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Report of the training module, A3: From Community Perceptions to Remote Sensing, Methodologies Used for the Assessment of Desertification in Southern Africa Given during the Desertification 2002 Conference, April 2 - 5 April 2002, Cape Town

By P. Klintenberg

Summary

The course was given by Pipen Anderson[1], Nickey Gaseb[2], Timm Hoffman[1], Patrik Klintenberg[2], Lehman Lindeque[3] and Mark Thompson[4]. Ten participants from Botswana, Mozambique, Zambia, Swaziland, Kenya and India took part in the training (see appendix 1 for contact details). The course started with a brief review of desertification and the key indicators generally used to identify the problem. The same day the definition and use of indicators for environmental monitoring, e.g. desertification was discussed and examples were given from the experiences of assessing land degradation on both a national and local level in Namibia. The second day was focused on community based monitoring of land degradation. Examples from the implementation of Namibia's Programme to Combat Desertification were given and discussed. Participants and trainers performed a role play illustrating the importance of community interaction and the need for environmental monitoring. Day three covered the methodology used to develop a national assessment of land degradation in South Africa. The final day explored the use of remote sensing techniques in the creation of spatially explicit models of land degradation in South Africa. The South Africa National Land Cover project was outlined and discussed in the context of other competing perceptions of land degradation in South Africa.

Detailed outline of activities during the course

Training started at 10.00 at the Stone Cottage just outside the Kirstenbosch gardens
Participants introduced each other to the group. The module had ten participants, coming from Botswana, Mozambique, Zambia, Swaziland, Kenya, India. For the first day, four trainers were conducting the training: Prof. Timm Hoffman, Pippin Andersen, Nickey Gaseb and Patrik Klintenberg.

Defining expectations of the course

The introduction of participants was followed by a discussion about what the participants and the facilitators of the training module expect of the training.

The following expectations were given:

* A clear outline of range of methods to measure desertification
* Attitude change towards land resource management
* Communities usually does not have enough knowledge to do proper natural resource management, want to know how to improve this
* Increased knowledge about remote sensing for evaluation and monitoring of desertification
* Methods to map desertification
* Indigenous knowledge to monitor desertification, minimising hardship for communities
* Indicators of desertification - be able to determine if an area has been degraded
* Identify local level indicators for mitigation of desertification
* Merging scientific knowledge with indigenous knowledge
* Facilitate group learning through participation

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Day 1: What is Desertification? A discussion about desertification and its definitions, facilitated by Prof. Timm Hoffman

Timm gave a brief introduction to the concept of desertification and the various definitions that have been developed through the years. It was made clear that the definition of desertification has changed through time with different emphasis on the causes, e.g. humans or natural variability.

Comments to the definition of desertification:

It is important to establish who is measuring desertification. The example of bush encroachment was given. Bush encroachment is affecting people depending on grazing for their cattle in a negative way, but people needing fire wood and maybe using wood for carvings or charcoal production might not see bush encroachment as degradation but rather as an improvement of the conditions. In other words, the definition of desertification depends on the objective of the land use.

It is important to identify the cause and effect relationships leading to the change and how it influences the various objectives of the land users.

Developing indicators for desertification monitoring (Pippin Andersson)

Introduction to the concept of indicators

The session started with the question: What are indicators?
Indicators were said to be an alternative or indirect way of measuring desertification, i.e. a simpler way to measure often complex relationships leading to manifestations of desertification.
Indicators also provide a way of communicating information and explaining causal relationships.

Identifying potential desertification indicators

After this introduction the participants held a brainstorming session aiming at defining potential desertification/land degradation indicators. Only a few of the participants had any experience in using desertification indicators in their daily work. After about 5 minutes the group had defined 49 desertification indicators, se list below.

1. Usage of bricks instead of trees for house construction. (Criticised as this can be an effect of development, not a lack of tree for traditional building). [Social]
2. Decreased fallow land. People do not give allowance for land to recover. Indicates increased pressure on the land. [Biophysical]
3. Fuel type (fire wood or cattle dung) Indicates deforestation [Biophysical]
4. Decline in honey production [biophysical]
5. Livestock size [biophysical]
6. Cultivation of marginal land
7. Vegetation cover
8. Vegetation destruction
9. Level of community organisation
10. Occurrence of Xerophytic plants
11. Increase in sand storms
12. Soil salinity, caused by
13. Salinisation
14. Livestock quality - indicates the quality of the grazing
15. Deforestation
16. Population pressure (human)
17. Livestock pressure - when is grazing pressure too high. Some argue that high livestock numbers does not cause desertification. Equilibrium vs. disequilibrium theory
18. Animal quality
19. Gully development
20. Malnutrition of children (humans) - low productivity
21. Migration (livestock movements)
22. Land dispute - degradation leads to increased competition for land
23. Soil erosion, overall indicator, gully development manifestation
24. Bush encroachment (indicates species change)

25. NDVI and SBI (soil brightness index) RS methodology
26. Soil fertility
27. Declining groundwater levels (associated to drought)
28. Dispersed settlements - people scattered throughout an area, how does this indicate degradation? Scarcity of natural resources. Dangerous, must be used in a change perspective
29. Veld fires
30. Rangeland quality - different vegetation species, what's there
31. Distance to fire wood
32. Livestock number per area unit
33. Droughts and famines
34. Mushrooming of alien plants
35. Declining income levels
36. Mono-culture - the agricultural system, intensity of land usage, mono-culture will exhaust the soil. Depends on the land management. If not properly managed - risk of degradation.
37. Increased sand dune movement
38. Change in livelihoods (mainly people depending on agriculture, community forced to change their income due to lack of natural resources). A change in livelihood structure might not be caused by land degradation, can be a natural change, e.g. urbanisation etc. Communal land around Victoria falls degraded. Community encroaching into the area next to the falls. Now Government
39. Number and distribution of water points
40. Loss of productivity
41. Increase in Government subsidies. Can indicate both increased and decreased degradation (i.e. RSA vs. Botswana
42. Levels of biodiversity
43. Loss of desired species
44. Change in vegetation composition
45. Level of micro organisms in the soil
46. Number of people in relation to carrying capacity and land availability
47. Numbers of flowers, heavy utilising leads to decreased flowers
48. Levels of poverty linked to degradation
49. Drying up of water sources (ground water)

Defining criteria for indicator selection and ranking
The following criteria were identified as being of importance:
An indicator must be:
Cost efficient
Measurable
Relevant to its objectives
Be accomplished within the time limit of the project
Feasible
Realistic
Achievable
Based on knowledge about causal relationships and/or processes leading to the manifestation being measured
Sensitive to its stressors (the variables being measured)
Further an indicator must have
Defined thresholds or bench marks
Well defined skills requirements, i.e. what skills are required to be able to implement the indicator, does it require specialist skills?
Exercise in ranking indicators based on the identified criteria
A project was defined, relevant indicators and criteria were selected. A matrix was used for selecting the most relevant indicators for the project based on each criterion. Pair wise ranking was used.

Procedures of implementing/using indicators
1. Establish objectives of the monitoring
2. Identify possible indicators

3. Identify criteria for selection of indicators
4. Rank indicators based on the selected criteria
5. Test indicators
6. Determine thresholds
7. Present findings
8. Constant evaluation of indicators

Day 2 Community based monitoring of land degradation - by Nickey //Gaseb and Patrik Klintenberg, Napcod, DRFN

The following topics were discussed:

1. Why Monitoring? Role play (based on the Namibian drought policy)
2. Base line data - gathering of socio-economic and biophysical data - the Napcod approach
3. The Namis approach - information exchange between communities an scientists
4. Forum for Integrated Resource Management (FIRM)

Introduction

The training started with an outline of the environmental and socio-economic setting in Namibia. For instance the two main tenure systems, communal and commercial arming was introduced and discussed. In Namibia the land is utilised by two sub sectors, the communal and the commercial sub sector. The commercial farms are utilising the land under freehold title deeds, the communal farms utilise the land under the communal land tenure system i.e. the government owns the land. About 36 million ha of land is occupied by commercial farms, mainly used for extensive ranching. It is made up of 6337 farms owned by approximately 4200 farmers with an average land holding of 8600 ha.
About 34 million ha of land is occupied by communal land and is used for subsistence rain fed crop production and extensive livestock production. This land supports about 95% of the countries farming community. Poverty and household food insecurity characterises this sub sector.

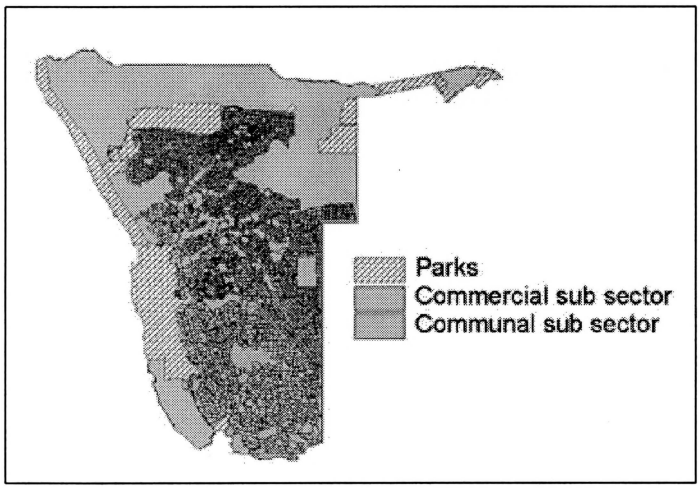

Figure 1. Map showing the location of the communal and the commercial sub sectors in Namibia. Striped areas are National parks or other conservation areas, not accessible for farming purposes.

Further, water resources are very limited and rainfall very erratic. Approximately 55% of the land area receive 100mm to 300mm rain per year. 45% of the land receives 301mm to 650mm per year.
Ground water is being abstracted from numerous boreholes throughout the country. The density of boreholes is highest in the commercial areas and almost non-existing in the north central communal areas, where the groundwater is very saline. People living in this area rely on shallow depressions, being filled with water during the rainy season (Oshanas) and hand dug wells. In some areas pipelines provide water. Until recently the Namibian Government has freely provided water and been servicing pumps and other equipment associated to abstraction of water, but now a plan for charging for the water is being implemented. This is now forcing communities to establish water committees that will be responsible for

determining who will have to pay how much and why. At this stage payment for water is being introduced at a number of pilot communities in the north central of Namibia.

1. Role play (based on the Namibian drought policy)
The role-play was based on the drought policy of Namibia. The overall aim of the play is to, in a participatory manner, introduce the participants to the concept of land management, the link to policy and the importance of monitoring the various resources.

The Namibian drought policy was described and explained in the context of the variable rainfall experienced in Namibia and the need for some kind of drought relief during years of abnormally low rainfall. Further, the concept of drought versus normal variability of rainfall was discussed. The Namibian drought policy states that for a farmer to receive drought relief he/she has to prove that actions have been taken to prevent the impact of a drought. Actions could be destocking or an improved management plan preventing or decreasing the impact of a drought situation.

A scenario was developed with a community of five farmers, who are situated in an area with different rainfall conditions. The highest rainfall is in the west, approximately 450mm per year with a rather, low variability. In the eastern part of the area the rainfall is lower, receiving approximately 150 mm per year and with a higher inter-annual variability compared to the western areas.
Farmer 1, living in the north west of the area has 400 head of cattle. This farmer has privatised a borehole in the middle of the best grazing area of the community. To the south farmer 2 has his homestead. He has 300 heads of cattle. Poisonous plants are invading his grazing land. In the middle of the area farmer 3 has 250 cattle. This farmer is planning to establish a communal campsite in order to generate alternative income. In the far south of the area farmer 4 keeps 150 cattle. The easternmost farmer, farmer 5 has 100 cattle. Farmer 5 has limited access to water as farmer 1 has privatised the borehole in the north.
All farmers have access to grazing and water during normal years as a riverbed cuts through the area. This river has water for half of the year during a normal rainfall year. The river is surrounded by highly palatable grazes and shrubs, which are utilised by all farmers in the area.
During the dry season the farmers closest to the river digs wells into the riverbed and can continue the grazing along the river. The farmer in the north with his privatised borehole has no problems as the water point provides water throughout the year. Grazing is also abundant as he is situated in the area receiving most rainfall. The three farmers in the south share the water from a borehole situated in the middle of the southern grazing area. The only farmer that experience problems during a normal dry season is the one in the east. The grazing is not abundant and he has no access to the borehole in the north, as it has been privatised by the farmer in the north. He has to rely on hand dug wells in the riverbed during the dry season.
The setting of the role-play was a community meeting where the five farmers met and discussed various issues. The conclusion of the meeting was that the farmers in the area should work together, trying to de-stock, support farmer three in establishing a community campsite by selling some of their cattle. The overall conclusion was that the community should organise themselves and not let government or NGOs from the outside come in and tell them what to do.

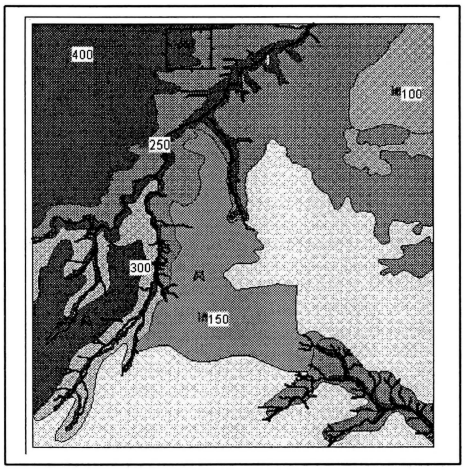

Figure 2. Map showing the distribution of the five homesteads, the grazing conditions, location of water points and the number of cattle owned by each farmer.

All farmers were asked what actions they would take in the incidence of a severe drought in order to receive drought relief. Most of the participants responded that they would sell of cattle to de-stock their lands. The play led to a better understanding of the importance of being able to show a change e.g. decreased livestock numbers in response to a decreased availability of grazing.

2. Base line surveys why and for whom?
An introduction to the topic was given based on the approach taken by Napcod. Napcod has carried out a number of biophysical and socio-economic base line studies in the three main pilot sites. The rational for this was to, based on scientific grounds to determine if and if so where desertification or land degradation occurs in the landscape. This information should then form the basis for the discussions and development of local level indicators for a local level monitoring system, in close co-operation with the local communities.

Methods used by Napcod
Initially the Landscape Function Analysis was used for the biophysical base line studies. This methodology was first developed in Australia as a method for rapid veld assessment. The method is based on measurements of basal cover, distance between plants and other obstacles along a 25-meter long line. At least 1 but preferably three transects should be done on a top, slope and plain along a gradient. Apart from patchiness and fetch distances various soil conditions, amount of litter, and bush density are observed.
By giving all variables a score and putting all results together based on a given classification a measure of the landscape's functionality can be obtained. The method was implemented at all three sites with mixed results. It turned out to be a rather time consuming approach for Namibian conditions, further, there was some bias between different file workers, leading to differences in results. The main critic came from other institutions that also have been doing veld assessments but applying different, more established methods. They claimed that it is not possible to compare the results from the LFA with already gathered information. Based on this critique, Napcod started to work closely with other institutions already gathering information on a local level. This resulted in the adaptation of a veld assessment methodology that had already been in use by various institutions in Namibia. The method is based on the use of a wheel point. For each revelation of the wheel point, i.e. the distance of 2 meters, the operator notes if the peg hits a plant or not along a 200-meter transects, i.e. giving a measure of the basal cover. This method was also used for determining plant composition by noting the species of the nearest plant at each 2-meter interval.
Socio-economic base line data has been gathered in the north by, based on a predefined questionnaire, interviewing headmen, herdsmen and other members of the communities in the different villages in the pilot area. The Sustainable livelihood Framework was used as the basis for the development of questionnaires.
The gathered base line information formed the basis for the next step, implementation of the Namis

3. Namibia's Monitoring and Information System - Namis - background and methodology
This method is a participatory method based on the Sustainable Livelihoods Framework, SLF that aims at gathering and sharing information between researchers and community members.
A short introduction to the SLF and the five capitals: human, social, physical, financial and natural was given. The Namis approach is based on a set of questions surrounding issues related to the five capitals and land degradation. The objective is to, in a participatory manner gather and share information about past, present and future conditions. The PRA tools used for this are:
A. Open discussion
B. Transect walk
C. Resource ranking
D. Village mapping
E. Key informants
F. Activity clock
G. Time line

4. Forum for Integrated Resource Management FIRM, the ultimate tool for integrated resource management?
The last session intended to explain the function of the FIRM.
This is a framework developed to strengthen communities, and put them in the lead of their own development.

Day 3 The South African approach to a national review of land degradation (Timm Hoffman and Lehman Lindeque)

Programme
1. Background to the South African desertification debate
2. Background to the national land degradation review
3. Approach and objectives for the national overview
4. Workshop - a hands on exercise developing a degradation index

1. Background to the South African desertification debate
Timm Hoffman outlined the background to the debate of desertification in South Africa referring to Acock's and other researchers work since the midd-50's, discussing the different perceptions of desertification and its extent in South Africa.

2. Background to the national land degradation review
South Africa committed to develop a National Action Programme to combat desertification 1994. To be able to do this some kind of basic knowledge about the extent and severity of land degradation was required. Due to the history of South Africa, very little information about the state of the environment was available at the onset of this project, i.e. 1997.
A tender proposal was prepared headed by the National Botanic Institute. The programme intended to hold a number of workshops discussion issues related to land degradation, i.e. one workshop in each district of South Africa, gathering information from extension officers. The project also developed a directory of projects active in any field related to land degradation in South Africa and compiled a review of all available literature dealing with land degradation in South Africa.

3. Approach and objective of the national overview
The objective of the project was to gather information about and to establish maps showing the degree of soil erosion and the status of vegetation in South Africa and to generate a map showing the overall situation of land degradation.
The approach was to hold workshops together with extension officers in each of South Africa's 36 agricultural districts based on a methodology first developed by WOCAT. This methodology is based on the perceptions of participants. A brief introduction to the concept of perceptives of land degradation was given by Lehman Lindeque.

4. Workshop - hands on exercise
Each participant of the training module selected one area which they are familiar with for which the methodology would be applied. The objective of the exercise was to give the participants a hands on experience of how the workshops held during the South African project were carried out, and to provide the participants with a tool which they can apply in their home countries.
During the "workshop" the participants determined the land use types and how many % of the total area that that are being utilised for each land use type. For each land use type the type, degree, extent and severity of soil degradation was determined. This information formed the basis for the calculation of a soil degradation index. Further, for grazing land the type of vegetation degradation, species being degraded, degree, extent and severity were determined. The values given formed the basis for the calculation of a veld degradation index. By combining the two indices a measure of the severity of land degradation in each agricultural district was developed.

Day 4: The South African Land Cover project - use of remote sensing for mapping of vegetation cover and land degradation in South Africa, by Mark Thompson

Mark presented the background to the South African land care programme, the objectives and the methodology applied for the land cover mapping. The maps were developed based on paper copies of Landsat TM scenes, covering the entire country. Maps were produced in a scale of 1:250 000 with the smallest mapping unit being 25 ha.

After outlining the methodology Mark explained the limitations of using remote sensing. He emphasised the importance of ground thruthing the images. The influence of seasonality on the resulting image and how it influences the accuracy of the maps was exemplified by a comparing satellite images of the same area but recorded at different seasons.

Mark also presented the results of an analysis comparing the results from the land degradation maps developed by Hoffman et al., 1999 and the maps produced by the land cover project. The overall correlation between the two sets of maps was approximately r2=0.5, For some areas the correlation was as high as 0.75.

The session was ended by a presentation of a more detailed erosion risk mapping carried out in a smaller area of South Africa, analysing the digital information of the Landsat TM scenes. Further the use of high-resolution aerial photos was presented and discussed amongst the participants.

The lecture given by Mark Thompson will soon be made available for download from this site.

Evaluation of the course made by the participants

A formal questionnaire was developed by the conference organisers. The questionnaire was anonymous and was filled in by 9 of the ten participant. Apart from this formal evaluation, a brief recap of the days activities was held with the group at the end of each day. This gave both the course organiser and the participants an opportunity to influence and adjust the content and focus of the course as it was progressing.

Question directly related to the course were:

1. Was information and preparation satisfactory?
2. Did the module allow satisfactory interaction?
3. To what extent is the information useful?
4. What would you have done differently?
5. What were the memorable lessons learnt
6. What is the most important lesson learnt?
7. Any important issues that should have been included

Question 1: Was information and preparation satisfactory?

The answers to this question could range from "highly satisfactory", "Average" and "unsatisfactory"

7 of the participants indicated that information and preparation was Highly satisfactory, while two of the participants said it was average.

"Highly satisfactory" comments given:

" Trainers were well prepared to face the queries of the participants"

" Most of the presentations were in line with the theme of the workshop"

" Information contained comparison of long time intervals an indication of serious preparedness"

"Average" comments:

Due to inadequacy of time

Question 2: Did the module allow satisfactory interaction?

8 of the nine participants stated that the interaction was highly satisfactory, one participant said that the interaction during the course was average.

"Highly satisfactory" comments given:

"Facilitators gave enough space for healthy interaction"

"Because it is arranged in a participatory approach"

"A lot of interaction, information sharing between participants from different countries"

"Active participation both by participants and trainers was superb irrespective of academic qualification or little experience"

Question 3: To what extent is the information useful?
7 of the nine answered highly satisfactory and two answered average.

"Highly satisfactory" comments given:
"Being associated with NGOs, GOs and VOs, I will be able to improve my work with communities in a better way"
"The different methods explained in the presentations can be tried out in my country"
"Might need support from trainers to carry out similar exercises"
"From approaches of gathering information in a participatory manner with communities to field assessment and presentation plus dissemination of what has been learned"

Average comments
"There will be need to integrate the learning into existing approaches to community resource management"

Questions 4: What would you have done differently?
Comments:
Give field application GIS and remote sensing application
Use of more cards by participants to be more participatory as some members tend to be more quiet.
Go into more details of the different methods e.g. remote sensing
Pre-prepared notes and bound them for distribution
I would have had more exercises on PRA and remote sensing techniques
Environmental audit

Question 5: What were the memorable lessons learnt
- A lot
- Methods to measure desertification especially Hoffman's questionnaire
- Participation by participants leading to sharing experiences in different countries is very important
- Learning how to rate land degradation
- When doing exercise on assessment of veld degradation was an eye opener
- Remote sensing
- Using people's perceptions to identify indicators
- Indicators, land use trends and status of natural resources

Question 6: What is the most important lesson learnt?
- Teamwork on the various indices
- The land degradation assessment charts developed in South Africa
- How to implement land degradation assessment at district level
- Team work
- Continue to encourage partnership as usual
- Land use trends and status of natural resources
- Remote sensing and selection of indicators
- That remote sensing can be useful to local communities. Remember 'tone down language and blow up picture'
- Defining local level indicators. Land use trends and status of natural resources

Question 7: Any important issues that should have been included
- Local level indicators of desertification measurements
- More hands on exercises
- Field work or visits
- Practice with computers, mapping

Concluding remarks

Based on the participant's comments during the course and the responses to the questions above it can be stated that the course was highly successful. None of the participants was unsatisfied with any of the components of the course. At least 7 of the nine participants found the course highly satisfactory and indicated that they had learnt new skills which they believed they would be able to implement in their own countries. The trainers that took part in the course all felt that the interaction between participants and the trainer(s) was very good, and that everyone learnt from this course, not only the students but also the lecturers.

The need for more remote sensing and GIS training came up at various points during the course. It would have been difficult to arrange hands-on training in remote sensing and GIS during the course itself, but it would be worthwhile to look into the possibilities of arranging a follow up course, maybe at Gobabeb training and Research Centre. A course like that would give the participants an opportunity to get more practical experience of both these tools.

Many of the participants requested notes from the lectures, not only for the specific module they took part in, but from all training modules given before the conference. Notes of the lectures given within Module A3 were distributed the day after the lecture. The possibility of collecting all notes from all modules and distribute them to all participants was not followed up during the duration of the course.

Appendix 1
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