to follow; in 1974 there were no system dynamics

models of differentiation. Nor were data pertaining to differentiation in West Africa available. The uniform model of pastoralists Picardi used obviated data on strata or differentiation, thus facilitating Picardi's work in the similar ways to his fixed rules and system structure. Stratification was, in any case, less apparent in the locality Picardi chose as the basis of his model. In that locality, Tuareg pastoralists had not become sedentary nor were they deeply implicated in the agricultural economy. They were thus closer to the systems analyst's desired pure or generic system.

Uniformity of model individuals facilitated Picardi's modelling in an additional way. When system dynamicists seek to establish the realism of their models, their prime means of persuasion is not to demonstrate close correspondence of model predictions with actual observations. Instead they render their models plausible by directing their presentations at non-specialists in the area in question, and drawing the listener or reader into the logic of the model. The rationality of modelled individuals is validated by the listener's personal experience—Would you decide any differently in the same circumstances? (Picardi 1974, p.199) The system dynamicist then uses system dynamics to demonstrate that locally rational decisions, when worked through feedbacks in the models, generate unanticipated and counterproductive outcomes. Hardin's tragic commons has achieved widespread recognition by the same means.

If, however, a system dynamics model specified a heterogeneity of individuals, its realism would be harder to establish by personal validation and weight of logic. The outcomes would no longer be simple and inexorable—with which of the strata would the listener identify? With all pastoralists alike, persuasion by logic was possible. Direct empirical evidence of selfish individual exploitation of the common range was not needed (Picardi 1974, p.162ff). Some specialists have proposed contrary or more complex possibilities,¹⁵ but these could remain out of Picardi's picture. USAID, in turn, was spared the difficult, politically charged task of considering explicitly ways that their programs of assistance and support for state policies would differentially affect pastoralists who had unequal access to resources, in particular, to the "common" rangeland.

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Through a counterfactual analysis of the two contrasts above and seven others,¹⁶ I generated an account in which the computer models of a pastoralists on a common rangeland were shaped by the modeler employing a range of diverse resources: the available computer compiler; published data; the short length of time both in the field and for the project as a whole; the work relations within the MIT team; the relationship of the United States and USAID to other international involvement in the region; the terms of reference set by USAID and the agency's contradictory expectations of the project, and so on. The practical considerations that were resources for the modeler's knowledge-

making were also commitments to certain social actions over others. In diverse, particular ways Picardi was affecting social change as the same time as making knowledge.

Although the perspective of heterogeneous construction is, I believe, applicable to all knowledge-making, the generalizability of any particular analysis is limited in several ways. The practical considerations or resources in Picardi's modeling would not transfer to another case of research on the tragic commons, let alone cases of research into locally managed commons. Even for the same case, the analysis would not remain the same if different analysts, also seeking to expose the diverse practical considerations with which Picardi dealt, entered the social realms at a point other than Picardi's modelling work. Such analysts would face their own sets of practical considerations, differing according to particular social situations in which each worked (Taylor 1992). Following this last point, interpretations of researchers' social situatedness in angle B could be recast as angle A', where the "situation studied" is no longer the commons, but the social situatedness of commons researchers. A corresponding angle B' would examine the the social situatedness of the interpreters of commons researchers.

The challenge of producing accounts that are readily communicated and digested (which I discussed at the end of the sections on angle A) has become more acute. Because I am aware of the complexity and particularity of heterogeneous constructionist accounts, I presented only part of my reconstruction of Picardi's modeling, and simply gestured towards the reflexive addition of angles A' and B.' Simplification for expository reasons is not, however, a simple matter. From the perspective of heterogeneous construction, all researchers take into account at one and the same time the situations they are studying and the social situation in which their knowledge-making is facilitated. Researchers who present their work in terms of angle A alone—the scientific dialogue with the situation studied—are making choices, no more or less than I am in combining angles A and B in a truncated exposition of heterogeneous construction. All researchers have to choose particular ways to address the complexities of the situations they study and their own social situatedness so as to make knowledge and affect social change.

ANGLE C. RESEARCHERS ADDRESS SELF-CONSCIOUSLY THE COMPLEXITIES OF THE SITUATIONS THEY STUDY AND THEIR OWN SOCIAL SITUATEDNESS SO AS TO AFFECT SOCIAL CHANGE

What social change can researchers affect with their various understandings? As I noted in the introduction, "social change" can be applied when researchers seek to persuade others which accounts constitute

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knowledge, as well as when they aim to stem the degradation of a common resource. Moreover, from the perspective of heterogeneous construction, all researchers are simultaneously knowledge makers and agents of social change as they address the complexities of the situations they study and their own social situatedness. In this section, I consider ways these dual roles might be pursued more self-consciously, so as to take situatedness less for granted. Although the examples to follow are not drawn specifically from commons discourse, the line of inquiry connecting knowledge-making and social change is particularly apt in the context of commons. Commons discourses, after all, center on ways that the actions of rational agents contribute to desired or unintended collective outcomes.

C1. Moves to discount or quieten complexity

Reflection on the interwoven complexities of situations and situatedness can lead researchers to discount or quieten those complexities. There are a variety of ways to do so:

a) They might decide that the most effective way to influence others is to recognize communicative and cognitive constraints and so aim for accounts that are:

i) transmissible, which means preferring simple and system-like type 1 formulations over the non-systemness of type 3, and angle A over a combination of angles A and B; and

ii) digestible, which necessitates departing as little as possible from terms of other researchers in one's audience. These terms typically focus on angle A, that is, on marshalling concepts and evidence, and take many aspects of their social situatedness for granted. It does not matter then that knowledge-making necessarily involves influencing other, socially situated researchers. Researchers' accounts need not delve into this situatedness, and their research need not include systematic examination of their own and their audiences' situatedness.

b) Researchers might be prodded to address their own social situatedness in ways other than drawing their attention to accounts that combine complexities of situations studied and researchers' situatedness (B3). Imagine researchers who had promoted a tragic or locally managed account of the commons (A1), but, when presented with an intersecting processes account (A3), decide that it better captures the dynamics of the use of common resources. Such persons might then seek to mobilize new collaborators, sources of funding, and so on, so they could undertake research of that orientation. Similarly, concern about the politics privileged by their simple or system-like formulations, once this connection is to conveyed to them (B2), might lead them to mobilize new resources so they can modify their research.¹⁷ Just as in a), the focus of accounts of research remains, however, on angle A.

c) If researchers use simple formulations as angles of illumination on situations, more non-systemness than a) allows can be acknowledged. That is, simple formulations can be taken, not as explanations on their own, but as heuristics to be woven together with other heuristics into a picture more complete than implied literally by the factors, relations, and boundaries of the different simple formulations. This approach is characteristic of history and interpretive social sciences. The reflexive turn, loosely associated with post-modernism, extends this approach to the researcher's own situatedness.

d) Researchers might use critical heuristics, as this essay presents them (see Table 1), in order to address two problems that emerge when simple formulations are employed as heuristics: i) How to achieve the weaving of multiple heuristics into the more complete picture, and ii) how to sustain the heuristic quality and resist any tendency to anchor one's account of complex situations with some bounded and system-like dynamics (Taylor 1997a). Critical heuristics build in a persistent opening up of issues, always pointing to greater complexity and to further work needed in particular cases, that is, to type 3 formulations (see A2). This orientation makes it harder to slip back into simple, system-like formulations (including the focus on angle A and discounting of angle B). At the same time, because critical heuristics do not involve particular and differentiated detail, they are more transmissible and digestible. Table 1 summarizes the critical heuristics identified in section A2, and those introduced implicitly in the subsequent sections.

Table 1—Critical heuristics*

- There will be a qualitative change in the analysis of causes and the implications of the analysis if:
 - a) the system's dynamics (the rules and system structure) are mutable (A2; B3);
 - b) social situatedness is considered primary (A2);
 - c) boundaries are treated as permeable (A2); and
 - d) the paths individuals can pursue are analyzed in terms of unequal individuals subject to further differentiation as a result of their linked economic, social and political dynamics (A2; B3¹⁸).
- There will be a qualitative change in the analysis of causes and the implications of the analysis if attention is given to the special conditions necessary for a simple model to apply to a situation (A2).
- There will be a qualitative change in the analysis of causes and the implications of the analysis if: structures are seen as viewed as subject to restructuring; boundaries and categories as problematic; and control or generalization as difficult (A3)

- Making and using knowledge are influenced by dialogues simultaneously with other knowledge-users and with the situation studied (Transition from A -> B).
- Over and above the impact of what researchers' accounts literally state, the framing of accounts has rhetorical effects on the audience (B2):
 - a) Simplifying secures a sense of progress by readmitting what it had first denied, and reinforces foundational assumptions;
 - b) Simple, undifferentiated models privilege certain political orientations or courses of social action;
 - c) Concerns about exotic situations are displacements of the concerns closer to home that the researchers have; and
 - d) Taking special situations as exemplars distracts attention from the historical processes that produced both the special situations and the others.
- Certain courses of action are facilitated over others, not just in the use or misuse of scientific results, but in the ways that the science is formulated in the first place (Transition from B2 -> B3).
- Interpreting the social situatedness of research is itself a socially situated research process (Transition from B -> C).
- Researchers take into account at one and the same time the situations they are studying and the social situation in which their knowledge-making is facilitated (Transition from B -> C).
- Researchers know more than they are prepared or able to acknowledge, until encouraged or prodded by interaction with others (C2).
- Knowledge-making, social-changing agents move or vibrate among their own variants of this essay's three kinds of formulation and three angles (C2).

* Corresponding sections of the essay are indicated in parentheses. "Transition" refers to the text at the ends of section marked off by a line of asterisks.

e) Members of an audience can take in more complex ideas when they practice using them in their own fields. In this spirit, I have presented abbreviated versions of this essay's three types of formulation and then led my audience through a set of exercises. They first identify an example of a simple/system-like formulation, then invent a critical heuristic, and finally begin to sketch a corresponding particular and differentiated account for topics from their own teaching or research.¹⁹ I plan to extend this approach to exercises concerning researchers' situatedness as well.

C2. Mapping workshops—a move to distribute agency

The moves in C1 involve few, if any, details about particular, differentiated agents.²⁰ The emphasis is on individual researchers producing accounts so as to have an effect on their audiences. In that sense, the formulations are system-like; the researcher is the inside of the system, the audience is outside "environment" whose characteristics are more or less given. Agency, in other words, appears concentrated inside individual researchers.

I contrast this with a distributed notion of agency, which highlights the range of different social agents involved and the diversity of resources they mobilize. Users of the locally managed commons have more distributed agency than in the tragic commons; differentiated agents situated in intersecting processes even more so. Similarly, distributed agency applies to researchers who employ heterogeneous resources drawn from a range of intersecting social realms. This is even the case even when the focus was on one researcher in section B3's account of heterogeneous construction. Picardi's modelling work could have been modified, but this would not have followed readily from a mere change of worldview on his part; instead many practical considerations and social negotiations would have been involved.²¹ Indeed, heterogeneous construction, like intersecting processes (see A3), points to multiple, particular change-inducing interventions or engagements (Taylor 1995, 1999).

Taking the notion of distributed agency further, researchers could identify multiple potential sites of engagement and change for themselves, instead of through a second party's reconstruction (e.g., B3). That is, they could reflect explicitly on their own situatedness in relation to their ability to study their situations of interest. To this end I have brought ecologists and resource economists into "mapping workshops."

Map-making begins with researchers focusing on a key issue—a question, dispute, or action in which the researcher is strongly motivated to know more or act more effectively. They then identify "connections," things that motivate, facilitate, or constrain their inquiry and action.²² These might include theoretical themes, empirical regularities, methodological tactics, organisms, events, localities, agents, institutional facilities, disputes, debates, and so on. Researchers then draw their "maps"—pictorial depictions employing conventions of size, spatial arrangement, and perhaps color that allows many connections to be viewed simultaneously. The map metaphor is used not to connote a scaled-down representation of reality, but a guide for further inquiry or action (Taylor and Haila 1989; Taylor 1990).

These maps are presented in a workshop setting so that each participant's thinking is exposed to questioning by other participants. The

workshop interaction is intended to lead participants to clarify and filter¹² the connections and to reorganize their maps so as to indicate which connections were actually significant resources. The ideal is that researchers self-consciously modify their social situations and their research together, perhaps in collaborations formed among the workshop participants. Such collaboration would take distributed agency a stage further than map-making.

A map, one not directly related to commons research, will serve to illustrate the map-making approach (Figure 1). It should be noted that this has been streamlined and redrawn on a computer for publication and cannot do justice to the real-time experience of its production during an actual workshop. The central issue on this Finnish ecologist's map is very broad, namely, to understand the ecology of carabid beetles living in the leaf litter under trees in urban environments. Below this issue the map includes many theoretical and methodological sub-problems, reflecting the conventional emphasis in science of refining one's issue into specialized questions amenable to investigation. Above the central issue are various background considerations, larger and less specific issues, situations, and assumptions that either motivate work on the central issue or are related to securing support for the research. The ecologist's research alone would not transform the urban public into recognizing that "nature is everywhere—including in the cities," but by combining the upward and downward connections, he reminded himself that work on the background issues, not just refining a working hypothesis, would be necessary to keep being able to do his research.

In narrating his map, the ecologist mentioned some additional history. Many of the ecologists with whom he collaborated had been studying a forest area, but the group lost their funding when the Forestry Department asserted that forest ecology was their own domain. It did not matter that animals are barely mentioned in the ecology of forestry scientists. The ecologists self-consciously, but of necessity, turned their attention to the interconnected patches of forest that extend almost to the center of Helsinki, and explored novel sources of funding and publicity, including a TV documentary. The upward connections were thus a recurrent, if not persistent, influence on the ecologist as he defined his specific research questions.

Many methodological and theoretical issues were raised by the initial, exploratory work on mapping workshops (Taylor 1990). Let me tease out here some implications that relate to the project of researchers addressing self-consciously the complexities of the situations they study and their own social situatedness.

The general picture consists of researchers as agents in a dialectical relationship with conditions that constitute their situatedness, including the actions of other agents with whom they work. The researchers reflect on

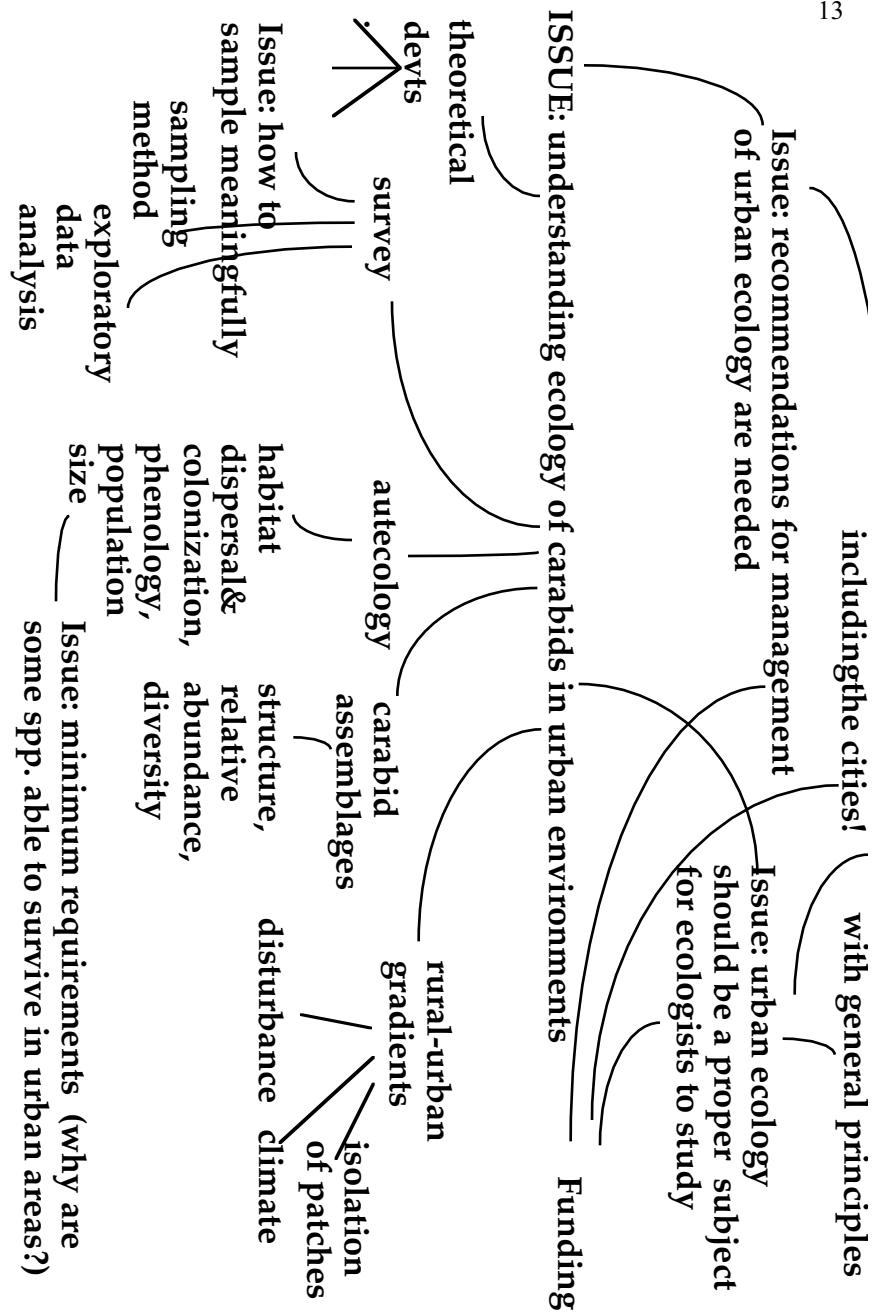
those conditions in order to modify or restructure them, which includes changing or developing their collaborations with other agents. Given that distributed agents depend on a diversity of resources and other agents, conditions need to be conducive to such reflection and to agents modifying or restructuring their situatedness. Let me comment further on a) agents reflecting, b) modifying or restructuring conditions, and c) changing collaborations, and on conditions conducive to all these processes.

a) Agents reflecting: In map-making and mapping workshops participants articulate connections that had previously been unexamined, unspoken, or discounted. That is, when encouraged or prodded by interaction with others, researchers show that they know more about their situatedness than they had been prepared or able to acknowledge. This acknowledgement of situatedness could be taken further. For example, with more time and suitable computer software to draw and redraw maps, researchers would be better able to revise their maps in response to interaction during the mapping workshops.

It follows, however, that day to day practice and discourse must be discounting researchers' awareness of their situatedness.²³ This means, according to the perspective of heterogeneous construction, that simple, system-like formulations about one's social situatedness must serve as resources for agents in their knowledge-making. Picardi, for example, claimed he wanted to demonstrate a case of the tragedy of the commons, and his motivation or drive to do so was undoubtedly one of the diverse resources he mobilized. Nevertheless, researchers' statements about their motivations, drives, or rationality do not capture all they know about their situatedness.

The tension between, on one hand, what is acknowledged and stated, and, on the other, what is known and could be acknowledged suggests a reconciliation of concentrated and distributed agency. Knowledge-making agents must always be moving or "vibrating" among their own variants of this essay's three kinds of formulation and three angles for viewing their own practice. If such vibrating characterizes, albeit schematically, what agents always do, then mapping workshops are not making researchers do something new, as much as strengthening the vibrations in the direction of particular dynamics (type 3 formulations) and self-conscious knowledge-making and social changing (angle C).²⁴

b) Modifying or restructuring conditions: Another workshop participant commented that mapping made it impossible to "simply continue along previous lines" (Taylor and Haila 1989). Yet, as it also turned out, the ecologist was not able to complete his study of urban carabid ecology. Making a map or some other account of the construction of research provides no guarantee that researchers become able to mobilize different resources to their advantage.²⁵ Moreover, mapping workshops to date have not yielded the new collaborations hoped for. The challenge then is



to establish through experiment and experience which kinds of conditions contribute to scientists modifying and restructuring the situations in which they undertake research. One might explore, in particular, workshop processes and other interactions that stimulate and support reflexive scientific practice.²⁶

c) Changing collaborations: A question opened up by the prospect of further development of workshops among reflective practitioners is the composition of their participants. Almost all the participants of mapping workshops have been advanced graduate students self-selected by their willingness to commit time to reflect on their research and possible future directions. Ironically, like the "design rules" for locally managed commons (see B2d), workshops privilege situations in which participants have decided to engage with each other in more or less intentional communities. The challenge then is to bring into interaction a wider range of researchers—or, even more, a wider range of social agents—and keep them working through differences until plans and practices are developed in which all the participants are invested.²⁷ The notion of distributed agency would be taken yet further.

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Mapping workshops bring researchers' attention to their diverse resources and dependency on other agents. At the same time, because workshop interactions center around representations made by individual researchers, they preserve a degree of concentrated agency. Indeed, this must be the case as long as researchers are encouraged to address self-consciously the situations they study and their own social situatedness so as to affect social change. Concentrated agency was also involved in mapping workshops when Yrjö Haila and I initiated and led them. At the same time, without our having greater institutional resources, status, workshop leading skills, and time, the workshops have not achieved their full ideal, namely, bringing together researchers and other social agents and sustaining their interaction until new complexity-addressing collaborations emerge.

Cases in which this ideal has been achieved might provide the obvious final component of my 3x3 framework. However, if I had such cases and used them to influence readers, the essay would end by returning the focus to accounts of the situation studied (angle A). Readers would be left the task of mobilizing new collaborators, sources of funding, and so on, so they could contribute to other work matching the ideal. Expecting such cases from any author and expecting readers to follow their lead would place too much weight on our concentrated agency. Instead, noting the vibrations between distributed and concentrated agency, I want to leave opened and active questions about the role of any individuals and their

knowledge, heuristics, and other awareness of situations and situatedness (Harvey 1995).

C3. Facilitating a culture of participatory restructuring

My final move, therefore, is simply to name the challenge to which the 3x3 framework points. That challenge is to facilitate a culture of participatory restructuring of the distributed conditions of knowledge-making and social change. In this spirit, I seek tools to share that strengthen the vibrations in the direction of particular dynamics and self-conscious knowledge-making and social changing.²⁸ Clearly, however, more work is needed on what agents can do—but not alone or through their accounts of the world alone—to contribute self-consciously to the on-going restructuring of the dynamics among particular, unequal knowledge-making agents whose actions implicate or span a range of social realms.

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* Based on a presentation made to a workshop on "Old and new directions in 'Commons' research," Rutgers University, February 1997 and a subsequent paper delivered to the Society for Social Studies of Science, Halifax, Nova Scotia, October 1998, on which Charis Cussins Thompson provided insightful commentary. This essay builds on Taylor (1992, 1999) and Taylor and García-Barrios (1995) and incorporates some passages from those publications. Important at various points while developing this paper's ideas and their exposition were Gwen Mills' research assistance, conversations with Arun Agrawal, Raúl García-Barrios, Bonnie McCay, and Jesse Ribot, and the comments of Ann Blum, Lee Freese, and the Life/Environmental Sciences Study Group of the Harvard University History of Science Department.

¹ In Taylor (1997a, 2000a) I extend the framework to more general questions of agency, not only that of socio-environmental researchers. See also the end of section C2 below.

² Many Science, Technology and Society (STS) researchers highlight the range of different social agents involved and the diversity of resources they mobilize (Latour 1987, Taylor 1995). Nevertheless, most STS researchers operate without a systematic

framework for addressing this "distributed" complexity and for exposing possible points of engagement for themselves and other agents.

³ See Taylor (1998, 2000b) for more details about the conduct of the class simulation.

⁴ See Galaty and Johnson (1990) for a sense of the historical and geographic variation within this definition.

⁵ To "discipline" some of the "unruliness" of the complexity of intersecting processes, I have also drawn diagrams of intersecting processes in which separate strands are teased apart (Taylor 1997a).

⁶ This picture is emerging in some of the papers presented at recent IASCP conferences, e.g., Agrawal (1998a), Pradhan (1998). See also McCay and Fortmann (1996).

⁷ Hymes, a socio-linguist, invented the term to describe the way Chomskyan linguistics gradually reconsidered the meaning of expressions after having first stripped the idea of language down to its underlying, "generative" grammar. The term is, however, apt in this context as well.

⁸ For a decade in the 70s and early 80s the goal of development projects was to produce fundamental changes in pastoral practices, through, for example, privatization of pasture, stock reduction and large-scale ranching schemes. These projects generally failed; research led belatedly to the perspective that herders respond skillfully and sensitively to their variable and uncertain semi-arid environments, provided the herders can remain mobile, maintain species diversity in their herds, and apply their local ethnosciences of range management (McCabe 1984; Horowitz and Little 1987).

⁹ These positions are dominant in environmental discourse more generally; see Taylor (1997b), and Taylor and García Barrios (1997).

¹⁰ This angle is derived from Haraway's historical and cultural analysis of primatology, in which she interpreted the primate research and displays of the Museum of Natural History in New York City in terms that had little to do with preserving primates and investigating their nature. Instead, Haraway interpreted concern for exotic species and situations in terms of the concerns back home of the researchers and their patrons, namely, the threats they perceived that immigrants, women's suffrage, and so on were making to the dominant, white, Anglo, male culture of New York City (Haraway 1989).

¹¹ Although some of these resources will be real, material and perhaps unmodifiable aspects of the world, heterogeneous constructionism is not a realist philosophy of science. The difficulty of modifying science always depends on how such 'natural' resources are linked by people in the making of science to other resources, including 'social' ones. For this reason, heterogeneous constructionism is not philosophical relativism either (Taylor 1995).

¹² Heterogeneous constructionism is similar to the "heterogeneous engineering" of Law, a sociologist of science, and to the related approaches of Callon and Latour. Heterogeneous constructionism places more emphasis on explanation. See Taylor (1995) for a discussion of differences.

¹³ There are more conventional ways to identify the factors that make a difference, including studies of controversy (Nelkin 1984) and the comparative method. In Taylor (1997b) I also proposed the use of "accusations." Broad interpretations

concerning the social situatedness of researchers, such as those in B2, would be presented to particular researchers. The intention would be to provoke responses that might reveal more of the diverse practical as well as intellectual resources that the particular researchers are employing.

¹⁴ For example, during the mid-19th century, Fulbe peoples codified conventions for land use and access in the floodplain of the inland Niger delta of what is now Mali. This code or Dina divided the floodplain into clan lands. A jooro or tax collector/pasture manager for each clan controlled access for livestock from other clans, in particular the timing of access. Under the colonial and post-colonial governments the jooro have less power to enforce their control over land use and access. Rice cultivators, for example, have encroached on lands traditionally grazed by the pastoralists' livestock. At the same time more jooros have begun to extract monetarized taxes for their personal benefit, further reducing their authority to regulate land use (Turner 1993). See Little (1988) for a historical review of comparable changes in East African pastoralism.

¹⁵ For example, Brokensha et al. (1977) point to labour demands rather than range area limiting pastoralists' herd expansion and Little (1985) connects environmental degradation with accumulation and impoverishment. See section A3 of this essay.

¹⁶ History a source of long-term values vs. conditions for future changes; Generic systems vs. local particularity; Constant vs. constructed parameters; Temporal and spatial variability leaves system structure unchanged vs. essential to system structure; Systems decomposable into subsystems vs. not decomposable; External forces simply mediated vs. "external" forces make for "internal" restructuring; Responses to crises require overall policy changes vs. local participation.

¹⁷ In Taylor (1997b) I amplified this form of prodding by highlighting the undesirable "surprises" that follow from undifferentiated analyses.

¹⁸ The contrasts in B3, used in the counterfactual analysis of the researchers' resources, can be converted into CHs for analysis of socio-environmental complexity. Similarly, for the seven contrasts in Taylor (1992) not discussed in B3 (see note 16).

¹⁹ See <http://omega.cc.umb.edu/~ptaylor/iseta98.html>. I have been stimulated here by participation in the International Society for Exploring Teaching Alternatives (ISETA; see <http://www.asu.edu/upfd/www/iseta>), where such "experiential" sessions are obligatory. This format lends itself to communicating pedagogy, but can be adapted to other topics.

²⁰ Particular details come into play in C1b to the extent that it envisions members of the audience addressing their own particular social situatedness, and in C1e when members of the audience are involved in adapting another researcher's particular account into their own arena.

²¹ This is amplified by the full analysis of Picardi's modeling (Taylor 1992).

²² This is a loose way of identifying heterogeneous resources. In the interest of participants exploring a diversity of potential considerations, they have not been asked to evaluate the significance of the connections before including them in their initial maps.

²³ Taylor (1993, 1997a) discuss ways that social studies of science and technology discount, pragmatically and discursively, the implications of distributed agency.

²⁴ The same effect is also intended by my introducing critical heuristics and other other practices I have begun to inject into teaching and research workshops. Freewriting allows participants to acknowledge other preoccupations first and thus clear mental space so that thoughts about the issue in question can emerge that had been below the surface of their attention (Elbow 1981). Constructivist listening, based on re-evaluation counseling, allows participants in pairs to delve deeper into emotions left from hurtful experiences that interfere with clear thinking, making sense of experience, and listening well to other participants (Weissglass 1990). The Sense-Making approach to identifying and bridging gaps between what people know and need to know also helps people to re-evaluate their customary or habitual responses, to acknowledge without becoming blocked by the emotional valences in scholarly and day-to-day interactions (Dervin 1999). Such practices can also be seen as a contribution to the rolling back of the intersecting processes that constitute any agents' situatedness and to the subsequent heterogeneous reconstruction of that situatedness.

²⁵ Yet, there is no logical reason to conclude, in a view expressed most forcibly by literary and legal critic, Fish (1989), that reflection on one's situatedness is irrelevant to changing it.

²⁶ In this vein the workshop processes developed by the Institute of Cultural Affairs (ICA) have become my model. ICA's techniques have been developed through several decades of "facilitating a culture of participation" in community and institutional development. Their work anticipated and now exemplifies the post-Cold War emphasis on a vigorous civil society, that is, of institutions between the individual and, on one hand, the state and, on the other hand, the large corporation (Burbidge 1997). ICA workshops elicit participation in envisioning and planning in a way that ensures the full range of participants are invested in carrying out the resulting plan. This is achieved by a neutral facilitator leading participants through four phases—objective, reflective, interpretive, decisional—a structure best represented in "focused conversations" (Spencer 1989, Stanfield 1997). For an elaboration of the basic propositions of ICA facilitation and group process, see <http://omega.cc.umb.edu/~ptaylor/ICAprpositions.html>, which is adapted from workshop materials of ICA Canada; see <http://www.icacan.ca/>.

²⁷ In this sense, I have long been inspired by Participatory Action Research (PAR), in which social scientists strive to empower the people most adversely affected by some issue and allow their inquiries to be shaped through on-going engagement with them (Park et al. 1993, Greenwood 1998). When it lives up to that ideal, PAR subverts the divide between outside analyst and the subjects whose social and ecological situation is being analyzed (Taylor 2000c). (It should be noted, even though it does not diminish the PAR ideal, that the mandate of "participation" can be wielded in disempowering ways by State or International agencies; see Ribot (1996), Agrawal (1998b). See also Peters (1996).)

²⁸ In addition to critical heuristics and mapping workshops, see notes 23, 25 and 26.