Desertification and Global Change

Proceedings of an International Symposium

Innovative Management of Scarce Resources in Semi-Arid Areas

Experiences from development and research: Challenges for a better future

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Table of Contents

1 INTRODUCTION 1

2 SYNTHESIS 4
- 2.1 General conclusions 4
- 2.2 Thematic findings 6
- 2.3 Outlook 8
- 2.4 Synoptic view of working group discussions 9

Annex 1: SUMMARIES OF TANDEM PRESENTATIONS

Theme 1: Management of competing demands for water in transnational settings

1 a) Hydro-meteorology in Central Asia (M. Baumgartner) 14

1 b) Managing competing demands for irrigation water - Case studies from the Ferghana Valley, Central Asia (C. Bichsel) 17

Theme 2: Competition for natural resources between unequal stakeholders

2 a) Poverty reduction and land management options in drylands of Pakistan (F. Malik) 23

2 b) Competition for natural resources between unequal stakeholders - A case of the semi-arid areas in Makueni District, Kenya (C. Speranza) 32

Theme 3: Market access, social services, and improved infrastructure for vulnerable stakeholders

3 a) Market access, social services and improved infrastructure for vulnerable stakeholders - Practical experience in different project and programme design and implementation missions (B. Peterhans) 39

3 b) Improved infrastructures, market access and social services for vulnerable populations in the Sahel (B. Bonfoh) 46

Theme 4: Climatic variability at local and national levels

4 a) How to cope with climate variability in the Mediterranean - The case of drought management in Morocco (T. Ameziane El Hassani) 51

4 b) Dealing with climatic variability at the local level: Experiences from water conservation research on the dry foot slopes of Mount Kenya (N. Lewis) 54

Annex 2: MATERIALS
- 1 Bios of presenters 60
- 2 Symposium programme 63

1 INTRODUCTION

“The desert is deserted only when man abandons it”
Touareg proverb

Desertification is known to be a complex but frequently neglected or overlooked phenomenon (MEA 2005[1]). Therefore, the International Year of Deserts and Desertification 2006 (IYDD[2]), proclaimed by the United Nations to celebrate the 10th anniversary of the UN Convention to Combat Desertification (UNCCD[3], established in 1996 and signed by 191 countries so far), was an attempt to raise awareness among a broader public, decisionmakers, and specialists in the field. Nevertheless, adding one more event to a range of activities all over the globe, in order to address the challenge of combating desertification, might seem like a pointless undertaking.

While most events took mainly a problem-oriented perspective and approach, the Bern Symposium held in May 2006 tried to adopt a more positive attitude by attempting to take stock of experience as well as best and worst practices in the past, both in development practice and in research. Through this deliberate focus on potentials, positive experiences, solutions and pathways, predominant passive and reactive attitudes and hopelessness might be better overcome.

[1] www.millenniumassessment.org/en/index.aspx
[2] www.iydd.org
[3] www.unccd.int/main.php

The Centre for Development and Environment (CDE[4]), which is involved in the implementation of research and in supporting development projects and programs, has tried to draw lessons from its development activities as well as from its research (in particular the NCCR North-South[5]). Prior to this Symposium, CDE elaborated a brochure entitled 'Coping with Drought' (SDC 2006[6]) concerning the numerous efforts of the Swiss Agency for Development and Cooperation (SDC[7]) related to desertification, and participated in an International Conference on Desertification, Hunger and Poverty in Geneva (IUED[8]). In the wider context of Sustainable Land Management (SLM), CDE helped to compile a 'World Soils Agenda'[9] which reaches beyond desertification by putting soil issues in a broader policy framework.

The aim of the one-day International Symposium in Bern was thus to further interaction between development practice and research in order to capitalize on recent experience and progress in both domains. Through discussions and debates, the participants worked towards identifying novel and promising approaches and pathways to more efficient management of scarce resources and improvement of livelihoods in arid and semi-arid regions. In a wider context, the Symposium contributed to a better understanding of mechanisms, obstacles and potentials for appropriate societal responses to the ongoing processes of global change in general and (regional) desertification in particular.

The symposium

The Symposium was open to a broad public, but mainly addressed development practitioners and researchers from the North and the South working in the field of rural development in areas affected by desertification. About 60 participants attended the symposium.

Goals

The **main goals** of the Symposium were:

- to provide researchers and development practitioners from the South and the North an opportunity to present and share their findings, experiences, and perceptions;
- to expand the focus of desertification research beyond purely environmental issues to the broader phenomenon of a complex syndrome of global change, encompassing social, economic, and ecological processes;
- to present innovative approaches to combating desertification as part of a comprehensive effort to improve livelihoods and sustainable development in semi-arid and arid areas; and
- to identify new ways in which scientific research can contribute to developing and implementing such new approaches.

[4] www.cde.unibe.ch
[5] www.north-south.unibe.ch
[6] http://162.23.39.120/dezaweb/ressources/resource_en_91565.pdf
[7] www.deza.ch
[8] www.unige.ch/iued/new/
[9] www.cde.unibe.ch/CDE/PubMed_Detail2_Cd.asp?ID=406

Themes
The symposium focused on four central **themes** in presentations, which were given more in-depth treatment in thematic working groups:

T 1: Management of competing demands for water in transnational settings

T 2: Competition for natural resources between unequal stakeholders

T 3: Market access, social services, and improved infrastructure for vulnerable stakeholders

T 4: Climatic variability at local and national levels

The core of the Symposium set-up consisted of 8 tandem presentations bridging development and research, as well as so-called transition and developing countries. Research interventions all built on results from the NCCR North-South. Most presentations focused on semi-arid contexts and livelihoods. Special foci were the complexity of multiple stakeholder relations and the links and interdependencies between areas affected by desertification, other eco-regions, and economic centres (urban areas).

Guiding questions for the thematic working groups
The presentations provided both background and inputs for the four thematic workshops. Each working group aimed to answer the following questions in its respective thematic area:

Q 1: What are the ***lessons*** to be drawn from a consideration of both the development and the research case studies presented?

Q 2: What is the ***relevance*** of the theme to the improvement of livelihoods and sustainable development in arid and semi-arid regions? How are regional differences and similarities to be accounted for in research and development work?

Q 3: What are the ***implications*** of previous findings for planning and implementing research and development agendas? How can they be applied in the development of promising and innovative approaches to combating desertification?

Q 4: What ***role*** can Switzerland play in contributing to the improvement of livelihoods and the promotion of sustainable development in arid and semi-arid regions? What are the advantages Switzerland has to offer and what is Switzerland's responsibility? What can the Swiss research and development communities contribute, and how? What are the most promising current entry points or opportunities?

2. SYNTHESIS

The presentations and subsequent discussions in working groups generated a range of interesting findings that can stimulate further thinking and implementation.

2.1 General conclusions

Address contextuality and complexity
In order to operationalise the concept of sustainable management of (scarce) natural resources in regions affected by desertification, a clear regional focus with relatively homogeneous ecological and socio-economic (frame) conditions is necessary. This can best be achieved by narrowing the object of intervention or research, e.g. to semi-arid areas – as opposed to all areas potentially affected by desertification. This makes it possible to reduce the degree of complexity to a more manageable and meaningful level. A further reduction can be achieved by limiting the scope to a geographical region such as Central Asia or the Sahel. Through this 'contextual regionalization' the complexity of the causalities that constitute the phenomenon of desertification becomes more understandable.

Promote multi-sectoral understanding
The case studies presented have shown the need for a multi-sectoral perspective and approach in order to avoid simply 'treating symptoms' when addressing desertification. This requires integrated analysis and thinking, as in the 'one medicine' approach (→ Bonfoh), or in considering unequal power relations at the local level (→ Speranza). Such an understanding does not imply addressing all relevant issues. On the contrary, this will allow a more focused and selected intervention related to specific drivers.

Consider institutional and political aspects
Since the capacities of different countries and regions differ considerably, the presentations revealed the necessity to thoroughly consider and understand the institutional and political conditions and mechanisms necessary for effective measures. This implies support for institutional development and capacity strengthening, for both research and development interventions (→ Baumgartner). However, several case studies (→ Bichsel, Malik) made clear that this is a rather difficult endeavour under the given economic and political conditions. Research should therefore address such obstacles in order to identify possible solutions or promising entry points.

Work at different scales
Studies have shown that on one hand local actor strategies have to be considered (→ Malik) and well understood, but that on the other hand actors at higher levels have power over natural resources (→ Bichsel). Both levels must therefore be included when designing research or development actions. The same applies to ecological issues such as evapotranspiration at the field level (→ Njeru), or contested use of water for hydro power and agriculture in a region (→ Baumgartner, Bichsel).

Develop comprehensive strategies
There is a need to link selected activities from different sectors (→ Bonfoh) into comprehensive strategies, thus realizing the potential of a multi-sectoral approach without falling into the trap of becoming active in all possible fields. This calls for broader cooperation and coordination among both development and research actors (→ Ameziane El Hassani, Bichsel).

Consider economic challenges and opportunities
Given the resource scarcity in many if not all semi-arid areas affected by desertification, economic opportunities are badly needed. At the household level, additional income can be generated by relatively simple technologies such as cost-effective soil and water conservation (→ Njeru), easy-to-process dairy products (→ Bonfoh), or improved market access. However, large-scale exploitation of natural resources such as water through certain public-private partnerships, which causes considerable ecological damage and increases poverty among the local population, needs to be critically reviewed.

Apply participatory and transdisciplinary approaches
Several case studies provided further evidence that participatory and transdisciplinary research approaches enhance the probability of better adoption of research results by local stakeholders. Similar statements confirmed the utility of participatory involvement in the planning and implementation of development activities. Approaches that link participatory research with development, for instance through transdisciplinary stakeholder seminars, also allow power issues to be addressed among unequal stakeholder groups.

Orient research towards implementation
The need to orient research much more towards implementation was strongly voiced and widely supported. This request is a reaction to the fact that financial and human resources are frequently very limited, and that such research has proven to be meaningful in helping to improve the living conditions of the local population.

The role of Switzerland
Regarding the role of Switzerland, attention was called to the long-term commitment and quality label of Swiss cooperation and research partnerships (KFPE[10]). Research partnerships are by now a well-accepted approach to research in the international context and have an important potential. However, their quality still needs to be enhanced. Similarly, Swiss expertise and experience in ‘decentralised governance’ can contribute to finding effective and equitable solutions to natural resource management. Finally, Switzerland was considered to have a comparative advantage in relation to highland-lowland environmental issues (especially related to water resource management) and semi-arid areas[11].

[10] www.kfpe.ch
[11] e.g. NCCR North-South

2.2 Thematic findings

The following paragraph presents some of the most prominent findings regarding challenges in development and research for each of the four thematic areas of the symposium. The findings stem from both the presentations and the working group discussions.

Theme 1: Managing competing demands for water in a transnational setting (Central Asia)

- ***Development:*** The bottleneck is less a technical than a social, political and institutional challenge. Unequal power relations often hinder the implementation of the principle of equitable access to and use of natural resources, particularly when promoted by international actors. Conflicting goals thus call for compromises between equity and efficiency considerations in order to mitigate certain conflicts.
- ***Research:*** Given the impacts of global climate change on water resources in Central Asia, it appears crucial to establish a well-functioning monitoring system for glaciers and river flow both at national and regional levels. Furthermore, special research efforts are needed to identify ways of institutionalizing and upscaling water management options identified at the local level.

Theme 2: Competition for natural resources between unequal stakeholders

- ***Development:*** Development interventions need to address and include the facilitation of a dialogue and negotiation process among all stakeholders in order to foster a sustainable solution. Special attention has to be paid to avoid the exclusion of the weakest. While tensions and hardships are a reality, they might at times be used as an entry point for initiating such a dialogue.
- ***Research:*** Contradictory sets of modern and customary laws often regulate access to and use of natural resources. This dichotomy calls for more in-depth research on how to reconcile rules and regulations based on different legal systems. Research on innovations and alternatives to reduce pressure on scarce natural resources should not be neglected.

Theme 3: Market access, social services, and improved infrastructure for vulnerable stakeholders

- ***Development:*** Special emphasis has to be given to providing support for improving the quality of local products and marketing them successfully, including market access at various levels. This has considerable potential to improve livelihood conditions in a sustainable way. Modern means of communication may be an essential supportive tool in such an endeavour.
- ***Research:*** **The** above-mentioned efforts should be supported by participatory research carried out in collaboration with the local population. By integrating local people into research activities (trans-disciplinary approach), joint solutions can be developed and more easily implemented (ownership).

Theme 4: Climatic variability at local and national levels

- ***Development:*** In addition to national and regional emergency support strategies and plans to respond to drought and climate variability, special efforts are needed to improve the resilience of communities and households, e.g. by diversifying, adapting and improving local agriculture.
- ***Research:*** The contribution of research to monitoring, forecasting and elaborating strategies for preparedness is considered essential. However, new approaches and innovations are needed to improve cost-effectiveness, and to secure long-term financing of research institutions. This calls for cooperation at the regional level, involving governmental and non-governmental organisations. Furthermore, research should continue to share knowledge on efficient soil and water conservation technologies (e.g. WOCAT[12]), develop drought-resistant crop varieties, and support the strengthening of coping strategies in local communities and of governments in adaptating to climate change.

[12] www.wocat.net

2.3 Outlook

The following are recurrent questions - relevant to both development practice and research – derived from case studies presented and from discussions.

- How to include and promote market access and economic considerations when searching for solutions to NRM and livelihood improvement?
- How to promote market conditions, social services, and infrastructure in order to avoid or reduce rural exodus?
- How to respond to the need to help empower target groups in development interventions and/or development research?
- How to promote and implement a multi-sector approach in development research and cooperation?
- How to contribute to the empowerment, capacity building, and self-organization of civil society as a crucial prerequisite for improving people's livelihoods?
- How to handle and/or address vested interests that hamper efforts both in research and in development activities?
- How to avoid generating tensions and conflicts when promoting the sharing of information or data and increase transparency?
- How to address the lack of effective and appropriate strategies needed to link local, national and interstate levels in the decision-making process in the context of (sustainable) development?
- How to handle the demand for 'no research without accompanying development measure(s) / projects'), as well as its risks?
- How can/must contextuality be adequately considered in research and development?

These questions were addressed without being comprehensively answered during the Symposium. They will need to be addressed in future research and development cooperation to enhance the effectiveness of activities in all fields of research and development. Drylands occupy 41% of the Earth's land area, and are home to more than 2 billion people. Finding answers to these questions is therefore an important and relevant need.

2.4 Synoptic view of working group discussions

What follows is a synoptic view of the working group discussions, i.e. the answers the different working groups found for each of the four guiding questions.

Q1: Lessons learned from development and research

T1: Managing competing demands for water

- The most difficult problems are not of a technical nature, but are a function of the respective socio-political and institutional setting.
- There is a lack of effective strategies that allow linkage of local, national and inter-state levels in decision-making processes.
- Too many actors and great competition between donors lead to abuse by recipient countries. Donor coordination and long-term commitments would be beneficial and require less financial resources.

T2: Competition for natural resources between unequal stakeholders

- The dichotomy between national laws and unwritten (traditional) customary laws is a special challenge, as customary laws may greatly influence 'gendered' access to and use of natural resources, but in many cases they also regulate societal functioning more effectively. The dichotomy is especially challenging for national law making.
- There is a need for better organisation and possible gains from being better organised in NRM (while avoiding an 'overdose' of organizational support!).
- Poor people often have a short planning horizon (due to risks and limited access to financial resources), while sustainable resource management requires a long planning horizon. Potential returns from improvements in NRM have to be made visible.
- Do people really want to become better organized, and if so, how?
- What improvement is there in the capacity of (better) organized groups?
- Local groups must be linked with available (governmental) structures such as financial, services, information and other structures.

T3: Market access, social services, and infrastructure for vulnerable stakeholders

- No research (not even a pilot study) should be done without implementation / development action. Implementation of research results requires previous validation by all stakeholders.
- Multi-sector approaches seem to be very promising, e.g. by bridging health and education, or human and animal health in mobile societies. Some sectors may be entry points for others (e.g. water points can develop into a site to provide market services and access to health services).
- Access and quality of services determine the willingness to pay. Besides free access (to e.g. basic health), non-monetary solutions such as exchange of livestock for services have to be considered.
- Access to markets has to be improved and promoted. Well-oriented research can contribute to the development of new markets (e.g. for camel milk) by supporting the improvement of product quality, storage, and processing.

T4: Dealing with climatic variability

- More powerful resource users who have a bigger say may not be interested in long-term monitoring and access to data that might compromise their power and competitive advantages.
- How can the methodology or approach of drought monitoring and preparedness – a result from research – be transferred to the development context / actors?
- Include local indicators in drought monitoring systems.
- Drought monitoring and planning centres exist, but their effect at the local level is not felt.
- While long-term research and monitoring is fundamental, ways have to be found to reduce related costs (e.g. combine different approaches and methods, promote synergies, make existing data freely accessible, use cheaper equipment, etc.).

Q2: Relevance for livelihoods and sustainable development

T1: Managing competing demands for water

- Considerations of efficiency, peace building, and equality need to be integrated at the project level, although the goals of achieving equitable and non-conflicting (water) resource distribution are often irreconcilable.
- Water management is a complex issue and interrelated with other sectors (e.g. agriculture, energy). It is thus important to consider all factors influencing water availability, quality and distribution; and to integrate them in a water management strategy.

T2: Competition for natural resources between unequal stakeholders

- Tensions (conflicts, hardships) surrounding the use of natural resources represent a potential (entry points, driving force) for innovative / more effective development efforts, which needs to be considered.
- Different contexts require different approaches (e.g. regarding gender, or livelihood). Competition for NR between unequal partners takes place within a variety of contexts.
- Competition may lead to exclusion, which may lead to degradation, and conflict (Where is the starting point?).

T3: Market access, social services, and infrastructure for vulnerable stakeholders

- Market access, social services and improved infrastructure are crucial for rural development and avoiding rural exodus.
- Rural development must be supported by effective decentralisation, i.e. not only delegation of responsibilities to lower levels, but also allocation of respective budgets.
- Sedentarisation policies are not relevant for mobile communities, since they do not correspond to the needs of a pastoral and nomadic economy. However, access to services, infrastructure and markets may lead to a shift in lifestyle with semi-sedentarisation.
- Access to information technology (radio, mobile and satellite phone, etc.) is relevant for the development of semi-arid areas. Synergies between access to communication, health services and developing markets exist and create new dynamics.

T4: Dealing with climatic variability

- In many cases, the importance of arid and semi-arid areas is not sufficiently appreciated at the policy level or at the level of government investment / budget.
- There is a tradition of concentrating efforts on the productive sector which, in arid and semi-arid areas, is obviously rather limited. There is a need to investigate alternatives in other sectors such as services.
- Too little is known about how climate change - it seems that climatic variability is increasing - will / may affect arid and semi-arid areas worldwide.
- Research is needed on how to better utilise arid and semi-arid areas, including understanding the livelihoods and strategies of nomadic people.
- Research is needed on interactions and influences among different systems, e.g. impact of large-scale irrigation on pastoralists.

Q3: Implications for planning and implementing research and development agendas

T1: Managing competing demands for water

- IWRM is innovative but impossible (i.e. wishful thinking). Nevertheless, it would be valuable to identify ways to couple interventions in the water sector with other sectors, and deduce 'field tested packages' from these experiences.
- Past interventions privileged certain non-governmental actors; the leading actor should be the national government that collaborates with other actors concerned.
- How can negotiated outcomes in water management be institutionalized?

T2: Competition for natural resources between unequal stakeholders

- Ensure participation aiming at full involvement (this is an accepted strategy of most agencies).
- Ensure integration of the interests of all stakeholders in NR development approaches.
- Advocate for weak stakeholders in development agencies, but avoid mere activism.
- Promote equal access to resources – reduce exclusion.
- Improve policy dialogue by integrating decision-makers from different sectors. Policy dialogue needs to be more accurately defined in operational terms.

T3: Market access, social services, and infrastructure for vulnerable stakeholders

- In nomadic environments policymakers are often totally absent due to remoteness or political tensions. Research can play an important role in bringing together stakeholders for dialogue.
- Action research and community-based needs assessments are good methods to gain confidence and make communities feel listened to. However, it is important that this is followed by implementation that benefits the local population.
- Promote transdisciplinary (science-society) stakeholder seminars (involving e.g. central and local authorities and communities).
- Capacity building concerned with planning skills is required.
- Political and ethnical tensions can be mitigated by partnership (fostered S-S, N-S).

T4: Dealing with climatic variability

- Governance and capacity building at the local / community level have a good potential to bring about positive changes in resource use.
- Resource users are confronted with different types of change, e.g. in power relations, climatic variability and land use, sometimes occurring simultaneously.
- There is a particular need for research on legal systems, land tenure, policy issues, resource users / community adaptation strategies, use of developed technologies, and development of non-primary sectors in arid and semi-arid areas.

Q4: Switzerland's role

T1: Managing competing demands for water

- Switzerland has considerable experience in mountain water management and related fields such as natural hazard management, etc.
- Switzerland can share experience with decentralization processes.
- Switzerland should/could have a greater presence on the international political scene (e.g. in Central Asia).

Some interesting and meaningful research questions for the future were identified:

- How can we connect policymaking at the national and community levels?
- How can projects generate sustainable 'in-situ' knowledge?
- Critical analyses of public-private partnerships.
- What is the role of scientific results in regional and local management?
- How can we institutionalize locally negotiated water management solutions?

T2: Competition for natural resources between unequal stakeholders

- The federalist structure of Switzerland and its tradition of successfully promoting negotiation processes and political dialogue qualify the country for a role in creating effective linkages between stakeholders in the field of NR development and planning. The Swiss Agency for Development Cooperation is qualified to support participatory planning and negotiation processes and community development.
- Responsibilities resulting from Swiss membership in various International Conventions, and as a member of several multilateral donor funds.
- Policy dialogue at decision-making level (see remark on 'policy dialogue' under Q3).

T3: Market access, social services, and infrastructure for vulnerable stakeholders

- Research should focus more on processes and systems than on single results and outcomes.
- Foster complementary research-development actions while considering improvement of communication and trust-building between researchers and development agents.
- N-S partnerships represent great potential, but the quality of partnership approaches (international and national networks, N-N, N-S, S-S) must be improved.
- Secure long-term collaboration, and shift capacity development from person-based (PhD, MSc) to institution-based (institute, organisation; senior, supervisor).
- Swiss research institutions should move towards a catalytic role to reach more institutions in the South.
- Support for increased research capacity in the South.

T4: Dealing with climatic variability

- Switzerland enjoys a great acceptance at the national level (in partner countries) but is also able/willing to work at the grassroots level. This is an important comparative advantage.
- Switzerland has developed long-term investments and partnerships, although it follows a project cycle that requires shorter evaluation and reporting periods.
- Switzerland could/should invest seed money or exploratory financial resources in innovative and eventually risky initiatives.

Annex 1

Summaries of presentations

T 1 Management of competing demands for water in transnational settings

Hydro-meteorology in Central Asia

PD Dr. Michael F. Baumgartner,
Managing Director, MFB-GeoConsulting

(compiled and edited by M. Giger, D. Maselli, and F. Bachmann)

1. Introduction

Irrigation agriculture has played an important role in Central Asia since historical times. During the Soviet period however, traditional irrigation structures were destroyed and trans-regional river and irrigation systems with cascading hydro-power schemes and reservoirs created. Cotton production was widely increased for economic reasons and irrigated areas expanded even until the early 1990ies. As a consequence the water resources of Amu Darya and Syr Darya rivers flowing to the Aral Sea were overused and mismanaged leading to an increase of the ground water table and salinization problems. The large scale irrigation schemes were generally not very efficient and not well maintained leading to huge losses of water. Intensive use of pesticides further led to pollution of ground waters and rivers. The drying out of the Aral Sea was the most evident consequence, leading to the deposition of salts and chemicals in agricultural regions, poisoned food cycles as well as genetic problems in the human populations.

2. Project background

The collapse of the former Soviet Union has led to a breakdown of economy and, consequently, of hydrologic and hydrometric services. The creation of new nations with artificial (administrative) boundaries has further led to new borders that separate trans-regional river and irrigation systems. The nation-building process has therefore generated interstate conflicts on water resources. This situation is exacerbated even more by the possibility of the internationalization of the conflict through Russian and American presence in the region, international (global) interests in natural resources, and the absence of bilateral military pacts.

The socio-cultural situation appears to be highly complex, too. Historically seen, the region never was fully independent. However, complex ethnic mixture has been purposely created during the Soviet period with local ethnic groups, and Russians, Koreans, Georgians, Germans, etc. but without a coherent territory for a specific ethnic group. After the collapse a major brain drain process started due to exodus of considerable parts of the society: Russians, Germans, and Jews in particular. More recently, Islam plays an important role but fortunately so far the conflict potential seems to be relatively low, although poverty could rapidly increase religious fanaticism.

The economic situation is completely different for each country (Kyrgyzstan, Uzbekistan, Tajikistan, Kazakhstan, and Turkmenistan) depending on the availability of natural resources as well as the current political system. During Soviet time, water as a commodity was free of charge but state-owned, while in Muslim countries water doesn’t belong to anybody.

3. Water conflicts

The main reasons for conflicts in the water sector are thus: a politically caused splitting of the region (emergence of new nations) and consequently of large river and irrigation systems (i), the artificial pattern of ethnic mixture (ii), and the collapse of the economy (iii) following the disintegration of former Soviet Union, which led to the deterioration of hydro-meteorological surveys and the decay of irrigation systems.

The water supply is frequently insufficient to cover the needs of the economy and the population. Per capita supply of water has been reduced from 7500m^3 in 1950 to 700m^3 in 2000. 1000m^3 can be considered as a lower general limit. Some of the countries are thus highly dependent on imported surface water as well as energy generated through hydro-power devices. The ratio between water supply and demand is often critical. Given the topography, water is not distributed equally between the countries and river flows are highly seasonal. For Uzbekistan for instance, water stemming from melting of snow and glaciers in Tajikistan (in summer) is crucial, since this process provides water in the most critical period. On the other hand, in Tajikistan water is preferably used for energy production, making it economically interesting to store the water in reservoirs during summer time and to use it in winter when electricity prices are high. This leads to highly conflicting national interests regarding the use of water resources in the region.

An area of particularly high risk of conflict is the Fergana Valley where borders of Kyrgyzstan, Tajikistan, Uzbekistan meet, and enclaves exist. The region has a high population density (450 inhabitants/km^2) and a high ethnic diversity with Kyrgyz, Tajik, Uzbeks (the majority), Koreans, Georgians (Meshketian Turks), and Russians. The unemployment rate is high, about 80%, creating a very sensitive social situation. The highest risk for conflicts at the local level relates to the joint use of irrigation systems by several national groups, particularly if there is discrimination. Conflicts may also arise when irrigation schemes serve different ethnic minorities on the two sides of a river, e.g. as in the case of the Amu Darya with Uzbeks in Turkmenistan and Turkmens in Uzbekistan.

Regional economic disparities also have an influence on the conflict risk: the trend towards a general impoverishment of mountainous regions in Tajikistan contrasts with more industrialized regions in the Fergana Valley e.g. Khodzhent. Moreover, the potential for conflicts stemming from environmental problems such as nuclear waste or polluted water in the Fergana Valley is difficult to assess.

4. Addressing water conflicts

In general, solutions to mitigating conflict potentials are seen in reducing water consumption, especially through renovation and modernization of irrigation systems as well as improved irrigation management schemes. This includes re-organization of water management and distribution systems down to the local/community level. Therein the introduction of water pricing has a potential to contribute to improve efficient water use. Its introduction in Kyrgyzstan has led to a decrease of water consumption by 30%, without losses in agricultural production. However, control systems are expensive and small farms may not be in a position to afford the costs, and therefore are at risk of impoverishment. This calls for an adjustment of the cropping patterns and for switching to other crops than cotton, which will however, still remain important for a long time due to its economic importance. Further efforts are needed to negotiate interstate agreements and to foster the democratization processes in order to secure the political basis for such improvements.
The refurbishment of hydrological, meteorological and other networks, combined with training and education at different levels, is therefore an important prerequisite for better management and effective utilization of water resources. Below, a project aiming at these objectives is presented.

5. Regional Centre of Hydrology in Central Asia

a. Project background and goal

The project started in 1995 and is still ongoing. It originated from three pilot projects within the World Bank's Project „Save the Aral Sea“ and was launched within the Program 2.1 „Improvement of the Hydro-Meteorological Surveys in Central Asia“.

The main objective was the establishment of the necessary infrastructure for runoff forecasting from snowmelt, in order to address the general lack of hydro-meteorological baseline information in the region. For this, a Regional Centre of Hydrology (RCH) had to be created. One of the major goals was to develop hydrological models for remote areas with sparse data, and to collect and analyze remote sensing data as input to hydrological modelling.

b. Project activities

The Swiss contribution to the RCH consists in supporting snowmelt runoff forecasting (Figure 1), introducing and implementing dilution methods and tracer hydrology, as well as in installing hydro-meteorological stations. In addition, professional technical and scientific support is delivered. The project involves five countries: Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan, and Turkmenistan.

Amongst others, the project supported the definition and establishment of a system for Hydrological Dataflow in Uzbekistan and financed, planned and supported a number of components of this system. The data are now made available through a system of email, websites and web database. The information is not publically available, due to the importance and sensitivity of the data on water resources.

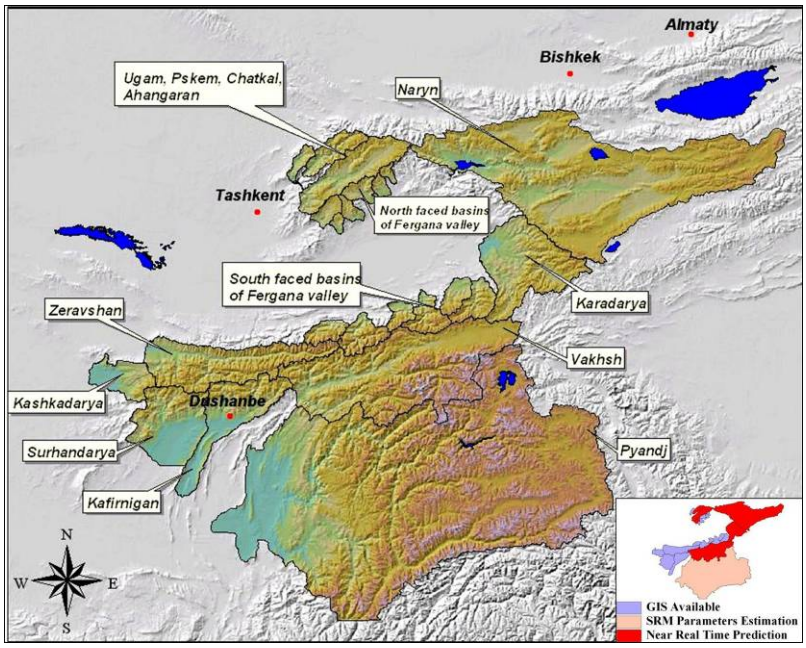


Figure 1: Basins under investigation

c. Experiences

From the perspective of a private enterprise the following experiences can be reported:
The funds provided by the Swiss administration allowed for the establishment and sustainable use of high-tech infrastructure. The project goal was jointly defined by Central Asian Partners and Switzerland. The project put emphasis on work to be carried out by local partners, but provided project management, monitoring and support by Switzerland. For the training, Uzbek partners were trained first, and they provided training subsequently to other partners. This approach was very successful, although more time is needed, than if all local partners would have been trained by foreign experts. The project was successful in integrating local specialists into a high- tech project environment. Experience also showed the importance of a good knowledge of existing systems and data-flows as well as of good working relationships with local partners.

Problems faced included a brain drain effect to Russia, Canada, USA, Israel, and Germany which led to a considerable loss of experienced and trained counterparts. Negotiations with local authorities, as well as the import of equipment needed, proved to be very time-consuming.

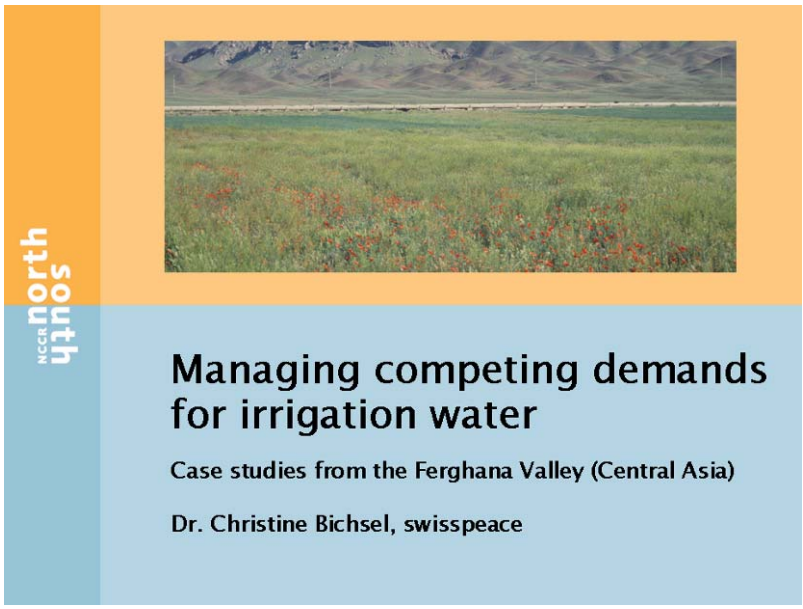
Lessons learned also include the importance of a joint investment of donor agencies and local institutions. For a private company, it was very important to get support in political and financial matters from the donor institution, for which close cooperation was necessary. A long-term commitment of 12-15 years proved to be necessary for such a complex undertaking, and a clearly defined transition period to terminate the project was equally important. The project – with the support of the donor - also negotiated a contractual commitment of the local institution to employ project personnel and pay them accordingly, once the project is/will be completed.

T 1 Management of competing demands for water in transnational settings

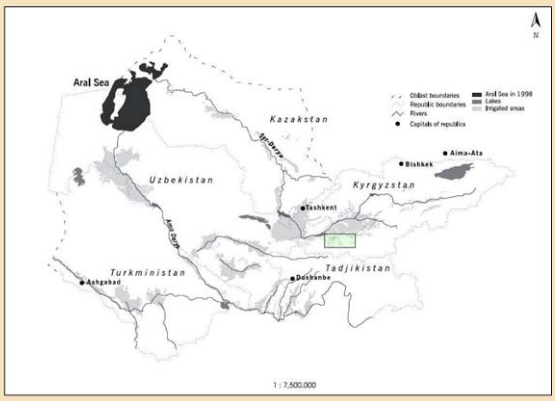
Managing competing demands for irrigation water

Case studies from the Ferghana Valley (Central Asia)

Dr. Christine Bichsel,
Swisspeace



The Aral Sea Basin



Source: Murray-Rust et al (2003)

The Ferghana Valley

Source: UNEP / GRID-Arendal (2005)

Case studies

- Two or three villages / municipalities
- Gravitational irrigation systems
- One or several water sources
- Agriculture (maize, wheat, sunflowers)
- Transboundary
- Groups of differing ethnic affiliation

Competing demands in irrigation systems 1

- Upstream–downstream
- Seasonality
- Water distribution and allocation

Competing demands in irrigation systems 2

- Competition is not an exception, but a rule
- Competition is not necessarily a consequence of resource scarcity
- Competition is not negative per se

Dysfunctional outcomes of competition

- Injustice (socially inequitable)
- Conflict (physical violence)
- Inefficiency (agricultural losses)
- Ill–being (ill health, endangered livelihood)

Responses to competing demands

- Avoidance
- Violence
- Procedure („Verfahren“)
  - Behavioural
  - Institutional
  - Resource-oriented

Approaches for managing competing claims

- Irrigation sector reform
- Conflict transformation

Conflict transformation 1

- Focus on conflict
- Infrastructure building and rehabilitation
- Joint social activities
- Transboundary dimension

Conflict transformation 2

- Resource base and behavioural
- [how should competing claims be mitigated?]
- [what are the main results?]

Irrigation sector reform

- Focus on inefficiency
- Towards Integrated Water Resource Management (IWRM)
- Establishment of Water User Associations
- Infrastructure building or rehabilitation
- Limited transboundary dimension

Irrigation sector reform 2

- Resource base and institutions
- [how should competing claims be mitigated?]
- [what are the main results?]

Conclusions for managing competing demands

- Integration of multiple approaches
- Integration of different interests
- Integration of different level

T 2 Competition for natural resources between unequal stakeholders

Poverty reduction and land management options in drylands of Pakistan

By Fauzia Malik & S. Irfanullah Khan,
Farm Forestry Support Project (FFSP) Intercooperation Pakistan

Executive summary

Degradation in drylands is believed to threaten the livelihoods of 1 billion people in some 110 countries according to the United Nations Convention to Combat Desertification (UNCCD). Areas with the greatest water loss and land degradation correspond closely with areas of the highest rural poverty and malnutrition, and food and environmental insecurity. Degradation of land and water resources increasingly threatens national and household food security in many parts of the developing world. Loss and degradation of water and land for agriculture are not universal, but are widespread and accelerating, particularly in developing countries. In these countries, degradation reduces options for our future and that of the next generation. (F. W. T. Penning de Vries, et al. 2003).

In Pakistan, arid and semi-arid region is the biggest climatic region that covers 53% of the country's total area (Source: National Conservation Strategy of Pakistan-IUCN). Most parts of Sind and Balochistan, and Southern parts of Punjab and NWFP are falling within this climatic belt. Major land-uses in this region include rangelands (48%) and subsistence rainfed agriculture (5%). Reduction in land quality in many different ways, leading to reduced food supplies, lower agricultural income, increased costs to farmers and consumers, and deterioration of water-catchment functions. (F. W. T. Penning de Vries, *et al*, 2003)**.** Due to prolonged drought in 1999-2002, the agricultural sector in Pakistan suffered a severe setback, with an overall negative agricultural growth up to 2.6% (Shahid Ahmad, *et al*, 2004).

Drylands therefore, deserve more attention due to the fact that they pose formidable challenges for sustainable development. However, despite the multifarious problems, there is a great potential to improve livelihoods in the drylands - much more than has originally been thought by most development agencies, and the gains to be achieved in improved development, living standards, and better natural resource management by investing in the drylands are considerable. (Synne Movik *et al*, 2003)

This paper is an attempt to portray the complexity and the diversity of the drylands and its people, and to outline some of the possible approaches and implications for action. It is our belief that paying attention to the drylands and recognizing their potential for sustainable development will pay great dividends, most notably in the improved livelihoods of the people inhabiting the dry regions.

The paper also analyzes the approaches implied by the Farm Forestry Support Project to avert the process of land degradation and provide livelihood opportunities for small farmers and poor women in drylands of NWFP. It looks into the available institutions for support and a vision for a suitable institutional setup to combat desertification and arrest land degradation.

1. Background

The survival of human life on the planet earth has been supported from the very beginning by presence of a variety of natural resources. These natural resources, in the form of land, water, vegetation, air and many more, have been the earliest supporters of life on earth. Where the availability pattern of these resources has shaped the socioeconomic designs in various parts of the world, the resource use patterns have given rise to a number of questions regarding the future of this great relationship between humans and natural resources. Today humans have discovered new ways and technologies to produce more food. Despite many efforts, it has not been possible to secure food for everyone on this world. An estimated 800 million people do not have access to sufficient food supplies, mostly in South Asia and Sub-Saharan Africa. Areas with the greatest water loss and land degradation correspond closely with areas of the highest rural poverty and malnutrition, and food and environmental insecurity (F.W.T. Penning de Vries, *et al*. 2003).

In many parts of the developing world, national and household food security is increasingly threatened by the degradation of land and water resources. Loss and degradation of water and land for agriculture are not universal, but are widespread and accelerating, particularly in developing countries. In these countries, degradation reduces options for our future and that of the next generation. Agro-ecological systems and societies have a threshold to degradation resilience, and collapse when natural resources are degraded too far, as had happened in the past.

According to the UNCCD, degradation in dryland areas is believed to threaten the livelihoods of 1 billion people in some 110 countries. Thus it becomes a global issue. Keeping in view the importance of land as a resource, and degradation or desertification as an issue, it is worthwhile to analyze the major concerns related to these. The phenomenon can impact the human livelihood in many ways but the most prominent are loss of water for agriculture, reduction in land quality in many different ways, leading to reduced food supplies, lower agricultural income, increased costs to farmers and consumers, and deterioration of water catchments functions, reduction in water quality due to pollution, loss of farmland through drought and conversion to non-agricultural purposes (F.W.T. Penning de Vries, *et al*. 2003).

2. Pakistan country perspective

Drylands can be defined as hyper-arid, arid and semi-arid areas with an aridity index lower than 0.5 (aridity index is the ration Precipitation / Precipitation Evapotranspiration. In general, drylands are the areas receiving less than 500-millimeter annual rainfall. In Pakistan, the situation is more severe where annual rainfall in most parts of the country is less than 250mm (Source: Annual Normal Rainfall Map – Pakistan Meteorological Department).

In Pakistan, arid and semi-arid region is the biggest climatic region that covers 53% of the country's total area (Source: National Conservation Strategy of Pakistan-IUCN). Most parts of Sind and Balochistan, and Southern parts of Punjab and NWFP are falling within this climatic belt. Major land-uses in this region include rangelands (48%) and subsistence rainfed agriculture (5%). The inhabitants of dry zone in Pakistan are generally very poor and their livelihood depends on rainfed agriculture and livestock.

Table 1: Land use pattern in Pakistan, 1999-2000

Land use category	Area (million ha)	% of the total land area
Cultivation	22.13	27.8
Forests	3.81	4.8
Cultivable waste	9.15	11.5
Not available for cultivation	24.36	30.6
Unclassified	20.16	25.3
Total	**79.61**	**100.00**

Source: Economic survey of Pakistan, 2002-2003

Either used for livestock production in the form of rangelands or taken as crop production unit for meeting food requirements, the dryland is a natural resource indeed for people dwelling on it. Restricted by many geophysical and socioeconomic factors, there are very few off-farm options for these people to base their living upon. The drylands support these livelihoods through the provision of food for human beings, fodder for livestock, fuel for cooking and warming, water for drinking and scanty income from the sale of medicinal plants and herbs, livestock and dairy products and wildlife. The land in dry areas thus becomes a basic production unit under severe climatic conditions where no other option exists.

3. Challenges in drylands of Pakistan

3.1 Social:

The livelihoods of the people in drylands are dependant on natural resources that in turn depends a great degree on climatic factors. Shortage of water, rather the unpredictability of rainfall is the major limiting factor in local production systems and livelihood support systems. The subsistence agriculture prevailing in the area can hardly support the rural families with food. Within the current socio-political set-up, the drylands are usually ignored in development portfolio due to lack of leadership and commitment. All these factors are bound to each other within a long history of human society development and the prevalence of geographical factors at the same time.

3.2 Institutional:

The already poor production systems in these areas, namely agriculture, livestock production, food and water are weakened by the lack of proper institutions for management and utilization. Increasing population growth rate has resulted into degradation in every aspect of resources and human livelihood standards.

The lack of proper institutional setup at local and regional level decreases any chances for increasing the production capacity on the part of land and land users. The government institutions in these areas are usually very weak, deficient in financial and human resources and usually cannot comply with local priorities. The community institutions are less developed, less skilled and lacking in organizational capacities. Their vision is not clear and the local leadership often fails to cater the local needs and priorities.

3.3 Competing demands:
Water is usually the main deciding factor. Where water is available in any form, the usual focus is on production of food through agriculture, without paying attention to any other system of land use. In areas of water shortage, the emphasis goes to livestock production and rangeland management. In these areas the livestock rearing is the largest sector of income generation through production of meat, skins, wool and dairy products.

With farm forestry perspective, integration of trees on farms is challenged by free grazing. In some areas, water source is a reason of conflict among different socio-economic groups or different sects. Due to shortage of water in the dry regions, there is a competing demand among humans, livestock and agriculture. Furthermore, in rural communities, women and men will have different priority uses for water, as per their need.

4. Potentials of drylands

The drylands deserve attention due to the fact that they pose formidable challenges for sustainable development. However, despite the multifarious problems, there is a great potential to improve livelihoods in the drylands - much more than has originally been thought by most development agencies, and the gains to be achieved in improved development, living standards, and better natural resource management by investing in the drylands are considerable. (Synne Movik, *et al*, 2003)

Indigenous systems: *Sailaba* Agriculture
In the valleys the runoff water of small streams is diverted and conserved in the field prepared by levelling and developing dikes around it. In some cases an artificial channel is prepared to collect runoff water from a hill slope and take it to agriculture fields for conservation. The system is a small-scale water spreading system. This type of agriculture in the hilly areas is called sailaba agriculture. The system is common in all the hilly areas of Balochistan but is more common in areas falling in the monsoon zone (Dr. B.H.Shah, 2005).

The UNCCD states that seventy percent of the world's drylands (excluding hyper-arid deserts), or some 3,600 million hectares, are degraded; and avers that desertification is a serious global threat. The drylands in Pakistan inhabit more than 70% of the total population; most of them living below poverty line under sever climatic and physical environmental conditions. The natural resources in these lands could however, be developed to a greater extent to support livelihoods. There is a need for change in approach towards current policies and practices. The main areas of focus should be the harvesting of rainwater, improvement of ranges and range management, support in livestock sector and improvement of service delivery through an efficient institutional setup.

Indigenous systems: Khushkaba Agriculture
In the hilly areas of Balochistan and some parts of NWFP, earthen dikes are constructed on the down slope side and extended upwards on both sides of the fields. The upslope side is kept open to trap the runoff water. In spring or monsoon season, if there is runoff producing rainfall the bunds are filled with water. On drying up of the water and reaching of the soil at field capacity the fields are cultivated for crop production. Such fields are commonly seen in the broad valleys in the Balochistan. The crop production system is called khushkaba agriculture. Melons and watermelons are produced with this system in spring season. Melons produced through this system are sweet and tasty and get high prices as compared to melons of the same variety produced through irrigation system. The system is used extensively in dry temperate zone areas as well as in monsoon zone areas in Balochistan (Dr. B.H.Shah, 2005).

5. Approaches in drylands management

In order to improve livelihoods in the drylands, there is a need to shift the focus from environmental degradation and desertification to the people themselves. What are the primary causes of poverty, and how can the livelihoods of people living in the drylands be improved; what effective means and actions can be employed to better people’s livelihoods? These are some of the questions that should be answered through drylands management practices. Below are some of the most prominent approaches that are being used in Pakistan perspective.

5.1 Silvo-pastoral systems: the case of Farm Forestry Support Project (FFSP)

The Farm Forestry Support Project implemented by Intercooperation and funded by the Swiss Agency for Development and Cooperation in Pakistan, is working in the drylands of North-West Frontier Province of Pakistan since 2000. The project aims to improve the socio-economic conditions of rural poor (esp. women and marginalized) through optimal natural resource utilization. The project purpose is to foster the market-oriented initiatives of small farmers and users (female and male) within the farm forestry system. The project selected to work in rainfed arid and semi-arid areas because these areas were having vast tracts of barren lands that were not suitable for farming due to climatic and topographic conditions. Rather, it was more suitable to pursue the farm forestry endeavours in these areas.

People dwelling in these dry tracts are living in poor livelihood conditions, with greater dependency on natural resources. The already meagre natural resources have been depleted at a high rate, due to increasing population pressure, and failure of regeneration because of drought conditions. Agricultural land use is very limited, restricted to very few tracts along the natural streams where water is available in specific seasons. Due to lower returns from agricultural practices, the opportunity cost of land is very low, thus increasing the scope for utilizing these lands for production of perennial crops in the form of trees, shrubs and grasses. Due to the same reasons, livestock production is the major livelihood source in these areas.

In order to supplement the indigenous system, the project decided to facilitate the local farmers and NGOs in promoting Silvo-pastoral practices in these lands. For this purpose, local level NGOs and Cluster Organizations were involved in identification and selection of sites for demonstration purposes. National research institutions played their role in technical support and providing inputs. It was decided that the treated sites should yield the following outputs to generate some value for local people;

- Increase in the production of tree and shrub fodder for livestock
- Production of fuel and firewood for household uses
- Production of grasses for feeding livestock
- Production of poles and timber for construction and furniture
- Protect the land from further degradation in terms of loss of soil nutrients and erosion (both wind and water erosion)
- Recharge the ground water that is already being depleted due to upcoming of a large number of tube-wells.

The challenge faced during the implementation of activities included the prevailing drought, lack of capacities of project partners and the lack of resources to execute such an ambitious system. The project addressed these challenges on a gradual basis. Whereas the project engaged local and regional expertise in harvesting and conserving the atmospheric water in project areas, the research institutions played their role in building the capacities of project partners and general farmers in executing the technical activities. In terms of financial support, the project provided machinery and equipments to execute earthwork, leaving the labour work to the villagers.

The FFSP Experiences: *Hillside Ditches*
Hillside ditches are the continuous ditches along the contour line having plant pits at the required intervals. The ditches have 66 cm width and 30 cm depth with a 30 cm ridge on the down hill side. Plant pits with 60 cm diameter and 30 cm depth are excavated at the required spacing. The excavated soil from the plant pit is placed in the ditch and extended upward on one side of the pit to break the continuity of the ditch so that if the ditches are not exactly on the contour lines, the water should not flow in the ditch and create a gully. The other benefit of the arrangement is that in case of breakage of the ridge only the runoff of the area above the two adjacent pits will over flow. The arrangement is also useful for on site conservation of water around the seedlings planted in the pits. (Dr. B.H. Shah 2005)

The project employed a number of water harvesting and conserving technologies in this regard. Contour trenches, hillside ditches and small ponds are some of the common names. The small ponds technique contributed a lot to ground water recharge, provision of water for household use and livestock.

The FFSP Experiences: *Diversion Ponds (Dams)*
The ponds are developed in the dry zone areas for fulfilling the domestic water requirement, stock ponds, fish culture or for small scale irrigation. As there are long dry spells, therefore water has to be stored for longer periods. The diversion dams are constructed near the command area for irrigation or near the villages where the water is required for drinking. A diversion channel is developed for diverting a portion of the stream and conveying the water into the reservoir. The design of the channel is according to the expected diverted flow. The dams are safe because only limited quantity of flow is diverted. In the reservoirs an exit G.I. pipe is kept at certain level for the release of the water above dead level. A dead level is decided according to expected siltation and water storage to be kept for drinking purpose. The diameter of the pipe is decided according to the irrigation requirement and the storage capacity of the reservoir. In case of small ponds developed for drinking purpose, measures are required for seepage losses and evaporation losses. (Dr. B.H. Shah 2005).

In order to promote the concept of dryland management and rehabilitation, the project also focused on institution building at local level and strengthening existing institutions. Capacities of project partners from civil society and private sector are being built through formal and informal means to enable them undertake similar kind of interventions on their own. It is also sought to interlink these organizations among themselves and develop their links with national service providers and research institutions for better and timely delivery of goods and services.

5.2 Agro-pastoral systems: the case of the Project for Livelihood Improvement (PLI)

PLI operates in the arid / semi arid zone that covers the wide areas of southern NWFP. Ecosystems are fragile and suffer from decreasing biodiversity, wind erosion and progressive desertification. Poverty is the oppressive in these areas however the communities living in these areas have determined survival strategies which have good potential for improvement. In the project area, farmers capture monsoon and spring water from hill torrents and distribute it for irrigation and drinking purpose. The project aims at complementing traditional knowledge in plant production, livestock and rangeland management with external knowledge for improved productivity and value addition. It aligns with SDC Human and Institutional Development (HID) Strategy Pakistan focusing on organizational strengthening through people centred approaches (PTD, FFS & REFLECT). Local NGOs facilitate participatory approaches with interest groups of both gender and with local farmer's organizations. The project aims at strengthening coping strategies of poor communities to improve their livelihood with special reference to women. The overall goal of the project is to enhance socio-economic status of disadvantaged communities.

The communities in these areas intercept the hill torrents that carry water and use it for farming and drinking purposes through a sophisticated canals system called “Rudh Kohi irrigation”. Rudh Kohi is the combination of two words e.g. Rudh & Kohi, where Rudh means bed of main hill torrents and Kohi means mountains.

Indigenous systems: Crop Production under Rudh Kohi System

A traditional method in tropical zone is the use of floodwater of the ephemeral streams. The floodwater is diverted through diversion dikes and taken to the plain areas through conveyance channels, and flooded in the fields through water spreading dikes for crop production. The system is centuries old and is an excellent example of participatory, self help development activity in which the inhabitants of many villages participate in the construction of diversion dikes and conveyance channel and use the water systematically from up stream to down stream areas. While the farmers construct the dikes around their fields individually.
The flood water in the streams flows from the watershed areas of Suleman Ranges located in dry zone areas with annual average rain fall ranging from 200 to 300 mm. Earthen dikes are constructed in the streams and diverted to plain area through conveyance channels. The conveyance channels are excavated and bounded by earthen dikes as seasonal canals and have inlets into the fields. Large size rectangular fields bounded by earthen dikes hold the floodwater to the depth of 2 to 6 feet. The fields are filled with floodwater through the inlets provided from the channels. The floodwater in the field stored for absorption in the soil slowly. On drying up of the water, the field is cultivated for crop production on conserved moisture in the soil. The communities of the different villages have made their rules for distribution of the floodwater among the villages and among the farmers with in a village. They follow the rules and use the water systematically. The major crops are sorghum and millets in the summer season and grams, oil seeds (mustards) and wheat in winter season. Melons and watermelons are also cultivated if the fields get water in spring (Dr. B.H.Shah, 2005).

Within the command area of Rudh Kohi system, the project is promoting new technologies for production of agricultural crops and fodder trees and shrubs to support the livelihood patterns in these areas. In order to implement the project activities, it develops partnership with civil society and research organizations. The PLI is working through people centered approaches such as *(Participatory Technology Development (PTD) Farmers Field School (FFS) and REFLECT* whereby PTD/ FFS capitalizes on the farmer’s ability to experiment and solve problems on their own and utilizing the literacy skill created by REFLECT for collecting data and sharing the PTD/ FFS experiments results and vice versa. Rural communities identify, analyze, prioritize, test and apply new options for the solution of their problems with the support of facilitators and researchers.

6. Conclusions and recommendations

The situation in drylands with reference to geo-physical and ecological aspects is complex. There are no single factors that could attribute to the dwindling livelihood conditions with respect to resource base. Complicated by the socioeconomic disparities prevailing in the area and demographical realities, the drylands problems need a much more committed and coordinated approach, both from development and research aspects.

There is a need for identification and quantification of the exact problems, the cause –and-effect scenario and possible roles and responsibilities for moving towards betterment. Keeping in view the existing situation on institutional ground, it is sad to note that the government departments are lacking human and financial resources. At the same time, the civil society organizations are either non-existent or lacking leadership and commitment. Strengthening the institutional base could insure the better delivery of goods and services to local people. In the **development** context, following are the actions to be taken:

- improve conceptual understanding of drylands (potential oriented),
- increase institutional commitment by govt. through policy making,
- recognize and support role and functions of stakeholders in dryland management,

- improve coordination among stakeholders,
- promote social fencing for controlled grazing,
- initiate management of water resource by community organizations to avoid conflicts,
- apply participatory planning – bottom up approach with both men and women,
- enhance linkages, coordination and collaboration, effective knowledge management,
- strengthen civil society and grassroots organizations,
- introduce new approaches, methods, tools and low-cost technologies,
- support indigenous survival strategies,
- scale up experiences and learnings from pilot studies.

There is also a need for further **research** into the individual production systems catering for multifarious needs and demands of the society and their inter-relationship. The options of agriculture, forestry, rangeland management, livestock production and dairy development need to be explored with a new zeal to improve livelihood options for inhabitants of drylands. Nevertheless, all these efforts should be accompanied with renewed commitment from government departments to promote health and education facilities, vocational training and improved infrastructure for improved service delivery. Research should particularly focus on the following aspects;

- concentrate in technical aspects of drylands management,
- share and disseminate research results to inhabitants and development actors,
- promote people's centred research.

Instead of working in isolation, much more impact could be created with a **shared vision and networking** facilities. There is a need for meaningful partnership among government departments, civil society organizations, NGOs, private sector, research institutions and donor agencies. There is also a need for expanding financial portfolio for drylands in the government fiscal plans and through donors' contribution at regional and international level.

Although much has been done at different times and by different organizations and individuals, yet the outcome of most of the research and development work is either inaccessible to each other or not documented at all. It is required to explore all these sources of information and analyze in their perspective of time and space. A central coordinating agency could be suggested for coordinating the efforts from a central place to collect and analyze the information generated and present lessons to policy makers for positive change.

T 2 Competition for natural resources between unequal stakeholders

A case of the semi-arid areas in Makueni District, Kenya

Chinwe Ifejika Speranza

A more complete document on the case study is planned to be published in 2008. Therefore we document here only a draft summary and the presentation.

This report focuses on the question of how the competition over natural resources among different stakeholders can be handled in situations of unbalanced power. This question is elaborated using experiences from field research in the semi-arid areas of Makueni district, Kenya.

The semi-arid areas of Kenya are characterised by sparse vegetation cover, soils of low to medium fertility and high rainfall variability in quantitative, temporal, and spatial dimensions. However, potentials also exist in these areas in terms of land that is still available for various uses, perennial rivers, ground water, wild life and sand harvesting, to mention a few. Yet, the semi-arid areas are experiencing increasing migration from the higher potential humid areas and the lower potential arid areas. Thus the semi-arid areas are exposed to pressures, not only from their marginal ecological characteristics relative to more humid areas but also from socio-economic processes such as increasing population density, competition between various stakeholders over the use of the scarce natural resources.

The stakeholders are smallholder farmers (both male and female), large scale farmers, government workers, politicians, tourist resorts, government institutions, government (in terms of policies and implementation), groups, male household heads and their spouses, rich and poor, commercial enterprises, ethnic communities, for example the Akamba and the Maasai. The nature of the inequality can be in terms of economic, political and cultural power differentials. The inequality may also be due to time aspects, in terms of earlier settlers occupying the better lands and those coming later having to do with the less favoured areas. Another dimension of inequality is access to knowledge as those that have access to knowledge use this to their advantages relative to other stakeholders. Some stakeholders also take advantage of the lack of governance to ensure better access to resources relative to other stakeholders.

The competition over access to resources can be between two or more stakeholders and can overlap. The dimensions of competition over natural resources among different stakeholders are illustrated with various examples from the field study area. In one of the sample villages, respondents report that their access to water is constrained because powerful people, in form of absentee civil servants and rich individuals, who own land parcels along the riverbanks, block their access.

Smallholder farmers occupy the less-favoured areas where irrigation cannot be practised due to the high gradient despite the nearby perennial river. Thus smallholders have to obtain permission from the absentee landowners before water can be piped to the areas occupied by the smallholders.

Commercial irrigated farms that raise crops several times in the year are located side by side with smallholder farms that depend on seasonal rainfall, where the crops in their farms have already dried up either due to lack of moisture or because the smallholders have harvested the crops for that season.

Further, collective action among smallholders may yield positive results for some individuals but other individuals are excluded from this group action due to poverty and by extension their inabil-

ity to pay the membership fees. This is the case for water users associations, whereby only members have access to a borehole or dam, and also among financial self-help-groups. Thus there are multiple dimensions of competition over resources.

There is also a dichotomy between cultural norms and modern law. Customary laws prescribes that women do not have right to own land but have the right of access through their marriage, while in modern law, both men and women can own land. This dichotomy constrains the ability of women to access natural resources.

Further, measures carried out by the government and civil-society to deal with unequal access to resources are elaborated. Some of these measures are effective in the short- or in the long-term. They can be in form of policies on resource use and conservation, but there is a wide gap between policies and implementation. An example is charcoal production and use, which is prohibited but is used by the urban and rural population. Further, due to poverty and lack of income earning alternatives, some smallholders are compelled to earn a large part of their incomes from charcoal production and sale.

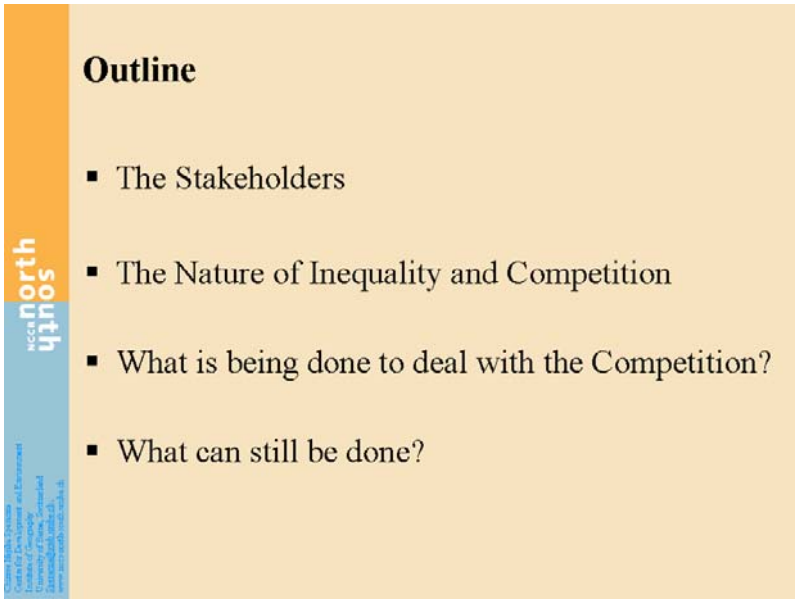
Although the government encourages farmers to practice Soil and Water Conservation (SWC), it does not have adequate resources to effectively and continuously support SWC. The government has also embarked on the fight against corruption but this is a long-term process. Other government measures include the provision of infrastructure and services, for example dams, boreholes and extension services.

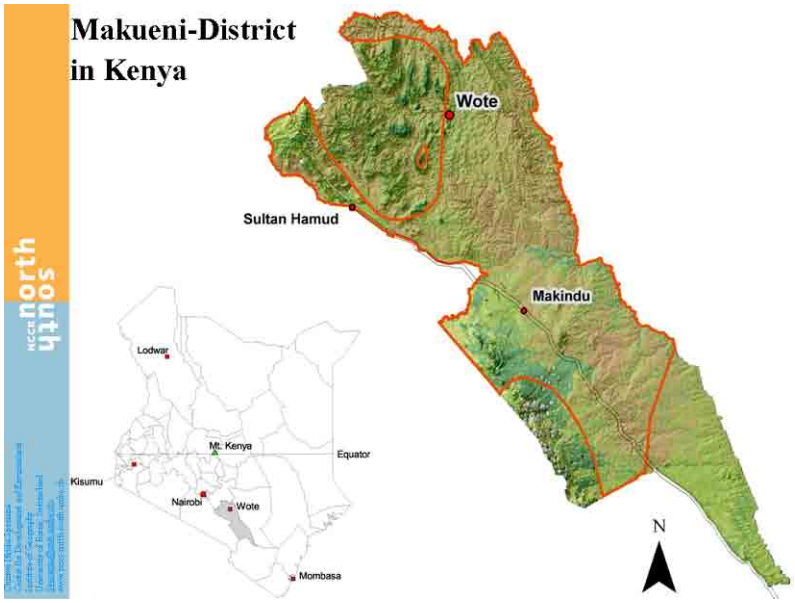
The civil-society (NGOs, churches and groups) also implements measures to alleviate constraints to access to resources. These include various poverty alleviation projects, e.g. building dams, sinking boreholes, supporting extension services and the farmers directly.

Gaps in measures dealing with unequal access and ways how current measures can be made more effective are also highlighted. The author finds that there is need to promote development to a base level from which further development by civil-society can take place. This includes the development and maintenance of primary infrastructure (e.g. roads, water and health facilities), changing perceptions and attitudes about natural resources use and conservation through public education/radio programmes, intensifying and readjusting poverty alleviation measures, promoting alternatives to charcoal production and use as well as fostering sustainable use through reforestation, reducing corruption and improving capacity for group (collective) action.

Further, the author finds that there is need for reality checks before policy design and implementation as many policies exist that cannot be effectively implemented in practice. There is also need to improve the capacity of government extension officers, and institutions dealing in natural resources management; introducing or improving advocacy for rural dwellers and women, and providing or promoting access to credit for rural dwellers. The aspect of credit is particularly crucial as poverty is widespread and avenues for earning income are limited and smallholders are often compelled to sell their crops and livestock at low prices in order to obtain cash to meet other needs.

Competition for Natural Resources between unequal Stakeholders
- A Case of the Semi-Arid Makueni District, Kenya
Desertification and Global Change
31. May 2006, Bern
Chinwe Ifejika Speranza
WP4, Swiss National Centre of Competence in Research North-South (NCCR N-S),
University of Berne, Switzerland


Outline
The Stakeholders
The Nature of Inequality and Competition
What is being done to deal with the Competition?
What can still be done?

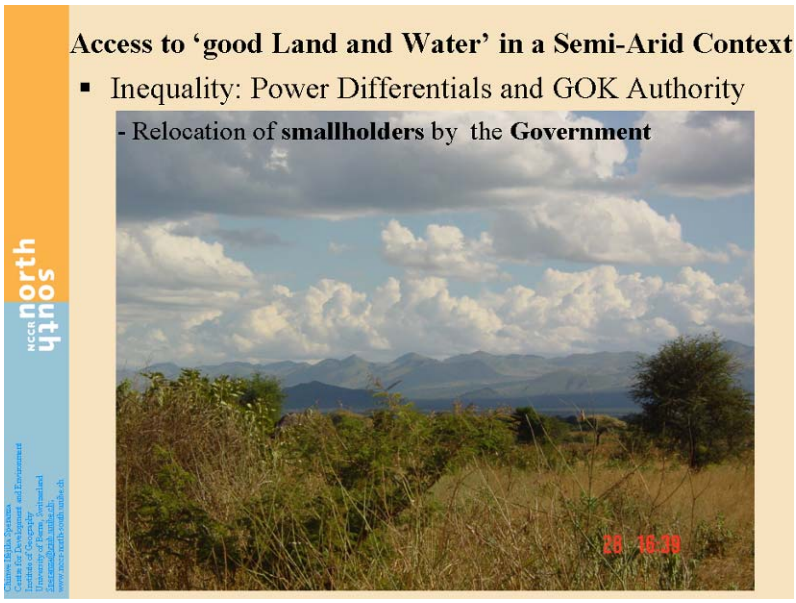

Makueni-District in Kenya
Wote
Sultan Hamud
Makindu
Lodwar
Mt. Kenya
Equator
Kisumu
Nairobi
Wote
Mombasa
N

Which Stakeholders?

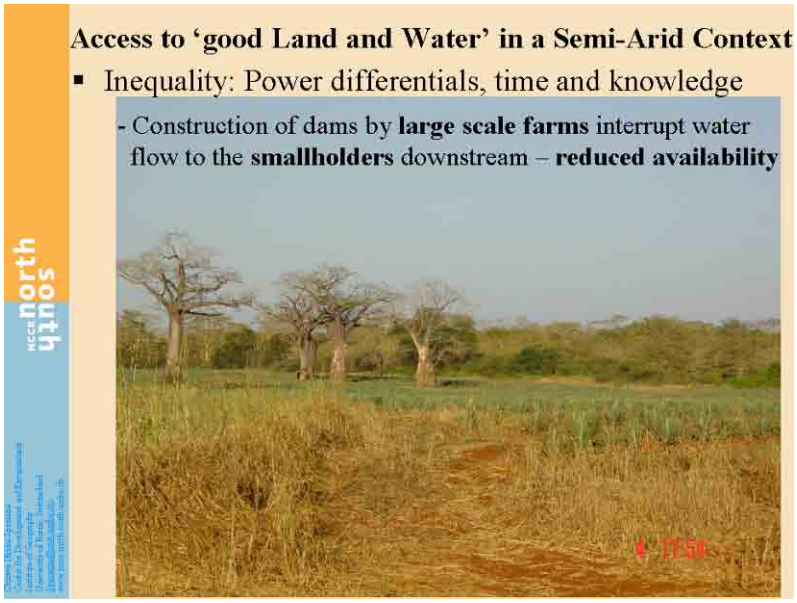
- Smallholder farmers (both male and female)
- Large scale farmers
- Government workers
- Politicians
- Government (policies)
- Government institutions
- Groups
- Rich and poor
- Ethnic communities (Agro-pastoralists/Pastoralists) e.g. Akamba/Maasai

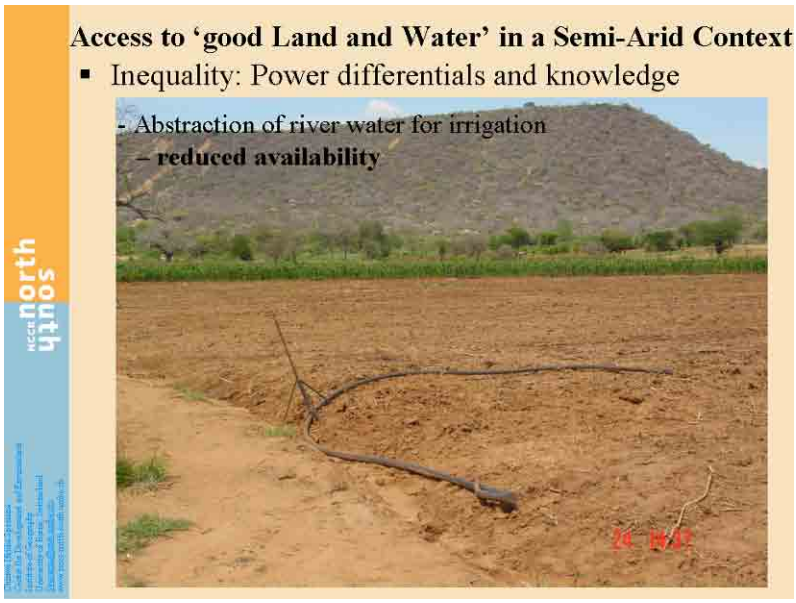
Nature of Inequality and Competition

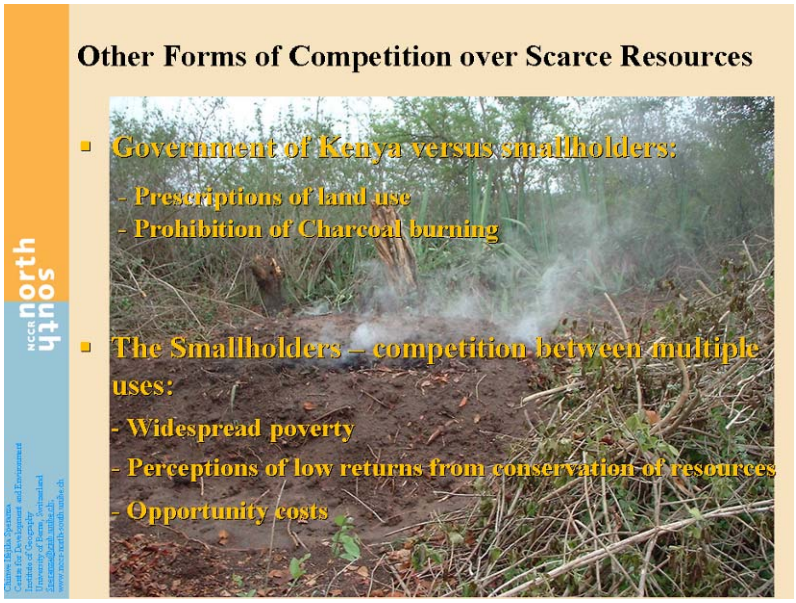
- Nature of inequality:
  - Power differentials (economic/political/cultural):
    - Higher economic capacity (rich versus poor)
    - Collective action (group members/non-members)
    - Power of civil servants and politicians
    - Dichotomy between cultural norms & the cash economy
  - Knowledge
  - Time – first come, first serve
  - Opportunities offered by an already in-transparent system – lack of governance
- Competition between two or more stakeholders

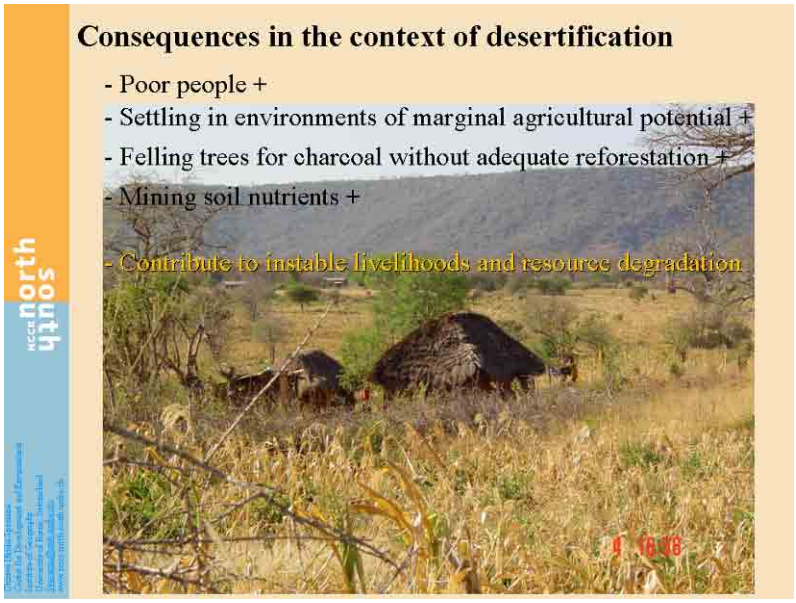

Access to 'good Land and Water' in a Semi-Arid Context
Inequality: Power Differentials and GOK Authority
- Relocation of smallholders by the Government
north south

Access to 'good Land and Water' in a Semi-Arid Context
Inequality: Power differentials, time and knowledge
- The better placed own large tracts of 'good' land beside rivers - constrained access for smallholders
north south


Access to 'good Land and Water' in a Semi-Arid Context
Inequality: Power differentials, time and knowledge
- Construction of dams by large scale farms interrupt water flow to the smallholders downstream – reduced availability
north south


Access to 'good Land and Water' in a Semi-Arid Context
Inequality: Power differentials and knowledge
- Abstraction of river water for irrigation
– reduced availability
north south


Other Forms of Competition over Scarce Resources
Government of Kenya versus smallholders:
- Prescriptions of land use
- Prohibition of Charcoal burning
The Smallholders – competition between multiple uses:
- Widespread poverty
- Perceptions of low returns from conservation of resources
- Opportunity costs
north south


Consequences in the context of desertification
- Poor people +
- Settling in environments of marginal agricultural potential +
- Felling trees for charcoal without adequate reforestation +
- Mining soil nutrients +
- Contribute to instable livelihoods and resource degradation
north south

What is being done?

- Government of Kenya (GOK):
  - Policies on resource use and conservation
  - Incentives promoting soil and water conservation
  - Measures against corruption – a long-term process
  - Incentives for group (collective) action
  - Provision of infrastructure and services e.g. dams, boreholes
  - Information dissemination through extension services
- Civil Society (NGOs, Groups, churches etc.):
  - Various poverty alleviation projects, e.g. building dams, sinking boreholes, supporting extension services in SWC

What can still be done?

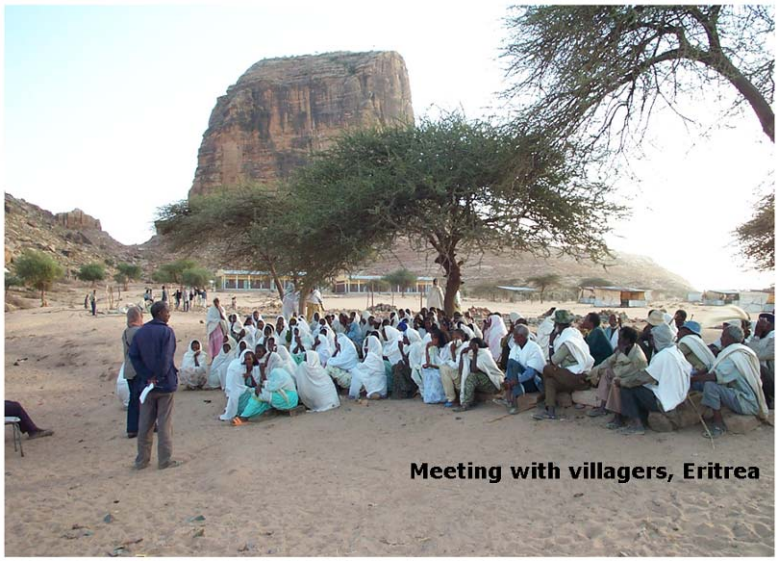
- **Need for Development to a Base Level:**
  - Develop and maintain primary infrastructure (e.g. roads, water and health facilities)
  - Change perceptions and attitudes – Public education/radio
  - Intensify and readjust poverty alleviation measures
  - Promote alternatives to charcoal production and use
  - Reduce corruption
  - Improve capacity for group (collective) action
- **Further:**
  - Reality checks before policy design and implementation
  - Improve capacity of government extension officers
  - Improve institutional capacities in NRM
  - Advocacy of access for smallholders and women
  - Provide/Promote access to credit for rural dwellers

T 3 **Market access, social services and improved infrastructure for vulnerable stakeholders**

Market access, social services and improved infrastructure for vulnerable stakeholders

Practical experience in different project / programme design and implementation missions

Bernadette Peterhans,
Swiss Tropical Institute



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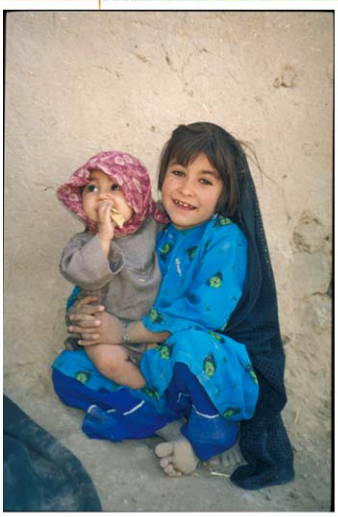
What did we learn?



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- Systematic situation analysis involving different stakeholders
  - Communities (Men, women, etc.)
  - Local authorities
  - Regional / national authorities
  - Other sectors involved (education, agriculure, health etc.)
  - Health service providers (public and private)

23.11.2007 4

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- Important to understand
  - Social environment
  - Political and economic environment
  - Health problems
  - Health service delivery
  - Health service organisation
  - National / international / global policies and strategies
  - Public / private / traditional service provision
  - Community perceived needs
  - History of the areas
  - Stakeholders benefits and losses

23.11.2007 5

Drug seller
Afghanistan

Swiss Tropical Institute
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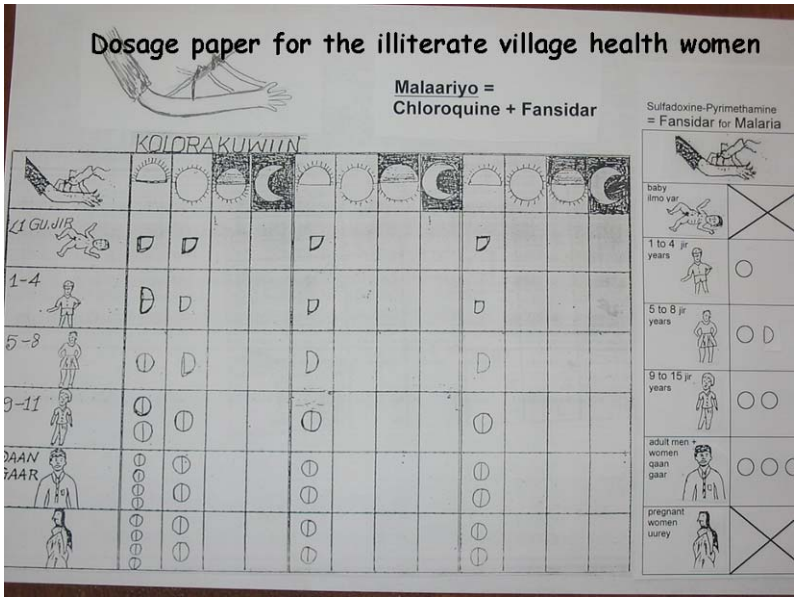
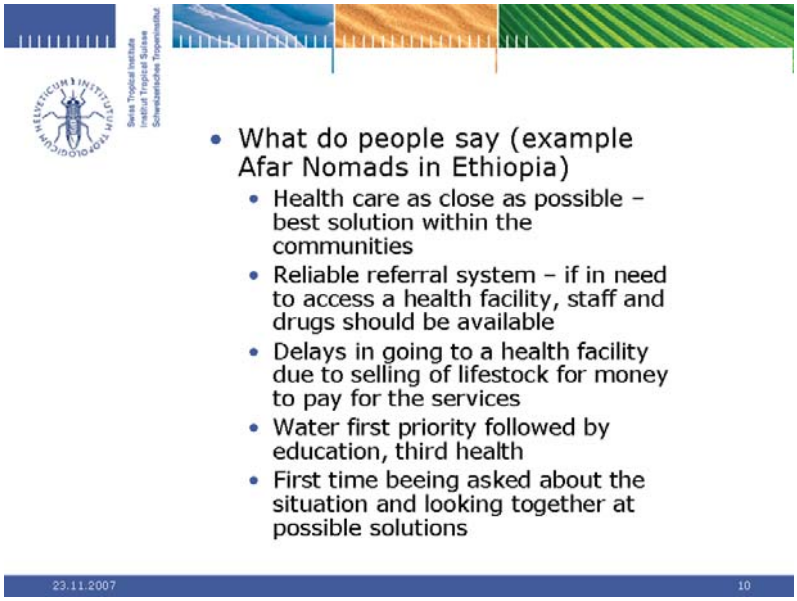
Schweizerisches Tropeninstitut

- Important to understand
  - Local versus expert priorities
  - Impact of intervention on the population and the way of living
  - The different gaps
  - Local strategies to solve problems
  - Health and disease perception
  - How to adapt interventions to local settings / local context
  - Integrated versus single intervention strategies
  - Processes
  - What can people afford to pay

23.11.2007 7


Dosage paper for the illiterate village health women
Malaariyo =
Chloroquine + Fansidar
Sulfadoxine-Pyrimethamine
= Fansidar for Malaria
KOLORAKUWIIN
1 GU.JIR
1-4
5-8
9-11
baby
ilmo var
1 to 4 jir
years
5 to 8 jir
years
9 to 15 jir
years
adult men +
women
qaan
gaar
pregnant
women
uurey


Swiss Tropical Institute
Institut Tropical Suisse
Schweizerisches Tropeninstitut
INSTITUTUM HELVETICUM TROPOLOGICUM
What do people say (example Afar Nomads in Ethiopia)
Health care as close as possible – best solution within the communities
Reliable referral system – if in need to access a health facility, staff and drugs should be available
Delays in going to a health facility due to selling of lifestock for money to pay for the services
Water first priority followed by education, third health
First time beeing asked about the situation and looking together at possible solutions
23.11.2007
10

Swiss Tropical Institute
Institut Tropical Suisse
Schweizerisches Tropeninstitut
INSTITUTUM HELVETICUM TROPOLOGICUM
What did we find
Background
Population 44702 (Afar agro pastoralists)
Semi Nomadic
Literacy less 15% evt. ca 3% among the Nomads
Political situation
Ethnic clashes
No real voice at national level
23.11.2007
11

- **Water and environmental issues**
  - Access to good quality and quantity water is a problem
  - Environmental public health issues (cadavers all around)
  - No sanitation facilities available
  - Not much information about sanitation practice

23.11.2007 12

- **Health system**
  - Less than 50% total population has access (28.9% of the Nomadic population)
  - Limited referral
  - Insufficient number of personnel and drugs in the clinics
  - Very much curative oriented
  - Very limited health budget ($ US 5.60 per year per capita, per person) under-funding
  - Community based health care not developed
  - No monitoring and supervision at the periphery

23.11.2007 13

- **Health status**
  - Very low EPI coverage (2.5%) for children and mothers (Nomadic population)
  - Maternal Mortality (800/100,000 national)
  - Infant Mortality (118/1000 national 97/1000)
  - Child Mortality (174/1000 national 166/1000)
  - ANC services limited (12.1%)
  - Most deliveries unsupervised
  - Harmful traditional practice
  - Major disease burden malaria, respiratory infections, diarrhoea, TB
  - Poor health seeking behaviour

23.11.2007 14

- Recommendations
  - Each intervention needs to be tailored to the context and the people
  - Regular dialogue between different stakeholders
  - Elaborate solutions together with the target population
  - Support processes / enough time
  - Combination / coordination when possible with other sectors involved
  - Livestock is very important for the communities and has often priority
  - Focus on women
  - Focus on systems **and** communities
  - Research include community based interventions
  - Bridge the gap between interventions and research

23.11.2007 16

Cattle camp South Sudan

T 3 Market access, social services and improved infrastructure for vulnerable stakeholders

Improved infrastructures, market access and social services for vulnerable populations in the Sahel

Bonfoh B.[1-2], Muench A.[3], Ag Mohamed E.M.[4], Bechir M.[5], M.O. Taleb[6], Weibel D.[2] E. Schelling[2], Zinsstag J[2].

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2. Swiss Tropical Institute, Basel, CH
3. Institut für Islamwissenschaft und Neuere Orientalische Philologi, Universität Bern
4. Faculté de Médecine y de Pharmacie et d'Odonto-Stomatologie Université de Bamako
5. Centre de Support en Santé Internationale, NDjaména, Tchad
6. Institut National d'hygiène, Nouakchott, Mauritanie

1. Drylands, degradation and social consequences

Drylands such as the Sahel have low (less than 200 mm/year) and variable rainfall. Variability is not only seen in interannual rainfalls but also in ecosystem structure and productivity ("patchiness"). Mobile extensive production systems are frequent in these zones where livestock production is one of the main economic activities. The production system is under threat from legal, economic social and political constraints. The key policy gaps include consideration and regulation of transhumance, investment in production infrastructure, health and social service delivery and conflict mitigation. It is not rare that households and communities loose within a short period their basis of income – their livestock - and are forced to out-migrate towards urban centres and abroad.

In this environment, the State is often unable or unwilling to use national and international resources to fight poverty. The prominent consequences are tension and conflict; weak infrastructure for the provision of basic services; and poor governance. The population is considered as marginalised to political power and markets and they are highly vulnerable to health risks, food insecurity and conflicts. Distance and dispersion relate to the low population density. Mobile pastoralists in the Sahel are considered as "hard to reach" for health, veterinary interventions and for primary services. Virtually no nomadic children are efficiently covered by conventional health programs (fig. 1). Vaccination coverage of this rural population is unacceptably low.

Figure 1: Children in Inagouzmi, 150 km North-East of Ber in Timbuktu region, none of these children have received a single immunisation. Photo Bonfoh, 2005

2. Potentials, strategies and opportunities

Mobile pastoralism is the most viable form of production and land use in semi-arid regions. Communities depend on their herds of cattle, camels and small ruminants as main source of income and nutrition (dairy products) directly or through exchange with settled people. There is a potential for capturing the economic benefits of their livelihood through improved marketing of livestock, processing of pastoral products and, potentially, by tourism.

Livelihood strategies in the Sahel are in most instances flexible to manage the high degree of uncertainty. Making best use of scarce resources by a mobile way of life will need to be supported with social and policy transformation processes. It is important to understand (i) the complex and highly adapted production and management strategies based on traditional ecologic knowledge as a key component of environmental sustainability and (ii) the mobile livestock production as an important contribution to national economies. Diversification of livestock species in the land use system has been seen as a strategy to minimise risks in the pastoral economies. Keeping different livestock species yields different products for subsistence and external market and can overcome seasonal shortage of dairy milk and thus make households less vulnerable to food insecurity.

Furthermore, crop-livestock integration is a key interaction between sedentary and mobile communities sharing the same social (ethno-linguistic) identity and products (grazing-manure and cereal-milk). In a changing environment, innovations in informal social organisation such as dairy and livestock traders groups are adapted to capture new market opportunities. There is an impressive potential in the Sahel, given that products (meat, milk, cheese, leather, etc.) find the appropriate markets. Short- and long-distance trade and market value chains critically have to be understood to understand ways of improving livelihoods in remote semi-arid zones (including tax and market infrastructures determinants).

3. Processes, innovation and initiatives

The potentials of irrigated agriculture are high in the Sahel (e.g. Delta of Niger). Technical innovation of irrigated agriculture (e.g. rice) and their impact on societies and the environment have recently received attention of States policy-maker. The same options likely apply to tourism enterprise. Pro-pastoralist service delivery generally refers to those interventions which improve access and participation by strengthening the relationships between policy makers, service providers and service users. This is achieved by community participation, and principles of equity. Service delivery involves different components and supports systems that are typically seen as the responsibility of the State. It covers social services (primary education and health services), infrastructure (water and sanitation, roads, market) and services that promote security (peace consolidation). In the Sahel, concepts and strategies to reach the vulnerable population strata in terms of equitable access to social services, access to market and representation have been developed and need now scaling up and accompanying policies. These issues are integrated in the transversal package project TPP “environment and societies” in collaboration with other initiatives (WISP/ GEF-UNDP) within semi-arid regions.

4. From research to stakeholder and policy dialogue

The geographical situation of Sahelian countries and their physical characteristics influence the populations’ health and their access to health services. New policies for preventive and curative health services are needed. Multidisciplinary research-action can contribute to assist governments in developing such policies. In the first phase of NCCR North-South research in the semi-arid context of JACS WAF, the research was focused on analysing determinants of access to social services (health, education) in Chad, Mauritania and Mali.

Human and veterinary medicine share the same paradigms and should not be viewed as separated. Thanks to a transdisciplinary approach using the concept of “one health” (fig. 2), a dynamic dialogue has been created among all stakeholders (communities, veterinary and public health authorities, actors, donor agencies). The set-up allowed stakeholders to better organise social service delivery to remote marginalised population.

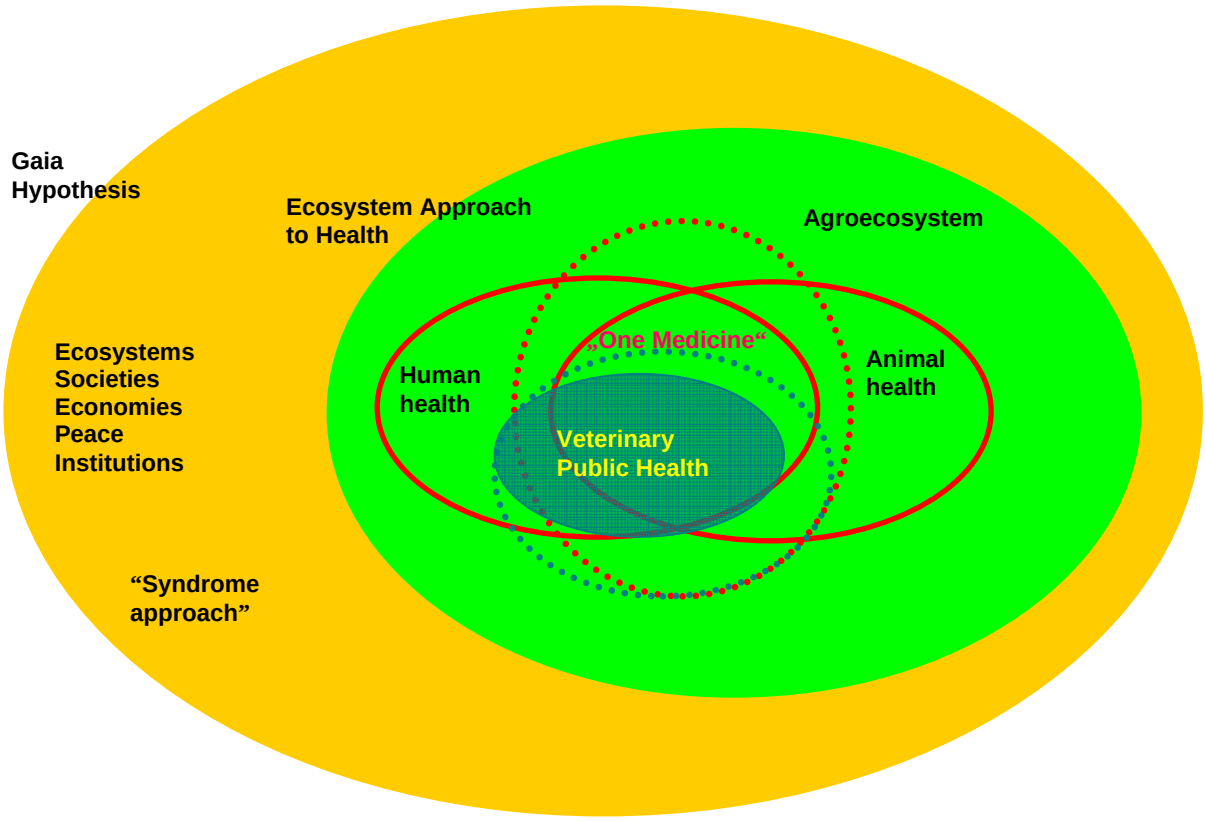

Figure 2: "One health" concept based on Gaia hypothesis

In Chad, joint vaccination campaigns could increase vaccination coverage (from 0 to annual coverage of 7-14% of children that are fully immunised) and allowed cost sharing between the public health and veterinary sectors (15% of the cost saved by the public health sector). The mobile joint human and veterinary campaigns strengthen the systems because they do not act beyond the sustainable capacity of the existing systems and do not create parallel delivery structures. Based on the positive outcomes and the provided evidence, the Chadian authorities are currently planning to go to scale with this approach. The initiative is now led by the Ministry of Plan within a framework of intersectoral policy dialogue.

The daily consumption of milk and cereals cover the human needs of fat, protein and partly of vitamins such as vitamin A. Nevertheless, the amount of intake may vary greatly due to season, location, and socio-economical factors and thus may make nomads particularly susceptible to developing avitaminoses that are reported in the Sahel. Livestock milk retinol and β-carotene clearly reflect β-carotene content in the fodder and the levels in the milk were directly related to levels of retinol in sera of women. This result suggests that livestock milk is an important source of vitamin A of these populations. But supplementation with other sources is still needed.

In Mali, the parastatal system of Cescom[13] is well established and adapted to sedentary and high density populated zones. This system was not adapted to the nomads' way of life in the North of Timbuktu where the population is highly dispersed. Through an innovative multidisciplinary research (cultural, veterinary and biomedical sciences) a first stakeholder workshop was held in the desert to validate the findings and identify strategies for the future well being of the population (fig. 3).

[13] Cescom : Communal health care centre using market development approach to health services.

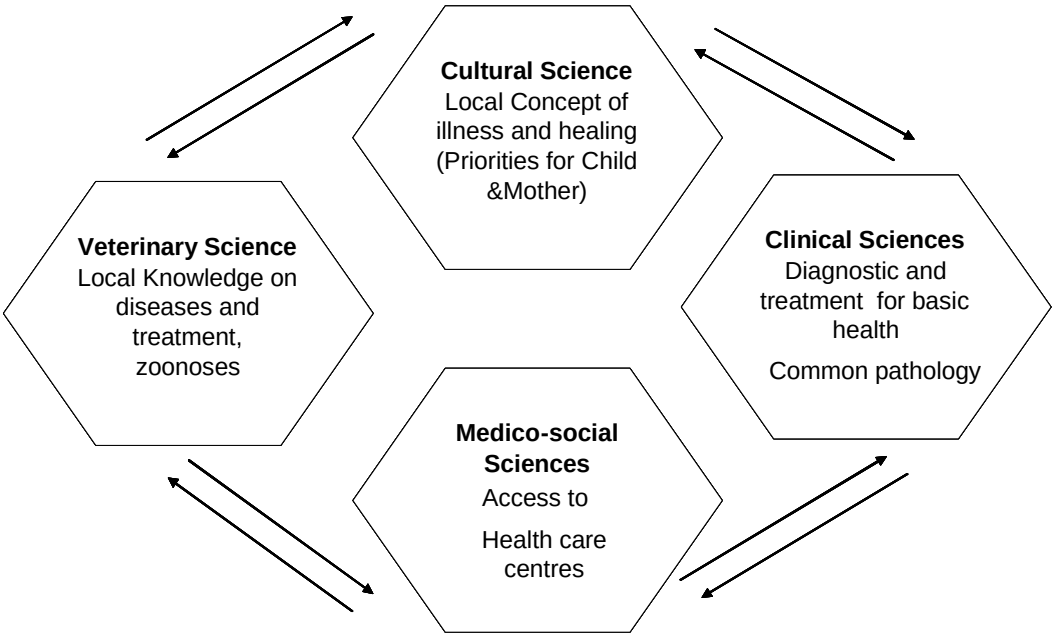

Figure 3: Conceptual framework for social services provision to Tamasheq communities in the North of Mali

Preconditions are needed for service delivery in such fragile environment. Peace consolidation and pumped water (Fig. 4) are seen as the roots of socio-economic development. Felt needs and strategies (joint information and training system and related infrastructures) are taken by authorities to be discussed in the communal development plan. Research stakeholder mediation and policy dialogue are needed alongside external support in this environment where resources are still not decentralised.

Figure 4: Well (depth 100m) for watering livestock and for human consumption, in Buneirup (250 km North-East Ber, Timbuktu region). Photo Bonfoh, 2005

In Mauritania, a similar initiative was conducted by a research programme on nomadic patient perceptions on tuberculosis in the context of lack of representation in health services, information and access to screening and treatment services. The health perspective of nomadic pastoralists is divided between traditional approaches and influences of modern medicine. For example, among nomadic pastoralists in Mauritania and Chad the biomedical concept of TB is referred to a set of different concepts depending on its perceived cause. Currently in the Sahelian nomadic

zones, pastoralists have very limited or almost no access to the direct observed treatment short course (DOTS) strategy for TB. An adaptation of the DOTS strategy to nomadic pastoralists should consider, besides information education communication (IEC) campaigns, the presence and influence of traditional healers together with specific contacts with modern health services which should be strategically placed following the calendar of livestock transhumance. Resilience patterns are being described to create awareness among the population, provide information package and set up of an implementation framework of innovated and adapted tuberculosis control strategy (mobile DOTS) for nomadic people.

5. Raising competitiveness of pastoral products and access to market

In the Sahel, research projects have worked to some extent with private service providers and NGOs, but one can hardly see these initiatives leading to tangible outcomes. The involvement of the private sector has never been really strong in the pastoral development because producers have rarely been seen as private entrepreneurs and direct partners but rather as beneficiaries. The experience of “Tiviski dairy” in Mauritania is considered as one of the best example of pastoral product promotion. This initiative has created a market niche for milk producers. With up to 25 000 litres per day from camel, cow and goat milk, the dairy processing plant is producing 14 different products. This translates into income generated for up to 1500 pastoral households. The company is the sole provider of camel milk products in Mauritania and the sub-region.

The private sector with the support of research for technology development (e.g. camel milk processing, starter culture development) and for improved quality has contributed to develop the pastoralist access to formal markets. It creates awareness in milk quality as well as a framework for other interventions such as services and good distribution (food, human and animal drugs, and information). In order to scale up these positive research and development outcomes and to develop adapted policies, a methodological framework and new tools for assessing socio-economic impact of milk processing plants on capacity building and well-being of nomadic population livelihoods are planned within the Transversal Package Project “Extensive production systems in semi-arid regions: options for future sustainable livelihoods.

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T 4 Dealing with climatic variability at local and national levels

How to cope with climate variability in the Mediterranean - the case of drought management in Morocco

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Introduction

In the Mediterranean region, vulnerability to climate variability has intensified as a result of demographic pressure, economic growth and natural resource use patterns. Because of aridity and water scarcity especially in south-eastern Mediterranean countries, it is believed that global climate change will add more to the existing problems resulting from drought and desertification. The increased prevalence and intensity of drought episodes, together with increased land degradation associated with mismanagement of natural resources, will certainly increase the threats posed to ecosystems and human wellbeing of these countries. Also, it is often reported that the recent increase in drought severity and frequency have occurred in conjunction with climate change in the region. Clear evidence for this has yet to be provided since tree ring studies over the 1000 years tend to confirm the prevalence of similar drought intensities and frequencies in the past. C*limate change*, *drought* and *desertification* are *interrelated*, but these are different processes and should not be confused or interchangeably referred to when addressing the complex issues of drought and water scarcity management in the Mediterranean region. Drought refers to an unusual deficit of precipitation over a rather extended period, which causes measurable impacts on productive economic activities, social well-being and natural environment. It is now agreed among specialists to distinguish meteorological, hydrological, agricultural and socio-economic drought.

In all climatic regions of the world, drought is a naturally occurring phenomenon and a normal part of climate variability. As a natural hazard, drought imposes differential vulnerability on populations and ecosystems depending on their degree of exposure to aridity but also on the prevailing drought management policy. The compounded effect of hazard and vulnerability generally represents the risk associated with the drought event. Exposure to drought risk varies from country to country, with South-eastern parts being more vulnerable than Northern parts, but nothing can be done to reduce the recurrence of the drought event in the Mediterranean region. Therefore, drought management should not be regarded as managing a *temporary crisis* as would think most decision makers in the region. Rather, it should be seen as a *risk management* process with emphasis on monitoring and managing emerging stress conditions and other hazards associated with climate variability. An important feature of the drought as a natural hazard is that it is a complex, slow-onset phenomenon, essentially *unpredictable* and can only be *monitored*. Weather forecast does not mean drought prediction, even in the case of meteorological drought. While scientific advances in seasonal climate prediction have been made in many tropical regions with substantial opportunities for weather predictability, our global understanding of the climate system in the Mediterranean as a whole currently limits skill in this region to very modest levels.

Drought in North Africa

Historical evidence corroborated by tree ring studies in North Africa clearly indicates the recurrent character of drought in the region. Drought episodes have been traced back to the year 707 in Tunisia where during the period 1907-1997 alone, 23 dry years were observed. In Morocco, the number of drought episodes as revealed by tree ring evaluation over the period 1000 – 1984 also varied from century to century around an average of 22 dry years per century.

The drought episodes have occurred more frequently during the 1980s and 1990s, and they are still on-going, with dramatic economic, social and environmental consequences. Analysis of current drought management policies indicates that decision makers have reacted to the drought episodes mainly through a *crisis-management approach* by declaring a national drought emergency programme to alleviate drought impacts on people, crops, livestock, pasture and forest. Relief packages generally include provisions of emergency drinking water / food supplies for the most seriously affected populations, emergency fodder supplies for livestock, as well as the Government's procurement programmes to create job opportunities for jobless farmers and herders. An example of such national emergency drought plan is the package which was implemented during the 2000 severe drought episode in Morocco.

Drought management strategy / preparedness / risk management

In most of the Mediterranean, the ongoing droughts have confirmed the critical gap concerning lack of a national drought strategy and action plan to prepare for, face and solve problems in the event of a drought. The drought management strategy should include, in addition to an effective early warning system, sufficient capacity for contingency planning before the onset of the emerging drought conditions and appropriate policies to reduce vulnerability and increase resilience to drought. These are the basic elements of drought preparedness and risk management component of the strategy that need urgent development in the region. Working towards this long term drought management strategy, the Mediterranean countries need to establish the institutional capacity to assess the frequency, severity and localisation of droughts and their various effects and impacts on crops, livestock, environment and wellbeing of rural populations. Based on these developments, vulnerability profiles may be properly assessed and drought-sensitive activities or economic sectors objectively identified and addressed. From this standpoint, drought management must be coordinated with the wider resource management policies and practices in each country.

Drought in Morocco

Considering the case of Morocco, the interannual variability of precipitations and decrease of rainfall levels during dry years greatly affect agricultural production, livestock and their contribution to overall gross domestic product (GDP). Such wide fluctuations of GDP in response to interannual fluctuations of precipitations are well illustrated during the period 1980 – 2001 with a severe shortfall in 2000. For that very dry year, only 1.7 million tons of cereals were produced against 10 million tons in the record year of 1996, yielding a ratio of almost 1 to 5 for the decrease in grain production between the two contrasting agricultural seasons.

The decrease of rainfall during dry years also severely impacts available water resources in the country. Limited water resources are a considered one of the greatest challenges facing the North Africa region. Each country is currently in a state of water stress, and the region as a whole is predicted to reach water shortage conditions (less than 500 cubic meters per capita, per year) by 2025. The imminent threats of water shortage in the region include diminished water quality, increased soil erosion and the salinization of soils. The agricultural sector is the primary user of water resources: agriculture consumes 80% of water resources compared to drinking water and industry, which consume, 13% and 7% respectively. It is likely that climate change effects, such as increased air temperatures and rates of evaporation, would exacerbate the problems of water stress and shortage. Therefore, an integrated water and drought management strategy is a vital goal for the region.

Drought preparedness requires national, regional, and international coordination
Comprehensive preparedness and response to drought risks can be strengthened through creating in each country a national networking effort of key stakeholders and a coordination mechanism that brings together the stakeholders and decision makers for an effective drought management policy. In Morocco, the national drought observatory was created in 2001 within the Ministry of Agriculture, Rural Development and Fisheries as an entity attached to the General Secretary of the Ministry. It is based at the Institut Agronomique et Vétérinaire Hassan II, as a result of a ministerial decision to locate it physically in an academic institution allowing multidisciplinary collaboration, and giving it certain neutrality with regard to policy pressures. At present, a clear policy decision has been taken to make the Observatory central to integration of the multidisciplinary issues of drought preparedness in the country.

Drought preparedness can also be strengthened by regional and international coordination through exchange of information and expertise on drought policies, planning methodologies, early warning systems, impact assessment and emergency response measures. Mediterranean drought preparedness networking is an initiative which can provide the opportunity for nations of the region to share experiences and lessons learned through a virtual network, using the web as the information delivery system. This may create the necessary synergy needed to improve preparedness strategies to mitigate the impacts of drought and desertification at the local, national, and regional level.

T 4 Dealing with climatic variability at local and national levels

Dealing with climatic variability at the local level: Experiences from water conservation research on the dry foot slopes of Mount Kenya

Njeru Lewis

Summary

This paper addresses the role of research in dealing with climatic variability at a local level. The discussion presented is based on the results of a 15 year study carried out to investigating the impacts of environment (climate and soils) and cultivation practices on maize growth and production within a subsistence farming systems on the dry North West foot slopes of Mount Kenya. Drawing from the result of this long term study, the paper examines the role of research in dealing with climatic variability at a local level. To deal with climatic variability at a local level, the paper draws four key lessons: that long term research is necessary to provide the dataset required to undertake local characterization and adapt simulation models, that to address the complexity of arid and semi arid production systems an integrated agricultural systems approach should be followed, that long term research should be supplemented with simulation model to provide a framework for interpolating research finding and integrating existing knowledge and finally that up scaling research results require partnership i.e. between farmers, government, research, non governmental organization, etc. In conclusion, the paper states that lack of local characterization and limited partnership when planning and implementing development projects has lead to limited impacts in improving land productivity. It further argues that opportunities exits to reduce food insecurity and poverty and move towards the attainment of millennium development goals.

1. Water conservation research on the dry foot slopes of Mount Kenya

The dry foot slopes of Mount Kenya form part of an ecological gradient that start from the Alpine zone of Mount Kenya and extend to arid Laikipia plateau. Vegetation and land use systems include natural forest on the upper slopes, large and small scale rainfed and irrigated farming on the lower slopes and pastoral grazing, game ranges and tourist resorts in the Laikipia plateau. This ecological diversity occurs within a distance of less than 100 km and competition for the limited water and land resources among the different uses results in conflicts.

On the lower foot slopes of the mountain, over three quarters of the population consists of small scale subsistence farmers who depend on rain fed crop production for their livelihoods. Production is however low and very risky as a result of climatic variability and farmers frequently server food insecurity. To address the food security problem, a study was initiated in 1985 to investigate the impacts of environment (climate and soil) and cultivation practices on maize growth and production.

Two representative sites, Kalalu and Matanya were selected and a number of measurements made between 1986 and 2000. Kalalu has an altitude of 2040m above seal level (asl), 740mm annual rainfall distributed across three rain season, a ferric Luvisol and a semi humid to semi arid environment. Matanya has an altitude of 1900m asl, 785mm annual rainfall distributed across two rain season, a vertic Phaeozem soil and a semi arid environment. At each site, two cultivation practices were assessed, the local cultivation practice and a water conservation cultivation practice involving minimum tillage using a hand hoe and mulching with previous crop residue resulting in approximately 60% soil surface cover at the beginning of the growing season.

Measurements included daily climate monitoring, weekly neutron probe soil moisture assessment, runoff water loss assessment after every rainfall event, weekly crop growth assessment and crop yield assessment at the end of each growing season. In total 15 seasons were observed at Kalalu (one season per year) and 30 seasons at Matanya (two seasons per year). Analysis focused on seasonal rainfall totals and distribution, crop water demand and use and crop growth, biomass and grain yield. The data from this long term research were used to calibrate the Agricultural Production Simulator (APSIM) model, which was then used to assess option for improving crop production in this arid environment.

2. Role of research in dealing with climatic variability at the local level

Drawing from the result of the water conservation study describe above, the role of research in dealing with climatic variability is examined along two lines: (1) Characterizing climatic variability and (2) Adapting a simulation model to develop a tool for exploring options for improving land productivity.

2.1 Role of research in characterizing climatic variability

Figure 1 shows growing period rainfall and the corresponding maize grain yields for the two sites during the long rains i.e. April to September growing period. The two sites show high rainfall and maize yields variability from season to season. For example, at Kalalu (Figure 1a), growing season rainfall varies from less than 100mm to over 700mm and this results in high variability in maize yields i.e. from complete crop failure to over 8 t/ha. Every season outcome is different but there are also clusters of high or low rainfall seasons, for example, the years 1989 to 1993 had generally lower growing period rainfall compared to the years 1994 to 1997.

Comparing the two sites, the seasonal rainfall totals are very different although the two sites are within a distance of 30 kilometers. Kalalu has high total as compared to Matanya and this is mainly as a result of a persistent dry spell in Matanya that occurs between mid June and mid August. This dry spells causes very poor yields at Matanya in the long rains as compared to Kalalu. Rainfall distribution in the area therefore shows both temporal (between season) and spatial (between sites) variability.

Water conservation in this dry environment helps to increase yield and reduce the number of complete crop failures. Combining all available data, water conservation increased yield by 27% at Kalalu and by 70% at Matanya. It reduced complete crop failure almost by half i.e. from 21% to 14% of the seasons at Kalalu and from 62% to 38% of the seasons at Matanya. Research there provides the necessary data series to characterize the local climatic and analyze its variability and the resulting impacts on land productivity. Such as series of data also helps evaluate the impacts of different water conservation strategies in a variable climate.

2.2 Role of research in developing and adapting simulation models

Although long term research is necessary to generate the data required to analyze the local climatic variability, conducting such research is expensive and can only be carried out in few places. However, arid and semi arid areas experience high spatial and temporal variability in the bio-physical, social and economic environments and hence production management strategies are required for a wide diverse of production systems. One approach to address this challenge is to combine long term research with use of simulation models. Simulation models supplements long term research by providing a framework for integrating existing knowledge and extrapolating research results to a wider range of production environments. Additionally, this approach helps to minimize the cost of long term research by helping to specify more accurately the research questions in the framework of existing knowledge and management questions. The challenge to this approach however is in adapting existing simulation models to the local environment.

Success in adapting simulation models to the local environment depends on availability of good research data describing the local environment. In this study, the data obtained from the long term research was used to adapt the Agricultural Production Simulator (APSIM) model to the lo-

cal farming system. The aim was to develop a tool that could be used to test and demonstrate options for improving the productivity of the subsistence production systems practiced by small scale farmer. The APSIM model was selected because it was developed to simulate agricultural production systems in arid and semi arid environments were water is a key limited factor. The model was configured to simulate the local production system and its performance was check against observed environmental water demand, surface runoff loss, soil moisture and grain yield. The initial model could not effectively simulate the observed data and a number of adaptations were made to improve model performance. Through this adaptation process, model performance was improved and regression r^2 between observed and predicted data for the final model was 82% for grain yield and 85% for biomass.

Using this final model, different options for improving land productivity for the small scale farming system were examined. The results showed that the biggest opportunity lies in reducing direct soil evaporation loss. Although the impact soil evaporation on production is not obvious, this study showed that soil evaporation loss accounted for up to 65% and 76% of the growing seasonal rainfall at Kalalu and 76% at Matanya respectively. This means that the production environment can be greatly improvement by developing production strategies that reduce soil evaporation loss. For example, in this study, between 20% and 28% of the growing season rainfall could be saved at Kalalu and Matanya respectively through a simple cultivation strategy involving minimum tillage and mulching.

3. Lessons learned and application in dealing with climatic variability

From the results of this study, a number of lessons can be drawn on the role of research in dealing with climatic variability at the local level. These are briefly discussed below.

To understand local climatic variability in arid and semi arid environments, long term research provides the series of data necessary to understand temporal and spatial variability and their impacts on land productivity. As highlighted above, almost every growing season was different with different outcomes in rainfall amount and distribution and the resulting crop yields. The long term data series also revealed clusters of seasons with either low rainfall with poor yields or high rainfall with good yield. If experiments had been carried out only in such years, the results would show different production potentials as compared to the long term situation which could lead to misleading recommendations.

In arid and semi arid areas, crop yield my not be predicted using simple rainfall models as its outcome is influenced by other factors such as rainfall distribution and water losses through evaporation and runoff. Information on total growing period rainfall is not sufficient to predict maize yield. For example, several seasons with similar rainfall seasonal totals had different yield outcomes. Therefore, to manage climatic variability in arid and semi arid area, an integrated agricultural production system approach will provide better results.

Long term research is very expensive and can only be carried out in a few areas. Simulation models provide a framework to extrapolate the knowledge gained from few research sites to the wider area and range of production systems. However, under the high spatial and temporal variability experienced in the arid and semi arid areas, the selected model should have adequate features to address the limiting resource environment experienced in these areas. The model should be tested against measured data to evaluate how well they can simulate the local environment and adjusted as necessary. This process requires a good series of research data but this approach enhances and extends research investments and lead to cuts cost of research.

Up scaling of research results requires partnership with different organizations and institutions. In this study, although farmers, government and development agencies were all interested in the results on the research, adoption was slow and momentum was only realized when different partners came in and made different inputs. The initiation of this momentum started with the formation of farmers self help group such as the Ndume self help conservation agriculture group which as seen significant improvement in crop yields and food security among its members through the

use of conservation tillage method. Other partners involved included ministry of agriculture, the research centre and non governmental organizations. Through the inputs of different partners, members of the Ndume group have witness reduction in crop failures to the extent that they harvest in almost all seasons (Photo).

4. Implication in planning and implementing research and development projects

The lessons learned from this study highlight four key issues: the need for long term research, the need to follow an integrated agricultural systems approach, the need to combined research with simulation models and finally the role of partnership in up scaling research results. These lessons have implications in planning and implementing research and development projects as discussed below.

Although research and development projects can conduct the research required to build the datasets required to understand local climatic variability and also to test and adapt simulation models to the local environment, a more sustainable approach would be to develop the capacity of relevant government ministries and resource management authorities such as river basin authorities to develop and run resource monitoring networks. The same can monitor the baseline information needed to implement development projects as well as the basic information needed for up scaling research results. This requires a long term commitment and should follow an optimized approach to minimize cost.

Research and development projects addressing arid and semi arid areas should embrace a multi disciplinary approach where the whole production system and the complex and varying social, economic and bio-physical environments are assessed. Simulation models can be used to provide as a framework to bring together the different components of the production environments and to integrate the knowledge of the different disciplines. Research and development project should therefore invest in developing the capacity to test, adapt and use simulation models.

Further, research and development projects should aim at develop partnership between the different parties that can play important roles in the uptake of the strategies and technologies for improving land productivity. These may include government ministries, farmers, research organizations, development organization, local entrepreneurs and commercial companies. Also, the experience of this study show that farmer to farmer learning and farmer to farmer training play a key role in adoption of conservation tillage in the area. Within the study area, large scale farmers have also contributed to the adoption of technologies to small scale farmers through field days when small scale farmer come to the large scale farms to learn. During these field days, all other parties are able to show their services and products. Through such partnership, it is possible to address the whole farming system in a long term and sustainable manner.

5. A national outlook

For many years, food insecurity has been a major concern in the arid and semi arid districts of Kenya, which constitutes over 80% of the country total area. Famines occur frequently in Kenya. Recently, several lives were lost following a severe famine which hit most of the arid and semi arid areas of the country. In Kenya, agricultural policies, technologies and packages focus at different administrative levels i.e. national, provincial or district. Although agricultural extension service extends to the local level i.e. below district level, many recommendations are applied at district levels with limited consideration of the local variability. Such lack of local characterization has lead to limited impacts of recommendations. Many of the arid and semi arid areas of Kenya continue to server chronic food insecurity as evident from the observed recurrent famines. However, the experiences gained from this study indicate that such extreme food insecurity situations can be avoided in many of the semi arid and arid district. Great opportunities exist if partnership can be developed between research, government, farmers and private sector to address food security issues and sustainable water and land resource development. The lessons learned and implications stated apply for the rest of Kenya's semi arid and arid areas. It is possible to reduce food insecurity, poverty and move towards attainment of the millennium development goals.

Annex 2

Materials

1. Bios of presenters

AMEZIANE EL HASSANI Tayeb, Professor of Agronomy at the Institut Agronomique & Vétérinaire Hassan II, Rabat, Morocco, where he also worked as Director, College of Agriculture and Natural Resources from 1992 to 2005. Agronomist by background, he earned an Advanced degree in Crop production from the Institut National Agronomique Paris-Grignon, France (1974) and graduated from the University of Reading, England (MSc in Crop physiology, 1981 and PhD in Agronomic Modelling, 1986).
As a faculty member of IAV Hassan II, Dr Ameziane has teaching, research and development activities and is in charge of supervising MSc and PhD home students and foreign students from universities and research centres within joint collaborative research programmes. He previously was research fellow at the Grassland Research Institute, England; scientific advisor for Agence Universitaire Francophone (FICU programme 1994-2002, Canada), and visiting scientist in several European and US universities. . He is member of the Editorial Board of the francophone journal ''Agricultures'', and member of the Strategic Orientation Committee of Sahara and Sahel Observatory (OSS). In 2001, he was appointed Director of the National drought observatory of Morocco.

Within the framework of development projects, research contracts and consultations, Dr. Ameziane has worked for several international organizations including FAO, IFAD, USAID, AUF, IUCN, IFA and GIWA.

BAUMGARTNER Michael is the founder and the Managing Director of MFB-GeoConsulting GmbH. GeoConsulting was established in 1998 and focuses on 'Solutions in Geographic Imaging'. MFB-GeoConsulting employs around 30 collaborators of which 7 are based in Switzerland. One of the corner stones is the operational application of digital image data (aerial photographs, ortho-photographs, satellite data) and their integration with Geographic Information Systems (GIS), database management systems as well as mathematical models.

Michael Baumgartner is Associate Professor and Head of the Remote Sensing Research Group and Lecturer at the Department of Geography of the University of Berne. His habilitation work dealt with the 'integration of digital satellite image processing, geographic information systems, database management systems and model computations in snow hydrology and climatology – a contribution to environmental diagnostics in the European Alps'. Michael's previous research experiences include assignments at the US Deptartment of Agriculture, Beltsville, USA, at the NASA Goddard Space Flight Center, Greenbelt, Maryland, USA, at the Institute of Geography of the University of Zurich, and at the Institute for Communication Technology at the Federal Institute of Technology in Zurich (ETHZ).

BICHSEL Christine holds a MSc in Geography from the University of Berne, Switzerland (1999). Her thesis focused on trade, tourism and socio-economic change in Solukhumbu, Nepal. In 2002 she began her PhD studies with the Swiss National Centre for Competence in Research (NCCR) North–South programme and joined swisspeace (Swiss Peace Foundation) in Berne as a doctoral student. Her PhD thesis deals with irrigation disputes and conflict transformation in the Ferghana Valley, Central Asia. For this study she conducted field research totalling 14 months in Kyrgyzstan, Uzbekistan, and Tajikistan from 2002 to 2005. Her PhD thesis is already submitted and the defense is scheduled for June 2006.

BONFOH Bassirou is a veterinarian graduated from Dakar University, Senegal (1992) and specialised in livestock extensive production systems. From 1993 to 1994 he was appointed as Assistant Lecturer at Dakar Veterinary School and as Assistant Researcher with the International Trypanotolerance Centre (ITC) program in the Gambia. From 1995-2000, he spent five years in West African as technical assistant in livestock development projects for Vétérinaires Sans Frontières in seven (7) countries. He spent several time in Switzerland as research collaborator of STI and ETHZ. From 2000-2005, he was assigned a post-doc research position to coordinate the program “Healthy milk for the Sahel” in 9 Sahelian countries. He has contributed to build a network of researchers assisting the West African Economic Union to develop a sectoral dairy policy with regard to the coming market opening in 2008. He has supervised several joint Msc and PhD studies (Swiss-Mali).

He is deeply involved in research on livestock development policy in the Sahel. He is now joint appointed in Mali by the STI and Institute of Sahel to coordinate the transversal package project TPP6 “environment and societies” within the framework of NCCR North-South in three Joint areas of case studies (West Africa, Horn of Africa and Central Asia).

IFEJIKA SPERANZA Chinwe is a geographer. Her PhD thesis is on drought vulnerability and risk in the semi-arid areas of Kenya. She carried out her PhD study within the Individual Project 1 (IP1) of the National Centre of Competence in Research (NCCR), North-South Programme, at the Centre for Development and Environment (CDE), Institute of Geography, University of Berne, Switzerland. She is also a Research Associate at the Division of Geoinformation and Cadastral Surveys of the Canton Lucerne, Switzerland. She has worked as a consultant in projects and has trained other persons in GIS, Food Security and Drought Management. She has field experiences in Kenya and Sarawak, Malaysia.

In her BSc., she majored in Climatology at the University of Nigeria, Nsukka, while she did her MSc. at the University of Zurich, Switzerland, with majors in Remote Sensing, Geographic Information Systems (GIS), Cartography and Development Studies.
Her main interests are environmental change research, concepts and methodologies, GIS, rural livelihoods, natural resources management, the interface between theory and practice, as well as interdisciplinary studies.

MALIK Fauzia is Project Coordinator for Farm Forestry Support Project (FFSP) that is implemented by Intercooperation (IC) Pakistan, and is funded by Swiss Agency for Development and Cooperation (SDC). She has joined this project 1 year ago. Previously she was associated with Catholic Relief Services (CRS) Pakistan for more than 6 years. She has worked on Food Security Program, combating issues of poor farmers and women in farming and management of other natural resources. She also developed a special program for women, “women’s empowerment program for Peace” that provided support to poor and marginalized women of the rural areas of Pakistan in many different ways like income generation, literacy, social and health awareness. In her previous career with National Rural Support Program (NRSP) – a nation wide Non-Governmental Organization, she received experience of working at grass roots level with the men and women of rural Pakistan. This was focused on improvement of their livelihood, after need based assessment.

Fauzia is a life-time fellow of LEAD network (Leadership for Environment and Development). This is an international network among the career oriented professionals. She is a member of a number of different associations and development organizations in different capacities. She has a lot of work done on gender aspect as well. By academic qualification she has done masters in Forestry and masters in Botany. During her career she has attended a number of development oriented workshops, seminars, symposiums, both on national and international level.

NJERU Lewis is an information resources coordinator for the Somalia Water and Land Information Management, a project whose purpose is to rebuild the water and land resources information for largely arid Somalia following prolonged civil strife. The project is funded by EC and implemented by the FAO. He received his PhD degree in Natural Science from the Berne University, Switzerland in 2005 and has a Master of Science degree in Hydrology awarded by the University of Nairobi in 1995. Before joining the FAO project, has worked for over 10 years in a water conservation research project on the dry foot slopes of Mount Kenya. He has wide experience in natural resources management and specialization in water resources management in dry land agricultural production systems. Njeru's research and publication has focused mainly in water and land resource management in arid and semi arid environment where he has been involved in a long-term water balance measurement and assessment study. He has tested several agricultural systems models in this environment and calibrated and adjusted the Australian developed APSIM model for the subsistence farming system in this area.

PETERHANS Bernadette is since 1997 a course coordinator at the Swiss Tropical Institute in Basel. Trained as nurse (Cantonal hospital Aarau), specialised in emergency care and management in Switzerland (from 1979 – 1992 / Zürich), and worked in several missions for the International Committee of the Red Cross (since 1992) mainly in health in conflict areas. She did a master of science in public health for developing countries at the London School of Hygiene and Tropical Medicine in 1998/1999.

Main professional activities now are

- Coordinator in charge for the Diploma Course in Health Care and Management in Tropical Countries (3 months core course for the masters degree in International Health MIH) and the advanced module in health district management (3 weeks) responsible for organising, lecturing and running the courses.
- Tutoring MIH students in their course planning and thesis work.
- Cooperating in international teaching/training network in international health.
- Teaching assignments in different programmes (Swiss master of public health program, nursing science University Basel, Institute of Child Health London, HELP course ICRC, University Geneva, University Copenhagen).

Consultancy work for the International Committee of the Red Cross (ICRC) and the Swiss Red Cross (SRC) mainly in assessment of health systems and project planning / evaluation for community based health care in conflict and post conflict countries with disadvantaged populations

2. Programme of the Symposium

09.00 Opening and Introduction
Urs Wiesmann (CDE & NCCR North-South)

09.15 Presentation and discussion of experiences from development and research

Theme 1 "Management of competing demands for water in transnational settings"
Development: Michael Baumgartner (MFB-GeoConsulting, Switzerland)
Research: Christine Bichsel (NCCR North-South & swisspeace)

10.00 Theme 2 "Competition for natural resources between unequal stakeholders"
Development: Fauzia B. Malik (Intercooperation, Pakistan)
Research: Chinwe I. Speranza (NCCR North-South)

10.45 Coffee Break

11.00 Theme 3 "Market access, social services and improved infrastructure for vulnerable stakeholders"
Development: Bernadette Peterhans (Swiss Tropical Institute, Basel)
Research: Bassirou Bonfoh (NCCR North-South & Institut du Sahel, Bamako, Mali)

11.40 Theme 4 "Dealing with climatic variability at local and national levels"
Development: Tayeb Ameziane El Hassani (Institut Agronomique et Vétérinaire Hassan II, Rabat, Morocco) held by Daniel Maselli
Research: Lewis Njeru (NCCR North-South & FAO Kenya/Somalia)

12.00 Lunch

13.15 Thematic workshops
Theme 1
Resource persons: Michael Baumgartner & Christine Bichsel
Moderator: Tobias Hagmann (NCCR North-South & swisspeace)

Theme 2
Resource persons: Fauzia B. Malik & Chinwe Ifejika Speranza
Moderator: Udo Hoeggel (CDE)

Theme 3
Resource persons: Bernadette Peterhans & Bassirou Bonfoh
Moderator: Jakob Zinsstag (NCCR North-South & Swiss Tropical Institute, Basel)

Theme 4
Resource persons: Daniel Maselli & Lewis Njeru
Moderator: Hans Hurni (CDE & NCCR North-South)

15.15 Coffee Break

15.45 Reports from the four groups

16.45 Plenary discussion, conclusions and closing remarks
Urs Wiesmann, Chair (NCCR North-South)