

**ASSESSING THE VALUE OF SOCIO-ECOLOGICAL SYSTEMS THEORY TO THE STUDY  
OF ENVIRONMENTAL MANAGEMENT IN THE FORMER TRANSKEI.**

By  
Herman Timmermans  
Institute of Social and Economic Research, Rhodes University

**Abstract**

The adaptive renewal model has emerged out of environmental science as a new way of thinking about the life-cycles of ecosystems. This model takes a long-term view and recognizes that eco-systems are dynamic and subject to disturbance events. Eco-systems are conceptualised as following a cyclic pathway moving through periods of exploitation, conservation, release and reorganization; depending on the magnitude of the disturbances, and the resilience of the system, disturbances may trigger the collapse of the system ('creative destruction'), leading to new cycles of adaptive renewal. This process of collapse and renewal is thought to underpin the natural functioning of ecological systems in response to an ever-changing environment. The management implication is that ecosystems have to be managed for change, rather than for stability. The inference of this model is that stability is an artificial construct.

A growing number of scholars content that the adaptive renewal model can be extended to social systems, notably those that are geared towards the management of dynamic natural processes. They have shown, in various applications, that an analogous four-phase process shapes the spatial and temporal dynamics of social systems. This paper explores the feasibility of this model in the context of environmental management in the former Transkei.

Three eras of environmental management are identified – the pre-colonial era, the period between annexation and reincorporation, and the post-apartheid era. Stages of the four-phase cycle are identifiable during each era, with the second era corresponding to a complete cycle and the first and third eras corresponding to partial cycles. Social pressure is identified as the primary 'disturbance event' driving change in the system. The paper argues that the adaptive renewal model may indeed be a relevant framework for understanding the longer-term evolution of environmental management systems, although various inconsistencies are noted. The paper ends with a call for more work to be done on the relevance of socio-ecological systems theory to the study of environmental management.

---

**Fort Hare Institute of Social and Economic Research**

**Working Paper No.29**

ISBN: 1-86810-097-9  
Contact: Anne King at [aking@ufhel.ac.za/](mailto:aking@ufhel.ac.za)

## Introduction

Despite much debate over the term itself, there is little doubt that sustainable development has elevated the position of environmental management on the development agenda. Yet, as is increasingly demonstrated, building robust environmental management systems in the context of rapidly changing external conditions, both social and ecological, is not easily achieved. This problematic has led to renewed interest in the study of environmental management institutions, particularly with respect to their internal functioning, their responses to disturbances and to their evolution over time (e.g. Holling 1995, Sanderson 1995, Holling et al. 1998, Holling 2001, Holling & Gunderson 2002, Gunderson et al. 2002). A number of authors argue that, given the inter-relatedness of social and ecological systems, an assessment of environmental management systems needs to be informed by a conceptual framework that bridges the divide between social and natural sciences (e.g. Berkes & Folke 1998, Becker et al. 1999, Costanza et al. 2001, Guha 2001, Martinez-Allier 2001, Holling et al. 2002). Much of this research transcends disciplinary boundaries and takes place under the rubric of ‘social-ecological systems’ (SES) research.

A number of themes underpin the new approach to human-environmental research. These challenge pre-existing ideas about how social and ecological systems work. Key amongst these are:

- the notion that there exist linear pathways of development (in societies or in nature) is replaced by the notion that change is dynamic and multi-directional, and,
- the notion that there exists one fixed modality of stability for every system is replaced by the notion that systems have multiple stable states.

One model being proposed as a common conceptual framework for the study of environmental management institutions is the ‘adaptive renewal cycle’ (Holling 1995, Holling & Gunderson 2002). Developed by natural scientists this model is based on the idea that there are structural similarities between the dynamics of ecological and social systems. Drawing on a range of case studies (e.g. Baskerville 1995, Lee 1995, Gunderson et al. 2002, Peterson, 2002, Walker & Abel 2002), the proponents of the model suggest that social, political and economic systems follow similar pathways of crisis, transformation and renewal to those of ecosystems. Informed by chaos theory (Crutchfield et al. 1986, Gleick 1987), the model is based on the premise that the only constant that can be assumed is that change will occur and that systems will only persist for as long as they are able to resist the disturbances/crises that episodically arise (Carpenter et al. 2001, Holling et al. 2002). The analytical focus, therefore, concerns building a better understanding of institutional vulnerability, resilience and responsiveness to changing environments.

In this paper I use the analogy of the adaptive renewal cycle to analyse the progression of environmental management in the former Transkei, the aim being to assess the utility value of the model to the study of environmental management in this region. Ever since its annexation (and possibly before that), environmental management in the former Transkei has been problematised by a number of factors. Foremost amongst these has been the conflict over natural resources between the state and local communities. Much has been written on the agricultural betterment policies and the levels of resistance with which they were met (Beinart & Bundy 1980, 1987, Moll 1988, Hendricks 1989, McAllister 1989, Spiegel 1992). Apart from betterment, environmental management in this region also comprised the protection of scheduled trees, demarcated forests, water sources, and 'wild' animal and plant resources, both terrestrial and marine (Fay et al. 2002a, 2002b). With a predominantly rural population, conflict between those wishing to implement these protective policies (the state) and those using these resources (communities) has been a dominant theme in the rural politics of the former Transkei since the annexation of the territory.

Three broadly defined eras of environmental management can be discerned. These are the pre-colonial era, the period between annexation and reincorporation, and the post-colonial era. It is demonstrated that the evolution of environmental management systems in the former Transkei display characteristics similar to those suggested by the adaptive renewal model. Three cycles - two partial and one whole cycle - are identified. However, there is some disparity between the theory behind the model and the evidence provided by the case-study particularly with respect to the causality of crisis. The paper ends with an assessment of the value of the model to the study of environmental management in South Africa.

### **The adaptive renewal cycle**

The model proposed by Holling (1995) essentially extends the traditional Clementsian view of ecological succession by incorporating new ideas about succession processes. The traditional view held that for any biogeographical region there existed a fixed ‘climax community’ of vegetation. A disturbance to the

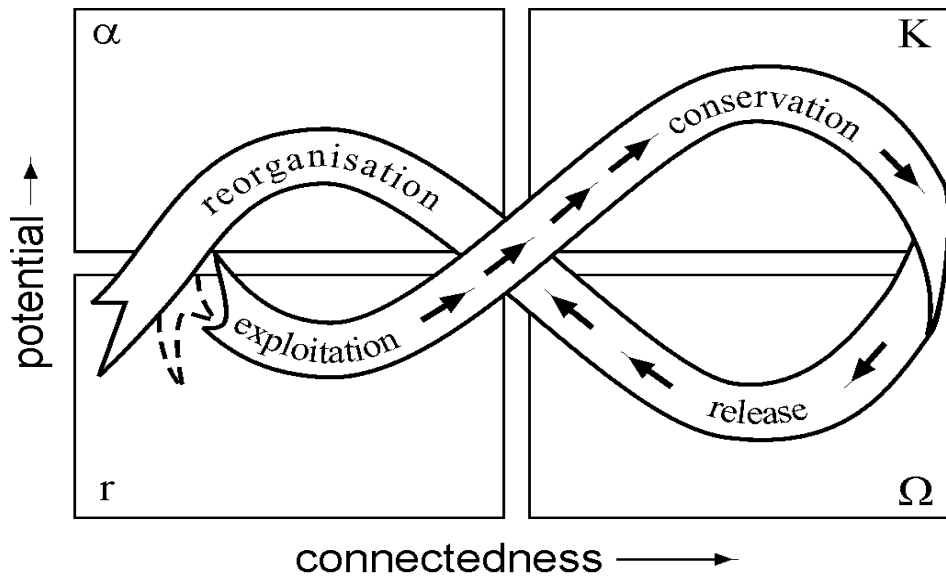


Figure 1 - A stylized representation of the adaptive renewal cycle  
(source: Holling & Gunderson 2002:34)

vegetation cover would lead to a highly ordered sequence of species assemblages, returning with time to the same climax community (Clements 1916, Glen-Lewin et al. 1992). This would include an 'exploitation' phase during which rapid colonization of the recently disturbed area would take place, and a 'conservation' phase, characterised by a reduction in species numbers and a slow accumulation and storage of energy and material (Clements 1916, Holling & Gunderson 2002). Species dominating the exploitation phase (pioneer species) are referred to as r-strategists, while those dominating in the conservation phase are referred to as K-strategists.

The model, depicted in Figure 1, adds two additional phases to this cycle. The first of these, 'release' (alternatively referred to as creative destruction) attempts to describe the phase during which 'climax communities' become increasingly vulnerable to disturbance events due to the tightly bound accumulation of biomass and nutrients, eventually succumbing to agents of change (e.g. fire, drought, insect pests, etc.). The term 'release' refers to the release of stored capital (nutrients, social capital), that takes place during this phase. This phase is referred to as the omega ( $\Omega$ ) phase.

The second additional phase that Holling identifies is the 'reorganization' phase. During this phase, which follows the  $\Omega$  phase above, released capital is reorganised and made available for the next phase of exploitation. It is during this phase that pioneering organisms begin to emerge. In social systems, this phase corresponds with one of innovation and restructuring in an industry or a society, normally

precipitated by economic recession or social transformation (Gunderson et al. 1995). This phase is referred to as the alpha ( $\alpha$ ) phase.

It is conceptually useful to conceive of the omega phase as representing the last phase in the cycle and the alpha phase the first. It is also important to note that, unlike traditional succession models, the adaptive renewal model does not assume a fixed, or predetermined 'climax community'. Rather, it incorporates the new understanding that there can be more than one possible climax state ('multiple states'), and that the trajectory embarked on following a disturbance is determined by the chance interplay of a small number of 'controlling variables' (Holling 1995, Carpenter et al. 2001, McClanahan et al. 2002).

Holling further introduces the concepts of 'connectedness' and 'potential' as axes of the model. Connectedness refers to the process whereby elements within the system become increasingly interconnected (or organised) as systems move from  $r$  to  $K$ . Low connectedness is associated with diffuse elements whose behaviour is dominated by outward relations. They are therefore responsive to outside variability. High connectedness is associated with 'aggregated elements' whose behaviour is dominated by inward relations. These relations between elements mediate the influence of external variability. Potential refers to the potential for change resulting from the accumulation of capital/resources.

Stages in the cycle are temporarily differentiated. Whereas time passes slowly from exploitation ( $r$ ) to conservation ( $K$ ) and throughout the conservation stage, it proceeds very rapidly through release ( $O$ ) and reorganization ( $a$ ) back to the exploitation phase (Holling 1995, Holling & Gunderson 2002). In ecological systems this relates to a slow build-up of nutrients and biomass during the progression from exploitation to conservation. The system eventually becomes so over-connected and tightly bound that it is unable to withstand a disturbance event, and rapid change is triggered. The stored capital is suddenly released and the tight organisation is lost to allow the released capital to be reorganized to initiate the cycle again.

In social systems, temporal differentiation within the cycle is thought to be the product of increasing institutionalisation and formalisation of management systems (Holling & Gunderson 2002). As conventional management systems progress, they often become geared to improving efficiency and routine, a process that often mitigates against institutional learning (Westley 1995). As institutions become increasingly bureaucratic and rigid, it is thought that adaptive capacity (flexibility) is lost and vulnerability to change agents increases (Holling 1995). Institutions can become 'self-fulfilling', i.e. existing with the main purpose of perpetuating their own existence, and connectedness to the dynamics of changing environments outside the system can decrease. This is thought to be particularly true of institutions that develop with the aim of 'stabilising' or 'controlling' ecosystems that are inherently prone to disturbance (see for instance Lee 1995, Light et al. 1995, Carpenter & Cottingham 2002, Walker 2002).

Eventually a crisis arises to which institutions are unable to adapt and the system goes into rapid change (Westley 1995). Accumulated resources are released from their bound, sequestered, and controlled state, connections are broken, and feedback regulatory controls weaken (Holling & Gunderson 2002). Revitalisation, or reorganisation, characterised by individualistic and apparently chaotic behaviour, ensues with new ideas and initiatives circulating (Westley 1995). The system is further characterised by conflict and disorder and there is a general lack of direction. This is a period of rapid change and learning, and a new order begins to emerge once the new insights are formalised into a new vision and are encoded in a new organisational structure (op. cit.).

The model is based on the premise that ecosystems and social systems function in complex, non-linear ways where discontinuous behaviour and structural change are the norm. Thus, unless remedial measures are put in place (e.g. proactively building predictive and/or adaptive capabilities, designing mechanisms to ensure institutional leaning, etc.), systems inevitably become vulnerable to change agents and collapse. Following collapse, they are reorganised to begin the cycle again. The stages of the new cycle remain the same, but the organisation of the elements within the system, e.g. the pattern of internal relations, or the kinds of elements becoming dominant, are likely to differ from the previous cycle (Holling & Gunderson 2002). In addition, there may be a certain amount of leakage of potential/capital as the system goes into a new cycle. Where leakage takes place (e.g. loss of nutrients through soil erosion following a fire, resignation of skilled bureaucrats following transformation), the system may flip into a less productive and organised system (op. cit.).

### **Using the model to interpret the evolution and efficacy of environmental management systems in the former Transkei**

Taking a long-term view, three cycles of environmental management can be discerned beginning in the period prior to colonization up until the present day (Figure 2). The identification of each cycle is based on the effective collapse of the pre-existing system of environmental management and the associated resource destruction that accompanied it. In the sections below, I describe the features of each era of environmental management in terms of the stages depicted in the model and the nature of the crisis that led to its collapse and renewal.

#### **Indigenous systems of environmental management (the pre-colonial era)**

During the pre-colonial era environmental management is understood to have been practiced as part and parcel of indigenous systems of social organisation and governance. It is generally maintained that the indigenous political, judicial and administrative systems of the Cape Nguni were decentralised, with a fairly high degree of local autonomy (Southall 1983, McAllister 1992). As ecological conditions suited the local regulation of resources, it appears that most decisions affecting land-use and production took

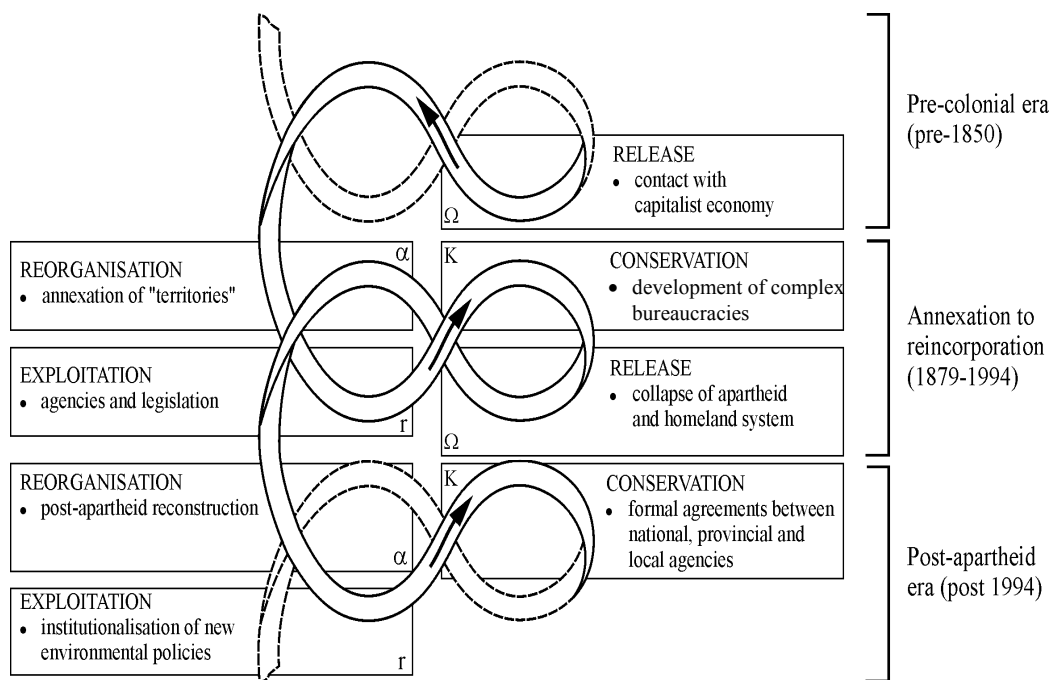


Figure 2 – Using the adaptive renewal model to depict three eras of environmental management in the former Transkei

place at the level of the neighbourhood (or sub-ward) and, if necessary these were ratified by the chief and council of the ward. Only on rare occasions was it necessary for ecological issues to be taken to a higher level of authority (Hammond-Tooke 1975). Certain environmental decisions appear to have been exclusively in the domain of the chieftdomship. These included the hunting of large game, the use of royal forests, access to emergency grazing and decisions to migrate between summer and winter grazing areas. Although documented information on environmental management during this period is limited, it would appear that the indigenous systems of environmental management of the Cape Nguni were fairly robust and well-adapted to their subsistence production requirements. It is, of course, unclear how indigenous institutions would have adapted to land and resource scarcity as a result of increasing population numbers.

While indigenous systems of environmental management appear to have been robust in the face of everyday challenges and crises under the prevailing socio-political order, they were nevertheless vulnerable to the pervading influences of the capitalist economy and the rapid socio-political changes that colonialism brought with it.

**The end of the first cycle of environmental management: penetration of the capitalist economy**

Contact with western societies and the growth of the Cape colony triggered a period of rapid and far-reaching change (release) in the pre-existing indigenous system of environmental management. Burgeoning trade was interspersed with periods of frontier warfare - the former resulting in new kinds of

pressures on natural resources, the latter resulting in population displacements and the disruption of indigenous land-use systems (Peires 1981). A key feature of this period was the uncontrolled exploitation of certain valued natural resources.

The expansion of the colony placed limitations on the territorial expansion of the Cape Nguni and, together with the loss of established territory, resulted in the removal of a key input into the socio-political system, viz. land (Hammond-Tooke 1975, McAllister 1992). Without access to new land, the hiving off of tribes was constrained, and existing land and resources began to come under greater human pressure (Hammond-Tooke 1975). This took place against the backdrop of nearly a century of sporadic frontier warfare, mostly originating in conflict over land, cattle and/or grazing (Mostert 1992).

The period 1750-1850 was characterised by increasing trade in wildlife products and cattle across the frontier (Peires 1981). As part of the trade, hunting parties originating from the colony would enter into the Transkeian Territories to hunt for ivory. Normally this was done with the permission of the chiefs, in exchange for gifts (Peires 1981). The lucrative trade led to an increase in the number of people hunting elephants, such that by 1850, the elephant populations of the forested coastal forelands had become extinct (Peires 1981, Skead 1987).

The valuable timber of the afro-montane and coastal low-land forests in the Transkeian Territories became the target of sawyers from the colony after the state had instituted regulations to control forest exploitation along the southern coast in the Colony (King 1941). There are reports of a number of forests being destroyed and converted to cultivated land during this period (Carlson 1896, Sim 1907, King 1941). Many of the most valuable timber trees had been removed by the time the Cape colonial government took political and administrative control of the territories beginning in 1879 (Henkel 1889).

### **The onset of a new cycle of environmental management ('reorganisation')**

Eventually the inevitability of submitting to the colonial government was reluctantly accepted by the various Xhosa chiefdoms, and between 1879 and 1894 all of the territories making up the Transkeian territories were formally annexed (Southall 1983, Maylam 1986, Mostert 1992). During this period new systems of administration and governance were developed, including the placement of district magistrates who, among their other duties, were tasked with regulating environmental management issues such as tree cutting, the provision of dip tanks and the protection of wildlife (Carlson 1896, Hammond-Tooke 1975, Vermaak & Peckham 1996). The period corresponded with a reconfiguration of the political landscape, the establishment of new systems, and the return of some control, albeit centralised, over unrestrained and commercially driven forms of natural resource use.

The policy that arose was one of ‘indirect rule’ which, according to Mamdani (1996), was about ‘incorporating natives into a state-enforced customary order’. The institution of traditional authorities was left intact, although it was manipulated and modified in ways that increased the control of the colonial administration and decreased the accountability of traditional authorities to the populace (Southall 1983, Ntsebeza 1999).

### **Moving from exploitation to conservation**

An exploitation phase ensued in which new systems of management, and the bureaucratic machinery needed to sustain them, were put in place. With environmental management a policy concern from early on (Southall 1983, Beinart 1984, Hendricks 1989, Beinart & Coates 1995, Fay et al. 2002a), over the next 100 years, the number of agencies and individuals involved in environmental management grew alongside an increasingly complex maze of local bureaucracy (Rogers 1933, Hammond-Tooke 1975, Southall 1983).

As the new systems of environmental management evolved, they became more and more rigid and authoritarian. This period would appear to parallel the movement in the adaptive renewal cycle from exploitation to conservation. Three inter-related phenomena characterised this phase. These were:

- an increase in state involvement in local production systems, either directly through agricultural conservation schemes, or indirectly through the prohibition of certain resource harvesting practices, and through the establishment of protected areas (Hendricks 1989, Fay et al. 2002a, 2002b);
- an increasingly complex web of institutions and reporting channels arose alongside the evolving Transkeian governmental system (Hammond-Tooke 1975, Southall et al. 1992); and,
- an increasingly oppressive and corrupt officialdom tasked with implementing environmental policy (particularly in the period since Bantu Authorities and ‘independence’)(Streek & Wicksteed 1981, Southall 1983, Spiegel 1992; Peires 1992).

Localised resistance to conservation interventions have been recorded as far back as 1913 (Beinart & Bundy 1980) and they continued, albeit sporadically, through the years. However, it was not until a change in the socio-political climate in the late 1980s and early 1990s that disaffected communities gained ‘political capital’ which they could use to effectively oppose unpopular conservation measures. During this time, increasing social resistance meant that unpopular environmental management systems became virtually impossible to implement and environmental management effectively collapsed (Gladwell Mpuhlu, pers. comm. 26/04/1995). A new phase of crisis emerged heralding the end of the prevailing cycle of environmental management.

### **The collapse of the second cycle of environmental management in the former Transkei ('release')**

The second period of 'release' occurred during the political transition from apartheid to democracy between 1991 and 1996. This period was characterized by the incapacitation of environmental management systems as a result of the popular resistance that characterised the political transition. It was also characterised by institutional chaos with respects to all forms of governance (including environmental management) in the provinces (Hauck & Sweijd 1999, Cocks 2000). The institutional 'grid-lock' that ensued within conservation agencies was largely the outcome of the reconfiguration of the administrative landscape, linked to sweeping changes at the political level (Kumleben et al. 1996). This involved, *inter alia*, the geographical reconfiguration of the provinces (from nine to four), the re-absorption of the former homelands and self-governing territories, and the proposed introduction of a new tier of provincial government (not to mention the urgent need to over-haul ineffective and under-resourced local authority structures)(Vermaak & Peckham 1995).

In the newly demarcated Eastern Cape, an over-riding concern was the amalgamation of three formerly independent administrations into one (i.e. Transkei, Ciskei and the RSA). The complexity of the procedures required in achieving such sweeping bureaucratic changes, including the need for new integrative legislation, effectively ham-strung governance in the province. On the environmental front situations arose for which there were no clear policy directives and officials were reluctant to take unilateral action without ministerial approval (Vermaak & Peckham 1995). This was a time of social and political upheaval in South Africa, coinciding with the dismantling of the old apartheid apparatus and its replacement with those of a democratic state.

### **The onset of a third cycle of environmental management ('reorganisation/renewal')**

It was clear that fundamental restructuring would be necessary to reflect the requirements of the new political dispensation. This included, *inter alia*, the incorporation of the bantustan administrations. In the newly formed Eastern Cape province, this required the amalgamation of three, formerly separate, environmental management agencies. Institutional restructuring was necessary at all levels, and new ideas, such as affirmative action, voluntary severance packages, and skills transfer programmes, arose as potential mechanisms to facilitate the process (Daily Dispatch 17/10/1998; Mail & Guardian 6-12/08/1999).

It was not until 1998, however, that advances were made with respect to the grid-lock within environmental management agencies. This was facilitated by the passing in that year of a number of new national environmental policies, such as the National Forests Act (No. 4 of 1998) and the National Environmental Management Act (No. 107 of 1998). A watershed year with respect to in environmental legislation in South Africa, 1998 could be equated with a transition from reorganisation to exploitation in

the adaptive renewal cycle. Further evidence that we are now in a phase of early exploitation can be seen from the clarification and formalisation of jurisdictional arrangements between national and provincial conservation agencies that is currently taking place (Eastern Cape Department of Economic Affairs, Environment and Tourism. Directorate of Nature Conservation 2002).

## **Discussion**

From the above it would appear that the adaptive renewal model fits fairly well with the experiences of environmental management in the former Transkei viewed over the long-term. In this sense it provides a useful conceptual framework for understanding processes of change. However, the fit is not perfect and a number of points require further discussion.

First, in the case-studies cited by the proponents of the adaptive renewal model, crises in environmental management institutions are normally the result of an institution's inability to stem negative changes in ecosystems that lead to a loss in productivity of valued resources. However, in the case of the former Transkei, the crises were more the product of social resistance to overly restrictive environmental policies, rather than to the inability of institutions to effectively manage ecosystems. Put another way, the 'environmental crisis' in this case was more of a social crisis, rather than an ecological crisis.

Second, the former Transkei case-study shows that while environmental management systems seek to manage ecological and social systems, they are not necessarily informed by the internal dynamics of either of these systems. Rather, as has been pointed out by Melissa Leach and Robin Mearns (1996) they are often based on received wisdoms and non-factual perceptions of environmental change. For instance, the perceived destruction of the Transkeian grasslands due to over-stocking has not stood up to empirical analysis (Shackleton 1993). Similarly the colonial conviction that the area covered by indigenous forests in the former Transkei had declined dramatically since human habitation and that consequently traditional local land-use practices posed a threat to their continued existence, does not match the archaeological record (McKenzie 1984, Feely 1987, Ellery & Mentis 1992).

Third, being socially constructed, understandings of environmental change differ amongst actors. In the case of the former Transkei, local people and conservation scientists rarely share a similar understanding of the dynamics of ecosystems, particularly with respect to the impact of human activities.

Two principle lessons emerge from the application of 'systems thinking' to environmental management systems in the former Transkei region. The first is that environmental management systems are inevitably sub-systems within larger political systems. As has been demonstrated in this case-study, the persistence of environmental management systems is closely related to the fluctuating fortunes of these broader political systems. This has particular relevance to developing countries where political instability is the

norm. In these situations, as in the case-study, socio-political factors, rather than ecological factors, are likely to constitute the key agents of release and renewal in systems of environmental management.

The second is that while pre-capitalist or 'traditional' systems of environmental management may be well-adapted to the requirements of prevailing socio-ecological systems, they can be vulnerable to pressures emanating from globalising forces. In the past such forces took the form of the colonialism. In modern times they are normally associated with market liberalisation and structural adjustment programmes (Bryceson 2002), or political reform as in the case of South Africa.

What, then is the utility value of the adaptive renewal model to the study of environmental management? These questions are best approached through a discussion of the model's strengths and weaknesses.

#### *Strengths of the model*

Analysis based on the model:

- encourages a trans-, or interdisciplinary approach to the study of sustainable development. In this sense it is an integrative, rather than a fragmentary, theory that helps us to make sense of a complex reality.
- encourages a view of institutional systems as open and evolutionary, with uncertainty as a central conceptual issue of design.
- encourages a move away from traditional bureaucratic entities toward more 'adaptive' institutions that focus on innovating, on reviewing assumptions, and on building skills of reflection.

#### *Weaknesses*

- To apply what is essentially a model of ecological processes to the analysis of social systems may be overly deterministic. How does the model accommodate the capacity of humans for learning, innovation and reflection?
- The model suggests that institutions are inevitably locked-in to a pathology of 'boom and bust'.
- In attempting to transcend disciplinary boundaries the model is perhaps overly general. As a result its utility value may be compromised.
- An underlying assumption of the model is that crises should be avoided through becoming more adaptive and resilient. Yet, system collapse should not always be negatively viewed - it may be that collapse and renewal are necessary to create system robustness.
- The model does not adequately account for situations in which the driving forces for change in environmental management systems are the result of broader socio-political processes of which environmental issues may only be a small part.

## **Implications for environmental management**

If we accept the model as a valid representation of a pathology within environmental management systems then the following practical implications arise.

- To improve their efficacy, environmental management systems need to become adaptive to the dynamic nature of socio-political environments. In the rural areas of developing countries where poverty levels are often high, resilience can be developed by designing environmental management systems to complement, rather than inhibit rural livelihoods and well-being. Such an approach will serve to legitimise environmental management systems and foster cooperation, rather than resistance, among affected communities.
- Resilience can further be promoted by ensuring that the information base upon which decisions are taken is informed by an effective programme of research and monitoring. In addition to the established pattern of focusing on the ecology of biophysical resources, research and monitoring needs to incorporate a strong focus on understanding rural livelihoods. Monitoring systems should be able to identify trends in rural livelihoods early on to ensure that environmental management systems remain responsive to the changing circumstances affecting rural environments and the poor.
- Lastly, greater emphasis on the decentralisation of management systems and local participation can promote higher-levels of institutional flexibility and responsiveness. The new 'joint' institutions of environmental management that have arisen as a result can provide an important mechanism through which to improve the flow of information between resource users and managers, enabling managers to remain abreast of the needs and aspirations of rural communities. At the same time they constitute a forum through which stakeholders can debate and negotiate locally relevant paths to sustainable development.

## **Conclusion**

The fact that the adaptive renewal model finds resonance with a range of situations and processes across disciplinary divides may have more to do with the fact that it approximates a tautology of birth, growth, maturity and death. Thus, from an analytical perspective it may be more useful to identify situations where the model does not apply, rather than to those in which it does.

No firm conclusions could be reached with respect to the model's utility value to the study of environmental management systems. However, as with all trans-, or inter-disciplinary research frameworks, the model throws up a series of analytical challenges, some of which have been alluded to

here. My feeling is that in as much as the model provides a fairly accurate representation of a complex reality, albeit at a general level, it provides an alternative conceptual framework to add to those more traditionally associated with the study of environmental management, e.g. political ecology, historical research, technico-legal research. Given the sustainable development problematic with which we are faced, and the difficulties of researching complex systems of human and nature, I believe that alternative frameworks that aim to integrate rather than fragment, are dearly needed. On this basis alone the model is worthy of further exploration.

#### References

- Baskerville 1995. The forestry problem: Adaptive lurches of renewal. In L. Gunderson, C. Holling and S. Light (Eds.), *Barriers and bridges to the renewal of ecosystems and institutions*. New York: Columbia Univ. Press, 37-102.
- Becker, E., Jahn, T. & Stiess, I. 1999. Exploring uncommon ground: Sustainability and the social sciences. In E. Becker and T. Jahn (Eds), *Sustainability and the social sciences. A cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. New York: Zed Books, 1-22.
- Beinart, W. 1984. Soil erosion, conservation and ideas about development: a Southern African exploration. 1900-1960. *Journal of Southern African Studies*, 11(1).
- Beinart, W. & Bundy, C. 1980. State intervention and rural resistance: The Transkei, 1900-1965. In M. Klein (Ed.), *Peasants in Africa. Historical and contemporary perspectives*. California: Sage.
- Beinart, W. & Bundy, C. 1987. *Hidden struggles in rural South Africa: politics and popular movements in the Transkei and Eastern Cape, 1890-1930*. Berkeley: University of California.
- Beinart, W. & Coates, P. 1995. *Environment and history: the taming of nature in the USA and South Africa*. London: Routledge.
- Berkes, F. & Folke, C., Eds. (1998). *Linking social and ecological systems*. London: Cambridge University Press.
- Bryceson, D. 2002. The scramble in Africa: Reorienting rural livelihoods. *World Development*, 30(5), 725-739.
- Carlson, K. A. 1896. Forestry in the Transkei. *Agricultural Journal of the Cape of Good Hope*, 9(12), 303-306 contd 334-337.
- Carpenter, S., B. Walker, M. Anderies, and N. Abel. 2001. From metaphor to measurement: Resilience of what to what? *Ecosystems*, 4, 765-781.
- Carpenter, S. R. & Cottingham, K. L. 2002. Resilience and the restoration of lakes. In L. H. Gunderson and L. Pritchard Jr (Eds.), *Resilience and the behaviour of large-scale ecosystems*. Washington: Island Press, 51-70.

- Clements, F. E. 1916. Plant succession: An analysis of the development of vegetation. Publication of the Carnegie Institute of Washington, 242, 1-512.
- Cocks, M. 2000. Empowering communities to manage natural resources: Where does the power lie? Fish River case study, Eastern Cape, South Africa. In S. Shackleton and B. Campbell (Eds.), Empowering communities to manage natural resources: Case studies from South Africa. Lilongwe: SADC Wildlife Sector - Natural Resources Management Programme.
- Costanza, R., Low, B. S., Ostrom, E. & Wilson, J. 2001. Ecosystems and human systems: a framework for exploring the linkages. In R. Costanza, B. S. Low, E. Ostrom and J. Wilson (Eds.), Institutions, ecosystems and sustainability. London: Lewis Publishers, 3-20.
- Crutchfield, J., Doynne Farmer, J. & Packard, N. 1986. Chaos. Scientific American, 255(6), 46-57.
- Eastern Cape Department of Economic Affairs, 2001. State forests managed by the province of the Eastern Cape. Draft. Bisho: Eastern Cape Provincial Government.
- Ellery, W. N. & Mentis, M. T. 1992. How old are South Africa's grasslands? In P. A. Furley, J. Procter and J. A. Ratter (Eds.), Nature and dynamics of forest-savanna boundaries. London: Chapman & Hall.
- Fay, D., Timmermans, H. & Palmer, R. 2002a. Competing for the forests: Annexation, demarcation and their consequences c. 1878 to 1936. In R. Palmer, H. Timmermans and D. Fay (Eds.), From conflict to negotiation: Nature-based development on the South African Wild Coast. Pretoria: HSRC & ISER, 48-77.
- Fay, D., Timmermans, H. & Palmer, R. 2002b. Closing the forests: Segregation, exclusion and their consequences from 1936 to 1994. In R. Palmer, H. Timmermans and D. Fay (Eds.), From conflict to negotiation: Nature-based development on the South African Wild Coast. Pretoria: HSRC & ISER,
- Feely, J. M. 1987. The early farmers of Transkei, Southern Africa : before A.D. 1870. Oxford: B.a.R.
- Gleick, J. 1987. Chaos: Making of a new science. New York: Viking.
- Glenn-Lewin, D. C., Peet, R. K. & Veblen, T. T. 1992. Plant succession: Theory and prediction. London: Chapman and Hall.
- Guha, R. 1999. From experience to theory: Traditions of socio-ecological research in modern India. In E. Becker and T. Jahn (Eds.), Sustainability and the social sciences. A cross-disciplinary approach to integrating environmental considerations into theoretical reorientation. New York: Zed Books, 96-111.
- Gunderson, L.H, Holling, C. S. & Light, S. S. 1995. Barriers broken and bridges built: A synthesis. In L. H. Gunderson, C. S. Holling and S. S. Light (Eds.), Barriers and bridges to the renewal of ecosystems and institutions. New York: Columbia Univ. Press, 489-582.

- Gunderson, L. & Holling, C., Eds. (2002). *Panarchy: understanding transformations in human and natural systems*. Washington (DC): Island Press.
- Gunderson, L., Holling, C. & Peterson, G. 2002. Surprises and sustainability: Cycles of renewal in the Everglades. In L. Gunderson and C. Holling (Eds.), *Panarchy: understanding transformations in human and natural systems*. Washington (DC): Island Press, 315-332.
- Hammond-Tooke, C. J. 1975. *Command or consensus: The development of Transkeian local government*. CT: David Philip.
- Hauck, M. & Sweijid, N. A. 1999. A case study of abalone poaching in South Africa and its impact on fisheries management. *ICES Journal of Marine Science*, 56, 1024-1032.
- Hendricks, F. T. 1989. Loose planning and rapid resettlement: The politics of conservation and control in Transkei, South Africa, 1950-1970. *Journal of Southern African Studies*, 15(2), 306-327.
- Henkel, C. C. 1889. Report on Crown Forests in the Transkeian Territories or Kaffraria proper, with rough sketch map. In Report of the Superintendent of Woods and Forests 1888. G.29 of 1889. Cape Town: Cape of Good Hope Government.
- Holling, C. 1995. What barriers? What bridges? In L. H. Gunderson, C. S. Holling and S. S. Light (Eds.), *Barriers and bridges to the renewal of ecosystems and institutions*. New York: Columbia Univ. Press, 3-33.
- Holling, C., Berkes, F. & Folke, C. 1998. Science, sustainability, and resource management. In F. Berkes and C. Folke (Eds.), *Linking social and ecological systems: Management practices and social mechanisms for building resilience*. Cambridge: Cambridge University Press, 346-366.
- Holling, C. & Gunderson, L. 2002. Resilience and adaptive cycles. In L. Gunderson and C. Holling (Eds.), *Panarchy: understanding transformations in human and natural systems*. Washington (DC): Island Press, 25-62.
- Holling, C. S. 2001. Understanding the complexity of economic, ecological, and social systems. *Ecosystems*, 4, 390-405.
- Holling, C. S., Gunderson, L. H. & Ludwig, D. 2002. In quest of a theory of adaptive change. In L. Gunderson and C. Holling (Eds.), *Panarchy: understanding transformations in human and natural systems*. Washington (DC): Island Press, 3-24.
- King, N. L. 1941. The exploitation of the indigenous forests of South Africa. *Journal of SA Forest Association*, 6.
- Kumleben, M., Ledger, J. & Sangweni, S. 1996. *Board of Investigation into the Institutional Arrangements for Nature Conservation in South Africa*. Pretoria: DEAT.
- Leach, M. & Mearns, R. 1996. *The lie of the land: Challenging received wisdom on the African environment*. Oxford: James Currey.

- Lee, K. 1995. Deliberately seeking sustainability in the Columbia River Basin. In L. Gunderson, C. Holling and S. Light (Eds.), *Barriers and bridges to the renewal of ecosystems and institutions*. New York: Columbia Univ. Press, 214-238.
- Light, S., Gunderson, L. & Holling, C. S. 1995. The Everglades: Evolution of management in a turbulent ecosystem. In L. Gunderson, C. Holling and S. Light (Eds.), *Barriers and bridges to the renewal of ecosystems and institutions*. New York: Columbia Univ. Press, 103-168.
- Mamdani, M. 1996. *Citizen and subject: Contemporary Africa and the legacy of late colonialism*. Cape Town: David Phillip.
- Martinez-Alier, J. 1999. The socio-ecological embeddedness of economic activity: The emergence of a transdisciplinary field. In E. Becker and T. Jahn (Eds.), *Sustainability and the social sciences. A cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. New York: Zed Books, 112-140.
- Maylam, P. 1986. *A history of the African people of South Africa : from the early Iron Age to the 1970s*. Cape Town: David Philip.
- McAllister, P. 1989. Resistance to 'betterment' in the Transkei: a case study from Willowvale district. *Journal of Southern African Studies*, 15(2), 346-368.
- McAllister, P. A. 1992. Rural production, land use and development planning in Transkei: a Critique of the Transkei Agricultural Development Study. *Journal of Contemporary African Studies.*, 11(2), 200-222.
- McClanahan, T., Polunin, N. & Done, T. 2002. Ecological states and the resilience of coral reefs. *Conservation Ecology*, 6(2), 18.
- McKenzie, B. 1984. Utilisation of the Transkeian landscape - an ecological interpretation. *Ann. Natal Mus.*, 26(1), pp 165-172.
- Moll, T.C. 1988. *No blade of grass: Rural production and state intervention in Transkei, 1925-1960*. Cambridge African Occasional Papers No. 6.
- Mostert, N. 1992. *Frontiers: the epic of South Africa's creation and the tragedy of the Xhosa people*. New York: Knopf.
- Ntsebeza, L. 1999. *Land tenure reform, traditional authorities and rural local government in post-apartheid South Africa*. Bellville: Programme for Land and Agrarian Studies, University of the Western Cape.
- Peires, J. B. 1981. *The house of Phalo : A history of the Xhosa people in the days of their independence*. Johannesburg: Ravan Press.
- Peires, J. B. 1992. The Implosion of Tranksei and Ciskei. *African Affairs*, 91, 365-387.

- Peterson, G. D. 2002. Forest dynamics in the Southeastern United States: Managing multiple stable states. In L. H. Gunderson and L. Pritchard Jr. (Eds.), *Resilience and the behaviour of large-scale ecosystems*. Washington: Island Press, 227-248.
- Rogers, H. 1933. *Native Administration in the Republic of South Africa. A brief survey of the organisations, functions and activities of the Department of Native Affairs of the Union of South Africa*. Johannesburg: Wits Press.
- Sanderson, S. E. 1995. Ten theses on the promise and problems of creative ecosystem management in developing countries. In L. H. Gunderson, C. S. Holling and S. S. Light (Eds.), *Barriers and bridges to the renewal of ecosystems and institutions*. New York: Columbia, 375-390.
- Shackleton, C. M. 1993. Are the communal grasslands in need of saving? *Development Southern Africa*, 10(1), 65 - 78.
- Sim, T. R. 1907. *The forests and forest flora of the colony of the Cape of Good Hope*. Aberdeen: Taylor & Henderson.
- Skead, C. J. 1987. *Historical mammal incidence in the Cape Province. Volume 2. The Eastern half of the Cape Province, including the Ciskei, Transkei and East Griqualand*. Cape Town: The Chief Directorate Nature and Environmental Conservation of the Provincial Administration of the Cape of Good Hope.
- Southall, R. 1983. *South Africa's Transkei. The political economy of an "independent" bantustan*. New York: Monthly Review Press.
- Southall, R., Segar, J. & Donaldson, A. 1992. Transkei beyond the transition: Towards good government or back to the frontier. *Journal of Contemporary African Studies*, 11(2), 270-279.
- Spiegel, A. 1992. A trilogy of tyranny and tribulation: Village politics and administrative intervention in Matatiele during the early 1980s. *Journal of Contemporary African Studies*, 11(2), 31-54.
- Streek, B. & Wicksteed, R. 1981. *Render unto Kaiser*. Braamfontein: Ravan Press.
- Vermaak, M. & Peckham, B. 1996. *Towards integrated natural resource management at Dwesa-Cwebe nature reserve & adjacent communal land: A preliminary survey of the legal history of the reserve, current legislation, & the legal rights & obligations of interested parties. Section One - Commentary*. Unpublished report. Grahamstown: Rhodes University.
- Walker, B. & Abel, N. 2002. Resilient rangelands - Adaptation in complex systems. In L. Gunderson and C. S. Holling (Eds.), *Panarchy: understanding transformations in human and natural systems*. Washington (DC): Island Press, 293-314.
- Westley, F. 1995. Governing design: The management of social systems and ecosystem management. In L. Gunderson, C. Holling and S. Light (Eds.), *Barriers and bridges to the renewal of ecosystems and institutions*. New York: Columbia Univ. Press, 391-427.

