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How do we know there is a population-environment problem?

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Abstract

Five fictional friends of the author have agreed to meet and talk, hoping that he was right when he claimed that discussion crossing the usual boundaries of their fields would enrich their different inquiries and concerns. Ecolo, a natural and human ecologist, breaks the ice. He wants to marshall scientific knowledge to persuade others of the seriousness of the population problem. He is questioned by Philoso, whose philosophical bent leads her to observe the models that people use and to ask how they support the claims they make. In turn, the other three join in: Activo, an activist who is interested in what one can do on the basis of claims made about the environment and about society; Reso, a researcher who analyzes issues about the degradation of natural resources; and Sociolo, who is prepared to bring in social considerations to explain or interpret the directions that are taken in science.

Ecolo (natural and human ecologist): Here's a quotation that expresses my concerns about human population growth. "We hold it to be self-evident [and] undeniable that prospects for the future would be more favourable if there were fewer people on earth" (Okoye and Smith 1994, 11).

Philoso (who asks how you support your claims): It is not self-evident to me. Can you explain the problems associated with a larger population?

Ecolo: The problems are environmental ones, in particular. The greater the population, the greater the erosion of arable lands, consumption of non-renewable resources, and production of greenhouse gases and pollutants in general.

Philoso: What is the basis for these claims?

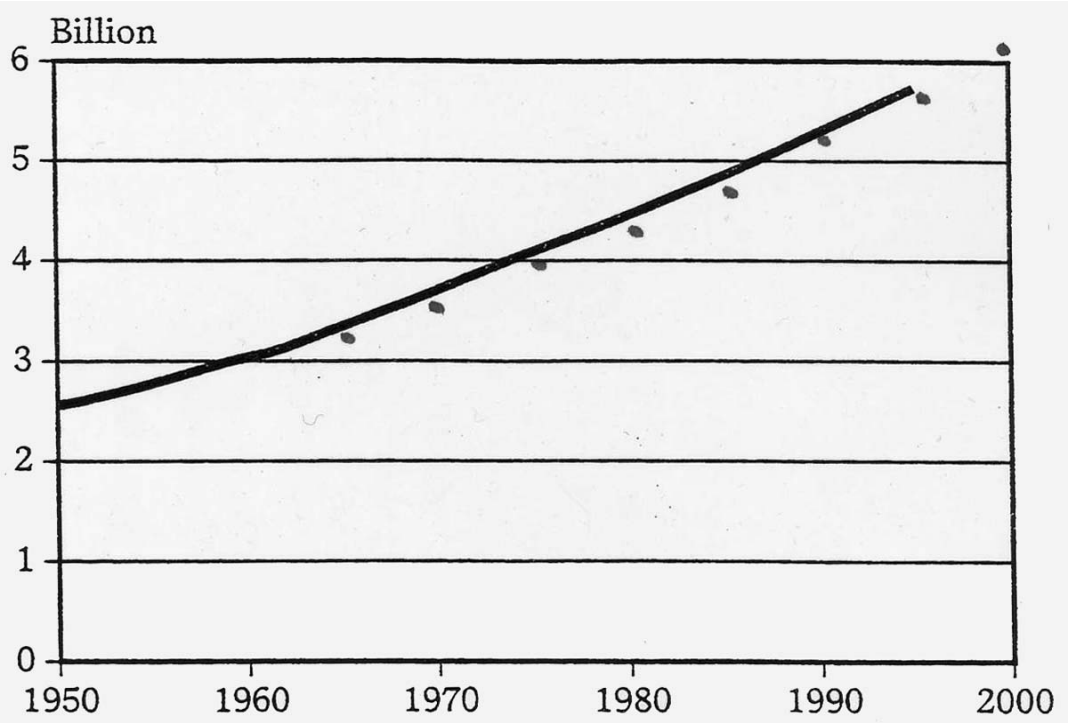
Ecolo: I simply extrapolate from past experience. Whatever per capita environmental effect people have had in the past will continue, unless something significant happens to change people's livelihoods.

Philoso: And extrapolating from past experience of growth is also the method you use for projecting higher populations in the future-and thus the higher total human environmental impact?

Ecolo: Yes, except that demographers take into account the division of the population into separate age classes and differences among countries.

Philoso: Have their past projections panned out?

Ecolo: In recent decades, yes. [Points to figure 1 -- World population growth: United Nations projections from 1963 (dots), superimposed on actual values (curve, from Brown et al. 1996)]



Activo (who asks what one can do on the basis of claims): So what do you propose should be done?

Ecolo: Population growth should be limited, of course. The most humane way is to promote contraception.

Philoso: Why contraception?

Ecolo: Obviously, so that fewer children are born and the population growth rate declines.

Philoso: Have you established that people have children because they lack contraception?

Ecolo: Can I ask you a question first-Do you really think we can afford the time to follow a path of philosophical scepticism? As some of my colleagues have noted, the "struggle merely to support today's population at today's living standards is causing environmental destruction on a scale and at a pace unprecedented in human history" (Ehrlich et al. 1995, p.1). It is action that is needed, and now.

Philoso: I think there's always a place for exploring different ways of framing our questions and answers. Bear with me for a moment and I hope you'll see this.

Ecolo: OK. About contraception then-Research has shown that the number of children desired by mothers in the developing world outside China is, on average, 1.1 less than the actual number they had (Sinding et al. 1994).

Philoso: But the basic model is that, averaged over all people of reproductive age, a person tends to have X children, and projecting this into the future, the number of humans continues to increase?

Ecolo: More or less. Demographers also take into account trends in the number of children per person of reproductive age and trends in the age at which they have those children.

Philoso: These details notwithstanding, the model is basically the one common in ecology texts. Future population growth is a consequence of current population size. In short, population is the cause of population growth.

Ecolo: Yes. What other model do you propose?

Philoso: I'm thinking about more recent models in ecology that trace the consequences of individual differences such as body size and spatial location.

Ecolo: I've heard about them, but not made time to understand them well. Remind me of their conclusions.

Philoso: In these so-called individual-based models, the growth trajectories of the population or biomass can turn out to be qualitatively different from those predicted by models that apportion the biomass into a population of uniform equal individuals (DeAngelis and Gross 1992).

Ecolo: I've already mentioned that demographers take into account differences among countries.

Philoso: The results of individual-based models derive not from simply dividing the population into different sub-populations, but from the dynamic relations among unequal individuals. Three equal-size fish might compete equally for the same food, but if one of them gets an earlier or faster start on growth, it can starve out the other two.

Ecolo: Intriguing, but what implications does that have for human population growth?

Philoso: It suggests to me that dynamic relations among unequal individuals may qualitatively change our understanding of population growth.

Ecolo: Really? How might that be so?

Reso (a researcher who analyzes natural resources issues): I can help here. Consider this simple scenario (Taylor 1997 [CL essay]). There are two countries. Each has the same amount and quality of arable land, the same population size, the same level of technical capacity, and the same population growth rate, say 3% per year. Country A, however, has a relatively equal land distribution, while country B has a typical 1970s Central American land distribution: 2% of the people own 60% of the land; 70% own just 2%. Both countries double their populations very rapidly, but five generations (120 years) before

anyone is malnourished in country A, all of the poorest 70% in country B would already be-unless they act to change their situation.

Ecolo: But sooner or later in both countries everyone reaches the carrying capacity of their land.

Reso: This is not just an issue of when the crisis occurs in the two countries. B's poor would probably first experience what others call population pressure in the form of food shortages. They would link these shortages to inequity in land distribution (see Durham 1979; Vandermeer 1977). They might attempt to take over the underutilized land of the wealthy. The wealthy, anticipating this possibility, might fund paramilitary operations that target leaders of campaigns for land reform. Or build factories that employ the land-starved poor. The availability and nature of foreign aid would influence the actual choices in specific instances. And so on.

Activo: Does this mean that we should support land reform and abandon population control programs? Or are you saying that we should back up these programs by boosting military aid to countries like B?

Reso: I would have to ask to whom "we" refers. People are never all part of a uniform "we;" no real country is like country A. The important thing to understand is that the crises to which actual people have to respond come well before and in different forms from the crises predicted on the basis of aggregate population growth rates and ultimate biological and physical limits to growth. Indeed, in a country like B the poor would be justified in viewing anyone who focuses on population control policies as taking sides with those who benefit from the inequitable access to productive resources.

Ecolo: I have always stressed that affluent countries and people have disproportionate effect on the environment because of their higher per capita consumption of resources and the corresponding higher production of pollutants.

Reso: But I'm not just saying that in any district, country, or ecosphere there are richer and poorer people. My point is that groups with different wealth and power exist, change, and become involved in crises because of their dynamic interrelations.

Ecolo: OK, but even if the dynamics of population growth are more complex, it is still true that the greater the population, the greater the environmental effects.

Reso: Not neccesarily. Consider this case of soil erosion in a mountainous agricultural region in Oaxaca, Mexico (García-Barrios and García-Barrios 1990). The severe soil erosion evident now is not the first occurrence of such a problem in the region. After the Spanish conquest, when the indigenous population collapsed from disease, the communities abandoned their terraced lands, which then eroded. The remaining populations concentrated in the valleys and adopted labor-saving practices from the Spanish, such as cultivating wheat and using plows. As the population recovered during the eighteenth and nineteenth centuries, collective institutions evolved that reestablished terraces. Erosion was reduced,soil dynamics were stablizied, and soil accumulation was perhaps stimulated. But this type of landscape transformation needed continuous and proper maintenance. If a terrace were allowed to erode the soil

would wash down and damage lower terraces; there was the potential for severe slope instability. What made the necessary maintenance possible was the collective institutions I mentioned, which first revolved around the Church and then, after independence from Spain, the rich Indians, caciques. These institutions mobilized peasant labor for key activities, which, in addition to maintaining terraces, included sowing corn in work teams and maintaining a diversity of maize varieties and cultivation techniques. The caciques benefitted from what was produced, but were expected to look after the peasants in hard times, a so-called moral economy (Scott 1976). Given that the peasants felt security in proportion to the wealth and prestige of their cacique, and given that prestige attached directly to each person's role in the collective labor, the labor tended to be very efficient. In addition, peasants were kept indebted to caciques, and could not readily break their unequal relationship. The caciques, moreover, insulated this relationship from change by resisting potential labor-saving technologies and ties to outside markets in maize.

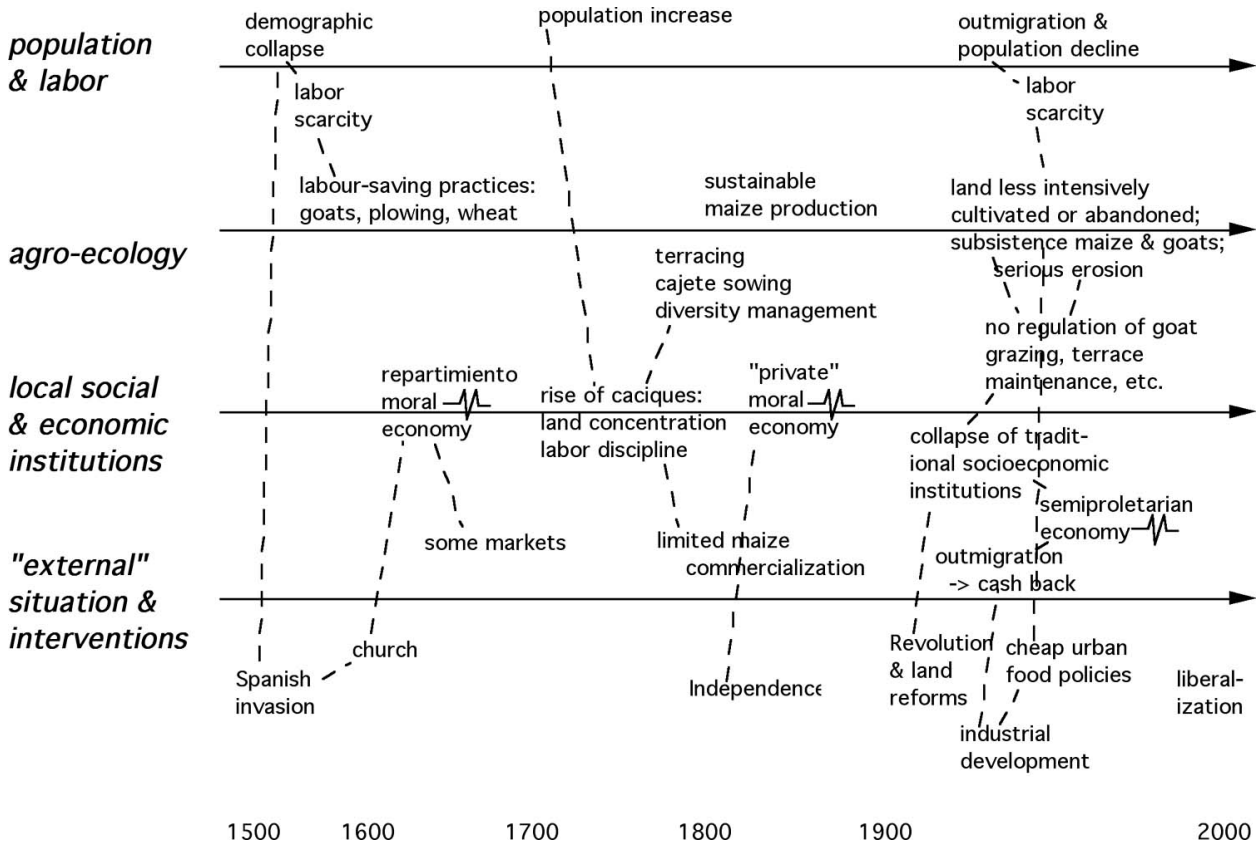
The Mexican revolution ruptured the closed system of reciprocal, albeit unequal, obligations and benefits by taking away the power of the caciques and opening the communities to the changing outside world. Many peasants migrated to industrial areas, sending cash back or bringing it with them when they returned to the community for periods of time. Rural population declined; transactions became monetarized; and prestige no longer derived from one's place in the collective labor. With the monetarization and loss of labor, the collective institutions collapsed and terraces began to erode. National food-pricing policies favored urban consumers, which meant that corn was grown only for subsistence needs in this area. Little incentive remained for intensive agricultural production. New labor-saving activities, such as goat herding, which contributes in its own way to erosion, were taken up without new local institutions to regulate them.

Ecolo: You're saying that environmental degradation was associated with population decline. But how far can you generalize from this one case?

Philoso: Good question.

Activo: Are you saying that environmentalists should support feudal-like social systems?

Reso: I don't think any such simple lessons follow. Let me show you a diagram that summarizes the different strands of this case (figure 2). (The dashed lines indicate connections across the different strands of the schema. The zig-zag lines indicate institutions that rely on relationships of inequality.)



Reso: Except when I need to grab someone's attention, I don't highlight the relationship between environmental degradation and the population decline shown in the top strand. After all, it's not population but labor that is important in this case. Labor is something defined by the technologies of production (the second strand) and the social institutions that govern it. Such institutions operate both locally (the third strand) and at places distant from where the erosion occurs (the fourth strand). Any relationship between population and environmental change is highly mediated, depending on the technologies used and the local and national social and economic institutions through which labor and production are organized. No one kind of thing, no single strand on its own, could be sufficient to explain the currently eroded hillsides.

Ecolo: The diagram helps, but I have to admit that these various strands are difficult for me to think about. I don't have training in the sociology, economics, and politics of rural institutions. I have to spend more time thinking about the soil erosion case and your two-countries story.

Activo: But you have campaigned for policy changes on the basis of population projections. Without training in the social sciences, you had confidence to do that.

Philoso: Moreover, developments in your own scientific field provided critical perspectives on aggregate population projections. Why hadn't you explored the new science?

Ecolo: I'm not sure. I'll have to think more about both of your challenges.

Philoso: OK, we'll lay off for a while, Ecolo. Reso, can I go back to the issue of how one might generalize from your case? Putting aside the specific details, could the underlying structure serve as a template to guide further field research on environmental issues? The particular details emerging from this new research would inevitably modify the structure, but researchers would still be better off than they would if they'd started from scratch.

Reso: What is the "underlying structure" as you see it?

Philoso: I think we can discern processes operating at different spatial and temporal scales. These work together not only to produce specific outcomes but to continuously transform one another and the situation as a whole. No one process-for example, population growth or growth in Mexican industry-is sufficient on its own to explain the environmental and social changes in that part of Oaxaca. The analysis centers on a local problem, erosion, but is "trans-local" in its explanation of that problem.

Reso: Yes, you've captured the way I see things. Reading the anthropologist Eric Wolf (1982: 387) led me to call this an "intersecting processes" model of complexity.

Philoso: Is "intersecting" the right word? It implies that population change, agricultural ecological production, (re)organization of local institutions, industrialization, etc., are separate processes, which happen sometimes to influence each other.

Reso: Perhaps we could invent a new word, then-"intrasecting"-to denote that the processes are actually inseparable constituent strands of an overall process. But I have to admit that I'm also uncertain about whether to use the term "process" at all. I'm trying simply to point to sequences of events that persist or are repeated long enough for us to notice them and need to explain them. For some people "process" connotes a basic underlying causal structure. Events come to be seen either as instances of the process or as noisy deviations from it.

Activo: While you are worrying about terms and concepts appropriate for the complexity, I'm worrying about the practical political implications. At first I thought I was getting the hang of your perspective, Reso. You're saying we have to consider the differential contributions different people make to environmental problems, and how these contributions are interdependent strands of the overall dynamics of social, as well as environmental, change. This means that people have to identify where they are positioned-or where they are trying to position themselves-within the particular dynamics of each case.

Ecolo: Before you get to the "but," can you make this concrete for me?

Activo: I could imagine conservationists from the U.S.A. coming into the region and promoting restrictions on goat grazing. Or grassroots development workers helping the community organize the new local institutions that, among other things, would regulate goat grazing so as to limit its effect on erosion.

Reso: A government policy of making credit available for new local enterprises could help. Otherwise, to keep up with the high interest rates money-lenders demand, everyone has to find wage-paying jobs-often

out of the region. Few can spare their labor to supervise goat grazing, however persuasive the conservationists may be. Yet the trend in Mexico, ever since the debt crisis of 1982, is to curtail government programs for poor sectors of the economy and promote export industries. Perhaps someone in the U.S.A. needs to pressure the international lending banks to ease up on their demands for indebted nations to reduce government expenditure for the poor.

Activo: And so on-I imagine we could identify many more positions from which different groups could attempt to influence the ongoing social and environmental change. Multiplying positions of engagement seems a positive alternative to exhorting us all to reduce population growth and consumption. My problem, Reso, is that the intersecting-processes perspective also implies that the different groups should not think of themselves as engaging separately. The significance of their actions depends on actions taken by others at different positions. How would you propose to get different groups collaborating or, at least, co-ordinating their efforts?

Reso: That's a big challenge. In fact, I get quite daunted when I reflect on an observation the cultural analyst Raymond Williams made, namely that, in the face of a progression of crises, there has been a tendency for "the practical cancellation of detailed, partipat[ory], consciously chosen planning." Crises are "simply exposures of existing real relations" in societies, he argued, yet it has been crisis-managers, who pursue a "politics of temporary tactical advantage" (Williams 1983, p.11-12), to whom citizens have been abdicating control of their futures. And in the time since Williams wrote, the idea of social planning has become further discredited through association with centrally planned economies that have failed and collapsed.

Ecolo: Aren't you asking too much, Activo, of Reso? Not only does he have to make sense of the complexity of the situation he has studied, but you're asking him to think through all the ways that different people employ his accounts in their subsequent actions or policy recommendations. I think he should be allowed to concentrate on his social scientific investigations, all the better to convince people like me that he can provide a more faithful account of the way the world really works.

Sociolo (who interprets the directions taken in science): I am sceptical of such a separation. Almost everything I've been quietly listening to has reinforced my view that when scientists make claims about the world-and here I refer to social as well as natural scientists- they also reveal their social concerns and commitments.

Philoso: What does it mean to claim ideas refer to two different kinds of things-the world and the scientist-in-society-at the same time?

Sociolo: First, let me ask you where individual-based models came from and why they emerged at the time they did.

Philoso: I don't know. I could hypothesize that someone borrowed the idea from another field. But then I'd have to explain how they arose in that field, wouldn't I? Perhaps many people had thought of them, but

the powerful computers needed to handle them weren't available until a decade ago. What's your explanation?

Sociolo: I don't know either. I'd have to investigate. But let me take a few steps back to explain the position from which my questions to you came. Notice that Ecolo's science of population projections is not simply determined by the nature of the world. Individual-based models and Reso's scenario of the two countries indicate that qualitatively different growth trajectories can result when models include dynamic relations among unequal individuals. Given these choices about how to model growth, we have to consider other influences to explain which models a scientist uses.

Philoso: Not necessarily. I am happy with the idea that Ecolo simply hasn't caught up with the better theories currently available for explaining population growth and environmental change. When he and his colleagues do, the accepted theory will be the one that represents the world most faithfully.

Sociolo: Personal and social influences might keep Ecolo from catching up as quickly as others have.

Philoso: Yes, but the effects are transient. By the time that a scientific community reaches a strong consensus about a theory, it is the world, and not the idiosyncratic situations of the members of the community, that accounts for the consensus.

Sociolo: How do you determine whether, and for what aspects of a theory, scientists are in the transient period? How do you know that they have reached the reliable consensus?

Philoso: When we look back over previous decades and centuries it is usually obvious.

Sociolo: Yes, but I'm interested in understanding science as it actually happens, not science only when it has settled down to a persistent consensus.

Ecolo: I'm with you in that regard-I wouldn't have thought that the science behind aggregate population models could be replaced by a better theory. But how would you explain my reliance-before this discussion, at least-on such models?

Sociolo: I would really need time to study you doing your work.

Ecolo: You also said that when asked to explain the origin of individual-based models. Can you at least venture some hypotheses?

Sociolo: OK. It is in the nature of people's cognitive functioning that they hold onto theories, at least for a time, in the face of accumulating counter evidence. Even though you don't seem very rigid, Ecolo, change can be inhibited by the language you're accustomed to. For example, the term "population"-we've all been using it-connotes an entity with all its components tied into one uniform whole. Undifferentiated analysis was certainly the dominant paradigm in the ecological community when you were a student, and even with the advent of individual-based models the textbooks show that your scientific community has by no means let go of that paradigm. So psychology, language, and paradigms reinforced by one's community probably all contribute to your reliance on aggregate population models.

Activo: Remember that my interest is in the policies or actions that follow from the science. How helpful is it to examine the ways that scientists do or do not change their ideas?

Philoso: Surely you want your actions to be based on the best scientific accounts.

Activo: Yes, but can knowledge about how science is made help me take action more effectively? After all, when it comes to taking action, Reso's analysis of social and environmental change and the differential contributions different people make gives me more than enough to work on.

Sociolo: As I said before, I do not believe the realm in which scientists make claims about the world can be separated from the social situations, broadly construed, that facilitate scientists' work. Let me illustrate the connection between science and social action with a simple classification of environmental analyses.

I distinguish three broad analytic orientations regarding environment and society. They differ in the units of analysis-the kind of person or other agent who is involved in phenomenon-and in the implied limit-that makes the phenomenon a problem. Reso's two-countries story gives us two of those orientations. On one island there were unequal, differentiating units, linked in their economic, social, and political dynamics, facing limits that are primarily social, and only sometimes biophysically conditioned. On the other island were uniform, undifferentiated units, which can be simply aggregated, and which face biophysical limits when they grow. I would add a third orientation, which acknowledges the existence of rich and poor strata, but does not provide an account of the dynamics that generate and maintain inequality.

What's important is not simply that the "differentiated dynamics" orientation is, as Reso showed us, probably more faithful to the actual complexity of the world. The different analyses suggest different conceptions of what social action is favored. The "differentiated dynamics" orientation, as Activo and Reso discussed earlier, means that different people have to identify where they are positioned-or where they are trying to position themselves-within the particular dynamics of each case. The "uniform units" orientation implies what I would call moral and technocratic political tendencies (Taylor 1997 [How do we], Taylor and Garc□a Barrios 1997). In technocratic formulations, objective, scientific analyses-often quantitative in form-identify the policies needed in order to restore order or ensure the sustainability or survival of society or humanity. Individuals, citizens, and countries are then expected to submit to those policies. Moral formulations, in contrast, avoid coercion and rely on each individual to make the change needed to maintain valued social or natural qualities of life. Yet in many senses the moral and technocratic approaches are allied. Both command our attention by stressing the severity of the crisis and threat to our social order . The solutions invoke common, undifferentiated interests as a corrective to scientifically ignorant leadership or corrupt, self-serving or naive governance. Moreover, although the solutions are supposed to apply uniformly to all of us, special places in the proposed social transformations are reserved for their exponents. The technocrat has a place as analyst or policy advisor; the moralist has a place as guide, educator or leader.

Ecolo: The uniform orientation seems like a straw person. Everyone recognizes that there are richer and poorer people and countries that have different effects on the environment.

Sociolo: That's where the third "stratified units" orientation comes in, but it occupies an uncertain middle ground. Suppose contraception is promoted among the poor to curb population growth and reduced consumption is promoted among the affluent to reduce the disproportionate environmental effect of their slower growing or stable population. Are these or other stratified policies and practices meant to be any different from those given by separate uniform analyses, one restricted to the poor, the other to the affluent? If so, more needs to be said. In particular, how and why are the proposals supposed to work? This question raises the need for an analysis of the dynamics, redirecting us along the "differentiated dynamics" orientation.

Philoso: There's certain logic to your claim that uniform analysis implies moral or technocratic politics, but do you have evidence to back this up?

Sociolo: Language is one line of evidence. It is very common for people talking about the population problem-or, more generally, talking about global environmental problems-to employ terms of moral recruitment and education and of management. One illustration cannot prove this, but it can help make my point plausible, so let me review an editorial by Meffe, Ehrlich and Ehrenfeld in the journal Conservation Biology (Meffe et al. 1993).

Ecolo: I know that piece. Indeed, I have often drawn the attention of my students and colleagues to it.

Sociolo: Well, see what you think of my reading of it. The editorial states that conservation biologists "possess the professional responsibility to teach humankind about the perils" (p.2) of continued population growth. These scientists have "the obligation to provide leadership in addressing the human population problem and developing solutions" (p.2), and are able to "help promote policies to curb rapid population growth" (p.3). The language speaks of leadership, in educating others and in policy formulation. The authors go on to say that "the population problem is stunningly clear"-as science shows-"and ought to be beyond denial" (p.2). Such statements suggest that social change is related to the psychology of individuals. This moral tendency is again evident when humankind is treated as if it were one person: "The human species ignores or denies" the impending calamity (p.2). A brief mention of the "critical importance... of educating and empowering women" (p.3) in the next to last paragraph hints that all people might not be equally responsible, but the conclusion returns to the dominant undifferentiated formulation: "Action is needed from everyone, at every turn...[in the cause of] human population control. Life itself is at stake" (p.3). Politics is simultaneously about morally committed individuals taking action and about control and management. Either way, the animating force is the seriousness of the problem.

Ecolo: This kind of language is used by almost everyone I work with in the environmental area. I can see that I sometimes come across as a moralist when I invoke my own record of reduced consumption and

small family size. But I don't think of myself as a technocrat. The very fact that I've kept listening to you suggests a lot more openness than "technocrat" connotes.

Philoso: Can I jump in for you here, Sociolo? The logic and evidence, Ecolo, creates a strong presumption that uniform analyses are connected to moral-technocratic politics. If you depart from this "null hypothesis," there must be other factors operating in your science or politics that you haven't yet shown us.

Sociolo: Indeed. The very purpose of this simple three-part classification is to elicit responses that reveal more about what shapes your actions and practices as a scientist who works in a specific social context.

Philoso: Alternatively, as you mentioned earlier, you could observe Ecolo working, review his lectures, papers, grant applications, and so on, and produce a particular account of his knowledge-making. This field work is analogous to that from which Reso generated the soil erosion case.

Sociolo: Yes, the simple three-part classification is not essential to my research and analysis.

Activo: Not so fast-it seems to be my role in this discussion to almost, but not quite, appreciate what's being said. I understand, Sociolo, the connections, both logical and linguistic, that you draw between the kinds of environmental analysis and the conceptions of social action. I remember you introduced your classification to show me that the realm in which scientists make claims about the world should not be considered separately from the social situations that facilitate the work scientists do. But are you saying that the views of social action scientists favor lead them to accept certain environmental analyses? Or is it that their environmental analyses lead them to favor certain social actions? Furthermore, whether the politics is an upstream influence on the science or a downstream consequence of it, the realm in which scientists make their claims still seems separate .

Philoso: Good point.

Sociolo: I see the relationship as reciprocal. The arrows between science and social action point both ways. I'm not talking only of the crude social influences on science, evident, for example, when foundations fund research on population and biophysical limits more often than they do the kind of socio-environmental research Reso described. Even reciprocal isn't quite the right idea. When I get into the particular cases, I find certain courses of action facilitated over others in the problems chosen, categories used, relationships studied, evidence required, equipment used, time spent in the field, kind of interactions pursued with the subjects investigated, and so on. That's what I mean when I say the complex socio-environmental situation ought not be seen as separate from the complex situation that makes the research possible.

Philoso: Intriguing, but you'd need to demonstrate this to me.

Sociolo: Of course, but for this I have to do my field work on Ecolo or others like him.

Activo: And we might ask someone to do field work observing you, so as to understand the factors shaping your work.

Sociolo: Right.

Reso: Before we direct all our energies in that direction, it occurs to me that Sociolo's simple three-part classification is like my two-countries scenario. I believe that detailed accounts of particular cases are more faithful to social and natural reality. However, simpler, general claims, such as "population growth leads to environmental degradation," are easier to convey and receive more notice than more complicated, particularistic ones.

Philoso: Yet the simpler accounts are not only rougher approximations, but, as the soil erosion case showed us, sometimes they are wrong.

Activo: And they facilitate policies and actions with unintended and even undesirable consequences, especially when international conservationists have been drawn into coalitions with the state and militarized institutions (Peluso 1993).

Reso: I agree with both of you. That's why I've started to think that an in-between approach is needed, one in which we formulate propositions that are simple enough to communicate, but disturb the simple analyses and always point to the need for further work to address the complexity of particular cases.

Ecolo: I see-the two-countries picture sticks with me, even though I've already forgotten the details of the soil erosion case. And the "disturbing" proposition would be that I should consider how the analysis of causes and the implications of the analysis would change if undifferentiated units, often simply combined into statistical aggregates, were replaced by unequal units, subject to further differentiation as a result of their linked economic, social, and political dynamics.

Philoso: Now I understand why Reso and Sociolo didn't proceed directly to particular complex accounts.

Sociolo: Yes, and that is another example of the ways that our representations of the world build in ideas about social action-in this case, simply ideas about how to help our audience digest the material we present and use it in their own work and thought.

Activo: "Simply"? Remember how Reso's particular account of the soil erosion case exposed multiple positions from which different groups could attempt to influence the ongoing social and environmental change. Surely, there'd be an equivalent situation if you produced a particular analysis of some scientific accounts of social and environmental change and then wanted to use it to influence the ongoing making of science.

Sociolo: You're right to bring me back to this issue. And I would make the picture even more complex by linking my accounts and Reso's. Given that certain courses of action are facilitated over others in the making of science, influencing the making of science should be part of influencing the environment and society-the situations that the science is studying.

Ecolo: My head is spinning. I'm not sure I could learn to grapple with these layers of complexity. I'm not even sure that it would be helpful to me if I did.

Philoso: Yes, given Ecolo's scientific training and skills, wouldn't he be more likely to influence others if he focused on improving the science in the population-environment area?

Sociolo: This may indeed be a pragmatic course of action for him. But can I turn the tables, Philoso, and probe the model you're promoting here? In trying to separate analysis of the making of science from analyses of environment or society, are you claiming that all the different activities scientists engage in to be able to do their work and have it recognized do not change what is held to be justifiably true about the world?

Philoso: If I were, that would be a strong claim. I'd have to demonstrate that no changes in those activities would have produced a significantly different account of the world. I'll have to think through this logic and spend more time scrutinizing the evidence in this area.

Sociolo: Can you explain why you haven't before?

Philoso: No. I'll have to think more about that as well.

Activo: I can see another angle on the question of why Ecolo and Philoso want to focus on scientific analysis. Reso has identified weaknesses, conceptually and in terms of evidence, of simple models in which population growth leads to environmental degradation. And I hinted at the undesired consequences of policy that invokes those models. Suppose some scientists who had used simple models heard these critiques and found them plausible. They might then decide to investigate the differentiated relationships among population, social organization, technology, and environment. However, the resources they would need would be complex and varied, like the socio-environmental situations they would study. Even though Reso and I know this, we might focus on our critique of the science and leave it up to the scientists to rework their particular tools, collaborations, models, funding, and so on.

Reso: So when we separate analysis of how science is made from analyses of environment or society could be made, we might have made one of my kind of in-between propositions.

Sociolo: I understand, but it's hard for me to accept this. I feel that the more comprehensive my account of the science, the more helpful it will be to scientists attempting to modify the direction of their work. But I realize this is inconsistent with my position that the actual state of the world is insufficient to account for what becomes established as knowledge of the world.

Reso: Don't get too upset, Sociolo, about this inconsistency. Helping scientists understand the complexity of the situation that enables their work may be no guarantee that they'll be able to effectively reshape that situation. But who needs guarantees? Wouldn't it be interesting and revealing if scientists could think systematically about the situatedness of their research at the same time as they probed complex ecological and social situations?

Activo: How would you do that?

Sociolo: That's a challenge I need to think more about.

Reso: It seems that each of us has identified questions we need to work more on.

Sociolo: And we've had questions opened up by interaction with each other.

Philoso: That's what our host claimed would happen when he invited us to meet, but I'm not sure that this is typical.

Sociolo: And I'm not sure that others reading what we've said would decide to take up these different questions.

Activo: So we'll have to ask our host to think about which conditions make interactions among people from different fields as open as our were today.

Ecolo: Right.

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