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Responding to Desertification at the National Scale

Detection, Explanation, and Responses

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ABSTRACT

Although land-use practices that lead to desertification are usually the proximate result of decisions by individual households and their communities, many important economic, legal, and technical frameworks that promote or combat desertification are elaborated at the national scale. A general appreciation of where the different forms of degradation that create desertification occur, and why, is important for directing policy intervention appropriately; however, it is difficult and probably unnecessary to define "desertification" too precisely at this scale.

Agreement on policy is paralyzed where contention persists, and a number of such scientific disagreements are discussed. Yet there are some desertification debates where more consensus has now been reached, and implementation is less fraught with uncertainty. A crucial role for national policymakers is the creation of an appropriate and secure context for local activities, for local participation in decision making, and for the creation of tightened information loops between local knowledge and Western science. National officials charged with mitigating desertification generally need "approximately correct" precautionary signals and cannot afford (or need) to wait for great precision of measurement. Although accurate scientific monitoring of the biophysical processes that create conditions of desertification and dryland degradation is desirable, it cannot "solve" the problem alone, unless there is responsive and effective capacity — and political will — to deliver new measures to assist the rural poor of the world's drylands.

INTRODUCTION

Land-use practices that lead to desertification are usually the proximate result of decisions by individual households and the community institutions in which they are embedded. In spite of

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this, most of the important economic, legal, and technical frameworks that may promote or combat desertification are elaborated at the national scale. States — defined here as a country or nation with its own independent, sovereign government — may enable or constrain appropriate and sustainable dryland management via key decisions about resource allocation and land uses. In this chapter, the "national scale" is used to refer to the nation-states of the world's drylands. Other administrative units that operate above the community level (e.g., districts and provinces) are also important units for decision making and policy implementation, and much of the discussion is relevant to them.

Numerous institutions operate at the national scale, including governments and their various components, large nongovernmental organizations (NGOs), farmers' associations, and even private sector enterprises. Clearly, governments have a particularly important role (along with some NGOs) in lobbying for greater recognition of desertification-related issues on the international stage, including their support for the drafting and ratification of conventions such as the United Nations Convention to Combat Desertification (UNCCD 1994). However, nation-states are also charged, for example, with implementing the National Action Plans set up under the UNCCD within their own countries.

Desertification — or degradation in drylands — is a term that has not only generated long-lasting debate in the scientific community charged with its accurate definition, measurement, and monitoring, but has also exercised the minds and actions of policymakers in dryland nations (Reynolds and Stafford Smith 2002a). The physical processes it subsumes include soil erosion, soil fertility decline, crust formation, soil gullying, salinization, reduction of pasture and ground cover, loss of biodiversity, and reduction in vegetation cover. These have strong, but often indirect effects on dryland peoples and their societies. These impacts are most severe in their effects when:

- ecosystems have low resilience to stressors like fire, grazing, drought, and inappropriate intensive land use;
- human capacities to respond to such stresses are insufficient, for example, due to a lack of appropriate technology, skills, or political will;
- dryland communities have a narrow range of productive activities and depend on resources affected by desertification processes (e.g., by crop failure, inadequate forage for livestock);
- the rate of change is such that the time available to rural people to adapt to environmental changes associated with desertification is short, thus not allowing new institutional responses to develop rapidly enough;
- local populations are severely affected by environmental or sociopolitical changes (e.g., warfare or famine) beyond the point where local coping strategies operate; and
- national institutions or development organizations are ineffective in providing relief or hardship alleviation to the people who really require it. This may be due to sheer inefficiency and lack of resources, or more sadly to ethnic intolerance and state-sponsored violence.

The interactions between these factors and household or community responses is universally modulated by policy settings at the national level, but when, why, and how much? In this chapter, we draw out some key definitional issues related to the impacts of, and responses to, desertification processes at the national scale. Recognizing the continuing debate that surrounds desertification, partly based on widely differing skills and experiences, we then explore some of the more or less controversial issues of relevance to policymakers, to identify areas where there is no excuse not to take action, and others where patience remains desirable. This leads to a discussion of indicators that might provide signals to national-level planners about the extent of desertification and the justifiable limits to these indicators. Finally, we outline some of the ways in which policymakers may respond to the elements of "desertification," and how science might engage in this process in ways that may allow future responses to desertification to be developed in a more open and participatory way. We see the linkages between detection, explanation and attribution, and response to be key in the desertification discourse (Figure 19.1).

DEFINING DESERTIFICATION

Before focusing on the science and policy of desertification, it is necessary to revisit the on-going debate about how precisely *desertification* can and should be defined, at least from the national-scale perspective. The apparent effectiveness of policy and management responses is constrained by this debate. Since the term was first coined by the French forester Aubréville (1949), there has been a lack of consensus over its scientific basis. While it might seem essential to settle these debates among scientists and assign clear parameters to match the Agenda 21 and UNCCD (1994) definitions (as many natural scientists would wish to see), our focus on the nation-state leads us to question whether the quest for a precise definition of desertification is achievable. As noted by Reynolds and Stafford Smith (2002a) and Prince (2002), if there were a single unifying framework for desertification science, could it ever encompass the social and ecological complexity that exists in drylands? "Reduction and loss" of productivity and biocomplexity are identified as negative phenomena in the current definition, yet such losses can be a normal feature of variability in all dryland ecosystems. Even if a single definition were agreed upon, how would the differing perceptions of dryland peoples be incorporated and properly understood by the scientific community? Instead, we agree with

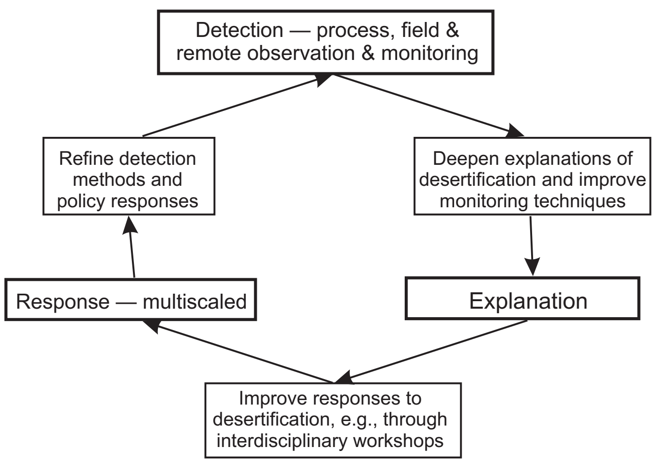

Figure 19.1 Linkages in national-level desertification issues.

Mortimore (1998) and Jiang (2002) in arguing that some of the most important questions are about the "... cultural implications of ecological transformation, rather than cultural–ecological reversibility " Jiang (2002, p. 195) — in other words, desertification exists in the eye of the beholder and particularly the land manager.

Countering this argument, a more precise definition, for example, restricting the term to nonreversible state changes in biophysical systems brought about by human impacts (see Prince 2002), might allow better comparative work on dryland processes. It may also permit the residents of environments branded as "desertified" to become more visible to international agencies. However, desertification science, as practiced by such agencies as the United Nations Environment Programme (UNEP) and the Food and Agriculture Organization of the United Nations (FAO), depends in the main upon global data sets that are easy to criticize and are inaccurate (Thomas and Middleton 1994; Mortimore 1998). The European Community's (EC) latest assessment of desertification reports a wide divergence in global assessments of the percentage of land affected by dryland degradation, which would merely serve to confuse any observer seeking "hard facts."

> "… the GLASOD (global assessment of soil degradation) commissioned by the FAO ... showed that 19.5% of drylands worldwide were suffering from desertification. A second survey carried out by the ICASALS[1] group in Texas came up with a much higher figure of 69.5% of drylands worldwide suffering from desertification, due to their inclusion not only of areas affected by soil erosion, but also where a change in vegetation had occurred." (European Commission 2000, p. 4)

The EC report goes on to note that even regional assessments have to overcome a paucity of data, and it is difficult to "scale up" or "scale down" existing data collected from diverse monitoring exercises and surveys. Indeed, local assessments of dryland livelihood systems are often much more positive in their findings than regional or national surveys, showing unexpected vegetation recovery or pinpointing areas undergoing sustained agricultural intensification (Tiffen et. al. 1994; Mazzucato and Niemeijer 2000). *Thus, there is a real question as to what level of precision is useful in deconstructing the term "desertification," at least in terms of its value to national-scale policy.* We shall return to this issue later.

Another issue in the debate is that the record of top-down schemes to mitigate even the most obvious symptoms of desertification in drylands, like gullying or the widespread denudation of ground cover, is poor. There have been abject and sometimes spectacular failures in terms of both biophysical and social sustainability of these interventions — especially when they have resulted from a routine misuse of externally sourced funding or they have become mired in internal political battles (Mortimore 1998; Batterbury and Warren 2001; Watts 1983). Learning from these errors, scientists and policymakers should refocus future policy more appropriately and think hard about how better public policy may be designed in drylands. *Better scientific definitions of desertification will not solve the problem, unless the capacity and political will to deliver effective responses is also present at the national level*. In this regard, the failures of past schemes, combined with the enthusiasms of present policymakers, are fortunately changing the ways in which national policy is delivered in

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1 The International Center for Arid and Semiarid Land Studies at Texas Tech University (http://www.iaff.ttu.edu/Home/ICASALS/).

dryland nations. For instance, in most dryland African countries, decentralization is the order of the day. Governance is therefore being delivered at multiple levels, from local committees set up under decentralization programs to the more established national "line" ministries, and by some regional bodies as well. In the three most affluent dryland areas (the southwestern United States, Australia, and southern Europe), there is state money available for sometimes costly environmental management, and powers to control land uses are already in place via city and regional councils and federal agencies. In contrast, in dryland China, most policy is still delivered through the state apparatus, but often without substantial funding (Jiang 2002). *The spatial reach of political power, therefore, varies greatly across dryland states, as does the capacity of the institutions charged with implementing policy to do their job effectively.* The question that then arises is, what type of policy intervention is most appropriate under different social and biophysical circumstances?

Finally, as in all discussions of biophysical processes, scale matters. The nation-state is a political entity. As a "container" of institutional and personal power, it rarely accords with biogeophysical units in any meaningful way, and governments have to grapple with the governance and management of national territories that may encompass combinations of anything from cold and hot deserts (as in Central Asia), to deserts and tropical rainforests (as in Brazil and Australia). Political boundaries often divide ethnic groups or have disrupted traditional dryland grazing patterns or farming systems relying on spatial flexibility. Some of the issues affecting nation-states have their origins in, or are best dealt with by, organizations and policymakers at other scales. Figure 19.2 illustrates a scaled approach to desertification drivers, clearly specifying the place of the nation-state within a hierarchy of scales. Aside from local committees and organizations, a multi-state "regional" scale falling between the nation-state and the global scale (see Lambin et al. 2002) is important because regional policymaking by bodies like CILSS (the Permanent Interstate Committee for the Fight against Drought in Sahelian Countries) in West Africa can monitor processes that occur at larger scales than the nation. It should also be noted that significant insights into national-level susceptibility to drought — a "driver" of desertification — might be gained from better-developed *regional* analysis of climate. We discuss this point in greater detail later.

Regional-level data generate different findings than aggregate data based on local-level studies, as has been shown with soil fertility (Gray 1999; Krogh 1997; Turner 1999). Exciting and useful work about the spatial dynamics of degradation has involved the creation of inventories of the status of much smaller management units (whether private or common property), based around existing subnational units or perhaps territories defined culturally or along ethnic lines. Such units offer a more practical basis for administering targeted interventions, given the tendency toward decentralized governance and an increasing reliance on local politicians and bureaucrats. However, this can result in a "tyranny of small decisions" (cf. Odum 1982, p. 728) that is not adequately understood when one focuses on higher-order processes occurring at the national scale. *Thus, indicators need to be appropriate for the scale at which they were generated, and national policy responses need to be driven from and tuned to the appropriate scales*.

In short, the *audience* (or, more broadly, *relevance*) of desertification assessment is a critical issue — not only for the sciences involved in investigating and monitoring the process, but more broadly in the desertification debate that occurs everywhere, from herders' encampments in Africa to the halls of the United Nations.

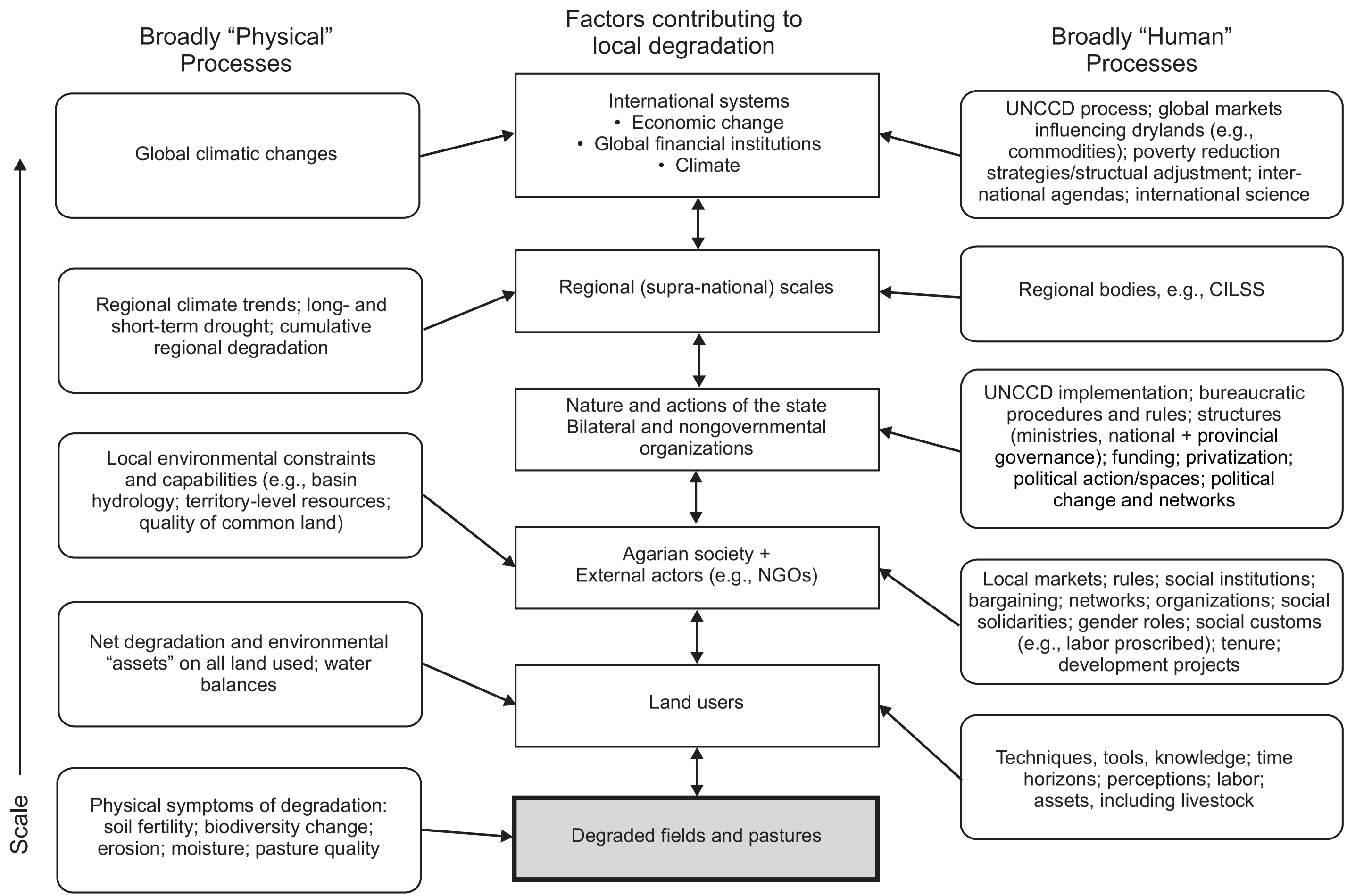

Figure 19.2 A scaled, political ecology approach to desertification. The existence of degraded fields and pastures is explained by physical and human processes occurring at interlocking scales.

DEBATING DESERTIFICATION

Explanations for, and consequent potential responses to, desertification abound, as is evident throughout this volume (Reynolds and Stafford Smith 2002b). Indeed, this volume is predicated on developing a new approach to clarifying these debates. The nature of policy is that it is hard to obtain action where there remains public contention; any action then tends to be based on ideology rather than reasoned argument. Scientific clarity, especially with the consensus of local communities, can contribute to reducing contention although, by itself, it certainly does not guarantee the best national policy outcomes. Therefore, it is important to be aware of areas in which there is still uncertainty and to recognize that these will impede, even paralyze, policy development at the national level. We will not review all the possible "factors" involved in this summary chapter. Rather, we discuss a number of areas where science has yet to develop a level of consensus to the point where the extensive application of research is feasible and productive, and other areas where broad scientific agreement has now been reached and policies can be widely implemented.

Continuing Uncertainty Constraining Policy Development

In the following five areas of contention among scientists — or between scientists and nonscientists — it would be premature to suggest that science can "talk to policy" in a straightforward way (Reynolds and Stafford Smith 2002a; Batterbury and Warren 2001). This may be because of scientific disagreement, or a lack of data, or of the tools to uncover them (Thomas and Middleton 1994).

Role of Grazing by Livestock

The significance of "overgrazing" by livestock remains a source of debate among scientists and other actors (Warren 1995). The UN *World Atlas of Desertification* (UNEP 1992) asserts that 58% of soil erosion in dryland Africa is the result of overgrazing by livestock. Many national governments have prosecuted long-running campaigns against "overgrazing" by pastoralists on common lands (Breman et al. 2001), particularly in East Africa, the West African Sahel, and in the American South West. In the Sahel, successive national governments have attempted to "stabilize" livestock herds by reducing their numbers or restricting their mobility (Warren 1995). Turner (1999) shows, at least in Niger, there is still a considerable hostility toward livestock herders and accusations are frequently made by conservationists about their role as agents of landscape change in savanna environments.

In the past decade, scientists have recognized the nonequilibrium nature of many semi-arid ecosystems, where limited coupling between animal and plant populations minimizes causal feedbacks in systems that exist in a range of semipermanent states dictated by disturbance, drought, fire, or insect attacks (Ellis et al. 2002; Illius and O'Connor 1999). Ecologists and range managers now recognize that "less" vegetation is not automatically "worse" vegetation and more sober estimates of the effects of grazing on soils and biomass appear in the latest version of the *World Atlas of Desertification* (UNEP 1997). However, the debate is not fully resolved since factors such as recent evolutionary history (Milchunas and Lauenroth 1993), level of climatic variability (Ellis et al. 2002), and the land-use goals all affect the outcome (Ash et al. 2002; Walker et al. 2002). Furthermore, even though scientists now understand the value of the heterogeneity and patchiness of pastoralist grazing strategies in drylands and, therefore, no longer automatically argue for restricting herd mobility, this mobility, at least in its traditional forms, may still conflict with other goals. These include the privatization of rangelands and herds that may increase net regional benefits and be taken up as populations diversify their income sources away from agriculture. In the absence of a clear scientific statement about where grazing is therefore important to desertification and where it is not, the implications have yet to be taken up transparently in policy.

Role of Fire

Fire, a natural phenomenon in dryland regions, has been exploited by dryland peoples for millennia to clear areas for cultivation, to rid rangelands of unpalatable species, and to hasten the release of key nutrients into topsoil. In West Africa, most burning occurs not at the dry Saharan edge, but in the more humid savanna zones. Yet in Africa, fire is still often seen as an agent of land degradation. Despite the paucity of scientific evidence, in the past many governments prohibited even controlled burns on agricultural land, branding it a "degrading practice"; similarly, in the U.S. and Australia, the use of fire was viewed with great suspicion by government agencies and most pastoralists for a long time. Wildfire suppression, however, has resulted in many unexpected outcomes, including the invasion of woody species on to rangelands (and arguably resulting in poorer rangeland quality) and more severe fires. While scientific evidence now tends toward the view that burning is vital for managing vegetation composition, and actually enhances soil fertility if carefully managed, the views of the public in Western countries are driven by media images of huge fires destroying land and property, so there is no clear consensus on the use of fire. Given the considerable research information and useful tools in existence (e.g., FARSITE, Finney 1996), this debate should be ripe for resolution.

Role of Population Growth

The effects of demography in rainfed dryland agricultural systems continue to be a source of contention. Despite decades of work showing that there is no *predetermined* Malthusian link between elevated population levels and more resource degradation in drylands (Gray 1999; Marchal 1983; Mortimore 1998; Raynaut 1997; Tiffen et al. 1994; Mazzucato and Niemeijer 2000), government resettlement programs continue to be driven by the assumption that increasing population necessarily causes resource degradation. In fact, most societies respond to rising population numbers through livelihood diversification (Batterbury 2001; Mortimore 1998; Vogel and Smith 2002), agricultural intensification ("working the land harder"; see Mortimore and Adams 1999) or increased mobility, rather than on-site resource depletion (see Box 19.1). Only when technological enhancements fail to keep pace with rising demands for food and other goods and services, or particular resources (e.g., certain tree species) are lost from the landscape or privatized, are high populations linked with increased rates of environmental degradation. A key need for policy is therefore to create greater clarity about when population increase per se matters, and when the focus should be on other institutional issues.

Box 19.1 Population and Resource Use.

As population densities rise, there is a strong incentive for rural people to intensify their labor — for example to invest in anti-degradation measures, and to initiate compensatory risk management strategies. This has been demonstrated most clearly for the Kano close-settled zone in northern Nigeria (Mortimore and Adams 1999, 2001), and in the well-known Machakos district study in Kenya (Tiffen et al. 1994). Despite this, national policy in Burkina Faso, for example, is to encourage farmers from the Sudano–Sahelian belt (the Central Plateau) to migrate to new lands in the wetter, southern portions of the country. These lands were opened up to settlement and irrigation in the 1960s by clearance of oncho vectors (black fly); resettlement was impelled in part by concern over exponentially rising population densities in the north and central parts of the country (McMillan 1995). However, where population density has continued to rise on the Central Plateau, unchecked by officialdom, widespread agricultural intensification and soil conservation has occurred (Reij 1994). Most areas of Africa with high population density also have intensive and closely managed land-use systems in which there is a constant cycling of nutrients through animal and plant populations (Turner et al. 1993). When population densities in rural areas are at low or median density (ca. 50 persons km^{-2} in African drylands), farmers often respond to localized degradation by the pursuit of nonfarm options, rather than by concerted investment in conservation (Bryceson 1999; Warren et al. 2001). Diversification away from land-based resource uses is often a good outcome, but it can lead to land abandonment (particularly in the Mediterranean) and temporary degradation as gully erosion or weed invasions go unchecked. Critical to most dryland peoples is not so much population density, but the maintenance of access to key assets — land, food, water, fuel — under any population–resource scenario. If entitlement to key assets can be maintained as pressure on resources rises (as has occurred around Kano) then policymakers should divert their efforts away from population controls and resettlement.

Role of Economics

Can economic incentives promote sustainable land uses? For example, if prices are adjusted upward for potable water or irrigation and the money collected is used to repair pumping equipment, will water be used more conservatively because of its higher price? Should prices for dryland commodities and livestock be allowed to “float” free of government regulation or be regulated, and will either solution harm the poor, who are generally those without access to capital, credit, and transport? On the one hand, freeing up trade regimes and markets to permit the free exchange of goods and services provides dryland peoples with outlets for their products and the ability to shop around for the best price for buying and selling. This replaces the monopolistic and exploitative structures common during the colonial period and in command economies that had state-owned marketing boards (Cour 2001). On the other hand, it is precisely the opening up of free markets and the reduction of subsidies for essential items like fertilizers, tools, medicines, and basic education (as has occurred in sub-Saharan Africa since the 1980s under structural adjustment programs) that has hurt many rural producers’ ability to meet their own food needs and to produce for the market in "dual demand" agrarian systems, particularly when the price of agricultural inputs shoots up after deregulation, and developed nations continue to subsidize their products. The susceptibility of dryland countries to the vagaries of world markets, in which they are often disadvantaged by virtue of productive potential or location, is acknowledged (Cour 2001). There are huge debates between free-market, Keynesian, and socialist economists and political scientists over these matters. The gradual drift toward free-market solutions and less government regulation in dryland countries since the 1980s has assisted some economic growth, but it has been accompanied by a continuation of hardship for the rural poor.

Role of Politics

Finally, there is a polarized debate about the role of politics in the "creation" of desertification. A standard argument heard in the halls of agricultural and environmental ministries in the postcolonial period was that rural producers were, in large measure, responsible for deforestation, land degradation, and poor rangeland management (Aubréville 1949; see discussions in Fairhead and Leach 1996; Leach and Mearns 1996; Mortimore 1998; Watts 1983). Where blame was placed firmly on land users for "unsustainable 'mining' of bioproductivity under human management" (Mortimore 1998, p. 127) strong top-down regulation was used, such as "codes" that prohibited biomass burning, and heavy-handed conservation projects (Reij 1994; Johnson 1986; Vedeld 1997). History relates that, in large measure, "top-down" has been replaced with "bottom-up" planning methods and a greater degree of participation by civil society in environmental governance (Vedeld 1997). However, opinions are still divided over the effectiveness of localized, decentralized, and hands-off management solutions. The efficacy of indigenous agricultural or pastoral knowledge to create sustainable land use (Richards 1985) has been challenged by commercial interests and by planners interested in agricultural modernization, as in contemporary South Africa. Whether developing country states really have the capacity and the efficiency to regulate behavior in far-flung dryland regions anyway, without more personnel or financial resources, has been seriously questioned in many countries (Mortimore 1998; Toulmin 2001). There are also cases of ethnically or religiously partisan behavior by politicians and administrators, for example, in southern Mauritania, Kurdistan, and in Zimbabwe, that have hardly assisted sound environmental governance. In short, dryland areas in most nations are distant from commercial and political centers that determine their futures, and their poor and marginalized groups have limited political capacity to understand their problems, identify appropriate solutions and, especially, to exert effective pressure on those who occupy positions of power within the state when the latter fail to deliver. Hence, the most appropriate pathways for political reform are still not unequivocal.

While we have raised these issues as unresolved debates, they are also the focus of intensive research, as the papers in this volume (Reynolds and Stafford Smith 2002b) reveal. In other words, these are actually questions that attract the attention of government policymakers — particularly international financial organizations and several of the main international donors and development agencies — and are therefore important points of engagement between research and policy.

Healing Wounds

A second suite of desertification issues are less controversial, less open to persistent challenge and scrutiny, and have successfully informed government and regional policy. Thus, in some areas of the debate it has been possible to cut through disagreements to reach a measure of consensus. Four examples (of the many possible) are discussed here.

Role of Common Property Resources

Neoclassical economic logic suggests that "getting the institutions right" is important for facilitating a land user's efforts to achieve sustainable land management, although policy prescriptions do differ (Ostrom 1990; Ostrom et al. 2002). A significant question has been over the sustainable use of common property resources like open rangelands and forests, where ownership is held in common, not by private individuals or by certain communities. Hardin's (1968) famous "Tragedy of the Commons" paper argued that privatization of grazing resources was not only economically efficient, but also delayed or mitigated the potential to overgraze the common range. We need not rehash the debate Hardin initiated here, since the weight of scientific evidence is now strongly in favor of the view that a range of tenure types, including true common property systems, derived rights including loan and share arrangements, and so forth, can sustain productivity and meet cultural expectations in societies where the privatization of land or water is only partial (Ostrom et al. 2002; Toulmin and Quan 2000).

The impact of scientists "banging on the door" of policymakers to support this wide range of tenure arrangements has almost achieved fruition. World Bank policy to support privatization unconditionally in the past has been almost reversed in the last few years. Uganda, South Africa, and Niger (Lund 1998) have designed especially progressive land tenure laws that recognize communal rights to land (although in all three countries, unfortunately, progressive legislation is presently stalled). The necessity of pastoralists to retain freedom of movement in a nonprivatized landscape has been widely recognized (IIED 1999; Lane 1998; Thébaud and Batterbury 2001). Comparative research by the French and British governments on African land tenure systems is leading to further institutional reforms and government-level drafting of new land laws, and several international conferences on legal reform have now been held (Toulmin and Quan 2000).

Role of Climate

Precipitation and drought episodes are recognized as prime drivers of land-use change and degradation. However the notion that loss of vegetation cover might actually induce regional drought episodes via feedback loops (see Nicholson 2002) appears to be relevant only at broad scales and coarse spatial resolutions (Phillips 1993; Nicholson 2002; see, however, Ellis et al. [2002] on greening). If such "feedback loops" are less important than once believed, then no matter how important the maintenance of ground cover is in dryland areas for erosion control, bare surfaces might not contribute significantly to regional climatic change via albedo effects. In Africa, another related issue involves the common view that the Sahara "expands and contracts" periodically with changes in rainfall, engulfing surrounding semi-arid regions. Evidence does not support this view. Reduction in the productivity of the land bordering deserts (as in the severe drought of 1984) and therefore localized degradation during droughts, is usually short-term (Hulme 2001; Nicholson et al. 1998). Of course, carbon dioxide-induced global warming and the ENSO (El Niño Southern Oscillation) have (or may have) differential and as yet uncertain effects on drylands, with the majority of current models suggesting increased rainfall and temperature variability in future decades.

Role of Soil Erosion by Water

Soil erosion is an important biophysical element of land degradation. Understanding soil erosion presents many difficulties, and some of the long-applied techniques have proven unreliable and labor intensive (Box 19.2). Soil erosion *rates* (soil loss/year) are a useful measure at the national scale, since they provide data to guide decisions about the targeting of state funds for mitigation and other projects. The principal difficulty has been over the provision of reliable absolute values, because of space-time sampling problems. However, there are now models that provide reliable estimations and satisfy the needs of most planners. If rainfall is low, models predict insufficient runoff to create widespread erosion, while at high rainfall, vegetation cover usually grows to a coverage and density that is enough to subdue erosion

Box 19.2 Soil Erosion Measurement.

Despite its significance as a component in land degradation, soil erosion has proved almost impossible to estimate over large areas with any degree of precision. This is because it is spatially and temporally highly variable and the techniques used (erosion plots and river yield estimates) have large errors and are no more than point samples. Soil erosion modeling is an attractive alternative, but it is not without shortcomings. The earliest modeling efforts were empirical equations, based on a large database from plot studies in a wide range of environments over many years, developed by the USDA into the universal soil loss equation (USLE). Kirkby (1972) has developed the simple Musgrave equation (Musgrave 1947) into a general equation for estimating total potential erosion rate, with a variant for rill erosion and a methodology for its use as an erosion indicator (see Kosmas et al. 1999). This approach, based on sound physical principles and readily available parameters, is superior to the more widely used USLE (and its variants, MUSLE and RUSLE). It is well established that erosion declines exponentially as its key controller, vegetation cover, increases; at 30% cover, the soil erosion is reduced to 30% of its value on bare soil. Data on vegetation cover can normally be obtained by direct observation (e.g., through remote sensing) or modeled. Vegetation is an "integrating" factor in desertification because it reflects not only climatic controls, but also a whole plethora of anthropogenic land uses ranging from agricultural land uses to grazing management. The Kirkby approach has been used to estimate monthly erosion rates for local, national, and regional levels in the MEDALUS project in southern Europe (Kosmas et al. 1999). In the last forty years, two new and promising methods have been developed. One is the use of radionuclides whose profile in uneroded soils can be used as a yardstick to compare with eroded soils (Warren et al. 2001). The second is cosmogenic isotopes that continually bombard the Earth and can be used to estimate the mass balance losses from catchments, through river loads and sediments caught in reservoirs and other structures (Cockburn et al. 1999).

quite dramatically, with an exponential relationship (Thornes 1990). Aeolian erosion and gully erosion are much more difficult to model in this way, leaving room for continued uncertainty. The MEDALUS program in southern Europe (Kosmas et al. 1999) has gone a long way toward facilitating understanding of erosion trends and patterns in Mediterranean regions.

Role of Interdisciplinary and Participatory Approaches

In all of these debates, the search has been for research methods and policies that are approximately correct rather than exactly wrong" (an expression attributed to John Maynard Keynes). Many uncertainties remain. However, in some respects we are moving closer to a more effective dialogue between consumers, producers, and implementers of desertification research in these domains. The old model of research uptake (Figure 19.3a) was unidirectional (Jiggins 1993), providing policymakers with little opportunity for input into the research domain. Their role was only to issue new requests for data or new research programs via funding of research by corporations, academic groups, and government institutes. After decades of work in community planning and participatory approaches, particularly since the environmental emergencies of the last thirty years (such as the Sahel drought in West Africa), this model is increasingly viewed as redundant and limiting. There is now much more engagement with what O'Riordan (2000) labeled "interdisciplinary environmental science" (see also Abbot and Guijt 1998; Batterbury and Bebbington 1999).

Interdisciplinary investigations (Figure 19.3b) are iterative processes. They are fundamentally more democratic than the standard model, which is the research-to-policy process that remains (regrettably) somewhat prevalent (Scoones 1999). This is because land users and other interested parties are fully involved in research — perhaps as shapers of the initial research agenda, perhaps as data managers, or perhaps as participants in lobbying governments for policy changes that could result from new research findings. Fine examples of interdisciplinary science have been applied in Senegal's efforts at watershed management, where the entire development of local environmental research and dam construction was directed by local people, with an international NGO sitting firmly in the background (Ndione et al. 1995); policymakers (working for NGOs and for the state) also shared in the elaboration of the research agenda and the design. Other examples include the redirection of African land tenure policy through government-funded research, participatory workshops, and widely disseminated publications on land tenure reform in recent years (IIED 1999; Toulmin and Quan 2000).

DETECTING DESERTIFICATION AT THE NATIONAL SCALE

Notwithstanding the debate about definitions, causal factors, consequences, and the difficulty of collecting appropriate data, policymakers need to know something of the spatial distribution and severity of desertification within a country in order to be able to respond to it. Furthermore, techniques for detecting desertification should ideally be extended to create a basic monitoring capability, such that the effects of public investment in rehabilitation, large- and small-scale, can be assessed against baselines. Before we explore the responses that

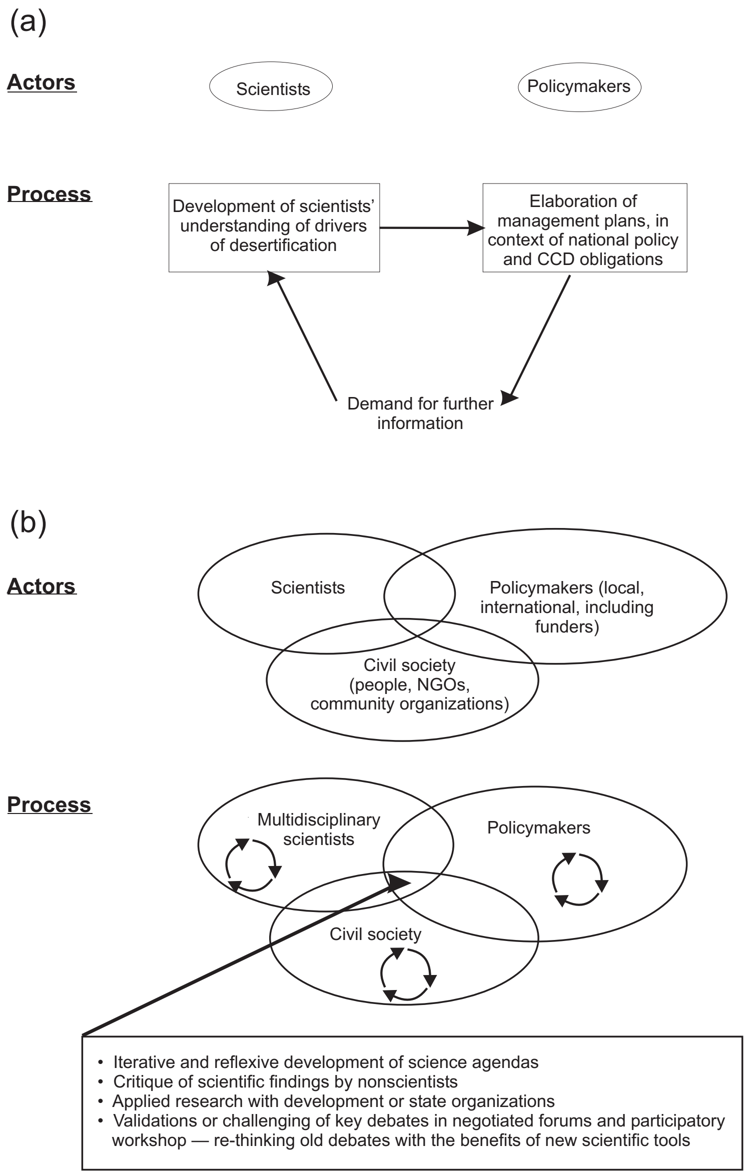

Figure 19.3 Research–policy linkage models: (a) conventional linear model, (b) interdisciplinary model.

science and policy can provide at a national scale, we discuss the potential for and limits to detection at this scale, keeping in mind that, as Stafford Smith and Reynolds (2002, p. 406) argue, "desertification in drylands is about changes in coupled human–environment systems that matter to humans, whether these are life-and-death or emotional concerns, and regardless of whether they are expressed explicitly or implicitly."

Potential Approaches to National Detection

Developing a methodology for detecting the processes that comprise desertification first involves understanding the processes involved. The need to focus on specific processes at a variety of scales has been discussed elsewhere in this volume (Prince 2002; Fernandez et al. 2002; Robbins et al. 2002; Lambin et al. 2002). Detection at the national scale has concentrated in the past on tracing land cover and certain land quality variables through some combination of direct measurement and remote observations, and if sufficient data exist, modeling. However, this is difficult, for the following reasons:

- Degradation commonly occurs due to small-scale human activities (enacted by households and communities) and it results (at least initially) in only small-scale modifications of the land surface and vegetation; these are difficult for coarser-resolution monitoring to detect (Okin 2001);
- Such modifications are distributed across a country in a very heterogeneous manner, such that is generally misleading to extrapolate from small-scale measurements to the national scale. For example, if most desertification in Tunisia is found in southern provinces (Mtimet et al. 2002), it makes no sense to "scale up" these measures to the whole country, and then to base national policy on them; and
- Similarly, it is not usually appropriate to "downscale" from regional or global assessments to a particular country, for example, by using continent-wide African soil fertility trends (Stoorvogel and Smaling 1990) in the absence of local and national statistics.
- Desertification as a long-term process is also masked by the high temporal and spatial variability of rainfall typical in arid and semi-arid drylands. Therefore, long observation periods and large measurement areas are desirable. National rainfall monitoring is possible and some countries have good coverage, but the logistics of measurement and detection are different in large and small states with different monitoring capacities, and depending on whether drylands form a large or a small percentage of the national territory.

Important biophysical changes that occur during land degradation include changes in biological plant production and vegetation pattern (especially reduced biological productivity and complexity), loss of soil fertility, salinization, and water and wind erosion. In Table 19.1 we list a variety of biophysical indicators of these changes that can potentially be derived at the national scale with sufficient spatial resolution to be mapped across a country. Several regional assessment and national resource inventory exercises have made such measurements (e.g., the Jornada Basin LTER site in south-central New Mexico, U.S.A.; the National Land and Water Resources Audit in Australia), but the resources available for such exercises vary greatly among countries. Measurement and modeling of these indicators are both expensive and time consuming, and many of them can only be interpreted meaningfully if their temporal evolution is known. Despite this, continued efforts are required to deliver low-cost and timely data, in which remote sensing has a major role to play (Okin 2001).

A number of problems emerge from collecting data *solely* on biophysical variables. Other chapters in this volume (e.g., Fernandez et al. 2002; Prince 2002) argue that the focus should be on "effectively irreversible and negative change," and identifying those thresholds in the

Table 19.1 Biophysical indicators of desertification with potential for measurement at the national scale (comments indicate how practicable this is). These indicators can be used to describe the spatial variability of different aspects of desertification within a country, to help direct national priorities.

Indicator	Aspect of Desertification	Data Sources	Reference/Comments
Rain-use efficiency: ratio of net primary productivity (NPP) to rainfall (P)	Reduction in biological productivity not caused by variability of precipitation	Normalized difference vegetation index (NDVI) or other remote sensing for NPP, rain gauges or satellite estimates for P	Prince (2002); Nicholson et al. (1998)
Difference between potential and actual NPP	Reduction in biological productivity	NDVI (or other remote sensing) for NPP; modeling for potential N	Prince (2002). Modeling introduces more uncertaininties but requires shorter observation periods.
Fraction of vegetation cover (or patch distances)	Change in vegetation (productivity and spatial heterogeneity)	High-resolution satellite images	See discussion on patchiness by Okin et al. (2001) and Okin (2001)
Fraction of grass, shrubs, forests (or species change)	Undesirable change in vegetation type/species composition, including shrub to grass ratio	High-resolution satellite images, NDVI, ground measurements	Ground measurements are often required, which are expensive.
Crusting	The loss of cryptobiotic and other crusts	High-resolution satellite images, ground truthing, air photos	Okin et al. (2001)
Nutrient concentration in soil	Decrease of soil fertility	Point measurements at the ground, preferably combined with nutrient budget modeling	Krogh (1997); proxy measures (Ramish 1999); difficult, expensive, large-scale estimates problematic (Stoorvogel and Smaling 1990)
Soil salinity	Increase of soil salinity	Point measurements at the ground	Mostly related to improper irrigation and drainage
Water erosion rate	Soil erosion by water	Sedimentation into reservoirs, local test site measurements, plus modeling extrapolation	Reservoir sedimentation can integrate over large areas; local test sites are expensive (Mtimet et al. 2002)
Wind erosion rate	Soil erosion by wind	^{137}Cs measurements at small test sites, analysis of dust source areas, multi-temporal remote sensing, plus modeling extrapolation	Warren et al. (2001); Middleton and Goudie (2001); Okin et al. (2001)

system that lead to this. However, the definition of what is "negative" depends on what the land is to be used for, and "irreversible" varies considerably with the financial and human resources available to apply to the problem. It is therefore hard to define a threshold value beyond which we can say that an area has become "desertified" (Prince 2002; but see Figure 21.4a in Stafford Smith and Reynolds 2002). Some extreme cases such as the complete removal of topsoil may be clear (though in principle with sufficient investment this can still be recovered), so the concern of policy must be with more subtle changes that provide earlier warning. Furthermore, short-term fluctuations in, for example, rain-use efficiency could be temporary, so it is also important to set such changes in their long-term context before inferences are drawn. Since there is little scientific consensus on how long the observation periods for each variable should be to achieve certainty (Prince 2002; Nicholson 2002), the alternative is to look for indicators that fluctuate less. In short, flexibility in modes of human land management and biophysical feedbacks, will always lead to uncertain impacts. As implied by the UNCCD's definitions, *desertification must really be seen as a continuous process with thresholds of sustainability that depend on "hybrid" amalgamations of human interventions and natural processes* (see Fernandez et al. 2002).

The indicators in Table 19.1, therefore, are useful inputs to the initial stages of national level monitoring of desertification, particularly to focus attention on subregions where further study and field investigation might reveal advanced land degradation. Susceptibility maps might also be produced for those factors that policymakers value, to help direct investment priorities. In this sense, scientific environmental data can be less speculative than other types. However, maps of environmental variables by themselves say little about how these subregions have come to be vulnerable to desertification, or much about the processes that give rise to degraded landscapes and environments. This leads us back to the causes and processes of desertification and the implications of these factors for national policy responses.

Indicators and Vulnerability

To complement the monitoring process, a set of integrated "indicators of vulnerability" to desertification would be desirable. Examples of potential biogeophysical and socioeconomic indicators include measures of meteorological vulnerability, such as aridity and rainfall variability, biophysical vulnerability to erosion or grazing, and human vulnerability, in terms of income portfolios, food systems analyses, or rural poverty. While indicators such as these might aid planners at the national level to identify areas of desertification susceptibility or vulnerability, and to respond accordingly, the creation of a set of "leading desertification indicators" (Okin 2001) faces significant obstacles to validation and interpretation. It is particularly difficult to "detect" many of the human factors that act as drivers to degradation and desertification in drylands. For example, as discussed above, the effects of demography are frequently misconstrued in the desertification literature. Such indicators thus have little value unless they are firmly placed within a system's understanding of how they play out in dryland regions. This requires policy users of the indicators to be fully aware of the complex relationships and feedbacks in such a systems model (whether conceptual or more formally quantified), which probably implies that they must also be involved in the development of that understanding.

Another issue is the instability of many social systems, such that decades-old practices can quickly be disrupted by external factors like warfare or land seizures (as in the case of Zimbabwe and its on-going battles over land allocation) that have major effects on land cover and land use. An apparently stable national political regime supporting incremental rural development activities can rapidly flash into violence, disrupting local livelihood systems and creating social — rather than biophysical — "state changes." During 2001, at least half of Afghanistan's estimated 26 million people were at risk of food shortage following a severe drought, which was compounded by dislocation caused by acute political instability, warfare, and attacks on the former Taliban regime (FAO 2001).

Notwithstanding these problems, there is a need to develop useful indicators of human vulnerability to match the biophysical indicators, but these must range much wider than measures like "population pressure on resources." The potential risk of a given population degrading the local resource base in the years ahead is *far more likely to hinge on the factors that constrain their own flexibility and adaptive skills, especially an enforced decrease in their political or economic power that leaves them socially or politically marginalized* (Blaikie et al. 1994; see also Downing and Lüdeke 2002; Vogel and Smith 2002; Davies 1996). Dryland degradation, both short-term and localized instances, can be a natural outcome of livelihood diversification and can sometimes impact local resource use negatively (Warren et al. 2001). When it does, compensation occurs elsewhere in the local environment by "human enrichment practices" (e.g., intensive livestock manuring or a move to cultivation of the most fertile soils) which allows degraded areas to slowly regain their fertility. These critical predisposing factors with predictive value are likely to correspond to the "slow" variables discussed by Fernandez et al. (2002).

In the light of these uncertainties, *many national governments actually have a limited ability to intervene, or indeed to monitor, the activities of rural people in dryland communities*. The portfolio of adaptive strategies assembled by most dryland households — given the political and economic freedom to implement them — is staggering (Netting 1993; Mortimore 1989; Robbins et al. 2002). But this does not mean that governments need do nothing. National monitoring efforts can (and have) been linked to concerns over food security in rural areas. The Famine Early Warning System (FEWS) in West and South Africa provides a good example of an information system that integrates some biophysical data with indicators of vulnerability in a sensible and realistic fashion, by taking the market prices of grain and livestock as a proxy measure of stress on the rural livelihood system and using rapidly rising prices (beyond the level at which many local people could afford grain) as an indicator of impending "crisis." The existence of social unrest, the use of wild famine foods, and the consumption of next year's seed stock are all standard measures of rising vulnerability. The worsening condition of animals and their sale, and the distress-induced migration of individuals, are later steps in a chain of responses that people have used to respond to stress for millennia (Blaikie et al. 1994). These data may be imperfect, but all of these processes can be collated and acted upon by national-level officials. They may then organize direct assistance in areas where the indicators show food stress and a drawing down of natural capital (Downing and Lüdeke 2002). *National officials, therefore, do not need full and complete scientific certainty on many detailed indicators, but a precautionary signal that something is wrong, rapid explorations to ensure that the signal is significant, and efficient mechanisms to organize disaster relief and aid.*

To conclude, the "precautionary signals" of the human aspects of vulnerability to biophysical desertification (and its genesis through human actions) can (and need) only be broad-brush for national-scale use. Despite a very incomplete picture from monitoring, national officials and other actors still have an obligation to act on the information they have, particularly where farmers and pastoralists are far from the centers of political power, as is usually the case in drylands. We now turn to how these responses may be formulated.

THE POLICY–SCIENCE INTERFACE

Concerns over the human drivers of desertification problems generate a set of policy responses that range from the draconian, e.g., the movement of people out of susceptible dryland areas, as happened during the Ethiopian drought of the 1980s, to the benign, for example, the formulation of new strategy documents that never receive a budget for implementation (in 1977, the UN Conference on Desertification produced hundreds of these) (UNCOD 1978). A short history lesson would show that at the national level, the "desertification threat" was used to justify authoritarian control over natural resources and land use by sometimes fragile political regimes (as was the "deforestation threat" in more humid zones). Today, now that most authoritarian regimes have left office, there is a need to develop policy dialogue with users, agencies, and governments at different scales. This requires a sustained and well-resourced effort, particularly in view of the need for a radical redirection of attitudes and practice on the part of scientists and policymakers.

Environmental research does not move forward as simple directives to local people in the form of land management projects or water provision schemes. Rather, land management policy is developed via the (often) painstaking process of debate, education, disagreements, and compromise — usually over sources of funding and priorities in particular — before it is enacted by a range of stakeholders over long time periods (O'Riordan 2000). "Policy" is an umbrella term that is used to describe anything from formal government planning, to knee-jerk reactions by state and nonstate actors, and it includes emergency radio broadcasts, the conservation of hillslopes, as well as swift military responses to conflicts over resources in dryland areas. Most importantly, there is a "politics of national-level planning" that involves struggle, negotiation, and often the appropriation of benefits for particular ministries, individuals, political parties, departments, regions, and other important interest groups such as transnational corporations and international development agencies. While national funds allocated for anti-desertification measures have often been deployed efficiently, in other instances there has been widespread abuse of these funds for political or personal ends. The record of some of the more ambitious and technocratic "desertification control" schemes and dryland management projects over the last few decades has not been good (Keen 1994; Batterbury and Warren 2001; Thomas and Middleton 1994; Moore 2001).

Improving the Value, Credibility, and Accessibility of Desertification Science

The following discussion identifies ways in which science could be better harnessed in policy responses, as well as how the national and international capacity of nations to respond to desertification could be enhanced.

We often hear impassioned pleas for better science, and for greater trust of existing scientific information. In this regard, information flows between civil society, the agencies that collect and disseminate environmental monitoring and data, and policy actors need to be improved and strengthened. The globalization of scientific and communications technologies (particularly remote sensing) assists this process, but a greater effort is required to include marginalized groups and poorer nations in the information loop. It makes sense that data obtained by (foreign and national) researchers should be transferred to national partners such that the knowledge obtained in research projects is rapidly available to them. "Policy workshops" are promising for improving information exchange among sometimes disparate scientists, decision makers, and civil society organizations. These workshops are places where ideas and viewpoints clash — for example, over the best way to distribute scarce international aid offered to support the UNCCD process, or how to reform land tenure — but sufficient time and money is available for the workshop to move on to develop compromise positions. A workshop might begin with the presentation of an integrated assessment of desertification at the national scale and the discussion of this evidence, but would develop a series of adaptive management techniques and policies to deal with the problem, including an agreement among NGOs and government ministries to share out responsibilities and territories for land management. Local voices need to be heard in such forums, and the government cannot act in isolation. Deliberative group discussions of resource management issues in this way have worked well in other settings, since they reduce hostilities and enable communication (Abbot and Guijt 1998; Toulmin and Quan 2000).

The provision of "useful" meteorological data is one important area for such discussions. The issues are: (a) can meteorological conditions be predicted and (b) how vulnerable is a particular region to climatic variability? It is not generally possible to forecast key elements (e.g., rainfall) reliably for more than quite short time scales, although seasonal projections have proven useful for planning agricultural production in West Africa (Roncoli et al. 2002). Thus the emphasis must be on the second question, which has two components: How likely is it that a region will experience climatic change, and how likely is it that desertification can influence the regional climate? At least partial answers to these questions can be obtained from regional climate studies. Those areas most likely to experience climatic change are those on climatic ecotones, that is, areas where there are sharp climatic gradients. Historical studies of regional climatic variability can also help to answer this question, provided that a significant body of climatic data is readily available. Climate change scenarios might be viewed as possible futures — and a range of these may be used to assess potential desertification trajectories in an area. A simple answer to the question of what effect desertification may have on regional climate is that it depends on the nature of the weather systems producing climate. In particular, regions where the precipitation regime is highly tropical (i.e., convective) are more sensitive than those with strong mid-latitude influences (e.g., frontal-type weather systems). This is a broad generalization. The vulnerability must be assessed on a regional basis, and clearly we need to understand the sensitivity of the systems to climate variables, such that one can move toward the production of models of the amount of climate change that a system can cope with over a given time period, and then direct attention to areas in which this sensitivity is highest.

Most dryland countries have specialized research institutes charged with research on natural resources, climatology, etc., and together with the international community, they require better, more appropriate, but rarely more complex methods for measuring degradation. There is a particular technical need for improvements to models dealing with the biophysical components of desertification that are largely outside of human control, for example, emerging techniques for determining water erosion, and particularly the estimation of soil moisture over large areas, which is so important for understanding other dryland processes like runoff.

As shown in the previous section, improved scientific knowledge is needed to design indicators for degradation such that they can be applied and compared across cases. It is unfortunate in this regard that desert science lacks an international body to coordinate and validate scientific efforts, which could be a homologue to the UNCCD, and equivalent to the Intergovernmental Panel on Climate Change (IPCC) in the climate change arena. In some countries, whole-country monitoring and information systems to support decision makers are appropriate. An example is the MEDALUS project, which for several years has provided monthly assessments of erosion risk. Elsewhere, local administrators — provincial bureaucrats in particular — need (and sometimes already have limited access to) data on past and predicted future rainfall, or may consult vegetation data generated from satellites or other media. Even the remoter Sahelian regional capitals of West Africa now have email access and internet. Local radio is universal in the settled drylands. Broadcasts of the probability of the late onset of rain important for crop growth can guide essential decisions taken by farmers over weeding patterns; this has now been tried for the first time in Burkina Faso (Roncoli et al. 2002).

Enhancing the National Policy Response

A national response to desertification problems involves mainstreaming the environment in the decision-making process at the macro, sectoral, and programs/project level. The circulation of desertification discourses in the media and in the deliberations of policy communities at international and national levels are a constant reminder to policymakers to consider environmental quality and trends as well as economic growth and social well-being in assessing national development. But aside from ensuring a minimal level of accuracy of data (as discussed earlier), dryland nations need rules and institutional frameworks that permit NGOs, state ministries and their field staff, pastoralists, and farmers to work together. Political interests and economic motives will always underlie such initiatives and produce a range of social surprises, including the potential for mismanagement, failed projects, and dissent.

A severe problem is the duplication of effort and the competition for "environmental" funds between different arms of the government and between different ministries. Leonard and Toulmin (1999) highlight the problem of "institutional territoriality" in four African countries. In Burkina Faso, for example, a duplication of effort between line ministries has led to the elaboration of overlapping, separately funded environmental action plans, some of them poor documents with little more than a listing of some environmental problems and a plea for funding to address them (Spiers and Marcussen 1998). Moore (2001) goes further, to accuse international organizations implicated in desertification policy in dryland West Africa of environmental authoritarianism, consistently promoting their own agendas and ignoring the centuries of successful dryland management practices of rural people. These problems should be minimized by governments maintaining a firm hold over policy and the cascade of decision-making units (Box 19.3), but still permitting democratic participation in the policymaking process, in which local voices are strongly heard. The best way to integrate

Box 19.3 Recent National Policy in Tunisia.

Tunisia's farmers and pastoralists have been making a living from dryland resources for centuries; Tunisia was one of the first countries to integrate the environment into national policy processes, particularly since independence in 1956. Desertification is a well-known policy field, and public awareness of the issues is high (Leonard and Toulmin 1999). Large-scale conservation projects began in Tunisia's dryland areas in 1962, pursuing an unpopular collectivist agricultural model until political changes in 1969 (de Graaf 1996). In one of the first National Environmental Action Plans, the country established clear priorities in national and regional environmental issues. In 1988, Tunisia established one of the first national environmental agencies in North Africa, reporting directly to the President, backed up by a politically powerful National Commission for Sustainable Development (established in 1993). Initially following a command and control philosophy, Tunisia enacted an early land-use law *(Loi de protection des terres agricoles*) to reduce erosion risks, and initiated a full cadastral survey of land use and ownership — still rare in Africa; environmental impact assessment is required for many new developments. The government has placed a big emphasis on water conservation — small lakes (*lacs collinaires*) and check dams have restored groundwater levels in many regions. Despite continued adherence to state-led intervention in environmental policies in some government circles (noted in the UNCCD Tunisian National Action Plan), Tunisia is beginning to adopt economic instruments as well as more broad-based information and communication techniques (Mtimet et al. 2002). Economic instruments have been used to curb water pollution by applying the "polluter pays principle" for waste water, and taxes are progressively reaching the level of similar pollution charges in Europe. Policymakers are conscious that some economic subsidies can contribute to pushing agriculture unsustainably into semi-arid areas. At the same time, stakeholders are increasingly involved in the decision- and policymaking processes through the creation of associations such as the *Associations d'interet collectif* to manage irrigation water, and there are NGOs, women's, and farmers' associations working with the Ministry of Public Domains and Lands, created in 1990. Conservation measures, initially large-scale and directed by the government, have become more integrated with the farming systems of small producers since the mid 1980s, under the Department for Soil Conservation (de Graaf 1996). The government has brought the importance of the environment to the attention of the population through targeted educational programs, and contributes to the UNCCD process through a National Coordinating Body.

desertification concerns in the management of a country is through participation in the decision- and policymaking processes themselves. Tunisia has moved in this direction in recent years, and although its earlier "command and control" policies would not please Moore (2001), their evolving form has yielded results (Box 19.3).

Participating on the International Stage

The governments of developing countries and various NGOs had a relatively strong involvement in drawing up the UNCCD (1994). The various UNCCD components are legally binding on the parties, and include specific measures (annexes) for Africa, Asia, Latin America, the Caribbean, and the northern Mediterranean.[2] Over 180 countries had ratified the Convention by late 2002,[3] and most dryland countries had drawn up National Action Plans. These are documents that elaborate how the terms of the Convention will be met over the next few years by existing interventions and projects, as well as by some new ones (if funding can be obtained for these).

Toulmin (2001), an insider to UNCCD formulation, argues that the international convention model under which the UNCCD has been designed and implemented is cumbersome, and could re-create the failures of the disastrous desertification measures instituted by the UN in the late 1970s. Certainly, the actions required by the UNCCD are poorly funded, and unsustainable in the long term without injections of funds or labor (it was announced on October 18, 2002 that direct access to funding from the Global Environment Facility may soon be available). Toulmin wonders whether a solely national-level approach to desertification mitigation would therefore be more appropriate[4]. This argument is strong, but most of the present authors (especially those with direct experience with national-level planning) are more positively disposed toward the UNCCD. We believe that the UNCCD should be strengthened by commitment, not weakened by nonparticipation, not least because a full exploration of its implications is not yet possible. The UNCCD has successfully raised the profile of desertification issues at the national and regional levels, and has boosted support for those at the national level who have responsibility for implementing it. Tunisia, for example, has a National Desertification fund to implement projects identified under the UNCCD, although most countries do not as yet (Leonard and Toulmin 1999).

It is important for national governments to insure that other groups (especially scientists and civil society organizations) are involved in the dialogue leading to National Action Plan formulation (Leonard and Toulmin 1999). In the first round of Action Plans, the elaboration of interdisciplinary models to discuss and implement the plans was largely absent. Stronger links with other conventions such as the Biodiversity Convention need to be established, and the problems of ministerial territoriality and conflicts addressed. Latent administrative and legislative instruments clearly need to be strengthened and integrated at the national level, although it is not possible to generalize across so many different countries as to how this should best be achieved.

CONCLUSIONS

In this chapter, we argue that desertification policy at the national scale revolves around the actions of the state, assisted by a variety of other institutions capable of influencing

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2 The Convention proposed the establishment of multi-state, intergovernmental, regional authorities. "That is, it allocates to regional authorities above the level of the state the responsibility of designing and coordinating regional action programs. The African country parties are to 'promote regional cooperation and integration' … The Convention also commits the signatory states to developing their own related national action programs'…." Moore (2001).

3 http://www.unccd.int/convention/ratif/doeif.php;
see also http://www.unccd.int/actionprogrammes/menu.php for a current list of national and other action plans.

4 For a vigorous debate on the UNCCD involving senior scientists and policymakers (including Toulmin), see Marcussen et al. (2002).

national-level policy. However, social and environmental drivers of desertification have their origins at other scales, and national-level planning must take note of the new breed of local-level studies of human–environment interactions in drylands. Focusing our discussion on a subset of scientific and policy questions, *our key conclusion is that better scientific monitoring of the biophysical processes that create conditions of desertification and dryland degradation is desirable, but is not the key solution to the problem at the national level. A responsive and effective capacity and political will to deliver new measures to assist the rural poor in the diverse nation-states of the world's drylands is also required.* The effectiveness of political power, however, varies greatly across dryland states, as does the capacity of the institutions charged with implementing policy to do their job effectively.

We challenge the view that the identification and measurement of desertification is relatively unproblematic. It is unlikely to be easily measurable through the identification of nonreversible deterioration in land-use systems. Desertification is a continuous process with thresholds of sustainability that depend on amalgamations of human activities and biogeophysical processes (see assertions in Stafford Smith and Reynolds 2002). Human vulnerability to pervasive forms of dryland degradation can be mitigated by centuries of carefully developed adaptive capacities, which include the mixing of resource-based livelihoods with other livelihood components, such as trade, migration, urban employment, and so on. We know that rich repertoires of conserving indigenous techniques exist, and some — like permeable contour bunds and advanced scouting for pasture quality — have already been improved through hybrid experimentation between farmers and scientists. Policies need to protect this diversity, rather than erase it, and promote the partnerships between local knowledge and Western science. As a generalization, resource degradation in the less developed dryland regions is usually a byproduct of something else — particularly poverty, need, exploitation, and conflict — rather than an intentional destructive act by rural dwellers. The concerns of policymakers to tackle dryland degradation are not always reflected in the views of local people, which resulted in the poor participation of the latter in early efforts to mitigate desertification through top-down, expensive land management schemes. In the more developed dryland regions, other processes apply; excessive urban development, for example, creates its own headaches for conservationists and water managers.

This line of argument is extremely important, since it suggests a need for many national governments to be better appraised of rural livelihood systems in susceptible areas. It also suggests a need for a more sanguine assessment of dryland degradation as just one *component* of rural livelihood systems or of economic growth. Local adaptive capacities in rural areas are unlikely to be captured by straightforward "population pressure on resources" — type measures that correlate population growth with higher levels of degradation, nor by accusations by the state that deride the everyday activities of its indigenous rural populations. Actions that constrain local peoples' flexibility and adaptive skills, such as an enforced decrease in their political or economic power, the fencing of common lands, inappropriate conservation schemes, restrictions on biomass burning, and draconian land tenure regimes, are quite likely to leave segments of rural populations more socially or politically marginalized than they might have been in the absence of state intervention. Thus the role of national policymakers in creating the right context for local activities is crucial.

We also stress that national officials in the various ministries and agencies of the state need "approximately correct" precautionary signals, before intervening or calling for aid in dryland regions where desertification appears as a symptom of economic or social distress. Their obligation is to carry out rapid explorations to insure that livelihoods or environments are not severely at risk, and to implement significant and efficient mechanisms to organize disaster relief, aid, or longer-term conservation measures where these are needed. We propose a model of interdisciplinary investigation that is fundamentally more democratic and more applicable to dryland environments than a research-informs-policy model. One of the implications of this model is that good policy responses can be triggered without having to define or measure desertification too specifically at the national level, since these policy responses must in any case be tailored through appropriate local participation.

Finally, it is obvious that the present international discourse on desertification, including the UNCCD and the actions of governments participating in the Convention, is a well-intentioned but relatively cumbersome policy instrument that often runs the risk of duplicating the work of government ministries, NGOs, and other institutions. While the jury is still out on whether the UNCCD can deliver real benefits of to dryland peoples — rather than to the coffers of their governments —we give it the benefit of the doubt. The final issue to highlight is that problems of "human and natural resource impoverishment" (Spiers and Marcussen 1998, p. 18) are, as we discuss, often "lost in the rhetoric of environmental action" — or, indeed, in the workings of desertification science. Desertification problems have much to do with the absence of secure livelihoods in the rural hinterlands of the world's dryland nations, and the construction of knowledge about those places that appears to be authoritative, but is not.

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