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Authors: Stephen Whitfield*, Helmut J. Geist and Antonio A. R. Ioris

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Abstract

Desertification is a complex process, characterised not only by a damaged ecology, but also by conflict over access to scarce resources and trade-offs between the needs of multiple stakeholders at multiple scales. As such, orthodox approaches to environmental assessment in drylands, which rely solely on ecological expertise, are gradually losing legitimacy and greater attention is being given to integrated and participatory assessment approaches, which draw on multiple sources of knowledge in order to accurately describe complex socio-ecological processes. Moreover, there is growing recognition that successful management of desertification requires a strategy that can accommodate the multiple, and often competing needs of contemporary and future stakeholders. In light of these conceptual advances, this paper highlights seven key criteria that dryland environmental assessments must meet: (1) accurately understand complex socio-ecological system processes, (2) focus on slow variables, (3) integrate multiple scales of analysis, (4) integrate multiple stakeholder perspectives and values, (5) ensure that future generations are fairly represented, (6) ensure that less powerful stakeholders are fairly represented, and (7) integrate local and scientific knowledge. The virtues and challenges of deliberative environmental assessments, a novel subset of participatory environmental assessment approaches which places emphasis on social learning, argumentation, and critical reflection, are considered in relation to each of these requirements. We argue that deliberative approaches have the potential to achieve accurate, progressive and integrated assessment of dryland environments.

Key words: deliberation, integrated assessment, participation, local ecological knowledge, desertification

1. Introduction

Desertification is a classic example of a complex socio-ecological issue. Its underlying drivers (e.g. market forces, climatic change) interact with local level adaptive strategies, in ways that are not easily reducible to linear narratives (despite the dominance of such approaches within drylands literature), and there is a high degree of uncertainty associated with future change. Orthodox approaches to the assessment of such complex environmental issues, which prioritise 'expert knowledge' in modelling and analysing biophysical data in a social, economic and political vacuum, are gradually losing legitimacy, as counter-evidence builds up against the inaccurate narratives of degradation (Leach and Mearns, 1996) that such approaches justify. The work of political ecologists, ecological economists and resilience alliance scholars, has highlighted the need for the assessment of complex environmental problems to be based on the integrated study of social and ecological spheres, focusing on the dynamics of the system, drivers of change and access to resources.

Integrated assessment is a term that was popularised in the 1990s (Dowlatabadi and Morgan, 1993; Haigh, 1998; Morgan and Dowlatabadi, 1996; Risbey et al., 1996; Rotmans, 1998; Schneider, 1997; Toth and Hizsnyik, 1998) to represent an approach to assessment that is based on the bringing together of multiple methods and approaches with the purpose of informing policy and decision making rather than simply generating knowledge (Reed et al., 2011). It has lost some of its popularity within academic literature today, partly as a consequence of being associated with a time before the prioritisation of complex system dynamics and local ecological knowledge. However, the principles of integrated assessment continue to be fundamentally important, perhaps more than ever, in light of these developments (Fish et al., 2010).

> *Integrated Environmental Assessment (IEA) is the interdisciplinary process of identification and analysed appraisal of all relevant natural and human processes and their interactions that determine both the current and future state of environmental quality, and resources, on appropriate spatial and temporal scales, thus facilitating the framing and implementation of policies and strategies*.
> (NERI, 1995)

The aims, approach and scope of an integrated assessment are determined primarily by the issue being considered, rather than the discipline or constraints of the researcher. As such, dealing with complex environmental issues through integrated assessment often involves the integration of multiple knowledge systems, values, disciplines and scales of evaluation (Tol and Vellinga, 1998). Integrated assessment requires engagement with multiple sources of knowledge in order to untangle complex and interacting process that are occurring on multiple temporal and spatial scales (Cash and Moser, 2000; Fish et al., 2010). As such, attempts to assess and manage desertification increasingly rely on the knowledge and participation of local stakeholders in addition to scientific expertise (Failing et al., 2007; Raymond et al., 2010; Reed et al., 2008; Roba and Oba, 2009; Stringer and Reed, 2007). Environmental assessments are increasingly recognised

as opportunities for knowledge sharing (Pretty, 1995), social empowerment (Chamber, 1997) and cooperative management planning (Smajgl, 2010). However, effective participation of independent and reflexive social actors requires recognition of the plurality of views and experiences, which all need to be equally legitimised beyond established hierarchical structures, inequalities of power, and conflict (Cleaver, 1999).

The challenge of designing and implementing integrated participatory environmental assessment approaches is being addressed within an innovative and growing body of literature (e.g. Dougill et al., 2002; González et al., 2008; Nachtergaele and Licona-Manzur, 2009; Patel et al., 2007; Reed and Dougill, 2002; Wang and Burris, 1997; Wood, 2005). A particular subset of this literature is reviewed in this paper. The focus of this essay is deliberative environmental assessment. Specifically, it considers a suggestion, which, although not new amongst political theorists, is somewhat novel in the field of environmental assessment, that facilitating deliberation within participatory assessment can promote knowledge-exchange and citizen values amongst stakeholder participants (Dryzek and List, 2003), therefore addressing some of the challenges of integrated participatory assessment. This paper critically reviews the rationale behind the use of deliberative approaches to assess desertification and highlights the virtues and challenges of deliberative environmental assessments in relation to seven criteria for the integrated assessment of complex socio-ecological issues.

2. Integrated Assessment of Desertification

The following review of largely theoretical literature addressing desertification highlights four key points about the complexity and scope of this important environmental issue. Firstly, it points to the fact that desertification is a socio-ecological phenomenon, one that is inherently tied to a complex relationship between socio-economic and ecological processes. Secondly, the drivers and causes of desertification operate at multiple temporal and spatial scales and the ecological importance of dryland ecosystems is such that stakeholders in the management of these environments include not only contemporary local land users, but also national and international agents, the global community, and future generations. Thirdly, the values and interests of the multiple stakeholders in dryland environments are often opposing and conflicting, particularly as a result of the scarcity of resources in these vulnerable systems. Finally, knowledge about the process of desertification, socio-ecological dynamics, and sustainable dryland management is diverse and dispersed. Local environmental knowledge and experience of system processes is valuable in understanding and modelling desertification, as is the expertise of hydrologists, ecologists, climate scientists, agricultural scientists, economists and political scientists.

2.1. Desertification as a socio-ecological phenomenon

It is estimated that 250 million people world-wide are directly affected by desertification and a further one billion are at risk of dryland degradation (UNCCD, 2009a). The consequences are multi-faceted, and their scale only partially represented by the estimated 42 billion USD annual income foregone in areas immediately affected by desertification (UNCCD, 2009a). The

degradation of drylands represents a loss of livelihood pathways, cultural landscapes and important environmental regulation services, as well an increase in vulnerability for land users in some of the world's poorest regions. The dependency of (often conflicting or competing) livelihoods on the services provided by ecosystems is greater in drylands than in any other ecosystem (MA, 2005) and the marginal properties of these ecosystems is such that the balance between sustainability and degradation is a very fine one (Geist and Lambin, 2004).

'Ecosystem services' is a concept that has come to dominate the framing of socio-ecological research today, particularly in dryland management. The United Nations Food and Agriculture Organization's (FAO) Land Degradation Assessment in Drylands (LADA) project, for example, have chosen to define dryland degradation as 'the reduction in the capacity of the land to provide ecosystem goods and services that support society and development' (LADA 2005). Similarly, the Millennium Ecosystem Assessment advances the idea that underlying drivers (Gesit, 2005) of desertification, such as market forces or climate change, constrain stakeholder options and result in the forced use of ecosystem services beyond critical sustainability thresholds. Such definitions are common within socio-ecological literature and are largely a product of the need to counter the historic dominance that biophysical methods and metrics, devoid of socio-economic and cultural context, have had over the definition, description and assessment of drylands (e.g. Hobbs and Cramer, 2008). However, emphasizing the utility of the environment in this way promotes a unidirectional, utilitarian understanding of the relationship between the social and the ecological components of a system, in which the former plays the role of consumer and the latter acts as provider. In using ecosystem services as an integrating concept, between the social and ecological, there is a danger that environmental assessment becomes an exercise in simply measuring the utility that ecosystem stakeholders derive from the ecosystem's provision of food and fuelwood, its clean water, its regulation of the climate, its cultural heritage, and other services.

Critics of weak sustainability, engaging in classical theoretical debates about the substitutability of natural and man-made capital, challenge the hegemony of utilitarianism within socio-ecological studies (Sagoff, 1998). They recognise, for example, that critical ecosystem functions, such as soil development, nutrient cycling and groundwater recharge, are integral parts of the ecosystem's functioning and are essential for the existence of the socio-ecological system, but are not valuable within a utilitarian framework, as their benefits to society are indirect. The ability of the ecosystem to continue to offer services which directly benefit human well-being is inextricably dependent on the sustained value of supporting services that are essentially of value to the ecosystem rather than to the contemporary stakeholder (Howarth and Farber 2002). Furthermore, the utilization and substitution of provisioning services may appear sustainable over a long period, but be enabled by a long-term depletion in the value of supporting services that does not become apparent within the utility of stakeholders until a threshold is surpassed. Kinzig et al (2006) describe the sustained productivity of cereal production in the Western Australian wheatbelt, explaining that replacing natural vegetation with wheat crops is resulting in a rising of the water table and an increase in soil salinity that will eventually pass a critical threshold beyond which it is unproductive.

The political ecology argument emphasises the co-constitution of humans and non-humans and the politicised basis of socio-ecological relations and Resilience Alliance scholars have effectively reconceptualised the socio-ecological system, by emphasizing the intrinsic and multifaceted links between society and ecology (Folke et al., 2004; Walker et al., 2006b). Such concepts are normally difficult to handle within the assessment frameworks typically employed in biophysical and socio-economic studies, which fail to address the socio-ecological basis of ecosystems because of the reliance on a fragmented view of the interdependencies between nature and society. Case studies of adaptation in drylands show how land users or dryland stakeholders substitute the utilisation of certain services, effectively adapting the socio-ecological system in response to external pressures in order to increase system resilience (e.g. Enfors and Gordon, 2007; Adeel and Safriel, 2008). Environmental assessments underpinned by the resilience concept seek to identify critical thresholds within the socio-ecological system, understand the nature of these thresholds, and assess the relative strengths of social and ecological drivers that push and pull the system towards, and away from, them (Holling, 1973; Folke et al., 2004; Walker et al., 2006a). In this way, assessment underpinned by the concept of resilience, moves beyond the problematic concept of weak sustainability, which is inherently utilitarian in nature and requires a separation of the ecological and the social, and instead seeks to evaluate 'the capacity of the system [as a whole] to absorb disturbance (...) and retain essentially the same function' (Walker et al, 2004).

The biggest challenge with a resilience approach to assessment is the amount and diversity of information that is required in order to identify thresholds and understand the interaction between the multiple drivers that push and pull the system. Studies that have adopted a resilience perspective in order to integrate social and ecological assessment find that uncertainty with regards to nature and criticality of thresholds becomes a factor that limits the accuracy of assessment (Olsson et al., 2004; Sallu et al., 2010). In particular, Folke (2006) recognizes the need to clarify system feedbacks and the role of adaptive capacity as being a significant challenge in resilience research.

Implication for Environmental Assessment:
Need to understand complex socio-ecological system processes

2.2. Multiple temporal and spatial scales

Desertification is a complex process that operates at multiple temporal and spatial scales. The processes driving desertification at regional and national scales, such as regional climate change and long-term government policies, can be distinguished from the land management decisions (e.g. crop choice, stocking levels, irrigation practices) and vegetation dynamics that operate at local and finer temporal scales (Xu et al., 2010). However, in terms of cause and effect, these multi-scale processes cannot be easily detached from one another (Sonneveld et al., 2005; Verdoodt and van Ranst, 2006). Reynolds et al. (2007) recognise that slow variables (i.e. those trends that are distinguishable from short term fluctuations and are characterised by thresholds that represent significant changes in system state) should be the predominant focus of environmental assessment. However, although 'slow' variables provide a better indication of

trends and underlying drivers of desertification, accurate modelling and assessment of a dryland system will require engagement with multi-scale processes, such that they incorporate the ways in which slow and fast, and local and global, variables reinforce, counter, or otherwise interact with each other.

The livelihoods of local land users are often critically dependent on the provisions of dryland ecosystem services, but the significance of dryland ecosystems, particularly in terms of cultural heritage and carbon sequestration, is such that the global community also has a stake in the system and concern over the issue of desertification (Safriel and Adeel, 2005). There is also an obvious temporal distinction to make here between contemporary stakeholders, whose primary consideration might be the current provision of ecosystem services, and future generations, concerned with the sustainability and longevity of the system and the maintenance of critical ecosystem functions.

The spatial and temporal scales of assessment are closely interlinked and it is important that they assessment covers all scales relevant to the desertification process. Reynolds and Stafford-Smith (2002) point out that what is considered a 'slow' or 'fast' variable within the socio-ecological system depends on the spatial frame of reference from which it is being considered:

> *'To an individual farmer, bank interest rates are slow variables that affect net disposable income after debt repayments (his fast variables); however, at the national scale, interest rates are fast variables driven by slower structural factors such as export efficiency. Likewise, shrub encroachment may slowly impact the forage production of one paddock, but on a regional scale it may be a fast variable in terms of a nation's total carbon budget, driven by slower land tenure system constraints.'*
> (Reynolds and Stafford-Smith, 2002: 411)

Covering relevant scales requires that environmental assessment is considered from multiple perspectives and that these multiple perspectives can be somehow linked. In reality, this involves considering the nested geographies of an environmental issue, drawing boundaries around the micro, local, regional and global systems and applying top-down characterisation that sees each level as being constrained (or driven) by larger scale processes, and being a constraint on (or driver of) smaller scale processes (Cash and Moser, 2000). Underpinned by this concept of nested geographies, the need to focus predominantly on 'slow' variables of change can be met through independent consideration of the processes at each scale, with the meaning of 'slow' being interpreted relative to the particular frame of inquiry. It is within each of these geographically bounded studies that thresholds, feedbacks and adaptive capacities are identified. By contrast, vertical analysis, the component of assessment that establishes links between these scales, focuses instead on drivers of change and constraints.

Implications for Environmental Assessment:
Need to focus on slow variables of change
Need to integrate multiple scales of analysis

2.3. Conflicting values and interests

The marginal properties of drylands are such that resources, particularly water, are scarce, and system properties operate at the brink of sustainability thresholds. As a result, in dryland management, decisions often involve trade-offs. Rodríguez et al. (2006) provide an excellent overview of trade-offs in ecosystem service management. They cite the example of dryland salinization in Australia to make the point that there is a tendency in management decisions to favour the trade-off of supporting services (such as soil conservation) in order to utilise provisioning services (such as food production). This is essentially a tactic of delaying a trade-off over time, with the negative externalities falling on those stakeholders from future generations. Without a representative voice to express interests and values, future stakeholders often lose out in trade-off management decisions (Rodríguez et al., 2006). In other cases these trade-offs manifest within conflict between alternative contemporary stakeholder values and interests. The classic scenario in dryland management conflict is one in which upstream land-users irrigate their land at the expense of water availability downstream, and conflicts of this nature range from local-level disputes to hostile international relations (Barbier, 2003; Lankford and Beale, 2005; Zeitoun and Allen, 2008). Trade-offs also result from the prioritisation of certain ecosystem services over others. The extraction of fuelwood, for example, might be justified on the value of provision to a particular stakeholder; however it is taken at a cost to those stakeholders concerned with value that the living tree has for carbon sequestration, slope stabilisation, water quality or recreation (Rose and Chapman, 2003).

In cases of conflict and trade-off, hierarchies of power are often demonstrated in the existence of winners and losers. Because of the nature of degraded and vulnerable environments, those whose livelihoods are most dependent on the ecosystem are often vulnerable and living close to the poverty line (Safriel and Adeel, 2005). However, the breadth of groups with a stake in many ecosystems is such that they also includes powerful multinational companies (e.g. Coca Cola in Kaladera, Rajasthan), the tourism industry, and agricultural entrepreneurs. The power of money within conflicts over natural resources has been emphasized within environmental politics literature (e.g. Shiva, 2002), and commentators have recognized that power can be exercised, but hidden in the exclusion of issues from political agendas (Bachrach and Baratz, 1962; Blowers, 1998) or the strategic collectivisation of individuals (Chhotray, 2011). Equally, power has been attributed to certain forms of prioritised knowledge, Wynne (1996) demonstrates that ‘expert’ knowledge often speaks more powerfully to policy makers than does informal or local knowledge, and Baviskar (2007) illustrates how power is exercised through the selective use of knowledge legitimized ‘ecological rationality’, effectively disguising the power-saturated landscape through which this knowledge came to be privileged.

A static understanding of power, one in which it is tied to the identity of actors, however, can disguise its pluralistic properties. Pellizzoni (2001) points out that argumentation, persuasion, and learning can effectively mobilise discourse and have influence over alternative perspectives and values. The plurality of power has been widely studied in the context of large scale protests, and is evidenced through examples of successful social movements and environmental campaign

organisations (Hajer, 1995), however evidence from local level environmental planning remains sparse.

Implications for Environmental Assessment:
Need to integrate multiple stakeholder perspectives and values
Need to ensure that future generations are fairly represented
Need to ensure that less powerful stakeholders are fairly represented

2.4. Diverse and dispersed knowledge

Although a syndromes approach offers a practical pathway for assessing dryland management, it is somewhat difficult to reconcile with a political ecology perspective that emphasizes the multi-scale and multi-stakeholder facets of dryland degradation. The combination of countless social, economic, cultural and environmental factors, operating at multiple scales, which creates a local context for dryland degradation, is such that each individual socio-ecological system is unique (Warren, 2002; Schwich et al, 2009) and is uniquely experienced by the range of people with a stake in it. This presents a problematic reality for the appropriateness of using generic tools in describing desertification. Steering away from complexities of the local scale might lead those adopting a syndromes approach to focus primarily on the broader scale (underlying) drivers of degradation, primarily those of national policies and market forces (Geist and Lambin, 2004) or on generic biophysical processes, as these appear to be the common denominators in an otherwise heterogeneous set of case studies. The reality that such underlying drivers do not in all cases result in degradation (Brown and Havstad, 2004) highlights the fact that sole focus on broad scale analysis is not sufficient for understanding the process.

Local environmental knowledge (LEK) is widely acknowledged today as being a rich and efficient source of information about the intricacies and dynamics of the socio-ecological system at the local scale (Berkes et al., 2000; Folke et al., 2002; Olsson and Folke, 2001). The experiential and context-specific knowledge of local people is often contrasted with the decontextualised and systematic nature of scientific knowledge (Ingram, 2008). As a consequence, some suggest that the two are complementary and contribute equally to a holistic understanding of complex processes (Stringer and Reed, 2007), whereas others argue that reliance on local knowledge compromises the scientific rigour of assessment (Abbot and Guijt, 1997). In fact, Reed et al. (2008) found that there was significant overlap between the knowledge of experts and pastoralists with regards to indicators of degradation in the Kalahari, suggesting that the distinction between scientific and local knowledge may be less pronounced than is often first assumed. In most cases, particularly with regards to ecosystem processes, both forms of knowledge are developed through a combination of systematic investigation and experience (Clark and Murdoch, 1997) and both are subject to uncertainties, assumptions and value judgements. As such, integrating local and scientific knowledge should be considered an exercise in optimizing the knowledge base rather than incorporating alternative knowledges. Particularly in systems where there is uncertainty over the dynamics of the socio-ecological system, integrating the knowledge and experience of local people with that of scientific expertise can effectively bridge knowledge gaps (Failing et al., 2007;

Mackinson, 2001; Stringer and Reed, 2007) and therefore improve the accuracy of system models (for examples see: Campo et al., 2010; Lynam et al., 2010; Mendoza and Prabhu, 2006; Özesmi and Özesmi, 2004; Rouan et al., 2010; Souchere et al., 2010; van Vliet et al., 2010).

It is widely recognised within resilience literature that LEK is essential for building the adaptive capacity of socio-ecological systems (Folke et al., 2002; Olsson et al., 2004). Involving local stakeholders in the early stages of the assessment, therefore, offers greater potential in terms of integrating the design of cooperative management strategies into assessment and improving the quality and durability of these strategies (Reed, 2008). Recent recommendations of the United Nations Convention to Combat Desertification (UNCCD), in particular, emphasize the need to integrate the knowledge of scientists and local land users in dryland assessments, for the purpose of developing adaptive, locally-appropriate and high-compliance management strategies.

Implication for Environmental Assessment:
Need to integrate local and scientific knowledge

2.5. The Challenges of Integrated Assessment in Drylands

The above discussion of the concept of desertification has highlighted several challenges that need to be addressed in order to integrate the assessment of this complex issue. These can broadly be categorised as challenges of integrating: social and ecological system processes, multiple temporal and spatial scales, multiple stakeholder values and experiences, and multiple knowledge bases. For the sake of a more targeted discussion, however, these four challenges can be deconstructed into seven, more practical, requirements:

i. To understand complex socio-ecological system processes
ii. To focus on slow variables
iii. To integrate multiple scales of analysis
iv. To integrate multiple stakeholder perspectives and values
v. To ensure that future generations are fairly represented
vi. To ensure that less powerful stakeholders are fairly represented
vii. To integrate local and scientific knowledge

The virtues and challenges of deliberative environmental assessments will be discussed in relation to each of these criteria.

3. Deliberative Environmental Assessment

The process of deliberation involves the presentation of alternative viewpoints and sharing of knowledge, including local and scientific ecological knowledge, within a group of stakeholders, such that they might become better informed about the complex functions of the social-ecological system and are exposed to alternative experiences of it. From informed positions, stakeholders debate and hold each other to account for the opinions that are expressed and, with an emphasis

on learning, justification and logic, deliberation targets a consensual or democratic outcome (Baber and Bartlett 2005; Owens 2000). Recent studies on deliberative participation suggest that through engagement in a deliberative process that targets 'cooperation, open communication of information, and consensus solutions' (Frame and O'Connor, 2011: 7), small groups of stakeholders are capable of achieving a perspective that looks beyond the utility that they derive as individuals (Owens 2000) and act as informed citizens capable of expressing values based on an understanding of complex system functioning and responsibility to other stakeholders (Baber and Bartlett, 2005; Owens, 2005; Pellizzoni, 2001). Moreover, deliberative assessments are capable of exposing the underlying values and assumptions of stakeholders and have the potential benefit of legitimizing decisions through consensual decision making (Fish et al, 2010).

Dryzek and List (2003: 9) identify four facets of deliberation: 'informational, argumentative, reflective and social' (reproduced in table 1) each of which distinguishes deliberation from the aggregation of individual opinion and makes rational collective choice possible.

Four Aspects of Deliberation	
Informational	*Confronts people with new facts, new information or new perspectives on a given issue, as well as corroborates or falsifies previously believed facts, information or perspectives*
Argumentative	*Draws people's attention to new arguments about the interdependence of issues, confirms or refutes the internal consistency of such arguments, makes explicit previously hidden premises and assumptions, and clarifies whether controversies are about facts, methods and means, or values and ends*
Reflective	*Induces people to reflect on their preferences, in the knowledge that these preferences have to be justified to others*
Social	*Creates a situation of social interaction where people talk and listen to each other, enabling each person to recognize their interrelation with a social group*

Table 1: Four aspects of deliberation described by Dryzek and List (2003: 9)

From a review of deliberative environmental assessments recorded in academic literature, it is possible to identify five broadly defined stages that essentially describe the structure and strategy of such assessments.

1. Identification of environmental resources, stakeholders and stakeholder access in order to establish the boundaries of the socio-economic system (the scope and constraints of the research will be an important influence on these boundaries)
2. Provision of a forum, and employ tools, for knowledge exchange and communication between stakeholders
3. Stakeholder description, and deliberation over alternative descriptions of, the socio-ecological system - this may be done through participatory modelling or qualitative descriptions of key processes and relationships
4. Discussion of trends in system properties and the implications of management strategies (e.g. through the use of scenarios)

5. Participant reflection on the process, focussing particularly on altered perceptions, knowledge and values

Within this structure, a wide ranging and innovative array of methods and tools for deliberative assessment have been conceived, developed, tried and published. This is a consequence of both a lack of precedence within this relatively young area of research and the necessity of designing strategies appropriate to the problem being considered. Therefore, one can find examples of site visits (Prell et al., 2007), role playing games (Vieira Pak and Brieva, 2010) and online forums (O'Connor et al., 2007) used differently to maximise participation and knowledge exchange within projects of different scope and stakeholder diversity. Similarly, modelling tools range from complex quantitative software (Anselme et al., 2010) to qualitative conceptual techniques (Huber-Sannwald et al., 2006) depending on the complexity and scales of the issue, and the capacities of stakeholders and facilitators.

The complex characteristics of desertification reviewed above, highlight the extent of the challenge involved in achieving an integrated assessment of this environmental issue. In the following discussion, the potential of deliberative approaches to environmental assessment to overcome the challenges of integrating social and ecological system processes, multiple temporal and spatial scales, alternative stakeholder values and experiences, and local and scientific knowledge, is considered. A number of tools, methods and studies are referred to in order to illustrate some of the virtues and challenges of deliberative methodologies.

4. The Virtues and Challenges of Deliberative Environmental Assessment

The aim of the following discussion is to critically consider the benefits and challenges of deliberative environmental assessments in meeting seven requirements of integrated assessment in complex socio-ecological systems. By making reference to recent studies and innovations in the use of deliberative assessments, both the virtues and challenges of such an approach are brought to the attention of the reader.

4.1. Requirement I: To understand complex socio-ecological system processes

The bringing together of stakeholders to discuss complex issues, such as uncertainty and adaptive capacity, represents a pooling of local knowledge and experience of the socio-ecological system, and the various knowledge bases that a deliberative approach is able to accommodate are essential for highlighting the intricacies and technicalities of the socio-ecological system relationships, thresholds, trends and indicators. The social and reflective aspects of deliberation are such that it challenges participants to think critically about their role within the social system, and in this sense a deliberative process can be both insightful, in as far as it can represent a condensed snapshot of the social dynamics within the system (Vieira-Pak and Brieva, 2010), and transformative, in as far as it can alter these social dynamics by offering an opportunity for interaction and collaborative problem-solving between stakeholders (Reed, 2007; Stringer et al., 2006). In fact, the deliberative process itself has been used in some research to directly simulate

the socio-ecological system through the use of role-playing games (Souchère et al., 2010; Vieira-Pak and Brieva, 2010).

Participatory modelling is an assessment approach that engages stakeholders in the process of identifying key socio-ecological processes and thresholds and describing the dynamics of the system. Modelling exercises can range from complex, formula-driven descriptions of a system for which participants determine the model parameters and provide input data (e.g. Anselme et al., 2010), to very simple qualitative descriptions of the system based on a few stakeholder-indentified relationships and thresholds (e.g. Huber-Sannwald et al., 2006). Such an approach offers a structured opportunity for deliberation over the nature of key system relationships, the criticality of system thresholds, and the identification of system feedbacks and adaptive strategies (Fish et al., 2010). A special edition of 'Environmental Modelling and Software' published in November 2010 presents a collection of papers about 'Modelling with Stakeholders' in which authors reflect on the application of methodological tools for achieving participatory modelling.

Triangulating and validating model input data is achieved, to a large extent through the deliberative discussions of stakeholders and scientists (Reed et al., 2008; Stringer and Reed, 2007). Biased or false information is unlikely to withstand deliberative interrogation and justifications can be made in reference to observed data, presented as part of the deliberative process. However, the volume and breadth of information a deliberative process generates, means that targeting the information that is most essential for characterising the system can be a challenge (Walker et al., 2006).

4.2. Requirement II: To focus on slow variables

Debating the nature of key processes, and characterising them in relation to smaller/faster and larger/slower system dynamics are essential parts of building a multi-scale model (Osbourne, 2004). The exchange and integration of knowledge is necessary for recognizing both the intricacies and the relative importance of the socio-ecological system dynamics. Focusing on slow variables requires that these dynamics can be condensed into more fundamental relationships, and driving forces of change, at the various spatial scales of analysis, such that policies and management decisions can be clearly targeted.

Targeting consensus in deliberative assessment can result in a focus on those general, and perhaps less contentious, processes in the system. In some cases these will be the slow variables of change, but this is not always the case, as often slow variables of change will be highly contested and complex (Forsyth, 2003). Deliberation over the structure and composition of environmental models, and discussion of the outputs of variant model runs and sensitivity analyses, provide useful ways of deconstructing differences of opinion over the slow variables of the system and identifying the main points of contention. In many cases, it will result from a difference in perspectives drawn from different spatial scale frames of reference. Liu et al (2008) describe the application of a Semi-Arid Hydrology and Riparian Areas Model that integrates three

resolutions of modelling, each of which is defined for a particular purpose and can be individually investigated with specific aims:

> *'A grid size of 100 m at the finest scale was selected so that eco-hydrological understanding and data acquired at the plot-scale (experimental scale) can be properly assimilated into the model; the coarse (sub-watershed) scale modelling effectively addresses institutional and socioeconomic issues and is designed for interfacing with the decision makers; and the medium resolution modelling focuses on engineering and land use/land management issues and serves as a bridge between the other two resolutions'.* (Liu et al, 2008: 853 – describing the structure of the SAHRA Model)

With careful facilitation of the deliberative process, such a modelling approach allows for particular focus on key slow variables relevant to each scale. Whilst structuring deliberation according to each scale of analysis, however, the challenge that remains is to successfully integrate the scales of analysis, so that assessment and management of environmental change is supported, rather than contradicted, across scales of implementation.

4.3. Requirement III: To integrate multiple scales of analysis

Cash and Moser (2000) suggest facilitating communication between scientists and policy-makers (e.g. through neutral forums for discussion) and the establishment of adaptive, iterative and flexible processes as central tenets of a strategy for addressing multi-scale environmental problems. They argue that such strategies 'increase the credibility of participants across scales, and simultaneously better assure the saliency of assessment products for assessment users' (Cash and Moser, 2000: 118).

A deliberative assessment approach allows for the bringing together of a broad range of stakeholders and expert knowledge that is representative of actors and processes at multiple scales, which is key for representing the linkages between scales and building multi-scale management strategies that are sensitive to the complexities and uncertainties of these linkages. Participatory modelling and scenario development represent useful deliberative tools for integrating multiple scales in environmental assessment, allowing for the integration of information that arises from separate discussions about horizontal processes: thresholds, feedbacks and adaptive capacities; and vertical ones: drivers of change and constraints. Multiple scale models allow for a hierarchical linkage of scale processes and knowledges and the outputs produced can present the outcomes of simultaneous inter-scale dynamics and temporal trends.

A scenarios approach has been adopted by EURURALIS (Westhoek et al. 2006), MedAction (Kok et al., 2007) and the MA (Lebel et al., 2006) amongst others. Participatory scenario development is an approach that covers methodological applications ranging from qualitative descriptions of future environments to quantitative model outputs, in all cases, however, stakeholders are engaged in the process of framing, describing and evaluating the scenarios. In developing scenarios the aim is not produce the most accurate description of what a future ecosystem might look like; rather it is to identify system thresholds and future uncertainty and describe multiple

potential futures in relation to them. Scenarios represent useful tools for integrating multiple temporal scales, allowing stakeholders to consider and discuss system processes from the perspective of temporal trends, which they might be creating, contributing to, or mitigating. Integrating a range of temporal scales of analysis in this way is particularly useful for drawing attention to issues of moral responsibility as well as contextualising, highlighting implications, and aligning stakeholder goals in management planning (Reed et al., 2011). The sub-global assessments conducted as part of the Millennium Ecosystem Assessment have generated a number of case studies of participatory scenario development. Although approaches to stakeholder participation within them are not well-documented and the uncertainties considered were typically related to governance, technology and markets, rather than ecological processes and feedbacks (Lebel et al., 2005), the exercise has been reported as being a useful tool in cooperative and adaptive management planning in several of the sub-global locations for which they were conducted.

Cash and Moser (2000) point out that 'perspectives, interests, capacities, and expertise shift as assessment moves from one scale to another and through time'. Providing the opportunity for these multiple perspectives to be presented and considered is the true virtue of the participatory approaches. Where deliberative assessment moves beyond the standard capabilities of participatory approaches, however, is in its focus on the integration of the multiple perspectives and values of stakeholders.

4.4. Requirement IV: To integrate multiple stakeholder perspectives and values

A deliberative approach to integrating multiple perspectives emphasizes convergence through learning and argument. The purpose of the process is not to aggregate disparate views, but rather is to build understanding and mutual respect of alternative perspectives and values amongst stakeholders such that these perspectives might be altered, tending towards a more socially (and perhaps scientifically) acceptable consensus. It may not always be appropriate to target a consensual outcome in deliberation, particularly where non-negotiable positions may be held by participants (Richards et al., 2004) or where such an approach results in a focus on general principles at the expense of intricate system dynamics (van de Kerkhoff, 2006). However, even where a consensus is not reached, the dialogue, in which stakeholders engage, can represent a useful process in terms of generating and validating information, and convergence in perspectives can represent the foundations for improved sustainable and adaptive management, even where disagreements persist (Pearce and Littlejohn, 1997). The opportunity for knowledge exchange and learning, in particular, can change the values of stakeholders that were a result of incomplete or misinformation. Robinson et al. (2008) reflected on their experience of using deliberative citizen's juries to derive a willingness to pay (WTP) for water quality improvements in the Bremer River catchment, Queensland, Australia. They found that citizens juries result in an improved understanding of the proposals on the part of participants when compared with those asked to provide a WTP as individuals, and through statistical analysis they discovered that educational background ceased to be an important determinant of WTP for jury members (Robinson et al. 2008). Liu et al. (2010) apply an integrated Deliberative Multi-Criteria Evaluation (DMCE) approach

to planning the management of invasive species. They found the approach offered the potential to reach an acceptable resolution to the competing goals of multiple stakeholders in the management planning process, as well as adequately tackle issues regarding risk and uncertainty in management planning.

Importantly, by presenting and discussing multiple perspectives, a deliberative approach encourages participants to think beyond their individual stake in the system and appreciate the implications and trade-offs involved in management decisions for the well-being of others (Turnhout et al., 2010). Essentially, it is about encouraging participants to act, and express values, as citizens rather than individuals.

A growing critique of participatory assessment in general, highlights examples of exclusion and strategic manipulation within the process (Baviskar, 2007; Cooke and Kothari, 2001; Dill, 2009; Mosse, 1994). From their study of Village Forest Committees (VFCs) in India, Hildyard et al (2001) claim that the poorest members of a given community were the most likely not be members and that these VFCs would often be dominated by landed elites who could steer discussions to meet their own ends, and Dill (2009) makes a similar argument about formalized community based organisations in Tanzania, which manipulate participatory processes by excluding the majority of community actors and set narrow agendas for consideration. Mosse (1994) points out that the practicalities of participation are often structured around the lifestyles of men, which can vary greatly from those of women, and as a result women will often find that they cannot participate for both practical (e.g. time and distance) and social reasons (e.g. excluded from social allegiances).

Achieving participation that is equal, fair and transparent requires that it is underpinned by a 'philosophy that emphasizes empowerment, equity, trust and learning' (Reed, 2008: 2422), ensuring that marginalized stakeholders (future generations and the less powerful) are fairly represented and involved in framing the agenda, and establishing the objectives, of the participatory process.

4.5. Requirement V: To ensure that future generations are fairly represented

Through scenario development and discussion, participants are encouraged to adopt the perspective of future stakeholders. Where this is done in the absence of a deliberative approach, participants are likely to transpose their understanding of their individual contemporary needs and well-being onto a future identity (Rawls, 2001). However, there is an inherent 'non-identity' problem involved in trying to value future socio-ecological system compositions (Parfitt, 1984). Norton (1982) explains that all interests and rights must be assignable to an individual and all individuals must be identifiable. Although it is morally responsible to consider the needs of future generations, it is methodologically problematic, because the preferences of future individuals are unknown and unknowable. Instead environmental assessments need to incorporate a notion of civic duty towards protecting the options and adaptive capacities of the future socio-ecological system. Sagoff (1988) argues that in order to ensure that certain ideals continue into the future,

we should come to collective societal judgements about what is right. Through facilitating social learning and argument, and emphasizing the justification of values, deliberative assessments provide a means of producing societal judgements.

NGOs or campaign groups are often included within a deliberative process as representatives of future generations, but whether or not this is the case, it is imperative that the deliberative forum is understood as an arena for moral responsibility and the justification of values (Ekeli, 2005). Kenyon et al. (2001) report on a citizen's jury approach to considering management options for forests in the Scottish Borders region. During the deliberative process, explicit statements about responsibility towards future generations, and preserving options and choices, were discussed. The result was that this became a principle around which consensus was formed and on which suggested management options were based.

4.6. Requirement VI: To ensure that less powerful actors are fairly represented

Stakeholder definition and representation in the participatory process often relies on a notion of structured and independent communities, the boundaries of which reflect the definition of an infinite suite of social, economic, cultural, political and religious characteristics and contain a population that is homogeneous in its adherence to them. For the sake of efficiency in identifying ecosystem stakeholders, the tendency will be to categorise groups in accordance with their use of specific ecosystem services, and assume homogeneity with regards to their systems of value. But even where community boundaries are defined from within, the reality is that 'the community is a site of both solidarity and conflict, shifting alliances, power and social structures' (Cleaver 1999: 604). Moreover, any one individual may consider themselves to be a part of multiple communities, defined either by their geography, family, employment, interests, religion, or political views, amongst others. Assumptions about community coherence collectivize the identities of individuals and put up a barrier to their individual agency, disguising marginalization, rather than transforming it. Achieving social equity and a fair deliberative procedure will necessarily involve focusing on securing the citizenship rights of individuals in order to 'challenge existing power relations rather than simply work around them' (Hickey and Mohan 2005: 250).

One approach to neutralising the impact of power relations is to emphasize a shift in focus away from the expression of values based on individual utility, towards the expression of collective or societal values based on what is best for the resilience of the system as a whole. Within economics, value is based on achieving utility goals and is perceived in relation to specific ends and purposes, which means that a thing 'is good for' a particular reason. However, one cannot assume that a socio-ecological system is in pursuit of a particular end-point (Farber et al. 2002). Without a frame of reference and with the potential for multiple steady socio-ecological system states (Folke 2006) a resilience valuation of alternative states must be based on inherent, rather than utilitarian, values and be associated with a judgment of about what is right and legitimate. Making such a judgement will require a combination of detailed knowledge of the processes, interactions and thresholds within the socio-ecological system (Puigdefábregas 1998) and a sense of moral responsibility ensuring that certain ideals continue into the future (Sagoff 1988) and

policies of depletion are avoided (Parfit 1984). The focus of deliberation on challenging and justifying values and promoting civic responsibility provides an integrating concept and common philosophy that sets certain boundaries for discussion. Through internal and collaborative reflection within this frame of reference, alternative values and perceptions can become somewhat organically integrated into a collective understanding, or even a consensus.

Facilitating the participation of marginalized actors will likely require more than simply offering the opportunity. It is necessary to give consideration to the practical accessibility of stakeholder meetings (timing, travelling etc.), the literacy and numeracy capacities of stakeholders, social and cultural norms with regards to the structure and composition of stakeholder groups, and the knowledge and confidence required in order to participate. Deliberative approaches have the capacity to enhance the knowledge of participants through informal means and enhance trust and relationships between participants, through emphasis on social interaction. This can be done in informal ways, Prell et al. (2007), for example, use site visits instead of discussion rooms as a way of neutralising power dynamics within a group of stakeholders that included both local farmers and doctoral students, therefore creating a more level playing field on which stakeholders can participate as equals.

4.7. Requirement VII: To integrate local and scientific knowledge

Both local and scientific knowledge play an informative role in the assessment of complex environmental issues, however, they are often utilised to different ends (e.g. scientific knowledge for describing biophysical processes and local knowledge for discussing management options). A deliberative processes allows for the integration of these knowledge bases such that they contribute to building and debating a holistic pool of knowledge, that can be drawn on in: identifying ecosystem services and stakeholders (Pahl-Wostl and Hare, 2004; Reed et al., 2009), modelling socio-ecological system processes (Anselme et al., 2010; Lynam et al., 2010; Worrapimphong et al., 2010), identifying indicators of socio-ecosystem sustainability (Fraser et al., 2006; Reed and Dougill, 2002; Yuan et al., 2003), discussing scenarios of future ecosystem management (Kok et al., 2007; Lebel et al., 2005; Westhoek et al., 2006), and designing sustainable and adaptive management strategies (Becu et al., 2008; Lagabrielle et al., 2010; Mamun et al., 2010; Pahl-Wostl and Hare, 2004; Reed, 2008; Simon and Etienne, 2010; Walker et al., 2002).

Through the focus on knowledge-sharing in a deliberative approach, local land users can gain access to scientific information on hydrological and ecological processes and may gain greater insight into the mechanics behind the processes that they observe. Similarly, ecologists and hydrologists gain insight into the intricacies of local level processes and greater understanding of how physical laws and biological relationships play out within a real socio-ecological context, through the contributions of local knowledge. The forum for sharing and debating knowledge within a deliberative assessment is open to all relevant knowledge, and each should be given a fair representation within the process. It puts ‘expert’ knowledge under the same scrutiny and critical debate as that of local knowledge, without prioritising one over the other, and requires each

assertion to earn its legitimacy. 'Prevention and Restoration Actions to Combat Desertification' (PRACTICE), a European FP7 research initiative, was created to develop an integrated approach for the monitoring and assessment of dryland restoration and management. The integrated assessment protocol being developed by PRACTICE details a set of expert-led common indicators and an methodology for engaging local stakeholder in the identification of locally appropriate indicators of dryland system health (Bautista et al., 2009). The project approach recognises that local knowledge might play a particular role within the assessment (selecting those indicators that are most relevant to the local context), but doesn't disassociate these from the common sustainability indicators within the assessment protocol – the result being an assessment approach that is both broadly applicable and locally relevant.

By emphasizing integration and focusing on multiple scales of analysis, multiple values and perspectives, and multiple forms of knowledge, a deliberative approach offers a number of benefits in terms of achieving an integrated assessment of complex environmental issues. Overcoming the challenges of deliberation will depend in part on choosing methodological tools that are appropriate to the social context, group dynamics and scope of the assessment. Reed et al. (2008) argue, however, that it is not the selection of participatory tools that will ultimately determine the success of the assessment, but rather it is the quality of the process: the way that group dynamics are handled, the quality of communication and the clarity of purpose and goals.

5. Conclusion

Participants in the UNCCD's 1st Scientific Conference, organized under the theme, 'Bio-physical and socio-economic monitoring and assessment of desertification and land degradation, to support decision-making in land and water management', held in September 2009 concluded that 'integrated assessment models facilitate inclusive, participatory and trans-disciplinary monitoring and assessment and enable decision-makers to pierce through the complexity to understand crucial issues, priorities and tradeoffs' (UNCCD, 2009b). The complexity of desertification, its multiple scales of process and impact and its socio-ecological nature, as well as the marginality and resource-scarcity of dryland environments, means that there are several challenges involved in its assessment. The seven recommendations presented in this paper suggest that the assessment of desertification must be capable of integrating multiple scales of analysis, multiple sources of knowledge and the perspectives of multiple stakeholders in order that the trade-off implications of management decisions can be accurately modelled and communicated, conflict over resources can be addressed, and marginalised stakeholders (including future generations) can be empowered. It is argued here that adopting a deliberative approach to environmental assessment presents real opportunities for successfully meeting these recommendations. A deliberative approach encourages stakeholders to participate in environmental assessment as ecologically-informed citizens rather than self-interested individuals, by emphasizing social learning, argumentation, and critical reflection. Moreover, the interaction between stakeholders that it fosters presents important opportunities for linking assessment to collaborative management planning, and improving the durability, adaptability and legitimacy of emergent policies. Progress in the development of deliberative approaches and methods has been achieved

through necessary creativity and innovation because of the unique properties of each socio-ecological system in which it is implemented. It is hoped that this review will encourage others to take up the challenge of utilising a deliberative approach to environmental assessment in new and creative ways.

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