ICIMOD

FOR MOUNTAINS AND PEOPLE

Mountain Development Resource Book for Afghanistan

IFAD

Enabling poor rural people to overcome poverty

About ICIMOD

The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush-Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.

Mountain Development Resource Book for Afghanistan

International Centre for Integrated Mountain Development, Kathmandu, Nepal

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Contents

Foreword

ICIMOD works in Afghanistan and would like to contribute to the recovery and rebuilding of the economy of this country. The underlying assumption is that because of more than 25 years of war and unrest, a lot of relevant local knowledge remains to be rediscovered and activated. The strong presence of foreign experts makes it important to draw attention to valuable traditional practices essential for the future development of the country.

This **Mountain Development Resource Book for Afghanistan** – the product of a cross pollination of ideas among ICIMOD and Afghan partners through a writeshop – is part of this effort. We acknowledge and thank the International Fund for Agricultural Development (IFAD), and German Technical Cooperation (GTZ) for support to this project. Each chapter and subject in this Resource Book provides a development option or technology carefully chosen and represents both ICIMOD and Afghan experience and expertise and are illustrated by Afghan examples. Development practitioners who work with communities in Afghanistan can use any chapter of the book that interests them, or choose a mix of options found in several chapters and apply the interventions where they work. The resource book also covers intangible but valuable dimensions such as gender and participatory approaches, acknowledged as important to the success of any development undertaking. The book offers leads to where to get further information and resources to implement them.

We want this resource book to be used, so as part of its dissemination strategy, the book will be translated in Pashto and Dari, the major languages of the country, and will have no limit on reproduction; we encourage its reproduction and use by others, and translation into other Afghan languages as development practitioners-users see fit. During the book's conception, the response to the idea of a resource book was positive and optimistic: our local partners liked the idea especially of a book because it is tangible and contributes to rebuilding the library resources destroyed by war, and because capacity building of government staff, especially at provincial and district levels, remains a major concern in Afghanistan. But the approaches are applicable also for nongovernment organisations or civil society and community-based and people's organisations. During the book's making, both our specialists at ICIMOD and our Afghan counterparts learned much from each other's experience through the interaction and exchange.

ICIMOD intends to foster more of these exchanges and knowledge harvest approaches with partners in the member countries and with the international development community as a regional learning and knowledge centre. ICIMOD would like to be a platform for exchange in the member countries and the global community. Part of our task as a regional mountain learning centre is to promote cross-learning and exchange, and to validate traditional knowledge and enrich it with scientific expertise. The English language version of the resource book is available on our website and provides a model for other member countries, should they wish to develop a similar resource of their own, a kind of Godavari Demonstration and Learning Centre in book form. As learning is a never ending continuum, we hope to update the book, particularly the online version, from time to time with inputs, refinements, and contributions from readers and users. Write to us about them, about what have worked and what have not, and about new technologies applicable and useful to know to improve the mountain condition and the quality of mountain life. We hope you find the book useful, that it contributes to your work to alleviate poverty and improve the conditions of the people in Afghanistan as well as provide starting ideas for similar work in the other member countries.

Andreas Schild
Director General, ICIMOD

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ICIMOD expresses its appreciation and gratitude to the people of Afghanistan for the warm welcome and for showing our staff the way. As the coordinator for this resource book, I am especially thankful to our hosts and facilitators, the Ministry of Agriculture, Irrigation and Livestock, especially H.E. Eng. Ghulam Mostafa Jawad, Deputy Minister, and Abdul Ghani "Ghuriani", and the Aga Khan Foundation team including Henri Suter, Akhtar Iqbal, Mohammad Shafi Hafizi, Andrew Billingsley, Amin Masood, and the staff of the AKF office in Badakhshan. I also thank Mirwais Ahmadzai of Kabul University, Verena Schild, and Farid "Mateen" Ahmad for their guidance and good advice. The financial support provided by the International Fund for Agricultural Development (IFAD) and GTZ – German Technical Cooperation – is also highly appreciated.

This endeavour required people from across ICIMOD programmes to work together in new ways. Therefore, I thank ICIMOD's management, particularly Andreas Schild, Director General; Madhav B. Karki, Eklabya Sharma, Michael Kollmair, and Mats Eriksson, for their valuable inputs and for the human and financial resources. I also appreciate sincerely the support provided by the ICIMOD Country Office in Afghanistan, especially Tika Laxmi Gurung, Sagendra Tiwari, Abdul Sial, Ambika Gautam, and Jawed.

The authors and editors merit recognition for their professionalism, hard work and dedication during the writing, rewrite, and review of the chapters. Several people deserve special mention for generously sharing their photos of Afghanistan; they are Ahmad Shah Siddiqi, Sanjeev Bhuchar, Andrew Billingsley, Yi Shaoliang, Arun B. Shrestha, Ghulam Mohd. Malikyar, Sima Rezai, Noorin Nazari, Abdullah Zaimi, Abdul Bassir Abid, and Zia Ahmad Farid.

Mohammad Shafi Hafizi, with his exceptional communication and language skills, was instrumental in building bridges between the Afghan and ICIMOD colleagues. His wealth of knowledge on agriculture and rural development in Afghanistan guided the choice of topics covered in the resource book and provided valuable insights to all of the chapters. He also helped to carefully identify the Afghan experts on each topic and bring them to Nepal.

Neetu Ghale's invaluable support made the writeshop and exposure visit run smoothly. Mohammad Ismail and Samden Lama Sherpa did a wonderful job in welcoming the Afghanistan delegation to Nepal, and organising the exposure visit with help from Local Initiatives for Biodiversity, Research and Development (LIBIRD) in Pokhara, and ICIMOD's Travel and Hospitality section.

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I thank you all for this great team effort and rewarding experience.

Elisabeth Kerkhoff
Coordinator
ICIMOD

Acronyms and Abbreviations

AKF	Aga Khan Foundation
BCR	benefit-cost ratio
CDC Council	Council of Community Development Councils
CRS	CRS Afghanistan project
DACAAR	Danish Committee for Aid to Afghan Refugees
GDP	gross domestic product
GHGs	greenhouse gases
GLOF	glacial lake outburst flood
GTZ	German Technical Cooperation
ICIMOD	International Centre for Integrated Mountain Development
IFAD	International Fund for Agricultural Development
IRR	internal rate of return
LDOF	landslide dam outburst flood
LFA	logframe analysis
MAIL	Ministry of Agriculture, Irrigation and Livestock
MDGs	Millennium Development Goals
MEW	Ministry of Energy and Water
M&E	monitoring and evaluation
MOVs	means of verification
MRRD	Ministry of Rural Rehabilitation and Development of Afghanistan
NPV	net present value
NSP	National Solidarity Programme
OVIs	objectively verifiable indicators
P3DM	participatory three-dimensional modelling
PM&E	participatory monitoring and evaluation
PRA/PRRA	participatory (rapid) rural appraisal
PTD	participatory technology development
RET	renewable energy technologies
RRA	rapid rural appraisal
WOCAT	World Overview of Conservation Approaches and Technologies

About This Resource Book

ICIMOD and Afghanistan

This resource book will guide you through some of the current topics on mountain development. You can either go directly to the chapters or sections you need, or read through all of the topics to gain insight and new ideas, or to just be inspired.

The book is organised in five chapters or themes: Working with Communities, Creating Livelihoods, Managing Natural Resources, Living with Risk, and Making Development Work. Its chapters cover a selection of technologies and approaches for development in mountain areas that ICIMOD recommends. They include: (1) Working with Communities (2) Enterprise Development (3) Beekeeping (4) Renewable Energy Technologies (5) Rangeland Management (6) Watershed Management (7) Soil Conservation (8) Water Conservation (9) Disaster Preparedness (10) Flash Flood Risk Management, and (11) Monitoring and Evaluation. Through the book, we aim to reach out to professionals working with communities in Afghanistan. These include extension workers, decision makers, and local leaders who decide on what to do to develop their mountain communities.

Readers need not be experts in the fields mentioned to be able to understand and use the book. We describe the basics of technologies and approaches, but you may need additional information to be able to implement some of them. Further information on certain topics is available in English from ICIMOD, and/or from partner organisations in Afghanistan. We do not assume that all of the options provided are applicable everywhere in Afghanistan. They will need to be tested and adapted to each particular situation or condition. During the trial or piloting phase, many other factors may need to be taken into account, as well as questions answered such as, does it solve the problem? Is it suitable and acceptable to the communities? Lastly, are materials accessible and affordable? Adaptation means making it more acceptable, for example by using locally available materials and tapping local knowledge, or by making it cost-effective or culturally more appropriate. Involving the communities in the process of implementing them can result in useful suggestions and innovative, new ideas.

How the Book was Produced

The book was developed as part of an IFAD-funded project, 'Enhancing Innovative and Pro-poor Upland Policies (2006-2008)'. Afghanistan has been a regional member country since ICIMOD's founding in 1983. However, this is one of the first ICIMOD projects to be implemented directly in Afghanistan after several years. As part of the project's learning and exchange process, a multidisciplinary team from ICIMOD first visited Afghanistan in 2007, going to the field and interviewing key officials of various Ministries and nongovernment organisations. The team felt,

however, that a visit was not enough, and that they needed more exchange with Afghan professionals to be able to write materials suitable to the Afghan conditions, socio-cultural context, and needs.

Therefore, this resource book was prepared through an intensive participatory exchange workshop called the 'writeshop', which took place March 3-7, 2008 in Nepal. This involved bringing together the Afghan and ICIMOD counterparts' expertise in the writing and assembly of the resource book's materials. A exposure visit preceded the writeshop, where our Afghan partners were brought to sites where some of the options recommended by ICIMOD were being practiced in Nepal.

The writeshop was a first in ICIMOD and a kind of 'learning by doing'. The team members came to the writeshop with preliminary drafts and other written contributions. The papers were read and critiqued, and many of the drafts underwent major revisions, sometimes complete rewrites as a result of the exchange with the authors and editors. This collaboration helped to make sure that what is presented here is relevant, appropriate, and usable in the Afghan context and provided ICIMOD with the opportunity to learn more about Afghanistan and strengthen its professional network in the country.

We hope you find the book useful, that it raises your interest in the topics discussed, and their importance and applicability. It should give you ideas on what can be done and where to find additional information. We also hope the process in which it was produced provides a model for exchanging experiences and capturing partners' knowledge and experiences in our member countries.

We welcome questions, comments, feedback on this resource book, and any interesting information about mountain development in Afghanistan. You can reach us at info@icimod.org.

The Resource Book team

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Working with Mountain Communities

A women's community consultation in a district in Afghanistan

Working with Mountain Communities

S. Zia Ahmad Farid, C.N. Anil, Min Bdr. Gurung, Brigitte Leduc

A community is composed of people belonging to different groups in terms of age, gender, ethnicity, economic class, marital status, educational background, religion, and political association. Each group plays specific roles, has different assets, faces particular problems, and promotes diverse interests. The social structure determines relationships, notably power relations among different groups of people, and therefore influences who has access to natural, social, and economic resources as well as who are deprived from accessing those resources. It is particularly important for development practitioners to understand the social structure and to identify the marginalised groups, such as the young, single men, the poor, ethnic minorities, people with little or no formal education, women, orphans, widows, and the disabled. These groups of people are often absent or silent during public gatherings for decision-making and, as a result, development programmes do not properly meet their needs.

Working with communities must be based on the principles of participation, inclusion of all members of the community, the right to development, peace building, and empowerment.

In Afghanistan, mountain communities are organised around strong traditional institutions such as the Shura (a consultative body) and have been able to develop a way of life based on the richness of their knowledge and experiences, utilising and managing natural resources. Even during war time, while government services hardly reached the mountain villages, people have been able to adapt and start over. The communal sense of belonging enhances solidarity within communities, which have developed self-reliance.

However, development practitioners working with communities face some challenges. It is important when working with communities to win their trust and build their confidence. Mountain communities generally lack awareness about development processes and their purposes, especially initiated by 'outsiders'. A low level of formal education amongst most mountain communities can present an obstacle. The difficulty to reach women and other marginalised people and involve them in development initiatives challenges our capacities to address their needs and to solve important development issues.

This chapter introduces different approaches to working with mountain communities that have been found effective in Afghanistan, notably community mobilisation, conflict mitigation, social auditing, the gender and development (GAD) approach, and participatory 3-dimensional modelling.

Leadership training in the Darwaz district, Badakhshan, Afghanistan

Some effective participatory tools

Participatory social mapping
Involving the community in identifying community composition, resources, and activities

Visioning and scenario planning
The community collectively or together analysing opportunities and planning for the future

Well-being ranking
Categorising households according to the criteria of wealth and poverty set by the community

Venn diagramming
Drawing diagrams showing different institutions, their location, responsibilities, the relationships among them, and their importance to the community

Transect walk
Literally a walk across the landscape of the community or study area by a group with community members to identify crop, soil vegetation, and settlement patterns and other natural resources of the community

Preference ranking
The community ranking its needs and projects according to what it considers important

4Rs (Roles, Rights, Revenues, and Relationships analyses)
Analysing the community's organisation and structure based on the four R's

General Principles of Participatory Approaches

What is a participatory approach?

A 'participatory approach' is a process through which the views and interests of all concerned people of the communities are integrated into decision-making and collective action. Members of the community define their problems and drive the planning, implementation, monitoring, and evaluation of interventions for their own development.

Many participatory tools, which range from visualisation to interviewing and group work, have been developed to facilitate interactive learning among different stakeholders in the process. The key element to facilitate the learning process is to use participatory tools that enable people to visualise and understand the issues, communicate with each other, analyse options, and take decisions.

What are the benefits?

Participatory tools

- contribute to ensuring genuine community involvement as well as provides a sense of ownership and responsibility towards development and environmental actions.
- add value to local knowledge and experiences, and thus, ensure the adoption of appropriate technologies based on people's capacities; development and environmental interventions are more efficient, effective, and sustainable because these lead to a community's sense of ownership of the outcomes.
- develop people's skills and build local capacities.

- provide people the power to manage resources and to find a balance between their needs and the necessity for conservation.
- raise awareness about the needs, interests and capacities of the poor and the marginalised and contributes to addressing their needs better.
- empower people.
- support the process of gathering the community together to solve their problems.

Some Participatory Methods

Community mobilisation

More and more development and environmental projects are being carried out by involving local communities to ensure the appropriateness of the interventions as well as to enhance the community's sense of ownership of the project or the intervention.

What is community mobilisation?

It is helping organise the community to take charge of its own development by providing information, building community skills, and mobilising community resources (see Figure 1).

How to do it?

- Meet with the district and local authorities. Introduce yourself and the project, and request their approval to work with the selected community or communities.
- Meet the key representatives of the community – the mullahs, teachers, elders, others. Explain the project, its objectives and targets; convince them of the importance and objectives of the project, work to gain their support.
- With help from key community representatives, meet with small cohesive groups within the community to provide information about the project and discuss the community's interests; women community mobilisers may also meet with women and go through the same project briefing process.
- When they feel ready, the leaders should organise a meeting with all the members of the community about the project. In the meeting, people should identify their resources and discuss their potential contribution and interests towards the project.
- Support the creation and formalisation of the Shura in the community, if this is not yet in place.

When people work together to illuminate their village

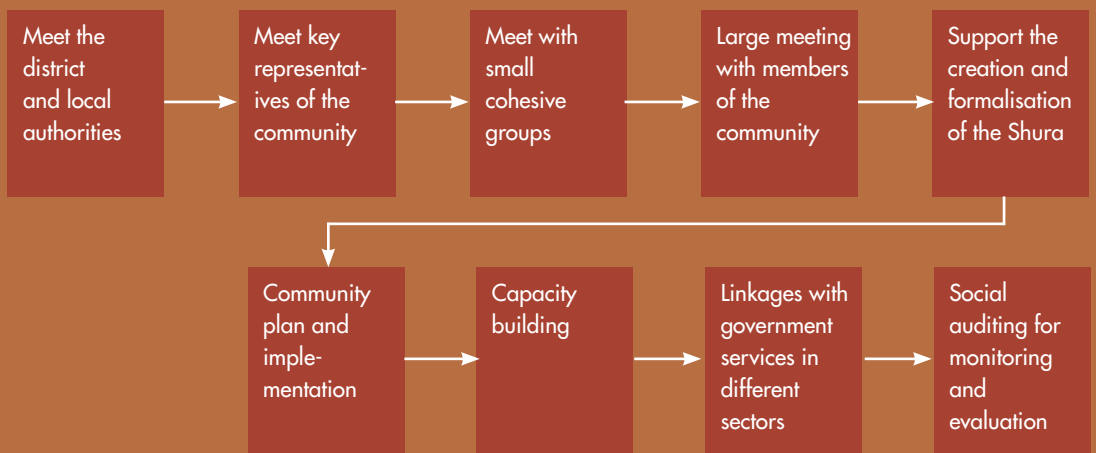
Five Shuras participated in an exposure visit to the village of Nawi-Jurm, Jurum district, where the local Shuras have implemented a micro hydropower project which provides electricity to the entire village. The project was implemented entirely by the Shuras using the community's resources. The Shuras participating in the exposure visit were inspired. The experience made them aware of their own capacities. After returning to their villages, they mobilised their own communities around a similar project for micro-hydropower, using their own resources, successfully implementing another project which now illuminates their villages.

- With the Shura, facilitate the process of identifying the community's natural, financial, and human resources, and the community needs; and help prioritise the needs of both the community's women and men.
  - Facilitate meetings with institutions providing helpful information for the community to make decisions about their future actions.
  - Support and build capacities to develop a community plan. Write proposals and mobilise resources.
  - Facilitate the submission of proposals.
  - Support the implementation of their projects.
- Strengthen linkages between the communities and government services in different sectors at both district and provincial levels.
- Build the capacities of the Shura and other community members in financial management, administration, conflict mitigation, leadership, teambuilding, and other technical aspects.
  - Contribute to building local capacities in governance and advocacy.
- Support the monitoring and evaluation processes, notably through social auditing.
- Help broaden the role of the Shura in other sectors of social well-being and development such as education.

What resources do you need?

- Committed, skilled, and informed men and women community mobilisers
- Support from government services of different sectors and local governments
- The community's trust
- Time
- Security/safety of the development workers

Figure 1: **Important steps to effective community mobilisation**



Conflict mitigation

Very often, a social mobiliser may find him/herself working in a community where there are conflicts. When working in such contexts, avoid interventions that could contribute to further fuelling the conflict. As a social mobiliser, you do not have the mandate to solve the conflict by yourself. Instead, your role is to facilitate the process of peace building and conflict resolution by building the capacity of community members to understand the causes of the conflict in order to be able to manage it and link the community with helpful external resources to aid in peace building.

What is conflict mitigation?

It is a process that aims to solve problems in the community in a peaceful manner.

How to do it?

- Build your capacity to analyse and mediate conflict.
- Meet both parties and try to find the roots of the conflict, who are involved, and the reasons behind.
- Do not take sides; use diplomatic approaches to save people's pride.
- Propose 'win-win' solutions – solutions that will benefit both sides.
- Work with the troublemakers to make them change their position.
- Collaborate with the elders or other leaders, or with people who could influence the troublemakers in a positive way.
- Facilitate meetings between the conflicting parties.
- Inform people about their rights and possibilities.
- Empower peaceful people – acknowledge their capacities to contribute to resolving the conflict.

Some tools for conflict mitigation

Root causes analysis, to identify the sources of the conflict

Analysis group discussion, to build the capacities of community members to analyse the situation

Consensus building, to agree on a common ground about causes of the conflict and find solutions

Brainstorming and cluster technique quickly lists the issues and topics of the components of the conflict

Convergence matrix, to identify key actors who are part of the conflict issues and who, in turn, could be involved in peace building

Decision making matrix to agree on actions to be carried out and by whom

A long time conflict solved with the help of the Shura

In a village in the district of Yumgan, there was a long-standing conflict amongst brothers over land issues and the conflict went on for more than 10 years. In vain, the brothers had tried to have their problem solved mediated by official authorities. Still the conflict persisted and became more and more violent. Finally, aware that it could affect the village's peace and stability, the Shura invited the brothers to talk things out about the issue. After much discussion, a solution convenient for all the brothers was found, agreed upon, and since then the conflict has been resolved.

What resources and enabling conditions do you need?

- Technical knowledge on conflict management
- A conducive environment to conflict mitigation and security
- Willingness of the community to solve the problem

Where to find more information

If you want more information about how to mitigate or resolve conflict, you may contact the following organisation:

- Aga Khan Foundation

Social auditing

Social auditing is an interesting tool for monitoring and evaluating the work of local organisations such as the Shura. It has many advantages:

- increases community participation in the governance process by incorporating the principles of transparency and accountability in project operations;
- increases people's confidence in the development process as well as in one another.

In Afghanistan, it is particularly important to conduct social auditing in a peaceful manner with consent from the Shura. The social mobiliser's role is to facilitate the social auditing process by providing information, and building the capacities of both the Shura and community members to conduct a social audit on their own.

A misunderstanding over the Shura's expenses

Sometimes, suspicion about how community resources are being used can lead to mistrust and create conflict within a community. During a social audit in one village, the presenting treasurer mentioned that 250 afghanis (AFA) were paid to five members for labour. This was objected to by some community members who mentioned that they had only received 175 AFA! Then the treasurer explained this was true, but since the budget was only for five labours and they had engaged seven, the total amount available was divided into seven. He also explained that the Shura had to prepare the report according to the agreement with the guidelines. The members were appeased with the explanation and thanked the treasurer for clarifying the matter to them.

What is social auditing?

It is a participatory process where community members come together on a common platform to evaluate how the Shura or other implementing organisations are utilising project resources. It is carried out through active participation from community members, project beneficiaries, and Shura members. During the audit, the social audit committee asks questions regarding how the resources were used, for which purposes, how much the project or activity cost, and who benefited. The process is conducted in a peaceful way.

How to do it?

- Meet the Shura and explain the social auditing process and its benefits. IMPORTANT: Shura members must give their consent to the conduct of a social audit.
- Meet with community members and support the creation of the social audit committee.
- Support the committee in the analysis of administrative and financial documents and the preparation of charts of the findings.
- Facilitate organising a meeting with community members (at least 75% of the households should be present), where project charts are displayed and a forum is opened for discussion.
- In some cases, a separate meeting or discussion may be organised with the women to provide them an opportunity to give their feedback. In other cases, women may directly participate in the main meeting.
- With the agreement of the Shura and the community members, draft key resolutions to institute improvements.

What is needed?

- The consent of the Shura
- Willingness of the community to take part in the social audit
- A good facilitator and mediator
- A peaceful environment and harmonious relationships
- Openness of the Shura members to answer questions and to be questioned

Gender and development approach

In Afghanistan, gender relations could differ greatly from one ethnic group to another. In some, it is very difficult to involve women in development interventions, public gatherings, or to even meet with them. In others, it is acceptable for the community members to work in mixed groups. Therefore, it is important not to generalise about what could be possible to do, and it is essential to acknowledge that men and women have diverse roles and responsibilities, both in the household and in the community, and thus their needs could be as different. These differences could also affect their capacity to be involved in development programmes.

What is the gender and development approach?

It is a collection of methods and tools to understand the roles of men and women in the household and in the community in order to address both their needs and ensure sustainable development.

How to do it?

- Recruit women and men social mobilisers from the community and build their capacity to use and promote the gender approach in development.
- Conduct a gender analysis that identifies the roles and needs of both men and women at the household and community levels.
- Facilitate women's participation in all development programmes; this does not mean that men and women have to work together in the same space.
- Support the creation of women's committees and build their capacities to participate in development by organising training sessions on management, leadership, conflict mitigation, communication, literacy courses, and other activities for skills development according to their interests. These committees should increase their capacity to manage some resources.
- Plan activities in the project to address women's needs. Find entry points to work with women.
- Acknowledge and value women's knowledge, skills, and experience.

When women participate in community life

In an Ouzbeck village in the Jurm district, women did not usually participate in development projects and public gatherings. But a women's committee existed in the village and, in turn, women received training on leadership and conflict mitigation. When the NGO supporting the Shura helped organise a social audit, they insisted on the involvement of women in the process. It was not easy at first to convince the Shura members because of village traditions. After some discussion and arrangements, however, women were finally and actively involved in the social audit.

Women's participation in social auditing in Gurm district, Badakshshan

- Where possible, sensitise men on gender issues and women's needs.
- Do not oblige community members to work in mixed groups.

What resources and conditions do you need?

- Women social mobilisers
- Gender-sensitive men social mobilisers
- Openness from community members to involve women in development activities

Participatory 3-dimensional modelling

A Participatory 3D-Model (P3DM) is a visual mapping tool made by community members. It serves as a platform for sharing information and helps in decision making and in managing natural resources, even by people with little or no formal education. The P3DM is useful in land use planning, forestry and watershed management, risk assessment, disaster mitigation, conflict mitigation, national parks management, community resource planning, and impact assessments. However, it requires intensive planning and investment in time by community members and requires technical support. In conflict areas, the tool may surface sensitive information and worsen the situation. The role of social mobilisers is to facilitate linkages among technical resources and the community and accompany and guide the community members in the use of the model.

What is participatory 3-dimensional modelling?

It is a process whereby community members produce a three-dimensional (3D) scale relief model of the community environment based on spatial information from topographic maps (see Figure 2). The model is made from locally available materials or rubber sheets.

How to do it?

- Collect the base maps and materials of the community, prepare the base map and orient the community about the map.
- Construct the module with local materials.

Some gender analysis tools

Division of labour between men and women helps to identify and understand the roles and responsibilities of men and women in the household and within the community.

Access and control over resources and benefits define which resources men and women use and how they decide on their access and use.

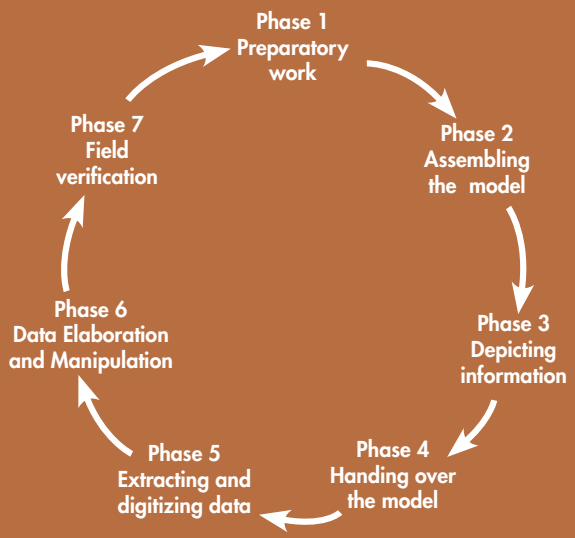
Levels of participation of women and men in a sector or in an institution is useful to understand the roles both play and the degree of control they exercise over resources, on their work, and the extent to which they participate in decision making processes within the household and in the community.

- Collect community information (lakes and bodies of water, settlements, forests, others) and incorporate these features of the community into the model.
- Hand over the model to the community.
- Extract and analyse information and produce resources maps.
- Analyse the dynamics of natural resources to visualise different options about their use and take decisions.
- Verify the information in the field.

What resources do you need?

- Open access to topographic data
- Motivation to involve local communities and grassroots in collaborative natural resources management and planning
- Existence of an enabling and positive policy framework
- Skills and dedication to shift from common sketch mapping to more demanding scale mapping
- Clear plan for future integration of community mapping with geographic information system (GIS) technologies

Figure 2: **Steps involved in building a P3DM**



Using a P3DM for community natural resource management planning in Sagarmatha National Park, Nepal

Practical tips for working with communities

For participatory processes to be effective, it is crucial that social mobilisers have the appropriate attitude and behaviour. Be respectful of community members and have a genuine interest in the community. Avoid showing off superiority and your education. Listen to and acknowledge people's knowledge and perspectives. This will make a difference in the kind of relationship or rapport you establish with the community. The social mobiliser's role is to enhance the community's capacities to improve their living conditions by providing useful information and technologies and strengthening their skills. To impart those skills and technologies requires an attitude different from that of teaching, directing, and ordering.
Here are some useful tips for working with communities:

- **Be open, honest, and transparent** about your objectives with all groups in the community.
- **Listen carefully** and try to understand the different voices and standpoints in the community.
- **Provide useful information and instructions in simple formats** – prefer visual (illustrated) to written materials. Use a vocabulary and language that can be understood by all – leave your scientific jargon behind.
- **Use practical and visual tools** – Visual techniques are good for involving the poor and the marginalised. Community people relate more easily to physical observations, photographs, maps, and drawings; they motivate community participation.
- **Work with small groups sharing common interests** – It is better to work in small groups in the beginning; people are often inhibited to talk in front of large groups.
- **Value people's knowledge and skills** – people's knowledge and skills are valuable resources often overlooked and untapped by outsiders during the participatory development process.
- **Be creative. Encourage the community to try something new or different** – It is important to share different experiences and encourage people to try something new. This is where exposure visits could be extremely helpful.

Further Reading

Integrated Approaches to Participatory Development (IAPAD)
www.iapad.org/
www.iapad.org/participatory_p3dm.htm
www.iapad.org/pafid/

Beekeeping and agricultural products are steady sources of livelihood in mountain areas

2

Creating Livelihoods

Planning and Developing Community Micro-Enterprise

Honeybees, Pollination and Livelihoods

Renewable Energy Technologies for Rural Development

Planning and Developing Community Micro-Enterprise

Dyutiman Choudhary, Ahmad Javid Ghyasi, Sima Rezai

Background

In Afghanistan, most micro-enterprises are easy-to-start income generating activities requiring little capital and often initiated and managed by households or individuals. Some are family enterprises such as carpet making, embroidery, and crafts handed down through generations. They make use of simple technologies, equipment, and resources usually available in the community and in nearby areas. Micro-enterprises owned and managed by local communities are called community enterprises. Various agencies in Afghanistan that promote enterprise development reach out to these small-scale community enterprise producers and artisans, offering training programmes on ways to diversify products and services, organising producers into enterprise groups to help link them to markets, and other services for strengthening strengthening micro-enterprises and improving community income.

Micro-enterprises provide off-farm employment and income in rural areas and benefit poor families, women, and disadvantaged groups. Although they require minimal capital, the requirements to start a micro-enterprise are nevertheless too high for the poor to afford.

Micro-enterprises in Afghanistan

Improving skills for enterprise development through bio-briquettes and a green house

- Backyard vegetable growing
- Dry fruits
- Poultry
- Dairy products
- Food processing
- Backyard soap making
- Honeybees and honeybee products
- Saffron
- Cumin
- Herbal medicine
- Gems cutting and polishing
- Seed production
- Fish farming
- Woolen yarn, carpet weaving
- Handicrafts

Small victories in micro-enterprise

Vegetable farming increases family income

After a bad harvest year, Asefa, a widowed farmer from Kool village, cultivated improved varieties of garden crops through a self-help groups' programme of CRS, a relief organisation working in Afghanistan. The little backyard enterprise has been her means of supporting her six children.

Qandi Gol, another woman farmer, has also been helped by the CRS self help groups programme. When her husband went to Iran for work, she supported her eight-year old daughter from income cultivating a new variety of tomatoes through the programme.

Seventy other women have been supported by this NGO's micro-enterprise programme to establish their backyard garden plots of garlic, okra, tomato, onions, saffron, and other crops. Backyard farming has brought food to their dinner tables and improved nutritional levels in the community. More important, the women gained income generating skills, greater confidence in themselves, and new hope for the future.

Therefore, micro-enterprise development requires thoughtful, careful planning.

Studies on micro-enterprise trends in Afghanistan have highlighted their existence within larger networks of firms and their dependence on other actors, factors, and conditions that affect their viability and performance. Using recently developed enterprise development approaches and methods, this section offers step-by-step guidelines on planning for the set up of a micro-enterprise.

Stages in planning a community micro-enterprise

Stage 1. Identify micro-enterprise activities or projects, set goals, and identify target groups

- Set the goals of the micro-enterprise and a programme for its development
- Identify where the operation will be located
- Define and decide the target groups
- Identify potential partners and other local organisations such as the Shuras
- Organise and mobilise identified target groups into interest groups
- Agree on the process of developing the enterprise with the identified partners; set partner roles and responsibilities.

For facilitators such as professional staff of nongovernment organisations, government agencies, business association members, extension workers, and others, it is important to understand the goals that the target groups have set for developing a micro-enterprise. Integrate these goals into the planning and development process. (For participatory approaches to integrating communities in the planning and development process, refer to the chapter on 'Working with Communities'.)

Stage 2. Select products and services and assess the markets

Selecting products and services

- *Identify products and/or services.* Consult community members through focus group discussions, key informant interviews and other methods, and refer to useful reference materials such as books, websites, others in preparing the products/services list.
- *Shortlist products and services.* Narrow down the list to realistically possible products and services based on social, economic, and environmental considerations. Social considerations include community interest, gender, social equity, access, tenure, policy, and institutional support requirements. Economic considerations include technology and the requirements of the market. Environmental considerations include impacts on the environment of sustainable harvest limits, ecology standards, pollution, hazards and risks of producing the products, among others.
- *Make a final list.* Select the final products or services to develop together with the target groups. A sub-sector ranking table can be used to make a final list of around 2-3 micro-enterprise products and services. (For detailed methodology see Frank Lusby, Promotion of Commercially Viable Solutions to Sub sector and Business Constraints, March 2004.)

Studying their markets

Carry out market studies to:

- identify market demand for the selected product/s and/or services including market prices and volume demand,
- identify market requirements in order to sell the products (standards; certification, laws, regulations, procedures),
- study the competition (competitors and competing products), and
- compare costs with similar products already in the market.

Carry out further market research to:

- obtain the necessary information for making decisions on marketing
- identify specific buyer requirements and demand trends
- see actual market opportunities for the products and services

Stage 3. Map and analyse the product/s' value chain

A value chain describes the many different activities required to bring a product or service through the different stages of production, transformation, and delivery to the final consumers (Kaplinsky and Morris 2000). The following is an example of the product value chain for saffron in Afghanistan as a whole, and in Herat in particular.

Value chain mapping, as illustrated in Figures 1 and 2 above draws a basic map of activities and actors or operators involved in producing and transforming the products and bringing them to the final consumers. A detailed value chain map allows us to explore key issues, constraints, and opportunities and identify where the target groups are in the chain. (Participatory market chain analysis [PMCA] is

Figure 1: **Basic sequence of functions in the saffron value chain in Afghanistan**

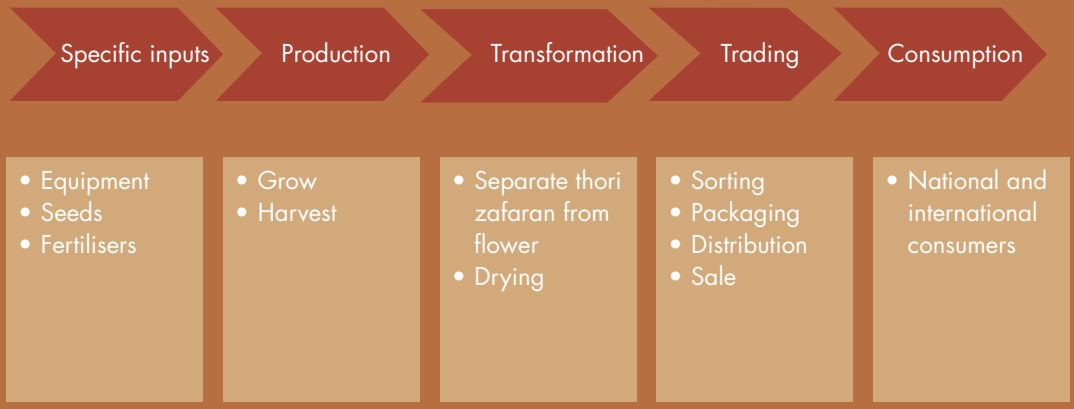


Figure 2: **Major operators in the saffron value chain in Herat**

an approach used by Practical Action, which is defined as a method of engaging market chain actors in sharing knowledge and building trust in order to generate joint innovations). Participatory value chain mapping and analysis is done to draw an outline of the value chain and is prepared by facilitators together with the target group/s and specific actors or operators in the chain. It helps in calculating the financial returns to operators of the chain (especially the target group), identifying important operators and ways in which returns are distributed among different operations. The value added at each stage is calculated.

Stage 4. Design an upgrading strategy

Developing a strategy or action plan to achieve the common goal/s set by the target groups is important in putting the micro-enterprise plan into operation. Develop a vision and strategy for upgrading, together with target group and stakeholders. Tap the opportunities or address the constraints in the value chain

The following steps may be taken to design the enterprise's value chain strategy.

1. *Develop a goal and strategy for improving the status of target groups and to facilitate their participation in the value chain.*

2. *List the different strategies.*
- Shortlist a few (2-3) effective strategies to address problems in the value chain and meet the goals.
- For each of the strategies review the factors for economic, social and environmental aspects to analyse the strengths and weaknesses of each strategy. This can be used as the baseline information for future evaluation.
- Select the best strategy for implementation.

3. *Identify important areas of influence that can stimulate change*. For example, simplifying processes and regulations for accessing credit in the rural areas creates interest among target groups to participate in the development of micro-enterprise.

4. *Assess Business Development Services (BDS).* These are any non-financial services provided to businessmen either on a formal or informal basis. They relate to research, production, processing, marketing, quality control, accounting, management, training, and other activities required by micro-enterprises at different stages. Business chambers, the private sector, specialised institutions in local areas can provide business development services to starting micro-enterprises.

5. *Source credit.* At present, financial services are available for entrepreneurs from micro-credit institutions. Self-help groups may also be formed to generate savings and provide loans among members.

Types of value chain upgrading

Process upgrading – reorganising productive activities to achieve a more efficient transformation of raw materials (inputs) into finished products and services (outputs)
Product upgrading – moving to better, high utility value products
Functional upgrading – acquiring new functions that use new skills, or abandoning old functions
Governance upgrading – strengthening local institutions and policy implementation
Value chain coordination upgrading – including different institutions and stakeholders to leverage support for upgrading
Market upgrading – targeting more profitable markets

Upgrading strategies and actions

- Facilitate for target groups to enter the value chain and be able to tap into opportunities.
- Improve the quality of existing production activities.
- Adopt more value adding functions.
- Increase links and working relations among micro-entrepreneurs and strengthen coordination of activities at the production end by the entrepreneurs.
- A combination of increased functions and horizontal links lead to coordination of production and other functions by target groups.
- Concentrate on fewer functions and activities.
- Reduce working links between micro-entrepreneurs.
- Simultaneously reduce working links and number of functions.
- If unable to successfully enter the value chain, voluntarily exit from the chain.

Stage 5. Make an enterprise development plan

Develop a business plan for the enterprise. A step-by-step process showing the elements to include in the business plan is shown below.

Stage 6. Begin the pilot phase and build competency

- Mobilise financial resources to start the enterprise.
- Build the capacities of entrepreneurs and stakeholders by organising training programmes and exposure trips.

Things to consider when making an enterprise development plan

- *Background and overall goals of the enterprise* – Examine the current situation, the rationale for the micro-enterprise, how it will change or improve the situation.
- *Production* – Describe the product/s to be produced or service to be provided, the supply and collection of raw materials needed, sustainable raw material production, quality control (for example, organic cultivation), harvesting, storage, product production process (primary and secondary processing), production capacity; in the case of crops, description of the site for the potential enterprise, communication facilities, infrastructure, others.
- *Technology* – Identify tools, equipment, machinery, packaging, infrastructure, energy, supplies needed, other technologies required.
- *Marketing and sales* – Incorporate the results of market research in the plan and how to appeal to the identified market, the market mix; develop a market strategy including how to develop customer relationship, get feedback, purchase and supply terms and conditions, promotion schemes, sales target, a sales plan, other marketing and sales details.
- *Management* – The plan should include the legal status of the micro-enterprise, its interface with regulatory bodies, skills, experiences and competencies of the community or staff in relation to the enterprise, management structure and team, decision making, operations, compensation, monitoring and supervision, relationship with stakeholders, interface with the community, distribution of benefits, and other management considerations.
- *Finance*[*] – Start-up costs and capital needs, gross profit, net cash income and net profit, proposed financing plan with a loan repayment schedule, payback period, breakeven point, return on investment, profit and loss statements, cash flow projection, are some key elements.
- *Risk analysis* – Anticipate and analyse the major risks to the enterprise specific to the industry and its geographic location.
- *Regulatory environment* – This includes general policies, business laws and regulations, legal acceptance, export/import requirements, access to resources, tenure, others.

[*] Field workers cannot be expected to be knowledgeable on all types of enterprises and may need to call on experts to ensure complete and reliable data for estimating cost and income factors such as input and output volumes, quality, prices, etc.

- Provide and seek support in establishing the enterprise.
- Form an entrepreneurs' association, federation or similar body and facilitate the process of drafting the by-laws and registering the enterprise through related government departments.
- Facilitate linkages with government agencies, input suppliers, chambers of commerce, markets, research agencies, banks, transporters, I/NGOs, other sectors.
- Document the results, problems faced, and share impacts and achievements with various stakeholders.

Stage 7. Evaluation, adjustment, or exit

- Evaluate the enterprise's result in terms of economic, social, and environmental aspects.
- Based on the evaluation, identify the constraints with the aim of overcoming them or further developing the sectors over the long run.
- Formulate a new/adjusted strategy and start a new cycle.

  or
- Where chances of success appear bleak, end the project and exit. Try to identify other areas or potential micro-enterprises through which the goals of the facilitating institution and target groups can be fulfilled.

Conclusion

Observations and Implications – The links of micro-entrepreneurs to the larger business environment are crucial in understanding the growth pattern of the industry, the power dynamics around it, and to have adequate support services to ensure the success of a micro-enterprise. Mobilising the micro-entrepreneurs to form business associations and linking them to the chambers of commerce are ways by which their local issues are conveyed, and desired changes put to effect through advocacy and reforms for the benefit of the small entrepreneurs. At the micro level, the poor need specialised services and an environment in which they can participate equitably in the enterprise and have a fair share of the benefits. But the bottom line for business support should be commercial viability of the enterprise that creates pro-poor outcomes.

Potential areas for intervention – For enterprise development these include vegetables and dried fruits, green house, poultry, and dairy products, food processing, soap and detergents, honeybees, saffron, cumin, herbal medicines, gems-cutting and polishing, seed production, fish farming, woollen yarn, carpet weaving, handicrafts, vocational training and services.

What do we need for it? Technical experts, training, exposure, market information, funding, technology, business associations, social venture capital, public-private partnerships, access to micro-credit, provision of business development services are some of the resources a starting or ongoing micro-enterprise will need.

Clockwise from top: Participatory enterprise planning; Accessing quality inputs for agri-enterprise development; Transport requires sufficient production volume to make it economical; Selling local products

Honeybees, Pollination and Livelihoods

Farooq Ahmad, Min Bdr. Gurung, Saeed Khan, Uma Partap

Afghanistan is one of the most important fruit and nuts producing countries in the region, with enormous and diverse plant and animal resources. Its agriculture and plant biodiversity is highly dependent therefore on pollination services provided by honeybees and other pollinators. Afghan beekeepers are well known for their beekeeping skills, commercial beekeeping having started here 56 years ago. At present, around 100,000 colonies of *Apis mellifera* honeybees are being maintained by Afghan beekeepers. More than 30,000 bee colonies are transferred to Pakistan every year for the flow of honey from Zizhyphus, a desert bush producing precious honey. This is one of the largest transboundary beekeeping operations for the mutual benefit of both countries. On average, 100 metric tons of honey is produced by migratory beekeeping enterprises in Afghanistan. *Apis cerana* beekeeping, which is confined to mountain areas bordering Pakistan, service the pollination needs of mountain horticulture and other plant resources, strengthening biodiversity at local levels and contributing in mitigation efforts to stabilise the impact of climate change in the country and the region. According to estimates of the Agriculture department 50,000 colonies are being maintained by mountain people in these areas.

Basic beekeeping is easy to learn, and Afghanistan's 29 million hectares of rangelands and forests need 'pollinator intensity' (a required number of pollinators to pollinate an area or certain plants) in order to rejuvenate biomass cover and bring better livelihoods to the poor and the landless). This enterprise based in nature contributes to strengthening the food chain and increasing wildlife diversity.

Honeybees of Afghanistan

The giant honeybee (*Apis dorsata ,see photo*)
Dwarf honeybee (*Apis florea*)
Asian hive bee (*Apis cerana*)
European honeybee (*Apis mellifera*)

The Economics of Beekeeping in Afghanistan: A Ten-Year Operation

Beekeeping opens livelihood opportunities and offers important ways of reducing poverty. This chapter gives some basic economics of migratory beekeeping with *Apis mellifera*, stationary beekeeping with *Apis cerana*, and managed beekeeping with *Apis cerana*. The table on the next page explains the three beekeeping related business options.

Table 1: **Economic analysis of honeybee businesses in Afghanistan under three different scenarios***

Migratory beekeeping with *Apis mellifera* (based on 100 colonies)			**Stationary beekeeping with *Apis cerana* (based on 10 colonies in log or wall hives)**			**Stationary beekeeping with *Apis cerana* (based on 20 colonies in frame-Newton or top bar hives)**		
Items	**Cost**	**Total**	**Items**	**Cost**	**Total**	**Items**	**Cost**	**Total**
Fixed Costs								
100 colonies	100	10,000	10 colonies	40	400	20 colonies	60	1200
Bee equipment (Smoker, hive tool, veil, brush, hand capping etc)	LS	100	-	-		Bee equipment (smoker, hive tool, veil, brush, hand capping etc)	LS	50
Empty hives (40)	40	4000	-	-		Empty hives (10)	20	200
Extractors (2)	200	400	-	-		Mini extractor	50	50
Total		14500			400	Total	-	1500
Operational cost								
Wax sheets	LS	1000				Wax Sheets	LS	200
Sugar for winter (7 kg/ hive /year	.5	3500	-	-		Sugar for winter (10 kg/ hive / year)	.5	1000
Equipment repair	LS	500	-	-		Equipment repair	LS	100
Transportation	LS	3000	-	-		Transportation	-	-
Labor	LS	5000	-	-		Labor	LS	500
Miscellaneous	LS	2000	Miscellaneous		100	Miscellaneous	LS	200
Total operational cost		15000	Total operational cost		100	Total operational cost		2000
Total compounded Interest @ 12%		41,910			890			4886
Total cost		71400			1390			8386
Benefits								
Estimated production of honey (20,000 kg)	5	100,000	Estimated production of honey (500 kg)	10	5000	Estimated production of honey (2000 kg)	10	20000
Colony multiplication (500 colonies)	50	25000	Colony multiplication	-		Colony multiplication (100 colonies)	40	4000
Wax (1000 kg)	6	6000	Wax (10 kg)	6	60	Wax (30 kg)	6	180
Queens (500)	2	1000	Queens	-		Queens (100)	2	200
Pollination services(100)	LS	1000	Pollination benefits to owned orchards	LS	1000	Pollination benefit to owned orchard	LS	1000
Total benefits from products and production		133000	Total benefits from products and production		6060	Total benefits from products and production		25380
Value of investment after ten years depreciation		7250	Value of investment after ten years depreciation		400	Value of investment after ten years depreciation		750
Total value of benefits and investment after 10 years		140250	Total value of benefits and investment after 10 years		6460	Total value of benefits and investment after 10 years		26130

*All item costs in US$ at rates based on Afghanistan prices in 2008

LS= lump sum

Migratory beekeeping with *Apis mellifera* gives a return of US$2 for every dollar of investment. High investment costs at the initial stage, compounded interest, high operational expenses, and little returns on pollination services result in comparatively low returns for this type of beekeeping. Stationary beekeeping with *Apis cerana* in log hives gives a return of US$4.5 for every dollar invested. Despite low honey productivity, compounded interest, actual returns on per unit investment are higher with this type of beekeeping because of small investments at the beginning stage, negligible operational costs, and additional pollination benefits to farmer-owned orchards. Return for every US dollar is more than US$3 with *Apis cerana* stationary beekeeping within moveable frame hives. The maximum number of colonies to operate the business with this type of beekeeping is 20 colonies in frame hives and 10 colonies in log hives. In the case of migratory *Apis mellifera* beekeeping, the minimum number of colonies should be at least 100 in order to be profitable. Financial analyses show that all types of beekeeping are economically profitable, but stationary beekeeping with *Apis cerana*, because it requires very little investments, is an option suitable for small, resource-poor farmers.

Beekeeping Management

Beekeeping management is easy and profitable but requires some basic skills, investment, and dedication. The following are some ways of managing the enterprise.

Training Afghan beekeepers in Kabul

Colony inspection

It is important to keep vigil and regularly inspect the bee colonies to be aware of the presence of a queen, eggs, and food stores such as nectar and pollen, to check and monitor the space for bees within the colony, and to note colony status (colony health and hygiene, presence of queen cells and drones, any signs of absconding, and presence of stores of honey). Colony inspection time varies depending upon location. It is advisable to inspect colonies only on sunny and clear days.

Uniting and dividing bee colonies

The queen bee is the centre of the beekeeping enterprise. Colonies need to be united if a queen gets injured or dies and there are no immediate possibilities of providing a new queen. It is also necessary to unite weak colonies as they cannot survive the rainy and winter seasons and are more susceptible to different kinds of stress conditions. Colonies can also be united to make a strong colony for honey production and pollination purposes.

Table 2: **Seasonal requirements in colony management**

Spring (March-April)	Summer (May-June)	Rainy season (July-August)	Autumn (Sept-Nov)	Winter (December-February)
• Inspect colony once a week • Clean the bee hives once in two weeks • Spring being a swarming season, colonies make a number of queen cells and rear a lot of drone brood • Destroy unnecessary queen cells and drone brood to avoid unnecessary swarming • Divide the colony if necessary • Open hive ventilation • If necessary, replace the old queen with a new one • Place honey super • Harvest honey if colony has stored some. • Put all the frames in the hive	• Provide ventilation • Place the colonies in shade • Make provisions for water for the bees • If necessary feed the colony with sugar syrup	• The rains wash away pollen and dilute nectar. Also during the rains bees cannot go out to collect pollen and nectar, creating a shortage in food for the colony. Therefore, it is necessary to feed the colony with sugar syrup and pollen substitute every week during this season. • Protect the colonies from rain. • Dry the hive from inside with the help of a dry cloth to protect it from fungus and harmful insects.	• Inspect the bee colony once a week • Clean bee hives during sunny hours of the day once in two weeks • Place honey super • Harvest honey if colony has extra store.	• Make arrangements to keep the colonies warm during winter – close the ventilation, reduce the size of hive entrance, cover the hive with newspaper • Feed the colonies with sugar syrup • Open the hive for inspection once in 2/3 weeks or only if it is absolutely necessary during warm and sunny days • Take out the empty frames, the super chamber and reduce hive size by putting in a dummy board • Place bee colonies in a sunny location

- Start moving the weak colony towards the colony to which it is to be united and destroy the queen of a weaker colony a day before uniting.
- Remove the outer and inner covers of the stronger colony, cover its brood chamber with newspaper, punch small holes on the newspaper and spread honey on it.
- Place the brood chamber of the weaker colony over the newspaper and put the inner and outer covers. After 1-2 days when bees of both colonies mix, remove the newspaper and brood chamber of the weaker colony.

Table 3: **Life cycle of a honeybee**

Stages	Queen	Worker	Drone
Eggs	3	3	3
Larvae	5	6	7
Pupae	8	12	14
Adult	16	21	24

When queen cell formation stimulates much activities in the colony and bee forage resources are abundant and weather conditions conducive (normally in springtime), beekeepers divide their colonies. This is to increase production of honey and income from its sale and the sale of colonies.

To divide colonies:

- Move the colonies to be divided a foot (0.3048m) away from their original position at night.
- Place a new, empty hive about a foot away from the original position, take out the queen with three to four brood combs from the old colony and give the brood new hive, leaving the remaining combs in the old colony with a sufficient number of eggs and larvae.

- If queen cells are available, select the best one, leave it in the old colony and destroy other queen cells.
- Provide the required number of frames for both hives; make sure that the number of adult bees is equally divided in both hives.
- Close the covers of both hives and observe whether the returning bees are entering both hives in almost equal numbers. If more bees are returning to one hive, the second hive should be placed closer to the original position.
- When bees are more or less settled, move the beehive gradually by 1-1.5 feet a day and put in a desired place.

Swarming

Swarming is the departure of a portion of the adult worker bees from the colony together with the queen during the active brood rearing period in search for a new nesting site. Swarming generally occurs between the months of March-June, depending on climate conditions. Signs that a colony is preparing for swarming is the construction of drone cells and the appearance of a drone brood, followed by the construction of queen cells.

Swarm of *apis cerana*

To prevent swarming:

- Assess the strength of the colony; if it is strong enough, destroy all queen cells except for one and divide the colony.
- If the colony is strong and the bees are congested but you don't want to divide it, provide more space by placing a 'super' (a store place within the hive where bees store excess honey) over the brood chamber and remove queen cells and the drone brood.
- If the colony is not strong but is still preparing for swarming, destroy all the drone brood and the queen cells.

Absconding

Absconding is the departure of adult bees from their nest, leaving behind whatever brood and food stores are in it. Bees abscond their nests for a number of reasons including a shortage of food supply in the nest, disturbance to the bees, excessive heat and cold or poor ventilation, old and defective combs, and attack by pests and diseases. A colony preparing for absconding does not defend itself against pests, ceases brood-rearing (although the queen continues to lay eggs), has a small, scattered brood or no brood at all, has little or no food stores. Bees also stop cleaning the hive, cannibalism is observed

(that is, adult bees first devour young larvae, then older larvae, and finally the pupae) and a progressive reduction in the relative number of pollen carriers entering the hive is noted.

Absconding can be prevented by:

- Feeding sugar syrup (prepared by dissolving two parts sugar in one part water) into the colony every evening;
- Providing shade during summer, warmth during winter, and adequate ventilation;
- Removing old and defective combs from the hive and keeping the bottom board clean; and
- Finally, taking up measures to control diseases and pests.

Robbing

Robbing is the condition where bees of one beehive try to rob the bees of another of their nectar and stored honey. Uncontrolled, robbing can lead to the death of many worker bees. Robbing occurs because of lack of food in one of the colonies, especially at the end of the spring and winter seasons and happens when honey and sugar syrup drops from the hive tools while inspecting the colony and bees of both hives try to eat the honey.

Robbing can be prevented by:

- Supplying brood frame from strong colonies to save weak colonies from robbing
- Uniting the weak colonies
- Preventing honey droppings while handling the combs
- Cleaning all equipment and tools after honey harvest
- Placing sugar syrup carefully inside the hive and always feeding the colonies at evening time.

Major bee diseases, parasites and predators

Better understanding bee diseases, parasites, and their control is important to manage beekeeping operations successfully. Selection of bee colonies to prevent the occurrence of bee disease is also vital. According to recent reports, in Badakhshan alone, more than 4000 colonies of *Apis mellifera* died from the attack of parasitic mites. Importing infested colonies and selecting the wrong types of colonies and weak colonies are seen as the root causes for such a phenomenon.

European foul brood is a common contagious bacterial disease which usually infects up to three-day old larvae in weak colonies. Its symptoms include scattered or irregular pattern of the brood, dead yellow and pale larvae that later turn dark brown and emit an acidic, sour smell. Dead larvae are found attached to the side of the cell and the worker bees are seen removing dead larvae from the hive.

This disease can be prevented and controlled by:

- Keeping the colony strong and healthy, feeding the colony with sugar during the dearth period, and keeping it warm in winter
- Removing the comb in which more than 50% of the brood is infected
- Caging the queen for 48 hours to break the brood cycle, and replacing the queen
- In extreme cases, feed the bees with Oxytetracycline or Teramycine at intervals of 3 – 4 days at least three times.

Thai sac brood viral disease is a highly contagious brood disease that first infects weak colonies and later spreads to the whole apiary. This disease normally occurs before spring. Symptoms include change in the colour of larvae from pearly white to grey, and finally black; death of the infested larva during pupation period, therefore the worker bees do not completely cap the cell, leaving small, poor, and infected larvae appearing like a sac filled with water, with their abdomen facing the opening of the cell.

Prevention and control measures include:

- Maintaining strong colonies
- Keeping colonies warm during winter
- Feeding sugar syrup immediately after the first symptoms are seen
- Removing the infested combs
- Caging the queen for 5-7 days to break the brood cycle
- Replacing the queen of the infested colony with a new queen, and
- Encouraging artificial absconding by putting the queen and worker bees in a new hive

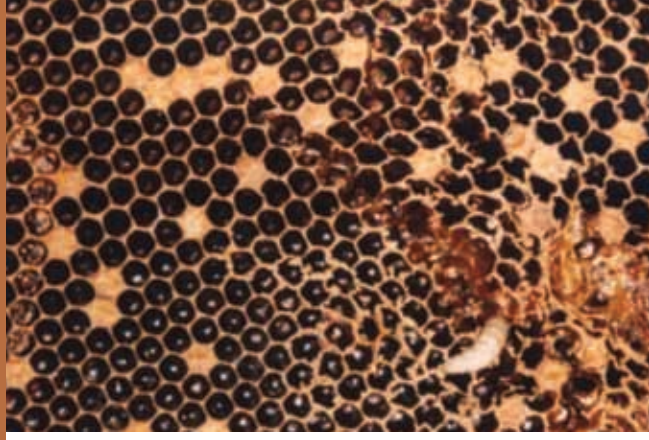
Acarine is caused by a tracheal mite called *Acarapis woodi*, which breeds in the trachea or breathing tubes of adult bees and infects the tubes. The mite derives its nourishment from the bee's blood, blocks the respiratory channels, and ultimately causes death to adult bees. The disease normally occurs in the winter and after the monsoon season. *Acarapis woodi* is invisible to the naked eye. Disease symptoms include inability of adult bees to fly due to imbalanced wings; a number of adult bees can also be seen crawling to the hive entrance and on the ground; adult bees make unsuccessful attempts to fly but fall on the ground after a small flight. Folbex strip, Perizin and Frow mixture can control this mite.

Varroa mites attack *Apis mellifera* and are capable of spreading and destroying entire colonies. Quarantine, efficient management, and selective use of Formic acid for treatment are the most important options for controlling the spread of these mites. In *Apis cerana* colonies this parasite is not a major threat as these bee species are resistant to this mite.

Two types of wax moth attack bee colonies: the greater wax moth and lesser wax moth. Wax moth larvae feed on wax combs and make tunnels and cover the combs with a web-like structure. They normally attack weaker colonies. To control this, it is important to keep colonies strong, hive entrance small, and repair hives and close holes and cracks. Besides these pests and diseases honeybees are

Bee products – honey, wax, pollen, royal jelly, propolis and bee venom

In Afghanistan, 100 metric tons of honey is produced from 100, 000 colonies of *Apis mellifera* annually. Another 20 metric tons of honey comes from 50, 000 colonies of *Apis cerana* every year. Except for small quantities of wax, other bee products are not being produced by Afghan beekeepers. The ecology of Afghanistan can support more than 500,000 colonies, raising the possibility of honey production to the level of 10,000 metric tons and providing jobs directly to more than 5000 people and indirectly contributing to the job market. A market focused cooperative model can be mobilised with the help of local Shura, communities and fruit growers associations to maximize Afghanistan's beekeeping potentials.



Damaged caused by wax moths to bee colonies

also predated by wasps, hornets, birds, and ants.

Queen Rearing

The productivity of a colony depends upon the quality of the queen bee. The queen bee produces pheromones, which help maintain cohesion in the colony. The queen also plays an important role in transferring the genetic characteristics of her colony.

Queen rearing is an artificial way of raising queens. The queen lays fertilised eggs in smaller worker cells and unfertilised eggs in larger drone cells. Fertilised eggs are capable of developing into a worker or a queen, depending on the types of cell it is developing into and the type of food it ingests. An egg laid in a worker cell can be moved into a queen cell and can develop into a queen and vice versa. The quantity and quality of food given to a developing larva determines whether it will rear a worker or a queen bee. By merely changing the queen in a colony, one can strengthen and change the characteristics of the colony.

Observing queen cups of *apis cerana* during queen rearing

Pollination, Productivity and Conservation

Pollination is the transfer of pollen grains from the anther to the stigma of the same flower, or another flower of the same plant, or another plant of the same species. An agent that helps in the transfer of pollen is a pollinator. Pollination leads to fertilisation, which results in the formation of seeds and fruits. In other words, the gene flow system in nature is directly dependent upon bees and other pollinators. By maintaining ample numbers of pollinators for perfecting fruit and seed set in entomophilous crops (crops pollinated by insects), quality and quantity of produce increases from 10% to 50%, depending upon the crop and ecological setting of the area. According to another estimate an investment of one US dollar in honeybees yields US$14, making beekeeping and managed pollination one of the most lucrative businesses in agriculture husbandry. Globally, the annual contribution of pollinators to agricultural crops is estimated at about US$ 54 billion. Some estimates show that the value of honeybee pollination to crop production in the US is US$ 14.6 billion. In the case of Afghanistan, where horticulture is a major source of income of poor farmers, and where rangelands provide necessary food and fodder to livestock, honeybees and other pollinators play an important role in providing essential pollination services. From the agricultural and economic standpoint the benefits of beekeeping are spreading to the poorest of the poor through increase in the productivity and quality of produce, besides benefits from honey and other bee products.

For Further Reading

Visit the ICIMOD website (www.bees4livelihood.icimod.org) and www.beekeeping.com
The hive and the honeybee (A DADANT publication)
All ICIMOD publications on indigenous bees and pollination.

To initiate a beekeeping business seek help from the Apiculture Resource Centre, Ministry of Agriculture and Livestock, Kabul, Afghanistan

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Renewable Energy Technologies for Rural Development

Ghulam Mohd. Malikyar, Bikash Sharma

Introduction

This paper guides users on how to choose the right combination of sustainable energy solutions in remote areas without electricity. It aims to help development practitioners understand basic concepts and the principles of the provision of sustainable energy service, and familiarises them with a number of important issues and criteria to consider before choosing alternative renewable energy technologies. The purpose here is not to describe the numerous renewable energy technologies available, but to provide guidelines for choosing the right options and implementing them. The guidelines should be used together with other available materials and methods used in development planning, such as gender sensitive evaluation of effects, social mobilisation, integrated development methods, and participatory action research.

Why Decentralised Renewable Energy?

Energy is an important instrument for development. It contributes to fulfilling the most basic and essential needs for human survival. Historically, rural communities in Afghanistan have been meeting their energy needs from traditional sources such as fuelwood and other biomass. But growing population, poverty, and environmental degradation, have made it increasingly difficult for the communities to meet their daily needs for electricity and energy from traditional sources. The use of modern forms of energy, especially electricity, is comparatively new and limited, and at present almost 99% of Afghanistan's rural population have no access to electricity. Making electricity accessible to large segments of the rural population remains a challenge. Moreover, electricity does not address the rural communities' cooking and heating energy needs.

Programmes for renewable energy technologies have been initiated (refer to ADB, 2006 and MEW 2007). Unfortunately, despite their great potential, these have not resulted in a significant increase in their adoption or use. In fact, the promotion of renewable energy technologies is hampered by several factors including: 1) the absence of appropriate policies to ensure matching energy resource and technology with local needs; 2) lack of technical, organisational, and financial support; and 3) failure to fully understand the unique characteristics of mountain areas, such as mountain fragility and marginality, among others, but also the unique opportunities they offer.

Hydropower is a key source of energy in mountain areas

When a crisis in energy is rampant in the rural areas, it is important to tackle the energy poverty first, to be able to combat the broader issues of hunger and poverty and achieve development in a sustainable way. Properly designed renewable energy supply and technologies, including micro, hydro, solar, wind, biogas, and others, can benefit communities in many ways, such as through savings in fuel and time, particularly cutting down the drudgery associated with collecting traditional biomass such as fuelwood, dung; improving human health; and reducing greenhouse gas emissions. Renewable energy and energy efficiency – the two pillars of sustainable energy – are increasingly becoming an integral part of the global effort to reduce poverty and improve livelihoods and the environment. International experts agree that without a rapid expansion in renewable energy, the Millennium Development Goals (MDGs) including reduction in greenhouse gas (GHG) emissions might be difficult to achieve.

Unlike big hydro dams, small-scale decentralised renewable energy options meet the needs of the poor, particularly dispersed populations in rural areas, more effectively. Such an approach is less damaging to the environment, and can be developed on a basis that is financially, institutionally, and environmentally sustainable. It would allow communities to identify their own needs and create the conditions necessary to make efficient use of local energy resources (micro hydro, solar, biomass, wind, others), as well as develop indigenous manufacturing and technical capability.

What is Sustainable Energy?

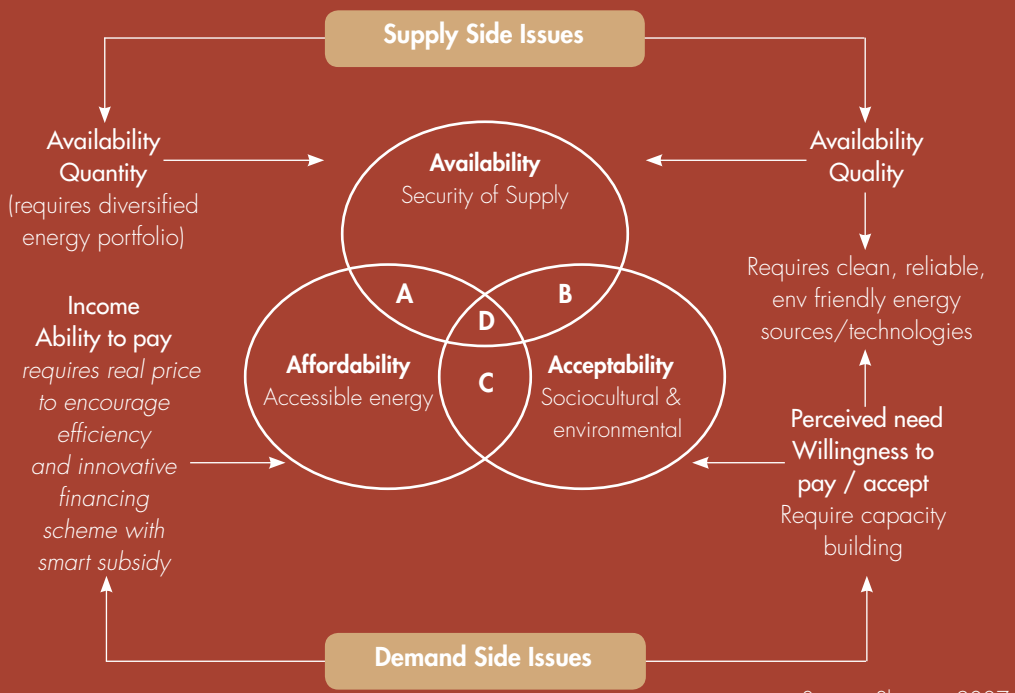
Sustainable energy is not just about using renewable energy. It is about wise and efficient energy use utilising energy generated from clean sources and clean technologies, and introducing energy efficient measures. Energy efficiency means utilising less energy to provide the same level of service and usually refers to installing energy-efficient technologies, or eliminating energy losses in existing systems. Being

efficient with energy use reduces energy bills, decreases the amount of energy we need to produce in the first place, and cuts down energy-related greenhouse gas pollution. The key question is not the use of clean energy like electricity, but whether electricity is generated from clean energy sources. Renewable energy such as wind and solar energy are good to consider because they can be replenished, and are clean and do little to harm the environment. But by the nature of their availability at certain times of the year (not all-year round), we need to ensure their reliable supply.

Framework for Addressing Sustainable Energy Service

Sustainable energy service calls for providing energy service from sources that are available, acceptable, and affordable. A holistic framework for this is shown in the Venn diagram below. The vast majority of mountain people cannot afford alternative energy sources even if they are available. Even when they can afford renewable energy, households may not use them if they are much more expensive than traditional biomass, or if they are not culturally acceptable. If a renewable energy system is not in place, households cannot obtain access to modern fuels, even if they can afford and accept them. In the diagram, area D represents a situation where all three criteria for sustainable energy services are addressed, meaning they they are available, affordable and acceptable. A, B and C represent situations where two out of three criteria and assessed.

Figure 1: **Framework for addressing sustainable energy services**



Source: Sharma 2007

Sustainable Energy Choices: Choosing the Right RET Solution

Finding sustainable solutions to the energy crisis is important not only in reducing poverty but also in addressing the impacts of energy consumption on the environment and human health. An increasing share of energy supply must come from non-polluting, non-depleting, environmentally and gender-friendly, and locally available renewable energy resources such as biomass, solar, wind, among others. Available energy should be conserved and used more efficiently than is being used at present. Choosing the right renewable energy technology solutions involves the following major steps.

1. **Discuss local problems and resources**. The process must start with discussions among local people on the problems and potential problems regarding energy supply, environmental problems, prioritised or ranked energy needs of men and women (gender needs assessment for energy), available financial resources, and people's ability and willingness to pay.

2. **Investigate demand for energy based on local consumption patterns and energy resource potentials or supply, and prepare an energy balance table**. To establish demand for energy, gather baseline data on energy use patterns for different energy purposes (cooking, heating, lighting etc) in the area. On the supply side, assess available energy resources using meteorological data on wind, solar, ambient temperature and others, in order to introduce suitable renewable energy options. They could be a stream available for micro hydro (Box 1), dung for a biogas plant, loose biomass for bio-briquetting, dry land for planting energy crops or biofuels, solar and wind energy potential, and others. Investigate both energy demand and supply and make this the basis for preparing an energy balance table and for forecasting energy consumption with new development.

3. **Assess the feasibility of renewable energy options**. A feasibility assessment aims to reduce the risks of a potential project by assessing whether the project is practical and workable and requires identifying its technical, financial, and socioeconomic impacts and drawing conclusions about the project's viability. The main factors affecting the economics of an energy installation are initial capital cost to install, and annual operating cost over the life of the installation. Life cycle cost analysis compares these costs to the energy output of a system. The factors affecting economic decision on the project include net present value, internal rate of return, benefit-cost ratio, payback period, annualised energy cost, energy cost at various levels, among other factors (Box 2).

4. **Identify the right mix of technologies**. Feasible alternatives identified by the feasibility assessment in step 3 should be discussed with the beneficiaries in the village. For local people, the influence factors are often initial costs to set up the technology (investment costs), convenience and profitability of the system, ease of operation and maintenance, reliability of the technologies, available spare parts (after sales service), safety and health concerns, among others (Box 3).

5. **Elaborate an action plan**. The plan should describe how solutions with the highest priorities can be introduced and integrated with other sectors, how they can be financed, what villagers should commit to, organisational solutions, uncertainties, and a financing plan. For a detailed decision making checklist refer to Box 4.

Box 1: **How to assess if a village could use micro-hydropower**

If a stream is located nearby, it is likely that the installation of the micro-hydropower option is technically feasible, meaning possible or do-able for a village.

To calculate how much power can be generated:

- Measure available flow (refer to ICIMOD 1999).
- Measure available head (refer to ICIMOD 1999 a).
- Calculate the power that can be generated using the following equation:

Power output in kilowatts (kW) = 0.5 x flow rate in cubic metres per second x available head in metres x 9.81

Other important factors to consider

- Rule of thumb for power requirements for lighting: the number of households multiplied by 100 watts [W]
- The demand for agro-processing services and other enterprises; higher daytime uses will increase the plant's income
- How much people are willing to pay for lighting
- The track record of the community for community organisation and leadership; if experience was lacking, the installation of an entrepreneur-led micro-hydro project would be easier
- Assess if there would be conflicts between downstream and upstream communities regarding the installation of a micro-plant

Operation and maintenance

It takes a trained and skilled technician to operate and maintain a micro hydropower plant. Therefore, it is essential to provide training to potential operators so that they can look after the plant once it is operating. Good operation and maintenance procedures increase the sustainability and life of the plant (refer to ICIMOD 1999 b).

Box 2: **Basic steps in benefit-cost analysis**

- Prepare physical input and output flow tables: include all purchased or owned input and output, sold or self-consumed.
- Create unit value tables for project input and output: in financial analysis, the prices of all inputs and outputs should be estimated at the time of purchase, sale, or consumption. In economic analysis, prices of inputs and outputs are valued at their opportunity cost (is the value of the next best choice that one gives up when making a decision.) to arrive at efficiency prices.
- Prepare financial cash flow and economic value flow tables. This could be obtained by multiplying the physical input and output flow tables (step 1) by their respective unit value tables (step 2).

Investment decision criteria: net present value (NPV), internal rate of return (IRR), benefit-cost ratio (BCR)

- Any project providing positive NPV is an efficient use of resources involved
- Internal rate of return is essentially a breakeven discount rate; at this rate, the present value (PV) of benefit equals the present value of cost (i.e., NPV = 0 and BCR = 1)
- Financial IRR illustrates to investors the average earning power of an investment
- Economic IRR shows decision makers what a society could expect to receive as a benefit from any given investment in a scarce resource

  The criteria generally used to select a project are:

  1) If the financial IRR is greater than the market rate of interest

  2) If economic IRR is greater than economic discount rate or opportunity cost of capital

Table 1: **Criteria for the choice of renewable energy technologies**

End Use Purpose	Available Technology	Renewable Sources of Energy	Availability	Reliability	Ease in operation	Operational efficiency	Environmental implication	Repair and Maintenance	Durability	Socio cultural acceptability	Capacity or Size of Plant
Lighting	Peltric set	Water	H	H	H	H	N	M	H	H	1 kilowatt (kW)
	Solar PV cell	Sun	M	M	H	H	N	M	H	H	15 watt (W)
	Biogas plants	Biomass	H	H	H	H	N	M	H	M	10 m3 plant
	Improved water mills	Water	H	H	H	M	N	M	H	H	1 kW
	Small scale wind mill	Wind	H	M	M	M	N	M	H	H	
Water heating	Solar water heater	Sun	H	M	H	H	N	M	H	H	20 litre (l) (2 panel)
	Small scale wind mill	Wind	H	M	M	M	N	M	H	H	
	Biogas plants	Biomass	H	H	H	H	N	M	H	M	4 m3 plant
	Briquette	Biomass	H	M	H	H	N	M	H	M	
	Electric cooker	Water	M	H	H	H	N	M	H	M	2 l capacity
	Electric bucket	Water	M	H	H	H	N	M	H	H	20 l300 W
	Back boiler	Wood	H	H	H	M	M	M	M	H	200 L capacity
Space heating	Solar passive heating system	Sun	S	M	H	H	N	M	H	M	
	Small scale wind mill	Wind	H	M	M	M	N	M	H	H	
	Improved cook stove (ICS) domestic/ institutional	Wood	M	M	H	S	M	H	M	H	
	Briquette	Biomass	H	M	H	H	N	M	H	M	
	Back boiler	Wood	H	H	H	M	M	M	M	H	100 L capacity
Cooking	Solar cooker	Sun	S	M	H	H	N	H	H	M	Card board box and parabolic type
	Hay Box cooker	Insulation	H	M	H	H	N	H	H	H	
	Biogas plant	Biomass	H	H	H	H	N	M	H	H	6 m3 plant
	Electric Cooker (Bijuli Dekchi)	Water	M	H	H	H	N	M	H	H	8 l
	Heat storage cooker	Water	M	H	H	H	M	M	H	H	per unit
	Domestic ICS		H	H	H	H	M	H	M	H	per unit
Grain milling	Improved water mill	Water	H	H	H	M	N	M	H	H	with 5 no rice huller
Agri- produce drying	Solar dryer	Sun	S	M	H	H	N	H	H	H	
Water lifting	Hydraulic pump	Water	M	H	H	M	N	M	H	H	
Water pasteurisation	Water pasteurisation	Sun	S	H	H	H	N	M	H	H	Piece

S = somewhat, M = moderate, H = high, N = not/no

Source: ICIMOD and CRT 1997

Box 3: **Decision checklist when planning and financing renewable energy projects**

Identify the needs and financial resources of the beneficiaries

- ✓ What are the households' energy needs (e.g., for cooking heating, lighting, etc.)?
- ✓ What are the households' monthly energy expenses?
- ✓ What is the ability and willingness of the users to pay for renewable energy technologies?
- ✓ How much can users afford to pay each month or year?
- ✓ What have been the experiences with source of loans in rural areas (money lender, micro credit, bank) and how could these experiences be used?

Identify appropriate renewable energy technologies and their dissemination

- ✓ What have been the experiences with renewable energy technologies in the localities?
- ✓ Which technology is most suitable and viable for the user?
- ✓ Can adequate servicing and spare parts supply be found?
- ✓ Are there local NGOs or experienced cooperatives on renewable energy technologies?
- ✓ Are there energy service companies in the area? If not, is it viable to establish such a company?
- ✓ What mechanisms are utilised by existing distributors for energy distribution or dissemination?

Establish financial disbursement scheme

- ✓ Are there rural credit savings and rural banking facilities in the localities?
- ✓ What interventions function with banks and borrower?
- ✓ Is international seed money or grant aid available for energy related activities?
- ✓ Will intermediaries be needed (e.g., community-based organisation for payment collection or running a revolving loan fund)?
- ✓ What will be the transaction cost?
- ✓ Over what period will repayment be made?
- ✓ How do these compare with the income streams of households?
- ✓ Determine payment level through cash flow analysis.
- ✓ Establish an incentive scheme such as smart subsidy with a clear-cut exit strategy.

Develop a business plan

- ✓ What will be the cost of managing the project? (revenue collection, training specification, standard development, quality control, and staff costs, among others)?
- ✓ What will be the internal rate of return, the rate of return on a capital investment from a business?
- ✓ Where will the funds come from and under what terms?
- ✓ How could borrowing and lending risks be minimised?

Establish an implementation and management infrastructure

- ✓ Local community mobilisation (refer to MEW/ADB/TA 2006, in Persian)
- ✓ Select financially experienced staff and train other staff or community members as required
- ✓ Establish networks with other organisations
- ✓ Develop a marketing and promotion plan
- ✓ Establish management responsibilities (who does what)
- ✓ Train energy service operators
- ✓ Are the lending parameters or measures acceptable or comfortable (lending and default rate per month, interest rates)?
- ✓ Establish criteria for monitoring and evaluating the project
- ✓ Adjust financial implementation parameters as necessary

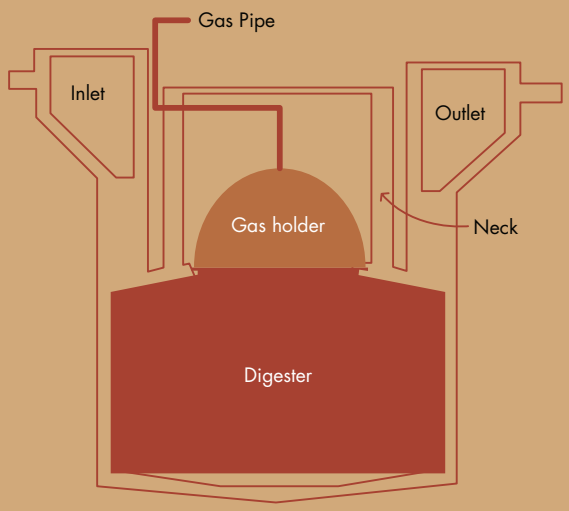
Some Promising Renewable Energy Technologies for Afghanistan

Based on examples from the ICIMOD Demonstration and Training Centre, Godavari, Nepal

Puxin model biogas plant

Biogas can be used for cooking, lighting, and generating electricity. Besides producing energy, residual slurry from the process can be used as fertiliser. Using dung in a biogas plant generates more energy than when using it in direct combustion. For example, 25 kg of fresh dried dung, when used to fuel cook stoves produces ultimate useful energy of about 1046 kilo calories. The same amount of dung can generate 2592 kilo calories of energy when used in a biogas plant and generated gas is used in a biogas stove. This is more than 100% of the energy generated in direct combustion.

Figure 2: **Schematics of Puxin model biogas plant**



The Puxin model biogas plant developed in China is a fixed dome-type biogas digester designed to operate in a batch feeding mode. Animal dung and other wastes such as grasses, fodder, and biodegradable household waste can be fed into the model at the ratio of one is to five (1:5), one part dung, five parts other wastes during initial loading. Properly used, it can generate gas good for six months, after which the materials should be replaced. It has a hydraulic pressure biogas digester which consists of a fermentation tank made of concrete, and a glass fibre reinforced plastic gasholder. The gas cover is installed in the tank neck and sealed up with water. The water seals the gasholder and protects gas from escaping while it also puts pressure on the gas cover, which is completely air tight. The level of water in the plant should always be above the gas holder. Water needs to be drained from the water trap regularly.

Beehive briquette making

Bio-briquetting

Briquetting makes use of compacted agricultural wastes for fuel. When produced manually by compacting biomass using some kind of binder, one can make about 30 round beehive briquettes with 19 holes which emit blue fire-flame when burnt. Beehive briquettes (a honeycomb beehive-shaped biomass briquette) are made using a hand mould although this does not produce a high briquette density. The weight of a hand-made, dried briquette is about ½ kg. Hardwood biomass charcoal briquettes with 20% clay content produce about 18 MJ/kg or about nine MJ/briquette. In practice, this may heat two litres of water in 15 to 20 minutes using an insulated (one briquette) metal stove. Depending on the quality of briquettes, one beehive briquette burns for about an hour and a half, which is enough to cook a normal meal for a family of four to five members.

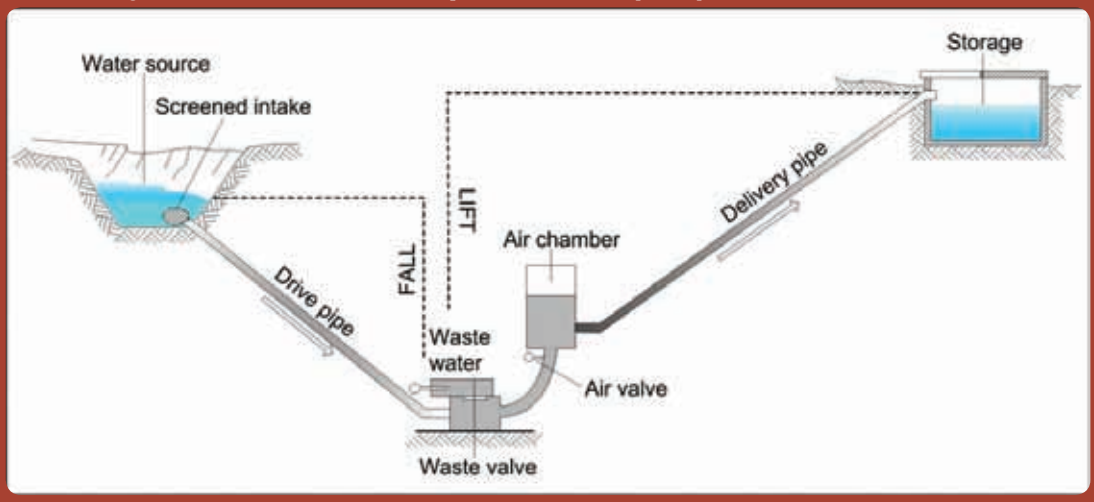
How to make beehive briquettes

- Collect and dry biomass for a few days. Put them in a pit and burn for 1-1.5 hours.
- Cover the carbonised charcoal with green biomass and then with soil.
- Collect the charcoal portion (not the ash) from the pit after 6-12 hours.
- 100 kg of biomass provide, on average, 25-30 kg of charcoal material.
- Grind the charcoal material and mix with bentonite clay at the ratio of 3:1 (3 kg charcoal powder and one kg bentonite clay)
- Put the mixture into the iron briquette mounder and dry the briquette for 2-4 days in the sunlight

Hydraulic ram pump

A hydraulic ram pump is useful where there is a water source which flows constantly and the usable fall from the water source to the pump is at least 91 cm (3 ft). The ram pump can be used for lifting drinking water from springs to settlements on higher ground, for pumping drinking water from streams that have significant slope, or lifting irrigation water from streams or raised irrigation channels. A hydraulic ram is a device which uses the energy of falling water to lift a lesser amount of water to a higher elevation than the source (see Figure 3). It is an attractive solution where a large gravity flow exists and where the water source can provide at least seven times more water than the ram is to pump.

Figure 3: **Schematics of hydraulic ram pump**



Before a ram can be selected, the following design factors must be known:

- difference in height between the water source and the pump site (vertical fall)=F
- difference in height between the pump site and the point of storage or use (lift)=L
- quantity of flow available from the source=S
- quantity of water required
- length of drive pipe from the source to the pump site
- length of delivery pipe from the pump to the storage site

Once this information is obtained, it is possible to see if the amount of water needed can be supplied by a ram using the formula as follows: D = (S x F x E)/L, where:

D = Amount delivered to storage/use site in litres per 24 hours
S = Quantity of water supplied from the source in litres per minute
F = Fall or height of the source above the ram in metres
E = Efficiency of the ram (for commercial models use 0.66 and for home-built use 0.33)
L = Lift height of the point of use above the ram in metres

To convert the pumping rate expressed in litre per day to litre per minute, divide by 1440. Suppose E = 0.6, S = 80 litre per minute, L = 24 m, and F = 4 m. The maximum pumping rate delivered by the hydraulic ram pump operating under these conditions is 11,520 l per day, or 8 l per minute

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3

Managing Natural Resources

A sheep herder in Obe district, Herat province grazes sheep near agricultural land

Rangeland Resources Management

Muhammad Ismail, Rohullah Yaqini, Yan Zhaoli, Andrew Billingsley

Rangelands are areas which, by reason of physical limitations, low and erratic precipitation, rough topography, poor drainage, or extreme temperature, are less suitable for cultivation but are sources of food for free ranging wild and domestic animals, and of water, wood, and mineral products. Rangelands are generally managed as natural ecosystems that make them distinct from pastures for commercial livestock husbandry with irrigation and fertilisation facilities.

Rangeland management is the science and art of optimising returns or benefits from rangelands through the manipulation of rangeland ecosystems. There has been increasing recognition worldwide of rangeland functions and various ecosystem services they provide in recent decades. However, livestock farming is still one of the most important uses of rangelands and will remain so in the foreseeable future.

Rangeland Resources and Use Patterns in Afghanistan

Afghanistan's rangelands are specified as land where the predominant vegetation consists of grasses, herbs, shrubs, and may include areas with low-growing trees such as juniper, pistachio, and oak. The term 'rangeland resources' refers to biological resources within a specific rangeland and associated ecosystems, including vegetation, wildlife, open forests (canopy coverage less than 30%), non-biological products such as soil and minerals. Today, rangelands comprise between 60-75% of Afghanistan's total territory, depending on the source of information. Rangelands are crucial in supplying Afghanistan with livestock products, fuel, building materials, medicinal plants, and providing habitat for wildlife. The water resources captured and regulated in Afghan rangelands are the lifeblood of the country and nourishes nearly 4 million ha of irrigated lands.

Rangelands are important resources for grazing livestock to produce meat, fibre, hide, and manure for fuel and organic fertiliser. The grazing of small ruminants, mainly closely herded flocks of sheep and goat, over the last 5000 years has been an important factor in shaping the development of Afghanistan's plant biodiversity. About half of the nation's GDP is derived from agriculture, and livestock products account for one-quarter of all agricultural sales. Afghan people's livelihoods depend entirely or partially on rangelands, whether they are from nomadic, semi-nomadic, or settled rural communities. Among them, pastoralists and semi-pastoralists are the main rangeland users and managers. More than 85% of the rural Afghan population hold livestock as a key component in their livelihoods. Accordingly, three basic rangeland and livestock management systems coexist in Afghanistan.

Sedentary System

A system practiced by farmers whose main activity is the production of field and fruit crops, and who also raise cattle, sheep, goats, and poultry. Many villages also have access to nearby designated areas for common grazing or rangeland. Large and small ruminants are maintained by a balance between grazing, fodder, and crop residues, and supplemented by little grain.

Transhumance System

A system is practiced by farmers whose primary activity is raising livestock, but who also cultivate grain and fodder crops. Traditionally, these communities move their livestock between different seasonal settlements – winter and summer settlements – together with other communities.

Nomadic Pastoral System

This is a system practiced by mobile pastoralists or Kuchis, whose main livelihood and lifestyle is based on raising livestock for the production of meat, dairy products, and wool, and who live tented lives. They move with their flock and herds as the seasons and grazing dictate, along well-defined lines of migration. Kuchis do not cultivate crops and usually depend on purchased fodder and grain from settled farming communities near which they camp in winter. Cattle, sheep, and goats are the main livestock, while camels, horses, and donkeys are also important. In particular environments, buffaloes and yaks are also raised. An estimated 1.5 to 2 million Kuchis still depend on their nomadic livelihood.

During the drought some farmers sold their oxes and must now make-do with a donkey for plowing the fields in Koohsan district, Herat province.

Conversion of rangeland into other uses: the hill in the foreground is being cultivated

Rangeland livestock are essential to the economy of Afghanistan and the survival of rural people. According to FAO, in 2003, the country produced 107,445 tons of meat, 139,000 tons of milk, 16,000 tons of fibre, and about 3.9 million hides and skins. For households with access to cropland, livestock provides not only the main source of income but also a major source of protein and fibre. The nomadic Kuchi population, of which 1.5 million are estimated to be still active pastoralists, is almost completely dependent on livestock. Livestock population decreased from about 4 million cattle and over 30 million sheep and goats in 1978, to 3.7 million cattle and approximately 15 million sheep and goats as a result of conflict and prolonged drought. The small ruminant sheep and goats are almost totally dependent on natural resources and therefore more susceptible to rangeland and climate conditions, while cattle are often fed with agricultural residues.

Despite the important role rangelands play in sustaining the livelihoods and overall economy of Afghanistan, many problems exist in relation to the use and management of rangeland resources. The problems include rangeland degradation and desertification, shortage of forage resources especially in winter and spring, low public concern for rangeland sustainability, susceptibility to drought and uncertainties, rangelands conversion into rain-fed agricultural lands, uprooting of shrubs for fuel, overall lack of capacity, and conflict over land tenure. The difficulties relate to the broader context of conflict in Afghanistan which, for the past two decades, the country has been saddled with continuously. Nearly 30 years of war has had devastating effects not only on natural resources but also on the Afghan people and the country's infrastructure, institutions, food production systems, and socioeconomic structure. The conflicts and induced poor management system during the last decades have also resulted in inequitable access to and irrational use of rangeland resources.

Key Points for Proper Management of Afghanistan's Rangelands

To tackle the numerous problems facing the management of rangeland resources, long-term dedicated effort involving the local people, especially communities most dependent on and knowledgeable about the rangeland resources they use, should address its proper management. Given the harsh environmental constraints and the current situation in Afghanistan, we propose the following.

Clear rangeland entitlements and responsibilities

In the recent past, legislative and customary use-rights and a few powerful people took over control and use of rangelands without respect for traditional use patterns and access rights. Many local people lost their entitlements as well as their enthusiasm to take up the responsibility for managing the rangelands. The Land Law decree 2003 has given the national government ownership over the country's forests and rangelands. Under this law, the Ministry of Agriculture, Irrigation and Livestock (MAIL) exercises full legal responsibility for managing forests, rangelands, and natural resources. The Ministry's new policies intend to encourage community-based management of natural resources, which acknowledges indigenous knowledge and assets and favours environmental sustainability. For the Ministry to disburse its functions and mandate properly requires technical and material support, as well as the support and active participation of local people, especially herders and farmers.

Wind erosion in Koohsan district blocked the irrigation canal and desertification is going on.

Farmers are cultivating wheat, barley, melon, water melon, and chick pea on rainfed hill land in Herat Province

All people dependent on rangeland, be they nomadic Kuchis, or sedentary communities, or communities somewhere in between, have rights over access to rangeland resources. These rights must be acknowledged and respected. When conflicts arise, a neutral moderator must work to bring the conflicting parties together to negotiate and come to some compromise agreement with all the parties involved.

Promote community participation

Despite the government's ownership of rangelands, local communities in Afghanistan, as in most other places, are the daily users of rangeland resources and should be regarded as its custodians. The new Afghan policy supports a community-based management approach, but ensuring communities' accountability poses a challenge given the disruption of pre-1979 statutory and customary rangeland use agreements, and tensions between nomadic and settled communities.

Improved rangeland management will only happen in a non-threatening environment in which rangeland users, through their representatives, can make their voices heard. It is necessary to establish local decision-making bodies (maybe a committee), and agreements for managing rangelands at the community level. Here, it is essential to recognise that communities are not homogenous groups but made up of different, sometimes conflicting interests. Therefore, in the make-up of these local co-management committees, we must involve representatives from different groups representing different pastoral experiences, ethnicity, gender, age, and well-being.

Encourage adaptive grazing management

Climatic variability in Afghanistan requires an adaptive management mechanism for rangelands. Many people especially decision-makers and researchers in urban lowlands tend to regard mobile livestock grazing – an ancient form of land use, as 'backward' and often propose and impose ways to 'modernise' rangeland use. They fail to recognise that traditional mobile livestock grazing is well adapted to the uncertain environment of rangelands. Rotational grazing – in which flocks move in accordance with the availability of grass and water – is a good practice that is supported by scientific evidence, and well suited to dealing with extremes in weather conditions and unpredictable climate. Mobile livestock grazing systems are therefore biologically-friendly and more resistant and adaptable to ecological and economic changes than sedentary grazing.

A challenge for the government is how to provide these mobile communities with services like education and heath care. An option would be to settle or semi-settle the old and children in villages if they wish. This way, strong herders, both men and women, can move in tents with their livestock while their aging parents and school-age children can settle in a house with better living conditions and where the children can go to school.

Improve rangeland productivity

Afghanistan's rangelands consist of alpine meadows and steppes in the northeast, open woodland and scrub mixtures along the Hindu-Kush range in the centre, and arid deserts in the south, west, and northwest parts. Most of the country's rangelands are believed to be under varying levels of degradation, despite the lack of scientific data to support this.

To enhance rangeland productivity over the short term, we can improve grazing management by a combination of rangeland resting and reseeding periods. For instance, the community may agree where to graze livestock at what times of the year, in such a way that different patches of rangelands can grow and produce mature forage seeds by turns. Farmers and herders can also collect seeds of nutritious and highly productive grass and herbal species from local rangelands and reseed them near scrub roots or other places with relatively good moisture and shade. Perennial forage plants in good vigour can withstand short-term drought, retain soil and moisture, and contribute to good animal health.

Given the shortage of feeds, Afghanistan can also introduce good quality fodder and forage species from Iran, China (Xinjiang, Gansu), Mongolia, Pakistan, India, and other countries with similar ecological conditions. Selection of

Long and severe drought across Central Asia in the years 1997-2004 resulted in a catastrophic loss in livestock and degraded rangeland conditions. In northern and western Afghanistan, from 7-80% of domestic livestock perished and more than half of the pastoralists lost their principal source of livelihood. Planning for droughts and other uncertainties is crucial in rangeland management.

hardy and drought-tolerant local species can be done for the longer term. Introduced and locally selected forage species can be cultivated and harvested to provide winter and spring supplementary feeding, especially to lambing ewes.

Identify alternative energy and livelihood options

More than 80% of Afghanistan's population depend on traditional energy sources such as fuel wood, crop residues, animal waste, and kerosene for their cooking, heating, and lighting needs. Therefore, solar, wind, and other forms of energy should be introduced. The rangeland team of ICIMOD is identifying potentials to fill in the gap between energy supply and demand in the rangeland areas of China, India, Nepal, and Pakistan. The programme may be extended to Afghanistan's rangelands.

Promoting alternative livelihood options for small ruminant livestock keepers offers to reduce the pressure on rangelands and provide the opportunity for risk management. Despite the reduction in livestock population in the last two and half decades until 2004, rangeland productivity did not seem to improve, and most of the rangelands were under varying degrees of degradation. This has been the result of constrained livestock grazing in certain areas, and the effects of prolonged drought. For instance, the nomadic Kuchis have no other options but continue to stay in small areas "to turn the land to dust", if they continue to be denied access to some of their traditional seasonal pastures. Identification of alternative livelihood possibilities, however, will have to be carefully studied, especially in terms of location and link to the broader economic and policy environments. Many non-governmental organisation working in Afghanistan, such as AKF, HELVETAS, and Mercy Corps are endeavouring to develop alternative livelihoods for rural Afghan people.

Education, training and research on rangeland management

Despite the predominance of rangelands, there is no curriculum on rangeland taught in any of the Afghan universities. Therefore, raising public awareness and building the capacity of related departments and stakeholders are needed urgently. Public awareness can be raised through various means such as mass education, training, even recreational events, or through the influence of administrative and religious leaders and community elders, radio and television, brochures, flyers, pamphlets, and other sources of information. The universities also need to develop curriculum on rangelands and their management.

Conducting basic and applied scientific research is equally important to identify rangeland resources, ecosystem status and functions, past and present rangeland use patterns and their effects. So far, there is not much information available about the nature and status of rangelands in Afghanistan. Understanding Afghanistan's rangeland ecosystems in Central Asia, for example, its types of alpine and sub-alpine meadows, semi-arid steppes and arid deserts, will not only help the Afghan people better manage their rangeland resources, it will also provide useful information on environmental change and adaptation strategies for Asian and other global rangelands.

Co-management of Rangelands for Multiple Purposes

Livestock grazing is not the only use of Afghanistan's rangelands. They are also used for many other purposes and services, including mineral products, water regulation, rich biodiversity, clean air, and carbon sequestration. For each of these, there are different users and stakeholders and their interests may be conflicting. This is why rangelands require coordinated management effort. If the parties concerned come together to negotiate among themselves how rangeland resources can be managed, they are managing rangelands in a collaborative way. This is called 'co-management'.

Resource mapping involving various stakeholders

'Co-management'
A situation in which two or more social actors negotiate, define, and guarantee amongst themselves a fair sharing of the management functions, entitlements, and responsibilities for a given territory, area, or set of natural resources.

Research and pilot cases from all over the world have proven co-management to be one of the most promising approaches to the management of rangeland resources and sustained pastoral livelihoods. The essence of co-management is that key government bodies and local communities – including other concerned parties or stakeholders – can negotiate, plan, and carry out strategies to manage rangeland resources through equitable processes and hands-on learning.

In the process of co-management, all the parties, the multiple stakeholders, realise that there is no 'unique and objective' solution for managing natural resources, but that they can tackle emerging problems together through collective wisdom and collaborative actions. Therefore, the co-management approach is in itself a process of 'learning by doing'. The co-management approach can have a different content depending on the place and people concerned. For instance, the parties may focus on various policies and the balance between people benefits and development and conservation at the ministerial, provincial, or national levels. But people will have to negotiate how to use small-scale rangelands, with agreements on where to graze livestock, by whom, for how long, and other issues at the community level. The monitoring and evaluation of co-management of rangeland resources should be participatory and should involve all the major interests and parties concerned. Researchers and non-governmental organisation are often in a good position to play neutral moderators.

The **co-management approach** involves three main steps towards reaching negotiated agreements: **preparation, negotiation,** and **implementation of agreements**. These are depicted in Box 1.

Box 1: **The Co-Management Approach**

Preparing and organising for the partnership

- A neutral moderator (from the government or an outsider) identifies the key issues and concerned parties in an area.
- The moderator goes to one party at a time to get their views on the issues and suggestions for solutions.
- Bring multiple parties together to develop or renew a partnership.

Negotiating co-management plans and agreements

- Encourage the partners to agree on a common goal.
- Create an easy atmosphere for each party to express their opinions and listen to others.
- Let the parties negotiate what should be done to achieve the common goal and the responsibilities and benefits of each .
- Agree on the rules and regulations that all parties should follow including sanctions and punishments for disobedience, and when to review the rules.

Implementing and revising the plans and agreements

'learning-by-doing'

- Each party goes back to fulfill their own responsibility in implementing the collectively agreed plans.
- Meet periodically to review progress and identify new problems and solutions.
- Review the rules and regulations periodically as negotiated, but none should upset previously agreed rules.
- If acute conflicts appear, the parties should go back to the negotiation stage and keep the process going.

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Herders on their way to the alpine summer pastures.

Watershed Management

Sanjeev Bhuchar, Andrew Billingsley, Madhav Dhakal, Isabelle Providoli, Samden Lama Sherpa, Ahmad Shah Siddiqi

Bamyan Province, Afghanistan

Introduction

The mountain watersheds, from which the bulk of Afghanistan's water resources derive, are some of the poorest, most physically degraded and agriculturally least productive areas in Afghanistan. They are characterised by steep slopes, of frequently biomass-deficient soils, shadowing tight, largely inaccessible valleys with extensive tracts of barren land, acute water shortages, small landholdings, and perennial food insecurity. Inadequate infrastructure and difficult terrain have combined to exclude many mountain populations from development opportunities in the lowlands.

Rationale

The majority of mountain communities rely on agriculture for their survival. Harsh weather conditions and prolonged cyclical droughts, however, have depleted what little fertile land exists. Rain shadow

areas, snowmelt, and springs remain the only sources of water for most of the population. Rivers with inconsistent and low levels of water run for only short periods, forcing communities to work on marginal land and to rely on lalmi – rainfed agriculture. Because of the nature of the mountain area's soil, erosion is significant. This and extensive deforestation of pasturelands has meant that yearly flooding remains a serious impediment to agricultural productivity. With denuded rangelands, limited access to water, and diminished biomass cover, fodder levels have dropped, severely affecting livestock populations, reducing further possible income-generating activities.

There are indigenous soil and water conservation practices, but the inaccessibility and remoteness of many communities, and the social trauma of many years of conflict has meant that new and viable technologies and methodologies are often not transferred within and between communities. Migration, limited exposure to external innovations, and lack of finances at the household level have all contributed to inadequate resource management practices.

Watershed management, a holistic approach to natural resource management, provides a potential integrated framework for the creation of biological conditions whereby communities can realistically envisage the regeneration of degraded watersheds and increase yields through improvements in soil and biomass cover. Water and soil resources, well managed at the community level, can lead to improvements in forest cover and offer opportunities for livestock improvement and livelihood development.

A watershed is a natural hydro-geological unit ecologically linking people, the sun, soil, water, and biomass cover from which precipitation finds a common outlet (Figures 1a and 1b). It exists regardless of political boundaries and necessarily incorporates interactions between upper and lower catchments. Because it specifically acknowledges the natural physical space, watershed management is a uniquely appropriate approach for programme implementation, community planning, and technical interventions and monitoring.

Afghanistan is divided into five major river basins (Figure 2a), which are further subdivided into watersheds (Figure 2b) and sub-watersheds.

Benefits

The advantages from a community-managed and planned watershed in Afghanistan could include the following possibilities.

- Improved water availability
- Improved water quality
- Reduced risks of natural disasters
- Higher yields
- Increased biomass cover
- Improved soil quality
- Increased income generation activities
- Improved habitats for flora and fauna and, therefore, improved biodiversity

Figure 1a: **An overview of a watershed in Drah Takhat area, Afghanistan**

Figure 1b: **Sketch of a watershed**

Figure 2a: **The five river basins of Afghanistan**

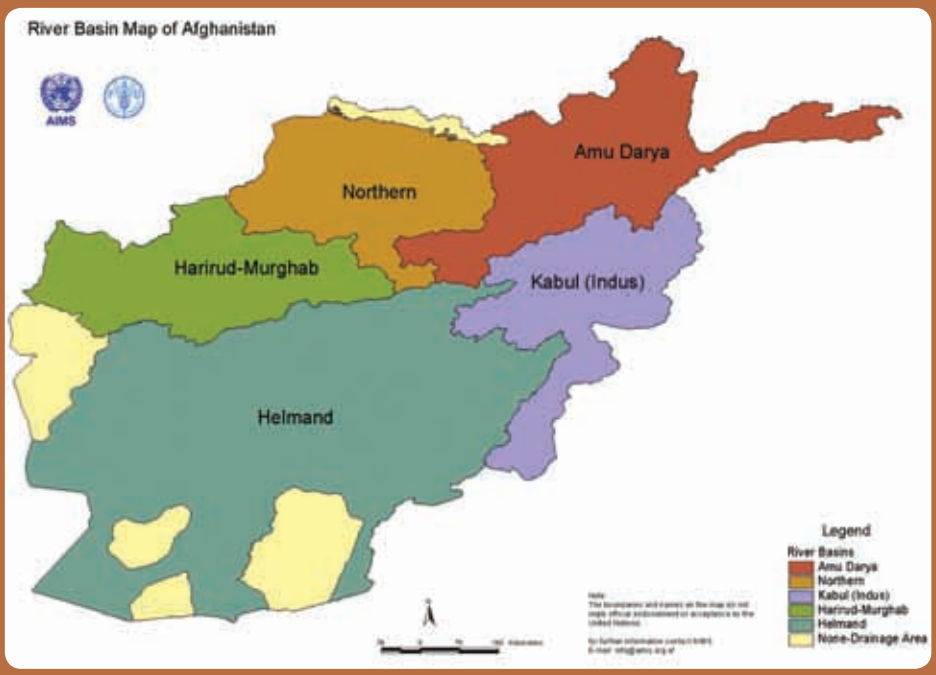
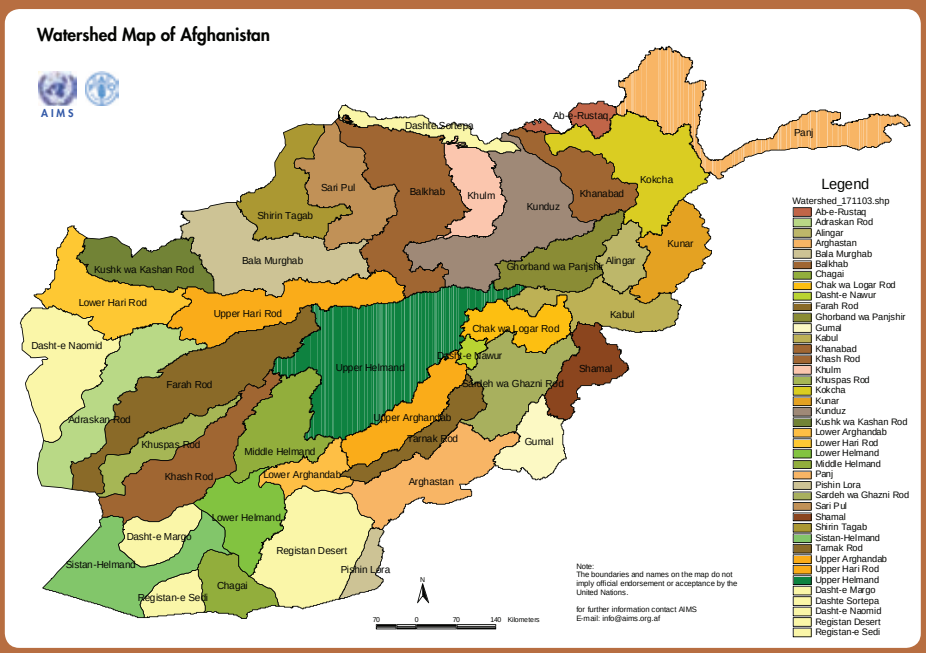


Figure 2b: **Watersheds of Afghanistan**



Source: FAO

Watershed Management Activities

Watershed management is inherently a community-driven process incorporating the ideas and knowledge of local communities and necessitating increased dialogue and exchange within and among social groups for natural resources planning and conflict resolution and mitigation (see Box 1).

Activities in a watershed management programme include the development of appropriate land-use planning and management for rainfed and irrigated lands in order to prevent soil erosion, increase biomass production, and improve the ecological balance. It could also potentially include promoting alternative income generating activities, developing the infrastructure and social services, and can reduce the effects of natural disasters related to poor natural resource management.

Methods

In Afghanistan, the extensive degradation of the natural resource base makes soil and water conservation a significant component of watershed management, in order to enhance the conditions for biomass regeneration and erosion control. Based on a study of the World Overview of Conservation Approaches and Technologies (WOCAT 2003), five categories of soil and water conservation measures are found in Afghanistan (see box next page) (see Box 2) .

Digging contour trenches (foreground) and eyebrow pits (background) in Kahmard, Bamyan

Box 1: **Case study from Bamyan**

The watershed of Qonoq lies in the most southerly district of Bamyan province. With communities found ranging between 2,900 and 3,300 m, the region experiences prolonged winter conditions, has few cropping options, and relies on melt snow for most of its water requirements. The area is ethnically and religiously homogenous, with communities mostly belonging to the same ethnic and religious groups, but competition over diminishing resources and inter-familial rivalry have historically limited the possibilities of coordinated natural resource management at the community level.

In response to survey findings suggesting that Bamyan's southern provinces tended to be neglected by development programmes, the Aga Khan Foundation (AKF) started an integrated Micro Area Development Programme which focused on integrated and broad ranging activities in specific watersheds in order to demonstrate pilot technologies and possible approaches to ensure impact.

The programme's initial phase targeted four communities in one watershed. The area or 'manteqa' was characterised by highly denuded rangelands, limited access to water resources, extensive soil degradation, and widespread conflict over land ownership. The extent of the conflict was such that those in the lower catchment villages were unable to pass through the centrally located bazaar to the upper catchment villages. As a result, AKF's intervention focused initially on social mobilisation: working closely with community members on resolving issues of conflict, group formation, the election of community representatives, and building the capacity of individuals and newly formed institutions at the community level.

Once representative institutions were in place, planning for the watershed at the household, community, and cluster levels commenced. A broad range of integrated activities including literacy, self-help group formation, child-to-child education, crop and horticulture improvement, composting, and greenhouse projects commenced. However, it was the soil and water conservation work involving community planned structures such as bunds, terraces, trenches and pits in the upper catchment zones at the watershed level that ultimately facilitated community members to recognise the importance of working together. By planning within a given space, highlighting the interrelatedness of ecological connections and the inherent linkages between upper and lower catchment areas that the communities that compose the Qonoq watershed united in order to manage their own natural resources.

Three years into the programme, the communities in Qonoq have created non-grazing conservation areas, rehabilitated significantly large tracts of upper rangelands through both social management, biological and mechanical structures, reseeded extensive upper catchment areas, and planned further watershed management work in their area. One-third of salaries earned by communities are voluntarily paid to the cluster level watershed management committee for the further management of the area. The Qonoq watershed has become a model for soil and water conservation in the high mountains of Afghanistan.

Box 2: **Types of soil and water conservation measures**

Agronomic measures such as mixed cropping, contour cultivation, mulching

- are usually associated with annual crops
- the measures can be repeated routinely each season, or in a rotational sequence
- are of short duration and do not lead to changes in slope profile

Contour planting of chickpea in Herat

Vegetative measures such as grass strips, hedge barriers, windbreaks, brushwood

- involve the use of perennial grasses, shrubs or trees
- are of long duration
- often lead to a change in slope profile
- are often aligned along the contour or against the prevailing wind direction, and
- are often spaced according to slope

Brushwood structures using willow in Punjab district

Structural measures such as terraces, banks, bunds, palisades, drip irrigation

- often lead to a change in slope profile
- are of long duration or permanent
- are carried out primarily to control runoff, wind velocity, and erosion, and to harvest rainwater
- are often aligned along the contour against prevailing wind direction
- are spaced according to slope

Earthen V-shaped and other bunds in Punjab district

Management measures such as land use change, area closure, rotational grazing

- involve a fundamental change in land use
- involve no agronomic and structural measures
- often improve vegetative cover, and
- reduce the intensity of land use

Grazing of sheep in Punjab district

Combination of any of these measures in conditions where different measures are complimentary and produce more effective results

Structural measures (in this case, contour bunds) with vegetative measures in Waras district

Strategies for Sustainable Soil Conservation and Watershed Development

- Strengthen people's participation in watershed development. Make the beneficiary men and women active participants and not mere passive recipients of projects and interventions.
- Involve all possible stakeholders. Identify and involve them, consider their views, and implement their workable suggestions. This encourages participation and ownership. Stakeholders include people from the watershed communities such as landlords, small and marginal farmers, the landless; external institutions such as government and nongovernment organisations, research and financial institutions, and others.
- Focus on appropriate technologies for watersheds. Farmers' own innovations with low- cost technologies can also be valuable resources.
- Conduct action research for watershed technology and management to support programme work.
- Mobilise resources for watershed management. Apart from public funding, explore the possibility of funding watershed activities through community-based and private institutions. A much larger area of rural credit should flow into land development and land reclamation.
- Build capacities and develop human resources for watershed management. Provide training to the community of watershed users and bring them to exposure visits to successful watershed projects. Farmers learn best by observing success stories from other farmers.
- Ensure project financial sustainability. Self-help groups organised as part of the project activities can play a role in sustaining the activities.
- Conduct monitoring evaluation and impact assessment. Realistic performance indicators to assess the impact of the programme should be developed with the help of professionals and in consultation with the communities.

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Soil Moisture Retention and Soil Fertility Options for Agricultural and Degraded Lands

Sanjeev Bhuchar, Andrew Billingsley, Madhav Dhakal, Isabelle Providoli, Samden Lama Sherpa, Ahmad Shah Siddiqi

Introduction

Land degradation is a common problem of farmers and herders in hills and mountain areas in the Hindu Kush-Himalayan region. Over time, people have used land resources haphazardly by either converting most marginal and sub-marginal lands including forests and natural grasslands in grazing lands and cultivated land, or by overexploiting the vegetation resources. In Afghanistan, about 11.2 million hectares (m ha) of land is affected by water erosion and 2.1 m ha by wind erosion (Lal 2004).

Soil erosion is regarded as a major threat to sustainable growth in agriculture and livestock production, and each year large amounts of top soil containing soil organic matter and nutrients are lost. Maintaining good soil structure and soil moisture and fertility are crucial for a good agricultural and natural resources base.

Rationale and Relevance

The application of soil and water conservation measures is important to:

- conserve moisture in the soil,
- increase organic matter content and bind nutrients,
- increase soil productivity, and
- increase biomass.

The climatic regions of Afghanistan are diverse; precipitation ranges from about 77 to 1,020 millimetre (mm) a year and average rainfall is 300 mm/year. This chapter presents potential options for soil and water conservation for three eco-regions, from lowland to mountains excluding extreme low land (Table 1).

Table 1: **Potentials of a variety of options in three eco-regions of Afghanistan**

Options	Lowland 900 – 1,300m	Upland 1,300 – 2,400m	Mountain Above 2,400m
Mulching			
Organic	H	M	M
Inorganic	M	M	M
Multiple cropping			
Sequential	H	M	L
Simultaneous	H	M	L
Conservation tillage			
Zero tillage	H	M	M
Min. tillage	H	M	M
Contour tillage	H	H	M
Surface Seeding	H	L	L
Compost			
Heap	H	M	L
Pit	H	M	H
Vermi	H	M	N
Black plastic	H	M	M
Green manuring	H	M	L
Hedgerow	H	M	L

Potential: H = high; M = medium; L = low; N - not possible

Available Technologies for Soil Moisture Retention

The following list suggests a few soil conservation measures to improve soil moisture status.

Mulching

Mulching is covering the soil surface by a layer of organic or inorganic material to create a favourable environment for plant growth (Figures 1a and b).

Benefits of mulching

- Mulch provides an insulating barrier between the soil and the air, thus moderating and stabilising soil temperature
- Conserves moisture in the soil through reduced evaporation and improves the soil's water holding capacity
- Protects seeds from being washed out

- Protects delicate plants from high soil temperature generated by intense sunlight
- Protects the surface from raindrop erosion by providing ground cover
- Suppresses weed growth, depending on mulch material
- If mulch materials are organic, adds organic matter to the soil, thereby increasing soil fertility
- The pH (acidity or alkalinity) level of the soil can be regulated depending on the selected mulch

Figure 1: **Plastic (a) and Organic (b) Mulching at Godavari Demonstration and Training Centre, ICIMOD**

Two main methods of mulching

- **Mulching around individual plants**: Apply 5 - 10 cm thick mulch around the plant. Leave 5 - 15 cm space around the plant. Outside this, the mulch should form a circle of about 75 cm radius.
- **Mulching to treat an entire area**: Mulch is laid across the slope to form a surface cover of 5 cm thickness. This type of temporary surface armouring is normally used to aid the establishment of grass seed.

Resource required

- **Inorganic mulch** which includes materials such as aluminium foil, plastic, stones, pebbles, brick chips, gravel, shredded rubber tyre, landscape fabric, and geo-fabric
- **Organic mulch** which includes rice and wheat straw (used in Herat), leaves (e.g. poplar, mulberry and juniperus, salix, alfaalfa), food leftovers, animal manure and compost; wood products (wood chips, chunk bark), and newspapers, if available in the region

Multiple cropping

Multiple cropping is a broad term for growing individual cropping in sequence mainly to improve soil fertility.

Benefits of multiple cropping

- Improves fertility and increases soil organic matter content
- Increases surface vegetation cover
- Improves infiltration and stability of soil structure, and
- Decreases soil erosion

The various multiple-cropping practices may be grouped into two broad categories: *sequential cropping* and *simultaneous cropping* (Figure 2).

Sequential cropping is further categorised into:

- crop rotation, and
- relay cropping.

Simultaneous cropping is categorised into:

- intercropping (Figures 3a and 3b)
  - Mixed
  - Row
  - Strip
  - Relay
- interculture, and
- adjacent cropping.

(Details of each category can be found in Joshi, 2007.)

For example, in Herat, peach trees are intercropped with Alfaalfa, and sunflower with watermelon or sesame. In some areas in Badakhshan, Kabul, and Jalalabad, sequential cropping is done with different crops (e.g. cereal crops with vegetables or orchards).

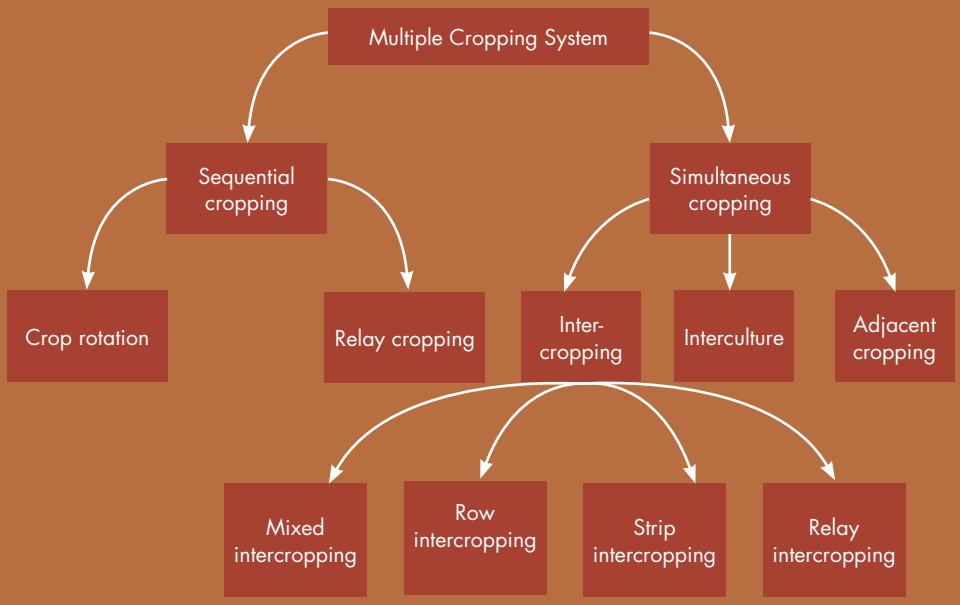
Resource required

- Seeds and seedlings of different crops
- Technical support services

Conservation tillage

Conservation tillage is a method of cultivating crops with minimal soil disturbance to reduce fertile top soil loss to wind and water. When tillage is reduced, the stubble or plant residues are not completely incorporated; most or all remain on the top soil rather than being ploughed back or incorporated into

Figure 2: **A reflection tree of multiple cropping systems**



Source: Joshi 2007

Figure 3: **Intercropping (a) mixed intercropping of maize and soybean, and (b) row intercropping of maize and ginger.**

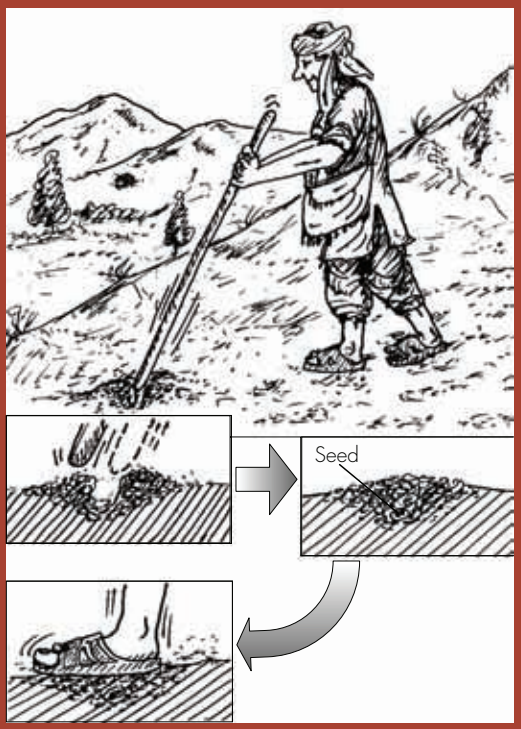
the soil. The new crop is planted into this stubble or small strips of tilled soil. Increased use of crop residue and organic matter in the soil under the conservation tillage system improves soil tilth and fertility after a few years of adoption.

Conservation tillage and sowing is performed after crop harvest. It results in timely planting but also conserves residual soil moisture. The field is not kept fallow under the conservation tillage system. If it is not possible to plant a major crop, a cover crop is sown during fallow period. Leguminous plants and grasses are the major cover crops. Every three to four years, one-time ploughing incorporates lime and fertiliser in the soil.

Benefits of conservation tillage

- Minimum soil disturbance, thus a significant reduction in soil erosion is noted
- Soil surface cover of at least 30% from crop residue conserves soil moisture, adds organic matter to the soil, and suppresses weeds
- Enhances agricultural productivity by improving soil fertility through biological processes
- Single pass bullock/tractor reduces operational costs of planting compared to multiple pass primary and secondary tillage before sowing
- A continuous no-till system increases small soil clumps or soil particle aggregation, making it easier for plants to establish roots
- Improved soil tilth also minimises compaction; compaction is also reduced by reducing trips across the field

Figure 4: **A dibble stick**



Conservation tillage methods

1. Zero tillage

   Under the zero tillage system, soil is opened through a narrow slit or small pit to place seeds and fertiliser and then covered. This tillage system includes dibbling using a dibble stick, sowing with a zab seeder, and use of a zero till drill (Figure 4).

2. Minimum Tillage

   Minimum tillage by depth. Under the conventional tillage system, several passes of tillage till the soil more than 10 cm deep. A minimum till drill is used which tills the soil of 2-4 cm deep, drops the seed, covers and presses the soil by a roller simultaneously in a single pass.

Minimum tillage by tillage area. In the conventional tillage system, the whole land is ploughed, whereas under the minimum tillage by area system, only a part of the land along the contour is ploughed, and a seed bed prepared instead of ploughing an entire plot.

Strip tillage. In strip tillage only a narrow strip is tilled and seeds are sown along the strip. In between strips the land is not tilled at all. A strip till drill also performs strip tillage.

3. Contour tillage
   Tillage is performed across slopes along contours, and plants are planted along the contours. Contour tillage enhances infiltration and reduces runoff and soil loss. It also reduces variation in tillage depth and speed, and consequently reduces erosion from tillage (Lobb et. al 2000).

4. Surface seeding
   Surface seeding is adopted for wheat crops after rice harvest if there is high soil moisture content. (Clearly visible footprints while walking on the field indicate high moisture content). The wheat seeds are mixed with cow dung and kept for 24 hours, then broadcasted in a field without tillage at late afternoon hours or at sunset. The seeds are mixed with cow dung to facilitate germination and prevent birds from eating them.

   Surface seeding can also be practiced in rangeland areas as practiced in Afghanistan.

   Resources required
   Special plough equipment manual or mechanical and seeds

Available Technologies for Soil Fertility Improvement

The following list suggests a few measures for improving soil fertility.

Improved compost and farmyard manure

Compost and farmyard manure are used mostly to supplement soil nutrients in rural mountain areas. Crop residues, animal waste, leaf litter, solid wastes, oil cakes, and other wastes are used to make compost. Proper composting and storing is important for efficient use in maintaining soil nutrients. For example, in Herat, heap composting has been applied and marketed.

A starter for the decomposition process can be sprinkled over each layer of 50 cm of plant material such as ripe compost from the previous batch, forest soil, or even a small amount of animal dung, urine, wood ash, lime, urea, or effective microorganisms (EM).

Turn and mix the compost every 30-50 days, depending on the mix and the outside temperature for better aeration. Pipes can also be stuck into it. The compost must remain moist at all times to avoid

slowing down decomposition and should be protected from direct sunlight, rainfall, and runoff to reduce the loss of nutrients.

Heaping or collecting the material in a pit helps the compost to reach the temperature needed (700°C) to destroy pests and weeds. A heap is made above-ground either plain or with different types of outer wall. Sealing the heap with mud or plastic helps to maintain moisture (see Box 2). (SSMP and ICIMOD, 2008)

Compost pit with roof

Once the compost is well decomposed and has an earthy smell, it can be applied directly to the soil or stored for later application. In Herat, marketing compost generates farm income.

Box 1: **Vermi-composting**

A special type of earthworm (*Eisenia foetida*) can speed up the composting process. Earthworms (*Eisenia foetida*) add casting, making the compost a high quality product.

- Add earthworms to the collection of animal and plant waste of succulent nature.
- No additives and no turning are required.
- Protect the vermi-compost from the elements (sun and rain).

Earthworm (*Eisenia foetida*)

Box 2: **Black plastic covered compost – an example of the heap method**

In the Jhikhu Khola watershed in Nepal, a traditional compost heap is covered with a piece of black plastic. This protects the nutrients from leaching during rainy days and provides a favourable environment for the growth of microbes (increased temperature and decreased evaporation loss). The approach is based on the principle of passive aeration, removing the black plastic from the compost heap for a certain period each day and covering it again.

Layered compost heap with black plastic cover

Using this method, compost decomposes in 45-50 days compared to about 4-6 months without a plastic sheet. Black plastic is light, easy to use and handle, and durable (thickness ~ 800 micron) and consumes less time and labour than the standard method.

Bio-fertiliser

Bio-fertilisers refer to living organisms which augment plant nutrient supply one way or another. Bio-fertilisers improve fertility of the land using biological wastes, hence the term. Biological wastes do not contain chemicals detrimental to the living soil. Bio-fertilisers also convert atmospheric nitrogen into ammonia by fixing biological nitrogen in the root nodules of legumes with the help of a group of bacteria called Rhizobia. Fodder, pasture, grain and leguminous trees fix 80-500 kg of nitrogen/hectare/year from the atmosphere and are the most intensively used bio-fertilisers.
In Afghanistan, use of bio-fertilisers are not yet in practice and may be useful to explore.

Resource

Motsara, M.R., Bhattacharyya P., Beena Srivastava (1995). *Biofertliser Technology, Marketing and Usage - A Sourcebook-cum-Glossary*. New Delhi: Fertiliser Development and Consultation Organisation

Bio-pesticides

Insect repellent plant species such as *Artemia vulgaris* (Dari – Darmanh–Drownah), can be used to make bio-pesticides. Application of chemical pesticides is increasingly associated with ill effects to human health and the environment, whereas bio-pesticides are safer and more environmentally friendly. Their use is therefore gaining popularity.

To make bio-pesticides

1. Chop or mince insect repellent plant species such as *Artemia vulgaris* into small pieces and mix it with fresh cow dung and fresh cow urine in a plastic drum.
2. Add small amounts of yeast and salt for quick fermentation. Stir the mixture for five minutes regularly for a period of one week, then stir only once a week for four to five weeks.
3. After the fifth week, filter the mixture by squeezing in a plain cloth to collect the concentrated bio-pesticide solutions. Dilute the concentrated solution in water at the ratio of one to ten (1:10), one part bio-pesticide, 10 parts water before applying to the plants.

Aside from *Artemia vulgaris* many other insect repellent species can be used.

Green manure

Green manuring is the incorporation of fresh leaves, twigs, succulent stems and other plant tissues into the soil.

There are two types of green manure:
- seasonal crops, and
- perennial trees or shrubs
  – leguminous
  – non-leguminous

Green manure grows fast, is easy to plant and cultivate, and produces large quantities of biomass in a short time. Leguminous green manure can fix nitrogen and concentrate phosphorous so that decomposition is supplied to growing plants. The proportion of biomass should be higher in leaves than in woody materials. In Afghanistan, Alfaalfa (Dari – Sabest or Rashghah, Pashto – Shpashtey), Artemisia, and chickpeas are used for green manuring.

Benefits of green manuring
- Increases organic matter and plant nutrients in the soil
- Helps in conserving soil nutrients by reducing leaching
- Improves soil structure by improving organic matter content
- Deep-rooted green manure plants bring up nutrients from deep soils, which is generally not available for shallow rooted cereal crops
- Contributes plant nutrients to succeeding crops through its residual effect

Methods of green manuring
There are two common methods:
- *In situ production of biomass*. This is growing green manure crops on the same piece of land using biomass produced to supply nutrients to the next crops. After attaining sufficient green biomass, the green manure crops are chopped into small pieces and mixed into the soil by ploughing using animal drawn tools (local plough) or tractors.
- *Biomass transfer* or green manure crops are grown on other fields after harvest. The green biomass is transported to the fields and incorporated into the soil.

Resources required
Green biomass and manual or mechanical plough equipment

Contour hedgerows

Contour hedgerows intercropping is a soil conservation technique that reduces soil and wind erosion and improves the soil environment. The technology involves planting nitrogen fixing plants or other

multi-purpose tree species along the contour lines of sloping land. The plants for hedgerows are selected according to need – whether for fuel or fodder – as for their soil conservation attributes or qualities. Planting local hedgerows or tree species is practical and applicable for the terrain and dry climate of Afghanistan.

Benefits of contour hedgerows

- Controls erosion, maintains soil organic matter and physical properties, augments nitrogen fixation, and promotes efficient nutrient cycling
- Offers opportunities to synchronise the release of nutrients from leaf litter or 'green manure'
- Litter rebuilds soil structure, making soil less erodable and better able to absorb and hold water
- Creates a more favourable micro-climate for crops by shielding them from dry winds
- Hedgerows planted on slopes also anchor soil and form natural terraces, preventing the loss of precious top soil during heavy rains and the overflow of water
- Provides fruit, fodder, green manure, fuel wood, and cash incomes

Methods

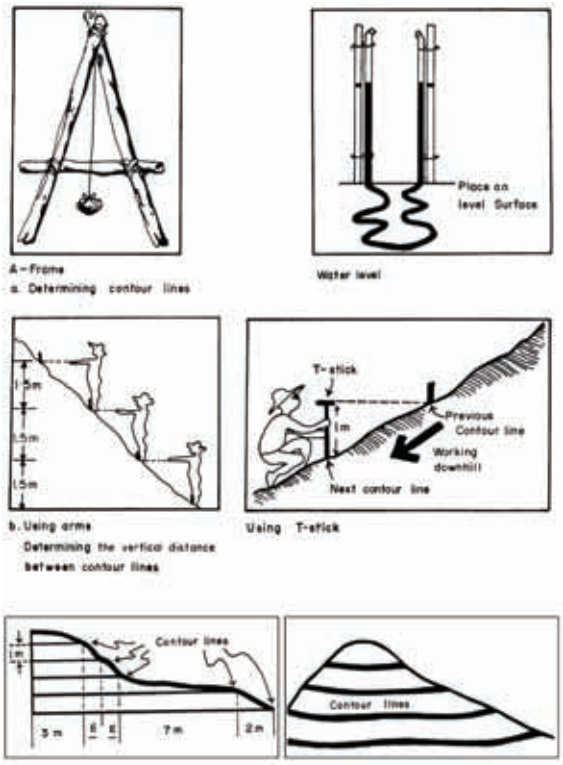
Setting up contour hedgerows (illustrated next page)

1. An A-frame is used to find the contour lines of the land. One person operates the A-frame and the second person marks the located contour line with wooden pegs. Begin marking contour lines near the highest point.

2. Space the contour line 2-6 metres apart. The closer the contour lines to each other, the less erosion occurs, but also the smaller the size of the plots in between. Therefore, the steeper the slope, the closer the contour hedgerows, and for gentle slope, widen the spacing of contour hedgerows. The distance between the double hedgerows varies from 30-60 cm. Plant-to-plant distance in each row should be about 10 cm.

3. For hedgerow species selection community participation is important (see Box 3) and the following site factors need to be taken into consideration:
   - mean annual precipitation and temperature
   - length and frequency of yearly drought
   - minimum and maximum temperature
   - incidence of frost
   - topography (elevation, aspect and slope percentage), and
   - soil pH, texture and depth.

   The promising species for hedgerow planting in Afghanistan are Alfaalfa (Dari – Sabest), Artemisa (Dari – Darmanh–Drownah), Mulberry (Pashto – Tuot), Agropyron (Dari – Alaf Gandomi), Artiplex (Dari – Shurak), and other locally available multipurpose shrubs and trees.



Step 1: How to make an A-frame (Partap & Watson 1994)

Step 2: How to locate contour lines using an A-Frame

Step 3: Preparing the contour lines

Step 4: Planting contour hedgerows with nitrogen fixing plants

Hedgerow species should have the following characteristics:

- Economic and livelihood value
- Rapid growth and biomass production
- Small bushy shrubs
- Deep rooting
- Good coppicing and re-sprouting ability
- Nitrogen fixing attributes
- Wide adaptability and stress tolerance
- Multi-purpose species

Resource required

- An A-frame, wooden pegs, and planting materials

Box 3: **Farmers' participation in making hedgerows**

Farmers' participation is a must for the successful development of hedgerows. Farming conditions vary greatly in mountain areas, so technologies such as hedgerows need to be adapted to local conditions.

Participatory Technology Development (PTD) is an effective approach to involve farmers actively in testing and modifying technologies, taking advantage of their local knowledge and expertise. Farmers and researchers decide together which options to try out, and what should be the evaluation criteria to make them more suitable, do-able, yet effective. This increases farmers' interest in the project, leading to easier and more successful implementation. The resulting technologies are more easily adopted and maintained by farmers.

In participatory hedgerow development in Nepal and India, farmers selected species that were more useful for their everyday needs and better adapted to their local environment, as well as reducing soil erosion and restoring soil fertility. They also changed the design of the hedgerows, including height and the distance between them.

Aryal et al. 2007

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Integrated Snow and Water Harvesting and Low-Cost Irrigation

Sanjeev Bhuchar, Andrew Billingsley, Madhav Dhakal, Isabelle Providoli, Samden Lama Sherpa, Ahmad Shah Siddiqi

Introduction

Precipitation in the form of rain or snow is a fundamental component of all mountain farming systems. Its management dictates the extent not only of crop yield and biomass cover, but also of the availability of drinking water for humans and livestock, irrigation patterns, flooding frequency, and soil quality.

Rationale and Relevance

Harvesting precipitation involves the collection, concentration and storage of both rain and snow from various sources. The harvesting of rainwater and snow can provide water for regions where other sources are far away or too costly to provide, or where other methods of water collection are impractical because of unfavourable geology or the high costs involved. Rain water and snow harvesting are possible in areas which receive as little as 50-80 millimetres (mm) of rainfall. In Afghanistan, rainfall varies from less than 100 mm to over 900 mm (FAO Country Profile, Afghanistan), with more than 50% of the territory in rain shadow areas receiving less than 300 mm of rain per annum. (Arid regions are regions with less than 250 mm of mean annual precipitation. Semi-arid regions, by the same general classification, receive 250-500 mm of annual rainfall). Harvesting all forms of precipitation is therefore crucial for a range of livelihood strategies especially requiring water, for example for irrigation purposes and for drinking water.

Because of its diverse topography, there are enormous differences in climate and precipitation levels within Afghanistan. The mountains provide a substantial proportion of the water necessary for agriculture, power, and human consumption throughout the country. The bulk of water originating from mountains derive from melt snow and its efficient management. This is a crucial component of farming systems, livelihood strategies, and disaster mitigation in Afghanistan. In the lower regions, higher amounts of rain occur, increasing the potential for the harvesting and utilising rainwater.

Available Technology Systems

This paper presents three precipitation management options: 1) rainwater harvesting and management, 2) snow harvesting, and 3) water-saving, low-cost micro-irrigation methods that can be adapted to different climatic conditions in the country.

Rain water harvesting and management

(Suitable for lower, rainfed regions)

Benefits of rainwater harvesting

- Improved availability of water for drinking and irrigation
- Increased water availability during the dry season
- Encouraging better sanitation through adequate supply and use of water, which translates to improved health
- As water is available near the house, reduction in time and drudgery in fetching water
- Reduced downstream flooding and downstream siltation

Method

A rain/runoff water harvesting system comprises the following sub-systems: a) catchment, b) conveyance, c) filtration, d) storage, and e) distribution (Figure 1).

a. Catchment sub-system

The roofs of houses are the most common catchments for rainwater. Therefore the selection of roofing materials should be done carefully to avoid lead and asbestos poisoning if collecting rainwater from roof for drinking purposes. Rainwater should also be intercepted before it reaches the ground to avoid contamination.

For irrigation purposes, catchment types like roads and landscape can be used for catching water either in its natural or treated state to increase run-off. Reshaping the soil surface, sealing the surface with chemicals, covering the surface with stones, and use of hydrophobic chemicals and water proof membranes are some of the examples of catchment treatment (FAO 1987).

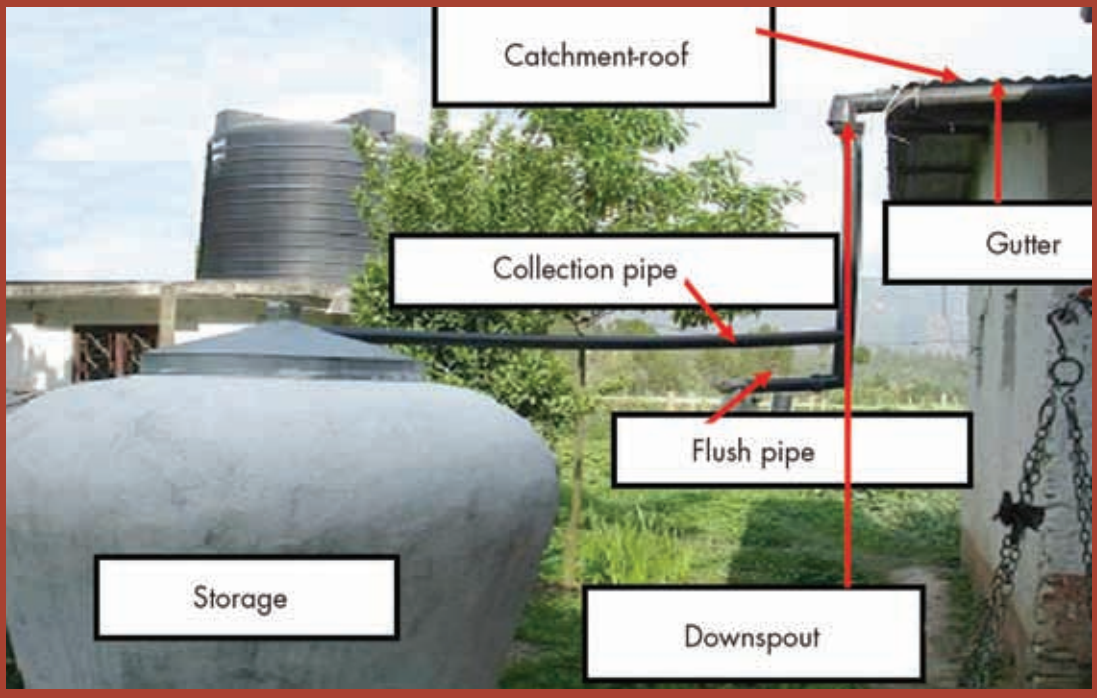
b. Conveyance sub-system

Simple improvised gutters, downspouts, and pipes are the conveyance systems for roof rainwater harvesting for drinking purposes. For irrigation, trenches lined with grass, stone, and cement can be used. They convey the runoff from catchment to storage sub-system.

c. Filtration sub-system

For household purposes, the first wash of water over the roof should be discarded because of their dirt, debris, leaves, and other contaminants that accumulate on the roofs. A simple net can be put

Figure 1: **Roof rainwater harvesting system in Nepal**



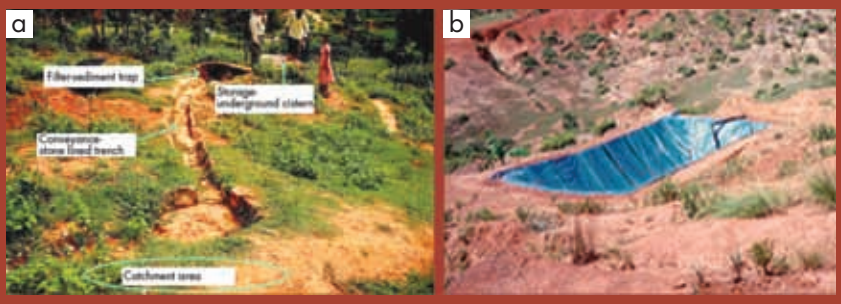
at the inlet of the storage to avoid the entry of insects. For irrigation purposes, pre-filter to keep out sediment build-up if the sediments cannot be easily removed from the storage sub-system. Sedimentation chambers before the storage can be made to filter sediments entering the storage.

d. Storage

For drinking water, any material can be used for storage. The water storage material should be air-tight, made of non-toxic material, and big enough to contain sufficient supply. Jars, barrels, tanks, or even drums can be used. The size of the storage should depend on the amount and frequency of rainfall, catchment available, as well as the demand for water. Cover the stored water to control evaporation and guard against contamination.

For irrigation purposes, structures like ponds, small earth dams, underground cisterns, and so forth, can be used as storage (Figures 2a and 2b). The size of storage should depend on the amount of rainfall/runoff amount and its frequency, the catchment available, as well as the demand for watering crops. Losses from evaporation and seepage should be considered when selecting the type of storage.

Figure 2: **Water storage in (a) an underground cistern, and (b) a plastic lined pond.**



Box 1: **Rain water harvesting with eyebrow pits**

Moisture stress is a major constraint for vegetation in drier sites. Eyebrow-pitting is an option for harvesting rainwater and improving infiltration, and hence improving soil moisture. Eyebrow pitting has been tested for rehabilitating degraded dry lands and the result has been very encouraging.

Eyebrow-pitting in degraded land in Nepal

Distribution

On a small household level, collected rainwater for drinking purposes is generally distributed through a tap. For irrigation purposes, collected water in any type of storage should be used efficiently.

Required resources

Construction material according to locally available materials (e.g. drums, plastic sheets, pipes, others)
Skilled labour

Snow management and harvesting in mountainous regions

Precipitation in the form of snow, as it falls, flows, and percolates through the soil, is as much a socio-political issue as it is an environmental, economic, and agricultural resource. Snow trapping is therefore not simply a physical intervention, but occurs in the context of broader land ownership issues, sustainable management, and productive need, and must incorporate in its implementation an appreciation for the various dimensions which exist between upper and lower catchments.

Box 2: **System of rice intensification as a potential option of water management**

The system of rice intensification (SRI) is a method of increasing the productivity of irrigated rice by changing the management of plants, soil, water, and nutrients. SRI practices contribute to both healthier soil and plants supported by greater root growth and the nurturing of soil microbial abundance and diversity.

In SRI management practices, rice seedlings are transplanted in the following way: very young - usually just 8-12 day-old seedlings, with only two small leaves carefully and quickly transplanted causing minimum disturbances to the root. Only one seedling per hill, instead of three to four together, is planted to avoid root competition. The seedlings are kept widely spaced for better root and canopy growth. They are transplanted in a square grid pattern, 25 x 25 cm or wider – 30 x 30 cm or 40 x 40 cm, even up to 50 x 50 cm with the best quality soil.

Soil is kept moist but well drained and is aerated to support increased biological activity. Water is applied in minimum quantity during the vegetative growth period; only a thin layer of water is maintained on the field during the flowering and grain filling stage. Better quality compost such as well-decomposed farmyard manure is applied to achieve additional yield increases. Since weeds become a problem in fields that are not kept flooded, weeding is necessary at least once or twice at the beginning, 10 to 12 days after transplanting, and preferably three or four times before the canopy closes.

SRI does not require additional inputs like new seeds, chemical fertiliser or pesticides, but does require skillful management of the factors of production and, at least initially, additional labour input of between 25-50%, particularly for careful transplanting and for weeding. As farmers gain skill and confidence in SRI methods, labour input decreases and can eventually become the same or even less compared with conventional rice-growing methods.

SRI farmer in Nepal reaping good harvest even with less water

What is it?

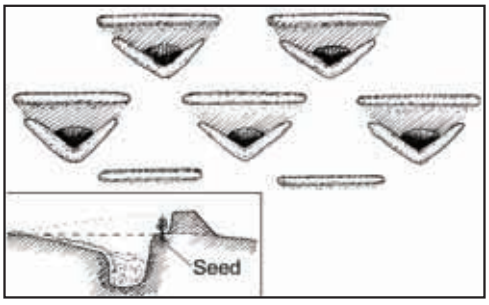
Snow harvesting and trapping structures represent the interface between people, water, the soil, sun, and vegetation. It is the process by which water in the form of snow is 'held' within or behind biological and physical structures in order to reduce evaporation, increase the time water has to percolate through the soil, and counter the erosive effects of flowing snow melt. The process is intended to aid in the creation of biological circumstances in which the rehabilitation of high mountain upper catchments and watersheds can occur.

Benefits of snow management

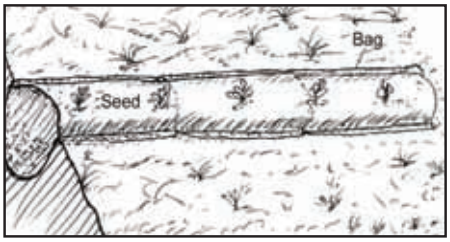
- Snow management through snow harvesting is a tool for increasing soil moisture content and reducing erosion.
- It improves biomass cover, and
- Increases the amount of water available for agriculture and enables the off-season cultivation of crops.

Method

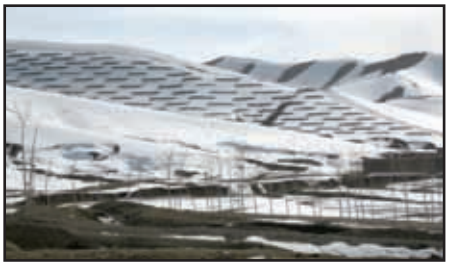
A number of options for snow management are possible, both economically and physically, for the conditions of Afghanistan. These technologies are often simple adaptations of existing technologies to specific snow-bound environments, the characteristics of which include high rates of evaporation in response to sharp sunlight, shallow soil depths, high rates of rill erosion, heavy, compacted snow for extended periods, strong swirling winds, and cold temperatures.



Bird bunds (Bundee parinda). These earthen structures are large pits up to a metre and a half deep topped with berms (mounds of earth usually engineered by humans to serve a specific purpose) leading to V-shaped bunds in a downward slope facing direction. The earth leading to the pit is removed to ever increasing depths so that snow can be collected in the structures' wings, and melting snow is directed to the pit. The bund and berm can then be seeded. The type of species should dictate where the seed is located. The structure in its entirety attempts both to trap snow, as well as provide shadow to the pit in the early months of spring in order to reduce evaporation. These structures are suitable for moderate slopes (5-8%).

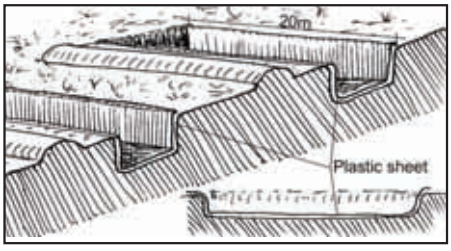


"Hesion bag bunds". This technology combines a number of elements. A trench 50-70 cm in depth running up to 20 m in length is dug along a moderate slope. The soil and gravel extracted from the trench is placed inside hesion bags and then placed back in the trench side by side. The filled bags act both as a bund reducing the flow of water and soil and increasing water percolation. The hesion bags retain moisture when the land around has become dry, thereby allowing seeds which can be placed inside, to germinate.

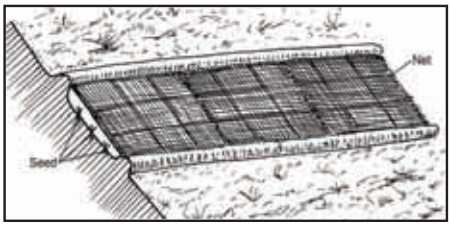


Snow trapping using contour trenches

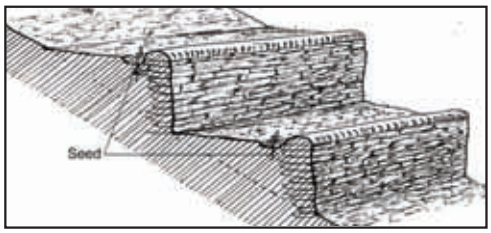
Earthen and stone V-shaped bunds. A direct derivation of the traditional bunds found in the lowlands, these structures are intended to check the movement of soil and gravel through the downward movement of melting snow and to increase the time available for water to percolate through the soil. Such bunds are usable for steep areas and are shaped into a 'V' to cushion the snow's weight as it rests across a smaller surface area. 'V' bunds also reduce the danger of uneven water settlement in the bunds that do not correspond to contours. They are a combination of the v-shaped bunds (bird bunds) and normal straight earthen and stone bunds.



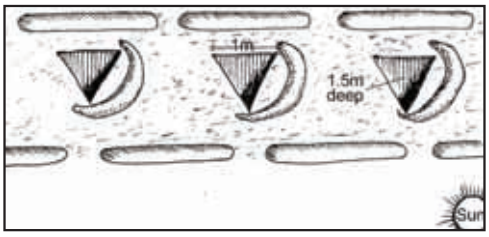
Plastic lined and non-plastic lined pits. Referred to as percolation ponds, these structures trap snow in large pits. Unlined pits or ponds facilitate the percolation of larger amounts of water through the soil though, depending on the size of the pit or pond, their surface area is such that they experience higher rates of evaporation than smaller structures. Plastic lined pits and ponds are lined with plastic to trap water and not allow it to seep through the soil. As the temperature increases, farmers are able to use the water trapped in the pit or pond for irrigation, drinking water, or for feeding livestock.



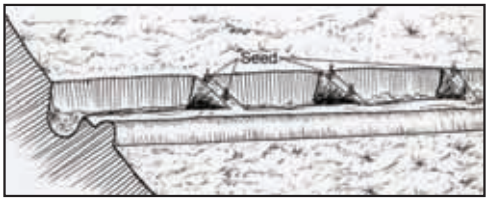
Hesion net. Seeds are sown horizontally along a slope. A series of hesion bags opened along their edges are then sewn together to form a larger net type structure and is placed over the seeds. An earthen bund is created above and below the structure to ensure that water does not pass directly under the net to wash the seeds away.



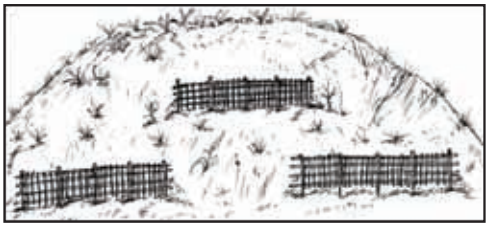
Earthen and stone bunds. These structures are found across a broad spectrum of topographical ranges where the angle of slope permits. Often proceeded particularly when trapping and harvesting snow, by a trench of corresponding length, bunds, earthen, and stone, retard the downward flow of water and increases the rates of water percolation through the soil.



Triangular pit. A triangular pit attempts to reduce the evaporative effects of the sun and wind. The pit, being triangular, exposes less of the snow trapped in the structure to evaporative elements. The shape also reduces the possibility of pit wall collapse which, depending on the soil, can characterise other pits formed in a circular or square fashion. Earth is piled on the sunny side of the structure forming a bund with a berm or mound type structure in which seeds can be placed. This structure provides further shade to trapped snow, reducing evaporation and increasing the amount of water percolation.



Compartmentalised and open trenches. The weight of snow, especially over a period of up to six months, can exert great pressure on bunds, particularly straight bunds. Excessive weight of snow can break bunds, concentrating the flow of water in specific areas and leading to further degrading the soil. To reduce the chances of this happening, earthen compartments or bunds within bunds can be added to the structure, directing the snow in sections and reducing the pressure across the length of the bund.



Brush wood structures. Made in sections one metre in length, willow branches are horizontally woven through three thick willow stems or trunks two metres high. The metre-long sections are joined to another by a one metre woven willow structure, forming a two-metre structure. The stems/ trunks are then anchored one metre to one metre and a half in the soil. (Soil type and slope angle should be carefully considered at this point as well as the amount of expected snow). This anchoring is crucial to structural stability. The structure is ideal for steep areas where other structures are not viable. They are used at the top of the watershed. The weight of snow tends to break these structures after two years if the willow

stems/trunks have not started to grow in the soil. Seeds can be placed behind the structures to add both to the stability of the structure and increase biomass cover in the area. A metal mesh can also be added to the structure to give it additional strength.

When working with snow harvesting structures, a number of key elements are important to consider.

- If you trap too much water on an unstable slope you can increase the chances of a landslide and/ or a land slip.
- Bunds and other similar structures must respect contours. If bunds are not straight and do not run along contours, water can form in the corners of the bund, putting pressure on the structure and increasing the chances of collapse.
- Local people know their slopes, their soil types, the flow and melt of water, and the weather patterns of their area. Their participation in the planning process is absolutely essential. No amount of hydrological data and watershed management experience can compensate for the absence of community-based ideas and understanding.
- Snow harvesting/trapping structures can be implemented anywhere in a watershed, but they are most crucial in the upper catchments. In Afghanistan, most communities live close to valley floors and are therefore far from areas where snow trapping occurs.
- Land ownership patterns must be considered. The current situation in landownership in Afghanistan is both complex and dynamic. Snow is a common resource and its harvesting and trapping and the benefits that can be derive from it must be seen as a common good for all communities in a watershed.
- While most snow harvesting/trapping structures are found in the upper catchment, they often benefit the lower catchments. It is crucial to ensure that the entire watershed is involved in the process and that issues of upper and lower catchments are discussed, understood, and agreed upon by the communities before work commences.
- Snow harvesting/ trapping can be an expensive business and, more often than not, requires much labour. It therefore involves a high investment for communities. Issues of management beyond the time of the project must be dealt with before work even starts.

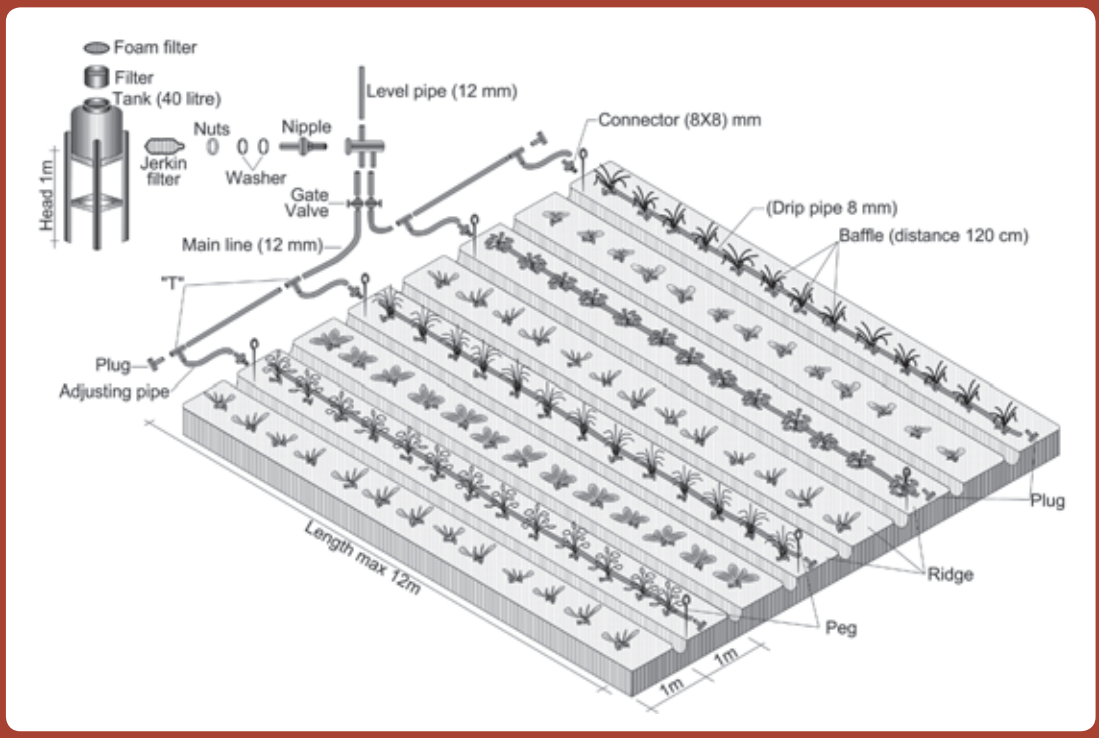
Required resources

- Skilled labour
- Snow
- Willow/poplar trees
- An understanding of resource dynamics
- Local seeds
- Hesion bags
- Metal wire

Technologies for efficient use of harvested water

Irrigation is practiced at all altitudes in Afghanistan. Various traditional technologies exist deriving water from rainwater and snow melt. Some of these technologies, however, can be enhanced using the following techniques including low-cost micro irrigation systems.

Figure 3: **Sketch of a drip irrigation system**



IDE Nepal promoted low-cost drip irrigation systems in Nepa

Drip irrigation

Drip irrigation, also known as trickle irrigation, is an irrigation method that applies water slowly to the roots of plants by depositing the water either on the soil's surface, or directly to the plant's root zone through a network of valves, pipes, tubings, and emitters (Figure 3).

Benefits of drip irrigation

- Delivers water slowly and precisely to the plant
- Enhances photosynthesis by maintaining consistent moisture in the soil
- Reduces water losses caused by evaporation, percolation, and distribution

- Saves considerable amount of water and labour compared to bucket irrigation
- Enables early fruiting and production of seasonal and off-season vegetables, thus enabling farmers to fetch better prices for these early or off-season agricultural products
- Provides opportunities for cultivating fallow land in water scarce areas
- Reduces disease in crops due to reduced water contact with crop leaves, stems, and fruits. Less weeds grow in drip plots because only the plants and not the surrounding areas are watered
- Water-soluble fertilisers can be applied more efficiently with drip irrigation

Limitations of drip irrigation

- May not function well in areas with sediment-loaded water
- Requires frequent cleaning of blockages in areas

Methods

There are generally two types of drip irrigation systems: surface and sub-surface. When a drip tube is laid on the soil's surface, this is called surface drip irrigation; if drip tube is buried below the soil's surface it is called sub-surface drip irrigation.

The surface drip irrigation system designed by the International Development Enterprise (IDE) in Nepal includes a plastic container and weather-proof lateral pipes with discharge holes or emitters at certain intervals.

- Each hole is supplied with baffles to ensure regular water dripping to the root zone of the plants
- Lateral pipes are connected to the container with joint pipes
- Water is dripped to the root zone from emitters at low rates of 2.5 litre/hr.

How to set up drip irrigation systems

- Drip irrigation sets are installed while the fields are being prepared by ploughing, levelling, and ridging, if necessary.
- Twelve metre (12 m) long lateral pipes are laid 1.5 m apart. At the same time a wooden platform (minimum 1 m height) with a storage tank is installed and connected to the lateral pipes.
- After the lateral pipes are laid out, planting holes are dug and spaced to coincide with the drip holes. These holes are usually set every 0.6 or 1.2 m along the pipes and depend on the crop type.
- Fertiliser and farmyard manure are placed in each pit and mixed with the soil.
- Vegetable seedlings are then planted in each hole and daily drip watering begins.

The set is available in different capacities as illustrated in table 1.

Table 1: **Size, capacity, and cost of drip irrigation system**

Size	Irrigation area	Number of lateral lines	Number of drippers	Cost (in US$ in 2006)
Small	125 m^2	4	80	17
Medium	250 m^2	8	160	30
Large	500 m^2	16	320	57

Drip irrigation is advisable or ideal in conditions where:

- water is scarce or expensive
- the soil is porous or too impervious or impenetrable for gravity irrigation, flood or furrow
- it is too windy for sprinkler irrigation
- irrigation labour is expensive or not available

This system can be used mainly on level ground to grow most kinds of crops that are not closely cropped.

Required resources

- Drip set and skilled labour to set it up
- Micro-credit facilities for poor farmers to be able to afford the technology

Pitcher irrigation

Pitcher irrigation is a traditional water saving and efficient irrigation system. The technology allows agricultural and horticulture development in areas where climatic conditions, the quality of the soils, and water scarcity have prevented the use of conventional irrigation methods.

The technology is suitable in arid and semi-arid regions, and for small-scale agricultural projects in areas affected by periodic drought. In its simplest form, pitcher irrigation entails burying an unglazed, porous clay pot next to a seedling. Water is poured into pots, and then seeps slowly into the soil, feeding the seedling's roots with a steady supply of moisture (Figure 4).

Benefits of pitcher irrigation

- A simple, low-cost, labour-saving, and easy to operate and maintain technology
- Reduces infiltration and evaporation losses through the pitcher
- Reduces fertiliser use by allowing application to defined, cultivated areas
- The technology reduces soil erosion

Figure 4: **Pitcher irrigation and pitcher filled with water.**

Source: Pakissan, http://www.pakissan.com

Methods

Pitcher irrigation consists, in its simplest form, of unglazed baked earthen pitchers, buried to their neck in the soil and filled with water. The water gradually seeps out through the porous walls into the root zone under hydrostatic pressure and/or suction to maintain plant growth around the pitchers.

In sandy soils there is the risk that the water will drain out of the pitcher very rapidly. Adaptive methods have to be used to cover the inner pitcher layer with cotton.

Required resources

- Earthen pitcher, cotton layer if applicable

Sprinkler irrigation

Micro-sprinkler irrigation is an efficient alternative method of watering cash crops if water is readily available. In Afghanistan, they are most suitable for cultivating vegetables in greenhouses.

For further reading

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4

Living with Risk

Local Knowledge on Disaster Preparedness

Flash Flood Risk Assessment for Afghanistan

Communities in Adraskan district, Midanak village, Herat province are digging a new channel for making a kariz irrigation system following the destruction of the channel due to the floods.

Local Knowledge on Disaster Preparedness

With examples drawn from experiences on droughts and flash floods in Herat Province, Afghanistan

Julie Dekens and Ahmad Shah Siddiqi

Natural Disaster Risks in Afghanistan

The people of Afghanistan live in some of the harshest environments in the world, characterised by extreme winters, recurrent droughts, and frequent natural hazards such as earthquakes, landslides, avalanches, floods and flash floods, and sandstorms. Combined with the impacts of prolonged war and other changing risk factors – population displacement, climate change, environmental degradation, and natural hazards – these factors contribute seriously to weakening the already tested capacities of the government and local communities. For example, all of the metro-hydrological stations in Afghanistan were destroyed during years of conflict, hampering data collection for the past 25 years. People – whether they are living in a remote village or in the suburbs of Kabul – are often the first victims of and respondents to natural hazards. They have developed knowledge and strategies to minimise, reduce, and/or avoid the effects of natural hazards on their livelihoods, properties, and on their daily lives.

This chapter provides a simple tool on how to understand, identify, and collect local knowledge for disaster preparedness, drawing from specific examples on droughts and flash flood disaster risks that have taken place in Herat and other provinces. The next steps – which are outside the scope of this paper – would be to assess local knowledge and practices and how to use it whenever relevant in order to develop new strategies and methods to prepare people for disaster. Since the Government of Afghanistan is organising itself to address disaster risks, this presents an opportunity to ensure that local knowledge and practices are considered in development activities. What local people know about natural disaster risks should be collected, made more visible, and be integrated into the decision-making processes.

What is Local Knowledge and Where is It?

"What do you do to prepare yourself for the natural hazards that you constantly face?", asks a local NGO worker working on disaster risk reduction to a local farmer. "Nothing!" replies the farmer, "What can I do? I don't have anything."

If you ask people directly about their strategies to cope or adapt to recurrent hazards, in most instances they will respond that they are not doing anything. Yet, when you start asking indirect questions about their day-to-day life and how they make a living, you realise that most of the time people are doing many things that help them directly or indirectly to better prepare for natural hazards. For examples, they are able to reduce human and property losses from natural hazards by adopting a few, simple short-term strategies such as storing food, saving important belongings, or moving temporarily to safer places. They also adopt long-term adjustment strategies such as: building houses in safe places, diversifying income sources, sustainable management of water resources. As such, what we call "local knowledge" covers a range of different dimensions. (Box 1)

Outsiders often perceive people as accepting their fate without trying to change or improve their situation, and that "people live at risk due to lack of knowledge". In reality, people often live in hazardous places not because they do not know the risks but because they do not have other options. Natural hazards are often among many other stresses that communities face, some of which might be perceived as more immediate threats than infrequent natural hazards.

Local knowledge is often misunderstood from 'outside' assistance. Indeed, it is a different type of knowledge. It goes beyond the standard sources of information (schools, books, radio, television, the Internet) and is often specific to a local context and derives more from oral transmission (story telling), learning by doing and experimentation (trial-and-error), and results in time-tested practices. Local knowledge is based on life experiences of a place or a region where people have lived for generations, instead of knowledge gained in the classroom. Local knowledge can be found everywhere: it is in people's heads, in buildings and other infrastructure and tools, in the landscape in urban and rural settings, in cultural traditions and practices, in taboos, local songs, proverbs, beliefs, etc. Outsiders often consider local knowledge as 'unscientific' and inferior to conventional and

Box 1: **The different dimensions of local knowledge**

Local knowledge is diverse and has many dimensions. Here are some examples.
Local technical knowledge, which includes local knowledge of construction methods, or the use and combination of specific materials for building.
Local environmental and **agricultural knowledge**, which includes natural resource management strategies, such as intercropping and agroforestry that conserve biodiversity and protect soil from erosion.
Local socio-cultural and **historical knowledge**, which refers to local beliefs, worldviews perceptions and any other socio-cultural aspects which influence the way natural hazards are perceived and the way people respond to them. Past experiences and understanding of natural hazards also influence current ones.
Local knowledge about development projects refers to people's beliefs about regional, state, and international actors that are likely to intervene in disasters and influence how people will respond to those interventions.

specialised knowledge. However, case studies all over the world demonstrate that local knowledge has an important role to play in disaster risk reduction.

Why is Local Knowledge on Disaster Preparedness Important?

Conventional knowledge is often not attuned to local contexts and realities. There are various examples all over the world of engineering projects which, in turn, created new disasters. Ignoring local knowledge may lead to human and economic costs, especially over the long-term. Exceptional disasters do require external means beyond the normal coping strategies. But strengthening local knowledge and practices is important in the context of recurrent shocks that could gradually increase the vulnerability of communities. An understanding of local knowledge and practices can help outside organisations minimise unsustainable local practices and beliefs and conversely strengthen practices that are sustainable and equitable. Finally, people themselves need to be convinced that they have knowledge within themselves, and that some of this knowledge could actually be useful.

How to Identify and Document Local Knowledge on Disaster Preparedness

Documenting Local Knowledge on Disaster Preparedness

Collect information on how people

- Observe
- Anticipate
- Adapt to, and
- Communicate natural hazards

Listen to different groups, including the most vulnerable and marginalised

- Women
- Children
- Elders
- Disabled
- Indigenous or ethnic minority groups

This will help you understand how different people have diverse knowledge due to differences concerning, for example, access to natural resources, education, training, information, the division of labour between women and men, and different livelihoods (e.g. farmers, herders, others).

Collecting data based on semi-structured interviews, group discussion and focus groups, especially with elders, can be carried out based on the framework proposed in Figure 1, around four dimensions:

Figure 1: **Framework for data collection on local knowledge on disaster preparedness**

(1) Observation

People's experience of the local surroundings

History of natural hazards
Examples: knowledge on the location, time, duration, frequency, intensity, predictability of previous hazards

Nature of natural hazards
Examples: knowledge on the onset, origin, velocity of water flow; knowledge of different types of rain

Evolution of social and physical vulnerabilities to natural hazards
Example: life stories explaining the impoverishment processes of households following recurrent natural hazards and other stresses

(2) Anticipation

People's identification and monitoring of environmental indicators

Early warning signals
Examples: interpretational knowledge of changes in animal behaviours, vegetation patterns; knowledge of local weather forecast

Time thresholds
Examples: knowledge of when it is time to buy and store food in advance, leave the house, move the cattle, and remove important belongings

Escape route and safe places for humans and cattle
Examples: knowledge of the safest and fastest routes

Key actors and skills
Examples: knowledge of who knows what, who does what and when, who stays behind, who goes first

(3) Adaptation

People's access to assets and their ability to learn, self-organize, re-organize, innovate etc.

Human assets
Examples: specific skills such as traditional carpenters and masons

Sociocultural assets
Examples: knowledge of different social groups depending on occupational physical ability, ethnicity, gender, caste, class, & age characteristics

Institutional assets
Examples: knowledge generated by local institutions and crossscale linkages

Financial assets
Examples: micro-finance arrangements such as credits and savings

Natural assets
Examples: natural resource management strategies such as intercropping and agroforestry that conserve biodiversity and protect soil erosion and can contribute to reducing the impacts of natural hazards

Physical assets
Examples: infrastructural safety arrangements such as boats, housing, embankments

(4) Communication

People's ability to transfer knowledge among themselves and between generations

Oral & written communication
Examples: local songs, poems, proverbs which help the younger generation and outsiders to learn about previous hazards; stories of previous hazards encoded in the name of specific places

Early warning systems
Examples: use of visual signals such as mirrors, fire or audio signals such as drums; having dreams of natural hazards in advance

Other practices
Examples: taboos which prevent people from going to certain hazard-prone areas; ceremonies, local art which helps the community to understand, remember past natural hazards, and relieve the anxiety related to the threat of future hazards

Source: Dekens 2007

Peoples' ability to observe their surroundings

Local knowledge on disaster preparedness is based on people's observations of natural hazards from daily experience of their surroundings. People especially know about past disasters in their locality, where the previous disasters occurred, at what specific point in time and under what conditions, for how long, with what intensity, and such details. They are able to explain the nature of past natural hazards in their locality, such as its onset, origin, and the velocity of water flow (in the case of a flood or flash flood). Life stories also explain the evolution of people's vulnerabilities to recurrent natural hazards in combination with other stresses faced by the household and/or community.

People's ability to identify and monitor environmental indicators

In some cases, people manage to anticipate or expect natural hazards in advance by identifying and monitoring local indicators, signs, or warnings of a forthcoming hazard. The most common early warning signals are based on the observation of changes in animal behaviour and vegetation patterns. People also manage to anticipate natural hazards through their knowledge of time thresholds – for example, when it is time to buy and store food in advance, leave the house for safer places, move the cattle, remove important belongings, and the safest and fastest escape routes. They also manage to anticipate hazards by relying on key actors (for example, community stewards, elders, local religious and political leaders) and they have the skills to know who knows what, who does what and when, who should stay behind, who should go first.

Irrigation canal near settlements in Injil district of Herat province. The community uses truck tires and plants trees to protect the houses from floods and to limit soil erosion

People's ability to adapt to natural hazard risks

In many cases, people manage to cope with natural hazards. In some cases, they learn to adjust, experiment, and innovate in the face of natural hazards. In the arid and fragile environment of Afghanistan water management is probably the most important strategy for ensuring that people survive especially during periods of acute water scarcity. Traditional methods of managing water are some of the examples of how people adapt to and cope with droughts. (Box 2)

Box 2: **Examples of traditional methods of water management in Afghanistan**

Over the centuries, Afghans have developed various water harvesting systems traditional based on sophisticated techniques. Examples include the kariz irrigation system, the houz and dabeh rainwater harvesting systems, and the Yakhdan or Barfdan snow harvesting methods. Combined with traditional regulation system for water rights, they allow for regular and equitable distribution of water to upstream and downstream communities. One such system is the mirab water distribution system (more details below). Another example of adaptation strategies to drought is found in the flat land of Herat and a number of other provinces of Afghanistan. A water management system takes advantage of the flood for agricultural purposes. Flood waters are diverted by canals and stored in a series of human-made plots of one to two hectares each located near the riverbed. Earthen bunds constructed from a few centimetres to two meters high enable water storage.

The community planting Ash trees to protect a canal in the Injil district of Herat province

Cultivation of willow tree close to the riverbed (right) to protect agricultural land (left) from soil erosion in Kushk Robat Sangi district, Herat province

Kariz traditional irrigation system

A kariz is an underground channel constructed to capture sub-surface water (Figure 2). This traditional irrigation system reduces water evaporation and requires less maintenance than open canals. It is used for irrigation as well as for drinking water. When Alexander The Great came to Afghanistan and saw the karizes, he praised Afghan wisdom. Underground water is collected through a series of wells built in the hilly areas and skirts along the mountain slope down to the water table. An underground tunnel allowing for the use of the water

downstream connects the wells to one another. Recently, people started to add fish to prevent the tunnel from eutrophication (excessive plant growth in the water), and to ensure that water in the tunnel remained clean. The underground tunnels range from one to more than 10 km long. Because of the war many people had to leave their villages, abandoning most of these systems in near collapse from lack of maintenance.

Water storage for animals to drink in Koohsan district of Herat province

The traditional kariz system has both positive and negative impacts: the system has found a way to reduce water evaporation, but poor maintenance can lead to contaminated waters. Therefore, one must investigate further what we can learn from the system and how it can be improved further. Consulting with elders, the government and NGOs began to rehabilitate some of these traditional underground irrigation systems, a concrete example of combining traditional and conventional knowledge. The elders and other water specialists in the community can determine the direction of the water flow by observing local environmental conditions. They can also advise on the best places to locate the wells and tunnel. However, over generations, they have forgotten how to build the rings used for the wells (the practice of using rings has been found to be at least 700 years old), a technique that is now being reintroduced by local NGOs, but using cement as ring material.

Mirab traditional water distribution system

For generations, communities in rural areas have been using a traditional system of water distribution called the mirab system. The community selects someone called a 'mirab' to manage water distribution from irrigation canals; the Department of Irrigation at district and provincial levels also recognise the mirab's authority. The mirab is knowledgeable about water rights, irrigation canals, their maintenance, how to protect them from flash floods, and other relevant information. He is responsible for the equitable and sustainable allocation of water among farmers. Based on the number of hectares of land owned by each farmer, the mirab allocates water rights for a certain number of hours per day. Gates at various levels control the water flow. After harvesting the crops, the community pays the mirab back with a small amount of wheat or other cereal crops. During the war, the system changed: powerful people started to take more water than allowed, and water gates were vandalised, some people installed water pumps to get more water, and other unregulated activities. Currently, the government is trying to introduce a new system of water rights, further threatening the use of this traditional water distribution system.

Box 3: **Story from the field**

In 2003, in the Adraskan district, a villager saw a flash flood during the night. Instinctively grabbing the loudspeakers in the mosque, he was able to warn community members before the flood could reach the village. The entire community managed to escape to neighbouring communities in time and as a result, no one died, everyone was spared from what could have been a calamity of great human toll.

Some adaptation strategies contribute only indirectly to reducing disaster risks. For example, people are adopting techniques that reduce underlying risk factors through natural resources conservation. The ghorogh system is an informal mechanism for controlling the pastures and forest area. The village leader decides which areas need to be protected from grazing or tree-cutting and for how long a time. The community ban is signalled by using stones, trees, topographic landmarks and others. This locally devised system contributes to rehabilitating pastures and forestlands. In some cases, people plant trees along open canals to protect the canals and prevent soil erosion (photos).

People's ability to communicate about natural hazards

The ability to spread the word about past hazards and imminent hazard risks is crucial to enabling people to react on time and to learn from previous hazards. Imminent hazard risks can be communicated among community members through visual and audio signals and other traditional means such as beating a big drum, playing the bugle, the sorna, building a fire to sound the alarm to community members. One such example is to utilised the mosque for flood early warning system. (Box 3)

Historic hazardous events have been transmitted for generations through various means including through local songs and proverbs, and names of specific places that reflect stories of previous hazards. Particular taboos may also prevent people from going to certain hazard-prone areas. Hazard risks might be further communicated through ceremony, which help the community to remember past natural hazards and relieves their anxieties related to threats of future ones.

How to use Local Knowledge in Disaster Preparedness

The importance of understanding local knowledge does not mean that the local scale is the only appropriate scale of action. Different things can be done better on various scales depending on the nature and type of natural hazards. For example, partnerships among local government, private sector, non-government organisations, and community groups should be explored.

Not all local knowledge, practices and beliefs are relevant in a given context. Nor are local knowledge, practices, and beliefs always sustainable or equitable. Still, local knowledge should always be taken into account to ensure project acceptance and sustainability.
The purpose of documentation is not to conserve local knowledge but to learn from it in order to create new concepts, methods, or strategies for improved disaster management, and to strengthen relevant and sustainable local coping mechanisms.

Examples of potential application of local knowledge in disaster preparedness include accounting for local advice about safe locations, construction sites (for example, for buildings and roads), combining local knowledge with conventional wisdom for hazard risk mapping, surveying, and other inventories in order to verify information, adapt communication strategies to local understanding and perceptions, and integrate local values into decision-making.

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Figure 2: **Kariz rehabilitation in Adraskan district, Herat: (a) Communities are digging a new channel for the Kariz irrigation system after it had been destroyed by floods; (b) Concrete rings to reinforce the tunnel; (c) Covering the tunnel with soil; and (d) A gabion wall protects a Kariz outlet in Sangi district, Herat**

Flash Flood Risk Assessment for Afghanistan

Mohammad Tamim Bahadurzai, Arun B. Shrestha

Why Flash Flood Risk Assessment?

Flash floods are floods that rise and fall rapidly with little or no advance warning (www.weather.com). They are usually caused by intense rainfall, or a sudden outburst of a landslide dam or glacial lake, the rapid melting of snow, or by failure of artificial hydraulic structures. In this chapter, we concentrate on the first three causes.

Flash floods are common in mountainous regions. Afghanistan is prone to flash floods because of its steep slopes in headwaters (Figure 1). Flash floods occur mainly as a result of heavy rainfall combined with rapid snowmelt, mostly during the spring months. Besides water, flash floods carry considerable amounts of debris. Amu River, for example, has an elevation difference of 2700 m between Pamir and Kham Ab and carries about 250 million cubic metres of sediment from flash floods every year. The river erodes large areas of land in Afghanistan. In general, Hairatan district in the north, and Harirood and Farahrood rivers (Hilmand basin) in the western part, are flash flood-prone. Lack of vegetation and denudation of the mountain areas are the major causes of flash floods. In recent years, flash floods have been occurring more frequently and with increasing ferocity in countries like Afghanistan.

Flash floods can damage lives, infrastructure, and the environment, and affect the livelihoods of mountain people. Assessing its risk forms the core of flash flood disaster risk management. Risk assessment helps identify potential risk reduction measures. Integrated into the development planning process, it can identify actions that can meet both development needs and reduce risk.

Flash flood damages can be reduced by establishing a proper flood control management structure to manage floods and reduce their ill effects. Taking precautionary steps, measures, and actions with the help of the government will deliver communities, agricultural land, infrastructure, and livelihoods in flash flood-prone areas to safety.

What is Risk?

The term 'risk' covers a whole range of meanings. For this manual, we consider the Source-Pathways-Receptor-Consequence model of assessing risk (Figure 2) proposed by Goulby and Samuals (2005).

Figure 1: **Major river basins of Afghanistan. Source: AIMS/FAO**

Risk arises when there is a hazard which has a source or initiator (for example, a cloudburst); when there are pathways between the source and the receptors (for example, flood routes including defense structures, overland flow or landslide); and there are receptors – people, property, the environment along the path that will likely be on the receiving end and will be adversely affected.

The first two components of risk (source and pathways) relate to **hazard**, and the last two (receptor and consequences) to **vulnerability**. Vulnerability describes the great possibility of a receptor (for example, a house) to suffer damage from a flash flood.

Assessing Flash Flood Risk

Risk assessment is essential in making decisions about managing flash flood risks (Figure 3).
The steps in risk assessment include:

1. Characterising the area
2. Assessing hazard or determining hazard level and intensity
3. Assessing vulnerability, and
4. Assessing risk

Figure 2: **Pathway-Receptor-Consequence Conceptual Model**

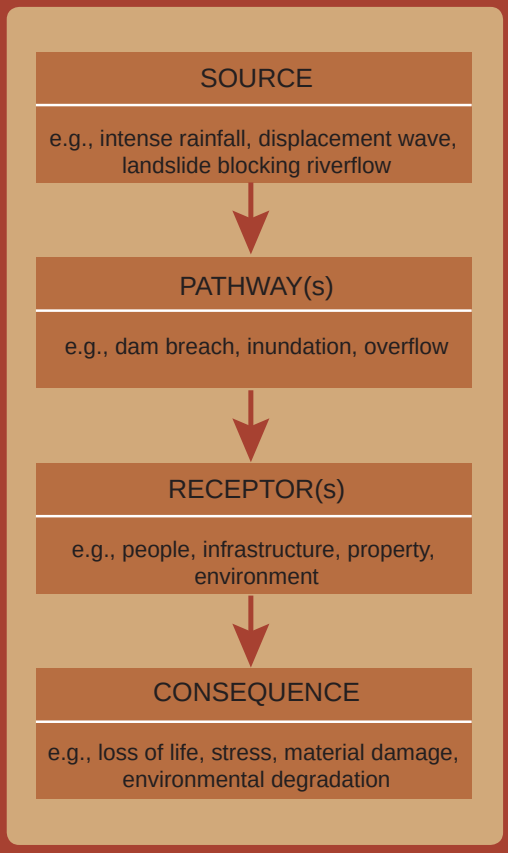
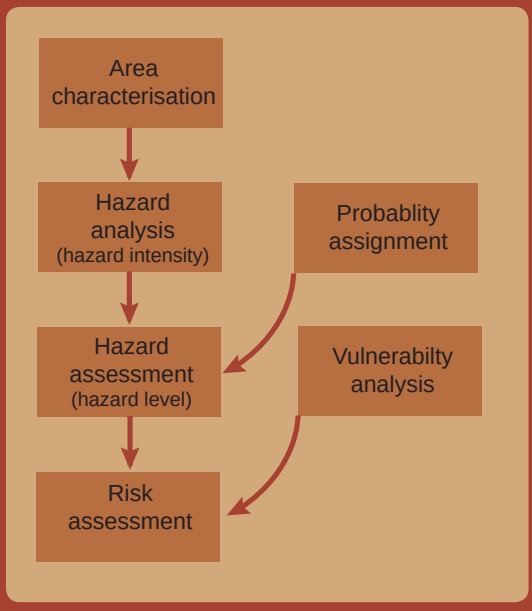


Figure 3: **Procedural diagram for flash flood risk analysis**



Source: modified from Colombo et al. 2002, and Goulby and Samuals 2005

This section provides guidelines for conducting flash flood risk assessment based on these steps. The assessment can be conducted by provincial level officers of the Ministry of Energy and Water (MEW) who have a good understanding of natural channel hydrology and hydraulics as well as some knowledge of spatial mapping.

Step 1: Characterising the area

Characterising an area prone to flash floods is important for both hazard and vulnerability assessment. The following information should be collected to give an idea of the character of the potentially affected area:

1. **Geography** (physical and social): for example, the length of a river section in an area, communes and provinces involved, peculiarities of the area, and its population
2. **Geology and geomorphology**: the properties of rocks and soil in the area, river courses, or pathways

Box 1: **Two approaches to managing flash floods**

Managing hazard exposure, and vulnerability is the best way to manage flash floods. Vulnerability can be both physical and social, thus requiring structural and non-structural measures. Building structures such as check dams and embankments can lessen the frequency or probability and intensity of flash floods and thus addresses physical vulnerability. Non-structural measures focus on community exposure and vulnerability. Changing or regulating land use, employing early warning systems, and developing community resilience in various ways are some examples of non-structural measures which can help communities cope in an event of a flash flood or some other disaster.

Box 2: **Risk assessment for risk management**

The results of risk assessment are generally presented in risk maps. What these maps show – potential areas at risk – can be communicated to community organisations working in potentially affected areas and can help communities anticipate, prepare for, and manage the risks. Aided by risk maps, communities can prepare in the following ways.

- By establishing local flash flood management committees and making flash flood contingency plans
- By managing flash floods using new technologies and local knowledge using participatory approaches (refer to the chapter on 'Working with Communities', and 'An Overview of Monitoring and Evaluation' for some participatory approaches and 'Local Knowledge on Disaster Preparedness' on documenting local knowledge), working with government agencies, communities, involving NSPs, CDCs, existing local committees including the Shuras, religious leaders, and elders
- Making disaster preparedness plans, conducting awareness raising activities within communities, and devising local early warning systems
- Based on the maps, identifying safe areas for shelter and restricting construction and other activities in flood-prone areas
- Constructing flash flood control structures such as embankments using gabion boxes and local materials
- Drawing the attention of national and international donor agencies for support in disaster preparedness and management
- Improving headwaters, watershed management, and better managing water resource structures
- Conducting training and workshops on flash flood preparedness

3. **Hydrology and hydraulics**: the properties of the river such as flow amount, cross-sections, slope, and other properties of the area's rivers and waterways
4. **Vegetation**: types of plants and trees that grow in the area
5. **Land use**: for example, land use types such as agricultural land, forest and other wooded land, built-up and related land, wet open land, dry open land with special vegetation cover, open land with or without insignificant vegetation cover
6. **Existing counter-measures**: for example, check dams, bioengineering work, others
7. **Historical analysis of floods that have taken place in the area**: for example, floods that have happened in the past (local memory, damaged environment, national and local databanks, newspapers, interviews from victims can be the sources of information)

Step 2: Assessing hazard or determining hazard level and intensity

Hazard analysis includes defining the strength of the flash flood (flash flood hazard intensity), and scenarios in the areas where it will hit (catchments). Determining hazard intensity is a step towards determining hazard levels. A simple way of assigning flash flood hazard intensity is shown in Table 1, although in reality, assigning hazard intensity is much more complicated. Alternatively, hazard intensity can be determined by the level of the anticipated flooding.

Assigning probability to a hazard scenario

To conduct a flash flood hazard assessment, assign probability levels to a hazard scenario. This means, determining how frequently a flash flood of a certain intensity is likely to occur in an area again. In the case of an intense rainfall flood, the return period or frequency of the rainfall occurring again can be used as the probability level. The return period or frequency of flooding caused by an intense rainfall can also be alternately used to determine probability (Table 2). Unfortunately, such information is not easily available in Afghanistan because of the lack of hydrometeorological observations. In such a case, the assessment would have to rely on secondary information such as books, reports from newspapers, and local accounts of community people.

Table 1: **A simple way of assigning hazard intensity**

Hazard intensity	Danger to population close to the stream	Danger to population in settlement (about 500m from the stream)	Danger to population 1 km away from the stream	Danger to population more than 1 km away from the stream
High	yes	yes	yes	yes
Moderate	yes	yes	yes	no
Moderately Low	yes	yes	no	no
Low	yes	no	no	no

Table 2: **Probability level of a hazard scenario**

Probability level	Frequency
High	at least once in 10 years
Moderate	once in 10 to 30 years
Moderately Low	once in 30 to 100 years
Low	less frequent than once in 100 years

It is difficult to assign probability levels to other types of flash floods such as landslide dam outburst floods (LDOFs) and glacial lake outburst floods (GLOFs) as they often occur only once or occasionally. In such cases, it is customary to use probability levels based on the characteristics of the lake, dam, or the surrounding environment (Table 3).

Table 3: **Pro bability levels for LDOFs and GLOFs**

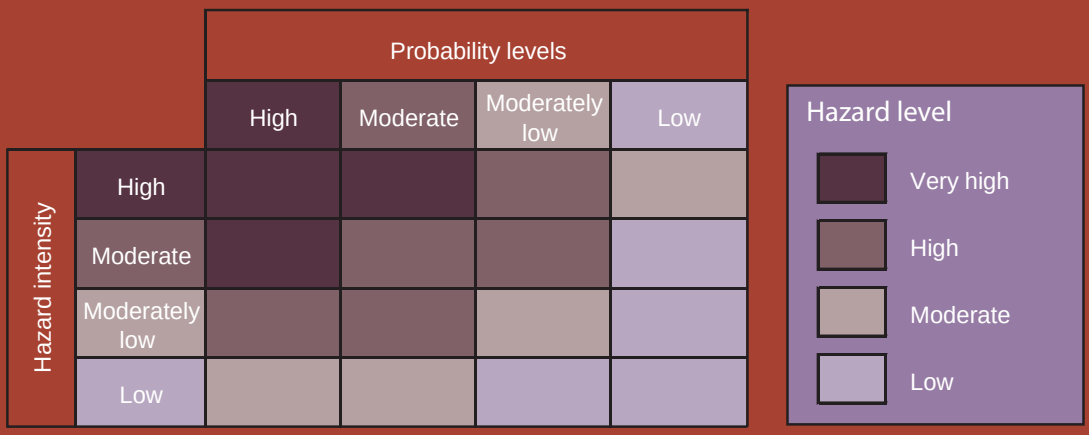
Indicator	Characteristic	Qualitative probability
Dam type	ice (inside the dam)	high
	moraine	medium high
	bedrock	low
Freeboard relative to dam (vertical distance between the water level and top of the dam)	low	high
	medium	medium
	high	low
Dam height to width ratio (Narrowness of the dam)	large	high
	medium	medium
	small	low
Impact waves by ice/rock falls reaching the lake	frequent	high
	sporadic	medium
	unlikely	low
Extreme meteorological events (high temperature/ precipitation)	frequent	high
	sporadic	medium
	unlikely	low

Source: RGSL (2003)

Assessing hazard

Hazard assessment as a process includes determining the hazard level scale by combining the hazard intensity based on the hazard intensity scenario, and the hazard probability level. An example of a hazard level scale is shown in Figure 4. The hazard probability level consists of four levels (very high, high, medium, and low) and the hazard intensity level of four degrees (high, moderate, moderately, low). In the resulting hazard level scale (4 x 4 = 16 cells), 4 different levels are identified (very high, high, moderate, and low).

Figure 4: **Hazard level scale**



It is common to present hazard levels in the form of hazard maps. But be sure to verify the conditions portrayed in the hazard maps with actual field conditions. Hazard maps can be prepared with community involvement. For best results, combine the technical hazard intensity maps with the community-based hazard maps. An example of a flood hazard map is shown in Figure 5.

Step 3: Assessing vulnerability

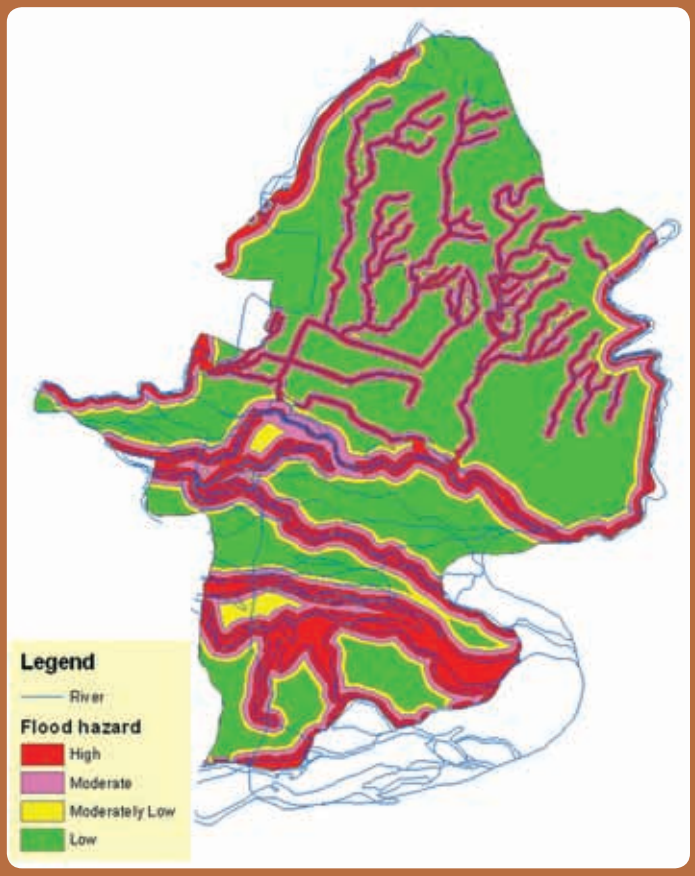
After assessing and identifying that a hazard exists, the next step in risk analysis is assessing vulnerability. This means looking at the characteristics of the receptor – the community, houses, or people – at the receiving end of vulnerability. Here we present an approach which combines physical vulnerability with social response and action (Cutter 1996, Messner and Meyer, 2005).

Assessing physical vulnerability

How physically vulnerable people and infrastructure are is expressed as a vulnerability index or measure and depends on susceptibility and exposure to hazard.

Susceptibility. Susceptibility to flash floods is the state of defenselessness to it. A high susceptibility, has the potential to endanger or lose lives, property, ecological species, and landscapes. Generally, higher value elements are assigned a higher vulnerability index. For example, people's lives have a higher value over property.

Figure 5: **A simple flood hazard map of Bhandara Village Development Committee, Chitwan, Nepal**



Exposure. The measure of vulnerability (vulnerability index) depends on the amount of exposure to flash flood risk. An exposure indicator depends on how far the receptor is from the source of the hazard (for example, distance from or height above a river source of a flash flood). Exposure can be described as high, moderately high, moderate, and low, which constitutes a (qualitative) description of level of exposure.

It is difficult to quantify or measure exposure of several elements at risk, such as people's lives, or that of ecological species, or landscapes, and therefore a vulnerability index has to be based on qualitative or described categories. A general guideline for assigning vulnerability level for different land use categories are given in Table 4.

Table 4: **Vulnerability level scale as a function of land use category**

Category	Vulnerability level
Natural areas (natural water courses, unproductive areas, etc)	Low
Agriculture and forestry (meadows, pastures, forests, etc)	Moderately low
Special agriculture (fields, orchards, etc)	Moderately low
Trade and industry	High
Local infrastructure (trails, secondary roads, tertiary canals, etc)	Moderately low
National infrastruture (main roads, railway lines, main canals, etc)	High
Settlements, mosques	High
Special objects (power stations, cultural heritage sites, strategic facilities, etc)	High

Source: RGSL (2003)

Assessing socioeconomic vulnerability

The capacity of a society in a physically vulnerable zone to adapt to flash flood or disaster risk determines socioeconomic vulnerability. Adaptive capacity of a society itself is a function of social and economic processes. New settlements along river banks or flash flood debris fans are a good example of processes that increase vulnerability to flash floods. Poverty and limited availability of land are governing factors behind this. Communities with access to communication, financial institutions, and markets, and have diversified income sources have stronger adaptive capacity and are hence, less vulnerable. Adaptive capacity can be expressed in terms of numbers (quantitative) or subjective description (qualitative). The list of quantitative indicators is given in Table 5 (Shrestha 2005); the qualitative indicators are listed in Table 6. In practice, combinations of quantitative and qualitative indicators should be used in assessing socioeconomic vulnerability.

Table 5: **Quantitative and qualitative indicators**

Parameter	Quantitative indicators
Accessibility	Road density (m/km^2)
Health	Number of health institutions/1000 population
Communications	Number of telephones/1000 population
Institutions	Number of GOs and NGOs/1000 population
Economic	Number of financial institutions/1000 population
Loss-sharing measures	Value of revolving fund (disaster fund)
Economic diversity	Percentage of families with a number of income sources

Source: Shrestha (2005)

Physical and socioeconomic vulnerability are combined to obtain the total vulnerability, which might again be presented as qualitative categories (e.g. high, moderate, moderately low, low, etc.).

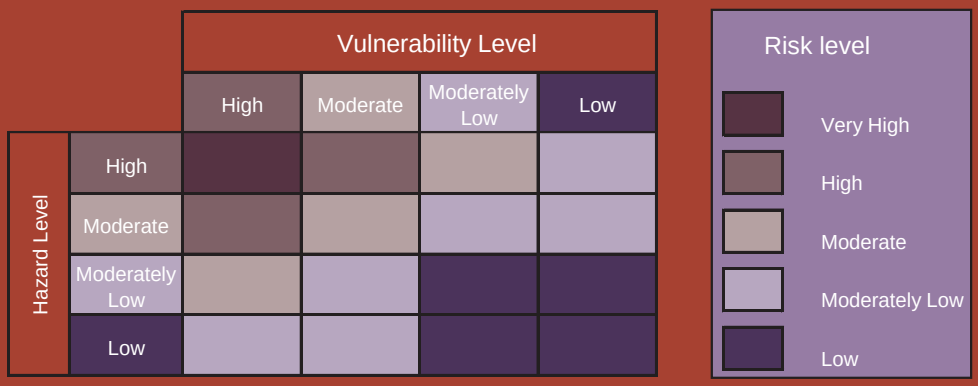
Table 6: **Qualitative indicators**

S.No.	Indicator
1.	Emergency facilities
2.	Warning system
3.	Loss reduction measures
4.	Awareness and attitude

Step 4: Assessing Risk

A risk level scale is a combination of both physical and socioeconomic hazard levels and total vulnerability level. Like the hazard level scale, the risk level scale is obtained using subjective judgment. Figure 6 shows the risk level scale that can be used to assess flash flood risk. Four levels of hazard and four levels of total vulnerability (high, moderate, moderately low and low) are considered here. The resulting risk level scale consists of 4 x 4 = 16 cells and may be classified in to five different risk levels: very high, high, moderate, moderately low, land low.

Figure 6: **Classification of risk level**



Resources needed

The following resources are necessary to be able to conduct risk assessment.

1. Technical and professional staff (for example, Ministry of Energy and Water central and provincial levels)
2. Community and local government authorities for the collection of information related to characterising the area

3. GPS and other devices to add spatial dimension to the information collected
4. A system for storing collected information
5. A geographic information system (GIS) for the graphical representation of maps and spatial analysis. Depending on the resources and capacities available, a simple community-based mapping approach can be adopted
6. A set of computer programmes for processing data such as hydrological and hydraulic models. A simple alternative can be a social hazard mapping of past floods and damages. Even if complicated computer softwares are used, the results should be verified by field investigation involving community members.

Conclusion

The methods presented in this section are some of many available in the literature on flash flood risk. They combine several methods or methodologies and may be modified, even simplified according to the specific conditions, resources, capacities, and available data in Afghanistan. In terms of spatial scale the method described can be adopted to the macro (provincial), meso (district), and micro (garia or village) levels, although, the approach described will be more effective at meso and micro levels. Each intermediate step in risk assessment results in different maps:

- a hazard intensity map,
- a hazard level map,
- a vulnerability (physical and socioeconomic), and
- a risk map.

Each of these map outputs have their own importance in flash flood risk management, particularly in the selection of structural or non-structural measures or combination of measures. While combining two outputs to derive secondary outputs (e.g., hazard and vulnerability levels to derive risk levels, an appropriate weighing factor can be used.) The outputs can be expressed in money terms, which can be a firm basis for feasibility study of intervention measures.

For Further Reading

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5

Making Development Work

An Overview of Monitoring and Evaluation

An Overview of Monitoring and Evaluation

Farid Ahmad

Why Do We Need Monitoring and Evaluation?

So you planned and implemented a programme of intervention – a project, a community micro-enterprise or livelihood. What comes next? You will need to monitor after some time whether the programme or project is going as planned. You will also need to evaluate at some point whether it is achieving what it set out to achieve in the beginning (programme/project objectives), if it is resulting in the desired outcomes and is making an impact; or if adjustments and changes need to be made to the strategies, approaches, or the programme as a whole, to make it more effective.

Monitoring and evaluation (M&E) is one of the major elements of managing programmes or projects. Without it, project transparency, accountability, and impact cannot be ensured. Therefore, M&E should be made an integral part of any project or programme right from the beginning – from planning – up to the end. Without a good project plan, an M&E strategy cannot be effective.

M&E provides us with ways of learning from experience. Regularly conducting it and implementing its findings and recommendations improves service delivery, resource planning and allocation, and shows the value of resources allocated for key or intended stakeholders.

Monitoring and evaluation

- improves programme quality and management;
- enables development learning on what works and what do not and why (lessons learned), and identifies successful strategies, approaches, and programmes;
- weighs resource allocation against performance (outputs), and improves accountability (who's responsible/accountable for what) and encourages transparency or above-ground actions.

It provides useful feedback to stakeholders including decision makers on development impact and achievements, and validates as well as justifies programmes to donors, partners, and other constituencies.

What is monitoring and evaluation?

Monitoring and evaluation are two different things, so it is good to make the distinction. **Monitoring** is the process of systematically and regularly collecting data on a programme or project over time to:

- aid management in decision-making,
- let stakeholders know what is happening, and
- enable donors to know and be able to show the value of their investment.

Evaluation, on the other hand, is the in-depth assessment of programme performance and progress in achieving its intended objectives, outcomes, and impact (see box 2 for examples). Evaluation relies on data generated through monitoring activities as well as information obtained from other sources. It is selective and should be conducted as objectively and systematically as possible.

Conventional Monitoring and Evaluation

There are at least seven steps in designing a conventional M&E system.

Step 1. Plan your M&E system according to your project resources and objectives. Prepare a logical framework of your project and review it. (Refer to box 2 to see what a LFA looks like.) Set your M&E objectives while analysing the project's Logical Framework. This will guide the conduct of your project's M&E.

How to conduct logical framework analysis

Logical framework analysis (LFA) is a tool for making plans, analyses, assessments, follow-up actions, and evaluation. A logical framework (Table 1) states all the key components of the project and shows how the activities and resources are logically linked to the goal, through outputs and objectives, as well as how achievements can be observed. The statements should be presented in a systematic, concise, and coherent way, thus clarifying the logic of how the project is going to work.

Logical framework analysis consists of nine basic steps.

1. Analyses of the project, the socioeconomic and physical environment, and related geographic information
2. Stakeholder analysis – analyses of who benefits, who suffers, and who gets what as a result of the project
3. Problem analysis – analysis to see the core problem and its causes
4. Objectives analysis – analysing how to solve the problem and its causes
5. Action planning – a plan of activities
6. Resource planning – allocating financial and human resources for the project
7. Indicators of objectives – developing indicators to measure success
8. Risk analysis and risk management – analyses of potential threats to project operations and success and how these can be tackled

Table 1: **Log Frame Analysis**

Statements	Objectively Verifiable Indicators (OVI)	Means of Verification (MOV)	Assumptions and Risks
Goal/Impact This is the highest order of objective to which the project intends to contribute, and may be realised by the end or even some time after the project is over.	Measures to verify the achievement of the goal in terms of quality, quantity, and time - how can we find out whether the goal has been reached	Sources of data needed to verify the status of the goal level indicators	Important external factors necessary for sustaining project impact in the long run
Purpose/Objectives/Outcomes This is a more specific objective which a project is responsible to achieve at the end. It describes a change – physical, or in behaviour or attitude of stakeholders – that a project intends/commits itself to bring about.	Measures to verify the achievement of the purpose(s)/objective(s) in terms of quality, quantity, and time	Sources of data needed to verify the status of the purpose level indicators	Important external factors necessary for achieving the goal/ impact
Outputs These are immediate results as a consequence of completed activities.	Measures to verify the achievement of the outputs in terms of quality, quantity, and time	Sources of data needed to verify the status of the output level indicators	Important external factors necessary for achieving the purpose/ outcomes/objectives
Activities Actions undertaken to generate desired outputs	**Inputs** The types of inputs that are required and their expected cost e.g., people, equipment, vehicles, printing, travel, others	Sources of data needed to verify the status of the activity level indicators	Important external factors necessary for achieving the outputs

Analysing problems in the field helps to set clear goals and objectives

Box 1: **S-M-A-R-T indicators**

Specific Is the indicator specific enough to measure progress towards expected results?

Measurable Is the indicator a reliable and clear measure of results?

Attainable Are the results in which the indicator seeks to chart progress realistic and achievable?

Relevant Is the indicator relevant to the intended outputs and outcome?

Track-able + time-bound Are data available at reasonable cost and effort within the stipulated time?

Source: "RBM in UNDP: selecting indicators". UNDP Evaluation Office "Handbook on Monitoring and Evaluating for Results", (2002).

9. Analysis of assumptions – analyses of the critical external factors which are out of project control.

Step 2. Develop indicators to measure objectives and outputs. An indicator is a pointer or a measure used to see whether the project or programme is achieving what it intended to achieve and whether it is going in the right direction. Indicators should be SMART (see box 1).

An indicator covers:

- **Quantity**: How much is required?
- **Quality**: Of what quality?
- **Place**: Where will it happen?
- **Time**: When is the indicator expected to be achieved?

Table 2: **Examples of Impact, Outcome, and Output Indicators**

	Definition	Example
Impact Indicator	These are measures of higher level results or effects of the project, hence its impact. Usually impact indicators are used for evaluation at the end of the project.	**Impact:** Poor households from Qonoq village earn increased incomes from the sale of farm produce as a result of the project
		Impact indicator: Number of poor households benefitted socially and economically. (Socially and economically may also be defined in clearly measurable terms.
Outcome Indicator	Measures showing the medium-level changes or outcomes as a result of project outputs.	**Outcome:** People from Qonoq use the bridge to transport their farm produce to the market.
		Outcome indicator: Number of villagers who have started doing business in the nearby market.
Output Indicator	These are measures to know the project deliverables or products in a more concrete manner.	**Output:** A bridge is constructed between village Qonoq and a nearby market.
		Output indicator: The bridge is constructed following engineering specifications.

An example of a complete indicator with all of the SMART elements is: 50 mounds of drought-resistant potatoes seed produced in Faizabad by the second year of the project. Examples of indicators for the impact, outcome and output levels are given in Table 2.

Step 3. Identify methods and tools needed for data collection. There are many M&E methods and tools, some important commonly used ones are provided in the following section.
Step 4. Get feedback. At this stage, project staff must plan a meeting, workshop, or a gathering of relevant people to gain their views as well as to share data and analyses on the work done by the monitoring team. This exercise is called 'critical reflection' because the project team sits down with the implementers and community representatives to seek their feedback on the work being done in the project area. This exercise will help the monitoring team adjust the M&E system based on feedback received.
Step 5. Adjust the M&E plan. Based on feedback, adjust the M&E plan in order to identify the gaps in the M&E capacities and to see what other resources are needed to meet the requirements of the M&E exercise.
Step 6. Share the M&E findings with relevant stakeholders and donors. This action is expected to gather suggestions and concrete recommendations for decision making.
Step 7. Based on the suggestions, recommendations, and decisions, **make adjustments, changes, and modification** accordingly **to project plans.**

Community-based participatory monitoring and evaluation

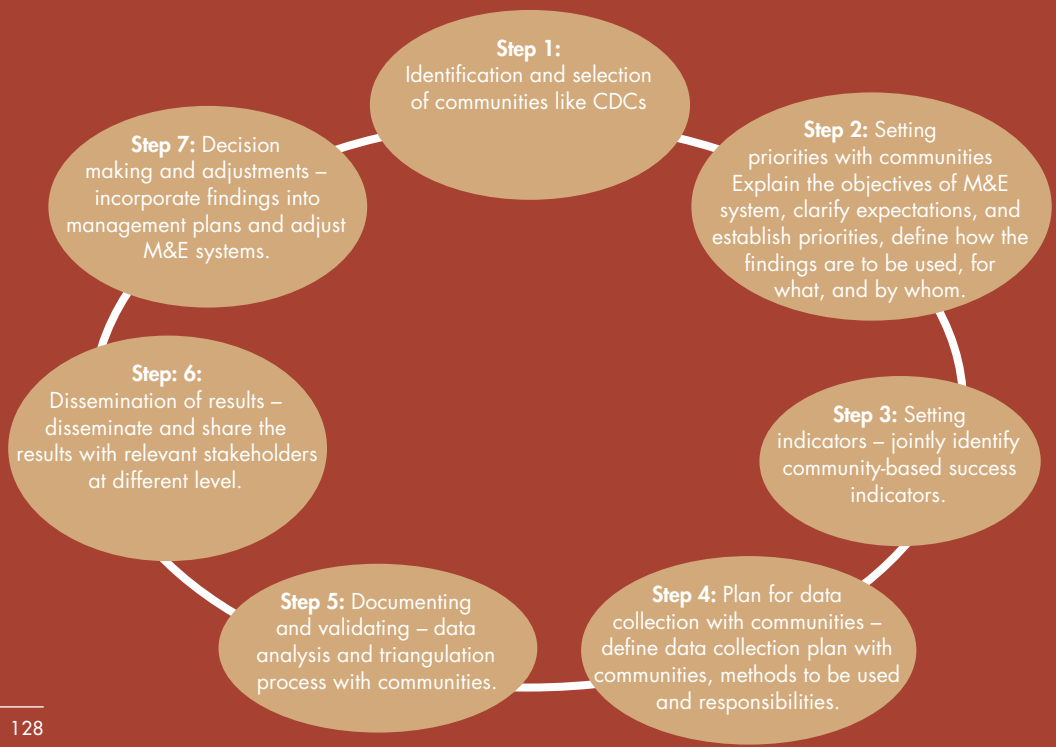
Community-based participatory monitoring and evaluation (PM&E) is based on the principle that stakeholders and beneficiaries should actively participate in the entire M&E process, including all its seven steps. Bringing the primary stakeholders or beneficiaries – usually the communities – together in a common platform enables them to influence the process of change in their lives in their own way. They should share the responsibility for and control over the content, process, and results, and participate in identifying and taking corrective measures. Here, the intention is not just to monitor project performance but, more importantly, build ownership of the beneficiaries and empower them.

There are, generally, seven steps involved in setting up a community-based participatory monitoring and evaluation system, as explained in Figure 1.

Identifying monitoring and evaluation methods and tools

A number of participatory development tools and techniques may be used in conducting M&E or community-based PM&E (see Box 2). Which tool to use will depend on the situation, the time element (how much time is provided to conduct and complete the process) and the information that needs to be gathered. Rapid rural appraisal (RRA) and participatory rural appraisal (PRA) are useful if a quick assessment needs to be made and there is little time for a more in-depth or precise investigation.

Figure 1: **Community-based participatory monitoring and evaluation system**



Box 2: **Some important PM&E tools**

- **Participatory social mapping*** This tool is generally useful to understanding the infrastructure, resources, and settlements within a village.
- **Matrix ranking and scoring*** This tool is particularly useful to know the communities' priorities and preferences.
- **Focus group discussion** Discussions are useful if you want to get in-depth information on specific topics or themes from specific segments of the society. PM&E persons might develop some important points and discuss them with the community. This is useful in verifying or validating already available information.
- **Transect walk*** This refers to a walk, which the PRA team has to take straight across the village in order to understand its physical environment.

Social mapping exercise in Badakhshan province

*Most of these tools are also found in the chapter, 'Working with Communities' as 'Some Effective Participatory Tools'

Rapid rural appraisal (RRA)

PRA provides quick feedback on performance at project midstream or at any stage of the project. It is a need-based tool which requires little resources. RRA methods consist of different tools such as key informant interviews, focus group discussions, direct observation, and others.

Participatory rural appraisal (PRA)

PRA is a rapid appraisal tool focused on sharing learning between local people and 'outsiders'. It enables development managers and local people to assess and plan appropriate interventions collaboratively, often using visual techniques so that non-literate people can participate.

Formal surveys

This is a standard tool for collecting information on identified indicators from a large number of people or stakeholders. Surveys mostly poll or take the opinion of or information from a sample population, for example, community households, or specifically women, or men, or farmers, among others. In conducting surveys, the purpose of the survey and what is being surveyed should be clear. Surveys of the same sample population can be conducted at various times to compare if a change has taken place over time.

Types of surveys

Integrated household survey. A household survey that serves many purposes and covers all socioeconomic dimensions of livelihood; this kind of survey is applicable for all types of interventions and can be tailored to the needs and conditions of the project and according to the project budget and other resources. http://www.worldbank.org/lsms/

Core welfare indicators questionnaire. This is a household level survey which specifically targets to get information on indicators of social development. http://www4.worldbank.org/afr/stats/cwiq.cfm

Client satisfaction survey. A tool to assess delivery of services provided by different agencies targeting specific clients http://www4.worldbank.org/afr/stats/wbi.cfm#sds

Integrated household survey: a multi-purpose integrated survey that covers all socio-economic dimensions of livelihood. This survey is recommended for all types of interventions. It can be customised according to the project situations, budget and other resources. http://www.worldbank.org/lsms/

Core welfare indicators questionnaire: is also a household level survey, which specifically targets social development indicators. http://www4.worldbank.org/afr/stats/cwiq.cfm

Client satisfaction survey: a tool used to assess the delivery of services provided by different agencies targeting clients http://www4.worldbank.org/afr/stats/wbi.cfm#sds

Resources needed

- Facilitator to conduct the exercise
- Stakeholders to participate
- At least two days to complete depending on the project

For Further Reading

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Earl, S; Carden, F; Smutylo, T (2001) Outcome mapping: Building learning and reflection into development programs, IDRC. www.idrc.ca/en/ev-9330-201-1-DO_TOPIC.html

Free management library – evaluation activities in organisations www.managementhelp.org/evaluatn/evaluatn.htm

Guide to project evaluation: A participatory approach. www.phac-aspc.gc.ca/ph-sp/resources-ressources/guide/index-eng.php

Monitoring and evaluation NEWS. www.mande.co.uk

Online Evaluation Resource Library http://oerl.sri.com

Outcome Mapping Learning Community www.outcomemapping.ca

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UNDP/GEF (2004) Participatory Monitoring and Evaluation Strategy

UNFPA (2004) The Programme Managers Planning, Monitoring and Evaluation Toolkit www.unfpa.org/monitoring/toolkit.htm

Glossary of Key Terms

adaptive management mechanism – in the context of rangeland management, this is the use of adjustable mechanisms such as rotating livestock production and resting and seeding periods in the management of rangelands

agriculture and plant biodiversity – the wide range and variety of plant and agricultural species

agricultural productivity – volume of products produced from agriculture

alternative renewable energy technologies – energy technologies other than electric power, such as solar, wind, biogas, hydropower, geothermal, and others that are renewable or do not deplete natural resources and cost little or no harm to the environment

ambient temperature – air or room or outside temperature at any given altitude

annualised energy cost – yearly cost to produce energy

annual operating cost – cost to run an installation or a project for a year

artificial hydraulic structures – human-made structures (such as dams) to divert, restrict, stop, or otherwise manage the natural flow of water

baseline data – basic information gathered before a programme or project begins; the data is used later to provide a comparison for assessing programme impact

bee colony – the aggregate of worker bees, drones, queen, and developing brood living together as a family unit in a hive or other dwelling

bee forage resources – plants that provide nectar and pollen and assure sources of food for bees, which bees in turn pollinate

beehive – an enclosed structure in which some species of honey bees (genus Apis) live and raise their young

benefit-cost ratio – a method of analysis trying to determine the proportion or ratio between costs and benefits of a project or programme

bio-briquettes – compacted agricultural wastes with beehive holes, which when lighted produce fuel useful for cooking and heating purposes

biofuels – solid, liquid or gaseous fuel derived from relatively recently dead biological material and is distinguished from fossil fuels

biogas digester – specifically constructed containers that digest or process animal and agricultural wastes (animal dung, grasses. etc) into biogas, a mixture of methane and carbon dioxide, for direct combustion in cooking, lighting, or to power engines or generate electricity

biomass – fuelwood, grass, manure and plant matter recently dead and can be used as fuel or for industrial production

biomass-deficient soils – soil with not enough essential biomass that enrich soil quality

biopesticides – pesticides made of natural biological materials such as plants with natural insect-repellent qualities

business development services – services that improve small enterprise in developing countries as a means to improve lives and reduce poverty; they include training, consultancy and advisory services, marketing assistance, information, technology development and transfer, and business linkage promotion

business incubators – programmes designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services developed and orchestrated and offered both in the incubator and through its network of contacts; successful completion of a business incubation programme increases the likelihood that a start-up enterprise will stay in business for the long term

business plan – a plan for engaging in business including planning on the cost of managing the project, calculating expected income or revenue from it, training requirements to run the business, quality control, staff and overhead costs, return on investment, and calculating borrowing and lending risks for running the business

buyer requirements – volume and quality of goods and services required by a buyer or customer

capital/capital costs – assets available for use in the production of further assets; total money needed to run a business or an enterprise

catchment – an area of land and what is on it (such as woodlands, farms, or towns) which drains water to the same lowest point such as a river or swamp; small catchments move into larger catchments, and upper catchments flow into lower ones

climatic variability – variations (ups and downs) in climate conditions on time scales of months, years, decades, centuries, and millennia

cohesive groups – formal or informal groups in a community organised and united by a common purpose or goal

commercial viability – ability to survive or operate without going into liquidation or requiring financial support from its shareholders, under all reasonably foreseeable market and operating circumstances

community-based management approach – an approach to rural development that lets communities take charge of managing forest, rangelands, and other natural resources

conflict mitigation – a creative search for alternatives and a potential future for the conflicting parties; intervention aimed at alleviating or eliminating discord through conciliation

conflict resolution – to voluntarily enter into an arrangement that identifies and treats the root causes of dispute and distributes the disputed values or interests in such a manner that the conflict will not reappear, not even in disguise

conservation areas – tracts of land that have been awarded protected status in order to ensure their natural features, cultural heritage or biota; in conservation areas, the cutting and use of resources is often restricted, if not totally banned

crop rotation – the practice of growing a series of dissimilar types of crops in the same area in sequential seasons for various benefits, such as to avoid the build up of pathogens and pests that often occurs when one species is continuously cropped, to balance the fertility demands of various crops, and to avoid excessive depletion of soil nutrients

customary use rights – claims to rights to use unspecified forest or land resources regarded as legitimate by people in the same area ; traditional rights of ownership and the protection and distribution of benefits of indigenous or local people over resources based on customs and traditions

cyclical droughts – prolonged dry seasons that occur periodically or in cycles

demand side issues – in the context of energy, these are issues related to demand for energy such as existing consumption and use patterns and requirements in the community and their availability to stimulate demand for energy

deforestation – the logging, burning, or removal of trees in forested areas without sufficient reforestation and results in damage to habitat, biodiversity loss and aridity; deforested regions often degrade into wasteland

denudation – to strip a forest or land by depriving it of something it needs in order to exist; for example, to strip it's surface layers, in some cases by erosion

development practitioners – those working either with the government or with nongovernment organisations, or donor organisations to help underdeveloped areas develop, find livelihoods for its poor, improve their living conditions, and protect the environment

Disaster – a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (United Nations International Strategy for Disaster Reduction, UNISDR, Geneva)

disaster mitigation – steps taken to contain or reduce the effects of an anticipated or already occurred disaster and involves various levels such as individuals, groups, communities; actions taken depend in part on perceptions of risk of those exposed

Disaster preparedness – the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. (United Nations International Strategy for Disaster Reduction, UNISDR, Geneva)

Disaster risk – the potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period. (United Nations International Strategy for Disaster Reduction, UNISDR, Geneva)

Disaster risk reduction – the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. (United Nations International Strategy for Disaster Reduction, UNISDR, Geneva)

drainage – the natural or artificial removal of surface and sub-surface water from an area; many agricultural soils need drainage to improve production

drone – the male honeybee which comes from an unfertilised egg (and is therefore haploid) laid by a queen

ecosystems – natural unit consisting of all plants, animals and micro-organisms (biotic factors) in an area, functioning together with all of the non-living physical (abiotic) factors of the environment

empowerment – an often used word in development circles but with no clearly defined meaning, but generally having the following attributes: power of decision-making, access to resources and information, a feeling of belongingness to a group and a sense of hope and capability for action, whether by themselves or with the help or initiation of others

energy balance table – illustrates in simple table format the general energy flow (input, output) from production to end users of a region in question

energy output – energy produced by a system or installation

energy resource potential – the possible sources of energy in an area or locality

environmental degradation – deterioration of the state of the environment –air and water quality, soil and natural resources, plant and animal life

environmental implication – in the context of energy, this is the effects or impact on the environment of the use of an energy source or an energy installation

environmental indicators – in the context of local knowledge in disaster preparedness, this includes minute changes in the environment such as in the behaviour of animals and vegetation patterns indicating a hazardous event is about to take place

environmental sustainability – the ability to renew resources and keep environmental conditions in good condition

ethnicity – social groups with a shared history, sense of identity, geography and cultural roots which may occur despite racial difference

ethnic minorities – a sociological group that does not constitute a politically dominant voting majority of the total population of a given society, and are often prone to a different treatment in the countries and societies in which they live

entrepreneur – a person who organises and manages a business undertaking, assuming the risk for the sake of profit and an innovative product or idea; an entrepreneur is not just about business, and entrepreneurs are often creative, imaginative people, always thinking up and supporting new and innovative products or ideas

feasibility assessment/feasibility study – the study or appraisal of whether a project or an enterprise is workable and will earn economic and social benefits and requires identifying its technical, financial, and socioeconomic impacts and drawing conclusions about the project's viability

fermentation tank – tank where biogas is fermented

financial cash flow – the amount of cash generated by an investment, business, or enterprise during a specific period; because cash is the fuel that drives an enterprise, many consider financial cash flow to be an enterprise's most important financial statistic

financial disbursement scheme – the plan on how and when to spend or disburse funds including where to source the funds, how to revolve funds, schedule and collect payments, expected income streams, and other factors taken into account

financial implementation parameters – monetary measures or guidelines to indicate at what point to implement a project or business

financial sustainability – a project or business's ability to keep its finances paying for itself and earning enough profit to go on; the ability to cover costs of an institution over a period of time

food chain – food networks and/or tropic networks that describe the feeding relationships between species within an ecosystem

food insecurity – uncertainty about food supply, where it is coming from, the means to get it, in order to feed people and communities

forest cover – all trees and other plants occupying the ground in a forest, including ground cover, growing more or less closely together

gender and development approach – an approach that encourages planning, implementation, monitoring and evaluation undertaken according to the principles of a) work on one level – practical and strategy needs – to bring about change in gender relations; b) work in a participatory way with men and women making sure to involve men and women because it takes men as well as women to change power relations; and taking a long historically formed view of gender relations and its social context

gender friendly – considers the effects of a project or undertaking on both women and men, and especially the disadvantaged among them

gender relations – relations between women and men in a society

gender sensitive evaluation – evaluation of a project considering the effects on men and women particularly on disadvantaged groups among them

greenhouse gas emissions – the gases present in the earth's atmosphere which reduce the loss of heat into space and therefore contribute to determining the temperature of the earth

gross domestic product – the total market values of goods and services produced by workers and capital within a country during a given period, usually one year, and is considered the measure of a nation's economy

horizontal linkage (in production) – the link between people and processes in production

human resources – people, an underestimated and often rich resource

hydrometeorological observations – studies on the transfer of water and energy between the land surface and the lower atmosphere

indigenous knowledge – refers to the matured long-standing traditions and practices of certain regional, indigenous, or local communities; traditional knowledge also encompasses the wisdom, knowledge, and teachings of these communities and, in many cases, orally passed for generations from person to person through stories, legends, folklore, rituals, songs, and even laws

intercropping – the agricultural practice of cultivating two or more crops in the same space at the same time

internal rate of return – a capital budgeting metric used by firms to decide whether they should make investments

investment cost – amount of money invested to run a business enterprise

key informant interview – talking to a key person; this may be a community leader or an expert in a particular field, and is called a key informant, to get their views on a particular subject of which they are considered an authority or would have valuable information about

land degradation – the decline in the overall quality of soil, water or vegetation condition commonly caused by human activities

land use planning and management – planning the uses of the land such as for settlements, forests, agriculture, industrial, and other uses, in the process balancing conflicting interests in an area and ensuring the protection of the environment; usually done in consultation with all possible stakeholders or groups affected

livestock farming – raising of farm animals such as pigs, goat, sheep to meet the need for food, dairy products, and income

local consumption patterns – overall trends of what people or a local population consume (such as food, water, energy, among others)

Local knowledge – in the context of disaster preparedness - what the residents know about natural hazard risks and what they believe and do about them in a given situation. Indigenous knowledge is part of local knowledge: it refers to local knowledge help by indigenous people, or local knowledge unique to a given culture or society (Adapted from Berkes 1999)

marginalised groups – disadvantaged groups in terms of socioeconomic status, caste, privilege

marketing and promotion plan – the plan on how to market and promote a business, enterprise, or activity

market demand – estimated total demand of all potential customers for a product or service

market research – primary or field studies (involving both quantitative and qualitative studies such focus groups, surveys, field tests, interviews or observation, conducted or tailored specifically to that product) and secondary research (based on other published data) that an organisation or an enterprise compiles from various sources which appears applicable to a new or existing product

meteorological data – information about the atmosphere and weather

micro-credit – the extension of very small loans (microloans) to the unemployed, to poor entrepreneurs and to others living in poverty, individuals lacking in collateral, steady employment and a verifiable credit history and therefore cannot otherwise meet even the most minimal qualifications to gain access to traditional credit

micro-enterprise – a business having five or fewer employees and a seed capital of not more than $35,000; typically, micro-enterprises have no access to the commercial banking sector and micro-finance institutions have become common sources of funding for micro-enterprises, particularly in the Third World

migration – the movement of persons from one country or locality to another

migratory beekeeping – beekeeping operations where bees, placed in sealed boxes, are transferred from place to place in search of nectar

Millennium Development Goals (MDGs) – eight international development goals that 192 United Nations member states and at least 23 international organisations have agreed to achieve by the year 2015; they include reducing extreme poverty, reducing child mortality rates, fighting disease epidemics such as AIDS, and developing a global partnership for development

mulch – a protective covering of rotting vegetable matter spread to reduce evaporation and soil erosion and conservation of soil moisture and the moderation of soil temperature

Natural hazards – natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. (United Nations International Strategy for Disaster Reduction, UNISDR, Geneva)

nectar – a sugar-rich liquid produced by the flowers of plants, in which it attracts pollinating animals

net present value – total present value (PV) of a time series of cash flows; a standard method for using the time value of money to appraise long-term projects; used for capital budgeting, and widely throughout economics, it measures the excess or shortfall of cash flows, in present value terms, once financing charges are met

off-farm employment – employment not involving the farm or agriculture; other sources of livelihood

operational efficiency – running an enterprise in the best possible way and least cost with best results

optimum temperature requirement – the most favourable or desirable conditions or greatest degree of temperature under a restriction, expressed or implied, for best results

payback period – the period of time required for the return on an investment to "repay" the sum of the original investment

pollen – the fine spores that contain male gametes and that are borne by an anther in a flowering plant

political association – a political party with which a person or group is associated or belong to

population displacement – the dislocation of people from their places or home because of a disaster, or various other reasons

power relations – the dynamics of mutual influence; in most situations such relations are activated in fields whose pattern is perceived by those who enter the field in terms of role relationships, or less consciously simply as appropriate behaviour, a predisposition to act in a certain way

precipitation – the quantity of water (rain, snow, hail, or sleet or mist) falling to earth at a specific place within a specified period of time

production – the process of producing a product and may involve getting the raw materials and combining a number of processes and technologies to make or manufacture the product

public-private partnerships – partnership between the public sector (government) and the private sector or private businesses or enterprise

relay cropping – a kind of multiple cropping in which the second crop is started amidst the first crop before it has been harvested

residual slurry – leftover waste

row intercropping – growing two or more crops at the same time with at least one crop planted in rows

sequential cropping – form of multiple cropping in which crops are grown in sequence on the same field

simultaneous cropping – that in which several crops are all coming forward on the ground at the same time

Shura – a local authority and traditional institution in Afghanistan making decisions for the community, mediating conflict, managing community resources, among others local leadership roles

small and medium enterprises/small-scale producers – (also SMEs, small and medium businesses, SMBs, and variations thereof) are those enterprise whose headcount or turnover falls below certain limits; small though they may be, the sector plays a pivotal role in the overall industrial economy of the country and provide incomes to small resource-poor people and communities

social audit – a method of measuring the extent to which an organisation lives up to the shared values and objectives it has committed itself to through systematically and regularly monitoring its performance and the views of its stakeholders; requires the involvement of stakeholders

social development indicators – measures or data collected for assessing human welfare and wellbeing; the indicators vary in different organisations but overall include progress in the quality of life of the people including their state of health, access to basic social services such as health facilities, education, drinking water, food supply, among others

social structure – how a society is organised, and may be affected by caste, economic class, religious affiliation of people, political beliefs, among other factors

socioeconomic acceptability – the acceptability of a project in terms of economic and social benefits for the people

soil conservation – the set of management strategies for the prevention of soil being eroded from the earth's surface or becoming chemically altered by overuse

soil erosion – the washing away of soil by currents of either water, wind, or snow

soil tilth – refers to the state of aggregation of a soil; aggregates are conglomerates of clay, silt, and sand particles that are held together by physical and chemical forces

stakeholders – persons or organisations who have an interest in, or who have invested resources in, the organisation or project and therefore have a stake in its success or failure

standards and specifications – provide guidance and instruction on how goods and services are to be designed, constructed, manufactured, handled, conducted or tested; specifications outline requirements for specific products or services, whereas standards provide guidance for more general applications

stationary beekeeping – beekeeping in a permanent place, such as a backyard, a hollow of a tree, or wall hives,

super chamber – a receptacle in which bees store honey; usually placed over or above the brood nest, called 'brood supers'

supply side issues – in the context of renewable energy, these are issues related to the supply of energy requirements, such as availability of alternative energy solutions (wind, solar, hydropower, etc)

sustainable energy solutions – solutions to providing energy that are wise, efficient, and mostly use renewable sources and technologies that provide little or no harm to the environment

swarm – a collection of bees containing at least one queen that split apart from the mother colony to establish a new one; a natural method of propagation of honey bees

topography – mapping the physical features of any locality or region with accuracy; topographic data is data on the physical features (mountains, hills, plains, etc) of an area, region or locality

value addition/ value added – refers to the additional value of a commodity over the cost of commodities used to produce it from the previous stage of production; the contribution of the factors of production, i.e., land, labour, and capital goods, to raising the value of a product and corresponds to the incomes received by the owners of these factors

vegetation – plants in an area including trees, shrubs, grasses, and herbs

velocity of water flow – speed and direction of water flow

venture capital – funds available for start-up firms and small businesses with great business potential

water erosion – the detachment and removal of soil material by water, that wears away the earth's surface

wildlife diversity – in the beekeeping context, this is the variety of wild plants

Annexes

Annex 1: Links to Organisations

For further information

International Centre for Integrated Mountain Development (ICIMOD)
GPO Box 3226, Kathmandu, Nepal
www.icimod.org

Aga Khan Foundation
H # 43 S#13 Wazir Akbar Khan
P.O.Box# 5753, Kabul, Afghanistan
www.akdn.org/afghanistan.asp

CRS Afghanistan Programme
Kabul, Afghanistan
http://crs.org/afghanistan/

Ministry of Agriculture, Irrigation and Livestock (MAIL)
info@mail.gov.af
http://mail.gov.af
www.agriculture.gov.af/english/English.htm

Ministry of Energy and Water
Darulaman Road
Kabul, Afghanistan

Apiculture Resource Centre
Ministry of Agriculture and Livestock
Kabul, Afghanistan

Annex 2: About the Contributors

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