Projecting Environmental Trends from Economic Forecasts

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Contents

1 Forecasting for sustainability

The purpose of this book is to outline a forecasting method targeted at changing current policy in the direction of sustainability; a method that bridges the gap between the goal of sustainable development and the barriers faced in the implementation of sustainable development. The forecasting techniques can be used to estimate the environmental impacts of economic policy choices in the medium term; the evaluation of current possible alternative paths is the most achievable forecasting goal. The mix of techniques we illustrate, and the attention to barriers to acceptance and implementation, are central to producing information with the potential to influence current choices towards more environmentally sustainable economic policies.

The concept of sustainable development is gaining currency in many, if not most, policy contexts. The concept of sustainable development emphasizes a balanced relationship between ecology, economy and social life, for current and future generations. Since its introduction by the Brundtland Commission (WCED 1987), in its broad outlines sustainable development has become an accepted vision of a development outcome. The implication of a sustainable development vision implies that choices in any one area require the assessment of consequences in the others.

However, in many political contexts there are many barriers to planning for sustainability. First of all, there are differences, some of which are quite deep, in concepts of the defining conditions of sustainable development. These differences are akin to different views of a "good life," or a "good society." Policy is made on some middle ground of current accepted views held by policy makers and politicians (Fiorino 1995). Sustainable development offers a vision of the future; a normative goal against which we can compare the many possible undesirable futures. The acceptable means by which sustainable development might be achieved are dependent on the

capacity for concerted and integrated actions, the legitimacy of public intervention, ideas of justice and individual freedom, as well as accepted concepts of resource scarcity.

The lack of consensus over the procedural and substantive norms of sustainable development presents a barrier to the implementation of sustainable development policy. Some writers have described an "environmental policy paradox"; in this view, the substantive changes that need to be made are clear. The paradox is that despite widely held consensus over needed policy changes, implementation is both slow and difficult (Smith 1992). In our work, we found not only a lack of consensus over goals, but a resistance among policy makers to both planning and to environmentalism as well. In part, this was in response to economic concerns over a potential tradeoff between prosperity and environmental protection.

Other barriers to planning for sustainability can be seen as a product of uncertainty or a lack of information. Problems are complex, and the assessment of future consequences is uncertain. However, the lack of reliable information about the future is a permanent feature of the policy landscape. Information is used to make policy decisions which is found to be sufficiently reliable and well founded. Judgments about the sufficiency and quality of information in public discourse can be based upon the extent to which that information is in accord with prevalent political views and the character and reliability of its source, just as much as more technical judgments of methodological quality. Decisions are made, typically, using the information that is available and least contested. These incremental decisions about economic strategy, social policy and ecological health are made in existing policy contexts. The policies chosen in the existing policy contexts, whether based on explicit concern for some view of sustainability or not, together constitute a policy direction.

Input to the policy process that seeks to affect the sustainability of future policies must address existing policy conditions. In developing information for policy, attention must be paid to crafting the information to the policy audience. Typically, policy is made in focused policy contexts. While sustainability requires a holistic approach, current policy institutions tend to have limited institutional roles, short time horizons, a single area focus and a limited mandate. Policy makers, however, often bind their consideration of strategies to one specific policy area. For example, economic development strategies are chosen with regard to their likely economic effects. Not only is this approach to viewing the problem likely to produce unintended effects on the environment, in the medium to longer term, these environmental effects may constrain the success of the economic development strategy.

Another important source of resistance in the American cultural context is the idea that policy makers should not consciously work towards common goals. There is a long history of reluctance to allow extensive power to any one policy institution. In the history of institutional development in the United States, the mandate of single institutions has been limited. As well, the overall legitimacy of the role of government in development has been subject to question. Currently, policy institutions have limited mandates, and policy makers see their own concerns as legitimately limited to a particular policy area. There are institutional limitations on the extent to which policy makers are able to take a holistic view (Scheberle 1997). While there is not a necessary contradiction between limited institutional mandates and the pursuit of sustainable development, the substantive consideration of holistic effects is made more difficult both by institutional structure and cultural mores.

Nevertheless, all policy choices have some environmental impact. Some of the environmental effects of alternative economic strategies are significant and some might defeat the policy choice over the long term. It is important to consider environmental impacts, including those policy contexts that do not fall under the mandates usually understood as "environmental policy."

The purpose of the project we undertook in the state of Kentucky was to examine policy alternatives and identify policy directions that held the promise of sustainable development that would enhance both the socioeconomic well-being and the quality of the physical environment for the people of Kentucky. While the details of the policy context and the institutional context may be specific to that particular task, we feel that the approach we used is potentially transferable to other contexts. We designed a process directed towards engaging policy makers in discussions of sustainability and environmental consequences at the same time as it would ensure the relevance to policy makers of the forecasts we produced.

The methodological contributions presented in this book include a unique mix of forecasting techniques, which include techniques that tailor the forecast to its intended policy audience and its social and political context. Methodological attention in forecasting often places more emphasis on rigor than on policy relevance. Our approach emphasizes that forecasts must speak to policy makers' current opinions. The methodological innovations we describe include techniques for ensuring that policy input is found to be feasible, relevant, focused and viable by a given policy audience.

We describe a unique application of nominal group technique and utilization of the cross-impact matrix technique to the process of deriving planning foci and alternative paths. The group methods and their utilization are central to producing a planning product that is focused on the issues currently considered salient by opinion and policy leaders in a nation or state.

This focus does translate directly into our substantive results. For example, we used the assessments of current policy actors to frame the assumptions about what degree of cultural, attitudinal and behavioral changes were believable or achievable. This rather limited possibility was incorporated into the scenarios we evaluated. While we did engage in an active participatory process in deriving the possibilities on which to model scenarios and projections, this educational process, while valuable, resulted in incremental change in participants' attitudes. These changes could not be expected to affect all state policy makers.

Forecasting using the assumptions of the audience has this aspect of a mirror-like projection. This technique does not assess the actual possibility for changes in attitudes and behaviors, it incorporates a believable degree of attitudes and behaviors; this is desirable as a response to the current policy audience. Not surprisingly however, using the assumptions gained from our current policy audience, our projections showed that technological change offered more potential for ameliorating environmental degradation in the future than did possible changes in public attitude or behavior.

On the one hand, this might encourage current policy makers to devote more resources to technological changes than to public education. On the other hand, if the policy input did not respond to the assumptions of current policy makers, even this move towards societal sustainability might be unimplemented. Policy input can be usefully constrained; wider realms of socio-political discourse support ongoing cultural and political changes. Information intended to change current decisions must be framed to focus on issues currently considered salient by public opinion of policy leaders and decision-makers. There is therefore a balance that must be struck between the amount to which a given forecast can move toward more sustainable outcomes and the degree to which it must speak to current conditions. This balance can be justified by seeing the problem of moving towards more sustainable outcomes as a longer-term process involving many small steps. These steps include education, awareness, and gradual changes in problem framing.

In forecasting, we used a scenario, or strategic planning, approach in combination with econometric forecasts and cumulative environmental modeling. Econometric forecasts, which are the platform on which the economic forecasts discussed here are built, are well known. The environmental forecasting technique employed in our project builds on econometric forecasts to derive cumulative environmental impacts. The particular model we used is one of a number of alternative systems for accumulating environmental impacts. The mix of the two projection techniques has been employed for policy-making in less developed countries.

However, this is the first effort to use the mix of the two production techniques for planning and examining alternative development paths for an advanced industrial nation or part of one.

Through a detailed description of our experiences, gained in completing a study of economy-environment interactions, we develop more general observations on principles, process and procedures. Our objective is to take advantage of the lessons learned in the course of a project we undertook to forecast the environmental futures of various economic scenarios in the Commonwealth of Kentucky. Our experiences with this project provide the basis for a guide to the ways in which data on the environmental consequences of economic development alternatives — and even choices about how to minimize negative effects — can be generated without generating resistance to utilizing the information in decision-making. The project we undertook in Kentucky offers a good example of the procedural steps which policy analysts can undertake to move the policy agenda towards sustainability, both in helping to frame issues and in evaluating policy direction.

Projecting the shadow of humanity on the environment of the Earth

Human beings, like any species in an ecosystem, have an impact on their environment, whatever they do. The ever-larger technological capacity of humans enables us to have far more significant environmental impacts than most species. This capacity for harm, or for good, can be controlled and directed by human volition. The exercise of volition, however, presumes two key informational inputs. First, decision-makers must recognize the existence of choices, that is, alternatives for action. And second, decision-makers must understand, to some extent, the consequences of those choices.

The discipline of economics describes itself as the science of choice, and its analytical focus is on constrained optimizations. The focus of economic analysis is the logic and process of the allocation of scarce resources to maximize the value of some objective function. The field of planning complements economics in that it explicitly addresses the processes by which objectives are derived by a decision-making organism such as an individual, household, private firm, government agency, or society. Economic planning combines the two approaches and explicitly addresses the decision-making processes: both the objectives to be pursued and the actions to be taken to attain those ends.

The pursuit of economic development and efforts to raise the incomes and associated standards of living of some population is a generally accepted

public sector planning function. Historically, such public efforts have compared alternative development paths and strategies, strictly on the basis of narrow economic consequences, measurable in monetary terms. Some more elaborate planning efforts have incorporated considerations of the effects on social systems and other aspects of cultures and traditional values of different economic paths. Only recently have such planning efforts begun to recognize that efforts to improve the well being of a population — whether income or access to goods and services — may be undermined by their *environmental* consequences.

We begin, however, with the more fundamental issue, that of envisioning *any* alternatives — the idea that alternative futures can be contemplated and then attained through conscious effort. If an organism cannot conceive of alternative futures, or choices, then it cannot act to attain a preferred outcome and no amount of information about the future will be of any use.

Without consideration of the environmental consequences of economic development alternatives, decisions about the perceived options before a polity may be seriously flawed. Paths may be chosen that have long term — even short term — adverse impacts on human well being. A failure to consider environmental factors and predictable outcomes may skew either the formulation of objectives or the formulation of constraints on choices. These failures may be attributed to some combination of two key shortcomings of the decision-making processes. First, there may be inadequate data on the interactions between human economic activity and environmental conditions. Second, there may be decision-maker resistance to incorporating evidence about economic-environment interactions in the policy process.

Decision-maker resistance to the consideration of environmental impacts often occurs through the dissociation of economic considerations from environmental considerations in both institutional mandates and in customary approaches. The very process of generating adequate data to provide a basis for choices that are better informed about environmental consequences may generate decision-maker resistance to using the information. The impact of the data-generating process on the economic planning decision process must be considered in deriving and selecting means of projecting economy-environment interactions and ensuring that strategic economic choices are made in the context of strategic environmental considerations.

It is imperative that in order to promote both improved economic well being and preserve environmental quality, planners seek an appropriate balance of economic development and environmental protection policies. We must find ways to move towards a sustainable future, to allow people to accomplish their current economic goals without encumbering the resources and quality of life for future generations.

The why and how of forecasting alternative futures

As we have already noted, human economies and their immediate natural environments are inextricably linked. Attempts to demonstrate these linkages and to trace the connections between economic activity and environmental processes can take many forms. One may look at the efforts to shape economic development processes and directions pursued by planning bodies or political jurisdictions to determine public priorities. Alternatively, one may examine private decisions by individuals, households, or the business expansion efforts of corporations as the driving forces of economic change. The choice of focus may reflect ideology or political priorities, but the basic premise is the same when one considers the relationship between economic activity and the environment. Economic activities are also ecological and environmental activities with specific impacts on the quality of air, water, land, and other local natural assets.

The quality of the environment and local natural assets or resources can shape the economic choices of private parties or local jurisdictions. A despoiled environment can diminish the attractiveness of an area for development. Alternatively, a clean, healthy, aesthetically pleasing environment can actually serve as a stimulus to economic growth, whether through the in-migration of population or through new business development. Similarly, assets such as fertile soil, mineral resources, or particular land contours provide the basis for for-profit activities that could not be pursued in other settings. Historically, humankind has taken the topography of an area as a given in most settings. However, the Netherlands' centuries-old reclamation of land from the North Sea — and certainly the far-greater earth-moving capabilities developed in the latter half of the twentieth century — indicate that even land contours need to be considered as variables in decision-making with respect to economic activity and the environment.

Resource depletion poses similar choice questions. The sustainability of particular local economic activities depends on decisions made about rates of current exploitation of natural assets. The measurement of the sustainability of natural resource activities is usually approached using stock-and-flow accounting. This approach can yield tentative measurements of sustainability, dependent on assumptions about technology and what is known about costs of replenishment of the "stock." Additionally, measuring sustainability in this way depends on the assumption that the activity or the resource will continue to be valued in approximately the same way in future economies.

Economic and environmental conditions are increasingly intertwined as the new technologies for production and disposal employed by humankind can change the biological and physical environments in which humans live. The

environmental effects in turn affect human well being, but the tradeoffs between increasing incomes of individuals or of populations and the resulting environmental conditions are not well understood. On the one hand, it is clear that the unregulated pursuit of economic growth could jeopardize many environmental futures; this conclusion is clear from the history of resource depletion and environmental degradation. However, under some conditions, economic growth could improve local ecological conditions, particularly as household prosperity increases and empowers an immediate concern for health. The prediction of overall ecological outcomes of any one type of activity is difficult. As well, the ecosystemic connections of even current activities are not yet well understood; we do not know how to predict or account for cross-media pollutants or for discontinuous changes in ecological health.

The inevitable uncertainty is compounded as economy-environment interactions are assessed from a longer time perspective. Our project was set in the context of a time horizon of thirty years. This timeframe was set for us in the terms of our project. The degree of uncertainty grows, as longer time horizons increase the likelihood of a completely unpredictable event altering some baseline condition. The significance of environmental impacts and interactions shapes their importance for policy.

In order to plan for the future, we must first understand how economic policies and actions impact environmental health. Efforts to delineate or model the modern human impact on the environment have grown more sophisticated over the last few decades, since this was first attempted on a global scale. There are many differences between these efforts; the key differences are in purpose and in the approach taken to uncertainty. In terms of purpose, some modeling efforts emphasize the attempt to influence the environmental policy debate, while others emphasize the production of a more precise or accurate delineation of environmental impacts. The key differences in the approach to uncertainty are between complex systems modeling and scenario-based approaches. Complex systems modeling attempts to incorporate the uncertainty within a single model, using mathematical models of randomness, chaos and surprise. Scenario-based approaches are based on narrative futures; rather than delineating the precise outlines of any one future model, several possible futures are derived.

Modeling and strategic planning are tools that can be used to provide information to decisions that affect the future. Some of this information may change the way the current problem is perceived. While the future remains uncertain, modeling can clarify some of the most logical outcomes of current actions. In this way, modeling and strategic planning themselves can be considered to have effects on the future. For example, if a modeling effort

produces a prediction that changes current attitudes, it may affect current policy and current actions and therefore change future outcomes. On the one hand, the given model is no longer an "accurate" prediction of the future, but it may still be considered to be a successful model. Modeling for sustainable development is modeling which seeks to change current actions. There is a tension between the normative effort to produce the best possible projections from the best possible data, and the normative effort to affect current policy decisions.

The first major global environmental forecasting was undertaken by the Club of Rome as part of their effort to affect decision-making through raising awareness. The model that was developed did not account for behavioral or technological adaptations. As such, the predictions that were generated by this model were dire Malthusian outcomes of overpopulation and resource scarcity (Meadows 1972). The Club of Rome model and its predictions have been criticized; from the perspective of accurate forecasting, the key criticism is that adaptations do in fact take place. Current trends cannot simply be extrapolated to generate a prediction. However, simple extrapolation does illustrate the fact that current behaviors may be destructive or problematic. Forecasting of this kind is intended to affect current debates and current behaviors through the quantification — or logical enlargement over time — to illustrate the consequences of current behaviors rather than to predict actual outcomes. An extrapolative model can be used to raise public awareness about the need for change: to change potential outcomes.

One of the outcomes which followed the Club of Rome model is that over a quarter of a century of work on modeling human impacts on ecosystems or environmental problems has followed, with local as well as global models developed. Many global modeling efforts have been based on econometric modeling. These models are basically a complex and interrelated projection of current trends. Like the initial modeling done by the Club of Rome, these project the present into the future. Some of the more sophisticated models incorporate feedback into resource substitution, or account for technological change through feedstock rates. Still, this approach does not account for significant changes in values, behavior, and rates of resource use or presently unknown environmental impacts of current behaviors (Arinze 1994; Charpin 1986; Hughes 1999; Woodell 1989).

Efforts have been made to build models that take account of behavioral changes brought on through economic and distributive feedback in a more complex system. Some of these changes include value changes in the societies being modeled (Daly 1973; Daly and Cobb 1989; Flinn and Reimers 1974; Forrester 1971; Odum 1971; Stigliani *et al.* 1989). Global modeling