EXPLORING ENVIRONMENTAL CHANGE USING AN INTEGRATIVE METHOD

Edited by
Mark Lemon

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Exploring Environmental Change Using an Integrative Method

Environmental Problems and Social Dynamics

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PREFACE

The International Ecotechnology Research Centre (IERC) is a multi-disciplinary unit consisting of physicists, ecologists, engineers, educationalists, economists, archaeologists, sociologists and hybrids thereof. Over the past eight years the Centre has undertaken work ranging from the eutrophication in the North Sea through the disposal of waste by land-fill to studies of knowledge and technology transfer and organizational change. This apparently disparate history does, however, have a consistent and central theme which lies in the importance of non-linear dynamics and complex systems thinking for understanding and managing change and in particular the role of knowledge transfer in the process.

While this theoretical starting point may be articulated differently by representatives of the disciplines, within the group a general scepticism about planning for 'end states' is matched by the recognition that no single disciplinary perspective can provide an adequate insight into natural-human interactions. An integrative method has been developed which is consistent with this interpretation of systems as complex but which is sufficiently flexible to recognise the need to select the relevant skills for particular pieces of research.

The emergence of this method, and the selectivity within it, has been accompanied by the need for disciplinary humility, a requirement that is not always foremost in the academic tool box. Making sure that the nuts and bolts are roughly in the correct place is fundamental to representing the machine. By the same token the absence of the odd nut or bolt will not necessarily be too detrimental to that representation. Herein lies an important point. What is being sought by the group is a representation of the real world that is capable of generating questions about possible futures rather than providing solutions. Those questions need to be relevant and as such must be capable of supporting choices relating to the future—in other words they must be policy relevant.

This study is an attempt to convey this integrative method through a specific context (natural resource degradation in the Argolid Valley in Greece[1]), however, it is intended that the process described is of a more general use and as such should not be restricted to a readership whose interests lie within agronomy or hydrology. Throughout the text background information will be provided concerning the techniques adopted and as such it is anticipated that an appreciation of the role to be played by other disciplines will develop. There are sections of the text however that are more technically demanding; this is particularly the case with the modelling chapters towards the end of the book. While the equations are not for general consumption it is hoped that these sections can be read at a more descriptive level which reinforces the underlying message of integrative method.

While it is not our intention to advocate the nurturing of multi-disciplinarians, a movement towards the acquisition of a set of transdisciplinary skills is desired. It is this which can support a more informed choice about when different disciplines and techniques are useful.

We would also like to acknowledge the support provided for this work by the Agricultural University of Athens, Department of Hydrology and in particular P.Giannoupoulos (Takis). The project is unlikely to have reached completion without the advice, support and at times forceful cajoling of Sander Van der Leeuw.

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1.
POLICY RELEVANT RESEARCH: THE NATURE OF THE PROBLEM

Mark Lemon and Roger Seaton

INTRODUCTION

Multi-disciplinarity and inter-disciplinarity have become part of the language of environmental education, research and management. Courses move between environmental biology, waste biotechnology, geographic information systems, risk assessment and even into ethics and aesthetics. An increasing acceptance about the complex nature of environmental systems and what is becoming recognised as the 'seamless web' between social and natural has accompanied a burgeoning of disciplines and skills under the environmental umbrella. While this is largely desirable two concerns must be expressed. Firstly, multi-disciplinarity can disappear into a generality which constrains the development of single disciplines. Secondly, and central to this book, is the concern that the introduction of more disciplines to the environmental melting pot is considered as the best way to represent the complexity of issues. This is a premature assumption if those issues are inadequately defined and the information requirements inappropriately specified. There is a danger that environmental education can become a catalogue of disciplines, information and techniques rather than *a guide to learning how to structure issues* or environmental problems (Lemon and Longhurst, 1996). It is this framework for structuring issues which should provide the basis for selecting the requisite contributions from different disciplines.

The environment encompasses human and natural interactions and as such encroaches on, and is considered by, a range of disciplines not traditionally linked to natural resource questions e.g. social theory as well as those that would normally be associated with them e.g. the natural sciences. A priority for environmental research and education should be to provide a framework for structuring issues and thereby selecting the contributions to be made by different disciplines rather than moving towards their assimilation under one umbrella. Environmental studies must reflect and make explicit the complexity of environmental issues, including spatial and temporal scale, through the development of a conceptual framework which is not interdisciplinary so much as transdisciplinary. This book is not intended either as a critique of the many attempts at integrated environmental education or to question the fundamental contribution to be made by good teaching and science within single disciplines. Rather, it is an expression of the need to define issues more clearly through the exploration of social and natural interactions and an improved understanding about when, and to whom, those relationships constitute a problem. Therefore, while the insights obtained from 'traditional' science about natural processes are of great importance, to be decision or policy relevant they must be related to the socio-economic and cultural environment in which they occur. This has a knock on effect for the way that environmental research is handled, environmental issues managed

and related policies formed. It also provides the rationale for the integrative method which is presented in the ensuing text through a case study of agricultural practice in the Argolid Valley of the Peloponnese, Greece.

The book is divided into three sections. Section one opens with a discussion on policy relevant research and integrative method in the context of sustainability. The case study area is then introduced, followed by an introduction to systems thinking and social enquiry which form the generic bases for integrative method as it is interpreted here. The second part of the text examines the agronomic, technological and socio-economic co-evolution of the Argolid Valley over the past fifty years and how this has affected the condition of the natural resource base, in particular ground water. A central feature of this analysis is the variation within the area and an attempt is made to classify this through the development of bio-physical zones and a typology of agricultural decision makers. The combination of these classifications forms the basis for a crop choice framework which highlights the difference between what could be grown (opportunity space) and what is perceived to be possible or likely (decision space). The final section of the book draws upon the information presented in the previous chapters and presents modelled representations of crop choice and the water-salt system in order to move towards the development of an integrated dynamic model. The current methodological, policy and local situations are then discussed and consideration given to the future development of each.

Building on the Local

It has already been suggested that policy relevant research needs to build upon 'local' knowledge and concerns, both in order to specify more appropriate forms of policy intervention, and to have a more informed view about the possible impacts of such intervention. The method described below is an iterative process which is still being explored and developed both in relation to the Argolid and in the Marina Baixa region of Alicante in Spain. It involves interacting with stakeholders[1] in the processes of local description, issue specification, impact assessment and interpretation. While these stages are appropriate to the understanding of change in real time they are also pertinent to the generation and interpretation of 'modelled' scenarios that can be used to explore a range of possible futures. Local people have been involved extensively in the 'qualitative' aspects of the work, however, to date they have been less active in the processes of model specification and the interpretation of the output that is generated. It is a central objective of ongoing work to address this issue and to involve stakeholders at each stage.

A second objective concerns the need to establish a more generic, accessible and policy relevant methodology. To this end the project seeks to provide a common method for examining the impacts of land use change in qualitatively different locations experiencing different forms and intensity of socio-economic and bio-physical degradation. It is anticipated that this approach will shine some light on the background to salient issues in the case study locality and in the process of doing so will contribute to a policy relevant framework, that is of value to local stakeholders, for the *exploration as opposed to prediction* of possible futures under different land use regimes (see McLain and Lee, 1996). For example the Argolid Valley will be seen to have moved towards the subsidised monocropping of citrus fruit over the past forty years and to have experienced a concurrent

[1] Stakeholders in the context of this work are taken to be those actors and agencies that affect and are affected by the processes under investigation.

degradation (salination and depletion) of its natural resources, in particular water. This degradation was of fundamental concern to the area in the early 1990's when the initial research was undertaken. However, in 1996 and 1997 there has been a marked increase in precipitation levels and the concurrent recharge of aquifers from local springs. These events have led to a shift in local priorities away from resource degradation and towards economic issues relating to the marketing of crops and changes in policy concerning price support and subsidy. While this book addresses the substantive issue of how strategic research and policy formulation can better contribute to the evaluation of sustainable water systems it will attempt to comply with its' own message of adaptive systems by incorporating these more recent changes into the description and analysis of local options.

The overall goal of water policy at the level of the European Union (EU) is one of "sustainable water supply" and this presents considerable operational difficulties for the assessment of spatial, water network (infrastructure) and environmental impacts. The idea of sustainability derives from the desire to pass on to current and future generations the same or an improved quality of life although, given uncertainty, not necessarily the same configuration of opportunities as exist now (Bruntland, 1987). It is thus necessary to avoid reducing that future capability by causing permanent damage to environmental systems in the pursuit of shorter term economic and social viability. The problem for policy at the European level is to help shape that shorter term viability so that it is more congruent with long term sustainability.

It is particularly important to consider the diverse circumstances and perceptions that arise from different cultures and traditions across the EU and in the wider European context. This has implications for how the aggregation of behaviour is treated in different locations and in turn what effects and policy options may be appropriate for consideration at the European level. The recipients of policy at the local level will also be responding to a wide variety of local, regional and national influences and the recognition of this diversity is fundamental to the concept of subsidiarity. Indeed the maintenance of diversity of life style is an important feature of a sustainable European Union. It is thus essential that the policy process has access to methods, models and techniques which enable properties and behaviour at each level to be formally linked.

At the same time different temporalities need to be considered, particularly the time horizons that are appropriate for strategic policy. The response to changes in water need, and use, may be relatively fast for marginal changes in quality and costs. More fundamental changes such as the introduction of new technologies and infrastructures may lead to structural changes regarding the source and level of demand in urban areas and regions over somewhat longer periods. Such spatial changes will also be influenced by changes in the physical, social, and economic environment alongside the evolution of innovative and spatially different infrastructures etc. The emergence of new inter-urban and regional spatial structures takes place over even longer time periods.

In a similar way the physical "environment" is not a passive entity but is driven by a complex set of factors which themselves have spatial and temporal properties. Dispersion and concentration of pollutants in air, water and soil, the rate of transformation of pollutants into other damaging phenomena and so forth all take place over different time scales. Changes in the output of pollution and the immediate affect on a recipient human population are likely to be faster than the speed at which their effects reveal themselves in the ecological system. It is no longer considered sufficient to control, where possible, the output of pollution or use of energy and materials without a better understanding of the how these outputs influence our future ability to function and what the longer term effects are on those affected by them.

Some Useful Distinctions

A number of the terms and concepts adopted for the work and used in this text need clarification. These are not intended to be taken as definitive statement but rather to serve as a route map through the methodology which has been developed. They are invariably derived from soft systems thinking and have been presented at greater length elsewhere (i.e. Winder and Van der Leeuw, 1997).

- *Actors* are the decision makers (individuals, groups, communities and organisations etc.) in complex situations.
- *Agencies* are those organisations, whether governmental, non-governmental, voluntary, statutory etc. which have any function that influences actors as a consequence of any intended policy implementation at any level.
- *Policy relevant* refers to investigations and research concerning a context and related issues about which policy may need to be formulated by a responsible agency on behalf of a wider group of organisations, communities or citizens.
- *Issue relevant* refers to specific contexts in which there are symptoms which the embedded actors perceive as a "problem".
- *Decision relevant* refers to contexts in which the actors have, either implicitly or explicitly, identified the nature of their problem and the choices and options and wish to further their understanding of the options and consequences.
- *Decision space* refers to the range and nature of options considered by the actor(s) to be relevant and potentially achievable.
- *Opportunity space* refers to the number and nature of all the options notionally available to the actor. This will include outcomes of decisions which are not perceived by the actor or cannot be considered viable in terms of their ability to access them.
- *Policy formulating process* refers to the qualitative, political, administrative and scientific interactions by which policy is derived.
- *Policy instruments* refer to the various types of intervention (economic, infrastructural, educational etc.) which can be used to enact policy.
- *Policy delivery* refers to the actions, mechanisms and management required for a policy to be enacted by agencies in order to impinge on the final recipients of policy. Often there is confusion between policy and policy instruments since within a hierarchy policy instruments at a higher level only reveal themselves as policy at the level down. In the case of EU policy this often involves a hierarchy of agents from member governments to local government or agencies. Policy delivery can be considered as a logistical problem by which the intended effects of the policy are determined not only by the choice of policy instruments but also by the choice and design of the delivery mechanism. Culturally and economically diverse agencies and recipients are likely to respond differently as are those agencies responsible for policy delivery. This suggests that in order for policy to achieve equivalent, but not the same, effect it may the policy instruments, and delivery mechanisms employed, to have sufficient variety to match the range of contexts to which it is delivered.
- *Decision-making process* refers to the sequence in which knowledge is used and the procedures by which decisions and subsequent acts and activities are derived and evaluated. Both this and the policy formulation process may be implicit rather than explicit and under some circumstances the actors may not consider that they actually agreed a policy or a decision.

- *Decision making* is itself a complex issue but can usefully be thought of as involving a number of attributes of the elements (decision space) relevant to the actor(s) involved. Thus a decision takes place in an attribute space specific to the actor. Where there are very similar decision issues and very similar decision spaces then the relevant attributes of one actor and another in the same cultural context will be similar and the probabilities of individual outcomes can be aggregated. More commonly, each person will operate in an attribute space which has some common attributes with some people or organisations but which may have others which are different. When the attribute spaces are sufficiently different as to result in systematically different outcomes then diversity is apparent. When the decisions concern the same attribute space but different combinations of intensity of each attribute then variety is apparent. It should be noted, however that what is considered a decision to an outsider may not be considered as a *"decision event"* by the actor(s) involved. (The notion of "a decision" may itself be a scientific or cultural construct). Similarly the decision space of a policy recipient may be very different to that of the policy which attempts to obtain change in the recipient's behaviour. Decisions and their pertinent attribute spaces are not just hierarchically juxtaposed but are also nested in the sense that on some occasions decisions by, say individuals, form the apex of a hierarchy while in other situations they are the object of decisions. Decisions at any level interact not only with a given issue but with other issues at different levels of phenomena.

It has been suggested that delay is often apparent between ecological distress and stakeholder perception of an 'issue'. This proposition can be extended further to include the delay between that ecological distress and the 'issue' as it is interpreted by non-local institutions or agencies. This suggests that issues have their own emergent characteristics which are grounded in perception and decision making, bio-physical processes and institutional responses. The concepts introduced above are intended to provide a framework within which such propositions can be explored.

PARADIGMS, PERCEPTION AND PROCESS: SCIENCE AND DECISION MAKING

In their reflections on the need for a more useful framework for analysing policy problems, several studies have concluded that the conventional scientific model is not appropriate (Dunn, 1981;

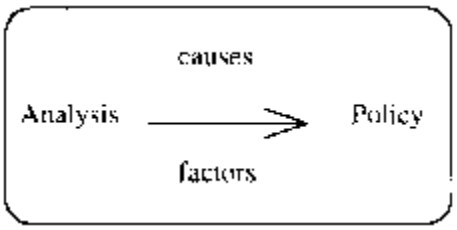

Figure 1–1 The 'rational' view of science and decision issues.

Cleveland, 1988). A major reason for this is the discipline specific approach which it promotes and tends to adopt. In his review of paradigms in policy making, Daneke (1989) states that:

> 'A significant paradigmatic shift is severely hampered by extreme disciplinary isolationism on the one hand and the pervasive imperialism of neo-classical economics on the other.'

Referencing the pioneering work of Holling (1978), Daneke calls for

> 'modest conceptual developments, seeking new applications for notions such as resiliency, adaptive learning, and other institutional dynamics.'

In other words there is a role for research which focuses on the "process" of change and which provides insights into how policy may guide it. The traditional, rational view of science research about decision issues is shown in Figure 1–1. This approach reduces complexity and seeks to identify simple causal relations. The adoption of such a paradigm is invariably considered necessary because it provides an appropriate way to develop an understanding of classes of phenomena about which scientific methods were developed and about which they are efficient generators of new knowledge. It can then be argued that policy should focus on those causes. In the complex, messy real world (Checkland, 1981) the consequences of such a view often result in "unintended" consequences which in turn become a new set of "unanticipated" decision-issues (Figure 1–2). Invariably the structures and procedures in place to manage change are based upon end state planning and an inability to respond, or even recognise, the complexity of the process. This 'closing' of the system in order to match it to formal management structures and practice invariably fails to account for the informal responses and interactions that form the basis of self organisation. In consequence there is often a poor level of congrence between this formal representation and the issues as they are interpreted at a local level (Lemon and Naeem, 1990).

The conceptual model shown in Figure 1–3 assumes that a "decision-issue" has been correctly identified. This presupposes firstly that symptoms of a "problem" have been appropriately linked to a single decision issue, that there is a single homogeneous audience for change, (the problem owners) and that the problem setting can be well bounded (i.e. there is no interaction between it and anything else). Secondly, there is a problem concerning the extent to which it is assumed that in future the causal factors and the problem setting will remain the same. Such an approach is based upon the false assumption that the future is forecastable. Although considerable progress has been made in handling the concept of risk, the notions of uncertainty and surprise resist formal analytic techniques (Jeffrey and Seaton, 1995). If it is inherently impossible to forecast the particular configuration of a situation in the future then it may be more appropriate to emphasise those attributes that are connected with the capacity to adapt and change, on an ongoing basis, such as resilience and flexibility.

These limitations of the traditional deterministic approach have quite serious implications for strategic decision-making although there are other types of decisionissue for which it may be appropriate. For instance, decisions about physical infrastructures still have to be handled with regard to the problems of engineering design and implementation. Thus end-state planning, while inappropriate for strategic decision issues, cannot be avoided in others that are 'project' oriented. Much depends on how artefacts and devices are embedded in ever changing organisations and communities. In consequence, there is a tension between technological solutions to problems with long lives and the rate of change of the context or location to which they are applied.

Figure 1–3 therefore conveys the traditional role of the technical analyst with respect to decision-making, the recipients of policy and the decisions themselves. Even in contemporary research this

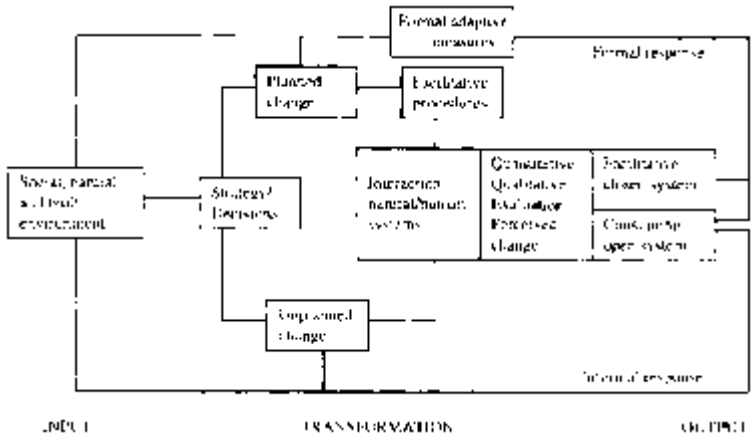

Figure 1–2 Congruence model for planned/unplanned change.

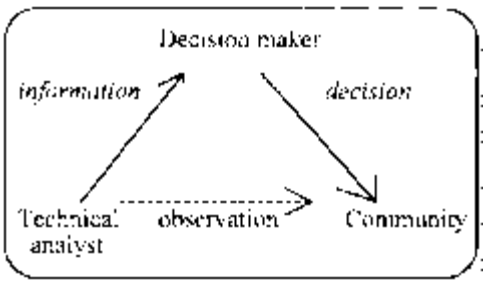

Figure 1–3 Technical perspective on decision making.

model is surprisingly common. Scientists and engineers are particularly vulnerable to its adoption when they apply themselves to policy issues. The most striking feature of it is the notion of "decision-maker" that is commonly used. In practice the vast majority of strategic decision issues involve a complex decision-making process which includes a diversity of information, views and participants. The idea of decision making as a complex, human centred process is common in politics, management and social policy, all of which may use formal intellectual devices with different traditions to natural science. Increasingly there is an emphasis on the role of social disciplines in formulating the appropriate decision context to which science and technology knowledge has to be applied (see Newby, 1992 and Chapter four).

There are further limitations in the application of a traditional science model to decision making. Firstly, it confuses accountability with agenda setting. In other words it sees the role of the analyst as providing information to the "decision-maker" on an issue that has been determined by that "decision-maker". This makes the questionable assumption that the agenda for change of the recipients of decisions and policy is fully comprehended by the decision-maker. (Lemon, Hart and Seaton, 1992). In other words the relationship between the decision-making process and the recipients of policy and decision making is assumed to be about the selection of options and not about option generation. In practice the amount of knowledge at the disposal of the policy

formulating process about the priorities for change and the likely response of a recipient population to a specific policy or policy instrument is often very limited.

A second limitation of the traditional model is the nature of the relationship between the researcher or analyst and the recipient population. This is shown as a broken arrow (Figure 1–3) to denote the lack of interaction between them. The recipient population is usually seen as a set of objects to be observed and analysed. Where they are questioned it is invariably about the researcher's agenda without adequate regard being paid to it's relevance for the respondents. The problem is that the analyst takes no responsibility for enquiring into those diverse agendas and decision spaces. The consequence is that the relevance of the nominated issue to people on the receiving end of policy and strategic change is never known (Lemon and Naeem, 1990). Thus one essential characteristic of policy relevant research is that attention is paid to the agenda for change and the receptivity of the recipients of change (Seaton and Cordey-Hayes, 1993). Receptivity in this context can be seen as the ability to assimilate change.

The weaknesses of the traditional approach have to some extent been recognised in the social disciplines through the development of techniques and mechanisms for the elicitation from populations about their perceptions of relevant "problems" and the prioritisation of decision issues. A strong complementarity between those developments and social anthropology has been revealed during this project (Green and Lemon, 1996), in part because of the contribution social anthropology can make to an understanding of social and cultural diversity and the influence that social and cultural factors have on the decision-space of policy recipients.

One of the problems of much current policy formulation in the technological and environmental fields is that it not only affects the target recipients, sometimes in an unexpected way, but that it also affects other unanticipated groups because of physical and social linkages that can only be identified through interaction with the population. To formulate a strategy and policy without regard to the likely response of the recipients is unhelpful but what is also required is the formal recognition of the diversity of agendas for change and the range of priorities for different individuals and groups. This calls for the adoption of appropriate techniques of enquiry into the agenda of needs and requirements and how these change over time.

In summary the traditional approach of the analyst and the related view of strategic decision-making has severe limitations when applied to decision issues that involve interactions between the social, technological and natural worlds. The approach that is presented in this text is a consequence of the increasingly evident failure of any single epistemological position or intellectual discipline to provide both the diversity of knowledge, and the integration needed, to formally link research disciplines together and to extend this formal linkage to a policy and decision making setting. While we do not claim to have progressed far along the path, we do feel that there is a need to look beyond the addition of different disciplines and to consider how best to harness their synergistic potential.

MOVING BEYOND MULTI-DISCIPLINARITY

What is presented below is an attempt to show how existing intellectual resources can be exploited to explore decision issues without resorting to such devices as "meta-disciplines" or "meta-methods". It is best seen as the application of a technological perspective to research knowledge in that it attempts to exploit knowledge generated from traditional disciplines and to show how such knowledge can be integrated in a way which makes it accessible to policy and decision making. It

does not depend in itself on a new theoretical framework but adapts conceptual devices and models from established and developing fields of research. The distinction is, therefore, between the development of methods for knowledge exploitation to support decision-making and the generation of new knowledge through theoretically based research.

Since such a decision relevant approach aims to exploit the knowledge in existing disciplines, it must be judged, as with all methods, by the usefulness of its application in the context of policy formulation and strategic decision-making. Thus the appropriate criterion is the extent to which such an approach provides "additional" knowledge and information for decision-making that is not available through the pursuit of a single epistemological position, nor indeed from the ad-hoc application of a number of these to the same issue in an unconnected way. Experience suggests that in such multi-disciplinary research the need for post hoc integration is seldom attained. This method is based upon the view that the world about which decisions are formulated and acted upon are, as noted earlier, dynamic, uncertain, messy and complex.

Dynamic: Not only that there exist many interactions but that these are changing over time.

Complex: While a component or sub-system affects another, it too is also affected by those it affects (feedback).

Uncertain: It is not possible to forecast future states because it is certain that unpredictable events will occur which will affect any assumed situation so radically that a further, unknowable vector will be followed.

Messy: Checkland (1981) asserts, that in reality there are no such things as "systems" (although conceptualising certain aspects of the world as though they were systems is certainly useful), thus messy denotes conflicting goals, values, behaviour and irrationality (at least in terms of any particular epistemological position).

In these situations, which are the ones that policy and decision making inevitably address, no one method of enquiry can expose the knowledge needed. On the other hand the knowledge required is considerable. Clearly just making bigger "models" of greater complexity is unhelpful as is more measurement without regard to the significance of that data to decision issues. It is useful to consider the nature of the contribution that formal research disciplines can make. Each discipline or system of thought that is relevant to the class of decision issues can be considered in two ways.

1. It consists of internal debates and enquiries which facilitate its evolution and which can provide knowledge about a certain class of phenomena and issues.
2. Thus the discipline and its sub-sets have their own internal dynamic, shared conceptual devices and agenda. Part of the Argolid project, which is reported below, has undertaken an initial investigation into the intellectual position of scientists concerning the "problem" as they perceive it.

However, embedded in that knowledge is some component which could be useful in a policy context. The difficulty is that the relevant knowledge seldom addresses directly the policy issues from a decision making point of view. It is articulated in a way that is appropriate to that discipline and not one that is relevant to policy formulation and decision making processes or to the recipients of those processes. The practical question arising out of this is how to arrange circumstances so as to obtain "emergent" knowledge, i.e. knowledge over and above that of a number of disciplines. Experience of multi-disciplinary research shows that not only does it often lead to conflict (resulting from attempts to redefine the issue to one which is tractable within one discipline as opposed to

another) but that we are left with a number of qualitatively different reports and insights. While it is apparent that no single one of them is sufficient we must give some consideration to the development of mechanisms that can combine them in such a way that we end up with more than the sum of their particular data sets?

PATHWAYS OF CHANGE

Policy relevant method is therefore grounded in the identification of salient issues at the local level. This does not assume homogeneous responses, indeed it recognises that the complicated picture that may emerge is invariably the subject of political arbitration or prioritisation. Similarly the local need not represent only the smallest unit but the representative voice of stakeholders at their constituent levels i.e. the village council, the farmer, the agricultural co-operative. Representatives of these groups may have very different perspectives and some individuals are likely to operate in multiple capacities which on occasions appear contradictory. By exploring these perspectives an improved, but often less clear, description can be obtained about how issues are defined, the processes that are seen to impact upon them and those that are affected by them. These perceived 'pathways' of change do not necessarily coincide with the political or academic agendas relating to pre-defined issues and as such can provide useful insights into the unanticipated consequences of planned change.

It has been argued that individuals often assimilate process in a more complicated manner than can be understood simply by focusing upon the changes in attributes defined by technical agendas.[2] It is of primary importance to establish whether those attributes, and the issues to which they refer, are of relevance to the stakeholders concerned; indeed as part of this process it may also be necessary to reappraise who those stakeholders are. At the heart of policy relevant method are a set of procedures for establishing how change processes are perceived and how decisions might be influenced by that perception. It is this which provides the basis for local description (Murdoch, 1995) and which identifies attributes and relationships that may be overlooked by more structured 'participation' exercises. By pursuing this description it is apparent that multiple possibilities for intervention develop and that the scope for future uncertainty is accepted rather than obscured by the procedures of technical simplification.

This requirement to 'ground' policy relevant method must reflect and make explicit the complex perceived paths which define environmental issues. These include the spatial (geography and organisation) and temporal (duration and tempo) components of substantive processes and the agencies or stakeholders involved. For example the provisional analysis of the Argolid data has considered a range of change trajectories and the relationship between agencies and the scale and location of that interaction.

While the 'projects' envisaged within 'closed system' approaches (Figure 1–4) vary considerably they can only be usefully evaluated in the context of how they are likely to impact upon the wider system and how those impacts are going to be interpreted by the local population. The engineering approach, which was adopted for the building of the Anavalos canal system for distributing spring water set in motion processes which ran counter to the original intention of the project (Figure 1–5). The building of the canal did provide irrigation water to large parts of the central Argolid Valley which had been particularly vulnerable to salination resulting from sea water intrusion. It followed a course through the central plain which meant that those who farmed the areas on the periphery did not have access to the transported water. They were also subject to less salination but had suffered

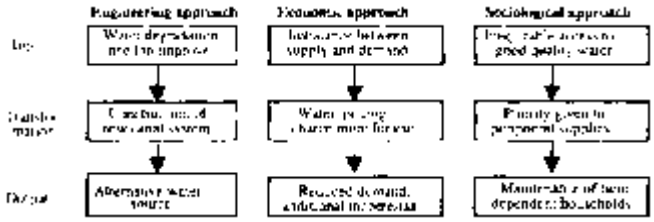

Figure 1–4 Technical (closed system) perspectives on the issue of degraded water.

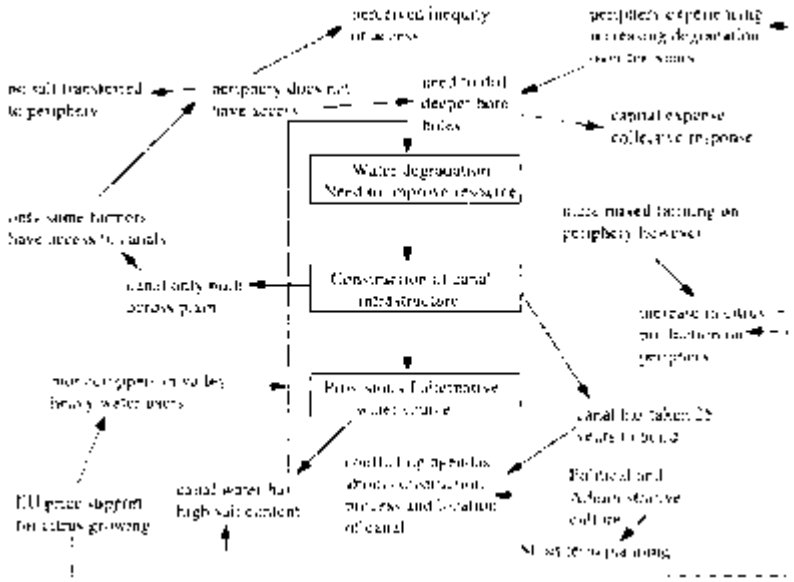

Figure 1–5 Open systems interpretation of new canal infrastructure.

resource depletion, much of which was accredited to the activities of the predominantly monocultural farming activity in the centre. Furthermore, the peripheral farmers felt that they were 'authentic', full time farmers whereas those in the centre were often perceived to be 'inauthentic', farming labour extensive crops because they had primary occupations and used their earnings from farming as a substantial income supplement. This situation was perceived to be caused or certainly compounded by the European Union's price support for citrus crops which are labour extensive and heavy water users.

This brief sketch is introduced to highlight the limitations of adopting restricted 'technical' perspectives. In so doing it makes clear that the objectives of a scheme may well be met i.e. through the transfer of better quality irrigation water and the possibility of improved aquifer stocks in the short term. However, when the quality of those stocks make them accessible again through bore-

[2] This may not always be matched by the ability to articulate process (see Giddens on levels of discursive consciousness, 1990).

holes it is likely that they will become so because little cost is incurred in the central areas where the water is close to the surface and at present the water provided by the infrastructure is charged for. The degradation spiral again becomes a real possibility. Similarly the existence of price support for water heavy crops has reinforced the need for additional technology, however, there is a current move away from price support. Of equal importance has been the perceived inequity articulated by those on the periphery of the valley who felt, during the period of low rainfall prior to 1995, that they are not only seeing their natural resources decline, in large part due to activities beyond their control, but that they are were also losing out on the opportunity of relatively 'easy money'. With the current change in emphasis away from price support these farmers are now more confident of their ability to compete in a free market situation.

By opening up a system of interest it becomes clear that the noise which emerges is not extraneous but is the basis of the uncertainty that has to be managed. This is a fundamental condition of policy relevant research and central to it is the variation with which processes of environmental change are perceived and the spatial-temporal scales over which they occur.

Human systems and their bio-physical environment are, therefore, complex and dynamic; changing and reproducing through time and across space. Each element of a change is the cause and effect of other processes, and as such cannot be measured using a baseline state and a subsequent movement away from that state (as in a closed system). Hence, the process of change can be viewed as a series of concurrent pathways within which interlinking themes or projects can be identified (Figure 1–6). These themes will appear linear in nature and, as has been suggested are often treated as such with the adoption of technical perspectives. However, it can be argued that the interaction of the non-linear elements in the process are often a more influential, although more complex indicator, of the possible outcome of that process.

Central to any process oriented approach which would seek to investigate perceptions of change is the proposition that individuals have a cognisance of process as well as of attributes. Any change in state must be seen in the context of a synthesis of other states and not merely as a trade off between one condition and another. It is suggested that individuals continually undertake this synthesis by updating the information they receive from external stimuli and the response to their own actions.

Figure 1–6 Multiple pathways and issues.

In summary, individuals seek to cognitively map their environment as a series of social interactions that take place within, and interact with, their bio-physical surroundings (Urry, 1987). The interaction of the natural, built and social environments form an idiosyncratic 'sense of place' that is continually evolving alongside, and in response to, local and non-local restructuring and reproduction (Lemon, Green and Filippucci, 1997). The approach to eliciting and mapping personal evaluations of change which is adopted in the case studies is rooted in an evolutionary and multi-dimensional interpretation of these phenomena in which one cited occurrence or process can at any one time be either cause, change or effect depending upon the context in which it is observed (i.e. simultaneously and in different processes, or at different stages in the same process). It is the diversity inherent within these pathways that conveys the variety in an open system, and in turn is responsible for the unanticipated consequences and uncertainty that end state planning has traditionally had problems with.

TIME, SPACE AND AGENCY

If we continue with the Argolid example of the canal (Figure 1–5) it becomes apparent that there are multiple agencies (i.e. farmers, engineers, hydrologists, agronomists, central government and the European Union) and processes (i.e. canal building, irrigation cycles, soil-water-salt cycles, economic cycles) operating at different hierarchical levels and over different time scales. These need not coincide with the anticipated progress and impact of the infrastructure. In abstract terms time can be seen as the duration of a process and the variation in tempo whereas space is interpreted in terms of geography and organisational scale (Figure 1–7). More in depth analysis using this framework will be reported later, however, for the time being it is worth re-iterating that an improved understanding of these pathways of change can inform about the range of options for intervention. Central to this understanding is the need to identify the appropriate level of investigation and perhaps more importantly the linkages between levels (see Hofstede, 1995). The pursuit of a multi-level analysis will inevitably cross disciplinary boundaries (i.e. psychology-sociology-policy and economics) and as such highlights the importance of multi-method approaches.

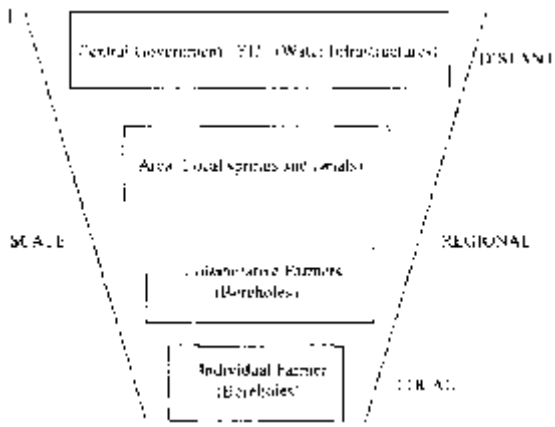

Figure 1–7 Organisational/geographical scale relating to irrigation.

It has been argued that it is only through an improved understanding of the context in which an environmental change is perceived that the issues relating to it, in terms of impact, can be anticipated. The systemic picture which emerges from this (i.e. agencies and interactions) forms the basis for specifying an issue, the information requirements associated with that specification and thereby an improved basis for anticipating possible futures (Figure 1–8).

One final point pertaining to the development of policy relevant method is the need for such a method to be transferable. The framework introduced above is generic however some consideration needs to be given to the transfer of insights from one location to another. If such a comparative framework is not available then the relevance of a piece of work may well be restricted to single locations and time periods. This raises a number of fundamental problems about the selection of case study examples as the basis for examining more far reaching processes such as desertification and has been discussed at length elsewhere (Lemon, Green and Filippucci, 1997).

CONCLUSION: SUPPORTING DIAGNOSIS

Figure 1–8 indicates a number of steps that are not disciplinary based but which are considered central to environmental diagnosis and as such should be incorporated into policy relevant research. This translates into procedures which require an appreciation of systemic thinking, social enquiry and conceptual and computer based knowledge or models. These skills sets will be introduced in chapters four and five, they will also be considered as the basis of the integrative method developed for the Argolid case study in particular but with the intention to provide a framework that is transferable to other locations. Each stage represented in Figure 1–8 is based upon the need for interaction—to a greater or lesser extent—with stakeholders. These can be summarised as follows:

- the 'system of interest' which defines an issue should be articulated by the population(s) concerned (issue specification).
- the mapping of this system should identify the range of information, and techniques required, to move towards problem diagnosis (issue representation and information specification).
- the future options that emerge from that diagnosis need to be generated and explored (scenario generation and issue (re)specification).

In conclusion the approach adopted to policy and decision relevant research draws upon a range of

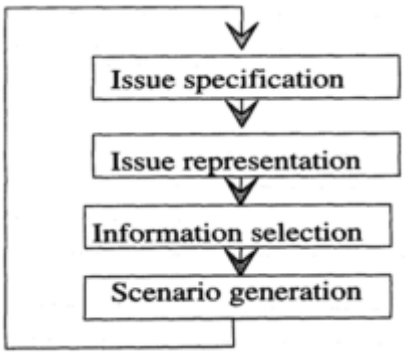

Figure 1–8 Iterative and diagnostic framework.

important ideas, from a number of fields of research. Firstly "pathways" are meant as the vectors of successive desirable change. These vectors can be seen in terms of a number of attributes which are associated with long term survival and evolution. Concepts from various branches of evolutionary theory such as resilience, adaptability and diversity are important and contribute to ideas about sustainability. There is also the difficult question of time scale. Access to future opportunities is an important attribute of survival but sometimes a short term reduction in opportunities may be a condition for an increase in future options. There is, therefore, some sort of balance to be struck between short-termism and long-termism. It is not possible to optimise with respect to the long term since it is certain that any criteria for optimisation depend on a forecastable future. Policy has to proceed towards the future by focusing on the *risk and consequences of being wrong* and the development of *survival* attributes in the face of change. This raises two fundamental questions for research relating to sustainability which will be considered in the context of integrative method in the next chapter:

- How can research be undertaken which aids in the planning of desirable and viable futures?
- How can research be made more relevant and accessible to policy formulation and implementation?