

Desertification and societal uncertainties

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Desertification, sustainability, and adaptability

The sustainability of dryland systems—both natural and human—depends on adaptability: not only to unreliable and irregular rainfall, but also to fluctuations in resource availability. Economic and political factors have changed the patterns and strategies of human occupation of dryland regions, where previous lifestyles of transhumance or nomadism and minimal involvement in a market economy permitted human occupation of arid and semi-arid lands without causing ecosystem stress, even in times of drought. Population growth and the trend toward permanent occupation of settlements are linked to the imposition of taxes, reliance on cash crops, and export of local resources and raw materials, which together with climate variability have resulted in overcultivation, overgrazing, and deforestation in many areas of the world (Mouat and Lancaster 2008; Middleton and Thomas 1997). These areas are highly susceptible to desertification, with up to 20% of them suffering to some degree. The economic sustainability of these areas is a major social and environmental issue and a potential driver for change.

The importance of climate change as a factor in exacerbating desertification has been discussed elsewhere in this issue. With rapid climate change, a concomitant shift is likely to occur both in the natural system, with grasslands perhaps replaced by shrub-dominated systems, and in human livelihood systems, with grazing and dryland farming becoming marginalized.

The environmental processes associated with desertification are insidious, cumulative and undoubtedly exacerbated by the pressures of modern society, increases in population, and social or political inequities. Environmental processes are interlinked and involve significant feedback mechanisms. For example, desertification may lead to reduction in plant cover, which will in turn exacerbate the processes of soil deterioration, leading to a change of scale in the spatial distribution of soil resources (de Soyza et al. 1998), an increasingly “patchy” landscape and a decline in sustainability that is difficult or impossible to reverse (Schlesinger et al. 1990).

However, an often overlooked factor in examining the various thresholds of these systems—that is, the point at which such shifts become irreversible—is that societal changes may either lessen or increase the risk of irreversible degradation. That is, desertification can be prevented and people can live within the confines of the areas affected—reducing poverty, migration, and social problems as well as maintaining (or even improving) ecosystem sustainability (MA 2005a). Social participation is an essential component of strategies to abate, mitigate or prevent desertification (Navone and Abraham 2006) and many countries have implemented programs to address the land and water management issues that are the driving forces behind desertification processes. Increased integration of land and water management, and of pastoral and agricultural

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land uses, may provide viable solutions if approached in a proactive manner including capacity building and institutional support at all levels (MA 2005b).

Dryland peoples have developed numerous coping mechanisms for surviving fluctuations in ecosystem services, which Bradley and Grainger (2004) have studied under three categories: *anticipatory strategies*, *response strategies*, and *survival strategies*. Of the two groups in Senegal studied by Bradley and Grainger, those who were more resilient had higher tolerance of “abnormal” conditions and a greater diversity of survival strategies. However, if dryland conditions get “worse”, possibly as a result of climate change, environmental security may become threatened (MA, 2005b) and people may run out of options for maintaining a sustainable existence. Thus, a lack of options as an outcome of living in an unsustainable environment is inextricably interlinked to human security. However, Bradley and Grainger (2004) pointed out that the social resilience mechanisms operating in the silvo-pastoral zone of Senegal could help to explain its lack of widespread desertification, despite the prevalence of significant productivity and areal constraints.

The strong links, both cause and effect, between desertification and poverty contribute to the social and political marginalization of dryland peoples (MA, 2005b), which is likely to further reduce their options in times of environmental and/or social change and stress. The worse-case options include taking no action (which may ultimately result in starvation), moving (often to urban centers; and not always a negative option), or revolting. In many cases, people in entire regions move to cities or neighboring towns (Glantz, 1994), where resources may be no more abundant, and where they are outsiders with different customs and beliefs.

Environmental refugees are typically poor and need shelter, food and medical care. Additionally, they may bring different customs, religions, agricultural practices and diseases with them, and many governments, at national or local scale, simply do not have the resources to deal with this situation (Tickell 2003). An influx of refugees into an area already experiencing environmental stress (such as desertification) and depletion of resources is, according to Liotta (2003), likely to result in ethnic clashes and infrastructure collapse. Adaptation is an infinitely preferable option, but may not be viable if decisions are put off until it is too late.

At regional or national levels, countries may initiate policies to alleviate disasters such as drought, which would, to a large extent, minimize migration and its associated problems. Long-term efforts to promote sustainable development, such as Agenda 21 which arose from the UN Convention on Development in 1992 (the “Earth Summit”), have in some ways revolutionized policy decisions made at national levels and include valuable aspects of capacity building. However, in spite of the fact that capacity building is typically aimed at the community level, the decisions are typically made at the top, and experience has shown that “top-down” solutions are generally less effective than those originating at community level (“bottom-up”). In fact, these bottom-up strategies are strongly advocated by the UN Convention to Combat Desertification (UNCCD).

Identification of the timeliest period for intervention and action is important. A proactive approach will increase the chances of people adapting, thereby reducing the likelihood of migration, revolt and death. In this context, we see “adaptation” as a peaceful process, whereas “revolt” is an organized opposition to authority which may involve bloodshed. “Eco-tipping point” is a term coined by Marten (2005) referring to the element of the natural–human system that can activate a chain of events leading to transformation from unsustainable to sustainable

(or *vice versa*). Marten cites examples of bottom-up decisions on topics as diverse as fisheries in the Philippines and a New York City community garden, to make his point that once started, community action can create a chain of events and positive spin offs beyond the immediate target of the proposed activity. The apparently simple steps of taking action and making decisions are thus critical components of response, and part of a philosophy that suggests examining future scenarios and their spatial manifestations: alternative futures.

Alternative futures analysis

Alternative futures analysis relies upon developing an understanding of the critical uncertainties that shape a region and its people or stakeholders (for additional information, see, for example Steinitz et al., 2003). The stakeholders include not only those people who live and work in the area, but also the policy makers, scientists, NGOs, media, and others who have a vested interest in the future of the region. The process that leads to the development of these alternatives, empowers people; acts as a forum for sharing problems, ideas and concerns; and may defuse tensions and conflicts caused by climatic variability, diminishing resources, an influx of refugees or other issues that face dryland areas from time to time.

An alternative futures analysis usually will not be effective in a serious crisis situation because people are often too preoccupied to focus and develop the necessary level of attention and interest. However, if conducted in a timely manner, the intervention is positive and is likely to result in increased communication among all involved; the illustration of possible conflicts, their causes and potential solutions; and a regional analyses framework that produces quantified results, maps, and figures showing status and impacts of possible change—which could be used by community members to address policy and decision makers, or by people in those positions to make their point at higher administrative levels.

The analysis employs spatially explicit futures models which address human–environment interactions through empirical representation of human-induced change across time. It may also employ “design” to spatially represent assumptions of development and change. Past patterns and correlates of change are then used to project alternative future scenarios and illustrate their potential effects. Scenarios are developed for each study based upon locally relevant framing issues and critical uncertainties identified in stakeholder workshops, questionnaires, and informal discussion sessions. The following are examples of possible framing issues that may be relevant in a dryland area and affect land use decisions:

- Should a group of farmers experiment with new types of drought-tolerant agricultural crop varieties?
- Should the area of currently cultivated land be extended?
- Should local governing bodies impose control over water use until there is significant rainfall?

These “shoulds” refer to factors over which the public, land owners/managers, and policy makers have some control and are the framework for developing the critical uncertainties—that is, the important issues facing a region, whose outcomes are unknown. Examples of these might include:

- Will there be enough water to irrigate this year?
- Will partnerships with neighboring communities provide a “safety net” to permit pursuing a crop diversification strategy?

- Will the drought in a neighboring province cause an influx of refugees?

In the example being developed here, people are considering crop diversification to provide an alternative livelihood and a potential “drought buffering” mechanism; thus, the stakeholder workshop process might also address such questions as:

- Will the area under cultivation need to be increased?
- Which part of the valley is most suitable for increased irrigation?

This process will result in the development of scenarios and, in turn, the identification of the “who”, “what”, “where” and “why” of actions based upon changing agricultural strategies. Each scenario is fully described in several pages of text (in some cultures oral role playing or graphics may be more appropriate). This exercise in itself requires that decision makers and those who will implement the decisions consider the specifics and implications involved in each suite of actions.

Summary

The challenges of environmental change, including desertification, are increasingly recognized and becoming better understood. Over-legislation, particularly of the “top-down” variety, is not likely to contribute as much as the implementation of policies which take advantage of local knowledge and experience, improve communication and reduce redundancy.

We are increasingly part of a global society, and the impacts of climate change and desertification extend far beyond the geographical area in which they originate (MA, 2005a). This emphasizes the urgent need for integrated and concerted action to identify those areas and peoples at greatest risk, and those countries which are unable to address these issues unaided. The challenge of connecting science and policy with the real world is still present, but, hopefully, will be eroded as human responses become increasingly assertive and directed.

Alternative futures analysis is an example of proactive community involvement and decision making that provides information, illustrates the consequences of human responses, and assists people to develop options and alternatives for maintaining dryland sustainability. An understanding of mechanisms of social resilience may assist societies in coping with change. We emphasize the importance of proactively setting prevention mechanisms in place rather than waiting until mitigation is necessary.

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