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# Fate can be changed! Arid rangelands in a globalizing world – A complementary co-evolutionary perspective on the current 'desert syndrome'

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ABSTRACT

Degradation in arid rangelands is an on-going concern, as they appear to be trapped in a vicious circle of desertification–marginalization–impoverishment. Recent theoretical developments in dryland research strive to provide keys to understanding linked social-ecological systems and land management. One approach, the desert-syndrome, depicts the socio-ecological evolution of drylands as being determined mainly by ecological factors. A second approach, the adaptive management paradigm, acknowledges the existence of socio-ecological systems in drylands which are considered to have adapted to a given political–economic context and a given range of economic and ecological variability. This paper proposes a conceptual framework integrating both approaches in order to point out supplementary important drivers of the socio-ecological evolution of drylands systems, especially rangelands at the global economic and political scale. The analysis is broadly conducted from a political ecology and co-evolutionary perspectives and discusses three main factors: (1) world-wide application of western-based paradigms in resource management and their effect on rangelands, (2) the fossil-fuel based Green Revolution, and (3) capitalist institutions used to regulate agricultural trade and the corresponding tools and policies. The marginalization of arid rangelands is avoidable, but requires real changes in the current general political and economic rationale under which resources are allocated.



## 1. Introduction

Desertification is the process of land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities (Reynolds and Stafford Smith, 2002). It is often described as a vicious circle, where poverty, marginalization and desertification are engaged in a positive feedback (Millennium Ecosystem Assessment (MEA), 2005; Essahli and Soukona, 2006). This complex socio-ecological problem is of concern to many countries in all dry regions of the world. At the global scale, arid and semi-arid regions cover more than 40% of the global land surface (Deichmann and Eklundh, 1991), and 72% of the dryland area occurs within developing countries (as opposed to industrial ones; MEA, 2005). This paper focuses on the lot of rangelands (i.e. as grasslands), within drylands (i.e. $0.05 < \text{Aridity Index} < 0.5$; Reynolds et al., 2007), which constitute 65% of global drylands, and thus a quarter of the emerged land mass (MEA, 2005).

Desertification debates have increasingly called forth actions in different domains ranging from research to policy (e.g. Glantz, 1987; Olsson, 1993; Reynolds and Stafford Smith, 2002; Reynolds et al., 2007). Research contributions to the debate with regard to assessment and monitoring dates back to the recent century (e.g. for reviews see Thomas, 1997; Verón et al., 2006). The international interest in addressing the desertification threat was crowned by the United Nations Convention to Combat Desertification held in 1994. Emerging from sustainable rural development and environmental management, advances in the understanding of complex socio-ecological systems – such as rangelands – emphasize the need to integrate human and environmental features in order to understand change processes, e.g. desertification (Berkes and Folke, 1998).

While land degradation can be mapped, physically observed and monitored, this paper claims that land degradation can only be explained and understood at levels where hidden social, political

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and economic structures are analyzed (Andersson et al., 2011). In order to address this claim, we present a political ecology perspective on the problem of marginalization and desertification of arid rangelands. This means that the paper focusses on the interaction among biophysical processes, human needs, and the political-economic context, and in particular, on the role of modernity and capitalism in environmental issues (Forsyth, 2003). In practice, the paper depicts how State (political) development interventions, evolving technologies and their shaping of economic competitiveness and social preferences, as well as the increasing integration of regional into global markets, lead local communities to be trapped in a vicious circle of desertification–marginalization–impoverishment (Robbins, 2004), in the case of the arid rangelands of the world. In particular, we show how arid rangelands as local systems are embedded in the greater political world and economic system, and evolved within this context. Thus, we highlight the co-evolutionary processes between global drivers and local system changes.

Our first objective is to highlight three global political and economic factors, which we consider to have strongly contributed to the marginalization of arid rangelands and their products: (1) world-wide application of western-anchored paradigms in resource management and their effect on rangelands, (2) the fossil-fuel based Green Revolution, and (3) capitalism concepts used to regulate agricultural trade and corresponding tools and policies. Our second objective is to deduce from the analysis opportunities for action in order to break the desertification–marginalization vicious circle.

This work is largely based on literature reviewing and global trade data, and it incorporates examples from our own research in Patagonia (Argentina) and Namibia.

## 2. Degradation as a local problem: existing concepts for the marginalization and degradation of arid rangelands

During the last decade, different attempts aimed at re-conceptualizing complex problems in arid and semi-arid environments (hereafter abbreviated as 'arid') emerged in order to set up priorities for research, policy and management. A first concept to understand complex problems and management was formulated from a rural development perspective and resulted in the 'Less-Favored Areas' (LFA) approach (e.g. summarized in Ruben and Pender, 2004). van Keulen (2006) describes the Less-Favored Areas as limited by biophysical constraints (e.g. low and variable rainfall, poor soils, steep slopes) and/or socio-economic constraints (e.g. limited access to infrastructure and markets, low population density). This perspective introduces the idea that both biophysical and socio-economic determinants shape the development of given areas. However, it implicitly suggests that some characteristics of arid environments are negative or less favorable regarding rural development and thus, sees problems as inherent to the system.

A second perspective rooted in system theory, highlights the fact that local socio-ecological systems (SES) have been adapting to their local conditions (i.e. in drylands especially to variability) over many generations through experimentation and learning by land managers, while being embedded in a particular social and political history (Whitfield and Reed, 2012). Such a process of adaptation has in many cases led to context-specific institutional arrangements conferring a degree of SES robustness, within a given range and type of economic and ecological variability (Janssen et al., 2007). Because of the increasing connection of local and remote SESs with the global economic and governance system promoted by the globalization process, various factors including national governmental policies, technological change and international economic agreements may alter the original range of variability within which the SESs were functioning. This change in context may in turn result in new challenges for the persistence of the SES, or trigger novel adaptations (Janssen et al., 2007; Whitfield and Reed, 2012). A key conclusion is that the global and local political–economic context matters and new adaptive management efforts will need to incorporate different types of knowledge, multiple systems models and new forms of cooperation among stakeholders (McLain and Lee, 1996). However, this approach still fails to show explicitly the linkages between the development paths taken and the influence of the global context.

Third and more specific to drylands research, the 'Dryland Development Paradigm' (DDP) was developed by Reynolds et al. (2007) to help understand linked human–environmental systems, land management and change. It pointed out that SES in drylands are characterized by a unique set of features, which are both necessary and sufficient to structure the analysis of change in drylands. Based on this paradigm, Stafford Smith (2008) developed a new concept, where seven features were determined to be causally linked and act as a consistent 'desert'-syndrome (hereafter called DDP syndrome). The syndrome consists of three features described as causal, namely i) climate variability, ii)scarce resources, iii) sparse population, which influence the four emergent features of iv) remoteness, v) social variability, vi) prevalence of local vs. expert knowledge and vii) cultural differences. The strength of the desert-syndrome is that it provides a holistic perspective by introducing new insights on how these different factors have been interacting in arid regions. However, the main causal features pointed out are biophysical drivers rooted in the ecological system. Thus, the DDP syndrome fails to fully recognize the potential role of key socio-economic drivers in the socio-ecological dynamics and evolution of dryland SESs (e.g. Geist and Lambin, 2002 for tropical regions). Rather, one may interpret the DDP syndrome and resulting desertification as an ecological fatality, as a consequence of the interaction of local to regional processes only.

However, more recent developments challenged the one-way-set of causal links as the only features that shaped drylands, by noting that biophysical drivers may probably first trigger low population and remoteness, but that the socio-ecological self-perpetuating marginalization comes as result of other forces and feedback processes (e.g. Nkonya et al., 2011; Stafford Smith and Cribb, 2009; Stafford Smith and Huigen, 2009).

The present paper contributes to the debate on causes and processes of desertification of rangelands by integrating the DDP syndrome and the adaptive management paradigm within one enhanced conceptual framework in order to identify additional socio-economic key drivers.

## 3. Methodological stance and conceptual contribution: proposition for a social-ecological co-evolutionary desert syndrome

We consider arid rangeland systems as socio-ecological systems. According to Glaser et al. (2008), "a socio-ecological system consists of 'a bio-geo-physical' unit and its associated social actors and institutions. Socio-Ecological Systems (SES) are complex and adaptive, and delimited by spatial or functional boundaries surrounding particular ecosystems and their problem context". An important attribute of SES in this definition is their embeddedness in a given context. Our analysis aims at highlighting how the context affects the evolution trajectory of SESs. It does so by re-interpreting the desert syndrome defined by Stafford Smith (2008) from a political ecology point of view and within a co-evolution framework.