Active Learning for Understanding Land Degradation: African Catchment Game and Riskmap.

KM Rowntree and RC Fox

Department of Geography, Rhodes University, South Africa

k.rowntree@ru.ac.za; r.fox@ru.ac.za

Abstract

Land degradation is the result of the intersection of a complex set of biophysical and socio-economic factors. The capacity of an individual or community to address land degradation is likewise constrained. While it is quite possible for professionals and learners to grasp the main issues around land degradation from a theoretical perspective, internalizing the reality of what it means to be the resource degrader is more difficult. We have developed two active learning methods that aim to address this problem. The first is the African Catchment Game, a role-playing game based on Graham Chapman's Green Revolution Game, adapted for the southern Africa context and incorporating a land degradation component. In this game participants play out the complex dynamics of rural-urban-global linkages against a background of environmental hazards. The second is based on Save the Children Fund's RiskMap computer simulation that models risk in terms of rural livelihoods for different income groups. Ethiopia is used as the example. This paper evaluates the two active learning techniques as tools for exploring the relationships between land degradation and poverty through an evaluation of participants' experiences.

KEY WORDS

constructivist teaching pedagogy, curriculum design, rural development, Africa, complexity, role play, livelihood strategies, development practitioners

ACRONYMS

ACG African Catchment Game, RPG Role Playing Game

Introduction

Land degradation through soil erosion has long been recognised as an environmental problem caused by inappropriate farming practices. As early as 1939 Bennett produced his book on soil conservation (Bennett 1939), no doubt in response to the perceived global land degradation of the 1930s. Jacks and Whyte's "Rape of the Earth: a world survey of soil erosion" was published in the same year (Jacks and Whyte 1939). Nearly 50 years later the problem was still with us, but the academic paradigm was changing. In 1987 Blaikie and Brookfield developed the concept of the political economy of soil erosion (Blaikie and Brookfield 1987), while more recently Gray and Moseley (2005) talk about the political ecology of soil erosion. The concepts of political economy or political ecology arose from the realisation that technical solutions on their own are ineffective and that we need to understand the socio-economic and political factors that underlie degradation. Although our

intellectual understanding of land degradation has expanded to encompass its biophysical and socio-political dimensions, the problem seemingly remains as intractable as ever.

The question that this paper starts with is 'Why, with so much research effort devoted to land degradation problems, are we still so far from a universal panacea? Are we misunderstanding the process of soil erosion, or are we inept at applying the correct solutions?' We start with the premiss that the will and capacity to utilize land in a sustainable manner depends on a complex group of interacting factors that can be difficult to unravel. This is well summed up Campbell *et al.* (2002) in their review of household livelihoods in semiarid regions where they stated that: "Any simple model of change...is severely limited when confronted with the complexity or rural production systems, with their multiple pathways of change and multiple causalities" (Campbell *et al*. 2002 Executive Summary pp. xiii).

Attempts to address the problem of land degradation often come through the efforts of outside agencies who advise farmers and other land users on sound soil conservation practices. If development practitioners or conservationists are to promote effective policies that sustain land productivity rather than promote land degradation, the practitioner needs to be able to empathize with the real decision makers - those who live on the land and make decisions about the use of its resources. Likewise, erstwhile practitioners, students who study land degradation, need to experience the decision making process of the resource users if they are to understand and theorize about the causes and consequences of land degradation and the potential for soil conservation. With this background in mind, this paper reflects on the outcomes of a course that we have developed at Rhodes University in South Africa which has the expressed aim of increasing student awareness of the complexity of the rural livelihoods and implications for land degradation in rural Africa.

Evolution of teaching pedagogy

At Rhodes University we have developed a course that has a core objective of giving our students the experience of being decision makers in the rural economy. The course has an interesting history that explains our own changing understanding of the land degradation problem. The course is offered at Honors level; this is the year following the completion of a three-year Bachelors degree. These are students who are likely to use their geographical training in some professional context. In 2002 we were teaching two courses: 'Rural development' and 'Land degradation'. We recognized that there were common areas; for students to recognize land degradation problems they needed to understand rural development issues and vice versa. We therefore started a combined course called 'Rural development and land degradation' in 2003. The course took a political ecology approach to land degradation, with a strong emphasis on the positive and negative outcomes of rural development policies, political agendas and so on.

Finally in 2005 we renamed the course to reflect its philosophy more accurately. It has become known as ‘Rural economy and land utilization in Africa (RELUA).’ This name recognized that a) rural areas may not be ‘developing’ in any real sense b) rural economy implies the importance of livelihoods, making a living and c) resource utilization may be both destructive (degradation) or constructive (conservation). Focussing on degradation alone seemed to be too negative.

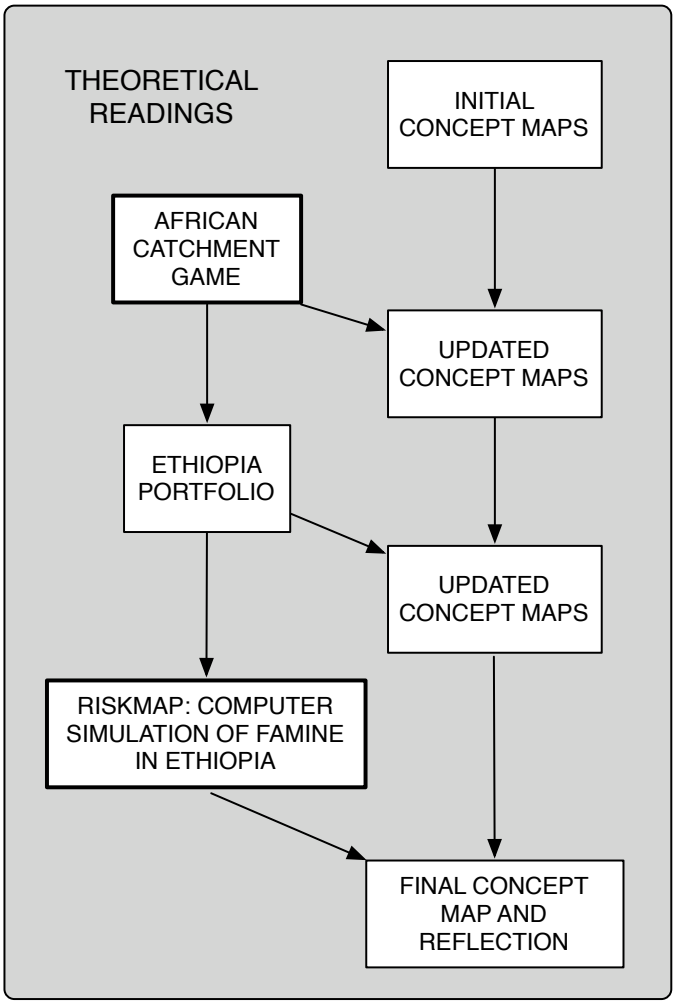

Figure 1: The structure of the Rural Economy and Land Utilization course, 2004.

To support student learning in this course we employ a number of constructivist learning activities. According to Rovai (2004), constructivism is learning through experience and involves the core components of experience, knowledge construction, reflection and sharing. The course structure is shown in Figure 1. We do not teach in the traditional sense, but rather allow students the opportunity to learn through experience (Fox and Rowntree 2004). Two of the learning activities are described here. The first is a role-playing game (RPG) "The African Catchment Game" and the second is a computer simulation "RiskMap". While the role playing game immerses the learners into a 'real' situation in which their decisions can have far reaching, but often unpredictable consequences, RiskMap allows learners to be more analytical in exploring how different groups of people in a rural society respond to a range of environmental situations.

The value of both activities were enhanced by being embedded within a course that is structured to provide a supportive framework for learning (Figure 1). For example RiskMap is backed up by an activity in which the learners compile a portfolio on the geography of Ethiopia, are given journal readings on original research and exposed to images of Ethiopia through DVDs, travel books and so on. Throughout the course the students developed their own concept maps that portray their understanding of the rural economy and resource utilization in Africa. The final map is accompanied by a written reflection that explains how the map developed through the different course activities. These maps proved to be a useful tool by which we as teachers could assess the development of the students understanding.

Our philosophy is based on the Active Learning paradigm which, as Ramos (2005) notes, has as its core collaborative learning for social change. He notes that *"In this age of heterogenous changes and multi-fold social challenges, we need to be able to bridge learning about our futures with action and innovation in the present, in a way that is effective and accessible for lay communities and organisations, not just experts."* Ramos 2005 p. 83. Through this course our students are the lay communities who may, through their professional careers, come to guide the futures of rural Africans.

The Africa Catchment Game

The African Catchment Game was developed from Chapman's Green Revolution Game and Exaction (Chapman and Tsakok 1984, Chapman 1987). These games were developed by Chapman in the 1980s to highlight the the importance of decision making by rural peasants in India. The initial game (Green Revolution) was based on a simple rural economy. At the behest of the World Bank this was developed into a more complex whole country game (Exaction). According to Chapman and Tsakok (1984), both games incorporate a similar set of dimensions: a dynamic physical environment, agronomy, society, politics, economies.

We have taken the game of Exaction and modified some of the basic parameters so as to more closely model the southern African situation. Key changes include the incorporation of a large-scale commercial farming sector, complete with starting assets and debt, cattle and HIV-AIDS. We also introduced a simple land degradation/soil conservation process. In the original game productivity would remain static unless increased through fertilizer application. Fertility would not decline. In our version we introduced a more dynamic process through which fertility could either decrease or increase depending on agricultural practices as follows:

- Continuous cultivation leads to a drop in soil fertility that is delayed but not prevented through the use of inorganic fertilizer;
- Fertility can be maintained through regular fallowing;
- Organic manure (from livestock) improves the long-term soil fertility.

This simple model was designed to encourage students to ask the following questions:

- What are the biophysical requirements for sustaining soil fertility?
- What are the long-term economic effects of poor farming practice that leads to a drop in productivity?
- What conditions, experienced by households from the different socio-economic groups, would act as incentives and constraints to the practice of soil conservation?

Playing the game

Playing the game as part of the RELUA course routinely follows a five step process. Prior to the game the participants are given a set of readings about game playing. The various aspects of the game, its basic rules, progression and nature of the physical pieces used are explained to the players in a classroom situation. We play the game itself in an out-of-town location to ensure that participants are taken out of their own reality and are also dissuaded from finding alternative evening activities.

The game is played with between 21 to 35 players. We therefore play with a combined group of Third year undergraduate students (as part of the course Environment and Development in Africa) as well as the fourth year Honours students. This means that many of the Honours students play the game in two consecutive years, thus increasing their appreciation of its learning outcomes.

To play the game we need a large room to accommodate all players and their assets. The room is divided into two areas representing the rural sector and the urban sector, with a trading and banking zone linking the two.

On arrival at the venue the first activities are to lay out the room, allow players to choose roles and give a full briefing on how the game works. The roles in the urban and rural sectors are given in Table 1. Farmers play in pairs to prevent pilfering of farm assets. All other roles are played by individuals, but alliances often form, for example between the buyer and seller.

Table 1: Urban and rural roles. Number in brackets are the maximum numbers that can play.

Rural Manager	Rest of the World Manager	
Rural Sector	Urban-Rural Interface	Urban Sector
Commercial farmers (2x2)	Banker (1)	President (1)
Subsistence farmers (8x2)	Seller (1)	Minister of Home Affairs (1)
	Buyer (1)	Minister of Land and Water (1)
	Trader (1)	Industrialist (2)
		Urban labour (2)
		Refugee (2) (can also be placed in the rural area)

At the beginning of the game assets are handed out to each player (or player-pair). For the farmers the family size is determined by chance cards, as are also livestock numbers per family. Commercial farmers have nine fields each, two of which are irrigated and planted to sugar cane; subsistence farmers each have a garden and three fields.

The game follows a series (normally five to six) of annual cycles of production which start with the announcement of the rainy seasons. Each game cycle lasts for approximately one hour and normally five or six cycles are played in one day. The game cycle is illustrated in Figure 2.

Box 1

A successful subsistence farm towards the end of one day's play. Two farms have amalgamated and acquired state land. The farmers have invested in wells to protect themselves from drought and have diversified in to livestock.

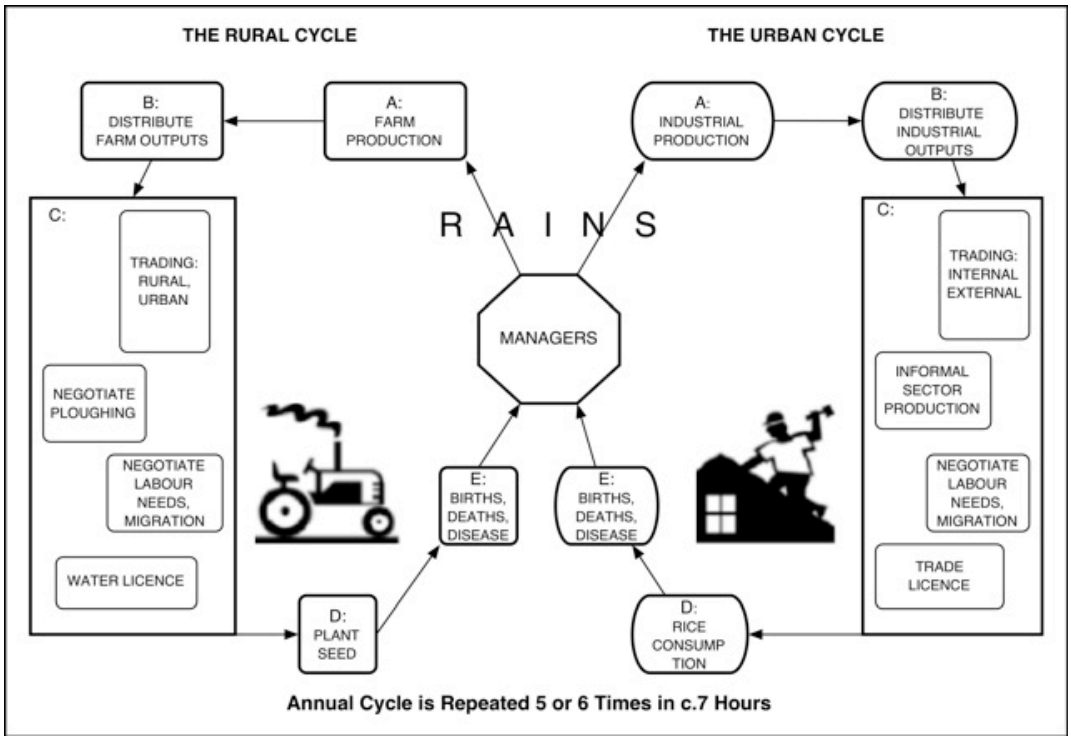

Figure 2. The game cycle.

There are three seasons - germination, middle growth and flowering - each of which may receive rain or drought according to cards turned over by the rural game manager. While all farms suffer the same weather conditions, individual farms may be subject to pest attacks. After announcement of the rains the farmers calculate their rice or sugar cane production depending on the type of crop planted, the sequence of rain and drought, pest attacks, use of irrigation, application of inorganic or organic fertiliser, and application of pesticide. Likewise calves will be born to cows that have been serviced by a bull and last year's calves grow up. During the rest of the year's cycle the players must cultivate their fields, plant seed, sell their produce and buy farm inputs. Rice is measured in maunds. Ten maunds of rice are required per year to feed each adult, five per child. At the end of the year, any family member not consuming sufficient rice dies. At the same time the rural game manager announces births and natural deaths from chance cards.

Meanwhile, in the urban sector, the government is formulating policy and trying to raise revenue to run the country, the industrialist is manufacturing farm inputs for sale to the farmers or for export, the urban labour is dependent on jobs in the industrial area and the banker, and the trader and seller are trying to keep goods and money flowing freely. The export sector and foreign exchange dealings are dealt with by the Rest of the World Manager.

The rules of the game are relatively simple.

- Every adult must eat ten maunds of rice to stay alive, each child five maunds.
- Farm productivity is determined by: rice variety sown, the sequence of rain and drought, pest attacks; mitigated by irrigation, pesticides, fertiliser (inorganic or organic), fallowing,

- Industrial output is subject to hazards such as water shortages and electricity failure, and machine failure, determined by turning over a set of cards.
- Global prices fluctuate according to cards.
- The banker, buyer and seller are seated at the interface between the rural and urban sector and are accessible to all game players, but no one can move between the urban and rural sector without some form of transport. The trader starts the game with a bicycle, the commercial farmers each have a farm vehicle and the government has one Mercedes car. The physical token for transport is a badge worn by the user.
- Rice can only be stored in a 'go down' or granary, which can be manufactured by the industrialist and purchased by the farmers.
- The President determines who can trade with the rest of the world by issuing trade licenses.
- All game activities must stop when the coming of the rains is announced.

From these simple rules a great number of game variations can develop. Each game consists of a complex set of transactions and networking; no two games are the same and the outcome of a game cannot be predicted in advance.

At the end of a day's play the players record their starting and finishing assets and make brief notes on what happened during the day. This is followed by a short debriefing session. The whole process is repeated the next day. Players may keep or change roles as they wish.

Two days after the game session the players are required to write a reflective description describing and interpreting what happened to them in the game. This exercise helps the students to consolidate their learning and put it into the context of the course. It is from these reflections that we as teachers are able to learn of the students' experiences.

What students experienced

The learning outcomes are best examined through looking at the student reflection exercises that they were required to write a few days after playing the game and the final reflections accompanying the concept maps at the end of the course. The work of the Honours class of 2003 is examined here. Five students made up this class: Taralyn and Jona from South Africa, Nomi from Lesotho, Phumzile from Swaziland and Olu from Nigeria. All students came from urban backgrounds. In the game Phumzile and Olu were subsistence farmers, Nomi was a commercial cattle rancher, Taralyn and Jonathan were refugees in the rural area. Seven quotes have been selected for discussion.

They learnt that in order to practice sustainable agriculture one not only needed to be aware of the consequences of land degradation, but one also needed the physical, human and financial capital to practice soil conservation. The stresses of survival and lack of access to land or to alternative sources of income were seen as significant deterrents to conservation: -

> *Whilst playing the catchment game, it became obvious that the issue of environmental degradation in the Third World is a livelihood issue. It made me discover that as long as people are concerned and preoccupied with surviving,*

> *they will never have time to concentrate on soil conservation issues.* Phumzile concept map reflection.

> *As Lal (2001) notes, in small farms the over utilization of land due to land shortage will always be a major contributing factor to soil degradation..... In our case, as refugees we only had two plots of land and this had to be used to feed ourselves. To survive, soil erosion preventative measures were not always adopted and this led to our land steadily declining from high to low productivity levels.* Taralyn, ACG reflection.

An important concept running through many of the participants reflections was that of developing risk aversion strategies to cope with the vagaries of life in Africa. Jonathan in his concept map reflection noted that *'I think risk aversion is the single most important concept that I have gained from this course, that is why I believe the catchment game is a vital teaching tool.'* Jona, concept map reflection.

On the second day some participants had learnt from the experience of the previous day and were able to put into effect risk aversion strategies. In this second game Olu was running a government farm and had access to increased assets and was able to protect himself from drought and pest attacks.

> *I had to modify my survival strategy (from) Saturday's game because of the experience I had when I played the role of a smallholder farmer. I provided my farm with all inputs that would produce high yields even in the worst situation where there would drought and pest attacks during the whole planting season*. Olu, ACG reflection.

Through playing the game the internal and external complexity of rural development and its links to the urban and global economy became apparent; solutions to land degradation would have to match this complexity: -

> *"Where land is not the scarce resource, cash or labour may be the limiting factors. This was the case for my group who were cattle ranchers in the ACG. Other small-holders within the game may have had labour, but not enough land to plant rice for their subsistence needs. What this (game) highlighted in terms of rural development was that local communities are dynamic and internally differentiated, and their environmental priorities and natural resource claims are positioned differently and governed by varying institutional dynamics, as well as differing and sometimes conflicting power relations."* Nomi, essay comparing RiskMap and the ACG.

The students as participants began to appreciate the gap between the expert knowledge of professionals and the realities of life as experienced by people living on the land or in urban areas who are trying to make a go of it: -

> *It made me think about how we as environmental professionals even begin to address the problems of rural development and land degradation when we are dealing with such a myriad of problems. Where do priorities lie when addressing the problems related to rural development and land degradation? This is a question that I definitely cannot answer.* Nomi, ACG reflection.

A particularly telling observation came from Jona whose whole perception of the challenges facing rural Africa was turned around: -

> *I had always assumed that the challenge for a rural person was to uplift themselves and progress forwards. After this game I now understand that for many people the challenge is survival, successfully supporting oneself and family. I realize that (not recognizing) this paradigm shift from upliftment to survival is one of the major stumbling blocks of aid policies*. Jona, concept map reflection.

Through these quotes we can see that the students not only better understand the constraints to soil conservation experienced by the individual householder, but that they have also become aware of the complexity of life in rural areas, of surviving through uncertainty and the importance of the household's asset base. In short, they would be better prepared to grapple with problems faced by a rural development agency or soil conservation office.

RiskMap

RiskMap was developed as an early warning system to monitor food security and is based on the Save the Children Fund-United Kingdom's household food economy approach (Moseley and Logan 2001). In our course we use it as a teaching tool to raise our students' awareness of how geography and social groupings contribute to the complexity of household food economies and the response to food deficits. Through this understanding the students can better contextualise the possible causes and responses to land degradation in a rural area of Africa beset by drought. The students apply RiskMap to Ethiopia.

RiskMap is a computer model that allows users to examine, for a given country, the way in which different households respond to food shortages. The model is based on real field data collected in rural areas and analysed by economic group – modal, rich, poor. The country is subdivided into food economy zones based on ecological regions and the agro-economy (Moseley and Logan 2001). For Ethiopia, data are available for each subregion by year from 1985 to 1999. Outputs are available for each economic group describing the actual deficits for the different income sources and how these deficits were made good – or not – as the case may be.

Model users start by examining the 'real' situation year-by-year; they can then run the model to manipulate parameters so that different scenarios can be examined for their consequences in terms of food deficit and response. We ask the students to run scenarios such as "what will be the effect on food security and household response if land degradation has reduced productivity by 10%?"

Students are asked to:

1. Select two regions for comparison, one from a highland region dependent on cropping and one from a lowland region dependent on livestock.

For each region :

2. Compare the real situation in good and bad years.
3. Compare the deficits and coping mechanisms for different income groups.
4. Run the model assuming that productivity has been reduced as a consequence of land degradation.

5. Consider the likely consequences of, and response to, land degradation for the different economic groups in the two geographic regions.

Model outputs

Examples of model outputs as presented by the students are given below. Model outputs can be in the form of tabulated data or pie charts.

The first set of analyses compare the household food economies of Tigray, a mountain area largely dependent on cultivation, and Ogaden, a lowland area where livestock are far more important. The first output, given in Table 2, is the percentage of 'normal' annual food need per household category for the two regions. It is clear from this table that the different income groups rely on different food sources, and that this varies between the two regions. In Tigray the rich are far more reliant on their own food crops and livestock while the poor have a wider range of food sources. In Ogaden it is the rich who rely most on their own livestock, while the poor are more reliant on food crops. In general the poor are less reliant on the land and more reliant on purchases. This highlights the importance of a cash income to this group. The implications are that the rich families are those who will both lose most through land degradation and have the resources to implement soil conservation. Poor families will be less impacted directly by degradation and neither will they have the resources to prevent it. These results raise important pointers as to who should be targeted in soil conservation projects.

Table 2. Food sources by household category ('normal' year)

	Percentage of food needs per household category					
	TIGRAY (highland zone)			OGADEN (lowland zone)		
Food source	Poor	Median	Rich	Poor	Median	Rich
Own food crops	35-45	55-60	80-90	15-20	5-10	0-5
Milk or meat	0	0-5	5-10	10-20	30-40	60-70
Fishing	0	0	0	0	0	0
Wild foods	0	0	0	5-10	0-5	0
Gift or relief	35-45	10-15	0	15-20	0-5	0-10
Purchase	20-30	30-40	5-10	40-50	45-55	30-35

The next table, Table 3, gives the results for one of the worst drought years, 1990. The poor of Tigray Highlands have the largest deficit, mainly through a lack of relief. The rich have a

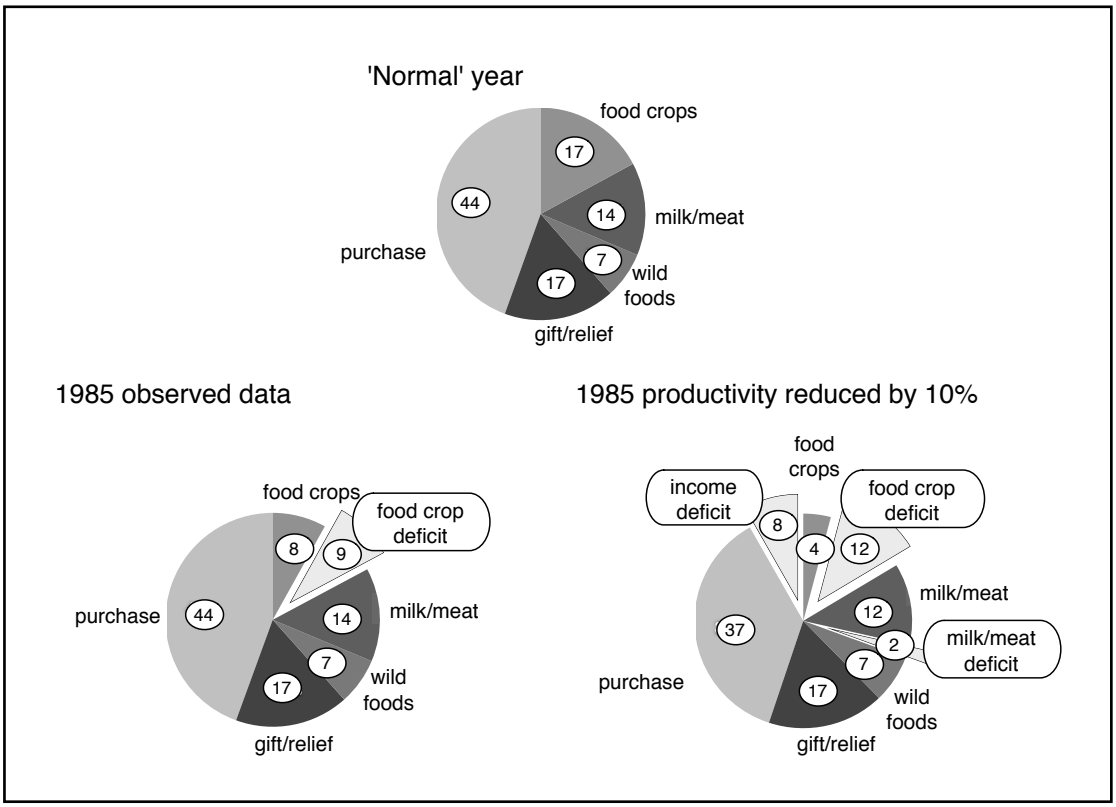

Figure 3. The impact of a 10% reduction in land productivity on poor households in the Ogaden rangelands in 1985, a year of moderate drought in the area. The chart of the 'normal' year shows the percentage by food source as experienced most frequently.

lower deficit , but it can be seen that their crops have suffered badly. In the Ogaden Rangelands the rich suffer from loss of meat and milk, while loss of income becomes more of an issue for the other two groups. These results reinforce the conclusion drawn above that it is the rich who are most dependent on the land and will suffer the most from direct loss of agricultural productivity. At the same time the rich are less vulnerable as they can fall back on food stocks and savings. The poor are reliant on gaining employment or, in the Ogaden Rangelands, gathering wild foods, an important food source for all groups in this area.

Table 3. Deficits and coping strategies for 1990, a severe drought year.

DEFICIT 1990	AREAS and their DEFICITS (%)					
	TIGRAY CENTRAL HIGHLANDS			OGADEN RANGELAND		
	Poor	Mode	Rich	Poor	Mode	Rich
Income	12	16	-	22	24	6
Food Crop	24	40	54	16	7	-
Milk/ Meat	-	-	4	14	32	59
Fishing	-	-	-	4	4	-
Relief	36	9	-	-	-	-

TOTAL DEFICIT	**74**	**65**	**58**	**56**	**67**	**65**
COPING STRATEGIES						
Food Stocks & Relief	-	-	35		5	15
Wild foods	-	-	-	16	17	14
Cash savings	-	5	17		4	19
Employment	20	18	6	15	15	11
Livestock sales	-	-	By employing the above, all the deficit is overcome	1	1	-
Other trade	-	-		-	-	-
Non-food production	-	-		-	-	-
Non-market redistribution	1	1		-	-	-
TOTAL REMAINING DEFICIT	**53**	**41**	**0**	**24**	**25**	**6**

The next example shows how RiskMap was used to explore the tasks:

- Run the model assuming productivity has been reduced as a consequence of land degradation.
- Consider the likely consequences of and response to land degradation for the different economic groups in the two geographic regions.

The results of this analysis for poor households in the Ogaden Rangelands food economy region are presented as three pie charts in Figure 3. The first chart represents a 'normal' year, where normal refers to that experienced most frequently. It can be seen that in this region poor households are more or less equally reliant on food crops, milk and meat and wild foods, but nearly one half (44%) of their food is purchased. The drought of 1985, illustrated in the second chart, caused the production of food crops to be reduced by one half. If the overall productivity of food crops and livestock products is reduced by a further 10% as a result of land degradation, illustrated in the third chart, the food crop deficit is increased and there is also a small deficit in livestock products. Of note is the increased income deficit due to decreased employment opportunities. This reduced the household's capacity to purchase food.

What the students experienced

Three quotes have been selected to exemplify the learning experience of the five Honours students who undertook the RiskMap exercise in 2003. These quotes tell their own story and illustrate how the students were able to link a reduction in food self sufficiency to land degradation, to assess the differential impacts on different economic groups and their potential or inclination to adopt soil conservation measures.

The first two quotes are from Jona who starts with a straightforward comment on the effects on food self sufficiency of reducing the productive potential of the land:

> *By modelling a 20% decrease in the productive capability of the land as a result of degradation, it was evident that this had a dramatic effect on the ability of rural Ethiopians to consistently meet their food requirements.* Jona, concept map reflection.

Jona then goes on to analyse how land degradation will impact on the different economic groups:

> *Risk map also enhanced this understanding, whereby it became evident that the more the land became degraded, the more the poor became vulnerable. This is because they have a low asset-base, no food stocks and no cash savings to fall back on in food deficit years. The rich and modal group at least have some food stocks, cash savings and assets to use for purchasing food during really bad times.* Jona, concept map reflection.

The last quote, from Nomi, shows a high level of insight that extends her thinking beyond the RiskMap exercise itself; she realized the danger of applying simplistic models to solving problems within a complex of rural environment.

> *Risk map reversed a commonly held conception, developed through the exhaustive reading of literature, that emphasizes the dependence of rural people on the land.… the model indicated that they have other sources of income to depend on. This indicated to me the possible reasons that attempts at addressing land degradation issues fail in a lot of African countries. This was a very insightful exercise.* Nomi, concept map reflection.

The strength of RiskMap is the way that it makes students aware of how different social groups in different geographic areas develop their own survival strategies to cope with drought related risk. The varying dependence on land will affect their vulnerability to land degradation as well as their willingness to invest in soil conservation measures. This in turn will impact on the effectiveness of soil conservation strategies, as noted by Nomi above.

Conclusion

Through the two learning activities, the African Catchment Game and RiskMap, the students experienced the complexity of rural livelihoods in Africa and began to make connections between this complexity and causes, consequences and strategies for controlling degradation. The students gained different but complementary insights from the the two activities that were quite different in their approach.

Through the African Catchment Game the learners gained real experience in an imaginary world. In the words of Chapman

> *In sum, these simulations replicate the reflexive complexity of reality because they create a true reality in which the clock cannot be turned back, in which ignorance, apathy, fear, excitement, ambition etc. play as important a role as in everyday life.* Chapman 1989 *pp. 311.*

In RiskMap the learners work with real data from a real country to explore the relationship between livelihood strategies and risk, but do not enter the lives of the people themselves. They experience an objective reality.

> *Risk map reinforced the concepts …by providing 'real numbers'. The use of actual figures 'made real' for me what previously were abstract concepts.* (Jonathan, student reflection 2004)

Nomi makes the perceptive observation that development practitioners must recognise that rural livelihoods are not necessarily dependent on agriculture, but on a whole range of options, an assessment reinforced through the two learning activities.

> *Riskmap and the ACG indicated how varying factors influence livelihood options of people in rural areas. The two simulations indicated how policy and interventions by extension officers should adopt a sustainable livelihoods framework of analysis, as this allows for a deeper understanding of the different livelihoods and the choices that rural people make, and thus underlying factors can thus be targeted in mediation. Without a firm understanding of the reasons that people make the choices that they do, agriculture will continue to be viewed as the mainstay of rural development even in areas such as Ethiopia that have inherent impediments to agricultural growth.* Nomi 2003 essay comparing the two activities.

Role playing games have been used since the 1980s as participatory tools to help both development practitioners and rural communities in developing areas to come to grips with their own complexity (Chapman 1989). More recently role playing games have been used as an adjunct to modeling multi-agent systems (MASs) so as to better address the complex social issues surrounding the use of common natural resources such as water (Daré and Barreteau 2006; Farolfi and Rowntree 2006). In this paper we have described the use of role playing games and simulation models to promote active learning by students, most of whom had little experience of Africa rural societies. Their reflections, examples of which are presented above, confirm that the students have begun to confront the complexity that underlies the political ecology of land degradation. As future professionals they are better prepared to contribute to the development and practice of development policies that support the sustainable use or natural resources and curb land degradation.

ACKNOWLEDGMENTS

The learning activities on which our course is based would not have come into being without the pioneering work of Graham Chapman or the researchers of the Save the Children Fund. Discussions with Graham around the African Catchment Game are gratefully acknowledged. For the reflections on the activities themselves we must thank the Honours students of 2003: Nomathema (Nomi) Mhlanga, Taralyn Bro, Jonathon (Jona) Stewart, Phumzile Tshabala and Olumide (Olu) Alebiosu and Jonathan Freeman from the Honours group of 2004.

REFERENCES

Bennett, H.H. 1939. *Soil Conservation*. New York : McGraw-Hill.

Blaikie, P. and Brookfield, H., 1987. *Land Degradation and Society*. London : Methuen.

Blaikie, P., 1985. *The Political Economy of Soil Erosion in Developing Countries*. Harlow, Essex : Longman Scientific & Technical, Blackwell Publishing, Ltd.

Campbell, B.M., Jeffrey, S., Kozanayi, W., Luckert, M., Mutamba, and M., Zindi, C. 2002. *Household Livelihoods in Semi-Arid Regions: options and constraints*. Centre for International Forestry Research, Jacarta.

Chapman, G.P., 1987. Gaming simulations and systems analysis: two factions of the truth. *Journal of Applied Systems Analysis*. 14: 3-15.

Chapman, G.P, 1989. Developing real imaginary countries. *Irrigation and Drainage Systems*, 3: 309-313.

Chapman, G.P and Tsakok, I. 1984. *Exaction*. Development Policy Ltd, 2a Green End Road, Cambridge.

Daré, W and Barreteau, O. 2006. A role playing game in irrigated system negotiation: between play and reality. *Journal of Artificial Societies and Social Simulation*, 6.3. http://jasss.soc.surrey.ac.uk/6/3/6.html

Farolfi, S. and Rowntree, K.M. 2006. Accompanying local stakeholders in negotiation processes related to water allocation through simulation models and role-playing games: an experience from South Africa. EMPOWERS Regional Symposium: End Users Ownership and Involvement in IWRM 13-17 November, 2005, Cairo, Egypt. http://www.empowers.info/page/2003

Fox, R.C. and Rowntree, K.M., 2004. Linking the doing to the thinking: using criterion-based assessment in role-playing simulations. *Planet*, 13. http://www.gees.ac.uk/planet/index.htm#P13

Gray, L.C. and Moseley, W.G., 2005. A geographical perspective on poverty–environment interactions. *The Geographical Journal*, Vol. 171, No. 1, pp. 9–23.

Jacks G.V. and Whyte. R.O., 1941. *The Rape of the Earth: a world survey of soil erosion*. London : Faber & Faber.

Lal, R. 2001:Soil degradation by Erosion, *Land Degradation and Development*, 6, 519-539.

Moseley W.G. and Logan B.I. 2001. Conceptualizing hunger dynamics: a critical examination of two famine early warning methodologies in Zimbabwe. *Applied Geography*, 21,3, 223-248.

Ramos, J. 2005: Symposium on action learning: Introduction. *Journal of Futures Studies*, 10.1: 83-84.

Rovai, A.P (2004) A constructivist approach to outline college learning. *The Internet and Higher Education*, Volume 7, Issue 2, pages 79-93.