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ENVIRONMENTAL PERCEPTION AND POLICY MAKING: CULTURAL AND NATURAL HERITAGE AND THE PRESERVATION OF DEGRADATION-SENSITIVE ENVIRONMENTS IN SOUTHERN EUROPE.

SUMMARY FINAL REPORT

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I. OBJECTIVES -

The project had three objectives:

1) To document social and political issues in the field of cultural and natural heritage. In particular to consider the ways an actor's perception of his/her environment conditions her/his response to these considerations. We noted that apparently straightforward political decisions often had unforeseen consequences in reality and were interested to investigate the proposition that some of these consequences could be understood in terms of the modes of perception and expedients of individual actors.

2) To develop mathematical models of perception and to use these to characterize general issues of relevance in this field. We were aware that applied mathematical methods were commonly seen as tools for policy-relevant research and that social scientists and mathematicians were not typically proficient in each other's fields of study. Our intention was to mount a 'pincer attack' on the problem, to see whether a set of researchers starting from the abstract, mathematical position could make effective contact with another set who had started with an empirical study.

3) To establish effective inter-disciplinary co-operation between 'hard' and 'soft' sciences and, if possible, to generate new knowledge at the interface of disciplines that could not be obtained within conventional disciplinary boundaries. Once again, we noted that policy-relevant research is commonly inter-disciplinary in nature but that in practice, much of this work is crudely multi-disciplinary. We were interested to know whether truly multi-disciplinary research was possible and, if so, under what circumstances.

4)

II. METHODOLOGY

Extensive anthropological fieldwork was undertaken in the Veneto and Epirus with a smaller sociological field project in the Argolid. A mathematical method was devised for the detailed analysis of questionnaire data using the entropy of the sentence structure to highlight consistent associations of ideas and emphases. Microsimulation and master equation models of the decision/perception problem were built and applied to farmer's crop choice in the Argolid.

III. MAIN RESULTS

The three social-science field projects yielded remarkably resonant results, despite methodological differences among researchers. The first was that an actor's contribution to discussion could be interpreted in the context of who that actor was. Individual actors acknowledged that their views were conditioned by their roles in society (many had several roles) or that the authority of others was determined by who (or what) they were. Even in the field of cultural heritage, the tension between those whose authority was due to external accreditation (administrators, academics and so on) were often in conflict with those whose credentials were established by a long history of being in a place.

It was decided to focus on water resources to establish some degree of comparability among study areas since these were often the focus of conflict. This was the case in the relatively well-watered regions of Epirus and the salinised, irrigated farmland of the Argolid Plain.

In each study area a number of interesting regularities were observed.

1) administrative structures were often organized hierarchically and the way individuals encountered administrative bodies determined their ability or inability to manage resources effectively. This was also true of individuals who, by their association with or access to administrative bodies were able to impact on the system at different levels. Some individuals were able to operate at different levels in the hierarchy and so were able to induce 'leakage' between levels that variously frustrated administrative desiderata or enabled them to 'work round' a seeming impasse.

2) Perceptions of landscape and of space were contextually determined with different actors having consistently different views of place. This was strikingly true in Epirus which contrasts with the other study areas in its perception of land as heritage rather than as commodity.

3) Perceptions of time and patterns of information flow were different among different actors.

4) Differential access to information, particularly through education, can introduce inter-generational and other conflicts. Since access is often determined in part by prosperity, the effect of this can be to exaggerate pre-existing social differences between young and old, rich and poor, local and immigrant etc.

Two mathematical studies were undertaken. The first undertaken under the supervision of Bourgogne developed ways of measuring the entropy of a stream of words and was applied to the study of formal interviews to show consistent associations of ideas and emphasis. The second study was a microsimulation model intended as a basis for inter-disciplinary discussion that established by simulating an imaginary world of malevolent goblins that actors which try to use past experience to predict the future can actually change the dynamic behaviour of the world in which they function. This exercise highlighted the principal source of misunderstanding between the hard and soft sciences, a tendency on the part of the former to abstraction that seemed to the latter to trivialize what was essentially a purely empirical study.

After considerable discussion it was decided to apply these modelling methods to crop choice in the Argolid and a model was negotiated that treated each farmer as a set of actors, each representing a plot of land which 'decided' on crop decisions in accordance with cost-benefit rules. Each farm was assigned two attributes, jumpiness, a tendency to change crops and timeframe, the temporal horizon over which cost-benefit decisions were made. It was found that different types of actor had different optimal timeframe and jumpiness values and that apricot was probably the most favoured crop. In particular, it was found that the timeframe most favoured by tree fruit growers was in excess of 20 years, an observation that resonated well with the common complaint from real farmers that the greatest threat to their livelihood was posed by political changes made by the EU.

Considerable progress was also made in the field of interdisciplinarity and papers were prepared on the problems of achieving effective communication across disciplinary boundaries. Two problems were characterised. Firstly, disciplines had a natural tendency to 'englobe' each other. For example, mathematical modellers tended to see social behaviour as a modellable system while social scientists saw modelling as a social process. It was necessary to devote considerable care to negotiating conditions under which neither tended to exploit the other. Secondly, specialists in different disciplines had strikingly different perceptions of the 'problem' being addressed and the best way of approaching it. Although many policy-relevant programmes claim to be interdisciplinary in nature, we suspect that very few are more than crude, multi-disciplinary patchworks. Multi-disciplinary research is certainly possible and was achieved but it often requires a willingness to dismantle the axiomatic basis of individual disciplines that individual scientists find frustrating and even distressing.

IV.SCIENTIFIC INTEREST AND POLICY RELEVANCE -

The detailed description of hierarchy and of the role of temporal and spatial perception in determining an individual's response to change is novel and has profound policy relevance. It implies a model of social and natural change in which each actor must be considered as an integral part of the system it occupies. This is true of individuals and of institutions, including administrative and governmental institutions. Socio-natural dynamics cannot be controlled or driven like a car because each actor can have an impact on the aggregate behaviour of the whole. In such a world, unforeseen consequences and policy failures are *to be expected* and it is the responsibility of those engaged in policy relevant research to undertake risk assessments and make contingency plans.

It is well known that social scientists are always willing to present a policy-relevant problem in its most intricate and realistic form, resisting reductionist science and excessive simplification. Our research is not exceptional in this. We note that socio-natural dynamics are complex and assert that unless we take account of this complexity, further unforeseen and undesirable consequences are to be expected. However, by marrying mathematical and social studies, we have been able to go one step further. To show that abstract mathematical models can predict the aggregate behaviour of complex dynamic systems in which the behaviour of constituent actors is inherently stochastic and unpredictable. The nested master equation model of the Argolid predicts that apricots will be the favoured crop among farmers when modern farmers tend to grow citrus. However, in the '60s apricot was the favoured crop. It was destroyed by virus and conscious decisions were made to replace it with other crops that increased the risk of further disease problems and salinised the aquifers. The model also correctly predicts the modes of perception likely to be favoured among such farmers and highlights the principal difficulty they face. (Short-term policy shifts at EU level).

The method used (the nested master equation approach) is novel and requires us to generate an eleven-dimensional probability density surface that represents a solution of an eigen-equation of infinite order. The

results it generates are immediately interpretable, even by a non-scientist. They show that the salinisation of the aquifer was an unforeseen consequence of decisions to support intensive top-fruit cultivation despite its susceptibility to disease.

Finally, we note that current trends in EU policy are towards an increasing dependence on tightly focused, issue-driven inter-disciplinary research. Our study of interdisciplinary research suggests that an *integrative* approach is often desirable in which the substantive insights from two or more disciplines must actually pass across disciplinary boundaries. This makes it necessary to characterise the subsets of knowledge that are not paradigmatically dependent and to characterise circumstances under which information flow is likely. The research suggests that current trends to force agendas in policy-relevant research imposes a paradigmatic selection pressure that reduces intellectual and paradigmatic diversity among scientists. It is important to realise that intellectual diversity fulfills a role in socio-natural dynamics analagous to that of genetic diversity in ecology. We need to maintain a diverse and divergent knowledge base to respond to emergent issues and unforeseen consequences.