Cutting Through *Confusion*

JAMES REYNOLDS outlines a new paradigm for understanding the interrelated factors that make up desertification, so as better to combat it

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Desertification is a very contentious topic, as well as a very important one. It evokes much disagreement and controversy. Issues surrounding the causes of land degradation and its consequences – and political responses to it – remain largely unresolved. They include, for example, the extent to which land changes are 'natural' (such as those driven by the climate) or anthropogenic (as through overgrazing); whether or not desertification is reversible; how to determine the amount of land affected, or at risk; and the role of abatement efforts aimed at social and institutional issues as opposed to scientific and technological ones.

There are at least four reasons for this confusion. First, there is no standardized meaning for land 'degradation' that fits all situations. Yet, nevertheless, up to 70 per cent of all drylands are routinely reported as 'desertified'. Second, land degradation is often triggered or exacerbated by climate variability, mainly drought, so that its causes are not necessarily anthropogenic. Third, not all changes have a direct, immediate effect on human welfare – and farmers are generally only prepared to accept that they may need to change their practices if land degradation is a direct consequence of their activities and/or it directly affects them or other members of society. And fourth, any elaboration of what constitutes land degradation must make it clear that while biophysical components of ecosystems – such as soil erosion, and the loss of grass cover – are involved, interpreting such changes as 'losses' depends on integrating these components in the context of people's socio-economic activities, often through using the term 'productivity'. Failure to recognize and include these interdependencies in decision-making has slowed progress in desertification research. Desertification is a complex topic, not amenable to simple solutions or answers.

Global change

Simultaneously assessing biophysical components (such as soil nutrients and erosion, and grass versus shrub cover) and socio-economic ones (such as household income, family size, and debt) is one of the most challenging, but potentially rewarding, topics in desertification research. A international effort, recently initiated as part of the Global Land Project of the International Geosphere-Biosphere Programme, has brought together researchers from global change programmes, representing both natural and human-influenced systems. The product of these new ideas is the Dahlem Desertification Paradigm (DDP), a series of assertions that emphasize key linkages between socio-economic and biophysical systems at different scales of time and space. Its constituent ideas contained within the DDP themselves are generally not new, but – as is the way with paradigms – bring together much of the previous work on the topic in a way that reveals new insights. Its main points are:

- An integrated approach that simultaneously considers biophysical and socio-economic attributes is absolutely essential. It is not possible, for example, to quantify the extent of desertification based solely on satellite images (recording such biophysical properties as changes in land cover) – or based solely on poverty (monitoring such socio-economic properties as changes in the local wealth of families). Elements of both are necessary.
- Selecting biophysical and socio-economic attributes must focus on 'slow' variables – such as the genetic ▶

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makeup of cattle herds, soil fertility and capital wealth. They evolve and change slowly, but are the crucial determinants of sustainable livelihoods. 'Fast' variables on which people depend in their day-to-day lives – such as grain yield, food reserves and interest rates – are very real issues for short-term humanitarian aid, but tend to confuse the strategic debate about desertification. Efforts to map and respond to land degradation affecting ecosystems goods and services are perpetually distracted by the immediate effects of short-term phenomena – like drought, shortages in household income and deaths of livestock – on these fast variables; but these simply reflect weather-driven noise. In reality, drought kills families who live on degraded landscapes with no social or economic stored capital: it may hardly be noticed by rich farming families who possess healthy pastures.

- The coupled biophysical and socio-economic systems of the world's drylands are not static: they are produced by a set of complex interactions between biophysical, social and economic factors. So their behaviour is emergent rather than predetermined, can rarely if ever be reversed to some exact prior state, and has a changing – and often unpredictable – path.
- The cost of restoring degraded socio-ecological drylands systems to make them productive and sustainable grows with increasing degradation. This growth may be steady or sudden, but once a threshold of degradation is crossed, the costs of recovery increase in a non-linear way. Case studies show that, once this happens, it is necessary to call on resources from a higher (e.g. provincial, state or international) or broader (e.g. other households or communities) scale in order to reverse the change.
- Both the social and ecological systems of the world's drylands are hierarchical. Hence there are always concens about scale. Desertification, as it affects both the land and people, is the regional expression of much local degradation. The word 'desertification', when used in the halls of the United Nations, usually has a different meaning than when it is used in at national, provincial and local levels.
- While change is inevitable, there does exist a constrained set of ways in which coupled socio-ecological dryland systems function, and this can allow us to understand and manage them. We do not need to understand everything but we must be able to distinguish what is understandable or predictable (even if uncertain) from that which is inherently unpredictable.

Conceptual holisim

The strength of the Dahlem Desertification Paradigm is in its cross-scale conceptual holism. While using the term 'desertification' is only really useful where large areas are seriously affected – with 'degradation' more appropriate for more local, and less severe, instances – the DDP framework embraces all levels of concern. At the international level, for example, implementing the Convention to Combat Desertification (UNCCD) must be framed in terms of changes in human-environment systems that matter to people. This dramatically changes the meaning of the 'extent of desertification', and both the timing and distribution of funding for intervention. Similarly, at the household or community level – where the concern is the specific type of land degradation taking place, and its local socio-economic consequences – the DDP channels resources towards identifying the essential biophysical and socio-economic slow variables that really matter in quantifying current and future risk.

The DDP framework is unique in two ways. It attempts to capture the multitude of interrelationships within human-environment systems that cause desertification, within a single, synthetic framework. And it can be tested, ensuring that it can be revised and improved upon.

The Assessment, Research, and Integration of Desertification research network (ARIDnet) has been formed to test the DDP, and has been operating in Latin America for the past two years. Details of two case studies, in Mexico and Honduras, can be seen at http://www.biology.duke.edu/aridnet . There are plans to expand the network to other regions.

We hope that, as case studies are conducted around the globe, the Dahlem Desertification Paradigm framework will help focus the attention of those concerned with implementing the UNCCD: to recognize, for example, that desertification cannot be framed in terms of biophysical nor socio-economic measures alone, let alone in terms of any single measure; that the task of quantifying 'desertification' is not hopeless; that at a high hierarchical scale there are a restricted number of syndromes of desertification, which define a limited number of critical slow variables, differing among systems in non-trivial but manageable ways; and, importantly, that elucidating the crucial socio-economic and biophysical slow variables will require the cooperation of multidisciplinary research teams ■

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