

## **Student Summer Course Evaluates Major Environmental Issues**

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Important environmental problems related to land degradation and desertification and their potential solutions are investigated with groups of Namibian university and polytechnic students enrolled in a summer field course. The course is designed so that experience and information developed in these courses can be conveyed immediately and directly to government officials and others influencing and implementing environmental policies. These class projects include participation by experts and affected stakeholders. The course emphasises acquisition of data addressing important and currently applicable hypotheses, analysis of these data and communication of results to a varied audience.

These environment reconnaissance exercises allow students and other investigators to initiate diverse projects, often leading to more extended analysis of identified challenges. Topics have included shared water use and water allocation in urban and rural settings, social and environmental impacts of illegal fencing, and grazing rights and grazing policies in differing land tenure systems. Student exercises have the potential to investigate sensitive environmental problems not easily addressed in other contexts and to promptly convey findings to a national audience.

Field courses incorporating training in the home country are relatively cost effective and, as in Namibia, may include individuals already or soon to be employed in jobs where they influence decisions. Students are carefully selected and are expected to be amongst the future managers and decision makers influencing environmental policy and management in Namibia. Experience of the past eight years has shown this to be the case with course alumni currently employed in at least five ministries, the private sector and with NGOs. [254 words]

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# ROLE OF RESEARCH IN COMBATING DESERTIFICATION

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## Abstract

Since global recognition of desertification processes during the 20<sup>th</sup> century, research has been applied by scientists to understand emerging issues. Research has been undertaken in all relevant disciplines while focusing on bio-physical manifestations of desertification. Research in socio-economic fields, in policy and government, economics and communication has recently gained acceptance.

Most research undertaken in the name of desertification has not contributed to reducing or reversing its impacts. Reasons for this are manifold but centre on limited participation and communication with non-academic stakeholders. Academically, the strongest research capacity lies in areas where desertification is not taking place. This research is driven, funded and evaluated by peer review based on published articles. This system eliminates participation by researchers in most developing countries, by staff of development programmes and by people affected by and affecting processes of desertification. Similarly, communication of research results is limited to the academic community.

The central role of research should revolve around enhanced understanding of the desertification process and its reversal. Since the ultimate causes of desertification are recognised to range from inappropriate policies and their application to an increasing population expecting improved livelihoods from diminishing natural resources to inappropriate development interventions causing reduced rather than increased overall productivity, the topics for research are boundless. The main issue for desertification research is, however, how can the understanding generated be applied to reducing or eliminating desertification.

Consideration should be given to three essential points.

- Identification of questions that decision makers and resource users feel would enhance understanding of desertification and contribute to its reversal;
- Participation of local researchers, resource users and people involved in development programmes;
- Interpretation and communication of research results, so they are in context and understood by academics but also by decision makers, resource users and people focused on economic development, is another essential step for enhancing understanding based on research. [308 words]

Ambio4

February 27, 2001 TUES / anne

Now at 3870 words, goal is about 3500

## **Namibia Student Training Course Evaluates Major Environmental Issues**

Mary Seely and Bill Hamilton

**Abstract.** Important environmental problems and their potential solutions were investigated with groups of Namibian university students enrolled in an austral summer field course. Experience and information developed in these courses can be conveyed immediately and directly to government officials and others influencing and implementing environmental policies. These class projects included participation by experts and affected stakeholders. We emphasized acquisition of data addressing important and currently applicable hypotheses. Environment reconnaissance exercises allowed students and other investigators to initiate diverse projects, often leading to more extended analysis of problems such as water use and water allocation in urban and rural settings, illegal fencing, grazing rights and grazing policies. Student exercises have the potential to investigate sensitive environmental problems and to promptly convey findings to a national audience. Field courses incorporating training in the home country are relatively cost effective and may include individuals already employed in jobs where they influence decisions. (149 words, 150 is maximum allowed)

### **Introduction**

Namibia, a recently independent, developing country, is the most arid country south of the Sahel with the lowest production of calories per capita in southern Africa. The population is increasing at more than 3% per annum and long-term environmental sustainability is not a central focus of development management.

Before independence in 1990, Namibia did not have a tertiary education institution. Students depended on institutions in South Africa and were financed by various aid agencies and other independent sources. In attempting to rapidly build the University of Namibia and Polytechnic of Namibia to serve the population of 1.6 million, the ministry organizing higher education has promoted a traditional, discipline-based structure. As yet reading and writing skills are not well developed in secondary schools, a deficiency that carries over to tertiary institutions. Nevertheless, as government restructuring proceeds, university and polytechnic graduates are frequently employed immediately upon graduation from four-year programs, despite their lack of extensive experience or appropriate job skills.

The problem solving approach to teaching is beginning to be addressed in conservation fields for university graduate students (e.g. Orr 1993, Touval and Dietz 1994). The

applications start at the graduate level and involve students with a background in conservation biology. They offer a cross-disciplinary approach addressing real-world problems. This addresses the need for graduates to make the transition from disciplinary training to jobs, usually without the benefit of any experience of problem solving.

In Namibia, we developed similar solutions to this problem in response to the particular conditions of that country, its education legacy and its current education system, but of necessity directed towards upper-class men, recent graduates and young professional consultants. Our objective was to balance the prevailing attitude at Independence (1990) that environmental studies referred to birds, elephants and tourism, not to the broad analysis of use of resources. A summer field course, instituted in 1992 by a non-governmental organization, the Desert Research Foundation of Namibia (DRFN) and funded by Sida (Swedish International Development Co-operation Agency), targeted important large-scale environmental problems for analysis in training exercises. The course was organized to provide skills necessary for environmental problem solving by applying research techniques to the analysis of current national environmental problems. Each year, in consultation with colleagues, we selected an overall topic reflecting a current environmental issue related to public policy or development. Some important Namibian environmental issues are being addressed with outdated and inadequate information, so these were targeted for study.

### **Methods**

Student selection. Students were selected based upon a competitive application process. Written applications were reviewed by DRFN staff for writing skills and interviews. We also considered language skills because Namibia is ethnically diverse and multilingual, and there are vast areas where only Damara, Bush or Ovambo are spoken; Afrikaanse also remains a key trade language not known to many young Namibians. We emphasized gender balance, not as a point of law but because we needed to represent the attitudes of women in our hypothesis formulation and evaluation.

Our goal is to enhance environmental awareness and the probability of sound outcomes in environmental decision making. This can best be achieved by attracting the most qualified applicants. Student expenses were paid, including all lodging and food costs. In Namibia today unemployment is widespread and, especially for university undergraduates, there may be no immediate job opportunities. In a country with limited job prospects career and other choices have a strong financial bias. Students may thus view this course as a marginal temporary job opportunity and most use the expense stipend, about USD 27/week, to balance personal and family expenses. A more liberal scholarship would be useful to enhance student selection by attracting the most capable students to the program.

Three broad areas for analysis by student projects were addressed; (1) the climate, its description and its effect upon environmental and economic planning, (2) ephemeral



rivers and their effect upon agriculture and water use and (3) the impact of boreholes upon patterns of settlement and land use consequences.

We hired consultants and joined with partners with expertise in specific areas to be a part of each course. These included experts with skills such as land use assessment, borehole drilling and management, rangeland analysis, water flow modeling and other relevant skills. In addition to teaching the students we were able to learn from one another and from citizen participation in workshops.

We synthesized our collective findings on the spot, in evening sessions, at the time of report writing and as we prepared our submissions to policy makers. We often dealt with controversial topics and had heated discussions about how to deal with them. All classes developed a consensus about our recommendations, usually well before we began presenting our materials.

Supporting objectives of the course were to provide experience in multi-disciplinary teamwork and application of the scientific method. Participants were expected to plan and carry out the project while meeting deadlines and solving problems they identified. The purpose of this paper is to describe the environmental problem-solving course and illustrate some of the results and recommendations arising. In the process, we also identify some major environmental issues in Namibia and Southern Africa.

We spent several weeks in the capital, Windhoek, defining the problem, identifying research tools, hearing lectures and being instructed by experts. We then divided into teams and prepared for fieldwork, including budgeting, rental of appropriate equipment, and all logistics. We contacted those we were to interview in the field and organized interpreters. At this time we planned communication of results to colleagues, decision makers and other stakeholders, including members of rural communities.

A month in the field was followed by a return to our desert training and research facility to analyze data, make charts and maps and prepare written and verbal reports. Results of these investigations were conveyed to decision makers in government and elsewhere by reports, news articles, song, plays, videos and word-of-mouth and by participation of government employees in the course as both instructors and students. We also held a weekend event, inviting up to 200 visitors to the desert to hear our presentations and to consider in caucus aspects of related environmental problems.

The several versions of this course emphasized the reconnaissance process and the importance of preliminary investigations. We were thus able to address topics of significance to public policy while fresh approaches were still welcome. Aspects of resource economics were integrated into all projects as part of a multi-disciplinary approach. Several of our projects were the subsequent focus of more extensive investigations.

Sida funded the course at about 40,000 USD/course of 16 students in 2001, considerably less in earlier years. We incurred substantial travel and operating costs to maintain our

parties with modern equipment in the field and in our computing laboratory. The course could not have operated at the level it did had there not been substantial inputs by DRFN and its several professional staff members, volunteers, both local and from overseas, and logistical and moral support from government agencies. Students were given money to buy food and purchase sundries, but scholarships, while desirable, were not provided. Financial incentives to recruit would have been useful. While this is not an inexpensive training effort, we suggest that the outcome is extremely cost effective.

Our multilingual students gained relatively unhindered access to local communities. One negative feature this study is that people in remote areas experiencing problems often view any interviewer expressing interest in their problem as an agent with capacity to help. We stated in all interviews that we had no standing with the government or with relief agencies and thus had no capacity to provide assistance. We also told people we would convey their concerns to the appropriate government authorities, and other agencies, which we did. In several instances we galvanized local opinion regarding problems leading to community based initiatives and missions, a mechanism we stress in our environmental problem solving activities.

## **Results**

### **Climate and desertification**

Mapping rainfall. To help evaluate desertification issues (see the discussion) our first class developed a rainfall map to characterize national rainfall. Long-term rainfall data from the Namibian Weather Bureau were analyzed and the range (mean maximum and mean minimum) values identified at the 90% level and the 95% confidence level. From these values a map of Namibia was elaborated incorporating ranges and the high and low rainfall expected based upon existing data in 90% and 95% of all years. The resulting color map, reprinted by the Namibian Agricultural Union for distribution to its members, was broadly distributed to decision makers and agricultural service organizations throughout Namibia (Figure 1B). A booklet giving practical interpretations of variations from mean values shown by the map emphasizes the need for planning based upon a probability-based expectation of drought (Seely 1991). This information is particularly important in Namibia because many of Namibia's newly installed decision makers were in exile in higher rainfall areas of Africa and elsewhere, and planning focused initially upon the expectation of mean rainfall, attained in Namibia only twice every 5 years. This map is now posted in government offices throughout Namibia.

### **Ephemeral rivers**

Water mapping. Following climate mapping a water basin map was prepared (Jacobsen and Jacobsen) to identify the watersheds of the ephemeral rivers flowing occasionally across Namibia to the Atlantic Ocean (Figure 1B). These catchments defined the scope of further evaluations of water usage, allocation and management, particularly in the Kuiseb River basin.

Water use by stakeholders in an ephemeral catchment. The northwestern 20% of Namibia is developed around 12 westward flowing ephemeral rivers. All but four of the smaller, northern rivers originate in commercial farmland. All but the two smaller southern rivers originate in or flow through communal farmland. The lower reaches of all 12 rivers traverse desert parks, two ending in sand dunes >50 km inland from the Atlantic coast.

The Kuiseb River is the most commercially developed of the 12, supporting a major port, the prime coastal tourist and recreation destination and, until recently, a large uranium mine in addition to commercial and communal farms and the Namib-Naukluft Park

Six major user groups were identified in the Kuiseb River catchment. On a per capita basis, higher economic groups in coastal towns used the greatest amount of Kuiseb water. For domestic purposes, ornamental gardens, and in other inessential ways. This suggested to the students an important avenue for reducing water use, which they proceeded to publicize.

The study found that many people directly dependent on the Kuiseb catchment are aware of a developing water shortage. Recommendations focused on conservation of existing sources, increasing awareness and water conservation measures by user groups, the interdependence of people using a single catchment and importance of a holistic approach to water development. Desalination to serve the west coast was supported because scarcity of water will undermine prospects for social and economically sustainable development.

Results were incorporated into weekly newspaper articles, compiled as an Occasional Paper of DRFN and information was used for Parliamentary 'Updates'. The study benefited from research leading to Ephemeral Rivers and their Catchments (Jacobson et al. 1995) and contributed to its formulation.

Farm dams. Evaporation from farm dams and reservoirs in the upper Kuiseb was identified as an avenue for water loss not easily measured. Using dam surveying techniques, vegetation and soil analyses, structured interviews, modeling and remote sensing, participants investigated in detail two sub-catchments of the ephemeral Kuiseb river and extrapolated their water holding capacity to the entire river system (G Van Langenhove, Department of Water Affairs, Hydrology Division). These data suggest that **on the average dams.....**

After independence there was a persistent concern that the privately owned farms, largely in the hands of white owners, were taking an increasingly large share of water that might otherwise flow downstream to communal herders' lands and to the marginally sufficient recharge aquifer near Walvis Bay, several hundred km from the farms. The Department of Water Affairs shared the perception that dams multiplied after Independence. Thus, our class exercise to measure the dams and to model river flows with and without dams confronted a potentially controversial issue.

In collaboration with the Department of Water Affairs (DWA) we surveyed 29 dams in two Kuiseb River subcatchments, determining their capacity to withhold water. These data were applied to an Excel model of water flow. Our model used a long-term series of DWA data on continuous measurements of water flow at several weirs. We used our own measurements of the surveyed capacity of the unsilted capacity of each dam. These modeled data xxxxxxxxxx All previous measurements were for single dams and did not attempt to identify the impact of existing dams upon .....

## **Boreholes**

Boreholes, wells tapping underground aquifers, are an essential component of rural life in much of arid Africa including all of Namibia away from the permanent boundary rivers. Several of our SDP projects evaluated the outcome of borehole drilling in the colonial past and during the decade of Independence.

Boreholes and settlements. National policy in Namibia today set by the 1990 Constitution, is to develop a water resource reticulation system allowing as many Namibians as possible (now 70%) ready access (within 2 km) to a reliable, high quality water supply. But in our SDP project in Western Bushmanland we found groups of thirsty resettled Bushmen living distant from boreholes, who would drink our five-gallon water jugs dry on the spot. Many of these people, both in western Bushmanland and in O and O depended upon recently developed and irregularly maintained pumps. Borehole developers, funded by overseas organizations, developed boreholes in remote areas. Their stated objective is to open the relatively lightly used grasslands for grazing and settlement. One political rationale for these developments is that the freedom fighters, the soldiers in the war for Independence, deserved land. But these wilderness grasslands are also the rainy season reserve of semi nomadic people who live permanently along the perennial rivers during the dry season.

Boreholes opened these remote reserves to permanent settlement, with counterproductive consequences. One student was able to document the age structure of the new settlements (5.5 children/family) where formerly only single young men tended livestock, mostly cattle. We investigated management of access to water points, usually diesel-driven pumps. These were usually under the control of single individuals or cliques rather than the whole community. Indeed, the whole issue of community support services was a concern frequently expressed to us and to our students. Missing services included adequate roads, lack of access to clinics, failure to deliver basic foodstuffs allocated by the government to more centrally located citizens and lack of an adequate, local and dependable water supply. Our recommendation is that any further borehole development be accompanied by an analysis of socioeconomic impact, and that boreholes not be drilled in remote areas used by migratory herders. We concluded that boreholes drilled in places distant from support services eventually require extensive additional support funds and deplete rather than contribute to national economic resources.

Communal farmlands in northwestern Namibia are situated within westward flowing ephemeral river catchments. These areas have long been in communal use. Other areas were divided into private farms for a 20-year period before being returned to communal use. These are marginal small-stock farming areas where wildlife and scenery provide opportunity for alternative income generating activities through recently developed conservancies dedicated to tourism. In the past, communal areas were used on a seasonal basis or only after exceptional rainfall. But the growing population and extensive resettlement has resulted in the area being farmed permanently. There is an overall move in Namibia towards restricting livestock movements by fencing and privatization in the form of conservancies catering to tourism and excluding livestock.

Illegal fences and access to water. Fences define the use of resources across Namibia (Fig. 1c; all legal parcels, parks, farms and communal areas). Privately owned farms on the average 10,000 ha, have border fences. All Parks are fenced. A major corridor fence limits livestock movement into disease control areas, qualifying meat products for export to the EC. Our study focused on the supposedly fence-free communal areas. In 1994 we investigated the problem of illegal fencing, a land grab in progress. Illegal fences were and are being constructed in the *communal* lands, sometimes eliminating access to both seasonal water pools essential to the nomadic herds and to boreholes. Using structured interviews with communal farmers, workers on newly fenced farms, government officials and regional service organizations, we examined the social and environmental impact of the fencing off of large tracts of communal land. Our students interviewed villagers, identified and contacted the complex regional government structure loosely related to the central government, and determined attitudes towards the new fences and their relationship to boreholes, which ranged from neutral (local authorities) to overtly hostile.

The substantial environmental and financial cost of these hastily constructed fences was not financed by residents of the area but by government employees and even high-ranking government officials and by relatively wealthy businessmen who have far greater earnings potential than subsistence farmers (Figure 2, - histogram). We used all our students and a network of contacts they generated to develop Figure 2, a degree of surveillance that would have been difficult for someone other than a student led group to achieve. The message our students took to the government was an outcry against the illegal fencing and its perpetrators, presented as a drama at our workshop finale and, by popular invitation, to a public audience in Windhoek. The President declared a moratorium on future fencing, but it does not appear to be enforced.

Elephants and water. Northwestern Namibia, straddling the Great Western Escarpment extends westward to the Namib Desert and the Atlantic Ocean. The escarpment supports a high species diversity of many endemic plants and animals. The mountainous scenery combined with free ranging elephants, rhino, lions and other touristically attractive game species endows this area with high tourism potential. In this area a few communal farmers attempt to eke out a living raising cattle and goats. In western Damaraland we investigated the elephant problem on two adjoining farms on the boundary between communal and private land. One farm focused on tourism and protection of elephants.



The other considered elephants to be in competition with livestock and a danger to people.

Working at the border between communal and commercial farmlands in the Huab River catchment (Fig. X), participants assessed vegetation condition, used Participatory Rural Appraisal (PRA) techniques and interviewed farmers, government officials and service providers to assess effects of elephants on current and changing productivity. As an attractive touristic attraction, and in accord with international CITES treaty, elephants are protected throughout Namibia. But in many areas outside reserves they are far from cherished. In this particular project we monitored attitudes towards elephants ranging inland from the sensational dunes environments, a major tourist destination. We found that elephants, expanding in numbers, precluded maintenance of domestic gardens, damaged water supply points and often were feared. The elephant population management issue is a pivotal Namibian wildlife problem not readily resolved. But we found that we could effectively identify issues during a reconnaissance and supply specific quantitative information about the impacts of elephants upon browse plant species used also by cows and goats. We found extensive degradation of these important livestock browse species by elephants, a result depicted in a film (ref) we made and circulated with the student project.

Environmentally involved Namibians should have a personal perspective about elephants and rhinos, both those living extensively outside parks and in contact with rural people. Our ability to introduce these problems to students identifies the capacity to view, understand discuss important environmental issues in an 80-day course.

### Discussion

Our discussion focuses on the issue of desertification and the role students can play in its amelioration. At the outset we acknowledge the paramount roles of climatic variability, aridity and expanding populations play in determining current conditions and immediate prospects. In the several iterations of our summer desertification course we dealt with poverty, poorly educated people, population increase, a struggling economy and the trivial water supply. Government policy remains egalitarian despite the broad income gap between civil servants and the marginally employed. People are not malnourished, largely because of strong family bonds that distribute wealth (pensions and salaries from government jobs) to all. An attitude of consensus building prevails. In our courses there was no tolerance for minority reports, and manageable recommendations from all sessions were eventually unanimous.

Several SDP projects investigated grazing and browsing situations, especially from the perspective of wisdom of prevailing and alternative practices relative to sustainability. The question of whether long-term degradation (desertification) is occurring in our study areas is unresolved and subject to active debate. Some problems that could lead to land degradation were identified: population pressure by people and animals, poverty, and communal land tenure coupled with poor management. These factors are reinforced by overgrazing, over stocking and deforestation and by government land policies. Although



exploitation of alternative incomes could improve livelihoods alternatives are not fully developed and the over-riding cultural importance of livestock must be addressed in sustainability planning

Community and researchers identified education and training to provide necessary skills and information as essential. Namibia, a country the size of Sweden, has only a tertiary education infrastructure largely confined to the capital city, Windhoek (Figure 1A). Thus there is an inadequate environmental outreach system capable of identifying and investigating environmental problems throughout the nation (but see DEA, ref to biodiversity volume, compilations, etc.) Student based environmental efforts may be limited in scale to campuses and their environmental ethos (ref.), but a legitimate and cost-effective training and local action exercise can be the basis for more extensive efforts (refs). The solutions offered by our students and their instructors are forward-looking, realistic, and increasingly well informed. Our experience demonstrates that student led projects associated with field classes are an ideal vehicle for identifying and addressing large-scale environmental problems, including those that are politically sensitive and thus beyond the scope of traditional analyses.

An evaluator from a visiting aide agency recently asked us if we were now able to turn the course and its operation over to Namibians. Besides the answer that one of us *is* Namibian, another answer is that the cultural exchange is not a one-way process. Consensus building is an advanced process in Namibia, as is ethnic tolerance and respect for the environment. Nor can we ignore the AIDS epidemic, estimated to affect 30% of all educated Namibians (ref.). With a current mean life expectancy of 6 years, the infected drop steadily from the rolls of the institutions we are building (1/3 may be lost in the next 12 years). Collectively, these contrary conditions burden plans and prospects. Anyone seeing a ray of hope in the population consequences of AIDS mortality is uninformed about the now well-understood demographic and economic impact of this disease (ref.). The loss of teachers, a particularly vulnerable target, has enormously counterproductive consequences. Population increase is continuing and the need for educated Nambians is urgent.

Against this backdrop Namibia is, nevertheless, an optimistic nation, in hearty agreement with its own green constitution, which emphasizes and showcases its environment. Past and future versions of student courses will help build an educated cohort of Namibians able to work and consult with foreign investigators to identify factors leading to desertification and solutions.

Desertification table here

**References and Notes** [not to exceed 50]

Jacobsen and Jacobsen 199 .

Jacobsen et al. 1995.

Orr, 1993.

Seely, M. 1991.

Touval and Dietz 1994.

Van Langenhove, G. 199

Film ref

AIDS ref

Biodiversity ref

Environmental ethos ref

**Data for Figure 2:**

**Caption: Ownership of large (> 1.0 km) recently constructed ((within 5 years) fences inn northeastern Namibia (Okontope-Okongele-Otandala area). See Figure 1 for exact location. Students individually contacted all owners.**

	<b>Nonresident businessmen</b>	<b>11</b>	
	<b>Government employees</b>		<b>10</b>
	<b>NAMDEB (diamond mine, nonresident) employees</b>		<b>8</b>
<b>\</b>	<b>pensioners, not local</b>	<b>2</b>	
	<b>traditional leaders</b>	<b>2</b>	

Table 1. Unsustainable use of natural resources obtained by DRFN students in Namibia

## Forest Products:

Decline in production of cattle operation (Ligline)  
 loss of migration movements (modeled loss)

Loss of forest products for building (population incurred)  
 Destruction of mopane forests (elephant overpopulation xxx)

## Grassland:

Overgrazing to insustainability (not observed – reported by xxx with  
 invalid documentation)

Overbrowsing – reduced production of veld shrubs resulting from overuse

## Water:

Building development - topnaar  
 Tree depth – well depth  
 Fishing xxxxx

## Social:

Excessive unprotected sex - AIDS  
 Depletion of educated population