

Working Paper

Food Security: A Conceptual Analysis of Linkages and Interests in UNCED Negotiations

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WP-91-24
August 1991



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Preface

This working paper represents research conducted as part of a study on prenegotiation sponsored by the Processes of International Negotiation (PIN) Project in support of the United Nations Conference on Environment and Development (UNCED). The overall purpose of the prenegotiation study is to gain a better understanding of collective problem solving at early stages in complex multilateral negotiations concerning environmental issues. This PIN study has two major objectives -- one to further research on prenegotiation and another to assist a particular prenegotiation process in a practical way. Specifically, this study seeks:

- o To examine the dynamics of the prenegotiation process and how they impact upon the possibilities for successful outcomes, that is negotiated agreements.
- o To support the leadership of the UNCED Conference while the prenegotiation is still in progress by identifying opportunities to facilitate compromise and agreement, as well as avert potential deadlocks and pitfalls.

The overall PIN study focuses on two specific questions that particularly characterize the dynamics of the current prenegotiation phase of the UNCED -- how issues are being linked *and* how national interests are demarcating the range of negotiable outcomes.

This working paper targets one complex, but significant, issue area being considered in the UNCED debates, that of *food security*. The author develops and refines the conceptual framework of the prenegotiation analysis, frames the structure of the food security issue area, and, at the same time, sets the stage for an innovative methodological approach to analyzing the dynamics of negotiation.

The author participated in the 1991 Young Scientists' Summer Program at IIASA and was awarded the 1991 Peccei Scholarship for her research contributions.

Abstract

Environmental and developmental concerns on the United Nations Conference on Environment and Development (UNCED) agenda are closely interrelated, both from substantive and procedural vantages. Food security, one of the proposed global goals of UNCED, is a concrete example of these concerns. This study explores practical applications of disaggregating issue complexity and explores a more formal way to improve understanding of how parties to the negotiation move toward mutually acceptable outcomes. Beginning with a broad framework, *conceptual space*, we identify six dimensions within which parties define a challenge like food security, their interests, and their beliefs about what should be done. Countries draw implications about the various *levels of linkages* within a particular issue area. At the same time that countries are defining the salience of an issue for themselves, they are also formulating judgments about possible policy responses to address the problems. These judgments are grounded in traditions of ethics and political philosophy, but manifest themselves as *preferences* among policies. Over the course of a negotiation, changes occur in perceptions, knowledge, and the relative importance assigned to corresponding problem and response attributes. *Decision analysis* models are well-suited to structuring this type of movement, and thus may assist delegates, conference leaders, and mediators while negotiations are still in progress.

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FOOD SECURITY: A CONCEPTUAL ANALYSIS OF LINKAGES AND INTERESTS IN UNCED NEGOTIATIONS

Amanda M. Wolf¹

1 Background and Objectives

1.1 The United Nations Conference on Environment and Development

The United Nations Conference on Environment and Development (UNCED) received its official launch with the December 22, 1989, approval of General Assembly Resolution 44/228. The overall goal of the conference is to narrow the economic gap between nations while paying attention to the integrity of the environment. "Sustainable development" is the desired outcome. According to 44/228, current imbalances in global patterns of production and consumption should be addressed, guided by the principles of proportionality and capability. The problems are characterized as common concerns of mankind. Solutions require international cooperation with simultaneous attention accorded to both environmental and developmental aspects. At the same time, the solutions need to respect the sovereignty of states.

Even though the negotiations are structured to address separate issues, such as desertification and toxic wastes, the overall UNCED mandate calls for a *synthesis* of environment and development objectives. Thus, the major challenge set by 44/228 is to achieve consensus on international policy to address the interface between the sociopolitical sphere and the biogeochemical sphere at which environmental problems are manifested.

Three kinds of outcomes are expected from UNCED. First, an Earth Charter will embody the principles the delegates want to guide the next phases of sustainable development. Second, a few agreements, currently being negotiated in other fora, may be ready for signing at UNCED. The two most probable are a climate change convention and a biodiversity/biotechnology convention. The third major output of UNCED is Agenda 21, a framework for planning, coordinating and implementing international actions.

1.2 Linkages and Interests in UNCED: Negotiating Food Security

Now that UNCED is underway, a major marker on the road to sustainable development has been reached. But many fear that the process will break down amid another episode of North/South disagreement. While the underlying rationale for linking environment and development into broadly sustainable policies is not particularly controversial, it is not

¹The author gratefully acknowledges helpful comments and suggestions by Bertram Spector, Daniel Druckman, Roderick Shaw and Gunnar Sjöstedt, and the resources and facilities of IIASA and the PIN project. Thanks also to Peter G. Brown and especially to H. Peyton Young for many discussions that have influenced the direction of this project. The National Science Foundation, through the American Academy of Arts and Sciences, provided financial support for the author to participate in the IIASA's Young Scientists' Summer Program (YSSP). Amanda Wolf is currently in the Policy Studies Ph.D. program at the School of Public Affairs, University of Maryland, Morrill Hall, College Park MD., 20742.

at all clear whether or how the wide variety of *national interests in specific aspects* of such a broad-ranging and long-term action plan can be successfully accommodated. Therefore, the primary objective of this study is to facilitate a better understanding of the complexity of environmental/developmental interactions on the UNCED agenda from a combined issue and negotiation perspective.

For the substantive basis, we have selected one of UNCED's principles of sustainable development -- to ensure food security on a sustainable basis.² Food security may also be conceptualized as an "issue constellation," bringing in many of the interlinkages implicit in the sociopolitical and biogeochemical spheres. As both a part of sustainable development and a more specific set of substantive issues, it illustrates well the complexity of the UNCED challenge. Once this issue has been disaggregated into its component parts, decision analysis models can provide a framework for understanding the relative importance of different attributes of the problem.

1.3 Overview of the Paper

The rest of the paper is in five sections. The first three sections discuss three organizing concepts, conceptual ways of organizing and setting the stage for analysis of a complex negotiation: *conceptual spaces*, *issue definition and linkages*, and *interests*. The next section describes a formal analytic methodology and illustrates the approach with a simple example. A final section concludes with an assessment of further research directions.

Section 2 begins with the broadest context for examining linkages and interests in UNCED negotiations. A *conceptual space* is a composite of issue definitions and perspectives of an issue at various levels. The "bargaining space" of a negotiation has much in common with conceptual spaces but critical distinctions can be made. In particular, in a negotiation like UNCED, characterized by multilateralism and issue complexity, some prior evaluation of conceptual space parameters is needed to lay the foundation for more conventional bargaining space analysis.

These parameters characterize perceptions of environment and development problems and relate to policy responses. They can assume two expressions. One originates in the "facts" of the problem -- the physical/scientific/technical aspects; the other relates to policy responses and is built upon a normative/ideological foundation. Six such attributes are described to prepare the ground for discussions of issue linkages and interests that follow.

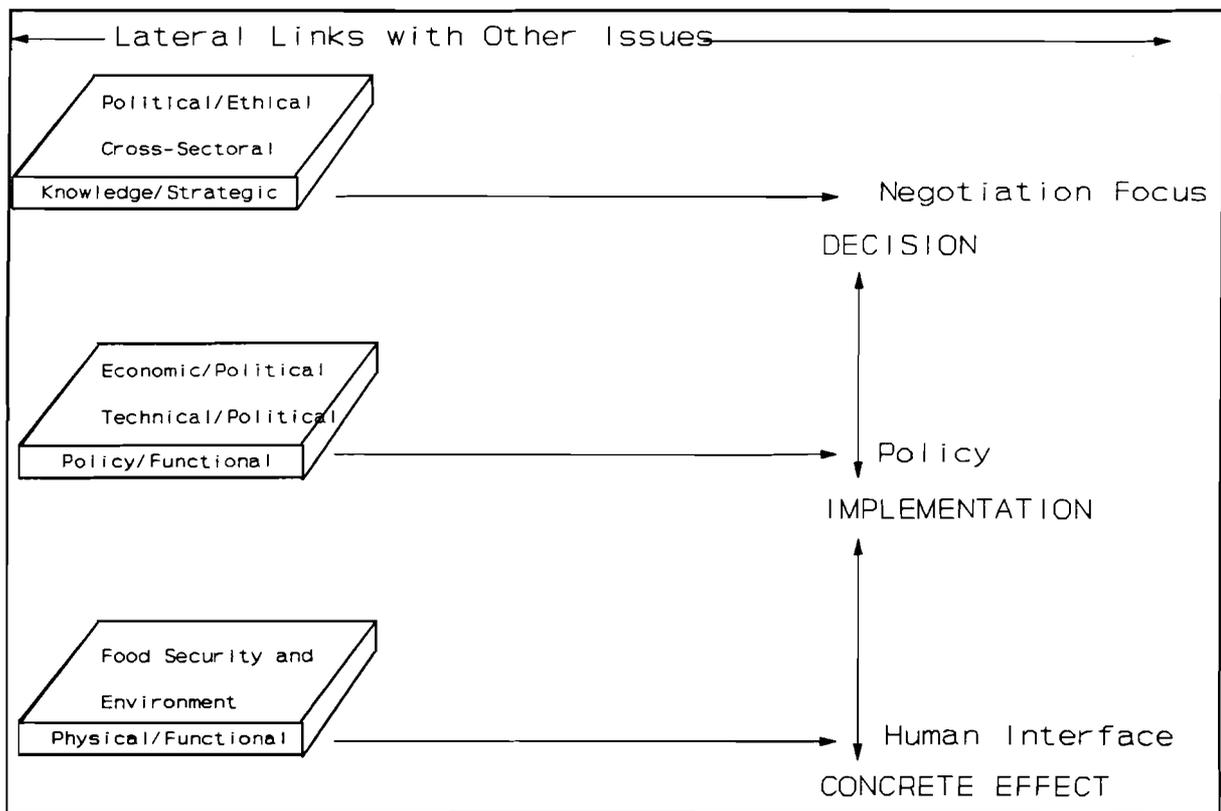
One way to get beyond the diplomatic rhetoric may be to understand better the *set of linkages* that together define the problem and the desired solution for the parties. The first part of Section 3 looks at definitions of the key UNCED concepts for our study -- food security and sustainable development. Next several different kinds of food security linkages are examined.

Linkages, or relationships, in the domain of food security may be roughly categorized as in Figure 1. Different levels of linkages and their relationships in a negotiation context are shown. The diagram makes clear the distinction between the *existence* of a linkage and

²UNCED PrepCom, A/CONF.151/42 para. 11 (vi).

its *implications*. For instance, it is a simple matter to state *that* there are relationships between CO₂ emissions, climate change, and shifting agricultural productivity. But what do these relationships imply for India or for Finland? What policies or negotiated decisions will be favored? Moreover, although scientific studies have greatly advanced understanding of many linkages, a number of important linkages are not "scientific" or "technical" at all. For example, there are ethical linkages, such as the linkages drawn between past emissions of greenhouse gases and responsibility for future climate change mitigation efforts. Another type of linkage is drawn explicitly by individuals or organizations to encourage the joint consideration of the linked elements -- the choice of environmental topics for UNCED is the best example. All of these different types of linkages influence policy decisions and the course of negotiations.

FIGURE 1 Levels of Linkage



The joint treatment of environmental and developmental concerns is at the center of

the interest dynamics in the UNCED negotiations.³ The UNCED timetable demands an expedient and pragmatic approach, one that gets beyond a debate in purely normative terms (which, in any case, has little prospect of resolution). To move in this direction, a better understanding of negotiation interests is also needed. In Section 4, we look at specific interests and identify some ranges of policy options that relate these interests to the six attributes of the conceptual space. Here, the focus is upon the way that the attributes characterize the perceptions of environment/development problems *in relation to* policy actions that may be the negotiated outcomes. While there may be some known, or at least knowable, "facts" or "objective" understandings that emerge from a careful examination of issues, the point remains that there is no consensus -- on such facts, on importance, or on priority for action. Policies are judged more or less acceptable according to the acceptability of the *balance* that obtains, in the agent's eyes, between imperfectly compatible, imperfectly substitutable, and imperfectly known connections.⁴ Satisfaction with an outcome is a fluid concept, usually meaning that the outcome is "good enough," "fair enough," or the "best that could have been expected given the circumstances."

The desired negotiation outcomes advocated by a particular country will be products of how they perceive the set of linkages -- that is, on the view the negotiator has of the relational characteristics of a causal factor and an outcome.⁵ In the *negotiation* context, the variety of national interests that overlay and shape the definition of the salient linkages, and provide the metric to judge the results, *for each particular delegation*, together shape the space in which an eventual satisfactory agreement must be situated.

Thus, we come back to the idea of a bargaining space. A consideration of the strengths and types of interests according to problem/response attributes may begin to show where maneuvering room exists (or is constrained) as UNCED proceeds. Over the course of the negotiations, perceptions shift and priorities are rearranged. To complete the requirements for a formal analysis, it is also important to know *who* perceives and believes *what* and which changes occur over time. Section 5 describes a methodology for assessing where the bargaining space lies given the various perceptions and priorities of the parties. The components of this analysis are the six attributes of conceptual space, proposed outcomes, and country or coalition preferences. This approach respects the vast complexity

³The term "interest" has been variously interpreted and subjected to criticism in the literature. While not completely avoiding problematic usages, such as in the phrase "national interest," by "interest" we mean a basic component of a preference on a given outcome. We must defer a more complete explanation until a later section of the paper.

⁴There may also be a moral incompatibility -- a so-called "moral dilemma" -- in the agent's eyes. In fact, it can be expected when the reference system of morals does not recognize a plurality of morally good outcomes (as, for example, with utilitarianism), but the agent does (as in a "common-sense" morality). This is interesting in its own right, and also interesting as an aspect of negotiation -- in which compromise and balance is characteristic of the outcomes. This has led some to consider negotiation a "dirty" occupation, one that requires moral compromise. Michael Slote (1989, *Beyond Optimizing*) presents evidence for the acceptability of rational and moral "satisficing" in a manner that seems applicable to negotiation processes.

⁵This construction is adapted from Coleman (1990, p 50). For Coleman, an agent is related to a desired "thing" -- a resource or event -- according to his/her interests and control. He uses the term "private world" in a manner similar to our use of the term "conceptual space."

of a multilateral, multi-issue negotiation while providing a systematic way of assessing important general themes that occur repeatedly. The procedure could be used to study the movements toward convergence or divergence of countries or coalitions throughout the course of a negotiation.

As the negotiation proceeds and as information becomes available, the conceptual framework can be refined. The analytical method could be used by the UNCED Secretariat or by national delegations and other interested parties during the preparation phase leading up to the 1992 conference in Brazil. We conclude with some recommendations regarding ways to validate and improve the methodology.

2 Conceptual Space

2.1 Conceptual Space and Bargaining Space

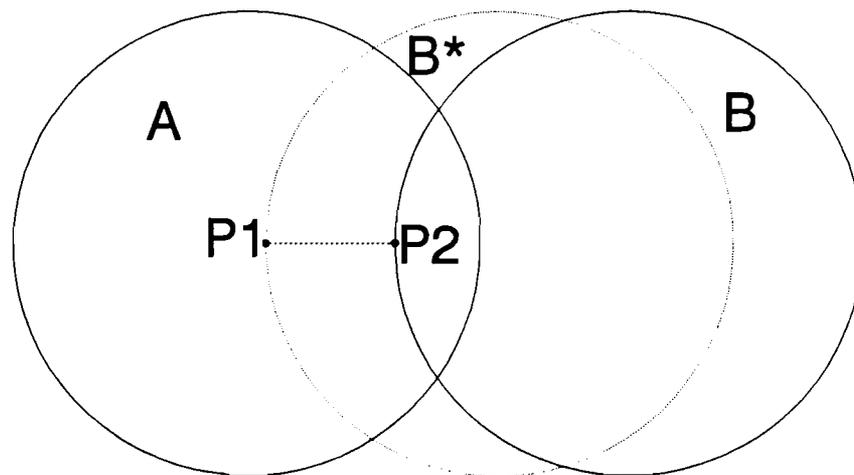
It is commonly assumed that effective and long-term solutions to global environmental/developmental problems will only emerge as a result of fundamental changes in world view. Typically, such changes have been seen as analogous to biological evolution: slow and incremental, with rare, dramatic perturbations leading onto a very different path. This evolutionary model implies a degree of human suffering and environmental havoc that many believe is unnecessary in a species of intelligence and will. To take advantage of the momentum set by UNCED to hasten a move to sustainable development, some clearer notion of what is a world view might help. How can we categorize the dimensions of various outlooks on the future environment/development interface that is the subject of UNCED negotiations?

In the introduction, we used the term "conceptual space" to mean a multi-dimensional/multi-attribute way of thinking about the interrelationships between issues and interests. Problems are only problems against a knowledge and value system that recognizes them as such. A negotiation is a means of addressing a problem.⁶ The most basic question that may be asked is are the conceptual spaces of various parties aligned? And if they are not, can (should) they be aligned? Or is understanding the differences sufficient? If spaces are not aligned, the situation may be characterized by the all-too-familiar case of delegates "talking past each other" -- failing to connect on the meanings behind the communications. But if, at the opposite end, satisfactory negotiated outcomes emerge despite differences in conceptual space, a true alignment of conceptual space may be an extraneous exercise. At a minimum, however, it is desirable to at least be able to situate and compare the parties on an equivalent basis.

⁶This does not, of course, rule out the increasingly common practice of using the first phases of a negotiation to *define* the problem. At some point, however, unless there is some threshold of agreement on this definition, the process stops with a decision to do nothing more.

A conceptual space⁷ is constructed of an agent's perceptions of a problem in relation to various beliefs about what is right, how the agent's interests are affected, and what may be acceptable solutions. The role of a mediator or conference leader can be seen as a task of either (1) operating on the *proposals or problem descriptions*, changing them sufficiently to make them comprehensible in different conceptual spaces or (2) operating on the *perceptions* of the proposals or problems. These choices are illustrated in Figure 2.

FIGURE 2 Options in Conceptual Space.



Suppose a proposal, P_1 , is on the table. It lies within agent A's conceptual space, but not within B's. There are two options: task (1) above would suggest modifying the proposal, or creating a new one, P_2 ; task (2) suggests a realignment of B's conceptual space to B^* . P_1 would then be within the conceptual spaces of both agents.⁸

A priori, since the functional results appear equivalent, in the sense that the "distance" involved is the same (line segment P_1P_2), it is not clear which task will be more promising to pursue. Would it be more fruitful to pour efforts into developing new proposals? This

⁷Daniel Druckman and Bertram Spector suggested this terminology and were helpful with discussions about it. The term is drawn from psychology, but it should not be pushed too far — after all, who is ever "of one mind" when making *any* decision? Rather, we want to shift the emphasis away from the "hard" sciences and toward the "social" sciences involving interpretations and perceptions.

⁸Note that this does not assure that proposal 1 will be accepted. It simply means that there is sufficient overlap in the parties' outlooks to explore the possibility.

would be recommended if B is very firmly set in outlook and not likely to move toward B*. Or are there means to easily arrange a shift in B's view of the issue (or interests relating to the issue)?

However, even if P_1 is within both A's and B's conceptual spaces, it may not be feasible. We see that bargaining space can be defined as a subset of overlapping conceptual spaces. A bargaining space shows a feasible region for negotiated outcomes together with regions of acceptability for each of the parties. The size of the space relative to conceptual space may increase or decrease over time. The outer bounds are determined by the feasibility, including the internal consistency, of outcome proposals. This boundary is the "efficient frontier." Figure 3 shows a simple diagram of bargaining space. The axes are some measure of "satisfaction," for example, "goodness" or "utility." The axes are scaled so that both parties have zero satisfaction at the origin. Outcomes that are situated in the shaded region determined by a^* and b^* are acceptable to neither A nor B, while outcomes to the northeast are acceptable to both. One common focus of negotiation analysis has been to examine ways to allocate potential gains that "would be left on the table" in cases in which the final outcome (for example, point X) falls within the acceptable space region, but short of the efficient frontier (shown in the diagram with a heavier line). Choosing the particular outcome from among those on the frontier itself has also been studied.⁹

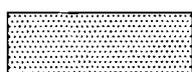
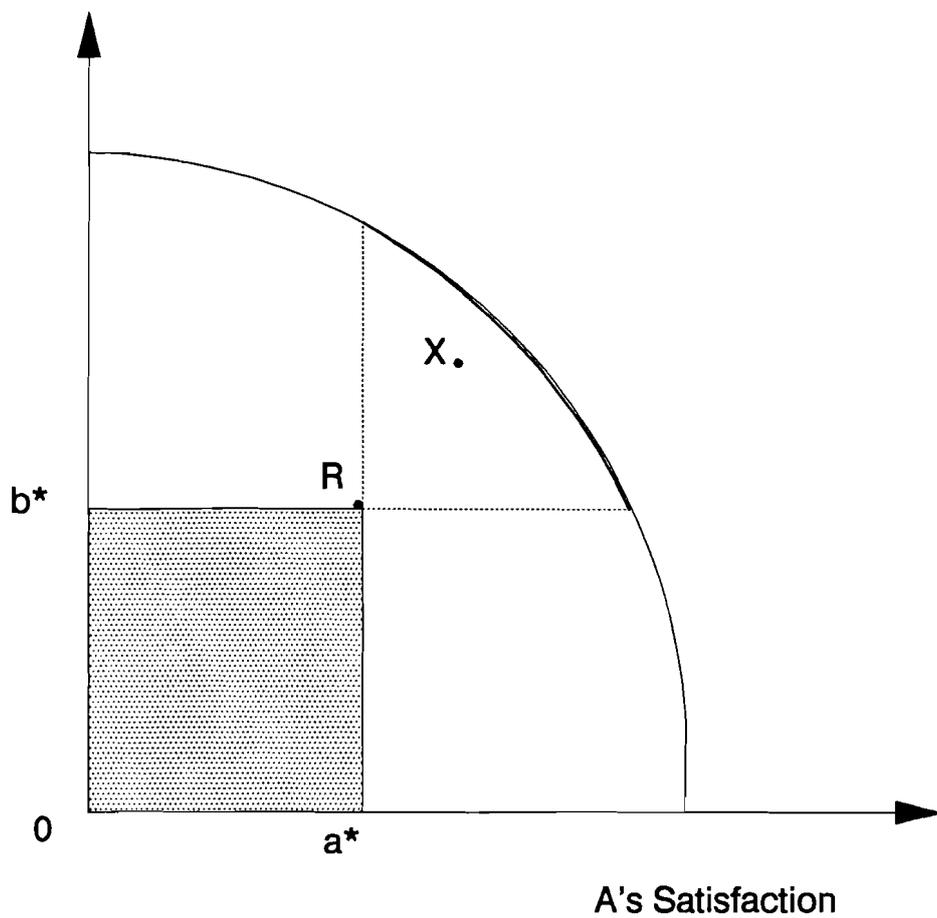
These kinds of analyses make some critical assumptions: first, that a^* and b^* are known, second, that a^* and b^* do not change (that is, that preferences are given) and third, that efforts *should* be made to reach the frontier. At this stage, a more fruitful approach may be to try to locate the boundaries of the *minimum* acceptable outcomes. Greater clarity of these minimum bounds would be important for several reasons. The agenda is so complex that it is difficult to be sure *where* in feasible outcome space a proposal may be, as well as where the efficient frontier may lie. Meanwhile, the North-South tensions are so acute that just keeping the parties talking may be a major challenge, thus highlighting the importance of sensitivity to resistance points. There is a moving target problem as goals are constantly revised during the process. Finally, sustainable development is itself fundamentally a *balancing* process among a number of "goods." Pareto efficiency may be one laudable objective, but why foreclose on other possible ways of assessing and describing the goodness of, or satisfaction with, outcomes on the basis of other criteria?

Thus, we first need to know what are the elements of the "goodness" measure; second, we need to know where each country locates its unacceptable point on each element. That is, we are interested in knowing how point R is determined: what elements compose the aggregate assessments a^* and b^* and how a^* and b^* are situated along the satisfaction axes.

⁹See Young, (1991a). We may also take note of the increasing debate concerning whether this type of model is appropriate in the case of sustainable development. Sustainable development is usually defined to include other criteria beyond efficiency. On the efficient frontier, it must be that A's loss is B's gain. There are limited ways to include other criteria -- by incorporating other values in the utility functions; or by redefining the frontier to include some other values. But these techniques seem almost self-defeating.

FIGURE 3 Bargaining Space

B's Satisfaction



No Agreement



Efficient Outcomes

2.2 The Dimensions of Conceptual Space

While there may be a very large number of distinctive attributes of the aggregate measure of goodness, we suggest that there actually are a limited number that are salient for UNCED negotiators.¹⁰ These attributes describe not only the problems and policy responses, but also connect with the underlying interests, from which perceptions, beliefs, flexibility, and other important negotiation aspects take their force. Table 1 shows the six attributes that will form a core around which we build a comprehensive definition of issue linkages and interest perceptions, as well as the preference criteria, for a formal decision analysis.

TABLE 1 Problem and Response Attributes

PROBLEM ATTRIBUTE	RESPONSE ATTRIBUTE
1. Uncertainty	Flexibility
2. Overconsumption/overuse	Reduction of activity
3. Relative scarcity of resource	Conservation
4. Risk	Risk management
5. Common good characteristic	Benefit and burden sharing
6. Inequality of resources and/or development	Redistribution, adjustment or compensation

Problem attributes, shown on the left-side, are based upon the physical and scientific/technological (and sometimes legal and historical) facts of a problem. Classifying problems by attribute is an experts' exercise. Ideally, no value judgments are involved in the assignments, although individuals judge the relative importance of problems, in part, by the way they contain more or less of one or another attribute. On the right-side, classifying responses by attributes is mostly based upon the underlying normative and ideological interests of the negotiators. Consider as an example, deciding to use an engineered bacteria in a food process. It involves risk, and calls for risk-management. Underlying themes might be rights to proprietary information, rights to food, and ideas about what is an "acceptable" degree of risk. An acceptable policy will have to, implicitly or explicitly, address these issues. Later in the paper, we will specifically relate the food security issue in UNCED to the left-side problem attributes and a variety of policy ranges to the right-side response attributes.

Before moving to consider issue definition in the next section, each of the attributes

¹⁰At this point, we are not able to fully defend our selection of attributes. They appear to stand up through the issue and interests analyses that follow, and they are introduced here to help orient those discussions. It is possible that additional thought and comments by persons familiar with the case could lead to a refined choice.

is discussed briefly. Here, as in other classification schemes, there is a degree of unavoidable ambiguity and oversimplification. One potential source of ambiguity arises due to a distinction between causal factors or the effects. This is a matter of focus. For example, if CO₂ emissions are considered a problem principally because they are associated with activities of *wealthy* people, less wealthy people may consider it necessary to reduce certain activities and address inequality issues; if, in contrast, the same cause/effect situation is perceived as overconsumption of fossil fuel resources, it may be viewed as a conservation problem (and play strongly on the interests of those people, rich or poor, who may be rich or poor in that resource). Moreover, the time dimension is overarching. Time perspectives play an important part in every cell in the categorization scheme. However, explicit treatment here would enormously complicate the discussion.¹¹

Uncertainty and flexibility

Uncertainty is a fact of life, ultimately grounded in sensory limitations, knowledge processing capabilities, wisdom and the spatio/temporal constraints of our existence. Neither complete certainty nor complete uncertainty has any real meaning, yet the concept itself has a deep intuitive feel. Thus, we may array outcomes by degree of uncertainty. There appear to be four important components of this process. First, there is the issue of "scientific" and policy uncertainty. Here, there are three levels of uncertainty: (a) uncertainty regarding what are the critical elements, or variables, of an issue or problem; (b) uncertainty in understanding how these elements influence the problem; and (c) uncertainty surrounding the ability to, or accuracy of attempts to, extrapolate the implications to the future.¹² The second important component of uncertainty is the value issue. No matter where within the domain of scientific uncertainty we may be, there is a question of evaluating the effects. Many changes have welfare implications that cannot be readily valued -- because they are not "traded" on a market or because they are not known.¹³ Implicit in these first two components is the third one -- that of time frames of reference. Degrees of uncertainty change with time, though not predictably. Since rates of time preference are an important factor in decision making, time is also a crucial factor in assessing the uncertainty of a problem or proposed solution. The final factor is the relationship between uncertainty and stability of expectations. This is a fundamental concept, grounded in individual psychology but with implications of far broader scope. Planning activities of all types, from investment decisions to land use planning, rely to some degree on assurances that basic factors will remain unchanged or change in predictable ways. Even if the underlying preconditions for such changes remain stable, if people's confidence is shaken, the planning functions will no longer be carried out in the same manner. For example, expectations of future climate-induced agricultural productivity changes may cause investment changes that would have a far greater impact upon some specified future economic conditions than would any possible climate change.

¹¹Thanks to Gunnar Sjöstedt and Katharina Löwenthal for comments that helped to clarify these differences.

¹²We are indebted to William Moomaw for these distinctions in the concept of scientific (as well as policy) uncertainty.

¹³James Hammitt, (1990), *Probability is all We Have*, p. 3

Uncertainty rankings are thus made within an expectations parameter by evaluating sensory input and knowledge, choosing a value criterion or set of criteria, and a time horizon. In negotiations, uncertainty cuts two ways. On the one hand, the attribution of particular effects (and their costs or benefits) may be more uncertain and cause countries to take on higher insurance-type policies; on the other hand, if the perception is that greater certainty will emerge in the near future, costs incurred today (in policy decisions) will not appear attractive. This outlook gives support to a status-quo, wait-and-see decision. Finally, we may explicitly recognize the "metacertainty" effect -- that is, that our best guesses are themselves subject to uncertainty.

Overconsumption and reduction of activities

This attribute manifests itself as a problem when there is too much of an activity. The word "activity" is used loosely: a given activity may be more or less environmentally damaging depending on the technology available; the choices of activity may also be influenced by relative cost considerations. The distinction between this attribute and conservation was mentioned above partly as a matter of focus. Similarly, like the uncertainty attribute, the time frame of reference is essential to keep in mind. The policy responses have the characteristic of requiring or encouraging the reduction of the activity. Important components are the selection and funding of alternatives such that the activity is effectively reduced; assurances that the reduction activities are not counterproductive in other areas of concern; and the determination of a system of allocating the reduction of activities among parties.

Relative scarcity and conservation of resources

Environment and development problems may fall in this category when they involve a resource that is scarce. Scarcity may be the result of absolute or relative physical scarcity of the resource, or of both. Resources, of course, are not only "natural"; they may also be human, economic, informational, and so on. Absolute scarcity refers to the physical limits of something, say of natural diamonds; relative scarcity is a function of price and technology. It is the relative aspects that are important for most policy responses, especially those that are not extraordinarily short-term. Funding of alternatives to the scarce resource and technological optimism influence the acceptability of the amount of conservation efforts. Conservation of resources ties closely with reduction of activities and with management of common resources.

Risk and risk management

This factor could be considered as part of uncertainty, but it may also be useful to separate it because it seems to entail a stronger ethical decision factor than does uncertainty. In other words, while uncertainty remains primarily grounded in the "world out there," risk management is a more identifiably individualized and human-mediated factor. Hence, it tends to take on a greater ethical charge in debates. The focus is most often on information - - both generating and sharing what can be or is known about the risks. Some practices are inherently risky and the degree of risk may be known with greater or lesser certainty. The willingness to accept risk hinges on such factors as the value of life and choice of time horizon. Because greater risks tend to be associated with higher technology content, the reorientation of technology is an important component of risk management

Commons and benefit/burden sharing

A commons is a shared resource such as the atmosphere or the oceans. There are degrees of commonality however, depending on value, physical characteristics, and technology. Commons become resource management issues only when value is recognized: the deep seabed was not a commons issue until the possibility of exploiting its mineral resources was seen as technologically feasible. Some now consider aspects of global economics to be a commons: that is, decisions made by one investor (say a transnational corporation) have repercussions throughout the global trading system. The policy responses fall into two main categories: those that address the problems of the commons and those that create a commons themselves.¹⁴ In the former category are various regulations and other tools for allocating the benefits and burdens of the commons as well as the choice of principles for such sharing and for the avoidance of harm. Policies may create a commons, as, for example, in much of basic scientific work and other forms of information generation. Information, once known, cannot be unknown (by choice) in the future. Finally, the problem-solving domain itself is increasingly a commons -- the new awareness of the critical need today for merging decision-making regarding the economic and environmental commons is evidence for this.

Inequality of resources/development and adjustment

On the surface this category may appear to be the most "factual" of those selected, but upon some reflection the notion of inequality has serious ambiguities that influence the perceptions of parties. Inequality is a relative term and it assumes a comparison of similar factors. As a mundane example, consider two people whose metabolisms are identical such that they have identical food requirements. But they may be of very different heights and weights; or one may need to work for five hours per day for his daily ration and the other may have to work only two for hers. In what sense then are these people equal or unequal? Fortunately, intuition helps in all but the most marginal cases: most of us have no difficulty pronouncing a starving person as starving. This category includes a number of interlinked effects that have both a positive and a negative side. Thus, inequality of development is a characteristic that does not distinguish development that exacerbates, from development that ameliorates, environmental degradation; resources, such as biodiversity, are more widely distributed in poorer countries, whereas the biotechnologies to translate the diversity into growth and development are disproportionately located in the wealthier countries. Inequality of resources or development leads to policy responses that accord priority to poverty alleviation, to legal principles such as non-discrimination on morally arbitrary factors, and to the establishment of minimum standards and guidelines.

3 Issue Definition and Linkages

In UNCED, ultimately successful policy responses -- those that simultaneously address environment and development concerns -- must be situated in a common conceptual

¹⁴We may also distinguish between policy measures that can be implemented within the bounds of a single nation and those that *require* international cooperation. (Gunnar Sjöstedt, personal communication, August 22, 1991).

space. This conceptual space includes various political, economic, and ethical linkages, as well as the more scientific ones. Nevertheless, serious problem-solving usually involves breaking problems into smaller pieces. Thus, the elements that comprise the conceptual space must be, at least partly, analytically distinguishable. It is to this task that we now turn, beginning with a general discussion of food security and development.

3.1 Definition of Food Security

Food security is a term that has been widely used since the early 1970s, but has typically meant different things to different people.¹⁵ The FAO definition has been generally accepted since the mid-80s:

Ensure that all people at all times have both physical and economic access to the basic food they need. Ensure production of adequate food supplies; maximize stability in the flow of supplies; secure access to the supplies on the part of those who need them.¹⁶

But it may be revealing, as we search for different viewpoints, to see that food security as addressed, tacitly or explicitly, in the literature has five separable elements. These are: (1) the composition (cereals vs. non-cereals) and nutritional adequacy of food to sustain an active life;¹⁷ (2) "who" is secure in terms of food availability-- a country, a household, a person, particularly the poor;¹⁸ (3) "security" -- the assurance of access to food as needed, which is really the heart of the concept -- expressed as physical supply-based assurance,¹⁹ effective real income demand-based assurance,²⁰ or both;²¹ (4) intertemporal elements -- whether food insecurity is transitory or chronic and whether consumption levels are sustainable as population expands;²² and (5) linkages with the developmental and political needs of the country (that is, with "national" security more broadly), and of the individual, such as

¹⁵Much of the material in this section is drawn from the author's "Food Security" paper prepared for the International Food Policy Research Institute, May 1990.

¹⁶Food and Agriculture Organization, (1987), *Evaluation of the Food Security Assistance Scheme*. The definitions cited in this section are contained in the Appendix.

¹⁷Valdes and Konandreas, pp. 28-29; Garcia, p. 127; Bread for the World, 1989, p.2; Huddleston, et al, p.3; FAO, 1987.

¹⁸Adams, p. 550; Koester and Valdes, p. 431; Valdes, p. 2; Lappe and Collins, p. 154; von Braun, p. 1083; FAO, 1987.

¹⁹Hathaway, 1981; Brown et al, 1984, p. 185; FAO, 1975.

²⁰World Bank, 1986.

²¹Advisory Panel, p. 3; Bread for the World, 1987; FAO, 1987.

²²FAO, 1987; Adams, p. 550; von Braun, p. 1083; Valdes and Konandreas, p. 38; Advisory Panel, p. 3.

guarantees of the right to work for reasonable wages.²³

To set the context further for discussing important linkages, note that a food security problem may arise in a number of ways. First, supply may fall short. Variations in production and world price, both of which can cause domestic shortages, have been substantial and are increasing. Weather is by far the largest source of variability, but civil strife, shortages of critical inputs, and misguided policy may all play a part. However, variability is much greater on a local or regional level than on a global level. World grain production has been quite stable around trend, with a variability averaging only 1.4 to 1.6 percent between 1950 and 1980.²⁴ The Intergovernmental Panel on Climate Change concluded in its well-respected report that food production at the global level could be sustained at levels sufficient to meet world demand under the test case conditions of a CO₂ doubling scenario, but that the cost of achieving this remained unclear.²⁵

Price variability is much higher in the world markets than in the domestic markets of most countries. Agriculture and trade policies, especially in the developed countries, and price policies that protect consumers, especially in the developing countries, insulate producers and/or consumers from supply shocks. The insulation forces adjustment onto a thin world market, magnifying the price effect of small global production shocks, and further reduces the ability of poor countries to rely on world markets for food security. Sensitivity to price thus becomes a crucial component of food security adjustments.

Second, the demand component adds to the food security problem as populations expand faster than agricultural productivity in many countries. Ezekiel²⁶ examined 104 developing countries for 1961-1983 and found that although only 16 of these countries had negative food production growth rates, 65 had negative *per capita* production growth rates. For example, Kenya had a production growth rate of 1.72 percent that was offset by a population growth rate of 3.90 percent, leaving a per capita growth rate in production of negative 2.18 percent. If this population is simultaneously enjoying an increasing level of per capita income, food demand will grow even faster. Fluctuations in non-food production and prices can lead to decreased real incomes, and thus decrease the ability to purchase adequate food.

Although all of the components of food security are important to the concept of sustainable development, it is likely that the national level is most relevant for UNCED. Countries may be particularly concerned about the decisions of other countries and of the international community. Different countries will judge the minimum acceptable level of

²³Huddleston et al, p. 3; Koester and Valdes, p. 4431; Lappe and Collins, p. 154; Lele and Candler, 1981, p. 102; *Bread for the World*, 1987.

²⁴Calculated from USDA data in *World Agricultural Trends and Indicators, 1970-1988*, (1989a) and *Agricultural Policy, Trade, Economic Growth and Development*, (1989b).

²⁵Intergovernmental Panel on Climate Change, (1990). *The Potential Impact of Climate Change on Agriculture and Forestry*.

²⁶Hannan Ezekiel, (1989), *Food Aid, Food Imports, and the Food Consumption of the Poor*, p.4.

assurance to occur in different degrees in the various proposed policies or "action plans."

There is good evidence that population growth rates tend to slow as incomes rise. Many also believe that agriculture technology still holds great promise for improving land productivity and overall supply. Nevertheless, both factors involve a time lag that may mean the existence of a disequilibrium for more than a generation (and even longer in the hardest cases.) Eventually, one hopes that economic growth will narrow the food availability gap to an amount that can be commercially imported. However, the way in which variability in production is allocated and smoothed out among consumers, stockholding, and trade, raises issues that go far beyond a standard economic supply/demand model. The attainment of food security entails a different balance for each country, given the unique set of internal and external supply and demand conditions and constraints it faces. Aggregate economic efficiency may be inadequate as the sole criterion of sustainable food security. The ultimate objective must also include reliability. This translates into the *right* of all people to be free from hunger.²⁷

3.2 Definition of Economic Development and Sustainability

Despite the difficult, and perhaps intractable, philosophical concerns raised by a discussion of rights, as in the right to be free from hunger, the notion is central to the concept of economic *development*. Development, in contrast with growth, carries much more of an individualistic sense. No longer is growth alone taken automatically as a good thing. According to the most widely used definition, sustainable development "meets the needs of the present without compromising the ability of the future generations to meet their own needs."²⁸ In the case of food security, the term "self-reliance" is sometimes invoked, further complicating an already murky distinction.²⁹

The notion of needs in the WCED/UNCED definition of sustainable development is, of course, an expandable concept. Many commentators have recognized that human needs are more than just subsistence requirements. The UNDP, for example, has addressed this in its Human Development Report.³⁰ Here human development is again framed in terms of rights; it is defined as the "process of enlarging people's choices." It incorporates basic needs (health, nutrition) with social needs (education, participation, and opportunities).

²⁷See for example the Food and Agriculture Organization *Den Bosch Declaration*, (1991), as reported in UNCED PrepCom A/CONF.151/PC/61.

²⁸WCED, (1987), *Our Common Future*, p. 43.

²⁹The term really deserves an extended treatment, which obviously cannot be undertaken here. Like the "national" in "national interest" it is not at all clear who is the "self" in "self-reliance." It is our view, that as the notion of sustainable development takes hold, the confluences of agents and responsibilities that are implicitly made will come to be more directly stated. Self-reliance should be developed as part of this largely philosophical future evolution of the notion of sustainable development. See Robert Goodin (1988), *Reasons for Welfare*.

³⁰United Nations Development Program news release, May 21, 1991.

Exactly how "needs" may evolve as development progresses is not well understood. Two points seem evident, however. First, all the characteristics of needs apply to *individuals* but are aggregated into a national frame. The way this happens is not necessarily directly related to the individual needs, or even predictable. Second, changes in needs, as politically defined, may occur over a different time frame than do changes in the causes of those needs. Nevertheless, it is such needs, however defined, that national representatives purport to represent at the international negotiating table. Since these needs are not easily pinned down in any objective sense, it makes it somewhat difficult to think of a negotiation as an exercise to achieve jointly a maximization of the satisfaction of needs. Rather, the objective might be to attain a satisfactory *balance* among competing needs and the pace of change in these needs.

3.3 Linkages

One way of organizing linkage maps is to classify them as physical (the biogeochemical sphere), functional (causal relationships that include human behaviors), or strategic (linkages "forced" intentionally).³¹ Because we are analyzing an illustrative "slice" of an overall environment/development relationship through various levels of linkages, we have found it useful to distinguish the linkages according to: (1) physical/functional, in which food security at the most general level is examined as an environmental/human interface; (2) policy/functional, which may be subdivided into (a) economic-technical linkages and (b) economic-political linkages; and (3) knowledge/strategic, that is, broadly actor-mediated ways of creating meaningful linkages.³² There are two subdivisions here: (a) ethical/political linkages and (b) the UNCED cross-sectoral linkages. It is at this third level of drawing linkages, and particularly of drawing implications based upon these linkages, that critical negotiation processes hinge. (Refer back to Figure 1 for an overview diagram of these levels of linkages.) However, the debate is politically charged at this level; a more promising

³¹Gunnar Sjöstedt, (1991), *The Issue Analysis: A Summary Research Outline* introduces these three categories.

³²This category is difficult to name or describe briefly. It clearly has an overlap with the functional categories, but the knowledge/belief dimension as it interacts with the "world out there" is extremely important in negotiation. Two justifications are already evident in UNCED PrepCom regarding information: information is highlighted by efforts to collect, manage and disseminate information, and delegates from the South are strongly pressing their perceived need for more information (See ECLAC, 1991, p 45; Sydnes, 1991.) Also, rather than considering separately the extremely important spatio-temporal linkages (which otherwise fits best in this category), we note that these are implicit in the functional and strategic maps.

approach might be to look at the various layers in order to identify some vertical connectors.

3.3.1 *Physical/Functional: Environment and development linkages of food security*

The most straightforward linkage map to begin with is the basic food security identity:

$$\text{Production} + \text{Net Imports} + \text{Net Carryover} \equiv \text{Consumption}$$

To judge whether or not a food-secure condition exists, we must first specify the frame of consideration: Do we mean food security for the individual, household, region, nation, or world? Do we mean food security throughout the year, across the years, for future generations? Then each term in the identity may be assessed. Factors affecting each term include:

Production: Production has two basic components, yield and land area under cultivation.³³ Changes in either can affect the production of food. (Water areas are also a source of food.) In Table 2 below, we have indicated some of the environmental factors, organized according to the UNCED environmental problem areas, that can influence food production. Macroeconomic policy relating to factor costs, terms of trade, availability of credit, etc., can also influence the choice of crops and levels of production. For food security, it is helpful to look at the micro levels of particular crops, regions, or seasons since significant differences can be noticed at these levels of disaggregation.

Net Imports: This term concerns debt and the economics of the trade situation, credit possibilities, foreign exchange earnings, managerial capacity for appropriate decision-making, environmental impacts in other countries, laws in other countries, and the political considerations of trade.

Net Carryovers: This term considers the stocks of food supplies that are held between periods, by households, governments and traders. Factors which can affect the levels of storage are related to finance for management and infrastructure and information and forecasting.

Consumption: Access to food, either because the consumer has produced the food

³³A secondary component of production is the processing of food. Further refining raw produce before it is marketed or consumed, or the production of livestock add another layer to the considerations delineated here, but do not substantially affect the analysis, and hence are here disregarded.

or has adequate exchange entitlement, determines consumption.³⁴ Other important factors are: macroeconomic policies that influence access; consumer information regarding health and nutrition practices; degree of health (lack of weakness and illness); technology and finance to get food to people under normal and emergency circumstances; labor, migration, or other conditions that influence the distribution of people relative to where the food is; population growth rates relative to the rates of change in food availability; and cultural factors and taste that relate to the ability to adjust consumption under changing conditions.

³⁴Amartya Sen, (1990), "Food, economics and entitlements."

TABLE 2 Linkages between UNCED environmental areas and food security**FOOD SECURITY**

Atmosphere	climate change leading to drought; poleward advance of the monsoon rainfall; other precipitation and temperature impacts on crops and biota production; air-borne pollutants; UV radiation; reduced soil moisture; acid deposition on perennials; climate change leading to sea flooding/rise impact on productive wetlands and decrease in agricultural land; species loss due to climate effects; change in habitat; ozone effects on biota;
Land, Agriculture	changing energy and other input requirements due to degradation; desertification; population and activity distribution pressures on land; clearing forests for crops; coastal erosion and siltation; destruction of nesting grounds; agrichemical pollution of productive resources; competition for water use; biota as a source of germplasm for genetic engineering; increased demand pressures; migration and labor considerations;
Forests	degradation of productivity after deforestation; land-use conflicts; decreased protection and habitat conditions for wildlife; decreased availability of fuel for food preparation; decreased soil protection (leading to decreased fertility as well as increased runoff into rivers); changes in the hydrological balance of the drainage basin.
Oceans	source of food
Freshwater	limiting factor on agricultural food production; contamination effects on crops; salinity; stability; possible increase in water-borne infectious diseases to livestock and humans; decreased quality/quantity of drinking or cooking water; habitat for fish.
Biodiversity	loss of species; loss of soil organisms;
Biotechnology	food production with specialized species; new varieties; release of modified organisms; increased forest production; maintenance of gene pool; substitution for traditional;
Toxics and wastes	land and water contamination into food chain; accidents; pollution in coastal zones; effects on biodiversity; persistent effects on health; elimination of land for alternative uses; eutrophication from sewage;

NOTE: Some factors may have both positive and negative consequences. For example, biotechnology can improve food production intensity, but may increase the risk of a local disaster, such as an entire crop failing simultaneously through a pest explosion.

Sources: UNCED PrepCom (1991), various documents and Intergovernmental Panel on Climate Change, (1990), *The Potential Impact of Climate Change on Agriculture and Forestry*;

Different countries will place more or less emphasis on various of the food security factors. Table 3 below, allows us to infer what may be, for each country, the important environmental/developmental interfaces with food security. For example, a country that has an important fishery may put more emphasis on conservation policies and be more concerned about legal and institutional factors regulating the use of the common ocean resources. Furthermore, countries may have rankings across the attributes themselves. So, for example, a country may simultaneously believe that there is no doubt that biodiversity has the characteristic of a commons but nevertheless maintain that it is of very low priority for international negotiated action. The cells in the table are marked according to what appear to be the main characteristics of the environmental problem area. But this is not to suggest that this is the only way the chart can be marked.

TABLE 3 Attributes of Food Security by UNCED Environmental Problem Area

Environment Problem	Uncertainty	Overuse	Scarcity	Risk	Commons	Inequality
Atmosphere	xx	xx			xx	xx
Land and Agriculture		xx				xx
Forests		xx	xx			xx
Oceans			xx		xx	
Freshwater		xx	xx		xx	
Biodiversity			xx		xx	
Biotechnology	xx			xx		xx
Toxics and Waste		xx		xx		xx

Notes: The environmental problems are those identified by the UNCED PrepCom. Atmosphere includes climate change, the ozone layer and transboundary air pollution; oceans include the protection of oceans and coastal areas and marine living resources; freshwater includes the protection of supply and quality; biotechnology refers to the management of biotechnologies; and the last category combines three UNCED problems: the environmentally sound management of toxic chemicals, hazardous wastes, and solid wastes.

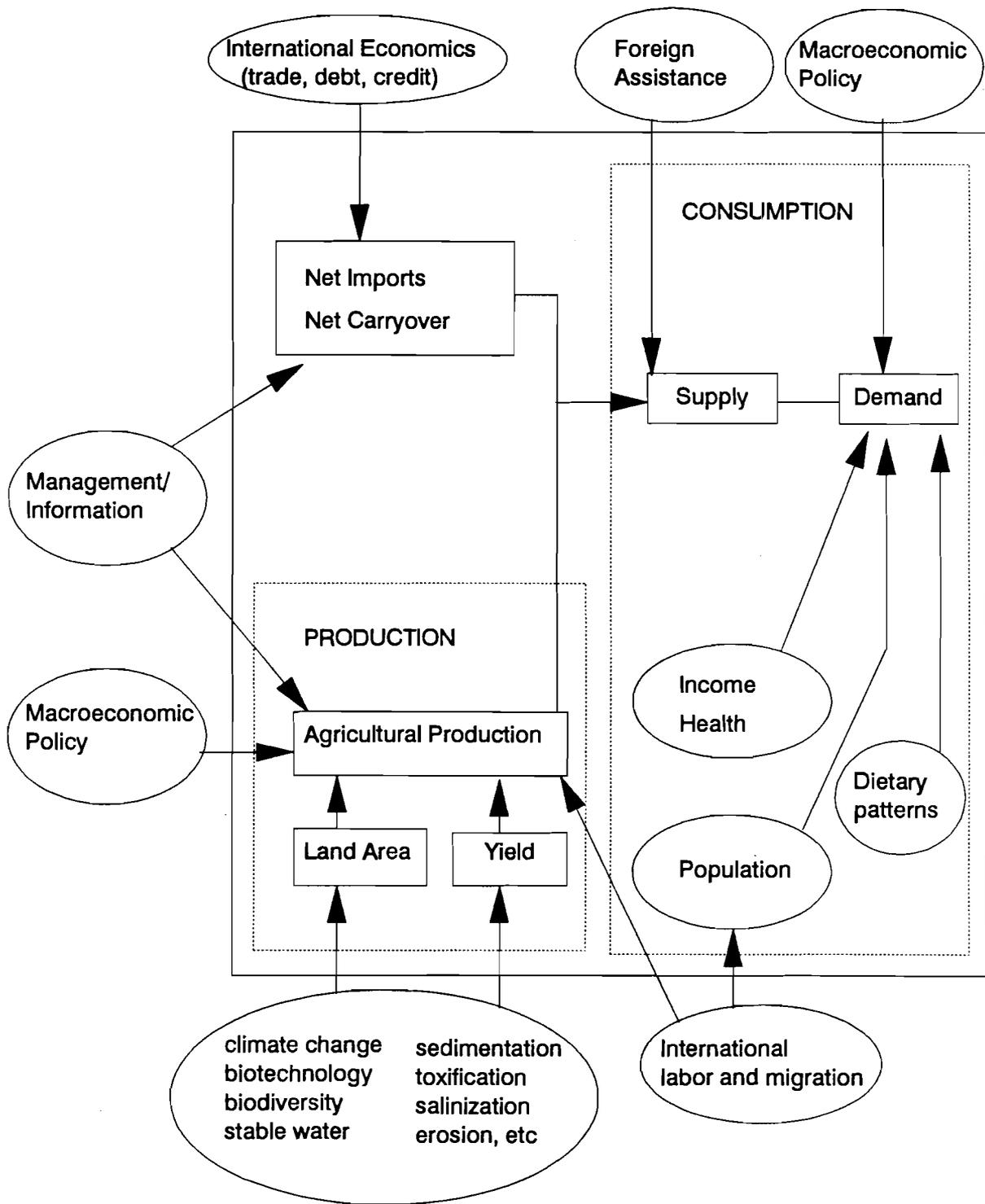
It is illustrative to study the chart by both row and by column. There are two particularly noteworthy patterns. First, assuming talks remain on track, there could be conventions ready for signing at UNCED relating to climate change and to

biotechnology/biodiversity.³⁵ This will provide opportunity to explore the empirical import of the attributes in much greater detail by mid-1992. Second, there are similarities of attribute clusters: oceans, freshwater, and biodiversity are common resources with anticipated solutions being of a conservative nature; biotechnology and toxics share the existence of a risk factor and highlight the inequality in the distribution of the causes and effects of the problems.

Many of the factors influencing the food security identity are shown in a chart format in Figure 4. Again, we note that different parties will view different sections of the map as more or less important regardless of how well the linkages seem to be factually known, and will have different judgments both regarding the relative importance of what is known, and the implications for policy. For example, one country may believe that stability of import supplies requires commodity agreements, whereas another might believe that food-security may be best assured only in a free market regime.

³⁵Pamela Chasek, (1991), *The System of International Environmental Negotiations*.

FIGURE 4 Food Security, Environment and Development



Note: This map is a modified version of one developed by Rod Shaw, Environment and Development Project, International Institute for Applied Systems Analysis.

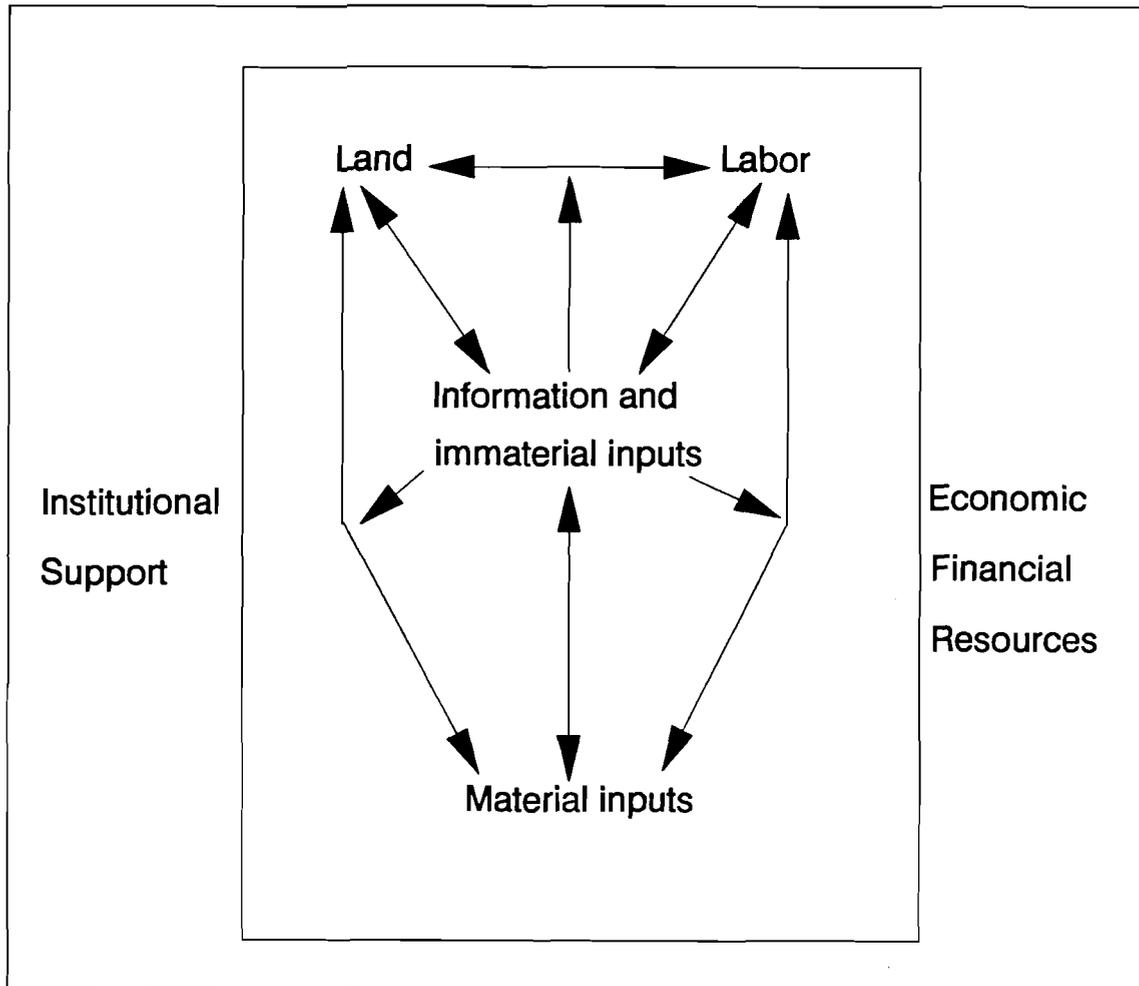
3.3.2 *Policy/Functional: Economic/political and economic/technical linkages*

The two linkage maps in this section are embedded in the physical/functional linkages of the previous section. However, the lens is focused at another layer -- that primarily of policy decision making. The economic/political linkages are most prominent in the consumption, trade, and storage segments while the economic/technical dominate the production linkages. Second level linkages show the interactions between decisions and outcomes, given certain external conditions. For a given country, the "world out there" consists not only of the physical environment beyond its control (e.g., weather), but also the consequences of decisions made by others. A country sets policies to try and affect change in the manner in which the "out there" is internalized. Thus, it makes trade policy in light of what others' influence -- products and volume -- is on the market; it may set agricultural subsidies according to the way it values competing goals of, say, agricultural/industrial terms of trade and degree of food self-sufficiency.

The first of the two policy maps is the simpler, but helps us grasp the importance of the interrelationship of technology transfer, institutional mechanisms, and financial and economic resources. Flows and kinds of technologies available to a country influence a country's prospects in the world -- that is, its opportunities for growth and development. Moreover, technology transfer, economic instruments/financial aspects, and institutional considerations are the three most important of the cross-sectoral issues as defined by UNCED PrepCom. These three are considered explicitly and separately in the work on Agenda 21 by the Secretariat. The model in Figure 5 was developed by Neva Goodwin³⁶ to show the move from classical economics (a land/labor tradeoff) through the neoclassical period (the addition of technology) to the "modern" emphasis on immaterial technologies that are information/human capital intensive.

³⁶Neva R. Goodwin, (1991) "Lessons for the World from U.S. agriculture."

FIGURE 5 Economic/Technical Linkages



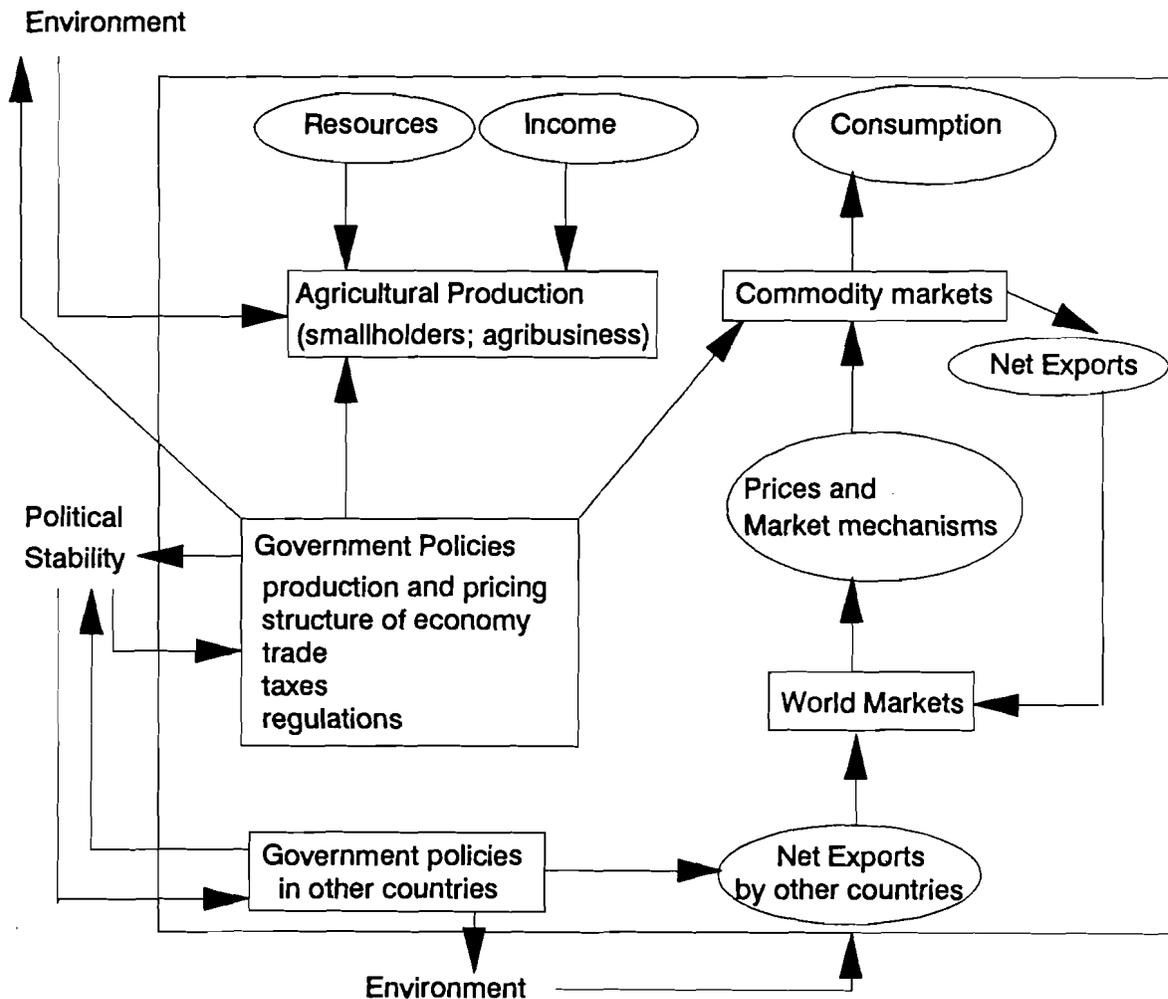
Notes: *Material based technological inputs* are chemicals, machinery, off-farm energy, other inputs. *Information/immaterial inputs* are integrated pest management, crop rotation/diversity, selective/creative breeding, mixed farm systems, recycling of wastes, agro-forestry, fine-tuning of inputs (timing and quantity), etc.

Source: Neva Goodwin, (1991), "Lessons for the world from U.S. agriculture: Unbundling technology." *World Development*. 19:1. (Internal frame only.)

The economic/political linkages that are important for food security concern the relative degrees of interaction of government policies with the components of the food security identity that are mediated by economic considerations. These policies encompass those that influence trade, pricing, the structure of the economy, labor and migration conditions, perceived and actual inequalities in the distribution of economic goods, policies influencing the relative desirability of factor combinations in production, and many others of a similar type. Figure 6 shows the linkages of one country in a world context. We have

indicated two contextual factors, environmental conditions and political stability. The bottom portion of the figure shows the external effects of other governments on the focal country. Environment and political stability both affect the internal linkages by setting limits on actions that can feasibly or effectively be undertaken.

FIGURE 6 Economic/Political Linkages



Source: Adapted from Kirit S. Parikh, (1990), "Chronic hunger in the world: Impact of international Policies." In Jean Drèze and Amartya Sen, *The Political Economy of Hunger, Volume 1*. p. 116

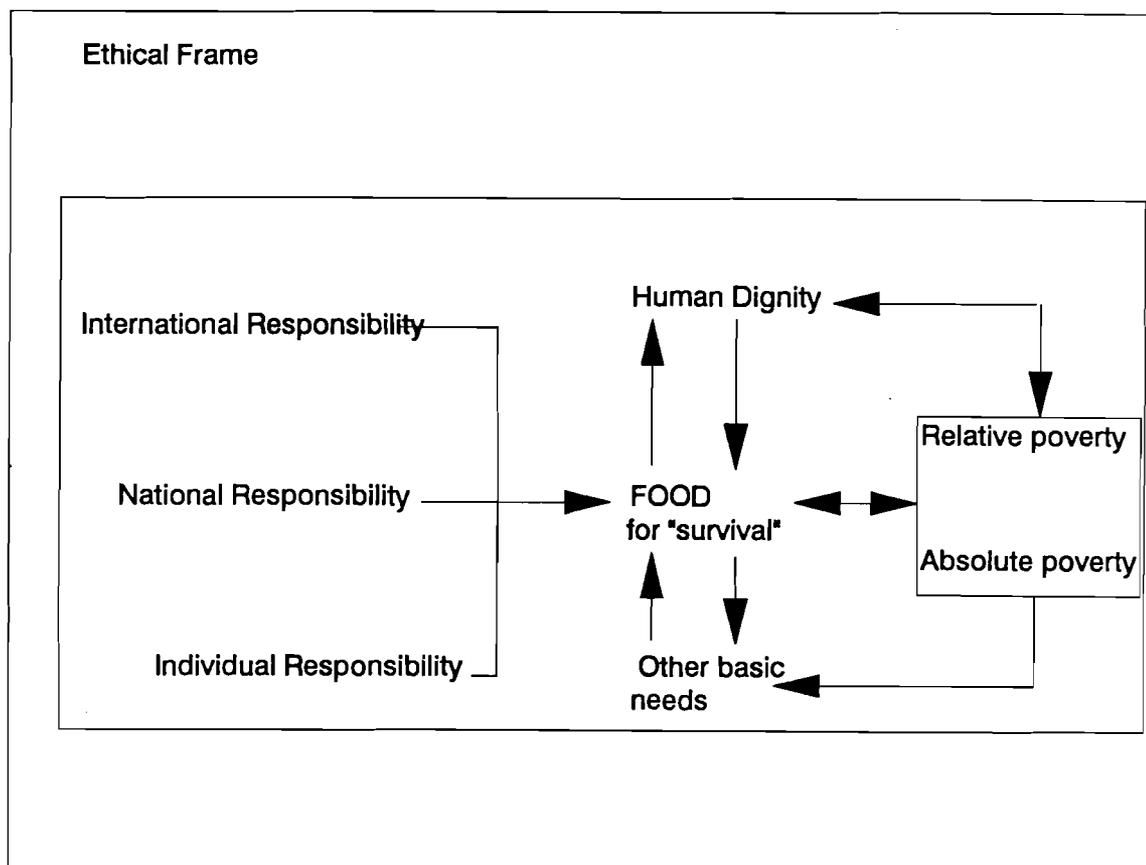
3.3.3 Knowledge/Strategic: Ethical/political and UNCED cross-sectoral linkages

Turning now to the third level, perceptions of problems have important foundations in cultural and social structures and in the institutions, laws and norms that have evolved within these structures. This "knowledge history" shapes more than perceptions, however.

It influences motivations to act (at all, or in specific ways); the cultural/social structures which have preconditioned perceptions are also evolving, and giving rise to new notions of justice and fairness, needs and desires, which can influence problem and solution boundaries.

There are a number of ethical considerations in the field of food security and it is not our intention to do more than simply suggest the nature of these considerations. Figure 7 is therefore simply a rough and impressionistic sketch of the ethical/political domain. The surrounding environment is an "ethical frame," perhaps a dominant theory, such as the United States' emphasis on individual human rights; perhaps a tradition-bound pattern of actions that is not legally codified. This frame implies what should be the division of responsibility for ensuring food to the hungry. Depending upon the allocation of responsibility, certain supporting policies are required. For this reason, the map is labeled "ethical/political." Country-specific maps would look quite different from each other, once the number of relevant social, cultural, religious, and political traditions were drawn in.³⁷

FIGURE 7 Ethical/Political Linkages



³⁷To our knowledge, a comparative exercise of this sort has not been, but could profitably be, undertaken with the specific conditions of an UNCED-like negotiation in mind.

The second set of linkages that we consider under the knowledge/strategic heading are the cross-sectoral linkages among UNCED problem areas. UNCED has specified these as: (1) economic/financial resources; (2) technology transfer; (3) legal instruments; (4) institutional considerations; (5) poverty and urban settlements; (6) supporting measures (education); and (7) science. The cross-sectoral linkages are a further expansion of the economic/technical and economic/political components of food security linkages. Cross-sectoral implies both that the issues are common to more than one sector and that they connect sectors. From this it follows that consideration of these issues needs to be cross-disciplinary and multiple-resource oriented. For example, economic and financial aspects link with all the others in terms of resources to carry out the scientific and educational tasks, or to undertake technological research, or to institute an anti-poverty plan that reduces environmentally stressful impacts. The resources themselves are a combination of differently trained personnel and different sources and types of financial resources. The *sectoral* concerns of agriculture link with other sectors, such as energy, transport, and industry through government policies and resultant human decisions. Each of the cross-sectoral issues contains relevant food security linkages within its own domain and between it and the others.

Almost all of the cross-sectoral aspects focussed upon by the UNCED PrepCom are related to each of the others. Below are a couple examples of these interrelations, with applications to food security.

Economic/Financial Instruments linked with Institutional Considerations:

- providing or facilitating loans and grants for food imports;
- making of financial policy;
- responsibility for economic data gathering and the use of economic instruments;

Educational Support linked with Institutions, Science and Technology:

- support of indigenous knowledge and decentralized activities;
- agricultural outreach efforts;
- management capabilities;
- access to technology; information technologies;
- research and development;

As a final note, it must be remembered that as "cross-cutting" as these "cross-sectoral" issues may be, they themselves link importantly outside the entire UNCED process and mandate -- as for example in the case of the relationships between environment and development and military expenditures.

4 Interests

There is widespread agreement in the international community regarding the UNCED goal of sustainable development. Most share a traditional fundamental belief that each generation has both duties and entitlements to the use of natural resources that includes

conservation and passing on value to future generations.³⁸ At the same time, however, much of international law has been shaped by a Western tradition that has, especially since UNCTAD, set in play a large degree of North/South development tension. This section expands upon the conceptual analysis of issue linkages to consider the range of national/regional interests. The interests are connected again with the six attributes that form the dimensions of conceptual space. The policy response side of the attributes correspond to ranges of policy choices that are typical of those that delegates are likely to face when specific proposals are on the table.

4.1 Country and Regional Interests

Together, the set of linkage maps described in section 3 (as well as those linkages we may have overlooked) give definition and detail to the "conceptual space" for food security in UNCED. Within this space are the concerns and interests of parties³⁹ attempting to incorporate a global goal and substantive action responses into an acceptable plan such as Agenda 21. But it still remains to separate out the interests from the issue definitions. These interests have two levels. First, "country goals" of a *fundamental* ideological/normative sort underlie issue definitions for each country. Second, there are the *particular* preferences of each country for various proposed outcomes.⁴⁰ For example, some countries maintain that the right to a healthy environment exists and is a basic human right; a particular preference might be that a per capita criterion be used in allocative decisions.

In negotiations, of course, focus is on the particulars. The UNCED Secretariat has summarized the task facing delegates to the conference, as well as all other interested groups and persons as one of discovering a detailed and particularized solution to a multiple challenge:

[H]ow to achieve the appropriate mixture of regulatory and market mechanisms, how to free social creativity, how to satisfy the need for economic development while protecting the resource base, and how to balance the requirements for social equity with both individual and communal needs.⁴¹

³⁸Edith Brown Weiss, (1989), *In Fairness to Future Generations: International Law, Common Patrimony, and Intergenerational Equity*.

³⁹We use terms such as "parties," "countries," or "nations" somewhat interchangeably to refer to representatives at a UN conference. None of the terms are satisfactory, because they are all abstractions of the interests of individuals, on whose presumed behalf the agents at the table are bargaining. But, even as abstractions, these are not singular notions, because the agent at the bargaining table represents views that may not be fully rationalized -- either because of unresolved internal country politics, because of indecision, or lack of knowledge, or confusion, etc. As many practitioners are fond of reminding analysts, there is a depth in the decision-making process that is beyond analysis, or at least beyond systematic understanding.

⁴⁰Bertram Spector was very helpful in clarifying these distinctions.

⁴¹UNCED PrepCom A/CONF.151/PC/63, paragraph 14.

Negotiations, which are joint problem-solving exercises, tackle exactly such challenges of finding balances among a number of objectives. In UNCED, the number of issues is quite large, and thus so are the number of details that need to be worked out. Parties arrive on the scene with different definitions of the problems and the work to be done. As the work gets underway, negotiators assess the quality of proposed outcome "packages" according to the interests that they *appear* to satisfy. Over time, there may be several types of movement: parties change their definitions of the problems (along any of multiple dimensions); new solutions may emerge that better match the definitions of parties; aspects of the negotiations themselves may enhance the process of convergence. Throughout the process, the parties are comparing the developments against a background of *interests* -- that are themselves capable of changing. As we have organized the negotiation context, only the abstract dimensions do *not* change.

Three of the five United Nations Regional economic councils have submitted public reports as part of the preparation process for UNCED.⁴² These reports state how environment and development problems and their interfaces are viewed from these regions. We briefly describe some highlights below. From these statements of objectives we can begin to infer interests about food security. Of course, as better information emerges during negotiations, these interests may be refined.

The Bergen Declaration, the product of the Economic Commission for Europe (ECE)⁴³ puts emphasis on the precautionary principle; on the need to "integrate environmental considerations with economic and sectoral planning policies" and on the importance of balancing the use of economic instruments with regulatory measures. There is an emphasis on cost/benefit analysis to determine the merits of "anticipatory and adaptive strategies." Among the important environmental needs, pollution control is labelled the single most important in a synthesis paper prepared from a number of national reports.⁴⁴ Transport and land use policies also receive attention.

The Final Declaration of the Ministerial Conference on Environment and Development for Asia and the Pacific (ESCAP) emphasizes an integrated approach together with the precautionary principle. The statements further reveal that this group sees the major cause of environmental degradation as the "unsustainable pattern of production and consumption" ⁴⁵ but also cites the importance of both population growth and distribution and of poverty. ⁴⁶ They further state that environmentally sound and sustainable development is primarily an economic issue and that states have sovereign rights to exploit their resources,

⁴²The African group held a meeting in late July 1991, and the Western Asian group is scheduled to meet in September.

⁴³United Nations Economic Commission for Europe, (1990), *Bergen Ministerial Declaration on Sustainable Development in the ECE Region*.

⁴⁴*ECE Synthesis Paper Based on the National Reports Submitted by the ECE Member Governments*, (1991).

⁴⁵ESCAP, (1990), Para. 6

⁴⁶ESCAP, (1991), Annex IB.

provided they do not cause damage.⁴⁷

The Tlatelolco Platform, and supporting information from the Economic and Social Council for Latin America and the Caribbean (ECLAC) highlights the principle of equity in changing production patterns and calls for a dynamic balance in the use of all forms of capital: human and cultural, natural, financial, and institutional.⁴⁸ ECLAC sees international competition and increasing trade, greater integration across sectors and levels of the economy, and intraregional cooperation as essential ingredients. Similar to ESCAP, ECLAC calls for principles of environment/development integration and the "harmonious occupation of national territory." Development depends on exploitation and marketing of natural resources, according to this view, and thus the developing countries must be able to realize the benefits of natural resources. This view implies the necessity for conservation efforts, but also the need for trade and other practices to ensure that the value these resources represent is not siphoned off by other (perhaps wealthier) countries.

Even though the African regional report was not available at this writing, some indications of African concerns are found in a report of the 1989 meeting of the Organization of African Unity (OAU).⁴⁹ Four such issues brought out are: (1) the need to prevent and reverse desertification; (2) the need to manage demographic change and pressure; (3) the requirement of self-sufficiency and food security; and (4) the need to maintain species and ecosystems.

4.2 From Preferences to Policies

Much of the information in the regional reports expresses "preferences" as well as "facts." Even at this stage, some of the divergences in interests are already apparent. Based upon their interests, countries propose policies and judge the desirability of others. We can hypothesize based on recent history and UNCED discussions to date, that five ranges along which specific proposals may fall might be:⁵⁰

- (1) the degree of *market freedom* (in contrast with regulation/protectionism);
- (2) the degree of international *control* (in contrast with national control or the primacy of national sovereignty);
- (3) the degree to which legal measures are *binding laws* (in contrast to "soft" laws);
- (4) the degree to which *scientific uncertainty* is tolerated and policies are flexible to accommodate change; and
- (5) the degree to which *development* is emphasized (in contrast with environment).

⁴⁷ESCAP, (1990), para. 18; (1991), para. 19.

⁴⁸ECLAC, (1991), *Sustainable Development*, pp. 9-10.

⁴⁹As reported in the *Brundtland Bulletin*, (1990), Issue 9/10.

⁵⁰Bert Spector contributed to the identification of these ranges.

These ranges (as well as many others) map onto the policy response side of the attributes:

TABLE 4 Attributes and Policy Ranges

RESPONSE ATTRIBUTE	POLICY RANGES
1. <i>Degree of flexibility</i> related to actions	1. Flexible to deterministic
2. Requires <i>reduction</i> of activity	1. Binding law to "soft" law 2. Free market to regulated/protected market
3. Requires <i>conservation</i> of resource	1. Binding law to "soft" law 2. Free market to regulated/protected markets
4. Requires <i>risk management</i>	1. Binding law to "soft" law
5. Benefit and burden <i>sharing</i>	1. International control to emphasis on national sovereignty; 2. Development emphasis to environment emphasis
6. <i>Redistribution, adjustment or compensation</i>	1. International control to emphasis on national sovereignty; 2. Development emphasis to environment emphasis

UN regional meeting reports, as well as National Reports now in the final stages of preparation, provide basic information to UNCED. Much of the information is raw data regarding environment and development problems, trends and goals. But as with the regional reports, the National Reports will also contain information relevant to the negotiation process itself. Assuming that countries follow the suggested format for National Reports,⁵¹ the following information, all related to the perceived implications of various linkages between aspects of environmental problems and the goals of sustainable development, should be retrievable:

- the key *attributes* that define the specific environment and development problems;
- characterizations of possible responses in *ethical terms* such as equity, equality, or responsibility.
- *relative importance* of issues in terms of the level of risk, of the degree of irreversibility, and of distributional aspects;

⁵¹UNCED PrepCom, A/CONF.151/PC/8. Of course, these reports may not in fact touch on these areas, in which case other sources of this information would need to be explored.

- *principles* favored for goals in connection with the various problems identified;
- *targets* favored for goals in connection with the various problems.

In particular, we would look for information specifically relevant for the food security linkages as outlined in Section 3. Once a fair number of these reports are studied, and concurrently with the winding up of the pre-negotiation phase of UNCED, it should be possible to observe commonalities among the countries across the interest expressions. These commonalities will present themselves in formations and activities of coalitions. In the final stages of a negotiation, the process dynamics are largely contingent upon the coalitions of countries that have formed and interacted over the course of the talks.

4.3 Summary of Issue/Interest Linkages

At this point, before moving to a discussion of formal applications, we may briefly sum up the issue/interest interactions. Beginning with a broad framework, the conceptual space, we identified six dimensions. The attributes of these dimensions, it turned out, could be used to help define the way countries draw implications about various levels of linkages within a particular issue area, food security in the illustrative case. At the same time that countries are defining the salience of an issue for themselves, they are also formulating judgments about possible policy responses to address the problems. These judgments are grounded in the traditions of ethics and political philosophy, but manifest themselves as preferences along a continuum of the policy ranges. Over the course of a negotiation, there are a number of changes that occur. Among them may be changes in "objective" knowledge about the problem, judgments about the importance of this change in knowledge; in the relative importance of the change within a given knowledge base, because of changes in preference determination; and in the formation and actions of coalitions in the day-to-day play of the negotiations. Using a concrete example, we explored how the environment problems on the UNCED agenda and ranges of policy responses are interconnected.

5 The Elements of Decision Analysis

As the previous sections make clear, issues at the environment/development interface are quite complex, but that this complexity is not without some possibility at organizational structure. In this section, we describe the elements of a decision analysis model based upon the study of issue linkages and interests. It is an approach designed to be used during the course of negotiations. The section concludes with a simplified representation of the model.

5.1 Methodology

In the foregoing sections of the paper, issue linkages and preferences were explored in a particular case. The basic elements for a more formal decision analysis of any particular

issue are the interests, the proposed outcomes, and a means of weighting the relative values of both. The overall objective is usually described as one of minimizing the differences, summed across all parties and interests, between the actual and the preferred outcomes. Our main goal has been to explore ways to improve the knowledge of the *composition and critical points* of the dimensions of the space in which a proposal falls, and hence is judged acceptable or not. As we indicated earlier, this is because sustainable development requires more than just efficiency considerations, and because avoiding a North/South impasse probably requires knowing more about different problem/response perceptions.

Proposals are evaluated according to the attribute characteristics as perceived by the party as well as the perceived attributes of the problem interface (according, again, to the perceptions of the evaluator). These proposals may be objectively assigned attribute values by the legal and scientific experts.

On each policy continuum, parties will have an (implicit or explicit) resistance point - a policy response that is viewed neutrally. To one side are all responses that are not acceptable, to the other ones that are. The resistance points are different for everyone, and together they describe a country's region in which particular policy proposals are acceptable. In the instance of uncertainty, on the negative side of the switch point a country may believe that there is too much uncertainty to warrant action now. On the other side, the country says that they have more than enough reason to act now. Together, the resistance points for all countries determine the collective zone of agreement.

There are several possibilities for weighting the elements: outcomes may be weighted according to their probability; interests may be weighted according to their importance for the agent; parties may be weighted according to their power in a coalition.

A full-scale analysis using this methodology would proceed as follows:

- (1) Choose a starting point in time, a set of parties (perhaps representative countries) or coalitions, and an issue.
- (2) On the basis of information in reports and conference statements to date, situate each party, relative to the others, on each of the six dimensions.⁵²
- (3) Choose a set of proposals to study, and situate these proposals as points in the space determined by the six attribute dimensions.
- (4) Calculate the distances that each proposal is from the minimum acceptable point of each party. The distance measure is given by the actual measure if the proposal is beyond the resistance point and by zero if it is equal to or less than the point. No distinction is therefore made between a proposal that is barely acceptable and one that is overwhelmingly favored.
- (5) Analyze the decomposition of the distances and the variations between

⁵²This methodology is appropriate for public, formal statements. However, much of the "real negotiation" takes place informally, and often the results reveal that the formal statements are much different than the real interests of the parties. When assigning attribute values, it might be useful to ask whether the value appears reasonable or expected for that country. Why or why not? The answers should help provide background for the interpretation of the quantitative results.

- proposals.
- (6) Perform sensitivity analyses on the distance components.
 - (7) Track actual changes in distances over time as preferences change and new and modified proposals are put forward.

By revealing where potential serious differences exist -- either because a particular interest value is quite far from any proposal, or because many proposals fall far from the aggregate zone of agreement, two avenues of constructive assistance to the negotiation process may be opened:

- Attention may be focused upon helping narrow *particular* differences: for example, by providing additional information, linking in other interests, and so on.
- The opportunities for creating successful new proposals could increase, as the domain of such proposals becomes clearer.

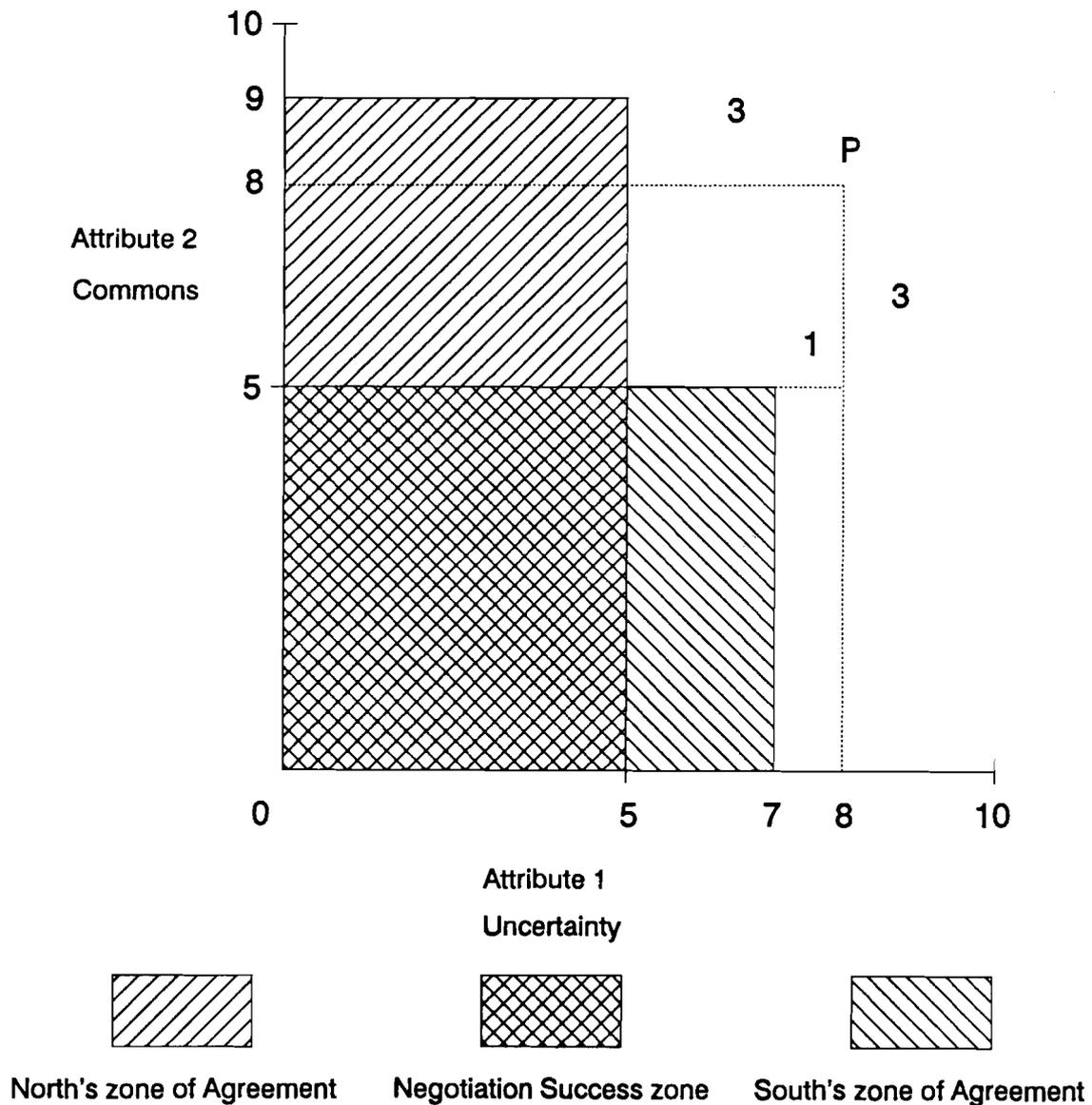
The methodology outlined considers one issue at a time, but is based upon a set of attributes that are the same for all issues. The "issue" we have examined, food security, is comprised of a number of sub-issues. The potential exists that countries will have significantly divergent attribute values across different sub-issues. (Or similarly, across the issue of food security and, say, ensuring adequate energy supplies.) A priori, we might not expect this, since there is a common normative/ideological framework giving rise to the relative importance of the attribute values. But, for example, one country may have a low average value for all attributes when the proposals concern international loans for food imports. When the proposal has to do with regulating open ocean fisheries, this country (which let us say, depends heavily upon its fishing industry) may have attribute values for commons and inequality that increase. If we want to assess the importance of one or another attribute across the broad issue, the results may be less precise. It is not clear at this stage whether this factor will be significant. If the objective of the analysis is to assess the broad issue as a totality of the sub-issues, then the differences among attribute weights in sub-issues should be accommodated at the initial attribute assignment stage. If the objective is to fine-tune specific proposals, we would allow for different attribute weights. Moreover, because food security is a part of the global goal of sustainable development, the zone of agreement in the conceptual space of the six dimensions used in this study, may be similar to that of other major issues.

5.2 An Example

To help visualize the setting for decision analysis, the diagram below shows a two-dimensional (instead of six-dimensional) space, with the acceptability ranges for two stylized coalitions, North and South, sketched in. Note that, unlike the bargaining space diagram (Figure 3 above), the acceptable region is in the southwest corner of the picture. This reversal is consistent with our emphasis on pinpointing the *minimum* acceptable proposal characteristics. Each coalition's acceptable region is shaded in and one proposal, P, is situated within the space. The unacceptability measure is computed as the sum of the distances given by the differences between the minimum acceptable value and the value of the proposal. The scale ranges from 0, totally unacceptable, to 10, ideal.

In the diagram, North has coordinate values of 5 on the horizontal axis (uncertainty) and 9 on the vertical (commons) axis. Relative to South, which has a value of 7 for uncertainty, South requires more attention to certainty in a proposal than does North. South, with a value of 5 for the commons, requires more attention to burden and benefit sharing than does North. Or from North's perspective, a policies need only a small measure of attention to the commons characteristic of resources to be acceptable. The proposal is situated at (8,8), and is therefore outside of either parties' zone of acceptability (and therefore outside the joint zone). We can decompose the distance from the minimum acceptable point (5,5) by determining the distance from P to the resistance points for each coalition. Thus, we see that P is three units away from North's acceptance point, all of which are accounted for by uncertainty; the proposal contains more than enough attention to,

FIGURE 8 Two-Coalition, Two-Dimensional Decision Analysis Space



or measures for, dealing with the commons. For South, the proposal is four units away: three because of commons and one because of uncertainty.⁵³

6 Conclusion

Environment and development concerns are certainly among the most vexing confronting governments and citizens today. It is encouraging and at the same time challenging that nations have agreed to face the complexity of the interfaces of these related concerns in UNCED, a high-profile international conference.

In this study we focused on a concrete instance of the complexity represented at UNCED. Using the issue of food security, we developed a number of interrelated descriptions of linkages. Among the most critical factors that influence decision making are the *perceptions* of these linkages against a background of fundamental interests: perceptions and knowledge of the problem and its scientific characteristics; degree of risk aversity; preconditions, precedents, and history; political factors and tradeoffs outside the immediate decision context; competing objectives and counterproductive feedback effects; financial and managerial capacity; and finally, aspirations, values, and beliefs. These factors overlay direct linkage effects. We distilled from a set of linkages surrounding food security some common attributes to analyze systematically. Using a decision analysis methodology, we illustrated a way to study the differences that may exist or emerge regarding specific proposals in a negotiation.

This extended exploration of a way of analyzing complexity in an ongoing international multilateral negotiation reveals a number of further and continuing research possibilities:

1. *Refined examples as new information becomes available.* The decision analysis model can be enriched and run iteratively as additional information becomes available. One of the primary sources of additional information is contained in National Reports, currently undergoing initial processing by the UNCED Secretariat. As this information is analyzed, several particular types of data should be assembled. These include ethical characterizations of problems and proposed solutions, key attributes of the interactions between and within problems, and various rankings of importance of issues and of importance of principles to be embodied in outcomes. This kind of information may also be culled from other national documents, UNCED PrepCom proceedings and other similar types of data. Surveys and interviews could bring out more focused views on the attributes. As the negotiations move through the final stages of preparation, we anticipate the emergence of coalitions representing similar interests, much more specific proposals, as well as a more developed sense of the points of most serious conflict.

⁵³When we first discussed the uncertainty attribute, we noted that the factor could cut both ways in a negotiation. In this example, we do not distinguish this. If North believes that uncertainty makes it less desirable to act, and South believes that it makes it more desirable, the zones of agreement may not overlap at the origin. In these cases, it would be necessary to redefine the way the attributes are evaluated so that the "goods" align. When interpreting the results, of course, it must be kept in mind, for example, which countries view uncertainty as a positive incentive for action and which view it as negative.

2. *Philosophical discussions of "sustainable development" and negotiation.* At a more abstract, philosophical level, there are a number of concepts that can be fruitfully explored as components of negotiations and the underlying basic human urge to solve problems and make the world a better place. These include:

- the meaning of "interest" in a sustainable development frame;
- how, if optimizing concepts are not appropriate, the "goodness" of negotiated outcomes may be assessed;
- negotiation as a balancing, rather than optimizing, exercise, the notion of a common-sense moral/rational satisficing, and the connection to a sustainable development goal;

3. *Other empirical studies.* The extent of generalizability of the methodology and the choice of attributes may be tested:

- in the negotiations currently underway to produce conventions on global climate change, and biotechnology/biodiversity for UNCED;
- in previous related environmental negotiations, such as the Vienna convention and Montreal and London protocols for the reduction of ozone-depleting substances;

4. *Comparative country studies.* Finally, a richer understanding of the role of underlying concepts, and how they play through to the salient attributes, might emerge from a comparative case study on countries of particular importance in environmental negotiations.

Appendix -- The Definitions of Food Security

Adams, p. 550. Ability of poor countries to hold year-to-year fluctuations in food consumption to an acceptable level.

Advisory Panel to the World Commission on Environment and Development, p. 3. Adequate stocks and flows of food and cash to meet basic needs; secure ownership of, or access to, resource and income earning activities; sustainable over the long-term.

Bread for the World, 1989, p.2. Assured access for every person, primarily by production or purchase, to enough nutritious food to sustain productive human life.

Bread for the World, 1987. Assured access to food, on the national level, requires a stable supply of nutritious food at equitable prices, an effective distribution system, maximum opportunity to earn a livelihood, and food subsidies for those unable to purchase food with their own resources. Internationally, it means trade policies which help assure fairness and price stability, as well as food self-reliance, development programs designed to increase food production in food deficit areas, increased family incomes and improved food distribution, and food aid that responds to need efficiently and effectively without inhibiting agricultural and economic development.

Lester Brown, et al, p. 185 The food security index incorporates both grain carryover stocks and the grain-equivalent of idled cropland, expressed as days of consumption.

FAO, 1987. p. 2. (After 1983 definition) Ensure that all people at all times should have both physical and economic access to the basic food they need. Ensure production of adequate food supplies; maximize stability in the flow of supplies; secure access to the supplies on the part of those who need them. Action will be needed on a wide front including all factors that have a bearing on the capacities of both countries and people to produce or purchase food. While cereals will continue to be the main focus of attention, action should cover all basic foodstuffs necessary for health. Agriculture and rural development, food production, food reserves, the functioning of national and international cereal markets, the foreign exchange needs of importing countries, trade liberalization and export earnings, the purchasing power of the poorest strata of the population, financial resources and technical assistance, the flow of food aid and arrangements to meet emergency needs; -- action needed to enhance food security.

Jorge Garcia Garcia, p. 123. Most discussions on food security consider food grains only. An inadequate definition of food can lead to an incorrect assessment of the magnitude of insecurity and the resources needed to reduce or eliminate it.

Dale Hathaway, 1981. The most basic element of food security is a strong and productive world agriculture with steadily growing productivity.

Huddleston, Johnson, Reutlinger, Valdes, p.3. Assurance that supplies and financing will be available to meet minimally adequate consumption requirements without domestic price increases, regardless of world market conditions.

Koester/Valdes, p. 431. Problem more severe the higher the food import bill relative to total export earnings, or the lower the correlation between the food import bill and foreign exchange earnings or both.

Lappe/Collins, p. 154. There can be no food security, no matter how much is produced, if the food-producing resources are controlled by a small minority and used only to profit them.

Lele/Candler, p. 102. Does not overlook certain realities of the food system, namely that not all food passes through market channels, that such markets are often not well integrated or in equilibrium.

Valdes/Konandreas, p. 25. Certain ability to finance needed imports to meet immediate targets for consumption levels.

Valdes/Konandreas, p. 38. Aims at balancing the year-to-year variability in aggregate consumption demand around a long-run trend -- designed to prevent consumption levels from falling below trend values.

Valdes/Siamwalla, p. 2 Ability of food deficit countries, or regions or households within these countries to meet target consumption levels on a year-to-year basis.

von Braun, p. 1083. Ability of all members of a household to acquire sufficient amounts of food continuously overtime for a healthy and productive life.

World Bank, 1986. Food security is essentially a matter of ensuring effective demand rather than a question of food supply.

References

- Adams, Richard H., Jr. 1983. "The role of research in policy development: The creation of the IMF Cereal Import Facility." *World Development*. 11:7, pp. 549-563.
- Advisory Panel on Food Security, Agriculture, Forestry and Environment to the World Commission on Environment and Development. 1987. *Food 2000: Global Policies for Sustainable Agriculture*. London: Zed Books.
- Bread for the World. 1989. *Agriculture Advisory Statement*. Washington, DC: Bread for the World, August.
- _____. 1987. *Policy Statement on U.S. Agriculture*. Washington, DC: Bread for the World, May.
- Brown, Lester et al. 1984. *State of the World 1984*. New York: W.W. Norton.
- Brundtland Bulletin*. 1991. Numbers 11 and 12 (March and July).
- _____. 1990. Number 9/10.
- Chasek, Pamela. 1991. *The System of International Environmental Negotiations*. Background paper. Washington, DC: Project on Multilateral Negotiations, The American Academy of Diplomacy and the Paul H. Nitze School of Advanced International Studies, Johns Hopkins University. April 19.
- Chen, Robert S. and Martin L. Parry, eds. 1987. *Climate Impacts and Public Policy*. Laxenburg, Austria: International Institute for Applied Systems Analysis.
- Cohen, Josh. 1990. "Global warming: The ethical issues." Mimeo. Cambridge, MA: MIT. July.
- Coleman, James S. 1990. *Foundations of Social Theory*. Cambridge, MA: Belknap Press of Harvard University.
- Costanza, Robert, H.E. Daly, and J.A. Bartholomew. 1991. "Goals, agenda, and policy recommendations for ecological economics." In Robert Costanza, ed. *Ecological Economics: The Science and Management of Sustainability*. New York: Columbia University Press.
- Drèze, Jean and Amartya Sen, eds. 1990. *The Political Economy of Hunger, Vol 1, Entitlements and Well-Being*. Oxford: Clarendon Press.
- _____. 1990. "Introduction." In Jean Drèze and Amartya Sen, eds. *The Political Economy of Hunger, Vol 1, Entitlements and Well-Being*. Oxford: Clarendon Press, pp. 1-33.

- Ezekiel, Hannan. 1989. *Food Aid, Food Imports and the Food Consumption of the Poor*. Mimeo. Washington, DC: International Food Policy Research Institute. December 27.
- Food and Agriculture Organization. 1987. *Evaluation of the Food Security Assistance Scheme*. Rome: FAO, November.
- Garcia, Jorge Garcia. 1981. "The nature of food insecurity in Colombia", in Alberto Valdes, (ed.) *Food Security for Developing Countries*. Boulder, CO: Westview Press.
- Goodin, Robert. 1988. *Reasons for Welfare: The Political Theory of the Welfare State*. Princeton: Princeton University Press.
- Goodwin, Neva R. 1991. "Lessons for the world from U.S. agriculture: Unbundling technology." *World Development*. 19:1, pp. 85-102.
- Hammit, James K. 1990. *Probability is All We Have: Uncertainties, Delays, and Environmental Policy Making*. New York and London: Garland Publishing Co.
- Hathaway, Dale. 1981. *Testimony before the United States House of Representatives Committee on Agriculture*, July 22.
- Helmuth, John W. and Stanley R. Johnson, eds. 1989. *1988 World Food Conference Proceedings*. 2 Volumes: *Policy Addresses and Issue Papers*. Ames, IO: Iowa State University Press for the Center for Agriculture and Rural Development.
- Huddleston, Barbara, D. Gale Johnson, Shlomo Reutlinger, Alberto Valdes. 1984. *International Finance for Food Security*. Baltimore: Johns Hopkins Press for World Bank.
- International Institute for Applied Systems Analysis, Environment and Development Project. 1991. *Systems Analysis, Conceptual Models, and Their Role in UNCED*. Mimeo. Laxenburg, Austria: IIASA, revised July.
- Intergovernmental Panel on Climate Change (IPCC). Martin L. Parry, lead author. 1990. *The Potential Impact of Climate Change on Agriculture and Forestry*. Draft report, April.
- Koester, Ulrich and Alberto Valdes. 1984. "The EC's potential role for food security for LDCs: Adjustments in its STABEX and stock policies." *European Review of Agricultural Economics*. 11: 415-437.
- Lappe, Frances Moore and Joseph Collins. 1978. *Food First*. New York: Ballantine.
- Lele, Uma and Winfred Candler. 1981. "Food security: Some East African considerations", in Alberto Valdes, ed. *Food Security for Developing Countries*. Boulder, CO:

Westview Press.

Moomaw, William. 1991. Personal communication, January.

Norton, Bryan G. 1990. "Context and hierarchy in Aldo Leopold's theory of environmental management." *Ecological Economics* 2: 119-127.

Parikh, Kirit S. 1990. "Chronic hunger in the world: Impact of international policies." In Jean Drèze and Amartya Sen, eds. *The Political Economy of Hunger, Vol 1, Entitlements and Well-Being*. Oxford: Clarendon Press, pp. 114-145.

_____, and Wouter Tims. 1989. "Food consumption, dietary status, and chronic hunger: An assessment of its extent and policy options." In John W. Helmuth and Stanley R. Johnson, eds. *1988 World Food Conference Proceedings*. 2 Volumes: *Policy Addresses and Issue Papers*. Ames, IO: Iowa State University Press for the Center for Agriculture and Rural Development, pp. 3-44.

Parry, Martin. 1990. *Climate Change and World Agriculture*. London: Earthscan Publications Ltd., in association with International Institute for Applied Systems Analysis and United Nations Environment Program.

Sen, Amartya. 1990. "Food, economics, and entitlements." In Jean Drèze and Amartya Sen, eds. *The Political Economy of Hunger, Vol 1, Entitlements and Well-Being*. Oxford: Clarendon Press, pp. 34-52.

Shaw, Roderick. 1991. *Environment and development: Agricultural land requirements in 2025*. Mimeo. Laxenburg, Austria: International Institute for Applied Systems Analysis. April 26.

Sjöstedt, Gunnar. 1991. *The Issue Analysis: A Summary Research Outline*. Mimeo. International Institute for Applied Systems Analysis and the Swedish Institute of International Affairs, June.

Slote, Michael. 1989. *Beyond Optimizing: A Study of Rational Choice*. Cambridge, MA: Harvard University Press.

Spector, Bertram I. 1991. *The Development of Agenda 21: Generating a Viable Formula*. WP-91-14. Laxenburg, Austria: International Institute for Applied Systems Analysis, May.

_____. 1991. *Interest Space Analysis*. Coalition Analysis Working Paper 4. Processes of International Negotiation, Laxenburg, Austria: International Institute for Applied Systems Analysis, February 5.

- _____. 1991. *Decision Analysis: Explaining the Processes of Multilateral Negotiation*. Paper presented at the International Multilateral Negotiation conference, sponsored by the Processes of International Negotiation project, IIASA. Laxenburg, Austria, July 1-2.
- Sydnnes, Anne Kristin. 1991. "Global climate negotiations: Another twenty years of North-South bargaining?" *International Challenge*. 11:1, pp. 58-66.
- United Nations Conference on Environment and Development, Preparatory Committee (UNCED PrepCom) Secretariat Reports. 1990-1991. A/CONF.151/various reports.
- United Nations Development Program (UNDP). 1991. *Human Development Report 1991*. press release, May 22.
- United Nations Economic Commission for Europe (ECE). 1990. *Bergen Ministerial Declaration on Sustainable Development in the ECE Region*. A/CONF.151/PC/10.
- _____. 1990. *ECE Synthesis Paper Based on the National Reports Submitted by the ECE Member Governments*. April. GE.90-21329.
- United Nations Economic Commission for Latin America and the Caribbean (ECLAC). 1991. *Sustainable Development: Changing Production Patterns, Social Equity and the Environment*. Santiago, Chile. LC/G.1648 (CONF.80/2)Rev. 1. February 12.
- _____. 1991. *Report of the Latin American and Caribbean Regional Preparatory Meeting for the United Nations Conference on Environment and Development*. LC/G.1656 (CONF.80/3). April 9.
- United Nations General Assembly. 1989. "United Nations Conference on Environment and Development (UNCED)." *Resolution 44/228*. New York: UN, December 22.
- United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). 1990. *Report of the Ministerial Level Conference on Environment and Development in Asia and the Pacific*. IHE/MCED/Rep., November 19.
- _____. 1991. *Report of the Meeting of Senior Officials on Environment and Development in Asia and the Pacific*. IHE/SOED/Rep and Annex. March 19.
- United States Department of Agriculture (USDA). 1989a. *World Agriculture Trends and Indicators: 1970-1988*. Washington, DC: USDA.
- _____. 1989b. *Agricultural Policy, Trade, Economic Growth and Development*. Washington, DC: USDA.
- Valdes, Alberto and Panos Konandreas. 1981. "Assessing food insecurity based on national aggregates in developing countries", in Alberto Valdes, ed. *Food Security for*

Developing Countries. Boulder, CO: Westview Press.

- von Braun, Joachim. 1988. "Effects of technological change in agriculture on food consumption and nutrition: Rice in a West African setting." *World Development*. 16:9 pp. 1083-1098.
- Weiss, Edith Brown. 1989. *In Fairness to Future Generations: International Law, Common Patrimony, and Intergenerational Equity*. Dobbs Ferry, NY: Transnational Publishers and Tokyo: United Nations University.
- Wolf, Amanda. 1990. *Food Security in Relation to a Major Employment-Oriented Development Effort: Policies for Ensuring Reliability of Food Supply in the Context of Increasing Demand*. Mimeo. Washington, DC: International Food Policy Research Institute, May.
- World Bank. 1986. *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. Washington, DC: World Bank.
- World Commission on Environment and Development (WCED). 1987. *Our Common Future*. Oxford: Oxford University Press.
- Young, H. Peyton. 1991a (in press). "Fair division." In H. P. Young, ed. *Negotiation Analysis*. Ann Arbor, MI: University of Michigan Press, pp. 25-42.
- _____. 1991b. *Sharing the Burden of Global Warming*. Working Paper 2. Equity and Global Climate Change Project, College Park, MD: University of Maryland.