Best Practices
using
Indigenous Knowledge

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(editors)

Photographs on front cover:

- Man manufacturing rattan handicrafts, China
  – Centre for Biodiversity and Indigenous Knowledge (CBIK)
- Women with adapted clay pots, Kenya
  – Robert E. Quick
- Traditional healer teaching youngsters about medicinal plants, Suriname
  – Amazon Conservation Team (ACT)

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Note from the editors

Notwithstanding its prominence in mainstream society, western-based formal knowledge remains but one knowledge system among many. Knowledge entails as well indigenous (local or traditional) knowledge systems, also referred to as non-formal knowledge, as well as formal ways of knowing. Acknowledging these 'other ways of knowing' leads to reconsideration of many fundamental notions about development, environmental conservation, heritage protection, and access to information and education.

Indigenous or local knowledge refers to a complete body of knowledge, know-how and practices maintained and developed by peoples, generally in rural areas, who have extended histories of interaction with the natural environment. These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, practices for using resources, ritual, spirituality and worldview. It provides the basis for local-level decision-making about many fundamental aspects of day-to-day life: for example hunting, fishing, gathering, agriculture and husbandry; food production; water; health; and adaptation to environmental or social change.[1] Non-formal knowledge—in contrast to formal knowledge—is handed over orally, from generation to generation, and is therefore seldom documented.

This publication, the second co-product of Nuffic's Indigenous Knowledge (IK) Unit and UNESCO's Management of Social Transformations Programme (MOST), is a contribution to global efforts to document local or indigenous knowledge before it is lost forever. By means of this publication various local communities and individuals are able to share and transfer their knowledge, experience and expertise. The practices they describe are for the most part illustrations of the intrinsic value of indigenous knowledge as it is used in its specific local setting. They are examples of strategies to help people—often members of ethnic minorities—in their daily struggle for

[1] See also: Nakashima, D.J. 2000. 'What relationship between scientific and traditional systems of knowledge?' pp. 432-444. In: Ana Maria Cetto (ed.), 'Science for the Twenty-First Century: A new commitment', Paris, UNESCO.

survival and development, and in their efforts to gain recognition for their cultural identity.

Using indigenous knowledge in development enterprises enables indigenous peoples and local communities to actively participate in the decision-making process. IK is a powerful resource of rural peoples and therefore a key element in the fight against poverty and social exclusion for many rural communities worldwide.

During the second phase, which started in June 2001, Nuffic selected 22 'Best Practices' in the field of Indigenous Knowledge. We call them 'Best' Practices because we consider them to be successful initiatives or model projects which make or have made an outstanding, sustainable and innovative contribution to improving the livelihoods of local communities.

Besides documenting IK as a valuable source of knowledge, the cases provide alternative solutions that can improve development planning by providing policy-makers and development practitioners with deeper insight into the many different aspects of sustainable development and the interrelated role of local peoples and their cultures. If the cases are held up as examples, as sources of inspiration, planning can be based on what really works in daily practice.

Since the first publication, three years have passed. We can conclude that the first phase contributed to increasing IK-related activities and cooperation in different regions. Other databases of good practices making use of IK have been published, for instance. We consider this to be a confirmation of the growing interest in documenting, studying and discussing the role of IK on a global scale. In relation to these developments in the field of IK, discussions regarding the protection of such knowledge systems have gained equal momentum. These have included debate on Intellectual Property Rights (IPR).[2]

At the same time, the editors are aware of the implications of improving access to IK practices. Storage in databases or registers like the ones we are

[2] Generic name for intellectual property rights, covering patents, copyrights and trademarks.

presenting now makes the 'misuse' of IK, or 'bio-piracy', much easier. To combat this obviously objectionable practice, we have specifically focused on describing the local context of the practice and the organizations and peoples involved. In doing so, we also have established a record of the rightful 'owners' of the practices while stressing the importance of a contextual approach.

We have found it encouraging to observe that, over the past ten years, there has been growing interest in the role that indigenous knowledge can play in truly participatory approaches to sustainable development. Many case studies and research projects have shown that there are no general technical western solutions for solving specific local problems. New insights reveal that development interventions have failed to induce people to participate because these interventions have lacked both the will and the instruments to allow people to use their own knowledge. It is our conviction that greater efforts should be made to strengthen the capacity of local people for developing their own knowledge base, and to develop methodologies that promote activities for improving livelihoods in a sustainable way.

This publication could not have been completed without the help and support of many people. First of all we wish to thank all the contributors who were willing to share their practices, experiences, thoughts and ideas with us and with the wider public. All cases are published with full consent of the people involved. In essence, this is their publication and database, an achievement in which Nuffic and UNESCO/MOST have played merely a facilitating role.

We would like to thank all the peer reviewers for taking the time to read the practices and for providing comments and critical remarks. Thanks also to the colleagues of Nuffic's IK Unit for their indispensable administrative and technical support, and to Nuffic's language editor Marilyn Warman for her never-ending patience in rephrasing and refining the texts.

Karin Boven
Jun Morohashi

The Hague, Paris, November 2002

Part 1

1. INTRODUCTION

1. INTRODUCTION

1.1. Cooperation in the field of indigenous knowledge

In 1998, UNESCO's Management of Social Transformations Programme (MOST) and Nuffic initiated cooperation in the field of Indigenous Knowledge (IK). The aim of their collaboration was to add IK as a theme to the Best Practices database. They succeeded in 1999. The first phase of the project resulted in 27 Best Practices involving IK: 27 cases illustrating the good use of IK in the development of cost-effective and sustainable strategies for poverty alleviation and income generation. The cases came from Africa, Asia, Europe and Latin America. The second phase (2001-2002) resulted in 22 Best Practices from Africa, Asia and the Americas.

1.1.1. Nuffic

Nuffic (The Netherlands Organization for International Cooperation in Higher Education) is a non-profit, professional organization aimed at making education accessible all over the world, especially in countries where educational infrastructure is lagging behind. One of Nuffic's main areas of activity is development cooperation, with a focus on the development of human resources and institutions. Nuffic's ultimate aim is to contribute to cultural, economic and political development throughout the world. To these ends, Nuffic's Department for Human Resource and Institutional Development advises government agencies, donor organizations and institutions of higher education and research; manages fellowship programmes and programmes that support inter-institutional cooperation; and works to enhance the international dimension of Dutch higher education.

The Indigenous Knowledge (IK) Unit is a section of the Department for Human Resource and Institutional Development. Its work is related to Nuffic's position as an international centre of expertise on IK. In the international world Nuffic has gradually established a name for itself in the field of Indigenous Knowledge Systems (IKS). Nuffic is part of a global network and a partner in international contracts involving local knowledge, higher education and development. Nuffic's IK Unit manages several externally funded projects.

Nuffic also acts as a specialized clearing house for IK. It facilitates efforts to make information on IK available at the interface between policy development, research and development cooperation. In the last ten years Nuffic has helped to set up and maintain an international network for the exchange of information about the application of IK for the benefit of development experts and scientists. Among other things, the IK Unit produces a newsletter called Indigenous Knowledge World Wide (IKWW) and publishes the IK Pages online.

In the coming years the global IK network will gradually be decentralized as Nuffic transfers its IK-related activities to several IK resource centres or other relevant organizations in different regions in the South.

Nuffic is based in The Hague, The Netherlands. For more information about Nuffic and its IK-related activities, please see: www.nuffic.nl/ik-pages

1.1.2. UNESCO/MOST

UNESCO's Management of Social Transformations Programme (MOST) started in 1994. It was designed as an experience in social sciences that was innovative in several respects: i) it was the first intergovernmental social science research and policy programme to be created in a UN Specialized Agency; ii) it aimed at fostering interdisciplinary and comparative research on important areas such as multicultural societies, international migrations, cities and urbanization, local-global linkages, poverty, governance and sustainability, that was defined to be truly international by design, conceptualisation, methodology and participation, and iii) its over-arching long-term objective was to enhance the linkages between social science research and policy-making, as well as various social and economic actors, such as NGOs, the media and the private sector.

The major modality for developing the programme was the setting up of large regional and international networks involving researchers and various users of social sciences. Also, MOST has been participating in more operationally oriented development projects, providing expertise in its domains as well as engaging in capacity-building.

The MOST Clearing House is the Programme's Internet site (www.unesco.org/most). It offers up-to-date information on the Programme's

projects, publications, activities and databases, including the Best Practices Databases (www.unesco.org/most/bphome.htm). The site also includes a keyword search facility, an e-mail announcement service, an agenda of events, and a reference service providing links to the partners in the Clearing House Network. At present, the MOST Database provides examples of Best Practices for policies and projects in Poverty Eradication, Social Exclusion/Integration, Women and Gender Equality, Urban Governance as well as Indigenous Knowledge.

1.2. Indigenous knowledge

This publication presents Best Practices related to indigenous knowledge, or IK. At present, many definitions are used to explain indigenous knowledge. Reference is made to IK in relation to situations and contexts varying from field practices to methodologies.

As IK is written about, the meaning or definition of the term IK differs, depending on the particular case and on the specific aspects the writer wants to stress. For the people to whom IK is an integral part of daily life, the discussion on how IK is defined is relevant of course but less compelling. They of course have their own words and terms to refer to ancient knowledge, or to particular local practices. It is only when we try to translate these local practices into western terms that we are confronted with the need to choose a certain definition, and we see how difficult it is to give voice to a worldview, which is sometimes completely different from our own.
In this publication we do not prefer one definition over the others. Just as the 22 cases differ (by country, by region, by subject, etc.), so will the definitions of IK in the various contexts.

IK can refer to the knowledge belonging to a specific ethnic group, for example: ‘Indigenous knowledge is the local knowledge that is unique to a given culture or society. It is the basis for local-level decision-making in agriculture, health care, food preparation, education, natural resource management, and a host of other activities in rural communities.’ Another useful definition is the following: ‘Indigenous knowledge is the information base for a society, which facilitates communication and decision-making. Indigenous information systems are dynamic, and are continually influenced by internal creativity and experimentation as well as by contact with external

systems.'[3] Or: 'Indigenous knowledge is the knowledge that people in a given community have developed over time, and continue to develop. It is based on experience, often tested over centuries of use, adapted to local culture and environment, dynamic and changing.'[4]

IK may be related to a common practice seen in communities that are indigenous to a specific area. Or the focus might be on the long history of the practice, in which case it is often called 'traditional knowledge'. The following definition is a combination of these different aspects: 'Indigenous knowledge, also referred to as traditional or local knowledge, refers to the large body of knowledge and skills that has been developed outside the formal educational system. IK is embedded in culture and is unique to a given location or society. IK is an important part of the lives of the poor. It is the basis for decision-making of communities in food security, human and animal health, education and natural resource management.'[5]

Analysis of this selection of definitions reveals that several interrelated aspects appear to be more or less specific to IK. IK is:

- Locally bound, indigenous to a specific area.
- Culture- and context-specific.
- Non-formal knowledge.
- Orally transmitted, and generally not documented.
- Dynamic and adaptive.
- Holistic in nature.
- Closely related to survival and subsistence for many people worldwide.

The Best Practices presented in this publication are diverse and a reflection of the broad and diversified character of IK.

[3] See Flavier et al. 1995:479.

[4] See IIRR, Philippines, 1996. 'Recording and using indigenous knowledge: a manual'.

[5] World Bank website text. See: www.worldbank.org/afr/ik/index.htm

2. METHODS AND PROCEDURES

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2.1. IK sources

In its search for Best Practices using IK, Nuffic consulted the global IK network. Research institutions and NGOs working in the field of IK were requested to submit practices. Experts listed in the IK database were asked to share their experiences, and authors of articles in the former Indigenous Knowledge *and* Development Monitor (the IK&DM)[6], were requested to convert their data into the format of a Best Practice. A call for submission of Best Practices was published in the IK&DM and in Source Weekly, the newsletter of the International Water and Sanitation Centre (IRC) located in Delft, The Netherlands.

Various mailing lists were used as potential sources[7], and individuals on the lists who were working on a specific topic were targeted. Other sources that were mobilized were the UNESCO/MOST Internet site, the IK Pages on Nuffic's website, the Global Development Gateway (GDG)[8] of the World Bank, and other potentially relevant websites.

2.2. Guidelines

A set of guidelines (see Appendix, paragraph 7.1) was used so that information would be presented in a way compatible with the UNESCO/MOST Best Practices format. During the first phase of the project, we were confronted with the unique characteristics of indigenous knowledge. Due to the technical requirements of the database used during the first phase of the collaboration, the Best Practices were described according to a rigid and fixed format. This format did not leave much room for narrative descriptions, and did not do justice to the unique characteristics and dynamics of IK. IK should be understood in a holistic manner, which precludes an all too strict format. One of the major problems encountered was that it is difficult to describe practices which are specific, flexible and

[6] Nuffic's journal the IK&DM ceased to exist in 2001 and was replaced by the newsletter Indigenous Knowledge World Wide (IKWW).

[7] Africadiv; ICT indigenous; IH-L; INEF; Indknow; Phytomed-L; EVM; HIF-net.

[8] www.developmentgateway.org/node/130646/

dynamic in nature, while following a fixed set of questions. This confirmed the fact that IK practices cannot be converted just like that to fit our western notions of data classification. Moreover, the format dealt only in a fragmented way with a number of interrelated aspects inherent to indigenous knowledge. The format seemed to favour practices in the form of projects or programmes, whereas it should also leave room for describing practices of a different nature: approaches, methods, and training, for example.

Well aware of these difficulties at the start of the second phase, we adapted the guidelines. The new format provided more room for a narrative description of an IK practice. The context in which the practice is applied is addressed more prominently, and there is more attention for socio-cultural dimensions and variation in the dissemination of IK. Overall, the nature of the practices is more diversified than in the first phase, as it also includes methods and approaches.
We specifically asked the participants to describe the local or regional context, as an introduction to the practice. The results give an indication of the potential contribution of indigenous knowledge to development.

2.3. The assessment process

To see whether they would qualify as a 'Best Practice', all the submitted cases were assessed by Nuffic as well as by independent experts (for a list, see Appendix). Although IK has proven its value in many cases, it cannot and should not be promoted without first being critically assessed. Not all IK offers sustainable solutions to pressing problems of today.

All the questionnaires that were sent in were first screened by Nuffic to make sure that the information was complete and that the practice met the general criteria. If there was any doubt, the contact person was asked to provide additional information. If the information did meet the basic requirements, it was assigned thematic keywords from the OECD Macrothesaurus, the UN guide for information processing in the field of economic and social development.[9] The case was then sent to the language editor, in order to make the text easier to read for the reviewer. The reviewer–an independent referee, considered to be expert in a field relevant to the proposed Best

[9] United Nations–Organization for Economic Co-operation and Development. UN-OECD, Paris 1998, 5th edition, updated by Anne Di Lauro and Alice Watson.

Practice–assessed the case, and advised Nuffic whether or not additional information was needed to make the description suitable for submission to UNESCO/MOST.

After completion of this phase the practice descriptions were sent back to the contact person for comment, together with the remarks of the peer reviewer. The authors' comments were integrated into the text. The description then went to the language editor again. The final version was sent back to the contact person one more time to make sure that nothing of the original intent had been lost along the way.

During the second phase twice as many cases were submitted as during the first phase (approximately 60 cases compared with 30 cases in 1999).

The main characteristics of the Best Practice project, as formulated during the first phase of the collaboration, were still valid (with some adaptations) in the second phase.
In the register of the UNESCO/MOST programme, Best Practices using IK have the following characteristics:

- They are innovative. (A Best Practice has developed new and creative solutions to common problems of poverty and social exclusion.)
- They make a difference. (A Best Practice demonstrates a positive and tangible impact on the living conditions, quality of life or environment of the individuals, groups or communities concerned.)
- They have a sustainable effect. (A Best Practice contributes to sustained eradication of poverty or social exclusion, especially by the involvement of participants.)
- They have the potential to be a source of inspiration to others. (A Best Practice could serve as a model for generating policies and initiatives elsewhere.)

Good communication was essential throughout the entire project. In all cases, communication was very much facilitated by e-mail–this in contrast to the first phase of the project (1998-1999) when communication was by fax or –more often–by telephone. The improved access to Internet facilities within the space of only three to four years–also in the South–proved to be a large step forward for cooperation between partners in North and South.

2.3.1. Best, good or bad practices

The idea of a Best Practices Database is based on the observation that carefully documented case histories can provide excellent guidelines for policy-making and for planning new projects in various areas such as poverty alleviation, local development, social integration, etc. The aim of Nuffic and the MOST Database of Best Practices using Indigenous Knowledge is to encourage researchers and policy-makers to incorporate indigenous knowledge into their project proposals, feasibility studies, implementation plans and project assessments, and to take indigenous knowledge and practices into account in all activities affecting local communities. In gathering this information, we did not go into the details of each practice (for example by giving the technical specifications of a clay pot or a fish-trap). Instead we focused on the ways that the practice has been adapted and applied as well as on the way the knowledge is transferred and disseminated. Many people are working on projects in which IK plays an essential and practical role. It is very important that information about these kinds of projects is made available worldwide so that other people can learn from the experiences.

Calling the practices 'Best Practices' is to suggest that they could be replicated (not without compensating the 'knowledge owners', however), that ideas could be generated from them, and that they can and should contribute to policy development and development practices.
But calling the practices 'Best Practices' could at the same time falsely suggest that there is an element of competition in this project. On the contrary, there are in principle no winners or losers. For this purpose the cases would be too difficult to compare, different in character as they are. Some practices refer to projects using indigenous knowledge rather than to the knowledge itself; others to methodologies or concrete case studies.

Again, the length and the profoundness of the descriptions vary from case to case, depending on the character of the practice, the local context, the amount of information available, but also on the writing skills of the author. Therefore, each case stands and speaks for itself.

Although many cases failed to meet the above criteria and have therefore not been included here, none of the cases that were submitted could be called

'bad practices'. Some of them in fact were worthwhile enough to warrant presentation under a separate category called 'IK-related cases'. Ten such descriptions were published in the IKWW newsletter throughout the course of 2002.

2.4. Dissemination

In addition to being presented in this publication, the practices have been added to the existing IK database which is available on the website of UNESCO/MOST: www.unesco.org/most/bpindi.htm
A special link to this register can be found on Nuffic's IK Pages at: www.nuffic.nl/ik-pages

The publication resulting from the second phase was announced in the IK newsletter, which Nuffic publishes both in printed form and on the Internet (see: www.nuffic.nl/ik-pages/ikww/).

3. DESCRIPTION OF THE PUBLICATION

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3.1. Sorts of information

This publication has three main parts.

1. The first part, made up of the first three chapters, provides background information on the project and the cooperating institutions, on IK in general, and on the collection process.
2. The second part (Chapters 4 and 5), which forms the main body of the publication, consists of the register of 22 Best Practices, arranged by continent and by country. As a final chapter within this second part, a synthesis is presented in which the practices are commented upon by the editors.
3. The third part consists of the indexes (Chapter 6). These enable the reader to search the information related to the Best Practices by subject and by geographical location. In the index the practices are arranged:
   - By country.
   - By Macrothesaurus subject category (for example Agricultural production, Fishery or Forests).
   - By keyword derived from Macrothesaurus subcategories (for example Agricultural development, Fishery equipment or Forest products).
   - By institution or organization involved in the practice.

3.2. Presentation of information

The Best Practices are presented by continent (Americas, Africa, Asia) and by country. The information on each practice is presented under the following headings and sub-headings:

1. *Country*
   Some countries are represented by several cases.

2. *Code number*
   Each practice is headed by a code number: from BP.1 to BP.22. The same code numbers are used throughout the document and database,

and practices are always referred to by their code number (for example: 'See BP.14').

3. *Title and subtitle*
   If the title did not sufficiently cover the content of the practice, a subtitle was added.

4. *Themes*
   The subject or subjects of the practice are indicated as its main themes. The choice of themes was based on information submitted by the authors and on the Nuffic team's analysis of the text. The themes themselves are derived from the OECD Macrothesaurus. The indexes (Chapter 6) also list the more detailed sub-headings (the specific keywords).

5. *Introducing the practice*
   The practice is described mainly in terms of the specific location and local context and the socio-cultural features. The time of the year when the practice takes place (seasonal, year-round) is indicated, as are its origin and the degree to which it remains current. The specific information on the local context was provided by the author of the case and has been edited only slightly. The style of the descriptions varies, as does the number of aspects described.

6. *Content and approach*
   This section indicates the purpose of the practice and the way the practice is carried out. In short, it answers the question, 'What is it meant to achieve?' Information about the people involved in the project is also presented here.

7. *The role of indigenous knowledge*
   This section shows the specific indigenous aspects of the practice, with special attention for the added value of IK. Information is given on how the practice relates to the socio-cultural values of the community. It is also mentioned whether or not the knowledge has been recorded or documented, and how the transfer of knowledge takes place.

8. *Achievements and results*
   In this part, the author explains why the case can be considered a Best Practice. This is done in terms of the main set of criteria, paying attention to such aspects as sustainability, innovation and cost-effectiveness. The strengths and weaknesses of the practice are analysed. These 'lessons learnt' are valuable for those who are inspired by the practice. Finally, the author discusses the case's potential for fostering development.

9. *Source of inspiration*
   This section indicates the potential for, and possible experiences with, applying all or part of the practice in other regions and to other topics. This information is provided by the authors and in some cases also by the peer reviewers. Within this section we stress the need to consult and consider the local communities involved in the practice, in relation to Intellectual Property Rights and ownership in general.

10. *Additional remarks and information*
    This heading offers a place for specifying publications and websites and for providing other relevant information relating to the practice.

11. *Administrative data*
    Here administrative information is presented about the organization or organizations involved and—if relevant—the names of the cooperating organizations are given. The name and address of the contact person (in most cases the author) is also given. The total budget available for the project or practice is indicated in US dollars (USD). If this is omitted, it means that we did not receive any financial information. Finally, the name (and address) of the person who has described the Best Practice is presented.

    The names and addresses of all persons and organizations involved are listed in the index (Part 3, Chapter 6).

3.3. Geographical setting of the cases

Ten practices are set in Africa. Next comes Asia with seven cases, followed by the Americas with six. The fact that in this second phase no cases are presented from Europe is purely coincidental. It is striking that three cases

are from Burkina Faso, while two of them even have the same subject, namely the *Zaï* practice. The decision to present two cases with the same subject was deliberate, since they illustrate so nicely how differences in descriptions by different authors can result in completely different cases.

Africa	
Benin	1
Burkina Faso	3
Ethiopia	1
Kenya	1
Nigeria	1
Senegal	1
Tunisia	2
Sub-Total	10
Asia	
Bangladesh	1
China	1
India	1
Indonesia	1
Papua New Guinea	1
Vietnam	1
Sub-Total	6
Americas	
Bolivia	1
Canada	2
Mexico	1
Peru	1
Suriname	1
Sub-Total	6

Table 1. Number of practices by continent and country

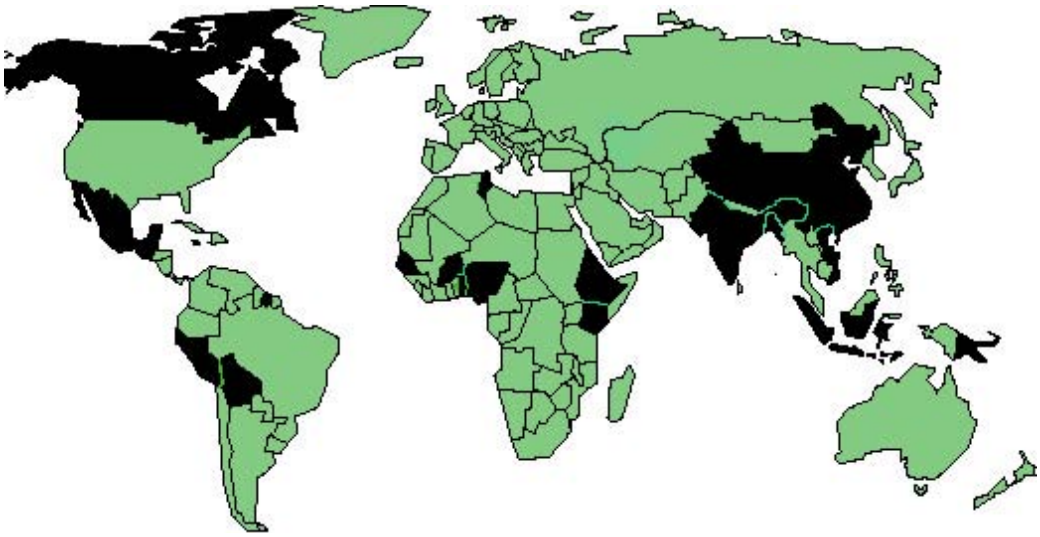

Figure 1. Distribution of the Best Practices according to countries of origin

Part 2

4. REGISTER OF BEST PRACTICES

Africa
Asia
Americas

AFRICA

Kenya
Burkina Faso
Nigeria
Tunisia
Benin
Ethiopia
Senegal

Kenya	BP. 01

Title

The use of locally produced clay pots modified for safe storage of drinking water in the home–a component of CARE Kenya's Nyanza Healthy Water Project

Themes

Community health, drinking water, health, pottery, water storage

Introducing the practice

This practice has been developed in three districts of Nyanza Province in Kenya: Homa Bay, Rachuonyo, and Suba. The major ethnic group are the Luos, who live on the shores of Lake Victoria, one of the largest fresh water lakes in Africa. The climate is hot and the population density very high. The main water sources are lakes, rivers and earth-pans, which are normally heavily polluted.

The main livelihood systems are subsistence farming, petty trading, agricultural wage labour, and small-scale commercial fishing. Local infrastructure and access to services is poor. CARE's 1996 and 1999 assessments found that only 34% of the population has access to safe drinking water and the incidence of diarrhoea among children is 47%. Poor sanitation, poor nutritional standards, high prevalence of STDs/HIV/AIDS, low food production, and lack of access to credit are all common in this area.

Traditionally, as in many parts of the developing world, people in these communities have stored drinking water in locally produced wide-mouth clay pots. The baseline survey indicated that over 90% of the residents use these pots, which have an evaporative cooling effect on the water, thus the high preference.

Water is drawn from the pots using a calabash or a cup. Often the cups, or the hands holding them, are contaminated. As a result, the water is contaminated and those who drink it become infected. Water contamination during storage and handling has resulted in diarrhoeal diseases, a problem that is further aggravated by poor water sources. Because the people were not

willing to change to plastic vessels designed to reduce or eliminate post-contamination, local potters, with technical assistance from the Nyanza Healthy Project team, began to produce modified clay pots. They fitted the conventional pots with a narrow mouth, a spigot, a lid and a flat base for easy water extraction. There is a space to retain sediment and the water is treated, stored and accessed through the spigot.

The technology to produce the pots relies on the indigenous skills of local potters. The modification is not a major deviation from the conventional pot; its original colour, form and function are maintained. Up to 90% of the raw materials are natural and available locally, while the others are available in local shops and markets. The modified pots are very popular with the local people. They can still store their water in the traditional way, which keeps the water cool and improves its palatability, while the modified design prevents the transmission of disease.

The practice of mounting taps on clay pots originated in the community and is nothing new. Potters throughout the region do it, although the practice is not widespread. Most pots with spigots were made in response to special orders from customers. The potters fix taps on the traditional, wide-mouthed pots for the same reason taps are mounted on the new pots: to make it easier to extract water. The only technical aspects that did not originate locally are the modified features, such as the narrow mouth with a lid, and the sedimentation pouch. These suggestions were made by the project team to make the pots technologically effective in preventing post contamination, while remaining acceptable to the local people.

This practice is ongoing. It started in February 2001 as an alternative component of the CARE Kenya Nyanza Healthy Water Project.

Content and approach

The purpose of the modified clay pots is to minimize the re-contamination of treated water during storage, and thus to reduce the incidence of waterborne disease transmission, which usually takes the form of diarrhoea in children under five years old. This purpose is served whilst retaining an aspect of traditional culture–the storage of drinking water in clay pots.

The modified pots are produced by a local women's pottery group. During the testing period, the improved pots were produced for distribution by the project, but more recently the women have been allowed to produce and sell directly to consumers (households) in the surrounding local markets, along with their other clay products. Ultimately, it is up to households themselves to buy and use the pots. In most cases, the mother of the household is responsible for the practice. All members of the household benefit from drinking safe water but the largest impact is expected in children under five years of age, as this group suffers most from diarrhoeal disease.

The pots are manufactured and sold to the community at an affordable price. This is an income-generating activity. At the household level, the water is treated with a sodium hypo-chlorite solution and stored in the pots. When the pots are empty they are cleaned with sisal or twine and sand and refilled. The project helps the producers to reach the consumers through hygiene education, social marketing and a community mobilization approach.

CARE uses social marketing techniques to promote the use of modified clay pots for the safe storage of water. These consist of football tournaments, puppet shows, posters, brochures and participatory educational theatre. After disseminating information about the pots, CARE uses a community-based distribution network to make them accessible and affordable to rural residents in the target area.

The role of indigenous knowledge

The community's indigenous knowledge was the primary factor in the design and production of the modified clay pots. Because the pots were produced locally, they are widely accepted by the population. The long experience of the potters helped them learn how to place a spigot in the pots.

The modification of the pots does not affect the long tradition in the community of using clay pots as storage vessels for drinking water, which has been passed on from generation to generation, since the pots maintain their original form and function. They still keep the water cool and improve its taste, as they always have. Clay pots are valued assets in households. This is evident in the careful way they are handled and maintained. Once a pot is bought it is used for as long 20-30 years without replacement.

The transfer of knowledge

The knowledge needed to make the modified clay pots resides primarily with the specialists, in this case the potters. The potters are paid for the pots they sell.

Young girls develop an early interest in making pots; they play with clay while their mothers mould pots, and they gradually learn to mould pots themselves. In every village there is at least one specialist who is able to transmit the skills to young, newly married women in the area who are interested in becoming potters. The potters do not record or document their knowledge at all, but pass it on informally from generation to generation.

Achievements and results

This is considered a Best Practice because it facilitates safe storage and reduces the diarrhoeal disease caused by the re-contamination of drinking water. Because the practice of making modified clay pots is based on indigenous knowledge, it is cost-effective. It is a technology that the community adopts easily because the modifications are compatible with the original product. The changes are minimal but vital for the effectiveness of the practice. There is evidence that this, by itself, would be effective in preventing disease transmission. Treating the water with sodium hypo-chlorite is clearly not indigenous. CARE Kenya is promoting both strategies, safe storage in locally produced clay pots and treatment with locally available sodium hypo-chlorite solution, to maximize the potential for disease prevention in communities with high rates of diarrhoea. This is necessary because the water in this region is highly turbid. The organic material in the water eventually settles in the bottom of the pot, but below the tap. This allows the water to exit through the tap. The promotion of both the sodium hypo-chlorite for water treatment and the design modification to raise the taps to allow for sedimentation are intended to improve local technology and increase the potential for disease prevention.

The 1% sodium hypo-chlorite solution is manufactured by a private Kenyan company and packaged in a bottle with an 8 ml cap that serves as a dosing device. The pots are cleaned with sand and sisal, a locally available fibre used to make ropes and commonly used for scrubbing dishes. The project uses hygiene education, social marketing, and community mobilization techniques to assist the potters in teaching buyers how to clean the pots

properly. However, the practice of scrubbing clay pots with sisal is indigenous to these communities.

When modified pots were introduced in the communities, demand for them was overwhelming. So far 180 pots have been sold. A traditional clay pot costs around two dollars while a modified one costs around four dollars. The target groups are poor families and yet the higher price did not stop them from replacing their old pots. This shows the value which the local people attach to the improved pot. They recognise its health benefits, particularly after publicity sensitised them to the issue. This practice facilitates the effective des-infection of water with chlorine over a period of time.

The population was monitored for diarrhoea for eight weeks to determine the health impact of the intervention. This data is still being analysed.

The practice is sustainable, cost-effective and locally manageable. Because the modified clay pots are sold (and not given away) to families, they are a source of revenue for the potters. As long as there is a demand for the pots, the activity is sustainable. Second, the clay pots are affordable for the average rural Kenyan family. For a small amount of money, a family can store water safely and thus prevent disease. The cost of missing work due to illness far exceeds the cost of the pot. Thus, the strategy is cost-effective. Third, the activity is locally manageable because the skill and materials for making the pots come from the community. Nothing external is needed for the production and sale of the pots. Local people benefit from this approach in two ways: first, households are able to access a tool that enables them to store water safely and thus to reduce the incidence of diarrhoea; and second, the approach promotes economic activity in the community as the pots are produced and sold by local pottery groups.

Strengths and weaknesses

This practice offers a safe way to store water in the home without a drastic change from the traditional method. The changes to the pots are small, but important. The opening is narrower, with a lid, and there is a spigot. In addition, the modified pot does not cost significantly more than the traditional pot. It also provides an extra way for local potters to generate income.

One potential weakness of the modified pot is that, for the poorest families, the small increase in price makes it slightly expensive. Often these are the families with the greatest exposure to diarrhoea risks. The pots are also fragile and need to be handled with extra care. Lastly, because the moulding is done manually, the pots are not of a standard size.

Safe water storage is one way of providing households with safe water. When combined with treatment with a disinfectant such as sodium hypo-chlorite the benefits in reducing waterborne disease are greatly enhanced. The practice can be improved further by developing a mould to help standardise sizes, synergising safe storage with water des-infection, and a behaviour change to maximise the health benefits.

Source of inspiration

This practice is applicable anywhere where clay pots are used for storing water in the home. The only local adaptations that would be needed are knowledge of the design modifications to make the pots safer for water storage. The availability of spigots would also have to be ensured.

Replication in terms of usage is very high. People from neighbouring villages have been flocking to the villages where the project is active to purchase the pots and are already using them. This has happened without intervention from CARE.

Replicability in terms of production has not yet picked up momentum. The groups wishing to manufacture the modified pots will need some training on workmanship, e.g. how to fix the taps, get the size right and narrow the mouth. This training is still under way.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

In the communities where this project is currently being implemented, the geology is such that improved water points, such as wells, are not feasible. Most people get their water from hand-dug earth-pans, ponds, rivers, or Lake Victoria. As a result, the only way the population can have potable water is

to store it safely in the home. In communities such as these, where the only water source is contaminated surface water, policy makers should promote household treatment and safe storage. However, even in communities with improved water sources, if water is stored in the home, safe storage and household treatment is necessary.

The project is currently grappling with the problem of producing moulds that potters can use to produce pots with standard volumes. We are interested in pots of 20 litres and 40 litres. So far, it has proved difficult for the potters to consistently mould pots with these exact volumes.

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Title

Namwaya Sawadogo: the ecologist of Touroum, Burkina Faso [10]

Themes

Agroforestry, composting, mixed farming, natural resources, resource management, silviculture

Introducing the practice

Namwaya Sawadogo started as a petty trader. Through great innovative energy and with the support of development agents who recognized his potential, he has managed to establish a highly integrated system of agro-sylvo-pastoralism.[11] He is now a widely known innovator in Burkina Faso and has received many visitors, including the Minister of Agriculture.

Namwaya Sawadogo was born in 1943 in Touroum, a village located in Pissila Department in Sanmatenga province of Burkina Faso. He has three wives and 12 children, but has to feed another five relatives, which means that he supports a total of 20 persons. His farm covers 14 ha, almost three times more than the average farm size in this area. He keeps four cattle, 15 sheep, nine goats, one horse, one donkey and poultry (chickens and guinea fowl) near his home, and owns another 15 head of cattle, which are cared for by Fulani pastoralists. He has therefore become a rich man compared with most Burkinabé farmers, but when he started farming in this area, he had only a few guinea fowl, one donkey and 1 ha of land–not enough to feed a family in this semi-arid climate with only about 600 mm annual rainfall. Namwaya has developed or taken up several new ideas related to land husbandry, but his major innovation is that he has become a forest farmer. Over the years, he has established a eucalyptus plantation covering 4 ha, in

[10] This case is an adapted version of an article published in: 'Farmer Innovation in Africa. A source of Inspiration for Agricultural Development'. Chris Reij & Ann Waters-Bayer (eds.), 2001. Publisher: EARTHSCAN, Earthscan Publications Ltd, London (UK) / Sterling, VA. www.earthscan.co.uk

[11] A combination of cultivation, tree farming and livestock keeping.

order to produce timber for sale. The wide spacing of the trees allows him to grow groundnuts or other annual leguminous crops in between.

For the last ten years, he has not been obliged to buy grain for his household, not even in the years of drought. When he could not produce sufficient grain himself, he would cut down some trees and sell them on the market in order to raise cash to buy food. In a year of 'normal' rainfall, Namwaya harvests about 8000 kg of millet and sorghum, which means that he normally produces a substantial surplus. Namwaya has a shop on the market of Pissila, about 10 km from his home, where he sells medicinal plants on the weekly market day. He also earns income from the sale of livestock, cereals and seedlings.

Namwaya's story

In the 1970s, Namwaya was a small itinerant trader in natural medicines who was constantly on the move. He often did not see his family for weeks or even months at a stretch. However, after he married and became the head of a household, he decided to settle down and concentrate on agriculture, limiting his commercial activities to the village.

In 1982, a government-built dam inundated almost all the fields of the Sawadogo family, which consisted of seven households ('hearths'), and there was land left for only two of them. Faced with this difficult situation, Namwaya decided to move to the periphery of the village where his uncles gave him about 1 ha of reasonably fertile soil. The *chef de terre* (the man traditionally responsible for distributing land) granted him the right also to use the uncultivated poor-quality land surrounding this field if he wished to do so. He cultivated this poor land for several years, but never managed to get a good harvest from it. Even with the 1 ha of good land, he could not produce enough food to feed his household. With his back against the wall, he decided to see what he could do to rehabilitate the poor land.

In 1988, Namwaya started to construct stone bunds along the contours on the poor land. He also planted a perennial grass (*Andropogon gayanus*) along the bunds. Contour bunds made of stones had become a well-known technique in Touroum following its promotion by the Association for the Development of the Kaya Region (ADRK), of which Namwaya was a member. This NGO specializes mainly in savings and credit, but between 1986 and 1998 it was

also very active in the field of soil and water conservation. Through ADRK, Namwaya bought a donkey cart on credit, primarily to be able to transport the stones. The contour stone bunds had some positive impact on yields, but still he could feed his family for only nine or ten months of each year.

Content and approach

The real turning point came in 1990, when government forestry agents proposed to train him in techniques of establishing and maintaining a tree nursery. He had already been trying to raise seedlings before this, but he felt that he had not mastered the techniques adequately, so he gladly accepted their offer and attended a short training course. At the same time, he tried to expand his cultivated area by applying mulch to part of his barren, degraded land. In 1990, for the first time since the dam had inundated the family fields in 1982, his fields produced enough millet and sorghum to feed his family for the entire year.

In 1991, Namwaya established a tree nursery next to the dam and produced 3000 plants in that same year. He planted 1 ha of relatively good land with a combination of locust-bean trees (*Parkia biglobosa*) and *Faidherbia* (syn. Acacia) *albida*, and intercropped the young seedlings with millet. On three sides of his field he planted a live fence composed of several local woody species that he could use for different purposes (fodder, medicines, etc.) in addition to protecting his field. This was his start as an agroforester. In 1992, however, most of the planted trees died. He decided to replace them with eucalyptus (*Eucalyptus camaldulensis*) trees. Also in this year, Namwaya dug his first compost pit. Both ADRK and the government extension service were promoting this technology. He used his donkey cart to transport water to the compost pit from the dam reservoir about 5 km from his farm.

In 1993, Namwaya doubled the size of his eucalyptus plantation, growing the trees in lines about 8 metres apart so that he could grow crops in between. That same year, he also planted eucalyptus on 2.5 ha of ancestral lands in Touroum that had been given to him by his mother's brothers. In 1994, after having been trained in animal husbandry through ADRK, he started applying what he had learned to his own livestock. He used his own resources to build a shed to store fodder. Also in that year, he took part in an agricultural fair in the regional capital Kaya, where he was distinguished as a model farmer and

awarded a certificate of honour. He then decided to buy a plough with credit from ADRK.

In 1995, Namwaya participated in a study visit to the Yatenga region, organized by ADRK. On his return home, he decided to dig planting pits (*zaï*) in his fields, like the pits he had seen in Yatenga, even though this meant that he would no longer be able to use his newly acquired plough on this land. He started a second compost pit. In 1995, a year of exceptional demand for tree seedlings, his cash income from selling seedlings from his nursery was CFA 600,000 (circa USD 950). This is a remarkable income compared with the estimated average income in Burkina Faso at the time (USD 230). The positive impact of the *zaï* soon became evident. Two years later, there was a serious drought and Namwaya was the only farmer in Touroum who could harvest enough to meet the food needs of the family. He provided cereals to those who asked for his help, feeling that this would morally oblige them to experiment with new practices, as he had done.

The gradual increase in the size of his household over the last decade has enabled Namwaya to invest in the expansion and rehabilitation of land for agroforestry. With three wives and 12 children, many of whom are of working age, he now has a considerable labour force.

An integrated system

Various agricultural technologies are combined on Namwaya's farm: contour stone bunds, *zaï*, barriers made of perennial grasses (*Andorpogon gayanus*), mulching (with cut wild grasses and lopped leaves of the shrub *Piliostigma reticulatum*), and composting. He sows millet and sorghum in the same planting pits as a strategy to reduce cropping risks. The quantity and distribution of rains in any one season determines which of the cereals he will harvest.

Namwaya has mastered all aspects of producing tree seedlings, also of local species. His key to success was his close observation of how the seeds germinate. This helped him to develop his own technical knowledge for treating seeds. Through observation, Namwaya also identified which tree species can be multiplied through root suckers. They include *Faidherbia albida*, tamarind (*Tamarindus indica*), kapok (*Bombax costatum*), *Diospyros mespiliformis, Balanites aegyptiaca* and neem (*Azadirachta indica*). In his

tree plantation, Namwaya prefers to sow nitrogen-fixing annual crops such as groundnuts between the lines of eucalyptus. If he does not grow a crop, he uses this space for grazing. In this case, he just lightly scratches the surface of the soil in order to improve the growing conditions for grasses.

In Namwaya's view, the purpose of livestock is to support crop production by providing organic matter for the soil. In his words, 'There can be no cropping without livestock.' His livestock holdings are diverse: bovines, equines and poultry. His innovations in animal husbandry are of both a technological and an organizational nature. He keeps his cattle, sheep and goats in a stable during the dry season so that he can collect their manure systematically. This means that much extra work has to be invested, especially by his wives and children, in feeding and watering the animals. To be able to feed his livestock efficiently, he has built the large shed for storing fodder immediately next to the stable. This reduces the waste of fodder to a minimum. The two compost pits are immediately next to the stable so that the manure can be diverted easily into the pits. The animals' urine flows through a drain that leads from the stable directly into one of the compost pits.

Namwaya cuts whatever fodder he can find that his animals are willing to eat. His theory is that most fodder species have complementary virtues. Some are good for nutrition, whereas others are good for animal health. During the dry season he feeds his livestock large quantities of ground pods of *Piliostigma reticulatum*. He has produced his own concoctions to treat certain animal diseases. He also produces salt-licks himself, using an extract of *Hibiscus spp*., bark of savanna mahogany (*Khaya senegalensis*), clay from a salty marsh, and salt (NaCl) and natron, both of which are Sahel products sold on local markets.

The role of indigenous knowledge

Namwaya has progressively integrated a number of indigenous practices into his farm and has gradually developed an agro-sylvo-pastoral system. This development was closely linked to the evolution of his own knowledge and to the level of equipment, labour and financial resources at his disposal. Whenever Namwaya started up a new activity, he always looked carefully at how it could be done efficiently in order to minimize costs and labour energy.

The practices are based in the community and they are part of the socio-cultural values and meanings of the people living in the community.

Transfer of knowledge
Namwaya is now a widely known innovator in Burkina Faso and has received many visitors. He has been honoured several times, most recently with a medal at an agricultural fair in Bagré in 2000. He has also been awarded cash prizes at fairs, for example in Ouagadougou in 1994, and in Bogandé in 1998.

The knowledge is known to all members of the community and transmitted within the community and through the Institut National d'Etudes et de Recherches Agricoles (INERA) in Burkina Faso.
His neighbours have started using some of his practices, for example a growing number of farmers have started pruning *Piliostigma reticulatum*. Namwaya also receives many visitors (farmers, agricultural technicians, researchers) and in this way his knowledge and experience is spreading.

Achievements and results
Namwaya's innovations are an example for other farmers who have poor land and only one source of income. In that sense, this case could be considered as a Best Practice.

Namwaya's innovations are sustainable (such as the plant seedlings, better natural resource management), cost-effective (Namwaya now produces enough cereals to feed his family), and locally manageable (he was able to work on his innovations locally, with the help of his family).

In Namway's own words
When assessing the impact of the innovations on his life, Namwaya speaks in terms of his gain in respectability, responsibility and popularity, but also his increased financial capacity and his ability to support those in need. He is proud of what he has achieved and enjoys the higher social status that his achievements bring. His market stall in Pissila, for natural pharmaceutical products, attracts many clients, even from other parts of Sanmatenga province. Namwaya views his trees as a form of life insurance and looks to

the future with much confidence. ‘When I am old, I can live from the income and the products of my plantations.’

The recognition and prizes Namwaya has received have inspired him to continue innovating and have allowed him to invest in both livestock and his ethnopharmaceutical business.

Source of inspiration

It would be possible to transfer the practices, but there would certainly be conditions and prerequisites to consider if they were to be transmitted to other countries and regions in Africa.
Namwaya’s practices are emulated in Burkina Faso.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

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Title

Zaï, an indigenous water harvesting and soil fertility management practice in Burkina Faso

Themes

Natural resources, resource management, soil fertility, soil improvement

Introducing the practice

The method of water harvesting reported here is practised by Mossi farmers in Yatenga Province in the northern part of Burkina Faso, in sub-Saharan Africa. The Mossi are the major ethnic group in Burkina Faso, making up about two-thirds of the total population. They derive their livelihood essentially from agriculture. They also ruled the region for over eight centuries, establishing five independent kingdoms, of which Ouagadougou was the most powerful. Even today, the traditional Mossi chiefs hold significant power in Burkina Faso.

The *zaï* method of water harvesting is seasonal, practised each year as necessary. The method is used to rehabilitate strongly degraded land known as *zî-peele*, which is usually found on relatively flat land on which no crops can be grown.

At the beginning of the dry season, farmers use traditional picks to dig holes 10-20 cm deep and 20-40 cm in diameter. The resulting shallow pits are spaced 80-120 cm apart throughout the area being treated. The earth removed from each pit is carefully piled in a half-moon shape along the pit's lowest edge so that runoff water will flow downhill into the pit. Throughout the dry season, the pits collect sand, loam and other organic materials carried by the wind.

In early May, with the first rainfall, farmers begin to prepare the pits for planting. In each one they put about two handful of organic waste, generally from animals. Attracted by the organic matter, termites dig deep tunnels beneath the pits, which by now are shaped like funnels. Water from the first

rains flow into the termite tunnels, creating pockets of moisture so deep inside the soil that it resists evaporation.

Through the practice of *zaï*, both water and nutrients are concentrated in the pits, where in early June the farmers plant the seeds. The increased water retention capacity of the soils helps crops tide over drought spells during the rainy season. The following year the practice is repeated, except that new pits are dug between the old ones. Within five years, an entire area of land that had been degraded and useless can be totally rehabilitated to produce yields where previously nothing could be harvested.

The practice, documented in the 1980s, originated among Mossi farmers in Yatenga Province. It is a survival strategy in this semi-arid area. *Zaï* is still in use today. In fact, because it is so effective in restoring soil fertility and thus in increasing agricultural production, the practice is expanding. It is now used by many farmers, in particular on the northern part of the Central Plateau of Burkina Faso. Both government and non-governmental organizations support the practice.

Zaï is a labour-intensive technique practised by both men and women. Its three main steps are digging, manuring and sowing.

The role of indigenous knowledge

Local knowledge about soil conditions and about the use of organic materials is essential. All members of the community know how to practise *zaï*. They learn by observation and imitation. *Zaï* is a strategy for survival and thus very important in the lives of the people who practise it. The practice has been documented in writing, and is discussed on radio programmes for farmers, which are broadcast in local languages.

Achievements and results

The practice addresses a major problem, helping to feed the population in a country that is not self-sufficient in basic foods. Recent inquiries among farmers in Yatenga Province revealed that in years when rainfall is average for the area, *zaï* enables them to harvest an annual 500 to 1000 kilos per ha of sorghum, millet, maize or other cereals.

The practice is entirely sustainable, very cost-effective, and easy to manage locally. Local farmers benefit from it directly through improved productivity. The practice has three main strong points:

- It keeps organic waste in the pits, where the most benefit can be derived from it.
- It restores fertility to depleted soil.
- It increases agricultural productivity.

Its only possible weakness is that it is physically demanding, but among the Mossi farmers of Burkina Faso, who are known for being hard-working, this is not a problem.

The practice could perhaps be improved if the farmers had more modern tools for digging the holes, or if *zaï* could be more systematically combined with stone bunds. This combination with another improved indigenous practice designed to slow water runoff would encourage the penetration of moisture into the soil.

Source of inspiration

There is no reason why *zaï* should not prove useful in other semi-arid regions. In 1989, farmers from the neighbouring country of Niger travelled to Yatenga Province to learn how to improve their own planting pits (Reij 1993, IK&DM, Vol. 1, nr.1).

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Administrative data

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Title

Pits for trees: how farmers in semi-arid Burkina Faso increase and diversify plant biomass[12]

Themes

Agricultural development, agroforestry, biodiversity, cultivation practices, desertification, natural resources, resource management, soil fertility, soil improvement

Introducing the practice

In recent years there has been a dramatic increase in the number of trees growing on farmers' fields in certain villages in the Yatenga region of Burkina Faso. This is due in part to the systematic protection of natural regeneration by individual farmers and to the use of improved traditional planting pits, or *zaï*, for growing trees. Through this method farmers have rehabilitated degraded land and increased the diversity of trees.

In Burkina Faso, the fight against desertification is a constant preoccupation of farmers, government agencies, NGOs and development-project planners. The reduction in vegetative cover has reached alarming proportions in the north of the country, leaving the soils exposed to erosion by wind and water. The farmers described in this best practice live in the provinces of Yatenga, Zondoma and Lorum in northwest Burkina Faso.

Rainfall in the region is highly variable. The long-term average for the regional capital, Ouahigouya, was 560 mm between 1950 and 1987. Ouahigouya received 590 mm rainfall in 1997, but it was poorly distributed over the season and the harvests failed. In 1998 rainfall was an exceptional

[12] This case is an adapted version of an article published in: 'Farmer Innovation in Africa. A source of Inspiration for Agricultural Development'. Chris Reij & Ann Waters-Bayer (eds.), 2001. Publisher: EARTHSCAN, Earthscan Publications Ltd, London (UK) / Sterling, VA, USA. www.earthscan.co.uk

969 mm, which led to a good harvest except in low-lying areas. The average population density in this region is 55 persons/km^2. The grazing pressure on the natural vegetation is high; according to the 1992 national livestock census, the Yatenga region had 140,500 head of cattle, 591,500 sheep and 708,100 goats (INERA 1994).

During the dry season, the animals owned by the local farmers depend to a large extent on crop residues for fodder. The traditional practice of fallowing to regenerate soil fertility has disappeared and the possibilities for expanding cultivation to new areas are extremely limited. Rehabilitation of degraded land is the only option left to farmers who want to increase production by expanding their farming area.

During the last 30 years, substantial tree-planting operations have been carried out. Village woodlots have been planted and there have been several national schemes, including the National Village Forestry Programme and, more recently, the campaign entitled '8000 Villages, 8000 Forests'. Millions of seedlings have been planted, but survival rates have been poor. There are many reasons for this lack of success, but the main ones are the poor care of the seedlings after planting, uncontrolled grazing by livestock, cutting of trees to clear land and to obtain fuel, and, in particular, the fact that farmers were not involved in the activities in ways that encouraged them to take responsibility for them.

Content and approach

The practice described here involves the improved use of a traditional technique involving pits known as *zaï*, where naturally occurring seedlings are protected or where seeds are deliberately planted. In Burkina Faso, where the technique originated, farmers are experimenting with it and have managed to re-establish and protect abundant perennial woody biomass on their fields. They have done this by sowing tree seeds, planting seedlings, selectively protecting natural regeneration, and sowing and planting grasses in the pits.

Compared with the early 1980s, there has been a dramatic increase in the number of trees growing on farmers' fields in parts of the Yatenga region. Many farmers have protected naturally regenerating trees but some have also made considerable efforts to grow trees in *zaï*. One example of a farmer-

innovator is Yacouba Sawadogo, in the village of Gourga. He developed the practice of growing trees in pits, but several other farmers can also be considered to be pioneers in this field.

The innovations of Yacouba Sawadogo
In 1979 Yacouba Sawadogo started to use the *zaï* technique to rehabilitate land. At that time, his main aim was to produce more cereals, mainly sorghum and millet. By digging wider and deeper pits and by adding manure to them, he managed to achieve very good yields from fields that had previously been so degraded that nothing could be grown on them. His improvements allowed him to achieve food self-sufficiency for his family. In addition, Yacouba was pleasantly surprised that numerous tree species started to grow spontaneously in the planting pits. The tree seeds had been deposited in the pits by the run-off water, or they were contained in the manure that had been added to the pits. Yacouba decided to protect the young trees. In this way, he discovered the use of pits for growing trees (*zaï* forestier). Already in the first years, the results were spectacular and highly encouraging. His next step was to start collecting the seeds of numerous useful local species of fruit and fodder trees, which he introduced into the *zaï* in the next wet season. These species included sheanut (*Butyrospermum paradoxum var. parkii*), yellow plum (*Sclerocarya birrea*), grape tree (*Lannea microcarpa*) and various acacia species, but also fodder grasses such as Gamba grass (*Andropogon gayanus*) and *Pennisetum pedicellatum*.

Within a few years, the piece of barren land was gradually transformed into a 12 ha forest with a large variety of species. Yacouba then had to make a difficult choice because the trees and shrubs started to compete with his cereal crops. He opted for growing trees. Each year he placed the seeds of desired tree species into the *zaï*, as well as alongside the stone bunds he had constructed in his fields to prevent erosion. In the month of August, he split and replanted clumps of fodder grasses such as Gamba. In order to protect his forest from livestock, he surrounded it by cultivated fields which livestock are not allowed to enter during the growing season, according to local land-use agreements. During the dry season, he or his children protected the forest against uncontrolled grazing, woodcutting and hunting.

Since the devaluation of the West African franc (CFA) in January 1994, many farmers can no longer afford to buy commercial medicines. This has

boosted an interest in medicinal plants. The farmer-innovators systematically protect and introduce into their fields all the species that can be used to heal common diseases (malaria, stomach ache, jaundice, etc.). The medicinal species named by the farmers include neem (*Azadirachta indica*), grape tree (*Lannia microcarpa*), yellow plum, eucalyptus (*Eucalyptus camaldulensis*), savanna mahogany (*Khaya senegelensis*), drumstick tree (*Cassia sieberiana*), and *Guiera senegalensis*. Yacouba Sawadogo has developed this activity more actively than anyone else. He has introduced species not previously known in his region and has focused on species that have largely disappeared because of droughts in the early 1970s and mid-1980s.

The role of indigenous knowledge

Around 1980, forestry professionals and other specialists in natural resource management working on the Central Plateau of Burkina Faso all predicted doom and gloom. They said that important species such as *Acacia* (*syn. Faidherbia*) *albida* were disappearing, that the stocks of baobab were ageing because of overexploitation and lack of natural regeneration, and that this was also the case for perennial grasses such as Gamba grass, which had retreated southwards over a distance of 200-300 km in the preceding 15 years. Twenty years later, farmers are actively protecting the natural regeneration of these species and several others, and they are planting Gamba grass along the stone bunds in their fields. In many fields, more trees were found in the year 2000 than in 1980. Twenty years ago, the expanses of severely degraded land were vast and expanding. Now, thousands of hectares of this land have been successfully rehabilitated by farmers in the Yatenga region using the *zaï* technique.

Transfer of knowledge

The rehabilitation of land and the improvement of the woody vegetation have greatly increased the social status of the farmers. Before they started to experiment and to invest, they were as anonymous as most farmers. Nowadays, their reputation extends beyond their provinces and even beyond the borders of Burkina Faso. They are in regular contact with the decentralized services of various ministries and have become focal points for improved natural resource management in their regions.

Yacouba Sawadogo receives many visitors from projects and from research institutions. Delegations of farmers also seek to learn from his experience.

Each year he receives perhaps another 100 visitors who ask him for various parts of plants (leaves, bark, roots) for medicinal purposes. Most of these are farmers, but some are traders and office workers. Because of his knowledge in this field, Yacouba is in constant contact with well-known traditional healers who consider him their partner. The field of medicinal plants is secretive and Yacouba did not want to indicate which species he has introduced for medicinal purposes. He only indicated that he has planted species that reduce hypertension and even mental problems. Apparently, he does not ask for cash payments for his products and services, being more interested in the social esteem that he derives from this activity.

Achievements and results

This case proves that, as a result of indigenous innovation and initiative, it is possible within a fairly short time span (5-10 years) to produce a considerable quantity of diversified plant biomass that can be used for many purposes, including fodder. This facilitates the integration of livestock keeping and cropping systems, which is the basis of sustainable agricultural intensification.

The practice goes a long way towards solving the problem of firewood. The lack of firewood in this part of Burkina Faso is a serious problem for the women who must often walk long distances (10-12 km) to collect enough fuel for the home. As the wife of one of the farmer innovators remarked, 'To have trees on the family fields is a great richness because we can save a lot of time that we can now spend on income-generating activities.' The possibility of covering at least part of the family's firewood requirements is one reason why the farmers protect and regenerate the woody vegetation. Most of the farmers prefer local to exotic species because they are better adapted to the environment and the farmers are well aware of the multiple uses to which they can be put.

The practice is efficient because it produces trees for multiple uses, including for medicinal purposes, and it provides extra income for full-time farmers. It is cost-effective because the seeds are readily available. And it is locally manageable because every farmer can use the *zaï* technique and also systematically protect the natural regeneration on his land in this way.

Impact of the practice on food security

As Yacouba Sawadogo explained, 'in the days before the *zaï* technique, I was a part-time trader and I used all the income this generated to buy cereals to feed my family. Since I started treating the land with *zaï*, I am self-sufficient in food and sometimes I sell a surplus of cereals and cowpeas to cover my financial needs.' One of the major advantages of the *zaï* technique is that it minimizes risks caused by variations in rainfall and ensures substantial yields on marginal lands.

The *zaï* have stimulated the production not only of cereals but also of leguminous crops such as cowpea (*Vigna unguiculata*). This is generally grown together with sorghum or millet as a cash crop. The substantial quantities of cowpea produced annually on the rehabilitated land contribute to the income of the farm families.

The *zaï* have indirectly had a positive influence on the crops produced by farmers' wives. Because the men now concentrate on the *zaï* fields, the sandy soils not suitable for *zaï* have been allocated to the women, who use them to grow common groundnuts (*Arachis hypogaea*) and Bambara groundnuts (*Voandzeia subterranea*).

Impact on livestock husbandry

The *zaï* also have a positive impact on livestock-keeping. Many farmers stated that, before they adopted *zaï*, they had few animals. The investment in *zaï* has been paralleled by changes in their livestock husbandry practices. It is only by adding manure to the *zaï* that the farmers can obtain good yields. Farmers whose cattle were formerly managed by Fulani herders now keep their cattle at the homestead. Those farmers who keep sheep do this not only to raise stock to sell, but also to produce manure, which is either applied directly to the *zaï* or used for composting. It is now common practice among Yatenga farmers to collect the pods and fruits of specific woody species (yellow plum, acacia species*, Piliostigma reticulatum*, etc.) for livestock feeding. When passing through the animal's digestive system, the seeds become softer and end up in the manure used in the pits. The seeds sprout and grow at the same time as the cereal crops, and the farmers protect them during weeding. The *zaï* have thus contributed to a stronger integration of livestock and cropping activities.

Impact on biodiversity

When the farmers started rehabilitating the tracts of degraded land (*zî-peele* in the Moré language), the land had only a few large trees from a very limited number of species. Yacouba Sawadogo counted only four: *Balanites aegyptiaca, Lannea microcarpa, Guiera senegalensis* and *Combretum micranthum*. Twenty years later, he has more than 60 species of tree on the same land. Yacouba has introduced into his forest several medicinal species which had disappeared from the region. He collected these during his travels outside the Yatenga area. When people come to visit his farm during the wet season, he asks them to dig some planting pits, plant some trees or sow some seeds that he collected.

Impact on income generation

Several farmers mentioned that they have also sold wood for the construction of roofs, sheds and the like. On an annual basis, this brought cash income of CFA 20,000-40,000 (approx. USD 30-60) per farmer, but the amounts can vary according to the amount of timber in their fields and to demand and supply on the local market. The main species for construction purposes are exotic, such as neem and eucalyptus, but certain local species are used for making chairs, mortars and pestles. The current drive to regenerate the woody vegetation is also linked to the possibility of gaining some cash income. The women have a stake in this as well: they collect leaves of the baobab, flowers of the kapok (*Bombax costatum*), and fruits of the sheanut (*Butyrospermum paradoxum* var. *parkii*) and the locust bean (*Parkia biglobosa*) tree for home consumption and to sell at local markets.

Farmers' motivation

The farmers' reasons for regenerating the vegetation differ and depend largely on the amount of land they have. Yacouba Sawadogo owns his land and has more than enough to meet his family's subsistence needs. He aims to create a multipurpose forest of 20 ha and gives priority to planting trees at the expense of producing cereals. He plans to invest more in growing medicinal woody plants and he would like to reintroduce wild fauna (small deer, hyenas, birds, etc.) into his forest.

Farmers who have only usufruct rights to the land they are farming generally hesitate to plant a live fence around the fields. This would make it easier to protect the trees against uncontrolled grazing but, in view of the local land-

use customs, planting trees on and around fields could evoke negative reactions from the landowners. The farmers can protect regeneration, however, which is different from the art of planting.

The battle against land degradation has not been completely won. Farmers involved in land rehabilitation continue to face many constraints, such as uncontrolled livestock grazing and the cutting of trees for firewood by outsiders. These are problems that can be solved only at village and intervillage level. Nevertheless, the environmental situation appears to be less gloomy now than 20 years ago because farmers have shown that something can be done.

Source of inspiration

It would be possible to transfer the practice, but there certainly would be conditions and prerequisites to consider.

It is now common to selectively protect seedlings that have regenerated naturally in the pits known as *zaï*, but only a few farmers deliberately sow tree seeds in them. Nevertheless, this practice has considerable potential.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

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Title

The making and use of traps for fishing in wetland ecosystems in southeastern Nigeria

Themes

Fishery conservation, fishery engineering, fishery equipment, fishery management, fishing, food security

Introducing the practice

The practice is most common among the inhabitants who live adjacent to the wetlands formed by the tributaries of the Idemili and Niger Rivers, which stretch for over 80 km between Obosi and Ihiala in southeastern Nigeria. The practices reported here were observed in Oba, a town on the Ose River. People who live in this town derive many benefits from the resources of the wetland ecosystem. The resources they extract include drinking water, fish, palm wine, firewood and wildlife as well as wild fruits and vegetables. These resources play important roles in the social and cultural life of the community. For instance, fish and palm wine are indispensable elements in marriage and burial ceremonies.

Trap fishing from the Ose River dates back many generations, certainly as far back as the 18th century. It is important because freshwater fish and forest wildlife have been the only major sources of protein for the people of the community.

Fishing is a year-round activity. Small trap fishing is usually done during the rainy season, from April to October, when the tide is high and there is a lot of water in the forest ecosystem. Big trap fishing is done during the dry season, from November to March, when bigger fish that come in with the tide are left behind in small pockets of water in the forest when the tide recedes. Fishing for different species of fish requires different sizes and types of traps. Rather it is the species of fish caught that is seasonal. For example, the eel is caught using small traps mainly in the rainy season (March-September) while catfish and other large fish are caught with bigger traps mainly during the dry season

(October-February). The practice involves knowing how to make the right trap for the right season, and knowing where in the ecosystem to place the trap in order to catch the desired fish.

Trap-making

The materials for the trap are derived solely from the raffia palm. They consist of solid strands for the body of the trap and fibres for holding the strands in place. The strands are obtained from the midrib of the compound leaf (frond). This is scraped and split into long strands according to the size of the trap. Strands of about 0.5 mm wide and 100 cm long are used for medium to large traps and strands of 0.5 mm wide and 50 cm long for small traps. The former are used for dry-season fishing while the latter are used for rainy-season fishing. The strands are smoothed with sharp knives and bundled in readiness for use. Fibres for tying are extracted from the base of young raffia palm fronds and arranged in pairs in readiness for use.

Actual trap-making involves twisting pairs of fibres over the raffia strands in a figure-eight fashion. A mat-like product results when fibres are twisted over strands at regular intervals. When enough strands have been linked to form a sizeable mat, the mat is folded so that the two ends join up to make a cylindrical shape. The frond of a young raffia palm can also be used as a tying fibre if it is split lengthwise into four parts. The flexible stem of a climber plant is used to make a circular frame, which is slipped into the cylindrical trap and tied firmly to the trap using the same fibre. This gives the trap a firm shape and frame. A conical door is made from tied strands and attached to the trap as an entrance. Another such door is placed midway into the cylindrical trap. The door has its base at the entrance to the trap and its apex inside the trap. With this design, the doors allow fish to enter but prevent them from getting out again. The rear end of the trap is tied with the same fibre. The tying gives the trap its characteristic conical shape.

Trap use

Small traps are placed along the bank of a shallow river or in discoloured pockets of water for trapping small fish like the eel. Earthworms are used as bait, but the worms are not alive as they are when used with hooks. One earthworm is attached to the trap using the midrib of an oil palm (*Elaeis guineensis*) frond, in the manner of a barbecue. As many worms as possible are squeezed through this stick, squashed and attached to the inside wall of

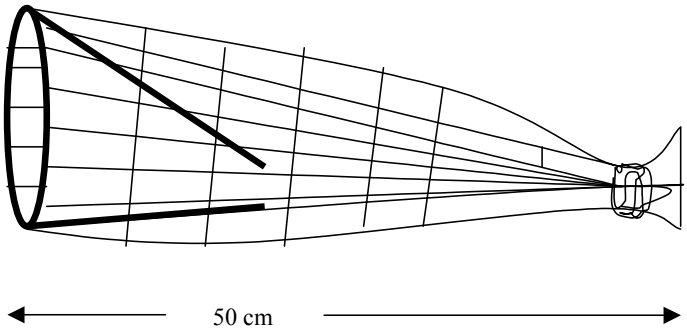

Figure 2. Small trap

the trap so that fish cannot reach them from outside the trap. The squeezing and squashing of the worms sends secretions into the water which attract fish to the trap. The number of fish caught depends on average yields in that particular ecosystem, on the expertise of the fisherman in placing and positioning the trap, and on the effectiveness of the bait.

Large traps are placed in stagnant ponds or pools inside the wetland or along the river banks in order to trap bigger fish such as catfish. These traps are used with or without earthworms, but experience shows that especially in flowing water, traps baited with earthworms catch more fish of many varieties than those without earthworms. The worms' secretions make the difference. These flow downstream and attract the fish. The entrance to the trap usually faces the current, which makes it easier for the fish to enter the trap.
Because it is the worms' secretions rather than the worms themselves that attract the fish, the bait remains effective even after the earthworm has been eaten by the first fish. The thrashing of the first fish captured also sometimes helps to attract more fish.

A big trap can catch as many as 15-20 catfish approximately 20-30 cm in length. A small trap can catch as many as 20 eels at a time. Traps attract all kinds of fish so that a single catch can be made up of three or four different species.

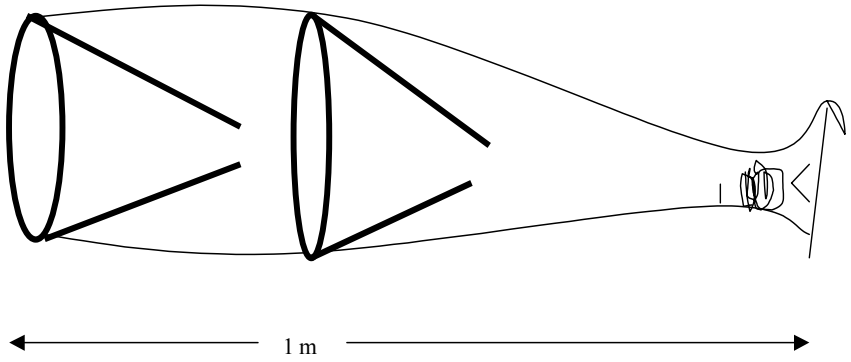

Figure 3. Big trap

Content and approach

The practice involves bundling the traps to be used for a day's fishing and transporting them down to the river bank. There they are loaded into a canoe, which is paddled towards the site chosen for the day's fishing. The traps are baited as necessary in the canoe. If the site is in a body or pool of water in the forest, the fisherman-entrepreneur leaves the canoe and wades into the forest to place the traps. Otherwise he selects a spot alongside the river bank. After clearing and preparing the site, the fisherman places the traps. He waits 30 minutes to an hour, in his canoe if possible, before checking the traps for fish.

The practice is labour-intensive, particularly the collection of the earthworms. Young boys of school age dig earthworms and sell them to fishermen, however. This is especially common where fishing is also done for recreation. But the other aspects of the practice are labour-intensive as well. The hard work is made worthwhile by the fact that trap fishing guarantees a fisherman at least some catch, whereas fishing with hooks can involve a whole day's work that is rewarded with no catch at all.

This fishing method is ideally suited to the slow-moving streams and stagnant water of the wetland ecosystem. The fish live in pockets of water that are often discoloured from fallen leaves. These pockets often contain the tangle of mud, clay and roots of trees, shrubs and grasses that characterizes the wetland ecosystem. In such pockets of water you cannot use nets. You cannot use hooks either, because some of the fish species do not have the well developed mouthparts or eyesight needed to seize worms from hooks.

The Best Practice is manifest in that the only practical way to fish in such an ecosystem, where nets cannot be used and even canoes cannot move easily, is by using the sort of tailored-to-fit technology which only hooks, spears and traps can provide. But hooks and spears cannot always guarantee a catch, not even in a whole day of fishing. The trap therefore becomes the only sure tool to use since it never fails.

The practice is still in use today. This is because the making of the trap can be learned easily, the required materials are still available in the ecosystem, and fish remains the major source of protein for the people. In addition, the practice is not capital-intensive. Old people who have retired from active farming or from government service can engage in it. At the same time, schoolchildren can engage in this form of fishing using knowledge they acquire from their parents or older relations. The practice generates income, making it financially attractive. Although trap fishing requires the use of canoes, which are paddled for distances of ten kilometres or more along the river, these canoes are always available. Most households along the Ose River have canoes.

Trap fishing, like the other forms of fishing in this community (hook and spear fishing), is done only by males. They are of all ages, however. It is possible that women are excluded from trap fishing more because of the strenuous nature of the activity than because of any intention to discriminate along gender lines. This seems likely because women engage in basket fishing (the use of baskets to scoop vegetation and organic waste from the bed beneath stagnant water and to pick out any fish that might be trapped in the mesh). In addition, after the fish caught with traps are processed and smoked, they are sold mainly by women.

It is difficult to say whether or not the practice originated in the Oba community. The author learned it as a boy; his father said that his own father and grandfather had practised it. The practice is common among all communities in the Ose River system, which stretches along a distance of 80-100 km and includes other towns.

The purpose of the practice is first to provide fish as food and a source of protein for the people. Second, it is a form of self-employment that can

generate much income if the fisherman-entrepreneur operates with multiple traps. Trap fishing is also a form of recreation for children during school holidays. It gives them the opportunity to paddle their canoes away from home, to explore the diversity of the ecosystem, to fish, swim, watch monkeys and other wildlife, and even to extract other natural resources from the ecosystem.

The role of indigenous knowledge

The practice in its entirety, from the making of the trap to the actual fishing, is an embodiment of indigenous knowledge. For instance, the collection of strands for making the trap frame requires knowledge of the quality of the plant. It must not be too brittle or it will snap while the trap is being made. The quality of the strands will also determine whether the traps made from it can last the entire fishing season. The fibres for making the trap are extracted from stems of raffia palms by people who know which age and type of plant will yield good-quality fibre. Inserting the trap's conical doors requires knowledge of the shape and angle that will prevent the fish from escaping after they are caught. The application of knowledge about earthworm secretions is definitely indigenous knowledge, as is the knowledge of how to hook the worm and attach it to the trap so that fish cannot steal the bait from outside without entering the trap.

It is also indigenous knowledge that tells fishermen that it is not the earthworm itself that attracts fish, but the chemicals which the worm secretes from its body. Determining where to place the trap also has a lot to do with the fisherman's knowledge of the types of water and habitat that suit particular species of fish.

The practice is embedded in the socio-cultural values of the people in the sense that some of the fish caught through trap fishing are required elements in certain traditional festivities in the community, including marriages. In addition, trap fishing is recreation or sport that is often undertaken during festivals that prohibit activities related to cultivation. On certain days, for example, the Ani fetish forbids everyone to harvest or even pick up anything from the ground. To avoid accidentally committing an abomination, people generally troop out to the riverside for trap fishing.

The transfer of knowledge

The techniques of trap making and trap fishing are known only to specialists. With the exception of females, anyone who is interested in learning the techniques can easily go to the specialists to be taught. The specialists are not paid for using their knowledge to make traps and to fish with them. Nor do they charge fees for teaching others. But if they make extra traps to sell, they do receive money for them.

Knowledge of trap making is generally transferred from father to son within a family that practises the tradition. A trap-maker can also teach a close friend or trusted relation. Fishing itself can also be learned from peers, age mates and friends who have made trap fishing a hobby or an income-generating activity.

This indigenous knowledge is not documented since most of those who possess it are older people who cannot read or write. Even now that educated youths are engaging in trap-making and fishing, it is still not documented. The knowledge is transmitted from person to person only by word of mouth and through practical demonstrations.

Achievements and results

The practice enhances the social welfare of the people and improves their health by providing them with a reliable and affordable source of protein. It also creates employment for members of the rural community, especially the aged and the relatively uneducated members of society who cannot easily find jobs in the urban areas. For the many people who cannot engage in profitable commercial activities–for example, people who have retired from civil service–trap fishing makes it possible to earn a reasonable living. It also provides recreation for children and youth and promotes the culture of the people.

Of the fish consumed in the communities adjacent to the wetland ecosystem under study, over 75% is supplied through trap fishing. Without it, consumers would have to rely almost entirely on smoke-dried fish from Lake Chad, which by the time it reaches southern Nigeria is stale and expensive.

The practice scores high in terms of sustainability, cost-effectiveness and manageability. It is sustainable because the raffia palm regenerates naturally

in a rather prolific manner in the Ose wetland ecosystem. Therefore, all the raw materials needed to make the traps are always available in large quantities. It is cost-effective because community members share common property rights to the wetland forest from which the necessary materials can be extracted. The practice is easy to manage locally because the community manages the entire ecosystem itself and has rules and regulations designed to govern the use of the ecosystem in a sustainable manner. The local people benefit from the practice because it provides them with employment as well as with fresh fish at affordable prices all year round. The practice thus helps to improve their nutrition and health standards.

The strengths of the practice lie, among other things, in its sustainability. It has provided employment, income and fish for many generations. It should continue to provide these for future generations, thereby contributing significantly to sustainable development and the promotion of local culture.

The practice's weakness is that as development progresses and more and more people are educated, fewer people will want to engage in trap fishing because of its tedious nature. In addition, some of the traditional male elders who possess the knowledge of trap-making are growing old and dying. With their children taking to education and urban life, it becomes less likely that the knowledge of trap-making and trap fishing will be retained and transferred.

The practice can be improved upon and developed in two ways. First, it needs to be documented in writing. Second, the traps could be made more durable by replacing the raffia strands and fibres with steel wires. The manufacturing could also be mechanized instead of done manually, as at present.
The integration of this practice with the modern fisheries practice of introducing fingerlings has also been recommended. If fishermen find that yields at a particular site begin to decline, they could introduce fingerlings, move to another spot, and when they return to the first site after some time the fish population would have been replenished.

Source of inspiration

The practice does also occur in South America and Asia, for example, and could certainly be replicated in other parts of the world, provided the

materials (raffia palms, earthworms, etc.) are available and there are appropriate wetland ecosystems where fishing can be done.

As far as the author knows, the practice is common throughout the Ose wetlands, which implies that it has been widely replicated. It has also been observed in mangrove swamps and along creeks of the delta areas of Nigeria. It is believed to have been brought there by people from the Ose wetlands who went to the city of Port Harcourt in search of urban employment. The author does not know of any replication outside southeastern Nigeria, however.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

This phenomenon needs to be investigated through research:

- To analyse what the secretions are and what they are made of.
- To learn why and how worms attract a variety of fish species, including species that have very rudimentary mouthparts and no visible eyes.

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Title

Women's innovations in rural livelihood systems in arid areas of Tunisia[13]

Themes

Irrigation systems, poultry, rural women

Introducing the practice

In central and southern Tunisia, women are involved in almost all activities associated with both rain-fed and irrigated farming. They are also responsible for specific tasks such as collecting firewood, managing the ovens (*tabounas*), fetching water, collecting traditional fodder, hoeing, weeding, irrigating, feeding and watering animals, and harvesting grains, fruits and vegetables. Some women have managed to increase production and their own cash incomes by developing innovations based on their experience in these activities.

The livelihood systems in central and southern Tunisia have changed radically in recent decades. New production systems have replaced the traditional pastoralism, which had been the dominant source of livelihood in this area for centuries. There are also increasingly closer links between the countryside and urban markets, and rural women need more cash to satisfy new needs. Women innovate not only to increase income, but also to decrease their workload. For instance, economizing on the use of water for irrigation reduces the time and energy spent on fetching water.

Married women are responsible for taking care of their homesteads and families and are in charge of certain agricultural activities. Rabbits and poultry are their major sources of cash income. Women generally innovate

[13] This case is an adapted version of an article published in: 'Farmer Innovation in Africa. A source of Inspiration for Agricultural Development'. Chris Reij & Ann Waters-Bayer (eds.), 2001Publisher: EARTHSCAN, Earthscan Publications Ltd, London (UK) / Sterling, VA, USA. www.earthscan.co.uk

most actively in those areas that concern them directly. One of the women innovators who was interviewed was engaged in crop production and raising sheep and goats. Most of the women also practised some handicrafts. The area of activity in which the largest number of women were found to be innovating was in livestock keeping. Other innovations were in cropping, handicrafts, the use of medicinal plants, the efficient use of energy for charcoal-making, and improved stoves and food processing, specifically the processing of milk from sheep and goats.

Content and approach

Innovations in livestock keeping are mainly related to the feeding of sheep and goats, and the keeping of poultry, bees and rabbits. Mbirika Chokri, for example, is a 70-year-old woman living in Sidi Aich (Gafsa) who practises rain-fed farming and specializes in poultry. Her innovation consists of incubating chicken eggs in dry cattle dung. She puts the eggs with some straw in plastic bags to preserve some humidity. Each bag contains 16-20 eggs. She puts the bags in small holes dug in the manure, covers them with a piece of cardboard to protect them against damage and covers the cardboard with a thin layer of manure. Each day, she opens the bags to check the temperature of the eggs and to turn and aerate them. From day 20 the eggs start to hatch. She puts the chicks into a box to protect them from the cold and feeds them couscous, vegetables and bread. Mbirika began experimenting in 1995 when one of her chickens, whose eggs were about to hatch, suddenly died. She decided to put the eggs into a pile of dried cattle dung. After some days the eggs hatched, to her delight. She decided to use manure again in the same way to hatch eggs. Mbirika has now mastered this technique and produces numerous chicks.

Handicrafts include making carpets and other products out of wool, and weaving mats and other household items out of alfa grass (*Stipa tenacissima*). Women innovators in this area are found in all age groups and in all regions. Specific innovations involve producing woollen mats and extracting natural dyes from leaves, roots and bark.

The innovations related to crops included fig pollination techniques and the use of plastic bottles for the water-efficient irrigation of melons. For example, Rgaya Zammouri in Zammour village (Médenine), who is over 70 years old, uses 1.5-litre plastic bottles to irrigate watermelons and melons.

She buries each bottle in the soil with the cork downwards. In the cork she has made tiny holes with a needle so that water is released immediately beside the plant. She fills the bottles with water from a cistern fed by run-off rainwater. The water infiltrates slowly near the plant roots and thus escapes the evaporation that is so rapid in this region. She started this innovative practice in the 1997-98 growing season. She used to carry the water from the cistern to the field in a bucket, but now the Indigenous Soil and Water Conservation (ISWC) programme has supplied her with a water tap and a rubber hose to facilitate her work.

The role of indigenous knowledge

Several women said that their innovations grew out of their own ideas and creativity, or were a chance discovery. Most innovations by women–such as those involving handicrafts and medicines–are rooted in local knowledge but adapted (in design, materials or use) to the new socio-economic context. Generally, women's innovations–like the bottles for localized irrigation or for incubating eggs in manure–are simple, practical and low-cost and therefore have good potential for widespread dissemination.

Transfer of knowledge

At the outset of the second Indigenous Soil and Water Conservation programme (ISWC-2) in central and southern Tunisia, training was given in various regions. This was meant to raise awareness of the innovation taking place among farmers, both men and women, and to place specific innovators in the spotlight. Local cultural norms do not usually permit male researchers and development agents from outside the area to talk with village women. As the ISWC team at the Institut des Régions Arides (IRA) was composed at the time exclusively of men, the help of professional women was enlisted for the identification of women's innovations. Some of these professionals were from technical agencies and local institutions, but most were teachers and students returning to their villages for the long summer holidays.

Some innovations are quickly known to all female members of the community. Others remain known only to specialists. One innovator, Mbirika Chokri, did not share her knowledge and experience with her neighbours, but she did agree to ISWC-Tunisia's request that she present her innovation on the radio (in a regional programme called 'Agriculture and Innovation') and later also on television.

Achievements and results

The innovations described here are examples of how women innovate in their own specific areas of activity. Some women have managed with their innovations to increase production and their own cash incomes, and to decrease their own workload.

More and more Tunisian researchers and development agents, as well as policy-makers at regional and national level, are coming to recognize the innovative capacities of rural women.

In 1999 and 2000, researchers and several women began collaborating on experiments to develop their innovations further. The challenge is to improve and expand this approach within Tunisia and beyond. Already, some of the innovations have been replicated in Tunisia.

Source of inspiration

The experiences of these women could be an example for other women in Tunisia and beyond. Because women's innovations are generally simple, practical and low-cost, they have good potential for spreading.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

Women's innovations have been documented in the Agriculture and Innovation programme of Gafsa regional radio and also on television.

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Title

Innovators in land husbandry in arid areas of Tunisia[14]

Themes

Fruit trees, natural resources, resource management, water conservation

Introducing the practice

Major socio-economic changes over the last four decades have led to a decline in farming in the mountainous parts of central and southern Tunisia and to the gradual abandonment of the *jessour* and other traditional techniques of harvesting rainwater. In these arid areas, farmers and scientists are carrying out joint experiments designed to reduce the labour required to maintain the *jessour*. In the process, they are encouraging each other to innovate in order to increase the productivity of rain-fed agriculture.

In nearly two-thirds of Tunisia, mainly in the centre and south of the country, average annual rainfall is less than 200 mm. Here, except in the irrigation schemes and oases, agriculture would be impossible without water harvesting. One of the most widely used traditional techniques to harvest water is the *jessour*, an ancient system of collecting run-off from long slopes. The system is used in agriculture in the mountainous regions of North Africa to this day. Farmers build earthen dams (*tabias*) across the valley floors to trap the run-off water and silt. Although the entire system is called *jessour*, the word refers in fact only to the cultivated valley floor.

In the arid, mountainous regions of southern Tunisia, two major rural livelihood systems have traditionally coexisted. One involves sedentary farming by agropastoralists in the Matmata mountain range, and the other

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nomadic and transhumance herding of camels, sheep and goats in the adjacent plains between the mountains and the Mediterranean Sea. Sedentary farming in the mountains is traditionally based on olive, fig and palm trees growing in the *jessours*, in combination with cereal and legume crops sown in years of good rainfall. Agriculture in this arid region involves high risks on account of the very low amount and high variability of rainfall. The infrequent but heavy rainstorms cause considerable damage to the *tabias* and much labour must be invested in repairing them.

Three major socio-economic changes over the last four decades have had a profound impact on the rural livelihood systems both in the mountains and in the plains. The first is that many men migrated to urban centres in northern Tunisia or Europe to seek employment. This increased and diversified sources of income for the families in rural Tunisia. The second is the enormous boom in the tourist sector along the coast of central and southern Tunisia, which generated demand not only for labour but also for fresh vegetables and fruit. The third is the descent of sedentary farmers into the plains. The government invested heavily in water-harvesting systems in the plains, not only to reduce the risk of damage by floodwater to infrastructure in the coastal zones, but also to replenish the groundwater. At the same time, this created opportunities for agriculture based on harvested water. The descent into the plains had two other effects, however: it led to the abandonment of *jessours* in the most isolated mountain valleys, and it reduced the grazing resources available to the pastoralists. Communal grazing lands were increasingly transformed into private, cultivated land. At the same time, livestock numbers grew, further increasing the pressure on the dwindling grazing resources.

Because of the high labour inputs, low productivity and high risk associated with farming in the mountainous areas, many young men have abandoned it. They prefer jobs in trade and commerce or the tourist sector. Under these circumstances, it is a major challenge to make farming more remunerative and attractive to young people. The decline in interest in farming is most strongly felt in the immediate vicinity of tourist centres, such as Matmata, and in isolated valleys. Extended families have disintegrated into smaller nuclear families, so less labour is available at household level. The use of machinery in mountainous terrain is difficult and costly. The challenge is to

reduce the maintenance requirements of the *jessours* and to increase the productivity of farming based on rainwater harvesting.

Content and approach

The best practice reported here began when a small number of scientists began to take a closer look at the innovations being developed or introduced by the people who continue to practise agriculture in the region. The practice is aimed at achieving technological change that could reduce the farmers' workload and improve the image of farming.

The practice is in fact a programme in Tunisia: the Indigenous Soil and Water Conservation programme (ISWC-2). Researchers have studied indigenous techniques of soil and water conservation and are working on ways to improve them. The testing of new techniques on farmers' fields has led to joint observations by scientists and farmers and to intense discussions between them. In some cases, the farmers and/or their neighbours have been encouraged to improve still further on the scientists' improvements. These changes have, in turn, stimulated new ideas among the scientists.

Agricultural diversification and innovation

In response to the growing demand from urban areas and the tourist sector for products such as apples, pears, peaches, plums, apricots, grapes, and almonds, some male farmers had begun to diversify the species of fruit trees planted in the *jessours*. Some farmers now have more than ten species of fruit trees in their fields–a radical change from the traditional olives, figs and palms. It is not unusual to find several varieties of each species (early maturing to late maturing varieties), chosen by farmers with a view to spreading the risk of harvest failure.

Some farmers are very skilled in grafting fruit trees, even grafting different species on one tree. For instance, combinations of apples and pears and of peaches and plums can be found. Farmers also graft onto the roots of trees that allow the young plants to grow in the shade. The greatest surprise to development agents has been the use of the *jujubier* (*Ziziphus lotus*) for this purpose. Development agents used to regard this as a 'useless' species and the small trees were systematically uprooted in the plains of central Tunisia. The farmer-innovators who graft fruit trees onto the roots of the *jujubier*

regard this plant as an indicator for reasonable levels of soil moisture and soil fertility.

Another interesting innovation was the construction of a concrete dam by a farmer in a region where such dams had never been built before. He also constructed small sediment traps in the catchment to reduce the silting of the dam, in which he had invested considerable money. He used the water behind the dam for supplementary irrigation to grow a wide range of fruit trees and some vegetables.

Béchir Nasri Jamii, a farmer in Gasr Jaouamaa village (Médenine), is one of the farmers engaged in more than one innovation. He introduced various species of fruit trees, is very skilled at grafting, provides supplementary irrigation for his trees using water stored in a cistern, has adopted and adapted a water-saving technique that was being tested by a scientist in a neighbouring farmer's field, and has changed the design of local beehives, thus increasing honey production substantially. Béchir's father was the first person in the village to introduce new species of fruit trees. He worked as a cook for the Bey (king) of Tunis and, during his visits to his village in the 1940s and 1950s, he brought home a wide range of seedlings. In those days, the villagers reportedly thought it was ridiculous to grow these types of trees. The son, who worked as a painter in France for ten years, has continued to build on his father's knowledge and skills. The growing demand for fresh fruit in the cities has led to a veritable explosion in fruit-tree diversification in the village, all of which began with an innovation introduced by a sole farmer. The first peaches to arrive on the Médinine market each year are from Gasr Jaouamaa and they fetch a good price.

Improving the jessours

Traditional water-harvesting techniques such as the *jessours* must overcome numerous technical and socio-economic constraints. One major technical constraint concerns the high ratio between the catchment and the cultivated area (5:100). Large catchments guarantee adequate run-off in years of low and average rainfall, but occasional instances of heavy rainfall cause floods which can damage all the *tabias* in a valley. Because the infiltration capacity of loess soils is limited, the run-off water can stagnate for weeks in the *jessours*, causing damage to both trees and annual crops. A researcher at the Institut des Régions Aride (IRA) developed a technology to evacuate excess

water. This was tested in a farmer's field in the village of Béni-Khédache. To avoid destruction of the spillways and of the dam during both normal and exceptional overflow, the lateral spillway was replaced by two joined tubes: one vertical and one subhorizontal. The drainage system consists of a basin and a floater. The initial results were not as positive as the scientist had hoped. The farmer Béchir Nasri, who had observed the initial experiment, suggested some improvements and these are now being tested.

One of the techniques to increase the efficiency of water use in the *jessours* is the 'buried stone pocket' for the localized, underground irrigation of fruit trees. The original idea introduced by the researcher was as follows: the bottom and lower edges of a planting pit (1x1x1m) are lined with stones (limestone, sandstone, lime crust, etc.) laid in three or four layers with two or three sides covered with plastic sheeting to prevent soil from entering the spaces between the stones. When the pit is filled again with soil, a T-shaped plastic tube (3-7 cm diameter and 80 cm length) is fixed vertically between the stones near the fourth side of the pit. Water flows by gravity through a rubber hose from a cistern higher up the slope to a tap near the pits. Another rubber hose connects the tap to the plastic tube in each 'stone pocket' in order to irrigate the fruit-tree seedlings planted in it. This technology leads to faster growth of the individual fruit trees, while using very little water. Farmers who have tested it have observed substantial increases in fruit production.

The farmers have not simply adopted this technology; they have been active in adapting and improving it to fit their own circumstances. Their tendency has been to reduce the depth and breadth of the 'pocket' originally introduced by the scientist. At a depth of about 40 cm, some farmers have laid out a small circle of stones, leaving an opening in the centre. They insert a plastic pipe vertically between the stones, cover the stones with soil, plant a tree seedling in the centre of the pit and give it water through the plastic pipe rather than by submersing the soil around the tree. One farmer decided to put the plastic pipe closer to the tree so that he could continue to plough the land around it. Another farmer modified the 'buried stone pocket' technique so that it could be used for growing watermelons. The scientists are observing and learning from these farmers' experiments.

Several farmer-innovators have now started on their own initiative to record the details of their experiments in a notebook. This allows them to compare their experiments with a control plot in their own fields.

Joint experimentation

In the second half of 1999, a small number of scientists, extension agents and farmers started to carry out some joint experiments. Some of the scientists had already been trying for many years to find ways to reduce the maintenance requirements of traditional techniques such as *jessours*, as well as to test technologies to economize on water use. Whenever possible, they had used local techniques as starting points. Since the ISWC-Tunisia programme started, experiments have been carried out jointly by scientists and farmers based on the latter's technique. These have included:

- Using plastic bottles to irrigate individual plants (watermelons in 1999, potatoes in 2000).
- Economizing on the use of water in greenhouses.
- Building cisterns to store water for the supplementary irrigation (by gravity) of fruit trees and vegetables.

One particularly promising experiment is taking place in the foothills close to Gafsa (average rainfall 140 mm). It involves the temporary storage of water in a small concrete dam on a large piece of marginal land that a farmer had bought ten years earlier. He built the dam in order to see how he could use water-harvesting techniques. Once the dam is full of water, this is pumped to a large cistern constructed downslope close to his arable fields. Storing the water in a cistern avoids evaporation. This water is then used for supplementary irrigation of olives and almonds planted behind *tabias*. The local Regional Centre for Agricultural Development (CRDA), which is monitoring the results of this experiment, has already received requests from several other farmers interested in developing similar systems on their farms.

An experiment to economize on water use in greenhouses is being carried out in the Mareth area. A farmer is comparing irrigation by submersion with drip irrigation that uses a buried water distributor made of plastic for each individual plant. The first indications are that this technology reduces the water needs substantially. This is of great importance to farmers who buy piped water to grow crops in greenhouses. The scientists and development

agents involved in this trial expect that this third technology will reduce the water requirements for crops by two-thirds.

The role of indigenous knowledge

The practice is based in the community and is consistent with the socio-cultural values and meaning systems of the people living in the community. The farmers involved in the experiments are well known in the community and other farmers who want to try the innovations in their fields ask them for advice and information. The local Regional Centre for Agricultural Development (CRDA) monitors all the experiments carried out in the ISWC-Tunisia programme.

Transfer of knowledge

In 1998 and early 1999, ISWC-Tunisia conducted four visits to farmer-innovators in Sned, Béni-Khédache and Mareth. Some 20 farmers, researchers and extension agents participated in each visit. The visits inspired some of the farmers to try out what they had seen on the innovators' farms. A camera team from national television accompanied one such visit. After seeing the new techniques on television, other farmers also began to try them out. Béchir Nasri reported that farmers who had seen his improved version of the 'buried stone pockets' on television had tried to make such pockets themselves and had invited him to come to their farms to see if they had done it well.

Achievements and results

In the ISWC-2 programme in Tunisia, researchers have studied indigenous techniques of soil and water conservation and are working on ways to improve them. The testing of new techniques on farmers' fields has led to joint observations by scientists and farmers and to intense discussions between them.

The programme has inspired many farmers and triggered their own creative capacities. Their innovative techniques increase the efficiency with which water can be used in the *jessours*, and serve as examples for other farmers in the arid region.

The results are sustainable (increased efficiency of water use), cost-effective (low input through simple solutions and techniques which are not very

costly), and locally manageable (farmers could adopt the innovations in their fields relatively easily).

Strengths and weaknesses

Through the ISWC-Tunisia programme, researchers, development agents and policy-makers have become more aware of farmer-innovators and their innovations. New links have been created between these different stakeholder groups. Development agents and even policy-makers are following with interest the process of identifying innovations, experimenting jointly, and spreading the results.

The joint experimentation has triggered not only cooperation but also competition between scientists and farmers. The best example is the case of Béchir Nasri. During the first half year of the ISWC-Tunisia programme, he simply observed what researchers and a neighbouring farmer were trying out together on an experimental plot. Then, one day, he approached the researchers to tell them that he had found a solution to their problem of pumping water out of a cistern without silt blocking the rubber hose. From then on, he produced a range of innovations, including a mechanical timer to control the duration and the quantity of water use for supplementary irrigation, a tool for threshing cereals, and a technique for feeding honeybees. The programme had obviously triggered Béchir's creative capacities, which he is now developing fully.

The practice does not have any obvious weaknesses. The intention in the next phase of ISWC programme is to intensify the farmer-innovation approach and to expand it to other parts of central and southern Tunisia as well as to other parts of the country. One way to achieve this will be to strengthen the links that have already been established with the Presidential Pilot Project on Agricultural Extension, which is being implemented under the responsibility of the National Farmer's Union.

Source of inspiration

It would be possible to transfer the practice, but there certainly would be conditions and prerequisites to consider if the knowledge were used in other regions of Africa. The practice has already been replicated in the arid region of Tunisia.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

Tunisian national television made a documentary on the innovations, and a paper about innovators in land husbandry in arid areas in Tunisia was submitted to the Tenth International Soil Conservation Organizations (ISCO) Conference, 23-29 May 1999, Indiana, USA.

In recognition of the work Béchir Nasri'shad had done, he was invited to join the Tunisian delegation to the regional Francophone workshop on Farmer Innovation in Land Husbandry, which was held in Cameroon in November 1999. He was also given the opportunity to present his innovations at an International Fair on Agricultural Technology held in Tunis in June 2000.

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Title

The promotion of non-conventional food resources: the case of snail and mushroom production in Benin

Themes

Animal production, food, food security, forest products, nutrition, resource management, rural women

Introducing the practice

Snails and mushrooms are examples of animal and plant species found in the wild that can make a substantial contribution to feeding a local population. As such, they can be classified as non-conventional food resources. Projet de Promotion de la Filière des Ressources Alimentaires Non Conventionnelles (PP-FRANC) is the name of a project by which indigenous and scientific knowledge are being combined to increase the production of these two food products in five regions of Benin, in West Africa: Atlantique (south), Couffo (southwest), Ouémé (southeast), and Borgou and Atacora (north).

Women, who have traditionally gathered wild mushrooms and giant snails, are now responsible for their cultivation and production. The women involved in the project represent three socio-linguistic groups: Waaba, Adja and Aïzo. This report describes activities among the Databa and Tancaba, which are two sub-groups of the Waaba tribe that live in the Atacora region. These people are farmers, living mainly from the cultivation of millet, sorghum, maize and yams. Millet is used to make a drink known as *tchoukoutou*, which is much appreciated by the local population. The men also hunt small game.

The Waaba are basically animists although several types of Christians are also found among them, including Catholics and members of the Celestial and Renaissance groups. The Waaba practise fetishism. A head, or chief, supervises the fetishist rites and safeguards the fetish and the entire clan. Generally, the Waaba are polygamous. They live in buildings resembling castles, which are known locally as Tata somba. These buildings are common among the various tribes living in the Atacora region.

The Adja and Aïzo are among the oldest tribes in south Benin. Both are descended from a unique and ancient group that emigrated from Tado (presently Togo). The Adja and the Aïzo were farmers well known for their cultivation of maize, cassava, rice, groundnuts, vegetables, cotton and palm oil. Nowadays both ethnic groups are found in all sectors of life in Benin and both have intermarried with other groups in south Benin, such as the Fun and Gun. It is primarily among the Adja, however, that men have multiple wives and woman are believed to be sacred beings.

The pilot phase of the PP-FRANC project ran from January 1998 to December 2000. The project was expanded and has been in its implementation phase since 1 January 2001.

Content and approach

Women have always gathered snails and mushrooms in the bush and forests and therefore possess considerable knowledge of the indigenous species and how to process them for consumption. The PP-FRANC project is improving the methods for producing and processing these food resources, as well as for marketing them. Local, rural women manage all aspects of production and commercialisation. This is providing them with income.

Besides being food items, some of the mushrooms and snails are widely used for treating certain ailments. There is a strong link between their medicinal and nutritional uses. In fact, throughout Benin as well as in much of the rest of Africa, food and health care systems are closely interwoven.

The practice of cultivating mushrooms and snails is ongoing and will no doubt continue indefinitely. Their production is an activity which fits perfectly in the socio-cultural context of rural communities in Benin.

Known as ‘the noble products of the forest’, mushrooms and snails are gathered daily and form a regular part of the diet of rural communities. The local population therefore has acquired and maintains considerable indigenous knowledge regarding this resource. This knowledge is being fortified through scientific verification of the products’ nutritional and therapeutic value. The PP-FRANC project is aimed at enhancing and perpetuating this indigenous knowledge and at guaranteeing that the products

can be harvested throughout the year. The success of the project can be ascribed to the fact that it offers simple, cheap technology which is easily integrated into the daily practices of the population.

The practice of gathering snails and mushrooms originated within the community. Since time immemorial, rural communities have been able to distinguish edible mushrooms from toxic ones and have known how to stimulate their growth by applying farm waste to the ground on which they grow. These techniques have remained much the same, but have been improved with the help of scientific insights. As far as snail-breeding is concerned, the animals are gathered in the forest and then kept in sheds made of clay. Their daily diet was well known to the local population.

The PP-FRANC is a project aimed at raising the level of food security and increasing the income of the community. It enables rural women to establish profitable, innovative and sustainable agricultural activities, thus increasing their economic power.
In order to achieve this global objective, six specific objectives have been defined for the project to increase women's participation in economic activities at the local level:

- To confirm the value of these non-conventional food resources for purposes of nutrition, food security and public health.
- To develop methodological tools for introducing PP-FRANC activities. The main activities are:
    - Identifying, selecting and training women who are interested in non-conventional food resources production.
    - Helping to produce and commercialise the products.

  These activities have been introduced to the project owners; the rural women.
- To initiate research at CECODI's (Centre International d'Eco-développement Intégré) experimental centre, in which local producers take part.
- To develop a self-managed commercial activity.
- To establish international and regional links for disseminating the practice.
- To improve CECODI's capacity for promoting the improved production of non-conventional food resources.

The project is led by CECODI. To guarantee the project's success, CECODI has joined forces with VeCo (Vredeseilanden Cooperatie; Belgium), SNV (Stichting Nederlandse Vrijwilligers, The Netherlands) and CBDD (Beninese Centre for Sustainable Development) and formed a consortium.

The project is above all beneficial to rural women. The products are generally produced by married women around the age of 35. Some 200 women took part in the pilot phase; their number increased to 400 in 2001. By 2004 some 1300 women are expected to have received training. Men do not profit directly from the project, but they took part by helping to build the production centre. The project outcome is of course beneficial to men, women and children by improving household incomes and food quality.

PP-FRANC projects have now been established in four locations with the help of NGOs, peasant organizations and government technicians. Other parties help to market the products.

The method

The project is based on a participatory approach. The people's own indigenous knowledge is incorporated into the technical training they receive at the centre (in how to feed the snail with wide leaves, for instance). Local individuals also take part in the production survey.

Women receive a three-day course of training. They learn various techniques for producing mushrooms and snails in their own village environment and for processing them for local consumption and for the market. At the end of the training the women begin as producers. They are monitored closely by a specialized agency, however, which supervises all aspects: technical, organizational, management and marketing.

The role of indigenous knowledge

Of the mushroom species presently cultivated, the women themselves chose the ones on which the project would concentrate. On the basis of their own knowledge, they also helped to produce a list of the 50 species most commonly consumed by the population. These were verified against detailed studies of the edible mushrooms of Benin.

The snail species chosen for cultivation were the indigenous species commonly gathered in the forest during the short rainy season. These species are also used in traditional medicine for treating certain ailments.

Snails and mushrooms also have a place in local beliefs. Many ritual practices make use of snails, which are thought to enhance fertility and manhood. Practitioners of the occult ascribe great power to snails. Snail meat is therefore much in demand, especially during periods of prayer and meditation among Moslems and animist groups. When certain species of mushrooms are found in the forest, they are thought to be special gifts from God. Mushrooms are believed to enhance perception. They play a major role in the local pharmacopoeia.

The transfer of knowledge

Women of a certain age are the keepers of the traditional knowledge pertaining to snails and mushrooms. They pass it on to younger women without any financial reward. Thus far this transfer of knowledge has been entirely oral and informal. The project may well result in the documentation of all the indigenous knowledge regarding food resources in the forest, however. A publication is currently being prepared.

Achievements and results

The PP-FRANC project is creating an innovative and alternative way to increase farmers' incomes while at the same time conserving biodiversity. The entire project is based on resources and knowledge already available in the local community. Indigenous knowledge and practices are being improved through scientific insights.

Indigenous knowledge and practices are collected during contacts and discussions with local populations. These took place during taxonomic surveys in various agro-forestry regions of Benin. The value of the local practices is therefore increasing.

The production techniques are based on a vertical system that makes efficient use of whatever space is available. Access to land is not necessary for increasing production. Besides only a small amount of space, the system requires few inputs.

Figure 4. Snail vertical breeding system

Atacora is a mountainous region of Benin where rocky soils are too fragile for conventional agriculture. By bypassing the difficulties of practising conventional agriculture, the PP-FRANC project has achieved unexpected but undeniable success. Similarly, women are able to get around the problem of their lack of access to land resources. They can develop their own economic activities independently without having to lay claim to land that could be cultivated.

The practice meets the three criteria of sustainability, cost-effectiveness and local manageability. As already mentioned, the system of mushroom and snail production is based on well-known practices that have been technically improved in collaboration with the local population. The local producers feel themselves to be useful. They are not only beneficiaries of the project but also its promoters. As such, they will help to expand it.

Strong and weak points

The strong points of the practice are the following:

- The products are known and consumed locally.
- The production techniques are simple and cheap.
- Inputs are locally available or produced in situ.
- Agro-ecological conditions are favourable.
- A wild gene pool is maintained that could be useful for genetic improvement.

- There are important local, national and regional markets for the products.
- The farming system is strengthened through the production of valuable by products.
- The production of these resources itself contributes to preservation of the forest and biodiversity.

Problems that remain:

- The PP-FRANC project introduces products and methods with which national decision-makers are not yet familiar.
- Research is needed on a continuous basis in order to improve the production systems.
- The channel to the market has not yet been firmly established.

Source of inspiration

These technologies could be easily applied in other contexts where mushrooms and snails are available and consumed. The approach could be used for other forest resources that local people consume, but only for those that propagate relatively easily and are not too specifically adapted to their forest habitat.

The main condition for the project's success is that the producers' own capacity for experimentation be appreciated and used. The relationship between them and project workers should be a partnership rather than a teacher-pupil relationship.

If such valuable indigenous knowledge and practices are to be improved and disseminated rather than being lost, it is essential that the data and results are properly recorded. This requires appropriate technical support.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

This project is not the only one of its kind in West Africa. There is also the 'Projet Promotion de l'Elevage dans l'Atakora' (PPEA), which is supported

by GTZ in Germany, and the Centre for Biodiversity Utilization and Development (CBUD), a programme funded from The Netherlands.

Apparently there is plenty of demand for such products. The project shows how natural resources that are on the decline can yield an income-generating activity while at the same time being protected and preserved.

Policy-makers and others who wish to follow this example should:

- Look for opportunities to 'cultivate' wild plants and animals that live in a particular area. This can prevent the species' extinction in the wild; generate income through the use of simple technology, particularly for women; and make use of indigenous, or local, knowledge.
- Explore the existing market to identify unfulfilled demand.
- Take steps to attract the attention of researchers and to raise awareness among policy-makers, scientists, producers and consumers.

Administrative data

Organization involved

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Funding

Total budget (in US dollars): USD 1,129,312
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Sources of funding: Fonds de Survie du Royaume de Belgique, CBDD, SNV, CECODI, VeCo.

Person(s) who have described this Best Practice

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Title

Daldal: dams to trap silt and water, an Irob innovation in northern Ethiopia[15]

Themes

Crop yield, food security, soil conservation, water conservation

Introducing the practice

The practice was developed by the Irob in northern Tigray in Ethiopia, on the border with Eritrea. The Irob speak Irobigna, which belongs to the Saho group of languages, and are ethnically distinct from the Tigrigna speakers in the Tigray region.

The Irob used to be a pastoral people, moving with their goats and cattle from the mountains on the eastern escarpment of the Ethiopian highlands to the lower plains. It was not until two or three generations ago that the Irob began to pay more attention to cropping, because they could no longer obtain enough cereals in exchange for their livestock products.

The landscape is very rugged and stony, with steep slopes and deep narrow valleys carved out of the plateau by flash floods. There is little land suitable for cropping. Over four decades, the Irob developed site-appropriate methods to capture soil and water for cropping. They built a series of checkdams in the seasonal watercourses and raised and lengthened the walls every year. In this way, they created step-like terraces that are now about 8 m wide and up to 10 m high, with about 20 m between dams. This innovation is known in Irobigna as *daldal*. It requires year-round effort over many years or even decades.

[15] This case is an adapted version of an article published in: 'Farmer Innovation in Africa. A source of Inspiration for Agricultural Development'. Chris Reij & Ann Waters-Bayer (eds.), 2001. Publisher: EARTHSCAN, Earthscan Publications Ltd, London (UK) / Sterling, VA. www.earthscan.co.uk

The practice originated in the community. The idea came from two Irob men: one who was regarded as crazy by his neighbours, and another who had served as a soldier in North Africa in World War II and had observed the traditional water-harvesting methods used there. Both men experimented with building small dams to catch water and silt, thus creating fields on which crops could be grown. They were observed by others, including Zigta Gebre Medhin, the innovator and leader who was also the main informant for this best practice. (See the address below.)

Using their indigenous engineering skills, the Irob have continued to improve the practice. Although building and maintaining the dams and cropping in the small pockets of harvested soil and water is very labour-intensive, it will be necessary for the survival of the Irob for as long as they want to remain in this rugged area, to which they have a strong cultural and emotional attachment.

Content and approach

Irobland is a land of extremes: of depths and heights, of droughts and floods, of frost and scorching sun. The altitude varies from 900 m (Endeli Valley) to 3200 m (Mount Asimba) above sea level; most people live between 1500 m and 2700 m. Rainfall in the main inhabited area is low (200–600 mm per year) and highly variable in space and time. A wet season is expected from mid-June to mid-August. However, water and soil eroded from the highlands, which receive more rain over a longer season, sporadically pour from the Adigrat plateau down through the seasonal streams that flow into two perennial rivers. These flow eastwards towards the Red Sea, but sink into the Danakil depression, 100 m below sea level, before reaching it.

As is common in tropical highlands, the daily variation in temperature is greater than the seasonal variation over the year. The annual mean temperature in Alitena (at an elevation of 1850 m), the heart of Irobland, is just under 20^{o} C; maximum temperatures can rise above 30^{o} C; minimum temperatures can fall to 5^{o} C. Frost occurs occasionally above 2500 m.

The Irob people, in trying to survive and even to cultivate crops in this harsh environment, have proved to be extremely inventive. Even in the early 1970s, when a Swiss geographer studied land use by the Irob, he marvelled at the ‘grosse Spielbreite an Techniken und Nutzungsformen’ (‘the broad gamut

of techniques and forms of land use') (Strebel 1979). He drew attention to the innovativeness of the Irob, who within an amazingly short period of time and without outside assistance, had developed site-appropriate soil and water conservation methods for crop production.

When the Indigenous Soil and Water Conservation action research programme (ISWC-2) commenced in Tigray in early 1997 and was seeking indigenous innovators in land husbandry, an obvious place to look was Irobland. Zigta Gebre Medhin, a man about 80 years old from Awo village near Alitena, the 'heart' of Irobland, told them the story of Ghebray Hawku from Daya village near Awo, who dreamt up a new idea about 50 years ago. In an attempt to catch the soil and water that rushed down the slopes, he had piled stones and earth across the stream's path in order to make a field for sowing grain. His neighbours saw his hard work and pitied him as they thought he was slightly demented. But Ghebray told them: 'Tomorrow you will all be as crazy as I am.' The others laughed but, as Zigta noted, a seed had already been planted in their minds. That seed began to grow when another Irob man, Kahsay Waldu, returned home as an ex-soldier. He had seen traditional soil and water harvesting by farmers near Tripoli. In a valley beside his home, he imitated the North African farmers by constructing a small dam, much like the one that Ghebray had built. Zigta observed this with interest and decided to experiment with the idea himself.

The daldal process

Zigta started in 1957 by fixing a large stone at the bottom of a seasonal watercourse beside his house. Silt collected behind this barrier. He sowed a few seeds on the newly created patch of land and harvested an armful of maize cobs. The next year, he placed more stones to make a somewhat higher barrier, collected more silt and harvested more maize. Over four decades he built a series of checkdams going farther up the watercourse, and raised and lengthened the walls each year. In this way, he created step-like terraces that are now about 8 m wide, with a horizontal distance of about 20 m between dams. Some of his checkdams are filled up to 10 m deep with silt that had been flowing down from the eroding Agridat plateau. Not only has new farmland been created where there had been only rock before, but well-filtered water can now be collected from the foot of the lowest dam during most of the year.

Over the years, Zigta watched how the soil and water flowed within the terraces and over the dams, and learned from these observations. He changed the shape of the dams by curving the walls outwards as he widened them so that more soil collected and the force of the water was spread. He scraped down other patches of soil to help fill in the area behind the newly raised terrace walls so that a larger cropping area would form more quickly. He improved the arrangement of the stones on the top of the dam walls and placed some very heavy stone slabs slanting slightly upwards at the outer edge so as to prevent possible damage to his structures from the overflow. He dug trenches both to increase run-on at some points and to divert excess water at others. He transferred sods of a tough local grass, known as tahagu, on to the deposited silt immediately behind the dam walls. The grass grew down and through the stones, holding them together like gabion wire. An additional benefit is that he can feed the grass to his animals. He planted trees in front of the walls to reinforce them. He did not develop techniques to fertilize the terraced land; he explained that soil fertility is maintained by the continuous addition of soil and litter, including tree leaves, with each flood.

The role of indigenous knowledge

At the time when Zigta began to build checkdams, wealth was measured not in land and crops, but in livestock. He was a skilled livestock keeper and had several cattle, goats and beehives. In the mid-1950s, his family consisted of four persons. He used to sell or trade animals to obtain cereals. However, after some years, as the terraces behind the checkdams became bigger, he was able to produce his own cereals and did not need to sell so many animals. He thus became richer.

His motivation for innovation came partly from necessity and partly from curiosity. When asked why he started the strenuous work of building checkdams, Zigta replied: The geographical conditions of Irobland were not suitable for cropping, and are still not very suitable today. So our main source of livelihood in the past was livestock. We used to travel to faraway towns such as Zalambessa and Adigrat in order to buy cereals which were carried on the backs of donkeys for days, up and down the mountain paths. Some people who did not have donkeys carried the cereals home on their shoulders. While experiencing these hardships, we were not idle in our minds. We were forced by nature to think for ourselves with a long-term view.

Because of the different seasons, wet and dry, we moved from place to place with our animals to seek grazing land. During these movements, I observed some things again and again: when it rains, dried leaves and fallen trees are washed down the valleys with the soil. Seeing what Ato Ghebray and Ato Kahsay (the first two Irob men who tried placing stones to catch the soil) were doing motivated me to start trying it myself, but if I had not noticed the things I mentioned just now, I would not have tried checkdams based only on these two men's examples. The main question I asked myself when I started was: 'Would it be possible to catch soil and water to create land and grow crops where this floodwater passes?'

Zigta described the years of developing his silt-harvesting system as a series of experiments: doing something with a vision of the benefits it could bring (in other words, a hypothesis, although he did not use this term himself), observing the effects, analysing the reasons for them, thinking of new ways to improve the technology, trying it out, observing, analysing and so on, in a process that continued until the Eritreans invaded Irobland in May 1998 and he had to flee to Adigrat. Sometimes in his experimentation, he recalled, he tried something and it worked well. Sometimes it did not, so then he reflected and tried something else. This entire development process went on without the aid of extension services. He depended on his powers of observation, his analytical capacity and his own creativity. This practice is thus based entirely on indigenous knowledge and informal experimentation.

Persons involved in the practice
Individual male farmers generally build the *daldal* in valleys near their dwellings, with the assistance of members of the extended family. These structures to create land for cropping by household members are built up gradually over many years.

When the Adigrat Diocese Development Action (ADDA) project, with support from the Catholic Church, started working in the Irob area in the mid-1970s, it stimulated community action to make larger dams more quickly in order to create more land that could be used in ways determined by the community. Men and women work together in constructing the dams; the work is supervised by older men from the community.

The transfer of knowledge

The practice became more widespread in the community after a small number of individuals who were held in high esteem because of their community spirit applied it successfully to create land and produce food. Zigta, for example, was recognised as a local leader, a rank that is conferred by ability rather than heredity in the Irob culture.

The knowledge behind the practice of building the *daldal* is now known to all male members of the community, but some Irob men are regarded as more skilful than others in adapting and improving the *daldal* and in experimenting with different ways of using the niches that they have created for crop, grass and tree production. Not all members of the community actually apply their knowledge by building the *daldal* for themselves, and it took several years before the practice began to spread beyond the first few men who initiated it.

The practice is already embedded in cultural and religious practices. The majority of the Irob who have settled around Alitena are strongly attached to the Catholic Church. The first Catholic church built in Ethiopia (in 1846) is in Alitena. Some communication about innovation takes place during church meetings, and priests are asked to bless new ideas. For example, when the Irob decided to regulate access to an area used communally for grazing, they invited the priests to say mass in the area and thus to give strength to the regulation agreements in the community.

Portrait of an indigenous innovator

Zigta sees himself as a hard-working and forward-looking man, and as someone who has been blessed with certain aptitudes. Other members of his family and community confirmed this. He is known as a man for whom laziness is next to sin. If he is convinced of an idea, no amount of difficulties and hard work will prevent him from trying to achieve it. His perseverance and conviction that he is right (some relatives also refer to this as his 'stubbornness') drive him on, even when others think it is impossible. He is also known as a man who is concerned about the future of the community and its resources. He initiated community action to manage the use of Sangade, a common grazing area in Irob. Upon his suggestion, the boundary was marked, rules were drawn up to regulate land use, and the priests say

mass there once a year to ensure respect of the rules. When the community has made such decisions, he is strong in seeing that they are put into practice.

Traditionally, a man who has many ideas, is talented with words and can organize activities well becomes a community leader. Zigta came to be recognized as such a leader. In his opinion, 'working closely with the other members of the community is the best way to teach them what one knows.'

Zigta's conviction that he was on the right track and that others should also benefit from his knowledge motivated him to spread his idea. He suggested directly to neighbours who had similar seasonal watercourses near their homes that they try building dams themselves and he advised them how to do so. He tried to encourage individuals, rather than whole groups of people. Zigta explained: 'at the time when I started building checkdams, community meetings and discussions were not very common. When we visited each other for other purposes, we advised each other in order to achieve better continuity in our farming.'

Some of these farmers, motivated by the results that Zigta achieved with his checkdams, copied his techniques in order to create new land for themselves. However, the spread of dams was initially quite slow. Even though many farmers recognized the potential of checkdams, it was not easy to build them because there were no handtools and it took some years before enough land could be created to grow enough cereals to make a substantial contribution to the family diet. Zigta summed up the reasons: 'Handtools were not available then. Others saw it as hard work and it was not clear how it would bring benefits. And not everybody has a clear vision of what they want in their lives now and in the future. God makes people who they are and arranges for them to have certain qualifications in life.'

Dissemination and development of the practice

Over time, communication improved between the farmers in Awo and other villages about how to capture more soil and water–for instance, by changing the shape of the dams and reinforcing them. For structural work on the dams, including major repairs, neighbours started to organize themselves into groups. As pastoralists, the Irob had been relatively individualistic, except for some agreements on the use of common pasture, but their growing emphasis on building and repairing dams to allow cultivation led to an increase in

mutual assistance. Almost all Irob farmers who live near seasonal waterflows now use the *daldal* technique.

A rapid increase in the building of such dams began after the small ADDA project financed by the Catholic Church made metal tools available for quarrying stone, and encouraged the Irob to apply their visions for development and their masonry skills to activities that were planned and implemented by the community, such as making cliffside paths and larger communal dams. This project started in 1975. There were therefore important interactions between indigenous innovation and an externally supported project. This helped the new ideas to achieve recognition and to spread, and it also made tools and funds available (in the form of food-for-work).

Achievements and results

The innovative *daldal* technique is a best practice because it is an indigenous innovation that has been recognised by many Irob people and by others living under similarly harsh conditions as a way of creating land to produce food and obtain a supply of clean water. It can be applied by anyone willing and able to invest the time and labour to build the traps for silt and water and to maintain them. It uses entirely local materials and lends itself to adaptation and experimentation by the agropastoralists. It creates new microclimatic niches in which further local innovation can take place.

The practice is sustainable in environmental terms, as it reduces soil erosion and makes use of soil and water that would otherwise have flowed down into the barren Danakil depression and been wasted. The *daldal* can be maintained by independent families living in the mountains of Irobland. The larger community dams are being maintained by community groups under their own management but supported by ADDA project funds. However, the larger areas of land behind the community dams built in flatter valleys (as opposed to the staircases of *daldal* built by individual families in steep and narrow watercourses) are now facing salinity problems.

The very labour-intensive *daldal* system provides a means of producing food for people who want to remain in the Irob area. However, many young people who have managed (through the Catholic Church) to obtain a formal education seek easier ways of making a living. They emigrate to other parts

of Africa and abroad, especially to North America, and send money back to their relatives in Irobland.

Strengths and weaknesses

In the past the Irob's main source of livelihood was livestock. They used to travel to faraway towns such as Zalambessa and Adigrat in order to buy cereals which were carried on the backs of donkeys for days, up and down the mountain paths. People who did not have donkeys carried the cereals home on their shoulders. Almost all Irob farmers who live near seasonal waterflows now use the *daldal* technique and grow their own cereals on the pockets of land they have created.

The practice is very labour-intensive and demands rigorous monitoring of the dams during the wet season. If the areas behind the dams become very large, as is the case with some of the community dams supported by the ADDA project, problems of soil salinity may occur.

The development process could be expedited if formally educated engineers with an understanding of local practices and conditions worked together with Irob farmers to improve the innovations still further and to help other farmers to adapt the innovations to other conditions. It is this interaction of formal scientific knowledge and indigenous knowledge and creativity that the Indigenous Soil and Water Conservation research programme is trying to stimulate.

Source of inspiration

The practice is suitable only for farmers living under certain conditions: in steep, rocky areas near a seasonal watercourse with a heavy run-off of silt and water, for example. Farmers living under other conditions may not be able to copy these feats of indigenous engineering exactly, but they could gain some ideas from them and adapt them.

The practice has spread into neighbouring areas of Eritrea. It can also be found in other parts of Ethiopia with very rugged mountainous terrain, but it is not clear whether this has been the result of contact with the Irob. It could also have been a case of simultaneous innovation by farmers facing conditions very similar to those of the Irob.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

The knowledge is documented in several articles and in a book:

- 'How to gain from erosion: catch the soil' (1997) by Abba (Priest) Hagos Woldu and Asfaha Zigta, in 'ILEIA Newsletter 13' (2): 16–18.
- 'Local research and higher action' (1999) by Ann Waters-Bayer, Fetien Abay and Mitiku Haile, in 'Forests, Trees and People Newsletter 39': 7–9 and reprinted in Ground Up 1 (1): 11–12, April–June 2000.
- 'Displaced and forgotten? The farmers of Irob' (1999) by Ann Waters-Bayer in 'Landmark 32': 6 – 8, and the French translation 'Chassés de chez eux et ensevelis dans l'oubli: les paysans Irob' in 'Agri-Repère 32': 7–9.
- 'Outwitters of water: outstanding Irob innovation in northern Ethiopia' by Asfaha Zigta and Ann Waters-Bayer: a chapter in the book 'Farmer Innovation in Africa: a Source of Inspiration for Agricultural Development', edited by Chris Reij and Ann Waters-Bayer and published by Earthscan, London (2001).

Several photographs have been taken by ISWC-Ethiopia within the context of the 'Indigenous Soil and Water Conservation in Africa' programme. A description of the innovation, written in the Tigrigna language, has been distributed through the Farmer Innovator Newsletter of ISWC-Ethiopia.

Administrative data

Organization involved

The Irob farmers themselves are responsible for the practice. They are located in the Irob District or the Tigray Region of Ethiopia and do not have the usual contact addresses and numbers.

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Title

Improving nutrition with Moringa 'miracle' trees in Senegal

Themes

Dried food, food security, health, malnutrition

Introducing the practice

The *Moringa oleifera* tree can be found throughout the world in the tropics and sub-tropics. Its edible fruit and leaves are a feature of diets in India, the Philippines, Senegal, Niger, Ethiopia and many other countries. Seed kernels of the tree possess natural flocculents and are used by people in the Sudan to purify the turbid waters of the Nile. In India, tradition maintains that the Moringa tree can cure 300 diseases, and local herbalists make extensive use of Moringa products to treat a host of ailments, including diabetes, ulcers, high blood pressure, pedal edema and kidney pains.

Church World Service (CWS) initiated a programme in Senegal which has demonstrated that the highly nutritious leaves of the plant are very effective at helping prevent malnutrition. The pilot phase began in June, 1997. AGADA (Agir Autrement pour le Développement en Afrique, or Alternative Action for African Development) is the local partner.

The Moringa tree is cultivated throughout Senegal, commonly seen grown as a living fence around compounds in villages. Leaves are periodically harvested to make a sauce, locally known under the Wolof name *mboum*. Elsewhere, researchers have known for years that these leaves represent probably the best tropical vegetable in terms of nutritional content. Laboratory analysis of fresh and dried leaves have shown that they are a very rich source of vitamins A, C, B-complex and E, as well as iron, calcium, potassium, magnesium and selenium. The leaves also contain all of the essential amino acids, rare among legumes. However, traditional cooking methods, in which the leaves are boiled up to three times and the water discarded after each boiling, result in the loss of much of the nutritional content. The CWS-AGADA project introduced the concept of drying the

leaves into powder form, in such a way that most of the nutrition is retained in a more concentrated form, and using this powder as a nutritional food additive (mixed in with the daily rice, sauce or infant formula). Collaborating health posts claim that this approach is very effective in helping to treat moderately malnourished infants.

The practice is now in wide use by health workers and individuals throughout the Casamance region of southern Senegal. After the results of the pilot project confirmed Moringa's efficacy in helping to prevent malnutrition, the project continued the training of health workers, NGOs and women's associations within the region. Thousands of new trees have been planted.

Consumption and use of the tree for various purposes is indigenous to many countries. CWS learned of the leaves' nutritional value from a development newsletter published by ECHO (Educational Concerns for Hunger Organization), which is located in North Ft. Myers, Florida.

Contents and approach

The purpose of the project is to teach local people the value of Moringa as a local, sustainable and inexpensive tool for maintaining good nutrition for the family. The project targets women and infants. Health workers are trained in preparing and using the powder. They are encouraged to conduct Moringa training seminars among the women who come to their clinics or live nearby. Pregnant women are encouraged to start adding Moringa leaf powder to their daily food early on in their pregnancy, and to continue taking it during lactation. Moringa is recommended as an additive to the food of babies six months or older who are being weaned.

Method

With support and cooperation from local health authorities, AGADA trainers schedule a series of seminars within a given region to teach the techniques to all the doctors, nurses and midwives working in that region. Additional seminars are scheduled for women's groups, village self-help associations and NGOs. A training film, booklets, brochures, posters and a newsletter have been produced as teaching and reinforcing aids.

The role of indigenous knowledge

The fact that Moringa was already well-known as a source of food and medicine by everyone in Senegal has made this message easy to get across. Senegalese generally respond enthusiastically to the information about 'their tree.' The information about Moringa's value is seen as an affirmation of what local people and herbalists have long known or suspected. Techniques of using and preparing Moringa are based on traditional practice.

Dissemination of information

Moringa was already known by everyone in Senegal, albeit under the local names *nebedaye* and *sap-sap*. The older generations know and have used the tree more frequently than the young, and *mboum* is frequently referred to as 'the sauce my grandmother used to prepare.' Now, within the original project area, the information on Moringa's nutritional value is spreading spontaneously. Already this knowledge is very widespread throughout southern Senegal. Many health workers, NGOs and community workers have become regular Moringa users and trainers. Local radio is often used to transmit information. There is even an amateur acting group which regularly presents skits about Moringa.

Achievements

Using Moringa to combat malnutrition, both by providing enriched food and by treating drinking water (Moringa flocculents can remove up to 99% of the bacteria in water within one hour of treatment), is an approach which supports indigenous knowledge with laboratory research. The Department of Engineering at Leicester University has extensively studied Moringa's flocculent properties and once implemented a pilot project in Malawi which used Moringa seed kernels to purify water in a community water-treatment plant.

Moringa trees can be found growing throughout the tropics and sub-tropics. Where they are not already common, they can be quickly introduced: grown from seeds or cuttings, the tree can reach a height of five meters and produce its first fruit within eight months. Trees are very drought-resistant and tolerate a wide variety of soil types. Once established, a tree can be cut back to ground level and will still grow back. Leaves can also be produced intensively within small backyard or rooftop gardens. Everyone can thus have easy, cost-free access to the product.

Strengths and weaknesses of the practice

A strength of Moringa is that it is a non-toxic, easily digestible source of nutrition which also has many beneficial effects on health in general. Recently, very extensive health and safety studies conducted at the Nogutchi Memorial Medical Research Centre in Ghana determined that Moringa leaf powder has no toxic elements. In this study laboratory mice, rats and rabbits were fed a diet which included up to 15 times the recommended daily dosage of Moringa leaf powder (i.e., the equivalent of a child consuming 375 grams of leaf powder daily). Absolutely no adverse side effects from even the most concentrated Moringa diet were observed.

A study will shortly be underway in Ghana to test Moringa's efficacy in HIV/AIDS nutritional therapy. Intensive cultivation of the tree could eventually introduce new cash crops for third-world farmers, as there is a growing demand overseas for the leaf powder and for the edible oil which can be extracted from its seeds. Farmers in India already produce Moringa pods, fresh and in tins, for both local and international markets. Moringa leaves are also a good food for livestock. The wood pulp can be used to make high-quality paper.

There is work to be done in developing international markets for Moringa products, establishing marketing networks, and encouraging its cultivation among third-world farmers. An international conference on Moringa's potential addressed these and other issues between 30 October and 2 November 2001 in Dar es Salaam, Tanzania. The conference brought together over 100 people from 27 countries: researchers, health workers and representatives of NGOs and industries. The conference was co-sponsored by Church World Service (CWS), by the Technical Centre for Agricultural and Rural Cooperation (CTA), and by the Centre for Industrial Development (CID). Propage and Asiafco coordinated the organization of the conference. Optima of Africa, a company which produces Moringa seed oil in Tanzania, helped host the meetings. Conference outputs included the creation of working groups to continue research into various uses of Moringa. Propage is currently developing a Moringa website.

Source of inspiration

It would be rather easy to transfer the practice of using Moringa for improving household nutrition, although some adaptations might be necessary. Use of Moringa leaves as a food may be more difficult to introduce in a society where tree leaves are not already used in preparing sauces.

In order to determine how Moringa leaves can be cultivated intensively, in 2001 CWS developed a 1 ha plot in northern Senegal with Moringa seeded at a spacing of ten centimeters and irrigated with drip lines. In this system, pioneered by the Biomasa research institute in Nicaragua, the Moringa leaves are harvested by cutting back the trees when they reach a height of one meter. The stumps rapidly put out new growth, permitting a second harvest eight weeks later. The CWS plot has been continuously productive for 12 months with an output of about 20 tons of dried leaf powder annually.

Thanks to publicity and the CWS publications, Moringa nutrition programmes based on the CWS-AGADA approach have been initiated in more than 25 other countries worldwide. New Moringa research projects are underway. These include livestock feeding trials at the International Trypanotolerance Centre in Gambia.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

A special acknowledgment is owed to Mr Martin Price, director of the Educational Concerns for Hunger Organization and editor of ECHO Development Notes. The many articles about Moringa published in this agricultural newsletter were the original inspiration for the CWS/AGADA project, and ECHO continues to be a very responsive and encouraging partner.

Features about Moringa and the CWS/AGADA project have appeared in the Los Angeles Times, in the International Herald Tribune, and in many other (mainly American) newspapers. CWS published a booklet on the tree in both

English and French; the English version can be seen at: www.moringatrees.org

A new version of the book, in both English and French, can be obtained by writing to CTA, P.O. Box 380, 6700 AJ Wageningen, The Netherlands. It is entitled 'The Miracle Tree' in English, 'L'Arbre de la Vie' in French. The CWS/AGADA project was featured as a documentary on The Discovery Health Channel and as a feature story on National Public Radio in the USA. CWS and AGADA have also prepared a training film showing case studies, posters, brochures and other training/demonstration tools.

Recommended for further reading:

- Mark Olson's Ph.D. research on the *Morigaceae* family of plants. His research is described in the CWS/CTA publication in the chapter 'Introduction to the Moringa Family', and at the website : www.mobot.org/gradstudents/olson/mohome.html
- Educational Concerns for Hunger Organization's (ECHO) resources on Moringa; see ECHO's website at www.echonet.org
- Moringa oleifera: A perfect tree for home gardens http://agrss.sherman.hawaii.edu/onfarm/tree/tree0012.html

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Funding

The total budget for the period June 1997 to December 2001 was equivalent to USD 450,000. The funds have been provided by the Church World

Service. Future projects currently under consideration include a study to measure Moringa's efficacy as a weaning food supplement through an intervention targeting communities in the Gambia.

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ASIA

Vietnam
Papua New Guinea
India
Indonesia
Bangladesh
China

Title

Village Forest Protection Regulations in Vietnam: strengthening participation in natural resource management

Themes

Community development, forest conservation, forest management, natural resources, resource management

Introducing the practice

The method of protecting forests reported here was introduced by the Social Forestry Development Project (SFDP) Song Da, a technical cooperation project between the Governments of Vietnam and Germany in the provinces of Lai Chau and So La in Northwest Vietnam. The area is inhabited mainly by Thai and Hmong ethnic minorities, who together represent almost 65% of the population. The rest are mostly members of the Kinh majority.

In both provinces the Thai minority is settled mainly around river valleys where they have established wet rice fields, fishponds and orchards on the lower slopes. Around the paddy fields and on upland plots maize and cassava are cultivated. Timber, fuelwood, bamboo and other products are extracted from the nearby hill forests. These are regarded as common property to which everyone has equal access rights, while the sustainability of the area is ensured by local customary rules. Only trees and bamboo clumps planted by individuals are considered individual property.

Traditionally, forest areas regarded as important for watershed protection have been maintained, keeping their ecological functions intact. Locally, where forest resources had become scarce, indigenous systems of forest protection and regulated utilization evolved, such as the *Nyom Pa* system in Chieng Hac commune in which the remaining patches of hill-top forest were protected by an appointed member of the community. The *Nyom Pa* system guided decisions concerning the location and length of rotation of upland fields, planting and felling of bamboo and timber, and the placement of forest fruit gardens. During recent decades the system has been displaced by committee structures. However, villagers indicated a clear need to reorganize

the *Nyom Pa* system as a very useful, traditional means of effective resource protection.

Trees are selected for cutting on the basis of the various species' properties, accessibility and timber quality. Rattan, fruit, mushrooms and medicinal plants are also extracted from the forest. In recent years, however, over-exploitation has made these products scarce. Only bamboo, with its vigorous coppicing ability, remains abundant on degraded soil unsuitable for agricultural production and is used in frequent ways by the local population.

Near a few Thai villages remnants of sacred forests still exist. Their origin lies in the old animistic beliefs and traditions of the Thai people. These patches consist of natural forest trees and bamboo clumps believed to shelter the spirits that influence the village. Clearly separated from the sacred forest are the forest cemeteries of the Thai people, which also consist of small groves of natural trees close to the village.

The Hmong are mountain dwellers practising shifting cultivation. Their main crops are upland rice and maize. Under pressure of diminishing land resources, rapid population growth and government programmes, the Hmong in many places have changed their system of cultivation from a wandering to a sedentary type. In some places they have developed complex upland farming systems that reflect intimate knowledge of natural resource management. Beekeeping is commonly practised using traditional methods.

Their system of shifting cultivation intersperses forest and upland plots and incorporates various species of useful trees. Individual trees along the edges of fields are claimed by households for private use. Tree ownership may be distinct from land ownership, particularly in the case of host trees (*Dalbergia hupeana*) on which the insects that produce the resin used in shellac production live.

Remaining forest areas not included in the shifting cultivation system are located on steep slopes and on limestone mountains. These forests provide timber for house building and fuelwood, and a few non-timber products. Traditionally, there is a common understanding among the Hmong that the forest is a resource to which everyone has free access. However, traditional rules limited unsustainable resource utilization.

The forest protection regulations

With the cooperation of the Forest Protection Department of Son La province, the SFDP began in late 1998 to develop a method of protecting forests and regulating their exploitation at village level. The government had identified such a need, and wished to improve farmers' ability to analyse their forest resources and traditional rules. The aim of the project was to develop and adopt regulations that would respond to the needs of both farmers and the government and which could realistically be enforced. Consequently, traditional rules and resource management techniques were identified and integrated into the regulations. Primary responsibility was handed over to the community itself rather than to external agencies. Up to now, over 500 villages have developed and adopted their own sets of regulations.

Contents and approach

In 1996 the government introduced official forest protection regulations (decision 77-CP). These consisted mainly of lists of prohibited activities and the sanctions associated with them. Local people were excluded from access to forestland by a system of fines enforced by the Forest Protection Units. In other words, the official regulations did not take farmers' needs and interests into account and therefore failed to achieve community-based forest management. At the same time, state capacity to enforce the forest regulations was weak.

At this stage the project facilitated a dialogue to increase the participation of the local population and succeeded in establishing trust, respect and an exchange of information among local communities and forest protection officers. It then assisted in the development of the new Forest Protection and Development Regulations through workshops with the stakeholders and agencies involved, trial implementation and final approval at provincial level. From the very beginning traditional rules were incorporated into the new regulations and as a result communities developed an interest in their continuation and success.

As described above, the practice of protecting forests and regulating their use originated in the community itself. Local people have always understood that they depend on the forest for their subsistence and for the role it plays in

local ecosystems. But there is also a more spiritual basis for their relationship with the forest. They have therefore always had rules for forest protection and management at village level. Some of these are still in force, others have become outdated as they could not be adapted to the present environment. In this context the new regulations provide a legal basis to revive and adapt traditional rules and to ensure that they are recognized by the local authorities.

The entire process of developing regulations is placed in the village and is carried out by the community itself. At village meetings the community members first share their ideas and opinions on the purpose of regulations and what they would like to achieve with them. The next step is to draft the regulations. This too takes place in a participatory way, ensuring that traditional rules are incorporated. The regulations define in detail (a) the areas concerned (grouped according to specific purposes); (b) rewards and penalties for certain behaviour; (c) hunting and grazing rules and (d) fire prevention measures.

The main feature of the method described here is that local people are actively involved in the decision-making process, so that regulations suited to the local situation are drafted. Standard regulations are no longer issued in a top-down way; instead each village develops its own specific regulations. The new approach ensures the commitment of the local community because taking over traditional rules and giving them a legal basis (through approval by the district authorities) serves that community's interests. Regulations are enforced at village level with the support of forest rangers, allowing local people to be directly involved in forest protection and management and traditional institutions to take responsibility in this area. In this way communities benefit from timber and non-timber forest products, without endangering the sustainable use of natural resources since forest utilization is linked with effective forest protection.

Furthermore, the relationship between local communities and officers of the Forest Protection Department has considerably improved. A dialogue in which opinions are exchanged and needs and wishes clarified in order to achieve a common understanding of the situation and the obstacles involved is essential to overcoming the communication gap between the two groups.

Community involvement

Male and female villagers of all ages take part in the process to establish Forest Protection and Development Regulations. Since women represent an important forest user group and the sexes often follow different resource utilization patterns in the same woodlot, their activities have to be identified and coordinated for mutual long-term benefit. This is essential if the regulations are to be successful.

The village meetings at which the regulations are discussed and drafted provide forest users with the tools and skills they need to analyse their own forest resources and to generate new ideas regarding forest protection and management. Village sketch maps are drawn as a basis for discussion and the distribution of specific natural resources identified and mapped using local names.

Regulations are drafted to cover any or all of the following:

- Harvesting of forest products.
- Creation of upland plots through clearing and burning.
- Fire prevention and control.
- Cattle grazing.
- Hunting of wildlife.
- Specification of the rights and duties of individuals who own and/or protect patches of forest.
- Specification of procedures for fining, compensating and rewarding.
- Dissemination of information about the regulations.

Once all members of a village have agreed on a set of Forest Protection and Development Regulations, the village leader submits the regulations to the communities' authorities, who forward them to the district authorities for approval. Local forestry officers facilitate the process of establishing the regulations and obtaining approval and feedback from district level. Once established, the regulations are distributed in the village either as a poster at common meeting points or as copies for each individual household.

The role of indigenous knowledge

'Islands' of forest containing valuable biodiversity are preserved in spite of the current pressure to place more and more land under intensive cultivation. Indigenous beliefs and practices regarding sacred forests and graveyard

forests have been instrumental in this. Even today new areas for graveyard forests are set aside by villagers and protected accordingly. The resulting patches of forest found near many villages play an important role in the general ecosystem, especially in watershed areas like Song Da. They also provide starting points for future natural regeneration.
Even today, funerals are major village events. Graves are elaborately decorated and great ceremony surrounds a burial. Such traditions give a society its cultural identity. Forest Protection and Development Regulations help to validate and preserve such traditions because they have adopted the traditional way of classifying the forest, which is shared and understood by all members of the village, both young and old. This common understanding prevents people from harvesting inside protected areas. The regulations also reinforce this valuable understanding by increasing villagers' awareness of the additional benefits of forest protection.

Achievements and results

To date, Forest Protection and Development Regulations have been approved and have legal force in both provinces. They are implemented by the Forest Protection Department, drawing on the national budget. This institutionalization of the process is considered crucial to ensuring continuation even after the project has ended.
The regulations have been established in more than 500 villages in the two provinces so far and implementation is continuing. Experience shows that villagers have become more aware of their forest resources and are committing far fewer violations. Incorporating existing and traditional rules of the community into the regulations increased their acceptance among villagers and ensured an independent commitment. Once regulations have been established, farmers feel responsible for their enforcement, since they drafted them themselves. This reduces the costs of external monitoring and ensures the long-term sustainability of the approach. Many villagers are concerned enough to protect certain forest areas voluntarily, without financial reward. The quality of the forests has improved remarkably; the incidence of forest fires in the dry season has fallen substantially and uncontrolled logging no longer takes place. For the people, the regulations combine responsibilities with benefits, so that forest protection and development becomes a concern of all. Experiencing the benefits of forest protection and regulated utilization should serve as an incentive to users to ensure that forest resources are used in a more sustainable manner.

This participatory method depends heavily on a good relationship between the forest ranger acting as facilitator and the villagers. It is vital that the facilitator be well qualified to guide the process of establishing regulations. Up to now, conventional forestry management has not included any training in participatory extension methods, which means that forestry officers do not possess the necessary skills. The staff involved must therefore be trained before they can do this work. To this end, the project provided training in facilitation skills and techniques and introduced aspects of adult learning for the staff responsible at district level.

What is more, the regulations can only be effective if villagers are themselves motivated to keep the issue alive during village meetings and on other occasions. Such independent initiative strongly depends on community spirit and/or on the effectiveness of Village Management Boards and other village organizations. Only if the whole village supports the regulations can a sense of ownership develop that is strong enough to guarantee their independent continuation in the long term.

Source of inspiration

This practice could be replicated in other areas or contexts provided several conditions are met. The first important condition is that the local authorities accept the approach. The authorities at district and provincial level must recognize the Forest Protection and Development Regulations and give them legal status. Only if the regulations are in line with other specific legislation can they be put into effective practice. Especially in cases of conflict between neighbouring villages, effective enforcement against outsiders can only succeed if the regulations are based on national law and are recognized by local authorities.

Furthermore, the process of land-use planning and land allocation has to be completed so as to guarantee the long-term tenure needed for the security of forest resources. This process mainly involves resolving and legalizing traditional claims on forestland and thus increasing local communities' sense of ownership of forest resources. Of particular importance are the definition of village boundaries and the settlement of lingering conflicts over them. Forestland allocation also increases people's sense of ownership of the resource pool and increases their independence within the decision-making process.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

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Funding

GTZ, period: 1993-2004.

Title

Using IK to predict the impact of human activity on biodiversity

Themes

Biodiversity, birds, community development, cultural identity, ecology, habitat

Introducing the practice

This practice involves the observation of birds in relation to habitat. It was developed in conjunction with the Hewa people of Papua New Guinea's Central Range (142 30' East, 5 10' South). The Hewa are swidden horticulturalists occupying foothills and lower montane forests at elevations of between 500 and 1500 metres. The 1993 Conservation Needs Assessment (CNA) described this territory as 'biologically unknown' and a conservation priority for Papua New Guinea.

The practice, or methodology, was developed during eight months of fieldwork conducted between 1994 and 1997. While it continues to undergo refinements that will make this knowledge more accessible to scientists and development agencies, it essentially records generations of Hewa knowledge in a manner that is useful for conservation purposes.

By using IK to predict the impact of human activity, the Hewa are attempting to make their IK available to the international conservation community. Although indigenous lifestyles have been described as blueprints for conservation (Posey 1992), western science knows very little about the relationship between traditional human activities and biological diversity (Stearman & Redford 1992). This practice takes advantage of the convergence of IK and science by presenting IK related to birds and their responses to habitat alteration.

Contents and approach

First, the Hewa informants made an inventory of the birds found in their territory by identifying them in field guides. This gave me, the investigator,

an opportunity to identify any cases of local people grouping several species under one classification. Secondly, informants identified the altitude and habitat favoured by each species. This made it possible to generate a list of birds that would not tolerate habitat alteration or shortened fallow cycles. These lists were then checked against transect bird counts and vegetation surveys to determine their accuracy. Finally, once the Hewa IK and these checks were in agreement, the results were submitted to Dr Jared Diamond of the University of California Los Angeles, an international expert on New Guinea birds and their conservation. Dr Diamond has concurred with our findings.

The practice/methodology of using IK to predict the impact of human activity has only recently been developed in cooperation with the Hewa. Yet it is the product of thousands of years of accumulated and transmitted knowledge. Because the Hewa are not tied to the economy of modern Papua New Guinea, a traditional lifestyle centred on horticulture, hunting, nature observation and intergenerational learning continues to dominate their culture. Employing IK to predict the impact of human activity is viable and cost-effective because it requires no costly equipment. The only conditions are that the birds of an area must be relatively well known and that the relevant IK must be intact. The practice can therefore be expected to remain in use.

The practice originated as a collaborative effort between the Hewa community and Dr William H. Thomas. More specifically three Hewa men–Wanakipa Tama, Tuki Toap and Tuki Telian–were eager to become involved with a conservation-based development programme. After the 1993 CNA, we decided that if the Hewa IK can be used to answer questions which the conservation community has neither the time nor the money to investigate, the Hewa can bargain for a greater role in determining the future of their land. It is also hoped that as the efficacy of IK as a conservation planning tool emerges, IK will form the foundation of a tradition-based school system and research station. It was thus primarily through the collaboration of four individuals that this practice was developed.

The aim of the practice is to go beyond indigenous inventories and to link Hewa IK with conservation professionals by providing information that only the long-term observations involved with indigenous knowledge can give. It

is meant to produce a dynamic picture of the relationship between human activity and biodiversity. This picture is typically absent (or comes after the fact) in the planning process.

The parties involved
Although three local men were primarily involved in developing this practice, many men over the age of 25 contributed to it. As in any society, individuals vary in their observational skills and interests. However, the information gathered was not strictly the property of the principal informants. In fact, many men who were avid hunters and enjoyed observing nature could and did contribute.

The project
A combination of methods was used to obtain and verify information. During my work three local men emerged as the most knowledgeable on the subjects of birds, trees and habitat preferences. They became my assistants and contributed their knowledge to all my interviews, transects and surveys. In the field guide 'Birds of New Guinea' (Beehler et al. 1986), each informant was asked to identify the birds found in the territory, and specify the altitude and habitat each bird favoured. Habitats were broadly defined using the indigenous categories garden, grassland, old garden, 'old garden true', and primary forest. The distinction between old garden and 'old garden true' described their perception of the differences between secondary forest growth that was less than 20 years old (old garden) and secondary growth more than 20 years old ('old garden true'). Later, during the vegetation transects (see below), informants were asked to identify not only the plants but also the birds that fed on the flowers and fruit of each tree.

In order to check the information that I obtained from interviews, I compared traditional ecological knowledge with both bird and plant censuses. I surveyed the vegetation in six plots where the secondary growth was more than 20 years old. I chose the six plots because this gave me two samples within each of the three altitudinal zones described by the Hewa. Plant censuses were conducted along the paths by counting the number of trees of different species that were at least ten centimetres in diameter at breast height, and within four metres of the path on either side. This procedure follows protocols described in Beehler et al. (1987), Blankenspoor (1991) and Bernstein (1995). Plant specialists at the University of Papua New

Guinea analysed the samples.

The age of each plot was determined relative to 1975, the date of Papua New Guinea's independence. The Hewa have a calendar based upon the fruiting of *pandanus* and *Pangium edule*. However, since this calendar describes the fruiting sequence and not the actual dates, it is somewhat ambiguous. Some of the *pandanus* species can be found at all of the altitudinal bands accepted by the Hewa. There can also be several months' difference between the time a fruit ripens at the lower altitudes and the time the same fruit ripens at the highest altitude. The Hewa calendar is therefore used as a guide for Hewa activity but not as an absolute marker of the days in a year. Papua New Guinea's independence day is a benchmark date that all informants could remember.

My informants and I also conducted transect bird counts along two fixed forest paths that climb from 700 to 1250 metres above sea level. We established ten stations at 50-metre altitudinal intervals, and recorded the birds we either saw or heard at each station during three-minute stops. Transects were conducted between 7 and 11 am, six days a week, from September 1996 through January 1997. Each route followed a ridge that threaded in and out of primary forest and secondary forest that had long been fallow. This protocol was derived from Beehler et al. (1987). As stated previously, these checks confirmed the IK, as did correspondence with Dr Jared Diamond of UCLA.

The role of indigenous knowledge

- IK substitutes accumulated traditional knowledge for years of research by western scientists.
- IK continues to involve respected and politically powerful members of the community in a process that may ultimately decide the future of the community.
- IK generates data that is understood cross-culturally and is a basis for testing hypotheses.
- By opening itself to the scientific method, IK is moving beyond the emic/etic debate and promoting a cross-cultural dialogue between naturalists.

The knowledge behind this practice is based on traditions that limit both population and disturbance. Hewa traditions produce a mosaic of habitats

that actually increase the biological diversity of the area. These traditions are not market-based. Instead, the subsistence economy of the Hewa allows time for nature observation and the exchange of information between kinsmen. It also encourages individuals to develop a personal relationship with the forest and to discover personal sacred places within this environment. Such places often are identified through ancestral visions experienced in dreams. Tradition encourages the person receiving such a vision to preserve the designated area (for example, by not cutting to make a garden) and to offer small sacrifices to the ancestral spirits when visiting the sacred site.

Transmission of knowledge

Not all members of the community possess this detailed knowledge of biodiversity and the effects of gardening. Instead, it is the property of those men who are interested in observing nature and who have the necessary experience. They pass on the knowledge to younger members of their kinship group.

The Hewa have no written language. Prior to this collaboration, all information was transmitted orally. Since 1994, we have been recording Hewa IK.

Achievements and results

The principal benefit of this practice to the Hewa is that it reconciles the relationship between their culture and biological diversity in a manner understood by conservation biologists. While some have suggested that traditional cultures like the Hewa might serve as templates for biodiversity conservation, the relationship between biodiversity and cultural diversity remains poorly understood. This may be due to the perception that IK, while able to generate inventories, is weak on the analysis of ecological processes. As a result, while IK research continues, mechanisms for using IK in conservation planning have been slow to develop. As nations like Papua New Guinea look to IK for ways of developing flexible conservation strategies, advocates for its use have not yet been able to shift the focus of research beyond solving immediate problems such as ways of increasing crop yields, controlling erosion, or using traditional medicines. However this practice enables conservationists to access the Hewa knowledge of ecological processes and shifts the focus of research from such immediate concerns to the ultimate role the Hewa will play in the future of their lands. In effect, it is

the mechanism by which the Hewa can become full participants in the conservation of their lands. Once conservationists recognize the contribution this culture can make to the global biodiversity debate, the Hewa should reap the benefits as a recognized partner in conservation.

Finally, this practice reinforces the importance of the Hewa culture in maintaining biodiversity. Traditions governing mobility, fallow cycles, birth spacing and land tenure play a role in promoting the diverse landscape that we seek to conserve. Such traditions are woven into the fabric of Hewa life. Rather than trying to stabilize shifting cultivators, conservationists armed with IK can capitalize on traditions that promote biodiversity. The Hewa will benefit by adding the powerful voice of the international conservation community to theirs in the search for development options.

Making a difference to the quality of life of the communities concerned

By making the connection between culture and biodiversity explicit, this practice makes IK valuable to the global conservation community and helps the Hewa play a greater role in their survival as a society. The partnership should affect several quality of life issues for the Hewa. IK will gain recognition as a tool for conservation planning. The Hewa will then have a renewable resource, with a global value greater than that of either their timber or mineral resources. Their natural IK capital will not only enable them to earn an income as paid research assistants. It also means that they can be paid royalties for conserving their lands. Potential sources of such payments might be nations interested in carbon sequestration reserves, or the national government in its efforts to provide drinking water to residents of the watersheds originating in Hewa lands.

The Hewa can now enter the conservation debate as full partners, armed with an intimate knowledge of the dynamics that shaped these lands and sustainable strategies for resource use. The expanded possibilities presented by their IK will help to craft the flexible and dynamic conservation programmes required to conserve both their biological and cultural inheritance. Full participation will enable the Hewa to improve their quality of life by designing a reserve that embodies their traditional wisdom and includes sufficient habitat for all species. By giving the government of Papua New Guinea an economically viable way to conserve biodiversity as well as traditional life, the Hewa will gain a measure of autonomy and status not presently accorded them. Rather than primitive remnants that must be

brought into the modern world, the Hewa now present a unique opportunity to combine conservation with development.

Sustainability

This best practice is sustainable because it highlights the value of Hewa IK for conservation and links it to the conservation of culture and resources. However, sustainability is contingent on the global community recognizing:

- The value of wild lands.
- IK as a planning tool.
- The connection between cultural and biological diversity.
- The economic value of ecological processes such as carbon sequestration and water purification.

And is further dependent on:

- National and international leaders allowing the economic benefits of biodiversity and intact ecological processes to flow to the locals, in effect compensating the Hewa for the restrictions that conservation will place on them.

At present IK and traditions survive through isolation. Unless a more accurate valuation of the services rendered by wild lands can be incorporated into national planning, local people and their lands will remain unprotected. Until the economic benefits of conservation begin to flow to the traditional inhabitants as compensation for their limited development options, local people like the Hewa will be unable to protect their lands through isolation alone.

Tangible benefits for local people

Currently the only mechanism for translating this best practice into a benefit for local people is the application of research results by conservationists. However, while governments like that of Papua New Guinea search their traditional cultures for IK that will lead to sustainable resource use, very little funding is dedicated to recording IK. In addition, there is some resistance on the part of scientists to accepting IK. Since scientists are the backbone of the conservation community, IK is fighting an uphill battle.

The best hope for translating this practice into benefits for local people lies in the publicity gained by IK through forums like this. Hopefully

conservationists will look to UNESCO and others for inexpensive, flexible solutions that are culturally specific and can be implemented quickly. The best practice developed with the Hewa represents one such solution.
To sum up, the practice:

- Bridges the gap between IK and western science by using birds as indicators of biodiversity, thus providing data that both parties understand to be relevant to the conservation of biodiversity.
- Because birds are one of the best known organisms on earth and good field guides are available, this practice moves beyond the emic/etic debate concerning IK. The Hewa understand the various habitats, altitudes and roles birds occupy in their environment and communicate in a manner that professional planners can understand.
- It places a premium on tradition. IK is obtained through years of experience and transmitted along traditional lines of cooperation. Community elders therefore retain their influence.
- It aligns the Hewa with science's current understanding of the relationship between disturbance and diversity.
- By acknowledging the value of IK, this practice will facilitate the continued transmission of traditions.
- By acknowledging the value of IK, this practice will facilitate the conservation process by giving the Hewa standing both as landowners and as naturalists.

The practice of using IK to predict the impact of human activity on biodiversity scores well in terms of sustainability, cost-effectiveness and local manageability. It is sustainable as long as traditional lifestyles are not severely compromised: that is, as long as the forest mosaic remains intact and young men are encouraged to spend time in the forest. The only costs of this project were the research funding for Dr Thomas. The IK is the intellectual property of the Hewa. Their land rights are guaranteed by the constitution of Papua New Guinea.

The practice has a number of strengths. It:

- Produces data that is accepted by and useful to the international conservation community.
- Can produce a detailed picture of the impact of activities on biodiversity, and it does this quickly and as part of the planning process.
- Involves the community.

- Acknowledges the value of their IK and traditions.
- Retains the traditional information and authority structure.
- Deals in ecological facts already accepted by the intellectual leaders of the community.

The practice will improve with time as scientists critique the methodology, and as knowledge from both science and other IK systems reveals new avenues of inquiry.

Source of inspiration

It would be possible to transfer this practice, provided certain conditions and prerequisites are considered. Using IK to predict the impact of human activity on biodiversity would be relevant and applicable in any context where:

- The community is interested in conservation-based development.
- Its traditional knowledge base is intact.
- The environment is intact.
- Species such as birds can be used as indicators.

To our knowledge, the practice has not yet been replicated.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

This practice can break down a major barrier and vitalize the dialogue between science, development professionals and traditional people. It removes from traditional societies the burden of maintaining a balance with nature. Instead, it places their activities in the realm of small-scale disturbance a process understood to contribute to biodiversity (Reice 1994). It seems likely that prior misinterpretations of the relationship between traditional societies and their environment have led to the current crisis in conservation-based development projects (Soule 2000). Small, cash-strapped nations like Papua New Guinea are often rich in both biological and cultural diversity. The practice offers the hope that these nations can tap their IK resources for sustainable development programmes before their unique cultural and biological inheritance disappears. Papua New Guinea in

particular has pinned its hopes for the future on the potential of IK to conserve the country's resources (Swartzendruber 1993).

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Title

Conjunctive use of water resources in Deccan Trap

Themes

Community health, community participation, groundwater, hydrogeology, hydrology, poverty alleviation, river basins, soil conservation, water, water management, water resources, water supply, water conservation

Introducing the practice

This practice resulted from a project carried out in and near the villages of Ambevangan, Manhere and Titvi, in Akole *Taluka*, Ahmednagar district, Maharashtra State, India. The community is made up of the tribal and rural people of three villages and outlying areas. They are on the lowest rung of the social ladder, with limited access to education, health and other social services. At the start of the project, the people lived in extreme poverty. Subsistence agriculture was the main form of livelihood. The main crop in the *kharif* growing season (June to September) is rice. Cereals are the main crop of the *rabi* growing season (October to January). However, the quality of the second crop in the past depended very much on the availability of soil moisture. The project area is located on the eastern flanks of the western Ghats, about 5 km from Kalsubai (1,646 m), the highest mountain in the range. The upland areas near Ambevangan and Manhere reach more than 1,500 m above sea level. The terrain is rugged in the north and west and undulating to the east and south. The overall slope of the land is to the south. Numerous streams and their tributaries drain the area, flowing into the Pravara River. Many of the streams are ephemeral (dry until it rains).

Water was very scarce before the project. Rainfall varies from 2,000 mm in the west to 600 mm in the east. It occurs almost entirely during the monsoon period (June to September). There is little or no rain during the rest of the year. The driest months are April and May, when temperatures climb into the 40^{o} C.

The monsoon rains used to flow as surface runoff, from the project area to lower elevations. The waters were laden with soil, eroded from the hillsides. These events provided continuity in a pattern of land degradation that began

in the middle of the 19th century with the destruction of forest in the area by outsiders.

The water-related hardships of daily life were borne by women and older children. The people had health problems, such as dermatitis and gastrointestinal conditions, arising from the shortage of water.

The tribal and rural people of the partner villages adopted technologies for water harvesting and spreading during the period 1992-96. The technologies are in use all year round.

The practice employs a wide range of approaches to water conservation and utilization in demonstration sites. Various barriers (contour bunds, *nalla* bunds, check dams, gabions) and shallow excavations (contour trenches, farm ponds, reservoirs in bedrock), at right angles to the slope, arrest the flow of surface runoff. Contour hedging and the replanting of nonagricultural land were introduced. These measures complement the terracing of hill slopes for agricultural purposes. Shallow excavations improve the infiltration of water (recharge pits and trenches). Masonry tanks contain the water from springs and seepages. Wells that have been dug are deepened; other wells are re-bored, thus making better use of the aquifer. Water is also collected from the roofs of dwellings. Domestic wastewater is used to irrigate the small kitchen gardens adjacent to dwellings.

The technologies are sustainable and remain in use today. They are small-scale, relatively cheap to implement and easily replicated. For the most part, they take indigenous knowledge as a starting point and are compatible with local approaches to land use. Maintenance has not presented serious problems for the people.

The technologies for conjunctive use of water resources come from a comprehensive survey of ancient and modern approaches to water-resource management in other dryland regions of India and worldwide. They have undergone modification to fit local circumstances, especially with regard to water, soils, bedrock and topography.

Contents and approach

The aim of the practice was to improve the management of water resources by the tribal and rural people of Akole *Taluka*. This involved explaining the shortage of water in the area and providing a strategy for a year-round water supply. Activities in support of these objectives included hydrologic and hydrogeologic research and the design and construction of demonstration

sites for water harvesting and spreading. In fact, the demonstration sites solved the problem of water shortage.

The practice originated from research collaboration between the non-governmental organization BAIF Development Research Foundation (Pune, Maharashtra, India) and University of Windsor Earth Sciences (Windsor, Ontario, Canada), who worked in partnership with the tribal and rural people of Akole *Taluka*. The beneficiaries are the people of the villages Ambevangan, Manhere and Titvi and outlying areas. At the start of the project, the population of the partner villages totalled 3,329. All age groups and both genders were and continue to be involved.

Participatory management was an essential factor in the project. BAIF field personnel carried out the early dialogues with the tribal and rural people at the level of the family. The needs assessment for the project was based on these interactions and on a rapid rural appraisal (RRA) carried out by a multidisciplinary team. The RRA concentrated on public health and water supply.

The people were unaccustomed to long-term planning. Their decision-making was mainly geared towards short-term survival. Early interaction with them focussed on generating ideas. For example, interested individuals were taken on visits to show them other communities which had benefited from projects involving water conservation. The people decided that they wanted to carry out agriculture more effectively. Initially, they placed the highest priority on achieving a year-round domestic water supply. Any excess water was to be used in irrigation.

Hydrological and hydrogeological research found possible solutions to the problem of water shortages. The research findings and possibile technological solutions were communicated to the people at public meetings that observed traditional formalities. The people decided which solutions were best for them. They took on implementation of the technologies at selected demonstration sites. They also assumed ownership of the technologies and full responsibility for maintenance.

In the valleys, a thin veneer of clay and fine silt occurs at the surface and prevents the infiltration of runoff. Contour trenches and infiltration pits were dug to break the continuity of this surface layer and direct the water underground. In addition, terrace-margin ridges (bunds) of soil were constructed to impound the monsoon waters at different levels on the hillsides and to facilitate infiltration. The farmers allowed the water to flow

down to lower levels of the hillsides through spillways along the terrace margins.

Images from earth satellites in orbit were analyzed in order to obtain maps of straight-line ground features, termed ‘lineaments’. These were defined by subtle differences in the distribution of soil types and vegetation. Many of them coincided with the traces of vertical fractures in the bedrock. The fractures commonly formed conduits for the circulation of ground water. Several of the more persistent springs issued from them. The spring waters were impounded in masonry tanks. Dug wells receiving water from bedrock fractures were deepened to improve their yields.

Masonry check dams, gabion structures, and gabion structures with impervious, ferrocement barriers were constructed across the valleys of ephemeral streams at different locations to impound water in reservoirs on the up-slope side. Gabion structures were held together by galvanized iron chainlink. Shallow bedrock provided the foundation. An underground stone dam also was constructed to localize the occurrence of ground water, which is accessed through a dug well.

Barriers, including some gabions and masonry gully plugs, were constructed at right angles to the slope to reduce runoff velocity and to trap eroded soil. Hedges also were planted at right angles to the slope on selected hillsides. Local vegetation was augmented through additional planting in areas of wasteland. These strategies of revegetation also had the effect of reducing soil erosion.

Roof water harvesting was introduced into the villages as a partial response to the priority placed by the people on a domestic water supply. The houses in the villages are of stone and mud and have tiled roofs, which form effective catchments. Gutters of galvanized iron were added and connected to ferrocement storage tanks by means of PVC pipe.

Infiltration (recharge) pits, in the vicinity of dug wells, had the effect of improving water yields. Existing bore wells were given an extensive workover in order to improve their yields.

The role of indigenous knowledge

Indigenous knowledge, attention to local religious practices, and respect for traditional and folk approaches to communication were indispensable to the success of the project. In addition, earlier practices of land use had given the people a familiarity with the relationships between slope, stream-flow and

soil genesis on a local scale. The project technologies provided logical extensions of this knowledge.

A watershed committee was formed in each of the villages to facilitate communication with the tribal and rural people. This was done on the basis of a tradition known as the *ayojan*, which is a village planning committee that takes responsibility for decisions affecting most or all members of the community.

Indigenous knowledge made an important contribution to the selection and siting of technologies for water harvesting and spreading. The people contributed detailed knowledge of the relationships between local topography and water sources on a year-round basis. This was especially important during the driest months of the pre-monsoon period (February-May).

The people applied traditional practices to the location of ground water. For example, they revere a tree, *Ficus glomerata*, known locally as *umbar*. *Umbar* is one of a number of *Ficus* species worshipped by the tribal and rural people for various reasons. It is also an indicator of shallow ground water. The presence of *umbar* marked places where wells were dug to tap springs. The people also provided a soil classification which proved to be a useful basis for categorizing the aquifer properties of local earth materials.

The people used to erect stone bunds across the larger streams and their tributaries. Plant material accumulated near the stream banks to form a type of compost known locally as *marwa*. The people built terrace bunding on the slopes between the streams and smaller tributaries. They recognized differences in soil quality between the ground along the larger streams and that around the tributaries. As a result, the people were able to discuss the merits of alternative water-harvesting and water-spreading techniques that could be introduced during the project.

Traditional cultivation of the land involves returning nutrients to the soil in the form of ashes that are left over from burning tree branches and leaves on selected plots. Rice and dry crops are planted as seedlings in the ashes after the first rainfall of the monsoon. Later, the seedlings are transplanted in the fields. This is the *rab* system of fertilizing, which takes its origin from a once widely employed type of shifting cultivation called *dalhi* (*kumri*). The water-spreading techniques of the project are compatible with and augment this local practice.

Traditional approaches to collective decision-making were important to the formation of self-help groups in Akole *Taluka*. For example, the women's

groups in the villages reflect the tradition of *wavli*, followed by the tribal women of Gujarat. This tradition protects the rights of women to have earnings, for example from vegetable cultivation. One women's group operates a mechanized flourmill to replace the labour-intensive stone grinders that were used in the past.

The knowledge behind the practice is widely understood by the people. Interested members of the partner communities were trained to implement technologies of water harvesting and spreading. The people also applied these skills to maintaining the project technologies. They were able to market their knowledge in other villages, as interest in using the same technologies spread across the surrounding area. The people also were given basic training in hygiene and sanitation.

At the start, the people said, 'Give us a water supply. We do not care about the quality. Just find us water.' The water-supply problem was solved through the introduction of appropriate technologies. The application of technologies for water spreading had the additional effect of improving soil moisture and increasing agricultural production. The people later saw the likely connection between poor water quality, sickness among family members, lost time in the fields, lowered agricultural productivity, and decreasing financial returns. As a result, they proceeded to take the health message of the other partners to heart.

Farmers asked the project teams to train them in how to clean dug wells so as to improve water quality. Village women now routinely strain the water from dug wells through several layers of *sari* material before carrying the water home. This has the effect of removing suspended particulate matter, including the larger organic impurities. Water is commonly boiled prior to domestic use.

Transformation of knowledge

BAIF field personnel lived with the people and shared their daily hardships. Each village has a watershed committee, which facilitated contact with the people. Communication was by means of public meetings and through on-site discussions between the researchers and individual farmers. Villagers, who gained experience of implementing project technologies at the beginning, served as role models for the rest of the communities and for interested parties from the surrounding area. Indeed, these role models hosted exposure visits by groups from other villages in the *Taluka*.

The demonstration sites in the project area provide lasting records of the shared knowledge generated through the partnership.

Achievements and results

The case involved the sharing of knowledge by all of the partners. In practical terms, this led to the integration of modern science (analysis of images from Earth satellites in orbit, and use of global positioning systems, geographic information systems, and field and laboratory techniques in hydrology and hydrogeology) with ancient Indian hydrology (for example, entries in the 'Brahat Samhita' of Varaha Mihira, Sixth Century), local religious beliefs, and indigenous technical knowledge. The project technologies are compatible with local land-use practice.

All 494 households of the project area have access to water for domestic and agricultural use. Up to 20% of the households obtain water from six developed springs. About 73,000 cubic metres of water is stored behind 14 masonry check dams and three ferrocement gabions. Water availability has increased by about 750 litres a day per person. A second crop (winter) is being produced on about 75 ha of land, and 300 ha of wasteland have been brought under cultivation as a result of increases to soil moisture. Formerly, the success of a second crop depended very much on the amount of rainfall and, as a result, occurred infrequently.

The project made a contribution to the advancement of gender equity in the area. The traditional, water-related hardships of women have been reduced considerably. Nowadays, women work longer in the fields and are seen as full partners on the land by the men. The men no longer have to go to other villages and towns to work as unskilled laborers in order to support their families. Instead, should they choose to work away from home, they can market the skills they have acquired in applying technologies for water harvesting and spreading. Illnesses connected with shortage of water are no longer seen in the partner villages.

There is a marked improvement in the morale of the people, evidenced by more outgoing attitudes, increased attention to personal appearance, and better upkeep of houses. There has been a major growth of community spirit. This is seen in people's eagerness to participate in the activities of watershed committees and self-help groups. The young people, for the most part, are no longer leaving the villages in search of livelihood. In fact, there have been several new housing starts each year in each of the villages since completion of the project term.

The technologies for water harvesting and spreading are sustainable. This is also true of the supporting technologies for soil conservation and revegetation. In general, the technologies are small-scale, cheap to implement, and easily replicated. The demonstration sites remain in operation all year round more than five years after the end of the project term. The people have assumed ownership of the demonstration sites. They have the knowledge they need to maintain the technologies effectively.
For example, the people routinely repair the terrace-margin bunds, where cave-ins sometimes result from the burrowing activities of large rodents. The villagers also are experimenting with natural pesticides to prevent this problem from occurring. In addition, the people repaired a masonry check-dam when its foundations became cracked as a result of the vibrations of an irrigation pump. In this way, local knowledge systems are expanded.
Maintenance of the technologies is relatively cheap. The people now are able to sell their surplus agricultural produce at local markets. The people are also experimenting with different kinds of cash crop. Tomatoes have gained widespread popularity in this regard. This has made the people able to bear the minor costs of maintaining the sites. They also possess marketable skills related to operation of the project technologies. They are employed as skilled workers in other villages of Akole *Taluka*.
It is noteworthy that even after two years with extended periods of reduced rainfall (1994-95 and 1995-96) the project technologies still brought beneficial effects to the area. This was mainly due to the increased amount of land under cultivation in the project area.

Strengths and weaknesses
The technologies of water harvesting and spreading are built upon a foundation of indigenous knowledge. They are compatible with local land-use practice. Accordingly, the people readily understood and accepted them.
In Akole *Taluka*, indigenous knowledge related to water and local land-use practice both have a lot in common with the documented records of ancient Indian hydrology. This continuity and also the researchers' attention to tradition made it easier for the people to adopt technologies that took indigenous knowledge as a starting point.
As mentioned above, even under conditions of prolonged low rainfall, the project technologies performed well and brought benefits to the people.
All practices in resource management have the potential to generate conflict. In Akole *Taluka*, this has not been the case, however. Perhaps the simplicity

of the technologies and the role of participatory management have been significant contributing factors.

Possible improvement

Both further additions of indigenous technical knowledge and expanded applications of modern science will bring improvements to the practice of conjunctive water use. There is inherent flexibility in any strategy of water resource management that employs multiple sources.

Source of inspiration

The practice is readily transferable across the entire Deccan Trap region, some 500,000 km^2 of western India, on the basis of similarities in bedrock geology. Many of the project applications of modern science emphasized the technique of fracture analysis to specify patterns of ground water movement. Combined with indigenous knowledge regarding how to locate shallow ground water, this proved to be a powerful tool. For example, these considerations were the basis for selecting which dug wells would be deepened and at which sites springs would be developed.

In general terms, the practice would no doubt be widely applicable in other areas, regardless of climate and geology. It should be emphasized that Akole *Taluka* initially was viewed as a very unpromising area for the development of water resources. The bedrock in other parts of the Deccan Trap probably lends itself better to the improvement of aquifer properties. It is also likely that other species of bottomland plant will prove to be even better botanical indicators of shallow ground water in these areas.

The practice has been replicated by BAIF Development Research Foundation over a wider area of Akole *Taluka*, thanks to support from the National Bank for Agriculture and Rural Development (NABARD), under the Indo-German Watershed Programme.

The striking success of the project has created an enabling environment for similar activities in neighbouring areas. Other villages subsequently formed partnerships with outside organizations, such as government departments and NGOs, and replicated the project technologies at other locations.

The lessons learned during the course of the project have been incorporated into a training course for the programme personnel of BAIF Development Research Foundation. BAIF and University of Windsor Earth Sciences have carried out the training from 1996 to the present day. The BAIF programme

personnel have a total constituency of more than a million families in seven states of India.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

Many of the tribal and rural people were suspicious of the intentions of the researchers at the start of the project. However, they readily agreed to the sharing of knowledge. This seems to point to a role for indigenous knowledge in breaking down barriers between cultures. People with knowledge to share feel like equal partners.

It is appropriate to give an example of how the people have improved on a simple technology in order to meet the needs of their particular circumstances. The people were given instructions on how to use the A-frame for the layout of trenches and ridges parallel to contours of elevation. This piece of equipment takes the form of a triangular wooden frame, with a vertical pendulum attached to the apex. When the pendulum coincides with a mark at the middle of the base, the base is level and the two bottom corners can be assumed to be at the same elevation. But the people found that strong winds on the higher slopes prevented the pendulum from coming to rest. So they did away with the pendulum altogether and attached a spirit level to the base of the A-frame. When the bubble is at the midpoint of the level, the two corners are at the same elevation.

The project outcomes yielded an abrupt increase in biodiversity in that part of Akole *Taluka*. Many animals returned to the area, for example, including the hare and the peacock. Some of these animals, notably the peacock, had been revered locally by previous generations of the tribal and rural people. In this way, the project 'gave something back' to local, religious practice.

Policies related to water management in dryland rural areas should take into account local customs and land-use practices. Sustainable solutions to problems stemming from land degradation can be developed only through participatory management and the integration—at watershed level—of strategies for water-resource management, soil conservation and the restoration of a vegetation cover. These strategies are complementary and each should include an important role for indigenous knowledge. In general, lasting success in tackling any one of them will only come through additional

attention to the other two. The coordinated use of multiple sources of water supply offers the versatility needed for addressing the widest possible range of water needs. It is also the logical starting point for the management of water demand. These remarks are equally applicable to governance and to research.

Administrative data

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Funding

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Period to which the budget applies: 1992-98
Sources of funding: International Development Research Centre, Ottawa, Ontario, Canada.

Person(s) who have described this Best Practice

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Title

Traditional harvesting and marketing of honey and wax in the upper Kapuas Lake region, West Kalimantan, Indonesia

Themes

Apiculture, forest products, honey, income generation, natural resources, wax

Introducing the practice

Traditional activities surrounding the harvest of honey and beeswax are being improved under the Danau Sentarum Conservation Project's (1992-1997) Conservation Products Enterprise programme. While the traditional harvesting system is being maintained, certain harvest and post-harvest practices are being adapted in order to increase yields and improve the quality of honey and beeswax derived from giant Asian honeybees, or *Apis Dorsata*.

The programme is taking place in various villages within Indonesia's Danau Sentarum National Park, formerly known as the Danau Sentarum Wildlife Reserve (DSWR). This is in West Kalimantan (Indonesian Borneo). The villages include Semalah, Bukit Tekenang, Semangit, and Nanga Leboyan.

The traditional systems of *tikung* (or honey board) and *lalau* (tall tree) were first described by Dutch explorers in the 1850s. These are both seasonal systems which depend on the weather and other factors that influence the arrival and swarming of the giant honeybees.

The research and subsequent improvements described here began in late 1994 and ended with the conclusion of the Danau Sentarum Wildlife Conservation Project in July 1997. This was Project 5: Conservation–Indonesia–UK Tropical Forest Management Programme (DSWR Conservation Project).

Prior to the conclusion of the DSWR project, funding was secured from the British Embassy in Jakarta for a three-year extension to the Conservation

Products Enterprise programme, of which the honey and beeswax project was a part. With the help of former local staff of the DSWR, a local NGO called Yayasan Dian Tama carried on this work until July 2000 with communities in the wildlife reserve. The same local individuals are still administering and supporting these activities, although the reserve is now a national park and the NGO is a new one called Yayasan Riak Bumi (Ripples of the Earth).

The *tikung* or honey-board harvest system is named after the carved hardwood plank (approximately 0.8 - 2.5 m long by 25 - 40 cm wide), which is convex on one side. Properly carving and shaping a *tikung* is a time-consuming process, often taking a full day to complete just one board. *Tikung* boards are attached to tree branches in the stunted flooded forests using notches and wooden pegs. They are positioned at a 30° slope with the upper part oriented towards the sky and the concave side facing downward to facilitate rainwater runoff. The planks are made of durable tembesu wood that can last over two generations and still be used after enduring a forest fire.

Ownership of a *tikung* is indicated by an individual owner's mark (*tikap*), usually a series of indentations at the side of the plank, recognized as the family mark. Each new generation (*son*) adds a new indentation (*taka*). This mark system is complicated, but well understood by all the *tikung* holders in a given area.

In one day five or six *tikung* planks can be placed in the submerged forest, usually two meters above the highest water level reached during the rainy season. Bee swarms arrive in *tikung* areas between December and February, although their arrival also depends on the timing of the preceding dry season. Prior to the arrival of the swarms, undergrowth is sometimes cleared and a small boat channel to the *tikung* might be dug. The last blossom from the *tahun* (*Carallia bracteata*) is the signal that honey is ready for harvest.

A five-step process took place during the DSWR Conservation Project to determine how the honey-collection system could be improved:
Research on systems of bee management and honey collection was conducted in the wildlife reserve in late 1994 (Rouquette 1995).

In early 1995, DSWR honey harvesters took part in planning activities to improve honey marketing and sales (Wickham 1995). DSWR was visited in early 1996 by technical staff representing a similar Apis dorsata honey-management system practised in Vietnam. DSWR honey harvesters paid a return visit to Vietnam in late 1996 (Wickham 1997a).
Various meetings, training workshops and field trials took place as improvements to the honey collection techniques were adopted (Wickham 1997b and YDT 2000).

Through the project, a traditional honey collection system and post-harvesting methods that have been practised for generations were described. The project also identified a number of common techniques that were harmful to the bees, produced an inferior product, or were wasteful of the resource.

Below is a table describing the adaptations that the DSWR project field staff initiated with the honey harvesters of Danau Sentarum in order to improve upon traditional practices and thus to produce larger quantities of better-quality honey and beeswax. The revised practice has the potential to generate more income for the communities, while also supporting and reinforcing principles of sustainability.

Common practice in the project	Problems with the practice	Suggested improvement	Advantage
1. Honeycombs are collected at night when bees are most docile.	· Bees need daylight to navigate. · Night harvesting results in bees losing their orientation, falling in the water and dying. · The remaining bees scatter and do not build new combs or produce any more honey.	· Daytime harvesting in combination with 'selective cutting' (see #3) allows bees to navigate and return to the comb to continue producing honey.	· Lower bee mortality during harvest. Increased sustainability of bee colonies.
2. Bees are driven from their combs by smoke from torches with exposed, smouldering embers.	· Many bees are burned and die. · Forest fire is a potential hazard.	· Hand-held 'smokers' can be used to ward off bees without exposing them directly to burning embers.	· Lower bee mortality. · Reduced risk of forest fire.
3. Honeycombs are harvested only once per season.	· Potential harvest is not achieved. · Full financial value of wax and honey is lost.	· Selected cutting of only the honey portion of the comb (leaving the brood intact) would permit 2-3 harvests per season.	· Larger honey harvest. · More income for the community. · Greater incentive to protect the forest.

Common practice in the project	Problems with the practice	Suggested improvement	Advantage
4. During the honey harvest the complete comb is removed.	· Bees do not re-settle. · Other potential honey harvests are lost.	· Only the honey part of the comb is removed. · The brood can be removed to prevent swarming.	· Allows bees to continue to build their nest on the same site. · Several harvests of honeycombs during one season. · Additional benefits as above.
5. Honeycombs are harvested without protective gear.	· Harvesting is done quickly, which increases the damage to the combs. · More bees are likely to die.	· Protective gear could be used: for example simple head-nets and/or gloves.	· More time and care can be taken during the harvest. · Reduced damage to comb and bees. · May ensure that fewer hives remain unharvested.
6. Honey is generally extracted from the combs by squeezing entire combs by hand.	· Pollen is mixed with the honey, making it cloudy and less attractive for the market. · The practice is unhygienic.	· Combs are cut into small pieces, placed on a clean cloth and allowed to drain overnight.	· Better quality honey. · More income for the community. · Greater incentive to protect the forest.
7. Beeswax is often contaminated, discarded, or incompletely harvested.	· Potential harvest is not achieved. · Additional financial value to the collector is lost.	· A system of melting the wax in boiling water, straining it through a cloth, and processing it with a stick-wax press can yield up to 47% more wax.	· Better-quality wax, and more of it. · More income for communities. · Greater incentive to protect the forest.

Table 2. Techniques for improved *tikung* beekeeping and better honey and beeswax yields

Stakeholders and beneficiaries

This project was one of a number of 'conservation enterprise' projects which DSWR project staff (including local staff) initiated together with some 30-40 honey harvesters living on the wildlife reserve.

It also involved taking three *tikung* honey harvesters to southern Vietnam, where they visited honey collectors who use a similar system and had adopted similar improvements. These individuals became local 'champions' because of the improvements made to the *tikung* system.

Local people become involved because they see the economic benefits of adopting improved harvest techniques, especially if these techniques prove to increase the overall yields and market value of these products.

As honey and wax generated more income, appreciation for the need to protect local forests from both fire and over-harvesting grew.

Men are the main collectors of honey and wax, but women and teenagers also take part in the post-harvest processing of honey and wax. How the financial benefits are shared among these beneficiaries has not been tracked, but could be the subject of further research.

Based on research undertaken within the DSWR project, approximately 25% of the people living in the reserve (up to 250 families) are engaged in the *tikung* honey collection system. This would be approximately 1500 to 2000 people in total.

The role of indigenous knowledge

The project worked with the indigenous knowledge and belief systems that were present in the community and that the people were familiar with. It did not try to introduce an entirely new activity, or worse, to introduce another bee species or import a foreign bee-keeping system with expensive materials and technologies. Instead the project was grounded in the belief that the unique and traditional honey-board *tikung* system is a valuable asset (in particular for marketing purposes). A training programme was built around the existing indigenous knowledge system and how it could be improved using simple and inexpensive, locally available materials.

Some of the suggested changes (outlined in table 2) were met with scepticism, but rather than insisting that these be adopted without question, project staff took local honey collectors on a fieldtrip to southern Vietnam to see how their Vietnamese counterparts had introduced these changes in similar surroundings. Following this exchange, these collectors became the greatest advocates of the changes.

Achievements and results

The improved quality of honey and wax has increased their value by a factor of 5 in the case of honey, and a factor of 10 in the case of beeswax. Improved harvest and post-harvest practices have increased yields of honey by up to 75% and of beeswax by 50%.

The local population is more aware of the value of their non-timber forest products, and of the need to protect them from unsustainable use and forest fires. Improved honey harvesting techniques which employ hand-held 'smokers' are also reducing bee mortality.

While it is more difficult to measure, another result of the project is the sense of pride that has developed among the people who took part it. Their products are now bottled, labelled and marketed to retailers in Pontianak, Jakarta, Singapore and the UK. They are even available via the Internet (see: www.tropicalforest.com). The people are proud not only of the products, but also of the knowledge they possess to make these products.

It is important to note that the NGO that has emerged from this project was created by, and is comprised entirely of, local people—those with the greatest stake in ensuring the success of the enterprise.

Strengths and weaknesses of the practice

The project worked with and built upon local indigenous knowledge and local resources. It did not try to replace them or expect people to invest in something costly or new. The Best Practice is a hybrid of the best of the original indigenous practices combined with proven improvements.

Any time the people did not understand or believe in the suggested improvements, the revised practices were demonstrated to them by local

people who had visited other communities and had seen the benefits for themselves. It was a 'farmer-to-farmer' approach.

But the economic benefits of bigger and better yields of honey and wax can be realized only if local NGOs continue to provide transportation and marketing support.

Why this is a Best Practice:

- It makes use of an existing practice (i.e. honey harvesting).
- It employs traditional skills, techniques and available resources (i.e. honey boards placed in trees, and local bee species).
- Local people are hired and trained to act as 'champions' on behalf of the project.
- Suggestions are made as to how indigenous practices could be changed to improve the quality and the quantity of the harvest.
- Local people were taken to demonstration sites to see similar activities being undertaken by honey harvesters elsewhere.
- With help, the product was marketed regionally and internationally.
- Producers earned maximum profits.

During the two-year period from 1995 to 1997, ten villages collected over 3200 kg of honey, which was marketed to retailers in Pontianak, Jakarta, Riau, Singapore and the UK. Honey brought in ten times more income than it did before 1995.

Source of inspiration

The adaptations of the traditional harvesting system described here are often done insimilar situations elsewhere. But to our knowledge, certainly within the West Kalimantan region, this is a rare undertaking. This example has the potential to demonstrate to local, regional, provincial and national government officials, NGO staff and academics the broad range of possibilities which exist for supporting and improving upon indigenous practices in Indonesia.

This particular practice would be difficult to replicate in other communities, however, as it relies upon a number of climatic, biological and ecological factors. But technical replication is not the only thing that matters. Of perhaps even greater importance are the attitude and behaviour of project

staff that work with local people. They need to be willing to respect and work with indigenous knowledge and to add extra value to it through the addition of other types of knowledge. This is particularly challenging, not only for expatriate staff (who often continue to discount the value of indigenous knowledge) but also for local staff and/or the rural people themselves, whose formal, western-oriented education has often denigrated their own local knowledge and practices.

The arrival of the bees and thus the season for harvesting honey is strongly influenced by two factors: the level of water in the lakes, which influences when the trees flower, and–in recent years–the forest fires that have plagued Borneo.
Very much depends on the accessibility of sites where *A. dorsata* can build their combs. In this respect the situations in the lake region of Danau Sentarum and in U Minh in Vietnam are unique. If accessible trees are not available, the bees will nest in tall trees.

Areas where these practices could be replicated include the marshy coastal region of the Sundarbas in India and Bangladesh and the Irriwaddy plains in Burma.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

A great deal of the knowledge required for this project came from the experiences of Mr Vincent Mulder (see address and contact numbers below), who worked with a similar honey-harvesting system in the U Minh Forest, in Minh Hai Province, Vietnam. He visited DSWR in January 1996 and sponsored a return visit to Vietnam in October of that same year.

Publications

Recent articles that have been published which describe this project in more detail include:

- Vincent Mulder, Valentinus Heri and Trevor Wickham (2000) 'Traditional Honey and Wax Collection with Apis Dorsata in the Upper Kapuas Lake Region, West Kalimantan'. In: 'Borneo Research Bulletin', Special Issue on Danau Sentarum National Park.

- Vincent Mulder, Valentinus Heri and Trevor Wickham (2001) 'Traditional Honey and Wax Collection from Apis Dorsata in West Kalimantan'. In: 'Beekeeping and Development', Number 59, 4-7.
- Vincent Mulder, Valentinus Heri and Trevor Wickham (forthcoming) 'Honey and Beeswax Marketing: Techniques to Improve Traditional Tikung Beekeeping from Apis Dorsata in West Kalimantan'. In: 'Beekeeping and Development', Number 60.

Other project reports are also available. Please contact Trevor Wickham directly.
Readers are invited to send us any additional information about your project, work or organization which you think might be useful.

Administrative data

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Other partner(s) involved in this practice

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Funding
Because this project was one of a number of initiatives undertaken by the DSWR Conservation Project over a five-year period (1992-1997), it is difficult to estimate the total amount that was allocated exclusively to this one project. From 1997 to 2000, the project also received support from the British Partnership Scheme (ODA) administered by the British Embassy in Jakarta. A very rough estimate of the funds allocated to this project over the eight years would be USD 150,000 to USD 175,000.

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Title

Sticks in the mud; Periphyton-based aquaculture

Themes

Aquaculture, fish, fish culture, fish production, fishery research, food security, income generation

Introducing the practice

Periphyton are the tiny organisms that live on the surfaces of objects under water. Periphyton-based practices have developed independently and are used to catch fish in open waters in various parts of the world. In West Africa the practice is known as *Acadja*, in Bangladesh it is called *Katha*, and in Cambodia *Samarah*. The present research project, which was conducted in Mymensingh, Bangladesh, has applied this technique to the farming of fish in ponds.

The people of Bangladesh are resource-poor. Most people live from agriculture, of which fish culture is an important component. Most households have multi-purpose ponds that are used, among other things, for bathing and sanitation, for irrigating fields and gardens, and for growing fish. The fish are consumed by the families as well as being sold.

The *Acadja* practice was first described by Welcome in 1972. The present periphyton project was conducted between October 1997 and April 2001.

Bamboo stems and branches, jute sticks, the remains of sugarcane stalks, and/or tree branches are all used as substrate. The various stalks are inserted vertically into the pond bottom, where they are colonized by the plankton, microbes, invertebrates and other organisms that make up periphyton. The best result is achieved if the surface area of the substrate is equal to approximately 50-100% of the pond's surface area. Ordinarily, fertilization is recommended for ponds with low productivity: for example the fortnightly application per ha of 4,500 kg decomposed cow dung, 100 kg urea and 100

kg Triple Super Phosphate (TSP). Ponds with high productivity need reduced rate of fertilization.

Under the project, ponds were stocked with three major species of Indian carp: 4000 *Catla catla*, 6000 *Labeo rohita* and 1500 *Labeo calbasu* per hectare of pond. Even without feed, ponds with substrate produced twice as much fish as ponds without it. In the project's experimental ponds, where bamboo was used as substrate and no extra feed was given, fish production reached 2,305 kg per ha within 90 days. The technology seems to hold promise for the farming of any herbivorous fish which is capable of harvesting periphyton from substrates.

Contents and approach

Traditional *Acadja*, *Katha*,and *Samarah* are still widely used. The periphyton research reported here was done at a field station. Farmers are also using this technique in ponds, but they cannot yet say exactly how much of their increased production is due to a periphyton substrate. More on-farm trials are underway, however. Thus far, it has been found that:

- The farmers believe that *shaola* (periphyton) can grow on substrate, and that this can be used as fish feed.
- Substrates are available within their farming systems.
- Substrates protect the farmers' ponds from fish poachers, since it is difficult to use nets in ponds with substrate.

The probability that the technology will be adopted is therefore very high; it could affect all rural areas throughout Bangladesh.

Origin of the practice

The practice originated in the community. The idea of using the periphyton technique in ponds came from researchers, but farmers grasped the idea quickly because the technique is traditionally used to attract fish in open waters. In rivers, for example, fishermen install bushy substrates where fish gather to breed, feed or shelter. After a time the fishermen catch the fish. Although the technique is practised mainly by households that farm fish, the whole community benefits because total fish production increases. At the same time, the pressure on over-fished natural waters decreases. The practice was first tried out in experimental ponds and subsequently disseminated to farmers by NGOs. The aim of the practice is to increase fish production

without increasing the level of nutrient inputs. The only additional input needed are sticks or branches, which the farmers can provide themselves.

In traditional ponds, phytoplankton is the basic fuel of the food chain and the most important source of energy. It does not generally meet all the energy demands of most herbivorous fish, however. They need supplemental feed or larger food that can be harvested more efficiently, such as benthic algae, detritus or aquatic plants of a higher order. Benthic algae rarely grows on the bottom of ponds because there is not enough light. But it will grow on hard substrates, or mats, installed in ponds, as will a film of bacteria and colonies of invertebrates. Fish can graze on these concentrated forms of food more efficiently than they are able to filter planktonic algae. Periphyton mats also improve water quality.

The role of indigenous knowledge

The practice originated from indigenous knowledge regarding devices to attract fish. The farmers therefore find it easy to understand and apply the technology. What the project did was to test whether the traditional technique could be used under pond conditions to increase production.

The practice can improve the socio-economic status of rural people by generating income and employment, and increasing fish consumption. The practice also has some weaknesses, however. Because substrates make it difficult to harvest only some of a pond's fish, the practice can interfere with a household's regular consumption of fish. If the practice is applied on a large scale, the need for substrates competes with other household purposes for which branches and sticks are used, such as cooking. Bamboo stems would be an option, but they are expensive. Nevertheless, this technology shows great promise since the increase in fish production is so large.

Transfer of knowledge

Although most members of the community already know how to use substrates to increase fish production in ponds, several NGOs—namely CARE-Bangladesh—are disseminating this knowledge to the community. Information about the practice has also been widely published in scientific journals, magazines and newspapers, and presented at workshops and conferences.

Achievements and results

The periphyton-based aquaculture used in ponds in Bangladesh is considered to be a Best Practice for the following reasons:

- Because the local people are acquainted with the practice in another context, they apply it easily to their aquaculture ponds.
- It is a simple technology requiring only simple, cheap and readily available inputs. Anyone can use it; specialists are not needed.
- The intensity of the practice can be adjusted to the availability of resources. If the technique were applied nationwide it could increase production considerably without any addition of nutrients. No other technique offers so much potential for so little investment.
- Because productivity is increased without increasing nutrient inputs, higher nutrient efficiency is achieved. This, and the fact that the system produces less waste, means that the farming system has become more sustainable.
- The practice reduces poaching.
- Aquaculture is practised throughout Bangladesh, and wherever aquaculture is practised, periphyton-based aquaculture can be practised.

Sustainability and cost-effectiveness

The materials used for the substrate are used in local households for other purposes as well. This means that aquaculture must compete with other activities for resources. This is not a constraint, however, since the increased production of fish more than compensates for the effort involved in finding alternative materials. Certain agricultural by-products could gain in importance as a result of the periphyton technology. One such example is jute stick, the by-product of jute fibre. Once called ‘the golden fibre of Bangladesh’, jute stick lost the battle with synthetic fibres two decades ago. If jute stick is used as substrate, it could regain importance as a major resource in aquaculture.

Another potential problem is that the increase in fish production through this technology could play havoc with fish prices. This is unlikely, however, since the demand for fish in Bangladesh is very great and continues to grow at least as fast as the rapidly growing population.

The practice is very cost-effective. More than half of the cost of all input is eliminated because it is no longer necessary to add feed to the ponds.

Substrate materials are relatively cheaper. Most farmers can even supply them themselves from their own farms. All farmers know how 'brush parks' collect periphyton, which means they have the knowledge they need. The substrate can be produced within the local farming systems, with farmers using their own labour and resources.

The most important strength of this practice is its flexibility. It is not a fixed technology, but can be adapted to the needs, capacities and resources of the users. The purpose for which it is applied can also vary: it can generate income or provide nutrition as required.

The only disadvantage of the practice is that it becomes impractical to harvest only part of a fish crop since all of the substrate must be removed before any fish can be extracted. A restriction of the practice is that not all types of substrate can be used. Some types of material cause the water quality to deteriorate. More research is needed on this point.

Development potential

Biodegradable materials can be used as substrate. This has at least two advantages:

- The substrate has broken down by the time the harvest takes place, so there is no need for its removal. Partial harvests also become possible.
- Biodegradable substrates can add additional nutrients to the system, giving an additional boost to production. Often these nutrients would otherwise be lost to the agricultural system.

Local people possess a lot of indigenous knowledge about polyculture systems—systems that exploit the ecosystem of the pond more fully by raising a number of fish species at the same time. Periphyton technology blends perfectly with polyculture systems. In on-station trials so far, the highest production levels have been obtained by combining periphyton and polyculture systems.

Besides improving productivity and thus food availability, the presence of periphyton has a positive effect on:

- Water quality.
- The health of the system and the animals in it. Preliminary research indicates that the presence of micro-organisms on substrates improves

the health of the culture stocks, resulting in less mortality or losses, and overall healthier animals.

The subjects mentioned above point in the direction of further research on such topics as the development of periphyton-based bio-filters, and the application of vaccines through biofilms in aquatic systems. These techniques would be applicable in both rural and industrial aquaculture.

Source of inspiration

It would be no problem at all to transfer the practice to another group, culture, land-use system, etc. Substrate can be added to any type of outdoor pond system. Basic indigenous knowledge regarding the use of *Acadjas* or 'brush parks' might be lacking in some regions, however.

The practice has been replicated in Mangalore, India, by researchers and fish farmers.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

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Funding
Total budget: 450,000 US Dollars. Period to which the budget applies: October 1997- April 2001. EC INCO-DC programme.

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Title

Protection and cultivation of rattan by Hani (*Akha*) People in Yunnan, Southwest China

Themes

Agroforestry, cultivation practices, cultural identity, forest conservation, forest management, forestry planning, income generation, protected resources

Introducing the practice

The method for growing rattan reported here is practised by the indigenous Hani (*Akha*) communities of Mengsong, Xishuangbanna, in Yunnan province of China. These communities have unique systems for managing natural resources and forests.

The communities differentiate forests and forest systems according to their function and products. There are forests that yield building materials (*lieshugejio*) or cash crops (*naqiluogo*), forests that enhance the landscape (*puchang*), forests used for graveyards (*nagbiong*) and protected rattan forest (*Sangpabawa*).

The practice occupies much of the year. The Hani farmers prepare the land in early February, in the middle of the relatively dry season. Rattan seeds are then sown in swidden fields, seedbeds or other protected areas. In March-April, when the seedlings are strong enough and 20-30 cm high, they are transplanted to spots beneath strong trees on which the rattan can climb. Additional planting takes place in July, but at this time cut stems are planted rather than seedlings. The entire process from sowing to harvesting takes about six to ten years. The forest is cleared regularly and managed in order to allow good rattan growth.

The importance of this practice and the reason for its selection as Best Practice lies in:

- The efficient conservation, reasonable utilization and stable output of rattan.
- Sustainability, since there is no over-exploitation of resources.
- The selective harvesting of rattan (every three to five years) so as not to destroy the plants' root systems, thus allowing new shoots to develop.
- Several possibilities for local production and marketing: rattan as a raw material, rattan furniture, and rattan strings for the annual festival of the Hani.
- The selective management of rattan and other plants, which protects biodiversity and does not disturb the natural water situation.

The practice is still in use because it provides long-term benefits to the Mengsong Hani and has a multiple function within the society. It has an economic value as it provides an income through the manufacture of traditional rattan furniture, such as stools, tables and baskets. The practice has an ecological function as cultivating rattan in swidden-fallow fields results in improved fallow management and enhanced biodiversity. Finally, rattan cultivation and production has a social and cultural value, through the exchange of rattan handicrafts between communities, the rattan 'swinging festival', wedding gifts etc. The government and the forestry office have recognized its value within the society and therefore encourage its continuation.

Origins of the practice

According to the villagers of Mengsong, the practice related to the local Sangpabawa or protected rattan forest originated about 100 years ago and has been maintained and developed ever since, covering an area of 300 ha in 1950. The chieftain (*Tusi*) of Mengsong made the decision to establish the rattan forest and to regulate its use due to depletion of wild rattan resources in the other forests. Villagers were allowed to collect a limited number of rattan canes for agricultural tools, for the annual *Yeku* 'swinging festival', and for house construction. Before that time the Hani had collected rattan canes and stems in all forest areas without control and exchanged them for rice with the Dai people in the lowlands. This was an important form of livelihood, particularly for poor families.

The diagnosed depletion of rattan in the wild and protection of rattan in the *Sangpabawa* led to indigenous innovations by some Hani farmers for cultivating rattan in the swidden-fallow fields. While they left swidden fields fallow, they immediately cultivated rattan seeds in them. The rattan growing period was well matched with the 7-13 years of swidden-fallow cycle. Hani people sometimes also cultivate rattan in the margin of forests and streams.

After liberation in 1950, the forest was allocated to the community, which continued the practice. In 1981 the state declared the rattan forest a state forest under community management. The community at that time resolved to manage the forest as they had been doing for the last 100 years.

Contents and approach

The purpose of the practice is to produce rattan for use within the community. It has further benefits, however. The practice results in the development of a protected forest area where the diversity of other plants is also preserved and enhanced. These include plants which the community uses for food or medicine.

All villagers take part in the practice and all benefit from it. One villager is in charge of organizing the village labour needed to clear sections of forest, plant stems and seedlings, and harvest the rattan. Experienced men–specialists–collect seeds in the forest, prepare the swidden fields for planting stems and sowing seeds, clear sections of forest for transplanting seedlings, and direct the harvesting process. Experienced men also make the rattan chairs. Women collect the rattan shoots which are consumed as food, and they help the men with sowing and planting.

In addition to the cultivation of rattan in the community forest, three years ago the community developed a strategy for converting swidden fields into permanent agro-forestry plots. This was done with the help of the Chinese Centre for Biodiversity and Indigenous Knowledge (CBIK). In the village of Hongqi, 50 Hani (*Akha*) families cleared an area of 40 ha for growing bamboo, rattan and other crops. Plots were allocated to the families. There they grow mainly sweet bamboo for edible shoots, corn, upland rice, vegetables, herbs, medicinal plants, and fruit trees. In one field the researchers found more than 50 different species of useful plants (for food, the market, fodder and handicrafts). Between the bamboo plants the farmers

transplant rattan, which will produce in three to five years. This rattan will help to make up for shortages of rattan in the community forest. The aim is to use the *Songpabawa* forest only as a source of rattan seeds (five different varieties) and to transform the sloping swidden fields into permanent fields where bamboo and rattan are grown on a permanent basis.

The role of indigenous knowledge

The local people know how to manage a forest in such a way that it remains productive over long periods of time. They know how to select seeds, how to propagate rattan, how to clear the forest and transplant seedlings, and how to obtain products for various purposes, including for food and for generating income. They also know how to protect areas of biodiversity, and how to organize themselves so that the swidden fields are beneficial to all members of the community.

The practice is reinforced by the community's system of values and beliefs. According to the legends of the Hani (*Akha*) in Mengsong, the gods had condemned the *Akha* to death by strangulation because when clearing an area of the forest for shifting cultivation they had damaged the plant and animal communities. But the Hani people were wise and used the rattan not to strangle themselves, but to swing on. Each year the Hani organize the *Yeku* festival ('swinging festival'), which enables them to survive against the initial will of the gods. The swinging was to show the plants and animals that the *Akha* had been punished for the damage to the plant and animal communities during cultivation.

The knowledge associated with the cultivation of rattan is mainly in the hands of experienced specialists, but it is not secret. Everyone learns how to maintain the rattan forest. But the specialists go to collect the seeds, they distribute seeds and seedlings to relatives and neighbours, and they prepare seed beds where they develop different varieties and achieve as much diversity as they can. The diversified plots of experienced families provide examples for other community members.

This knowledge is transmitted to the community from the village head and the forest specialist and within each household from elder to younger. Transmission was strictly oral until 1990, when ethno-botanists searching for

different varieties of rattan and bamboo noticed the practice. It was not documented before, however.

Achievements and results

Some 15,000 clumps of rattan are growing in the more than 300 ha of forest managed by communities. Each year they produce approximately ten tons of rattan canes. Hani people classify rattan into two large categories *dahong* and *lei*. Two-thirds of the clumps are rattan *dahong* and one-third are rattan *lei*. From one clump of rattan *dahong*, the villagers collect one string about ten meters long every three years, and from a clump of rattan *lei* one such string every five years. By rotating the gathering of strings from the clumps, the village can harvest about ten tons a year. The villagers are clearing more forest in order to add more rattan plants and increase production.

The practice is sustainable as no trees are felled and the forest is maintained to provide an ecosystem for rattan growing which is close to a natural forest. The difference is that it is managed by the villagers. By harvesting carefully and replanting rattan, productivity is even higher than that of a natural forest. With the intercropping of upland rice and rattan in the swidden fields, there is a complementary relationship between shifting cultivation and rattan forest.

The practice is cost-effective: while the input of labour is not constant, the benefits are year-round. Rattan obtains a high price at both local and regional markets, it provides food, and it generates income by providing raw material for tools, handicrafts and the festival.

The practice is locally manageable, as the Hani villagers have shown. They control both the practice and the natural resources themselves, using their own customary forms of village organization. They have also transferred application of the technology from the forests to the swidden fields, transforming 40 ha of swidden field into highly diversified agro-forestry plots.

The practice has proven to be a viable way to manage a highly diversified forest so as to derive economic benefit from it, and to transform swidden fields into permanent agro-forestry plots containing more than 50 different plant varieties. The practice depends for its success on the community's

skills in cultivation, joint management and internal organization. At the same time, however, the practice itself improves families' livelihoods and strengthens the community. In other words, there is a strong relationship between IK and the local community.

The practice does pose a danger of overexploitation, however, if the demand for rattan increases and prices go up. External pressure to extract timber could also affect the area of the rattan forest.

The practice could be improved through further experimentation and through discussion among the Hani about the improvements. The practice should be disseminated to other areas and villages with similar conditions. Transforming more swidden fields could increase the total area under permanent agro-forestry, with the result that rattan and other tree crops can be harvested after 7-10 years.

Source of inspiration

The practice could be replicated elsewhere but there would certainly be conditions and prerequisites to consider. Since this is a social practice with cultural meaning and differentiated tasks, requires a strongly organized community. At the same time, it requires the ecological conditions for rattan production.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Administrative data

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The role of CBIK and its staff has been:

- Documentation: CBIK researchers have noted, documented and publicized the best practices of rattan management.
- Technical support: Farmers' nurseries for raising rattan seedlings for purposes of large-scale production have been improved through the integration of indigenous knowledge and scientific knowledge.
- Extension: CBIK staff work with state forestry agencies to achieve large-scale extension in Yunnan, and to transfer the best practices to other, similar biophysical and socio-economic environments.

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Title

Collaborative application of empirical criteria for selecting high-quality fleeces: Tzotzil shepherdesses and sheep scientists work together to develop tools for genetic improvement

Themes

Animal genetics, clothing, domestic animals, income generation, quality standards, rural women, sheep, team work, weaving, wool

Introducing the practice

This practice was developed in the mountains of Chiapas, in Southern Mexico. A number of different ethnic groups live in this region, each one with its own culture, language, and traditions. The Tzotzils are one of these. Their livelihood strategies depend largely on agriculture: maize and beans are the main crops, and sheep production provides wool for weaving and manure to fertilize the cropland.

Sheep husbandry among the Tzotzils is the exclusive responsibility of women, and it accounts for up to 36% of family income. Most traditional clothing is made of wool and produced within the household, which means little expenditure on clothes. Fleeces, garments and woollen crafts are regularly taken to the local markets. Besides, sheep can be sold when cash is needed urgently.

The small family flocks (ten sheep) are very important for the Tzotzils, and many conventional interventions have tried to improve living standards through sheep production strategies. In the last 25 years, various exotic sheep breeds producing 'high-quality' wool have been introduced in the area, along with 'modern' husbandry techniques. They were not successful. Government authorities failed to acknowledge the strong link between the Tzotzil culture and the husbandry of their 'sacred' sheep, and also the differences in wool quality standards. Likewise, extension workers have not appreciated either the local sheep or the traditional management practices developed by endless generations of illiterate yet expert shepherdesses.

The best practice described here involves the collaborative application of criteria for judging the quality of fleece. This takes place every six months at

the University of Chiapas's sheep farm. The practice began in 1995 as a wool-grading exercise with local shepherdesses and weavers; its aim was to help the sheep scientists to identify the local criteria for 'high-quality' fleeces. It has evolved into an interactive and participatory methodology that is now integrated into the programme to genetically improve local Chiapas sheep through selection.

Prior to the semi-annual shearing of the flock, groups of Tzotzil women apply their own local criteria and empirical methods to assess fleece quality. Their tacto-visual approach subjectively assesses fleece in terms of its volume, staple length, looseness of staples, textile aptitude, softness, colour and cleanness. Sheep scientists translate the women's key words and the results of their tacto-visual appraisals into a fleece quality grade from 1 (poor) to 4 (excellent). The women have established 'staple length' as the most important factor, and have developed a complex measuring system that defines eight different sizes on the basis of finger lengths and widths. The 'textile aptitude' of the fleece determines whether, when spun into yarn for the traditional weaving process, a fleece is best suited for the weft or the warp.

The various elements of the tacto-visual appraisal are closely related to objective parameters of fleece production. The subjective assessment of staple length correlates significantly with its metric-system equivalent, and textile aptitude indicates the proportion of fleece fibres that are long and coarse. The compounded grade given for fleece quality correlates significantly with staple length, greasy fleece weight, body weight and wool growth. An index for high quality fleeces as judged by local standards is now used as a selection tool.

This collaborative fleece-grading system has been standardized over time. It has been in use since 1995 and has evolved into an efficient and reliable method of improving local sheep through selection. Women's participation has ensured the establishment of culturally appropriate fleece-quality standards. It has also directed efforts to produce high-yielding, environmentally adapted sheep that Tzotzil women identify as members of the respected local breed which they call *batsi chij* ('the true sheep').

The collaborative system has also served to identify and discard certain objective parameters of wool production and fleece quality that were redundant. This has made the selection programme more efficient.

Content and approach

The methodology for assessing and grading fleece quality represents a blend of the traditional knowledge possessed by illiterate Tzotzil shepherdesses and weavers with the tools for genetic improvement used by sheep scientists. Countless generations of Tzotzil women developed empirical fleece-quality criteria to meet their textile needs, as well as adequate assessment methods. Sheep scientists have adopted these elements and translated them into genetic selection tools to produce animals with fleeces that are of high quality by local standards.

The purpose of the practice is to:

- Ensure technical success by using local animals and traditional husbandry systems.
- Incorporate the expertise and traditional knowledge of local peoples (fleece-quality standards) into tangible assets (culturally acceptable selection methods).
- Learn from the experts.
- Promote bottom-up approaches.
- Preserve and improve the local species of wool-producing sheep.
- Re-value empirical technologies.

Persons involved

Groups of Tzotzil women from different villages are collaborating in the fleece-grading exercises with sheep scientists from the University of Chiapas. As the programme progresses, more and more Tzotzil shepherdesses will be able to obtain a superior animal of the local breed which not only produces the type of wool required for the local textile process, but also passes its genes on to following generations. Tzotzil interpreters and facilitators also participated in the project. In the near future, extension workers will have to be involved as well.

Method

Groups of Tzotzil women are invited to the fleece-grading exercises. They come from different villages. Animals in the university's flock are allocated to different sheds, in groups of about 25 sheep. The best sheep in each group is selected visually as the animals move around (based on an estimate of its fleece volume). The animal is removed from the group and tacto-visual appraisal begins. By gently handling the fleece, the Tzotzil women estimate

staple looseness, a desired trait. Staple length is determined using the empirical system of finger lengths and widths. Textile aptitude of the fleece is assessed according to the relative amount of long/coarse fibres and short/fine fibres. Secondary parameters are also considered, such as a relative lack of kemp fibres, the colour of the wool, and the cleanness of the fleece. The scientists then translate all these elements into a compounded fleece-quality grade.

At the farm, additional technical information is obtained: greasy fleece weight, body weight, wool growth, and proportion of fibres. A selection index based on the Tzotzil criteria for high-quality fleeces is used to identify the best animals on the university farm. The top 15% of rams are left on the farm as replacements, and the rest of the rams with scores of 'good' and 'excellent' are identified as superior rams suitable for introduction into village flocks.

The role of indigenous knowledge

The collaborative effort guarantees that the improvement programme is producing exactly what the Tzotzil shepherdesses and weavers need. Animals will have fleeces of the highest local standards. If top-down approaches were used, industrial standards of short, white and fine wool would be applied, exactly the opposite to the Tzotzil standards for high quality fleeces, which call for long staples of coarse, black fibres.

Chiapas sheep, the local breed, is a highly respected animal. In Tzotzil culture sheep are sacred; they are never killed or eaten, and they are given names and considered to be the ritual children of women. No other animal occupies the place in Tzotzil culture and society that the sheep does.

Sheep are the exclusive responsibility of Tzotzil women. Wool is processed using ancient techniques and then woven and sewn into traditional clothing for the whole family. Black skirts, shawls and coats predominate among the Tzotzils, and black sheep are highly regarded, although wool requirements for the traditional white jackets and brown ceremonial blouses give animals of these colours an important place too. Empirical selection of animals over the last 500 years has resulted in an adapted animal producing the type of raw material that can be processed using the traditional weaving technologies of spinning with a wooden spindle and weaving in a back-strap loom. Using

the highly appreciated local breed and the locally developed fleece-quality criteria gives the collaborative grading exercises the cultural value they deserve.

The transfer of knowledge

Most Tzotzil women (70% of more than 15,000 households) have their own small flock of Chiapas sheep. They all know a lot about sheep husbandry and weaving. But what is being developed jointly with the sheep scientists is a blended product that puts together the best of traditional and scientific knowledge in the area of fleece improvement.

In the Tzotzil villages, most women are illiterate and do not speak the official language (Spanish). What they do as shepherdesses and weavers is something they have learned orally from their mothers and grandmothers and through the everyday contacts associated with their domestic responsibilities. Knowledge and practices are shared outside the household through social networks and informal communication within and between Tzotzil villages.

Written materials about sheep husbandry are generally rare. In the Tzotzil language they are non-existent. Various ethnographic studies do, however, describe the Tzotzil livelihoods. The traditional sheep husbandry system has been studied using an ethnoveterinary approach.

Achievements and results

Collaboration to achieve a selection index for a genetic programme designed to produce sheep that meet local standards is a best practice because it recognizes and values the traditional knowledge of Tzotzil women. Local standards for fleece quality are given top priority. The practice validates indigenous technical knowledge and gives it the same weight as scientific technical knowledge. It is incorporated into a development effort as an essential element.

The interaction between Tzotzil women and sheep scientists has resulted in convenient methods for genetic improvement. At least 36 women from 10 different Tzotzil villages have collaborated regularly in the application of fleece-quality criteria. In the last two years, no fewer than 130 superior rams have been introduced into village flocks. Many Tzotzil women from the villages are requesting information about how to buy or borrow one of these

animals. A nucleus flock of 400 sheep is currently being monitored using this inter-ethnic approach.

The practice is sustainable, cost-effective and locally manageable.

- It is sustainable because the superior rams are more productive as a result of their superior genes, and not because they are heavier or larger, thus requiring proportionately larger amounts of food.
- It is cost-effective because no additional inputs are necessary and the traditional management system does not need to be modified in any way for these animals to perform as superior breeders. More wool and fleeces of higher quality mean that better clothing can be woven, and that better handicrafts can be sold. This has a direct impact on livelihoods.
- It is locally manageable because Tzotzil shepherdesses recognize these superior animals as members of the respected and appreciated local breed of 'true sheep'. The animals are perfectly adapted to the environment and maintain their hardiness.

Strengths, weaknesses and requirements for the future

The practice has a number of strong points. It ensures that improvement of the local breed through selection results in an end product (high-quality fleeces) that meets all the demands of the shepherdesses and weavers who are supposed to benefit from any intervention involving sheep-production strategies. The interaction between experienced women and new shepherdesses that takes place during the grading exercises facilitates the transfer of indigenous knowledge. The grading exercises are a dynamic and interactive process through which quality criteria are established and modified according to the local requirements for raw material for weaving. The Tzotzil women are the experts, and the sheep scientists are the apprentices. Together they act in synergy to design and develop genetic selection methods.

One problem has been that fleece graders who take part for the first time find it difficult in the beginning to assume their role as experts, and to interact openly and on the same level with sheep scientists. Another problem is that sheep numbers at the university farm are still low.

The practice will have accomplished a social objective when the 'blended' outcomes in the form of selection indices and genetic methods can be taken

back to the villages and applied by the Tzotzil women to their own flocks. Extension strategies will have to be developed to make this blended knowledge available to all Tzotzil shepherdesses. These strategies will have to take into account the facts that very few of them can read and they have been accustomed to the more common 'top-down' approaches.

Source of inspiration

It would be fairly easy to transfer the methodology of the practice to other marginal, indigenous, sheep-related economies located in high mountains and associated with hand-processed fleeces.
However, more important than the practice itself is the overall concept that traditional knowledge which has been developed locally to solve specific problems has to be analysed, validated and applied, after being blended with scientific knowledge if necessary. The holistic analysis and enrichment of traditional knowledge is not just possible, but should be a pre-requisite when development interventions are being considered.

Adaptations should derive from the particular needs, practices, beliefs and culture of the people whose traditional knowledge is being used as the basis for development. There is of course no universal recipe for successful interventions, but before any interventions are designed and applied, there should be a commitment to understanding the cultural and socio-economic context of the area, the people, and their livelihoods and traditions.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

The programme for the genetic improvement of Chiapas sheep has been evolving for the last ten years. It began with an analysis of the characteristics of Chiapas sheep, the native breed. An open-nucleus breeding scheme has been used to improve wool production and fleece quality. The University of Chiapas sheep farm maintains the nucleus flock under traditional management, with wooden shelters and extensive grazing on native pastures. Use of feeding concentrates is restricted, and maize stover supplements constitute the feed during the dry season.

Several articles published in social-science and technical journals describe the approach and implications of the genetic improvement programme based on collaboration with local experts.

Articles in English include the following:

- Perezgrovas, R., A. Parry, M. Peralta, P. Pedraza & H. Castro. (1995). 'Wool production in Chiapas sheep: Indigenous knowledge provides the basis for selection'. In: R. Crawford, E. Lister & J. Buckley (eds.), 'Conservation of Domestic Animal Genetic Resources.' Rare Breeds International & AgriFood Canada. Ottawa, Canada. pp. 240-244.
- Perezgrovas, R. (1998). 'Ethnoveterinary studies among Tzotzil shepherdesses as the basis of a genetic improvement programme for Chiapas sheep'. In: E. Mathias, D. Rangnekar & C. McCorkle (eds.) 'Ethnoveterinary Medicine: Alternatives for livestock development.' Proceedings from an international conference. BAIF Development Research Foundation. Pune, India. pp. 47-48.

Administrative data

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Title

Shamans and Apprentices Programme: Promotion and Integration of Traditional Medicine

Themes

Botany, community health, cultural identity, diseases, education, health, health centres, self reliance, traditional medicine, training

Introducing the practice

In Suriname (South America), traditional healing practices are being revived among the Trio Amerindians of the communities of Kwamalasamutu and Tëpu, in the far south of the country. Kwamalasamutu is the community most remote from the capital Paramaribo. It is accessible only by air. A Cessna charter flight to Kwamalasamutu takes two hours; a flight to Tëpu takes an hour and a quarter.

The programme to breathe new life into traditional practices began at Kwamalasamutu in 1988, following recommendations from ethnobotanist Mark Plotkin, president of the Amazon Conservation Team (ACT). He lamented the fact that the old shamans were dying and taking with them all their knowledge, without having transferred any of it to younger generations.

The traditional healers involved in the present programme are shamans of the Amerindian tribes of the Suriname Amazon. Shamans are inheritors of a great medical tradition that has its origins in the beginnings of civilization. In the social firmament of Amazonian tribes, shamans act as healer-priests, responsible not only for the health of their people but also for their spiritual welfare. In this capacity, shamans are the keepers of both tribal traditions and rites as well as the knowledge of medicinal plants. Over thousands of years, Amazonian tribes have accumulated a vast storehouse of knowledge of medically useful plants growing in the rainforest. Although a large number of important pharmaceuticals have been discovered from studying the traditional medicine of indigenous people, medicinal plants are just one component of traditional health systems. Ceremonies and rituals, songs and

colourful dances, incense and invocations often accompany the use of medicinal plants in healing.

It is customary for shamans to teach the next generation about medicinal plants, their belief systems, methods of diagnosis, and traditional concepts of illness. At Kwamalasamutu, this practice was greatly enhanced in July 2000 with the opening of a clinic for shamans and apprentices, and with the operation of a training facility where youngsters aged about 12 receive introductory training in traditional health care. The shamans and apprentices' clinic operates in conjunction with the clinic managed by the Medical Mission, the agency responsible for providing primary health care in the interior of the country. The aim is to establish structural cooperation between the two clinics. At Tëpu, a similar clinic was opened in August 2001. Also scheduled to be part of the programme are medicinal plant gardens.

The programme is ongoing. With the opening of the traditional medicine clinic at Kwamalasamutu in 2000, the programme entered a new phase of implementation. It has not yet been evaluated. The aim is to expand the programme to cover the entire interior of the country. International exchange is also envisioned to foster the programme's further development.

The clinic has been so successful that it was initially in operation seven days a week, mornings and afternoons. Eventually the shamans could be convinced that it is 'against the law' to work seven days a week, so that the clinic is now closed on Sundays although the shamans are still on call.

The Trio themselves are fully in charge of both the transfer of knowledge and the treatment of patients in the clinic. The practice is efficient, cost-effective and manageable. It also plays a vital role in the cultural recovery of the tribe.

Outside influence (missionaries) had discouraged the tribe from maintaining their traditional healing practices, persuading them that 'the white man's pill' was superior. But it was also outside influence (ethnobotanist Mark Plotkin) that was instrumental in reviving those practices. By explaining to the tribe that certain of 'the white man's pills' were derived from plants in their own forests, Plotkin made a valuable contribution to restoring the shamans to their rightful place within the tribe. He recommended setting up a shamans and

apprentices programme and he helped the Trio to produce a handbook, in their own language, of medicinal plants and their uses.

Content and approach

The purpose of the Shamans and Apprentices Programme is to improve health care in the community. Everyone involved in the programme is firmly convinced that the integration of traditional health care with western health care, as provided by the Medical Mission, will result in better health care for the community, and that the programme will eventually have a ripple effect, enhancing health care nationwide.

The Shamans and Apprentices Programme is an essential component of an effort to recover and conserve tribal culture, which in turn is part of an overall effort to achieve sustainable development.

Persons and organizations involved in the practice

The community as a whole is involved in the practice. At Kwamalasamutu, the community has approximately 1500 members. There are three shamans, six apprentices and 20 youngsters (novices) directly involved. Their services are available to the entire community. The establishment of individual gardens where certain medicinal plants are grown will be promoted.

The Medical Mission (MZ) provides free primary health care services to the approximately 50,000 people living in the interior of Suriname. The Medical Mission is a non-governmental organization and the product of cooperation between three religious groups and the Suriname Ministry of Health. The Medical Mission operates 45 health clinics distributed throughout the Interior and staffed by Community Health Assistants, trained health care providers who mostly originate from the communities they serve. Six physicians circulate according to an established schedule between the different clinics of the district for which they are responsible.

The Medical Mission's ability to penetrate and deliver primary care into the interior has recently been severely compromised because of the government's inability to provide regular and timely funding. In 1999, delays in funding almost forced the Medical Mission to close its operations and clinics in the Interior indefinitely. Deferral of health sector payments has had

a broad-ranging impact on most Suriname health care providers and hospitals and will certainly persist, if not escalate, in the foreseeable future.

In the course of working with indigenous peoples, Medical Mission physicians and community health workers have observed that patients often respond well to traditional medicine and that certain Amerindian and Maroon remedies, such as treatments for leishmaniasis and setting bone fractures, are perhaps more efficacious than the pharmaceutical interventions and therapies they can provide. In addition, shamans have several seemingly effective medicinal plant treatments for gastrointestinal disorders, an important disease burden in these communities. Such treatments are cost-effective and give indigenous communities greater responsibility for their own health care. For these reasons, the Medical Mission is seeking to understand traditional medicine better by cooperating closely on a basis of trust and openness with traditional healers in Kwamalasamutu and Tëpu, as well as in the Maroon community of Kajana (where ACT has a third traditional medicine clinic under construction), and sharing in the responsibility of delivering quality healthcare to the communities.

The method

The components of the practice can be summarized as follows: transfer of knowledge, clinical skills and traditions from the traditional healers (shamans) to the apprentices and novices, related to medicinal plants and their uses; operation of a shamans and apprentices clinic; management of a medicinal plant garden; cooperation/coordination with the Medical Mission on the integration of traditional health care; exchange with other communities/tribes both national and international. A medical student from Yale University, and one from the University of Suriname Faculty of Medicine are providing guidance to the shamans and apprentices. To facilitate replication, they are also working on a scientific evaluation of the operation of the clinic and a research programme. German Zuluaga MD, ACT's Colombia Programme Director, is an experienced doctor with considerable knowledge of indigenous medicine. He has been consulted on the development of the programme since its initiation. ACT makes a modest payment to the shamans and apprentices, as reimbursement for their services to the community. During this transitional period, efforts are being made to develop income-generating activities, in order to enable community members

to pay for the services received at the clinic. Finally, ACT also provides support in the form of supplies for the clinic.

The role of Indigenous Knowledge

The practice is all about indigenous knowledge in action. The Shamans and Apprentices Programme is managed entirely by the indigenous community itself. Cooperation with the Medical Mission is aimed at achieving integration of the two forms of health care. The support provided by ACT merely facilitates the practice. At the same time other efforts are undertaken to make the programme more sustainable. These are part of an overall effort to achieve sustainable development through such activities as mapping the lands of local communities, helping to solve the land rights issue and to protect forests, and helping local communities to generate income through the exploitation of non-timber forest products (such as sustainable harvesting of Brazil nuts).

The practice plays a vital role in the recovery and conservation of tribal culture. This will help the indigenous community to deal better with the outside world. The partnership with the Medical Mission will enhance the indigenous population's awareness that they have a valuable contribution to make, for their own benefit and for that of the outside world. This realization is expected to contribute greatly to their self-esteem, which in turn will encourage them to recover and conserve their own culture.

Transfer of knowledge

The knowledge of medicinal plants and their uses is vested in traditional healers, who have taken it upon themselves to transfer this knowledge to the next generation of both apprentices and novices (youngsters aged 12). This transfer is the programme's most essential component. Training deals with various subjects: how to recognize plants in the forest, which parts of the plants to use, which plants should be used for which ailments, and how to prepare and apply the medicines.

These communities, though traditionally self-sufficient and wholly reliant on what the forest has to offer, are increasingly being drawn into the monetary economy. People need money to buy all kinds of basic necessities, such as machetes and batteries. The shamans and apprentices are no exception. This is why ACT is initially paying them a modest amount, and why the aim is to

develop income-generating activities to enable community members to pay for the shamans' services in the future.

An international exchange is scheduled which should help the Surinamese shamans to benefit from the experience of Colombian shamans who are members of UMIYAC (the Union of Yage Healers of the Colombian Amazon). This organization has made great progress with its own shaman and apprentice programmes, whose results include a code of ethics for traditional healers.

The Shamans and Apprentices Programme was started out of concern that the shamans' knowledge was being lost. Efforts are therefore being made to document this knowledge. One of the first activities was the preparation of a handbook on local medicinal plants and their uses, in their language, undertaken several years ago by ACT President, ethnobotanist Mark Plotkin. However, the knowledge of the paramount shaman of Kwamalasamutu, a Sikiyana from Brazil, has never been documented in text. During this programme, a medical student collaborated with him to document his extensive knowledge of medicinal rainforest plants. After numerous trips into the rainforest, they produced a preliminary draft of his pharmacopoeia. Over the course of the next year, this draft will undergo numerous revisions to ensure accuracy and completeness and will be translated into the Trio and Sikiyana languages for future generations within the tribe.

Establishing a traditional medicine clinic enables the shaman's clinical skills (including rituals and belief systems) to be preserved in practice and provides an opportunity for apprentices to observe and develop their own clinical skills. This is not dissimilar to the role of the university teaching hospital in undergraduate western medical education.

In any effort to record or document their knowledge, due consideration has to be given to intellectual property rights, and protecting the interests of the indigenous peoples against charlatans, pirates, and the like. The knowledge contained within texts or utilized in the traditional medicine clinic belongs exclusively to the shamans and tribes of Kwamalasamutu and access to such texts will thus be restricted. ACT does not engage in bioprospecting.

Achievements and results

The case described here is considered a best practice because it has proven to be successful and meaningful to the community. Besides the direct benefits to the community, there are the derived benefits (described earlier) related to cultural recovery and conservation and overall sustainable development.

Currently an evaluation is taking place of the first year of operation of the traditional medicine clinic at Kwamalasamutu. Beyond its role in the evaluation of the present programme, the evaluation and research programme represents one of the most comprehensive documentations ever undertaken of a traditional health system in an Amazon indigenous community and will offer invaluable opportunities for scientific analysis.

The activity is sustainable, cost-effective and locally manageable.

- It is sustainable because it focuses on transferring knowledge from the shamans to the next generation. Judging from the enthusiasm of the apprentices and 12-year-olds, a continued supply of apprentices should not be a problem. The modest payments that ACT makes to the shamans and apprentices cannot be considered to threaten the programme's sustainability. The support from ACT is merely extra encouragement for the programme; without it the practice would continue. The community is still primarily oriented towards mutual support. If monetary compensation for the shamans and apprentices were not available, they would still go about their business and accept compensation in kind.
- Cost-effectiveness is not a major concern since the focus is on making use of what nature provides. Any necessary facilities can be constructed from locally available materials so that little out-of-pocket investment is required.
- The programme is managed entirely by the indigenous peoples themselves. They cooperate with the Medical Mission on a partnership basis in order to integrate traditional and western health care.

Strengths and weaknesses, and room for improvement

The strength of the practice is that it falls completely within the beliefs and experience of the community. Traditional healing practices can be highly effective, particularly for ailments where western medicine is deficient.

A weakness could lie in attempts to cure ailments for which no effective traditional medicine is available; inability to provide a cure, or even a fatal outcome could undermine credibility, especially since what is taking place is actually a recovery (but not a rediscovery) of traditional medicine practices following the discouragement of its use under the influence of missionaries. However, in the case of Kwamalasamutu, this has proved to be just a theoretical concern, as the medicinal plant knowledge passed on through the generations is still intact. Moreover, the shamans are clinicians with years of training and experience and are aware of their limitations, particularly where introduced diseases and conditions that require surgical management are concerned.

One thing should be clear: neither western medicine nor traditional medicine have all the answers to all the problems. There are cases where traditional medicine is more effective, as there are cases where western medicine may be a more appropriate therapy. Integration of the two will result in improved health care for the community.

Expectations are that the practice can definitely be developed and improved, both by blending it with other indigenous knowledge as well as with modern science and technology. An example of the former is exchange with other cultures leading to an expansion of the medicinal plants used; at Kwamalasamutu there have already been cases in which visitors (shamans, doctors, herbalists) from overseas have informed the community of a medicinal use of certain plants which were present at Kwamalasamutu but were not being used by the community.

Examples of improvement through blending with modern science and technology are:

- Providing adequate follow-up treatment (city hospital/surgery for initial diagnosis and treatment in the community).
- In the case of Kwamalasamutu, which is far bigger than traditional Amerindian communities, the shamans need to travel deep into the forest to collect medicinal plants; this has created the need for a solar-powered refrigerator for the storage of perishable medicines.

Source of inspiration

It would be fairly easy to transfer the practice, although some adaptations might be necessary. Two preconditions, however, are that the practice is in the interests of the entire community and is managed by the community itself. An example of a situation where adaptations might be needed would be if in a particular culture shamans only pass their knowledge on within their own family. And obviously, if traditional and western knowledge are to be integrated, there is a need for a willing partner like the Medical Mission in Suriname.

Scope for replication is the main reason why the clinic at Kwamalasamutu is being evaluated as a possible model. The results should be very useful for this purpose.

The programme has already been replicated on a small scale. Following the opening of the clinic at Kwamalasamutu in July 2000, a clinic and training facility were built in the Trio community of Tëpu. These opened in August 2001. Another clinic is under construction in the Saramaka Maroon community of Kajana. These efforts are all part of ACT's Suriname Programme, involving partnerships with the Trio Indians and the Saramaka Maroons. ACT is engaged in similar efforts (shamans and apprentices programmes) in Colombia, Brazil, and Costa Rica.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

The Trio communities of Kwamalasamutu and Tëpu, and the Saramaka Maroon community of Kajana, are pilot sites for a more elaborate plan that would target the interior of Suriname in its entirety. Besides the shamans and apprentices programmes, traditional medicine clinics and medicinal plant gardens in the three pilot communities, workshops are envisioned at all levels: local, national and international. All of these would include participants from the three communities as well as representatives of the Medical Mission. Unfortunately, ACT and the Medical Mission have not yet managed to secure funding for the expansion of the pilot programme. Nevertheless, in view of the programme's importance for the communities,

ACT will do what it can within its own budget to put these plans into practice.

Administrative data

Organization involved

Responsibility for the practice rests with the Trio community itself. The Amazon Conservation Team, within the framework of a broader partnership with the Trio Indians, is providing support. ACT is considering helping the community to establish its own website and thus its own direct links with the world. This will reduce ACT's responsibility even further. But for the present, the organization to contact is ACT.

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Title

Waru Waru, a cultivation and irrigation system used in flood-prone areas of the Altiplano

Themes

Archeology, community participation, cultivation practices, cultural identity, drainage, irrigation systems, swamps

Introducing the practice

The *waru waru* restoration project began in 1991 in the southern Andean department of Puno, Peru. It is a rural development initiative for the Altiplano. The aim is to recover a technology, invented by the Tiahuanaco culture, that fell into disuse around 1100 A.D. It is believed that the system was abandoned when the Tiahuanaco culture went into decline as a result of extreme drought which occurred before the Spaniards' arrival.

This system makes it possible to bring into production the low-lying, flood-prone, poorly drained lands found all over the Altiplano. *Waru waru* are being restored in areas where their remains could still be seen.

The project has introduced an ancient cultivation, irrigation and drainage system that made poor land productive: land with high salinity levels and poor drainage located in an area with frequent droughts and frost. The project involves the restoration of earthworks about one meter high and 10 to 15 meters wide. These are surrounded by wide, shallow canals which, when filled with water, ensure a microclimate that acts as a buffer against night-time frosts and provides moisture during droughts and drainage during the rainy season. The canals also act as barriers to keep out crawling insect pests.

Restoration of the *waru waru* system has demonstrated the potential of traditional knowledge which is applied with the help of well organized, collective work. As marginal lands are being reclaimed, the ancient system has proven both efficient and effective for improving soil conditions. The

good results achieved in terms of productivity and climate mitigation have aroused the interest of many practitioners.

And so, after two five-year project phases, more than 120 communities have now incorporated *waru waru* into their crop production systems. The system currently covers more than 1600 ha of reclaimed land, 850 ha of which are intensively farmed to produce food crops. The first communities that began participating in the project during its first phase (1991-1996) continue to replicate and maintain the practice.

The main reason for using this system is that it provides a real opportunity to bring into production lands that would otherwise remain uncultivated. The system also achieves higher productivity levels than traditional cropping methods and reduces weather-related risks. Another important effect is that the system unites small, dispersed properties since the effect on the microclimate is greater when blocks of land larger than family parcels are used. At the same time, family-group productive units have been set up which form market-linked, second-tier associations.

Origins of the practice

The practice and its recovery are well known. Its recovery stemmed from archaeological research in the second half of the 1980s. Remains of these systems, which appear as small undulations on the ground, are scattered across a wide area of the plains. The potential area where *waru waru* systems can be restored is estimated at 100,000 ha.

Over the ten years of the project, the method of restoration has been systematized, as has the application of research findings regarding aspects of production, and the technical assistance and training provided to the communities.

Land tenure and organization

Waru waru have been restored under three different types of land tenure and organization:

- As a communal initiative on communal land.
  Here, all community members participate in the work of reconstruction and crop production. Field tasks are shared out equally among the families.

- On communal land, as an initiative of a group of families.
  In this case, a group of families united by ties of kinship or friendship join together to reclaim communal land that has been abandoned or fallen into disuse. Once the land is rehabilitated, the community awards it to the participating families. Generally each family is given the right to use a piece of land proportionate to its contribution, but permanent property rights are also occasionally granted.
- On private land, at the initiative of a group of landowners.
  In this case, interested families agree to combine their parcels of land to form a waru waru unit. They maintain their individual property rights, however.

If an initiative is undertaken by the entire community, the community assembly decides which families will perform which tasks. If a family group has taken the initiative, a system known as *ayni* is used, by which all members work together on one plot at a time until all the plots that make up the *waru waru* unit have been completed.

Content and approach

The practice makes it possible to bring into production lands that would otherwise remain unused. The fallow, low-lying and flood-prone lands of the Altiplano recover their value and become a resource for communities that suffer extreme poverty and land shortage. The *waru waru* system provides peasant farmers with greater harvest security and reduces the risks associated with frosts and drought. The farmers view this production system as another alternative to add to their diversified farming systems, which also include the cultivation of hillsides and plains.

Rural communities in the Altiplano occupy different agro-ecological zones where different production systems are used, depending on the soil conditions and climate. On the slopes the farmers use *andenes* (bank terraces); on the high plains they manage *bofedales* (marshes) and pastures; and on the low, flat plains they now use the *waru waru* system. All these production systems are used in a complementary way.

Parties involved in the practice

The communities themselves take charge of restoring the *waru waru* and are also responsible for their maintenance. The project's role has been to

demonstrate the restoration process and the proper use of *waru waru* under a crop rotation system, which is of interest to the region's farmers. Having achieved that objective, the communities themselves then continue to replicate what they have learned by restoring other *waru waru* and providing maintenance during the initial years.

Waru waru are now a feature of the Altiplano landscape and offer new prospects for growth under market-linked, organized production systems.

Method
First, an inspection is carried out to identify suitable communities where the system might be put into practice. Several training sessions are held in the selected community to explain the purpose of *waru waru*, the principles on which they work, and the advantages they offer. The response level of the community is analysed and preliminary agreements are made on that basis.

Within each of the communities taking part, an inspection is made of potential areas where *waru waru* can be restored. Topographical surveys are conducted, sites are agreed upon, and discussions are held to determine the size and characteristics of the blocks of land, the zones which will supply the canals with water, and the drainage areas. Once the plans have been drawn up, agreements are reached regarding the organization of the teams that will build the earthworks and the annual schedule they will follow. By the end of three or four years, the communities should have made at least 6 ha of land fit for cultivation (not counting the surrounding canals).

During this process, training sessions are held on the subjects of restoration, how the system works, and maintenance. As the restoration work progresses, credit is extended and technical assistance is provided for the growing, managing and marketing of crops. Each year the participants review the progress they have made in the areas of production, income-generation, and food security. Over the past two years, the project has emphasized organization-building.

The role of indigenous knowledge
This practice died out two or three centuries before the arrival of the Spaniards. The colonial system, which relied on slave labour, introduced the hacienda (or large estate) system, and with it new forms of land ownership

and use. As a result, traditional practices were lost. The identification and recovery of the *waru waru* system is now reuniting the people with their ancient culture and serves to strengthen their identity. They have therefore taken to the practice with great enthusiasm. Recovering an ancient practice used by their ancestors raises their self-esteem, and encourages among them a positive attitude towards forming productive organizations.

Traditional systems of agricultural production have also been found on flood-prone areas or zones with a high water table. Two examples demonstrate how these systems are based on indigenous knowledge and skills for managing soils and the crops that grow on them.

The first example is the crop system based on rounded ridges, which are two metres wide and crossed with furrows. The ridges are constructed with a traditional tool named *chakitaclla*, which is a pointed stick with which the soil is mounded up, softened and aerated. This creates a layer, safely above the water table, where the roots of plants do well. A second example is a crop system also based on rounded ridges, but the furrows run lengthwise instead of across the ridges. Because seeds are planted in two rows, the system is called *panayra* in Aymara. This means 'two eyes'.

The first *waru waru* were rebuilt from existing ruins. Farmers incorporated the ruins into the canals and terraces they built in their fields on the basis of their own traditional knowledge and designs. Construction methods and the technologies for managing water and growing crops have been systematically improved through participatory applied research. It can therefore be said that *waru waru* systems are the result initially of combining two sets of traditional knowledge.

Transfer of knowledge

The restoration of an ancient technology has been strongly promoted by NGOs, first through archaeological research and later through the efforts of development agencies. The concepts involved in the practice are easily grasped and acquired by the farmers, who are already familiar with the basic principles of microclimates, soil management, drainage, droughts and frosts.

The purpose of the project has been to build up a critical mass of communities (more than 100) that are using the system. The demonstration

effect can then attract new converts to the practice and ensure its further dissemination. The initial results show that there has indeed been replication, and that communication has taken place mainly through on-site visits and the sharing of experiences among peasant farmers.

Several documents have been produced over the course of the project: technical proposals, semi-annual reports, project files, and intermediate and final assessment reports.

Achievements and results

The practice increases the value of unused, flood-prone lands, as well as helping to reduce the damage caused by drought and frost. Experience shows that the minimum night-time temperatures reached in *waru waru* areas are two to three degrees centigrade higher than those of the surrounding plains. The moisture provided by the canals lowers the impact of sporadic droughts during the cycle and, in the rainy season, prevents the subsoil from becoming waterlogged by ensuring adequate drainage. Crop yields, in particular yields of potatoes and other Andean tubers, are 50% to 100% higher than the yields obtained using traditional farming techniques.

The practice is sustainable, cost-effective and locally manageable. The restoration of 1 ha requires between 400 and 600 man-days of work (USD 1,143 to USD 1,714 per ha). Studies carried out over the past eight years, covering rotation cycles of five years of cultivation plus three years of fallow, and estimated on the basis of an economic life of 20 years, showed a 7% annual average increase in profits even after maintenance costs were deducted. This result has been achieved in spite of two El Niños. The replication of the practice without any direct prompting through the project is also a good indication that it is sustainable. The technology is simple and within the farmers' reach.

Strengths and weaknesses

Its value as a practice is very appreciable in an area like the Altiplano, which has such adverse weather conditions. Specific strengths are the following:

- It increases the cultivated area by recovering unused lands.
- It acts as a buffer against night-time frosts and sporadic droughts.
- It controls salinity levels in poorly drained soils with virtually no gradient.

- It increases crop yields.
- It encourages collective work by uniting individual crop parcels.
- It strengthens local capacities by providing an alternative production method.
- It provides a natural barrier against crawling insect pests (like the Andean weevil).
- The silt at the bottom of the canals is rich in organic nutrients and can be recycled in the raised beds to boost soil fertility.

The practice has only one weakness. The amount of labour initially required to restore a *waru waru* can be a discouraging factor. This is why the project, during the first year, offered farmers tools and seeds as an incentive. This helped to win the commitment of the communities, which was sorely needed in view of the considerable amount of labour involved in the rehabilitation work. Each community agreed initially to rehabilitate an area of at least 6 ha. The communities later expanded these areas to 10 or 12 ha of their own accord. In the last two years one-third of the participating communities have begun, at their own initiative, to use tractors to shift earth.

The results of the system could be improved if crops, including pastures, were rotated on a long-term basis.

Source of inspiration

It would be possible to transfer the practice to other places, but there certainly would be conditions and prerequisites to consider. The practice is suitable for soils that are very flat, dense, poorly drained and flood-prone. Its adoption by farmers depends on the local tradition of collective organization, as restoration and maintenance work require considerable labour.

It is reported that in the Bolivian Altiplano efforts are also underway to restore this practice.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

'The terraces throughout the Andean slopes, and the *waru-waru* (raised fields) and *qochas* in the Altiplano, are sophisticated expressions of landscape modification that have historically rendered more than a 1,000,000 ha of land for agricultural purposes.' (Rengifo 1987). The past and present existence of these and other systems for intensive agriculture prove that indigenous farmers have been able to adapt successfully to difficult environments. 'In fact, applied research conducted on these systems reveals that many traditional farming practices, once regarded as primitive or misguided, are now being recognised as sophisticated and appropriate. Agro-ecological and ethno-ecological evidence increasingly indicates that these systems are productive, sustainable, ecologically sound, and tuned to the social, economic, and cultural features of the Andean heterogeneous landscape.' (Earls 1989). For further reading, see: 'ILEIA Newsletter' Vol. 12 No. 1 p. 7, at www.ileia.org/2/12-1/12-1-7.htm

Administrative data

Organization responsible for the practice

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Funding

The total budget for the period September 1996 to August 2002 is the equivalent of USD 2.5 million. These funds are provided by The Netherlands.

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Title

The Generative Curriculum Model: A bicultural, community-based approach to building capacity for Early Childhood Care and Development in indigenous communities in Canada

Themes

Child development, community development, community participation, consciousness raising, cultural identity, curriculum development, early childhood, education, educational innovations, educational policy, ethnic groups, learning, teaching

Introducing the practice

Between 1989 and the present, the Generative Curriculum Model has been demonstrated in eight rural locations in western Canada, on lands reserved for First Nations. Members of 55 First Nations communities have been involved. There are approximately 540 First Nation bands or tribal organizations registered in Canada, each with its own culture, dialect, and traditional territories.

The practice consists of a two-year training programme. The first of eight programmes to date was developed and delivered from 1989 to 1992. Since that time, the programmehas been delivered in seven other locations, including three programmes delivered simultaneously from 1997 to 1999 and one programme that is currently underway.

In all eight partnership programmes completed to date, the Generative Curriculum Model has provided university-accredited training in students' own communities leading to unprecedented educational outcomes, vocational outcomes, and capacity-building, as well as personal and community transformations that reach far beyond the classroom.

The practice

First Nations Partnership Programs (www.fnpp.org) is the context in which First Nations communities and members of a university-based team have worked together over the past 12 years to deliver an innovative programmeof post-secondary training for community members in Early Childhood Care

and Development (ECCD). The content and outcomes of the training are derived from a socially inclusive process of dialogue, study, self-reflection, and exploration through practice. Community members consider community-specific indigenous knowledge and cultural practices as well as euro-western research, theory, and practice models. This 'best practice' is called the 'Generative Curriculum Model.' The curriculum and its outcomes are not pre-determined, but rather are 'generated' each time the programme is delivered, in order to reflect the unique indigenous knowledge and the particular needs, goals, and circumstances of the communities participating in the programme.

This is a method of training specialists in Early Childhood Care and Development (ECCD) as well as an approach to community development and cultural sustainability. Key features of the Generative Curriculum Model of training that make it at the same time a community-development approach are that it is community-based, community-paced, community-driven, multi-generational, and focused on a socially inclusive dialogue about indigenous knowledge.

There is one two-year programme being delivered in a tribal organization, as well as extensions of four former programmes with participating communities. An adaptation of the Generative Curriculum Model is also currently being piloted programme in Africa.

The Generative Curriculum Model effectively enables communities to further four inter-related objectives:

- To improve conditions for development of the youngest generation through organized Early Childhood Care and Development initiatives.
- To build the community's capacity for filling paid jobs as providers of care and other development services for young children and families.
- To support the pursuit of income-generating employment and training among adults by providing accessible, safe, and culturally consistent child care.
- To sustain indigenous culture and traditional language by ensuring that training for community members includes an enhancement of their knowledge of, and facility with, their own cultural practices and language.

Content and approach

Many indigenous community members in Canada have sought training and development through monocultural approaches, either exclusively 'mainstream' western training or exclusively indigenous training. Many reports indicate that neither of these singular approaches have successfully met the communities' need to sustain indigenous practices while ensuring that community members benefit from euro-western research and experiences and are prepared to 'live and work in both worlds.' The Generative Curriculum Model provides an effective framework for incorporating local knowledge into ECCD policy, programmes, and research in order to sustain culture and promote community development.

The origins of the practice

The practice originated in the community. In 1989, Tribal Council representatives of five Cree and four Dene communities in central Canada contacted the University of Victoria in search of collaborators who would be willing to enter into a creative partnership with them. Their aim was to develop the capacity of community members to enhance provisions for young children's care and development and for parent's employment and training, while also ensuring the sustainability of the Cree and Dene cultures and languages. The original collaborators recognized that in each community the richest source of indigenous knowledge were the Elders. Elders were therefore invited to become co-constructors of the training curriculum and, in some cases, co-instructors in the training programme. The Generative Curriculum Model originated through this initial partnership, and it has been elaborated and evaluated in the context of subsequent community-initiated programmes.

Each training programme using the Generative Curriculum Model has been in some ways 'original.' For each programme delivery, a new curriculum is constructed through the participation of community members, especially Elders, who articulate, teach, and demonstrate culturally important ideas and practices.

From the point of view of indigenous communities, the purpose of the practice is to provide geographically and socially accessible training in ECCD in ways that are culturally congruent and culturally sustaining. Community objectives for providing the training are to strengthen the

capacity of the community: (a) to support the optimal development of children 0 to 6 years through culturally consistent, quality child care; (b) to support the employment and training of adults by providing safe, accessible, culturally consistent child care; and (c) to ensure the preservation and revitalized use of indigenous knowledge through inter-generational participation in constructing training curricula, policies and practices pertaining to child care and development.

From the point of view of the university-based partners who help to conceptualize, deliver and evaluate the programmes, an additional objective is to pilot and document an effective approach to capacity-building that successfully incorporates indigenous knowledge and is socially inclusive. This demonstration work is intended to stimulate discussion and re-thinking among the various parties involved in capacity-building and development initiatives.

Parties involved in the practice
The First Nations Partnership Programs are the vehicle for utilizing and evaluating the Generative Curriculum Model. These programmes are delivered through partnerships between a team based at the University of Victoria, and representatives of First Nations communities. These partners come together to plan and deliver the programme in an indigenous community setting. Four of the eight programme deliveries to date have also involved an additional post-secondary institution that has facilitated aspects of training.

A project office at the University of Victoria houses the team members who respond to requests from First Nations communities to deliver the programme. Such requests are initiated by the First Nations community, and asks the University to develop a partnership through which the programme can be delivered. The First Nations community is responsible for raising funds, usually from federal and provincial sources, for delivering the programme. The community ensures that all the necessary components will be available: facilities for housing the programme, instructors and Elders to teach in it, and community members to be enrolled as trainees.

Beneficiaries

Many groups of individuals in the participating communities and training institutions have been shown to benefit from the programme.

Community members who become trainees/students in the programme are the most immediate beneficiaries. After successfully completing the two-year programme, they receive university transcripts and a two-year university diploma in Child and Youth Care. This makes them eligible for provincial/state certification in the profession of Early Childhood Education. They are well qualified to seek and accept employment within and beyond their community, in indigenous and non-indigenous settings.

The children of trainees have also been shown to benefit as a result of their parents' training. Their knowledge and skills regarding child care have been enhanced, as have their knowledge and sense of pride regarding their own culture and language.

Parents and other primary care-givers in the communities benefit from organized child care and other support services that help them to care for their children and that ensure their children's exposure to indigenous culture and language. Parents are able to continue their own education and training as well as to seek employment as a result of having accessible child care. By increasing the community's capacity for child care, the programme results in income-generating activities and poverty reduction.

Elders in the participating communities benefit from: (a) having a valued role in the training program; (b) having a forum for sharing their wisdom, experience, and skills; and (c) having more opportunities to forge new relationships with the younger generations in their community.

Community administrators/organizers benefit from the experience of partnership with a mainstream institution and from enhanced social cohesion within their communities.

University-based team members and affiliated individuals outside of the indigenous communities benefit from opportunities: (a) to build bridges between often disenfranchised indigenous communities and themselves; (b) to engage in dialogue and to learn about indigenous constructions of

childhood, care, and development; and (c) to explore new ways of making post-secondary education and training relevant, accessible, and sustaining of indigenous cultures.

Other participants
Instructors and Practical Training Supervisors are recruited and hired by the community, generally from outside both the First Nations community and the university. For many instructors, especially those who are not members of an indigenous population, their experience with the Generative Curriculum Model contributes to their cross-cultural understanding and competence, and to their willingness to adapt their professional practice to meet indigenous peoples' needs.

To date, 136 indigenous community members have taken part in the two-year, full-time training programme:

- 98% of the community members who have taken the programme have been members of First Nations (aboriginal).
- 98% have been women, ranging in age from 21 to 50.
- 11% have had an indigenous language as their first language; the remainder have had English as their first language.
- Nearly half have completed secondary school education before beginning the programme.

The method
The Generative Curriculum Model is used as a set of guiding principles for planning, co-constructing, delivering, and evaluating a curriculum for two years of full-time training in Early Childhood Care and Development. The vehicle through which the Generative Curriculum Model evolved and has been demonstrated to date (although it is applicable to other types of programmes) is called the First Nations Partnership Programs. It consists of a series of community-university partnerships for delivery in indigenous communities of 20 university-accredited courses. The courses cover the subjects common to most programmes of training for early childhood educators, including: (a) child development; (b) Early Childhood Education programme development and delivery; (c) communications and professional ethics; and (d) practicals. All of the students are recruited by the partner First Nations community and most are members of indigenous communities in a particular region. At the conclusion of the programme, students receive a

two-year diploma in Aboriginal Community-based Child and Youth Care from the University of Victoria, as well as provincial/state certification as Early Childhood Educators.

Community-based delivery. No one needs to leave their community in order to access the training programme. Indigenous students' success has been attributed in part to high levels of social support and practical help from family and friends. Students do not experience the family disruptions and 'culture shock' that often deters indigenous students from seeking or completing post-secondary education. Many community members besides the registered students can participate in programme delivery processes. This results in an enduring, mutually supportive 'community of learners.' Because the community is actively involved in the programme, it is supportive of the projects for children and families that are initiated by programme graduates.

Co-construction of training curricula through dialogue. Throughout the 20 courses delivered in a host community, locally recruited instructors and indigenous Elders engage in dialogue about their own culturally-based child care practices and about euro-western research and practices for promoting optimal child development.

Social inclusion. Evaluation of the First Nations Partnership Programs shows that the Generative Curriculum Model responds effectively to the search of First Nations for a culturally specific alternative to the prevailing 'pan-indigenous' training programmes and the cultural additions that are tacked onto mainstream training programmes. Elders' involvement in co-constructing the curriculum results in a good fit between the attitudes and skills reinforced through the training programme and the specific goals, needs, and circumstances of the children and families in the particular cultural community.

Preparing to walk 'in both worlds'. At the request of First Nations community leaders who initiated partnerships for programme delivery, part of the training involves supervised practicals in a wide range of settings so that the community's trainees learn to work in a broad range of jobs involving child and youth care in both aboriginal and non-aboriginal settings, both within and outside their own communities.

Career laddering. The programme is fully coordinated with a four-year university degree programme in Child and Youth Care. Up to now 11% of programme participants have gone on to the third year of university studies and beyond.

The role of indigenous knowledge

The evolution of the Generative Curriculum Model has been based on the premise that we need to recognize and accept responsibility for the potentially acculturative effects of mainstream curricula upon the development and delivery of programmes for children. We need to explore new ways of being responsive and accountable to the cultural communities whose children come to us for care and education.

Far from being culturally neutral, curricula for training early childhood educators are cultural constructions grounded in the world views, beliefs, and norms of those who conceptualize and teach the curricula. The training experiences that shape the care-giving practices of early childhood educators and other out-of-home caregivers can exert a major influence upon which culture, and which aspects of that culture, are sustained. Children reproduce the culture of their primary caregivers, peers, and the media with which they interact from their earliest years. Caregivers and teachers continuously perpetuate their own culture by encouraging particular response styles, forms of interaction, ways of understanding events, and enactments of implicit beliefs. When a 'one size fits all' approach is taken to training, all too often the result is a homogenizing, monocultural, colonizing approach to caring for children in ways that are inappropriate to the social ecologies of which children may be a part.

The reproduction and modification of culture through educational curricula and human service programming has been cited as a problem by many aboriginal community representatives in Canada. Most aboriginal peoples in Canada have experienced seven generations of cultural holocaust. One of the main avenues for subjugating aboriginal peoples to colonial culture and governance has been through the imposition of child care and education that has denied the legitimacy of thought, lifestyles, religions, and languages of First Nations people. Most First Nations communities in Canada are now actively engaged in multi-faceted efforts to revitalize their cultures, to assert the legitimacy of their culturally based values and practices as integral to the

fabric of Canadian society as a whole, and to foster among First Nations children positive identities with their aboriginal cultures of origin.

This is the stance that has been taken by the First Nations representatives who have initiated partnerships for the delivery of ECCD training using the Generative Curriculum Model. As university-based partners in these programmes, we accept as a starting point that non-native educators based in universities and colleges are simply not in a position to be solely responsible for making valid and useful decisions about how to extend the reach, relevance, or appropriateness of early childhood education training and programme development in aboriginal communities. Although the Generative Curriculum Model was not conceived within the crucible of scholarly post-modernist discourse, the First Nations partners and we share a 'post-modernist' valuing of multiple voices and an insistence upon situating alternative constructions of experiences with reference to the historical, cultural, political, and personal contexts in which these constructions were generated.

Re-conceptualizing 'success' when indigenous knowledge is key to programme delivery. Evidence from the evaluations of demonstrations of the Generative Curriculum Model shows that the positive impacts of this approach to ECCD training include, but also go far beyond, the benchmark credentials that students receive. These 'value-added' outcomes result from the elevation of indigenous knowledge to a core place in the curriculum, from the reinstatement of Elders' traditional roles in teaching about the language and culture of the community, and from the creation of a self-sustaining, inter-generational community of learners. Community members who have been trainees in the programmes most often measure their 'success' in terms of: (a) discovering their own ability to create and share knowledge; (b) learning to critically evaluate alternative conceptual frameworks, alternative forms of interacting with children and families, and alternative human service models; (c) learning to synthesize knowledge and experience from a variety of sources within and outside their own cultural communities; (d) becoming better parents; and (e) articulating their own goals for children in terms of their own culture as well as in terms of the larger social ecology in which they are embedded.

First Nations partners have said that one of the keys elements of the ECCD programme is that it fosters community healing through cultural re-connection.

Co-creating culturally situated understandings of early childhood. The Generative Curriculum Model shifts away from a determined search for universals to a celebration of the reality and richness of diversity. By bringing together the two worlds of western academia and aboriginal communities, this form of capacity-building opens a door to developing culturally specific understandings of children, their families, and their ECCD programme needs in varying eco-cultural contexts.

Socio-cultural values, meanings and spirituality of the community.
By involving the community, the Generative Curriculum Model has the potential to uncover and focus on elements of the social ecology of the First Nations community, how community members construe those elements, and their perceptions of the implications of these elements for child care and development. Elements of the social ecology of the community that are typically the subject of extensive debate in the training programme include: roles of parents, siblings, other children, grandparents and other elders; historical experiences with school; literacy; culturally influenced learning styles; culturally appropriate instructional processes; traditional language; approaches to problem-solving; impact of social relationships on cognitive performance; indigenous definitions of intelligence; cultural goals of maturity and their influence on guided participation; communication with children; interaction between children and adults; and children's social partners. Cultural activities led by the Elders during the training programme often include traditional ceremonies and practices, and the collection of items and documents of cultural importance.

The transfer of knowledge
Using the Generative Curriculum Model, indigenous experience and culturally-valued knowledge are articulated primarily by tribal Elders and other well-informed community members who can describe, explain, and/or demonstrate indigenous concepts and practices related to child care and development in a community context. In addition, trainees themselves are often asked to reflect on their own experiences growing up in their culture and their community, or returning to it after a period of absence. They are

encouraged to discern the ways in which indigenous knowledge and practices have been embodied in their own life stories.

Payment of those who transmit IK or participate in reconstructing the community's culture is handled in various ways by the host community which has raised and is managing the funds for the training programme. Typically, Elders are paid in money (approximately CAD 50 for a 1-2 hour session with a group of trainees) and/or gifts. Gifts can include the traditional gifts of tobacco and seasonal cloth, or useful items made or prepared by the trainees (e.g., baskets, preserved fruit, fish).

The Generative Curriculum Model leads to the evolution of a socially inclusive, multi-generational 'community of learners.' In these communities, the roles of teacher and learner are somewhat fluid. Each course in the training programme is structured using an 'open architecture', leaving room for students and the community to enter into a generative teaching and learning process. Throughout the two years of the programme, a community member in the role of 'Intergenerational Facilitator' organizes the participation of Elders and other respected community members in regular meetings with students and instructors. These knowledgeable persons share what they know of cultural traditions and community history pertaining to the aspects of child care and development covered in each course unit. This generates the community-specific part of the curriculum. Trainees are then invited to discuss historical, political, and cultural factors affecting children with individuals who best understand these contexts.

The Generative Curriculum Model facilitates the reconstruction and reorganization of traditional knowledge, as well as an original application of existing knowledge to new endeavours in community/child development, and the syncretic combining of indigenous and imported knowledge in order to pursue community/child development objectives.

Generated concepts of child care. Community members who are active in the training programme, as students or otherwise, work together to explore various possibilities for interpreting the meanings and practical implications of 'child development,' 'quality care,' and 'family life' in the context of their own culture and community. Guidelines for culturally desirable child-care practices emerge through dialogue in class about: (a) cultural reconstructions

and experiences elaborated by Elders; (b) contemporary social conditions and goals for children; and (c) ideas and research found in mainstream texts and curricula.

For example, a salient feature of most indigenous cultures in Canada is their extensive use of stories rather than direct instruction or explicit feedback. Stories are the preferred medium for teaching children the norms, moral values, and behavioural expectations of their community.

Documentation of IK

All First Nations that have been involved in programmes using the Generative Curriculum Model have preserved the 'words' or 'teachings' of the Elders and, in most cases, the creative generation of new knowledge that incorporates the wisdom of the Elders. Recording has taken various forms, including self-published books, unpublished collections, and video and audio recordings. Trainees have made extensive use of the teachings of the Elders in preparing materials and activities for children and families. Most importantly, indigenous knowledge has been preserved through the personal transformation of individuals involved as trainees and supporters of the programmes. Their identity and pride as members of their culture of origin has been enhanced along with their knowledge of the values and forms of representation of that culture. The cultural character of the participating communities has been enhanced and sustained as a result of renewed valuing of indigenous knowledge and forms of interaction, particularly the central role of Elders as guides in the community.

Achievements and results

A comprehensive programme evaluation completed in June 2000, documented the multi-dimensional success of the Generative Curriculum Model in the First Nations Partnership Programs. In each of 47 First Nations communities involved, the programme has promoted academic achievement, achievement of vocational goals, career-laddering, improved parenting, and personal healing among adult community members. Community-wide development is evident in the increased availability of quality day care and school readiness programmes for young children, in after-school programmes and learning assistance for school-age children, and in innovative programmes for youth.

Educational and vocational outcomes:

- 86.4% of the trainees completed one year of full-time, university-accredited study. For students in British Columbia, this resulted in eligibility for the Ministry of Health's basic certification in Early Childhood Education (ECE).
- 77.3% completed a full two years to obtain a Diploma in Child and Youth Care. This compares favourably with the performance of First Nations students in other post-secondary programmes, where national completion rates average 40% or less.
- 95% of programme graduates (students completing one or more years) remained in their own communities.
- 65% of programme graduates introduced new programmes for children, youth and families.
- 13% of graduates joined the staff of existing services.
- 11% of graduates continued on the education ladder towards a university degree.

Evidence of real improvement or development

Initiatives produce sustainable results when there is growth in capacity (or 'social capital') and where a broad representation of community interests (or 'stakeholders') have been mobilized to work effectively toward a common set of goals. In the First Nations Partnership Programs, administrators and other members of the participating First Nations communities have pointed to the community-wide impacts of the programme. They attribute these largely to the socially inclusive nature of the curriculum development and delivery. The following impacts were cited:

- Cultural healing, continuity, and pride.
- Increased parenting effectiveness.
- Community-wide advocacy for child well-being initiatives.
- Networking between the community and other groups.
- Development of a cohort of skilled community leaders.
- Enhanced social cohesion.

The results are cost-effective. In each partnership, at least 80% of the money paid for the programme has remained in the community, unlike the many development and training initiatives which are funded and managed financially from outside the target community. The communities have delivered the programme in their own facilities, they have provided their own

administrative and support services, and they have contracted instructors. Approximately 20% of the expenditure has been for university-based liaison, record-keeping, and provision of the euro-western portion of each course.

In evaluation research, members of the indigenous community have underscored the benefits of the way the programme was conceived and delivered to the community as a whole. In contrast, they reported that their investments and involvements in mainstream, institution-driven training programmes have sometimes benefited individual community members, but have not had widespread ripple effects. This is because: (a) the individual had to leave the community to receive training; and/or (b) training may have taken place in the community but did not actively involve the community.

Community participants have identified the following features as distinctive for the Generative Curriculum Model:

- The unprecedented high rates of student retention and completion of the programme because students 'resonated' with what they were learning.
- The application of culturally consistent training to the development of community services.
- The far-reaching ripple effects on the community as a whole.

Community-based administrators have reported high levels of satisfaction with the returns on their investment in the First Nations Partnership Programme in terms of the extent to which the programme has furthered the community's social and economic goals.

The programme evaluation research yielded largely anecdotal evidence of how the First Nations Partnership Programs compared with other programmes of post-secondary training in Early Childhood Care and Education in terms of costs and benefits. The results of comparison can be summarized as follows:

- The First Nations Partnership Programs are unique in enabling students to earn university credits for courses culminating in a two-year diploma which can then be applied to a degree programme.
- The First Nations Partnership Programs are unique in Canada with regard to the extent of community involvement in programme delivery.
- No other programmes provide opportunities to develop capacity through a generated curriculum in which cultural knowledge, community

conditions, and locally articulated goals for children's development figure centrally in what students learn and how they are prepared to take on professional roles as leaders in their own communities.

- The First Nations Partnership Programs are slightly more costly and lengthy than other programmes.
- First Nations Partnership Program outcomes run against the tide of programmes that foster 'brain drain' because students are required to leave their communities, or to study in isolation from them. When students are removed from their communities, either geographically or socially or both, they rarely return to work in their own communities. By contrast, 95% of the students who completed one or two years in the First Nations Partnership Programs remained in their communities after the programme, and most assumed roles in community-based child and family services.

With the exception of community members trained under the Generative Curriculum Model, there is a visible and well-documented lack of First Nations people practising in the field of Early Childhood Care and Development, or—for that matter—in any other field of human services in Canada. This suggests that mainstream post-secondary training programmes have been largely inaccessible or ineffective in supporting the growth of capacity in First Nations, a conclusion that supports the view of the Generative Curriculum Model as a 'Best Practice.'

A recurrent theme emerging from the programme evaluation was the congruence that programme graduates experienced in a training programme that focused on their own community and on its goals for the well-being of children and families, its socio-economic circumstances, and its readiness and strategies for responding to the needs of children and youth. Many students contrasted this with previous experiences in mainstream educational institutions, which they described variously as 'totally white,' 'impractical,' 'culturally contradictory,' 'spiritually bankrupt' and 'foreign.' Because the Generative Curriculum Model adopts a 'both/and' approach that presents euro-western theories and research alongside indigenous traditions, values and practices, the curriculum resonated with the realities of the daily lives of community members.

The results can be managed locally. Partner indigenous communities have mounted an array of programmes that meet the needs of young children, generate employment, and enable parents to pursue employment and training. Children's programmes initiated or staffed by programme graduates include:

- Out of home, centre based day-care.
- In home family day-care.
- Aboriginal 'head-start'.
- Cultural programmes.
- Infant development programmes.
- Individualized, supported child care for special needs.
- Indigenous language enhancement programmes.
- Children's programmes in women's safe houses.
- School-based teacher assistance/learning support.
- After-school care programmes.

Actual and potential advantages of the practice

The Generative Curriculum Model has had widespread effects on community development through: (a) the focus on children's well-being; (b) the involvement of a broad representation of the community in programme planning and delivery; and (c) revitalization of indigenous knowledge and social forms. The 'ripple effects' of the training programmes are, indeed, the most unique and powerful advantage of Generative Curriculum Model, and have been identified by First Nations participants as, in fact, the 'main effects.'

The use of the Generative Curriculum Model in the First Nations Partnership Programmes demonstrates the increase in cultural pride, social cohesion, and income-generating potential that can be achieved when we open up the way that capacity-building initiatives are conceived and delivered. The Generative Curriculum Model demonstrates one way to honour the knowledge and traditional ways of teaching, learning, and care-giving within indigenous communities, and to combine the strengths of communities and mainstream training institutions.

Actual or potential negative effects

Negative effects have not been noted or documented. There are a number of challenges to implementing the model, however. Most importantly, it has been difficult for indigenous communities to raise the funding needed for a

full two-year training programme. Another challenge has been the need for groups of trainees large enough to make programme delivery cost-effective. Communities that have successfully mounted the programme have built bridges with neighbouring indigenous communities to form a consortium, with each community essentially sponsoring places for their community members to enrol in the programme. This consortium approach has had many advantages, especially building social bridges and sharing indigenous knowledge across contiguous cultural groups.

Another challenge to funding has been the preference among many government funding programmes for short-term training ranging from two weeks to six months, rather than the two years of full-time involvement required in the First Nations Partnership Programs. Variations in the use of the Generative Curriculum Model are possible, including shorter training. However, the First Nations partners who have initiated programmes have specifically sought training that is comprehensive, university-accredited, 'career-laddered', and spread over a sufficient time period for trainees and other participating community members to undergo significant personal change.

How the practice could be developed or improved

The programme is already built upon the principle of giving simultaneous consideration to indigenous and euro-western knowledge. Improvements do not appear to be called for in the Generative Curriculum Model itself. Its application in various delivery modes and settings should be explored and documented, however. This could involve a series of workshops, courses on the Internet, or perhaps a master's degree programme to develop leadership capacities among aboriginal community members.

Source of inspiration

The practice would be rather easy to transfer to other places although some adaptations might be necessary. Throughout the world, cultural groups are seeking ways to ensure the survival, revival, or re-envisioning of their cultural beliefs, values, and practices, while at the same time ensuring that their community members have access to and are prepared to work in the dominant culture settings. The Generative Curriculum Model is an approach to building on indigenous knowledge to create capacity in a variety of settings around the world across a range of subjects, especially in areas of social/human service and education.

A key prerequisite for use of the model is that the community itself initiate the programme delivery and select the trainees. This provides a foundation for social inclusion in the teaching and learning process, and the likelihood that sources of indigenous knowledge can be tapped for the co-construction of culturally sustaining, community-appropriate models for social policy and human service practices.
In many settings, especially outside North America, there is not the same strong desire for university-accredited training or for professional career-laddering. This is not a requirement of the Generative Curriculum Model, but it would be a change from the demonstration projects conducted with First Nations partners in Canada to date.

An adaptation of the Generative Curriculum Model is currently being piloted in an innovative programme in Sub-Saharan Africa. Called the Early Childhood Development Virtual University (ECDVU), this is capacity-building designed to help meet the urgent need for ECCD leadership and ECCD development in Africa (www.ecdvu.org). The programme retains the Generative Curriculum Model's focus on the co-construction of concepts and practices relevant to child well-being in local cultural ecologies through the consideration of both indigenous and euro-western knowledge sources. Similarly, it is assumed that everyone has knowledge and experience that embodies their culture of origin and contemporary cultural identity, and that this knowledge is important for informing dialogue and decision-making pertaining to policies and programmes for children. Participants are both learners and teachers. Participants also consult with holders of indigenous knowledge in their own communities, and bring this information to the cohort of programme participants. The ECDVU differs from the use of the Generative Curriculum Model in First Nations in Canada in that the ECDVU combines distributed learning methods, including face-to-face seminars, web-based study and cohort interaction, CD-Rom and video-conferencing.

Some evidence of the impacts of the Generative Curriculum Model is apparent in recent changes that certain Canadian post-secondary institutions have made in their approach to meeting the training needs of indigenous community members. In fields ranging from community health to forest resource management, there have been significant increases in the community-based delivery of programmes, in flexible admissions policies,

and in willingness to consider indigenous knowledge. Although less common, there have also been a few recent examples of successful inter-generational participation and incorporation of indigenous languages.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

Culture is not static. Therefore the incorporation of IK into policies and programmes should not be construed merely as a process of 'transmission.' Rather, culture is embodied in processes of communication, and the meaning and value of cultural knowledge and practices are always being reinterpreted within cultural communities, implicitly and explicitly, individually and in dialogue. Thus, encouraging a recognition of the value of indigenous knowledge should be understood as valuing the social process of knowledge transmission and the ongoing social construction of individual and group identities. Individuals creatively and selectively recall, use, and shape both the accumulated wisdom and traditions of their culture of origin and the process of their own enculturation (i.e., of their own valuing, learning about, interpreting, and reproduction of that culture perhaps in traditional or in new, hybridised forms). For this reason—in strategies of poverty alleviation, income generation, and other social development initiatives—encouragement should be given to emphasizing the 'generation of indigenous knowledge' or the 'social reconstruction of indigenous knowledge,' rather than the 'transmission of indigenous knowledge.'

Additional documentation about the practice:

- Booklet of research findings: First Nations Partnership Programs: Generative Curriculum Model.
- Short evaluation research report: Program Evaluation Summary.
- Booklet of short programme examples: Children are our Future.
- Article expanding on implementation: Two sides of an eagle's feathers.
- Article expanding on partnership processes: It takes a village...and new roads to get there.

Administrative data

Organizations involved

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First Nations partners in Canada

Cowichan Tribes
Little Shuswap Indian Band
Meadow Lake Tribal Council
Mount Currie First Nation
Nzen'man' Child and Family Services
Onion Lake First Nation
Tl'azt'en Nation
Treaty 8 Tribal Association

Partner training institutions in Canada

Saskatchewan Indian Institute of Technology
Nicola Valley Institute of Technology
Malaspina University College

Funding
The average cost of delivering a two-year, full-time programme in a community has been CAD 500,000. The programme consists of two years of full-time course work plus one year of pre-programme preparation and six months of post-programme follow-up.

The sources of funding are variable. First Nations communities typically receive funds for post-secondary education from provincial governments, funds for special projects targeting child health and well-being, and for aboriginal employment and training from the federal government, and funds from charitable foundations.

The university-based project team has received funding for course development and programme evaluation from:

- Human Resources Development Canada, Employability and Social Partnerships Branch.
- The Lawson Foundation.
- The Vancouver Foundation.

Person(s) who have described this Best Practice
Jessica Ball, Co-Coordinator, First Nations Partnership Programs (as above)

Title

'Voices from the Bay': Documenting and Communicating Indigenous Ecological Knowledge from the Hudson Bay Bioregion

Themes

Community participation, cultural identity, curriculum development, ecological research, ecology, ecosystems, environmental management, learning, resource management, teaching

Introducing the practice

The coastal and island communities of Hudson Bay, James Bay, Hudson Strait and Foxe Basin, covering an area of 1,150,995 km, practise the traditional ecological knowledge of the Inuit and Cree peoples, who are indigenous to the Hudson Bay Bioregion of arctic and sub-arctic Canada.

Twenty-eight communities previously unidentified on area maps of the bioregion participated in the Hudson Bay Traditional Ecological Knowledge and Management Systems (TEKMS) Study: 15 Inuit and 13 Cree communities with populations ranging from 250 to 2,500 persons.

Each of these remote and geographically dispersed communities has its own unique identity and socio-cultural features stemming from its ancestral relations, traditional land use and occupancies, and historical contacts with Europeans and the Government of Canada. Three Inuktitut dialects and five Cree dialects are spoken in the region.

In the early 1990s, concern was expressed in both southern and northern Canada about the cumulative impact that several proposed hydroelectric projects would have on the natural environment and the indigenous inhabitants of Hudson and James Bays. The Hudson Bay TEKMS study was initiated in response to these concerns during the winter of 1991 as part of a three-year initiative undertaken by two non-governmental organizations and the community government of Sanikiluaq. A community-based work plan was developed and grant proposal was drafted.

Thirty communities were identified and invited to participate in the community-led study to document the traditional ecological knowledge of Inuit and Crees living on islands and areas surrounding the Hudson and James Bays. The aim was to inform public policy and environmental decision-making for the Hudson Bay bioregion.

The community of Sanikiluaq on the Belcher Islands in southeastern Hudson Bay hosted an initial regional meeting of nine coastal and island communities in October 1992. At this meeting, the indigenous delegates discussed their environmental concerns, selected communities for involvement in the study, and identified the discussion topics for a series of regionally based meetings. Six regional, community-based meetings were held in 1992 and 1993. Seventy-eight Elders, hunters and women participated in these meetings and shared their knowledge concerning rivers, currents, sea ice, weather, animals, human health, traditional management, and the effects of development in the coastal, marine and some inland areas of the Hudson Bay bioregion.

IK recorded on map overlays, audio tapes and paper was translated and transcribed into English in the host communities and sent to the study office in Sanikiluaq. There it was organized into general topics and synthesized for review and verification by the same IK holders during a second series of meetings in the fall of 1993, and a second regional workshop in January 1994. In May 1994, 12 IK holders from the study presented and discussed their findings on climatic changes, changing current and ice regimes, long-term effects of flow diversions, habitat change and loss, animal population and migration changes, contamination of the Hudson Bay food web, and changing land use patterns. This was done in a joint workshop with an equal number of scientists familiar with or working in the Hudson Bay area. The implications of the environmental changes for social, cultural and physical systems were also discussed.

Contractual obligations were met in 1995 with the preparation of a report and production of GIS-generated maps on environmental changes in the Hudson Bay bioregion. Also in 1995, the community of Sanikiluaq was selected for international recognition by the Friends of the United Nations. The community received one of 50 awards in honour of the United Nations' 50th

anniversary. The award was for promoting cultural integrity and positive multicultural relations among Cree and Inuit of Hudson and James Bays.

Editing of the report resulted in publication of 'Voices from the Bay: The Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion', which was compiled by Miriam McDonald, Lucassie Arragutainaq and Zack Novalinga and published in 1997 by the Environmental Committee of the Municipality of Sanikiluaq and the Canadian Arctic Resource Committee. A relatively quiet time followed publication of the book. The issue of development and its cumulative effects disappeared with the 'shelving' of the Great Whale Hydroelectric Complex project. Members of the Sanikiluaq study team participated in workshops; symposiums and conferences upon invitation, but neither the study nor the book generated much interest or concern either inside or outside the community.

In the year 2000, the Environmental Committee of the Municipality of Sanikiluaq became aware of a resurging interest in industrial development of the mineral, oil and gas and hydroelectric potential in the Hudson Bay bioregion. Interest in 'Voices from the Bay' is increasing as a result. This has presented new opportunities to express indigenous ecological knowledge, communicate study findings and participate in integrated management-planning activity for the Hudson Bay region.

In May 2002, a joint Municipal Council-Environmental Committee meeting with the Premier of the Government of Nunavut and Deputy Minister of Executive and Inter-Governmental Affairs affirmed the value and validity of the practice, in recognition of the fact that a healthy Hudson Bay is essential for the success and well-being of Sanikiluaq and the other coastal and island communities in the Hudson Bay bioregion.

The practice

'Voices from the Bay' as an IK practice originated with the Hudson Bay Traditional Ecological Knowledge and Management Systems (TEKMS) study. The aim of the study from the perspective of its indigenous participants was to put their ancestral knowledge of the environment into writing so that it is appropriately transmitted and incorporated into environmental assessments and policies and communicated effectively to

scientists, the interested public, and the youth of the participating communities. The aim of the study from the perspective of those who funded it was to ensure that the traditional ecological knowledge of Inuit and Cree living in the Hudson Bay bioregion is an integral part of decision-making for the Hudson Bay bioregion. The aim of the study from the perspective of the three-year initiative known as the Hudson Bay Programme was to identify and record environmental changes in the Hudson Bay ecosystem from the observations and knowledge of the indigenous peoples living in it.

Current use

Traditional ecological knowledge as an IK practice is still in use throughout the Hudson Bay bioregion on a daily, seasonal and year-round basis. Elders, hunters, women and youth acquire and apply it in pursuit of sustainable livelihoods. Young student-teachers use the 'Voices from the Bay' publication as a resource and incorporate it into their course activities and teaching. Youth learn of IK through stories and the sharing of food with Elders on the land and in the communities' primary and secondary schools.

'Voices from the Bay' as an IK practice is at the early stage of entering into a new phase of activity. Its messages are starting to be communicated within the Canadian political world and could well be heeded as agreements regarding hydroelectric development and regional economic development in various jurisdictions are negotiated and implemented over the next 25 years. The IK holders continue to have a role in the affairs of the Sanikiluaq Environmental Committee, and the multi-jurisdictional Hudson Bay Oceans Working Group encourages expression of their views and communication of their knowledge.

Origins of the practice

The indigenous ecological knowledge associated with this practice originates from interaction with animals in the marine waters, islands and lands surrounding the camps and communities of Hudson and James Bays. It began being acquired by the ancestors of Inuit and Cree peoples as they occupied the area after disappearance of the Laurentide Ice Sheet about 10,000 years B.C.

The indigenous peoples' connection to the lands, waters, animals and atmosphere is a continuous thread through time in the evolution of the

Hudson Bay ecosystem. Their indigenous ecological knowledge continues to be generated and expressed in the communities of today through educational activities, cultural pursuits, artistic expression and subsistence activities.

The Hudson Bay TEKMS study originated in the Inuit community of Sanikiluaq. The idea emerged following a national radio interview with Grand Chief Matthew Coon-Come, who asked who would be listening to the Cree peoples when they talked about the effects of existing and proposed hydro-electric development on their traditional ways and lands.

Content and approach

The purpose of 'Voices from the Bay' is to document and communicate indigenous ecological knowledge in such a way that it will be heard and taken into consideration for responding to changes occurring in social, cultural and physical processes of the Hudson Bay bioregion. Its aims are:

- To make known the indigenous ecological knowledge of Hudson and James Bay inhabitants with respect to their natural and cultural environments.
- To support policy and decision-making processes interested in incorporating traditional ecological knowledge in their systems.
- To advance global knowledge systems by combining traditional ecological knowledge and scientific data for educating and informing people on the dynamics of a particular ecosystem.

Parties involved in the practice

Many parties were involved in the study:

- The Environmental Committee of the Municipality of Sanikiluaq.
- The Honourable Peter Kattuk, Member of the Nunavut Legislative Assembly for Hudson Bay.
- Elder and academic advisors.
- Regional coordinators.
- Community leadership.
- Indigenous-knowledge holders.
- Linguistic translators.
- Community researchers.

The Environmental Committee of the Municipality of Sanikiluaq was responsible for the practice. The beneficiaries of the practice are the Hudson

Bay Programme, the indigenous participants and peoples of the Hudson Bay bioregion, and environmental decision-makers, policy-makers and educators. In the study, an average of two or three TEKMS holders participated from each of 28 communities. Most were either Elders or active hunters, and the average age was 56 years. The youngest contributor was 26 years old and the eldest was born in 1909. More men (72) than women (6) participated in the study because of its focus on understanding the dynamics and changes occurring in the Hudson Bay ecosystem, which is generally but not exclusively gender-based knowledge. Indigenous knowledge is used in both the planning and the execution of the practice.

A community-based, participatory research approach was used for developing the initial study. Indigenous peoples from two different cultures became involved in the design, development, implementation and research aspects of the study as well as being the only contributors of information to it. The Study Coordinator was an indigenous resident of Sanikiluaq, and the Research Coordinator a non-indigenous resident.

The first step was to identify the communities in the coastal and island areas of the Hudson Bay bioregion and to develop a work plan which would become a funding proposal and guide for implementation of the study. The purpose of the study was to place the ecological knowledge held by indigenous residents of the Hudson Bay bioregion in the spotlight and to show the contribution it can make to advancing global knowledge systems related to the Hudson Bay ecosystem.

'Voices from the Bay' has to date remained apolitical. It is not self-promoting and has not developed an ideology. Respect, perseverance and teamwork are cornerstones of the practice.

The role of Indigenous Knowledge

Indigenous knowledge is at the core of the practice and its value is immense. It was both the premise for and basis of the study: an historic, empowering and rewarding experience for many of the IK contributors. It was historic in that the IK contributors were cognisant of putting their orally communicated traditional ecological knowledge into writing for the first time in history. It was empowering in that they shared this mission with peers from many communities sharing the same environmental outlook, and they believed it

would make a difference in the way decisions affecting the environment and communities of the Hudson Bay bioregion would be made. It was rewarding in that for many it was the first time they had the opportunity to formally meet with their peers to discuss in their own language and amongst themselves what they know about the natural environment and the changes occurring within it and their cultures through the introduction of western industrial systems and practices.

Indigenous knowledge can contribute to a better understanding of the Hudson Bay ecosystem and can help to identify changes and indicators of change within it. It can also provide indigenous insights into the growth and effects of human activity in the bioregion. This information is valuable for the management and protection of the Hudson Bay, and for ensuring that human activity does not exceed certain limits.

Indigenous knowledge is also contributing to the formation of new partnerships which could result in development of a unified approach to addressing the increasing effects of human activity and to developing a multi-jurisdictional framework for managing and protecting the Hudson Bay. 'Voices from the Bay' honours the expression, and endorses the socio-cultural values, of two distinct cultures, recognising that their societies, cultures and politics differ but they have unifying values concerning the natural world and human-animal relationships.

It has been beyond the scope of the practice to document in detail the socio-cultural values and spirituality of the two cultures with respect to the natural environment. Some IK contributors have suggested that this should be done.

The traditional ecological knowledge of Inuit and Cree in the Hudson Bay bioregion is specialized knowledge in that it is acquired and refined through an accumulation of concrete, personal experiences. It is practised in the course of traditional land-use activities, and acquired from observing, listening to, and interacting with other people and with the land, water, rivers, sea ice, currents, atmosphere, climate, and animals on a regular and frequent basis.

The holders of traditional ecological knowledge in the Hudson Bay bioregion have few opportunities to earn money from their knowledge because there

are significant barriers to their entry to the wage economy. They do use it, however, to alleviate poverty in the subsistence economy.

Some IK holders are paid for the cultural education work they do in schools and for the services as guides which they provide to tourists and scientists.

The transformation of knowledge

The IK of this practice is transmitted between the members of communities primarily through participation in land-based activities, conversations, meetings and gatherings.

Traditionally, it is transmitted between generations through the observation and play of young children and then, from the time the children start taking their first animals at around the age of eight, through active participation in land-based activities. There is a strong reliance on observation and allowing children to make mistakes. As the children get older, their elders start correcting them for their mistakes. As young men, Inuit are encouraged to go out and learn directly from their natural surroundings under various circumstances. In James Bay and western Hudson Bay, Cree youth used to spend a specified period alone on the land, during which time they became men.

Both Cree and Inuit contributors said it is currently a challenge to transmit their knowledge to young people, who now learn primarily from being taught in classrooms and not from observing in the outdoors. Today it is difficult for the young people to actively participate in the full cycle of annual traditional activity, and they are unable to observe the land-based activities of their parents during much of the school year. Recent gun regulation laws are also having an impact on the transmission of knowledge in that it is now illegal to use a gun until a gun registration license is obtained at 18 years of age.

The Cree and Inuit contributors expressed regret that they had lost control of the education of their young to the Government of Canada. They also questioned what type of future their young would have if their knowledge fails to be adequately transmitted.

Schools are becoming increasingly active in developing cultural programmes and engaging students in land-based activities. Elders, hunters and women

participate in these programmes and activities as instructors. The traditional principles and methods of transmitting knowledge also continue to be applied but under very different circumstances than two or three generations ago.

The Hudson Bay TEKMS study produced a volume of information that only scratches the surface of the great depth of knowledge held by the IK contributors.

The IK was recorded on audio tapes that were translated and transcribed for the production of written documents and a hypertext database, which searches and links keywords in the original transcripts. It was also documented on a series of multi-layer map overlays for the generation of regional maps and a GIS system and database. The environmental concerns, observations and perspectives of several indigenous contributors were documented on videotape as well.

Achievements and results

The approach and methodology developed for the study resulted in the active participation and commitment of a number of indigenous communities and individuals living in a large, remote and sparsely populated biogeographical region of Canada. It was community-based and community-driven, which means that indigenous peoples were actively involved in all aspects of the research process: design, development, compilation, synthesis and the production of results. The combination of active participation and involvement resulted in indigenous thinking and knowledge being integral to the study.

'Voices from the Bay' demonstrates what small, isolated communities can achieve when they are given the opportunity to contribute to identifying and understanding the ecological processes and dynamics of the Hudson Bay ecosystem. This is a necessary prerequisite for pursuing and practising sustainable development. From 'Voices from the Bay', scientists and other interested persons have become aware of how weaker currents are changing sea-ice regimes, of the departure of belugas whales from river mouths that have become too shallow for moulting, of the sensitivity of sturgeon to changing water quality and river diversions, and of the type of damage caused by freshwater diversions. They have also learned that many environmental indicators used by IK holders can no longer be relied upon for

predicting the weather and forecasting seasonal events, and they have read about how much the Inuit and Cree peoples value and revere the natural world.

The Hudson Bay is referred to as 'the black hole of Canada' because so little is known about it despite its domination of the Canadian landscape. 'Voices from the Bay' is starting to fill this 'black hole' with the knowledge of its indigenous peoples who, in the words of one reviewer, clearly convey the fact that the Hudson Bay bioregion is 'not the pristine and untouched wilderness of southern imagination.'

Although it is taking at least ten years for 'Voices from the Bay' to reach its intended audiences, the initial work is withstanding the test of time and proving itself a credible study. It shows how traditional knowledge can complement scientific data for better understanding of the environment and the effects of development. As a result, the book is establishing a basis for indigenous leaders, government regulators, public policy-makers, industrial decision-makers and scientists to seriously consider the importance of 1) managing the effects of industrial development, 2) protecting the Hudson and James Bay marine ecosystems, and 3) developing a unified approach amongst the stakeholders for addressing the problems that will arise from further increases in development activity over the next 25 years.

'Voices from the Bay' has been sustainable, cost-effective and locally manageable for the past ten years, resulting in the protection and safeguarding of proprietary knowledge. Local peoples benefited from being employed for the study and from playing key roles in its development and evolution. The younger Inuit and Cree involved in the community meetings benefited from being exposed to and becoming aware of the rich and detailed traditional ecological knowledge held by their elders. They found a new pride and value in their culture, their elders, and the traditional ways of life. The IK contributors benefit from knowing that their knowledge is now considered important, and from having the opportunity to meet with their peers to discuss matters of importance to them.

The activity surrounding the initial study created some potential opportunities for local individuals. This potential is not being realized, however. The situation would benefit from capacity-building within the

community, from adoption of a unified approach to sustainable development of the bioregion, and from creation of new institutional arrangements for monitoring and managing human activity in the bioregion.

Development of the two databases, creation of a network for monitoring indigenous ecological knowledge, and the training of local persons in how to access the databases, and compile, synthesize and disseminate the information they contain, are four more areas where the investment of capital and human resources in sustainable, cost-effective initiatives could produce useful results. These possibilities have not been properly explored yet for several reasons, however: the isolation of the host community, the lack of genuine interest in the Hudson Bay on the part of provincial and federal governments, and the lack of communication amongst the stakeholders.

The study's methodology is the strength of the practice. It has been replicated and improved upon since 1995. The semi-directed workshop/meeting format has the following advantages:

- Small groups of people can hold focused discussions on topical areas of interest. These generate considerable information and take into account a range of geographical, climatic, historical and cultural factors that an interviewer may not be aware of.
- Participants have the opportunity both to contribute and to learn from each other, thereby augmenting their own practical knowledge.
- The methodology can be used to document indigenous knowledge in cross-cultural settings and over large geographical areas. Contributors will question, verify and build upon the information provided by other contributors.
- IK holders find meetings more interesting than interviews because of the interaction and exchange of information that take place within the group.

Another strength of the study is its demonstration that traditional ecological knowledge can complement scientific data. A potential advantage of this strength in the present case is that indicators could be developed and baseline information collected for monitoring changes in the Hudson Bay ecosystem which are not yet being measured by western science.

Room for improvement

The practice has not been effectively communicated within the local communities so that community awareness and support are lacking. The practice could be developed further if its purpose and aims were reaffirmed, if resources were allocated to developing a database for disseminating information to targeted audiences, and if its tangible benefits were demonstrated to the participating communities.

Source of inspiration

It is imperative that the ecological knowledge of indigenous peoples be demonstrated and incorporated into environmental decision-making and sustainable development initiatives throughout the world.

The practice would be rather easy to transfer because it is flexible and adaptive and based on listening, working together, and learning by doing. Some adaptations might be necessary depending on the subjects of inquiry, and the communication modes and availability of computer hardware and software.

Features of the study's methodology have been replicated and refined in other parts of Nunavut by the South Baffin Bowhead Whale Committee, the Government of Nunavut, Nunavut Tunngavik Incorporated, and in Alaska for the Barrow Symposium of Sea Ice.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

Students enrolled in the three-year Nunavut Teachers Education Programme in Sanikiluaq have incorporated information from the 'Voices from the Bay' publication into their learning and planning activities.

The Curriculum Division of the Government of Nunavut's Department of Education is examining the publication's usefulness for the design of senior secondary science curricula on terrestrial systems, marine systems, climate systems and conservation.

There are many structural barriers in place that impede development of the practice. The Environmental Committee is limited in what it can achieve without more community support and new partnerships, for example.

It is not an explicit objective of the IK practice to have a sustainable effect on poverty eradication and social exclusion. However, it is recognized and communicated when appropriate that the traditional ecological knowledge of the indigenous peoples of the Hudson Bay bioregion can contribute to eradicating poverty and creating a more promising future for young people if it is incorporated into the development of new political and economic systems that support and encourage its transmission. An excellent example of this would be the development of a community-based marine environmental quality monitoring system for the Hudson Bay.

Administrative data

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Total budget (in US dollars): USD 545,000
Period to which the budget applies: 1992-95
Sources of funding: Private foundations, Government of Canada Government of Nunavut, Regional Aboriginal Organizations, Public Utilities.

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Title

Control of Chagas' disease through a Cultural Context Model: Proyecto Britanico Cardenal Maurer in Sucre, Bolivia.

Themes

Community health, education, housing construction, hygiene, insecticides, insects, medicinal plants, plant products, training

Introducing the practice

The practice has been used among Aymara and Quechua speakers in the Andean regions of Peru, Bolivia, Chile, and Argentina. The aim was to devise a culturally sensitive approach to teaching people how to improve their houses so as to prevent Chagas' disease. The project reported here, which was based in Sucre, Bolivia, was carried out in the department of Chuquisaca between 1989 and 1997. It involved year-round activities.

Through the project, a method was developed for teaching peasants about how triatomine insects—popularly known in Spanish as *vinchucas*—carry and transfer the parasite responsible for Chagas' disease. The peasants are then taught how to build or improve their houses to make them *vinchuca*-free.

90% of all houses in the region are infested with *vinchucas*. Between 60 and 80% of all *vinchucas* carry *T. Cruz*, the deadly parasite that causes Chagas' disease. 'Chagas' produces a higher rate of DALY (disability-adjusted life years) than any other disease in Latin America. It disables workers in the prime of life, often killing them. Many widows and orphans are thus left behind with no source of income.

The practice is still in use. Since it employs native personnel and resources that are locally available, the practice is sustainable. It is in fact held up as a model for other projects (see Bastien 1998).

The practice did not originate within the community. It began in 1989 when the British Embassy began to collaborate with Ruth Sensano, the director of Proyecto Britanico Cardenal Maurer (PBCM).

The project developed an approach based on existing (global) disease control knowledge (improvement of housing is the most cost-effective way to control the disease) combined with local, indigenous knowledge on construction.

Content and approach

Ruth Sensano worked with a training team consisting of two traveling doctors and a number of technicians (specialized in building, spraying, and epidemiology) and nurses. In the communities, the team worked with local community health workers.

Each community selected a community health worker to be responsible for educating the people, organizing the villagers, and coordinating interaction with the PBCM team. Approximately 80 small communities were involved, each with an estimated 40 to 200 families. Responsibilities were equally divided between men and women. Children were taught about the disease and its causes and prevention through school plays (they portrayed insects and were driven out of houses) and through dances, songs, and educational material. An important element in the project was that schoolchildren passed on to their parents what they had learned about the dangers of the *vinchuca*. Because housing and housing hygiene are culturally sensitive subjects and vary from one region to the next, it was essential that a culturally sensitive model be used to educate the peasants involved (see Bastien 1998).

The process

PBCM selected four communities to serve as examples. Their success attracted the interest of subsequent communities. The method is as follows:

- Each community elects from among its adult members someone to be the community health worker. ‘Chagas’ control is one of this person’s responsibilities.
- The community health workers receive three two-week training courses in applied public health and in how to collaborate with the PBCM team.
- At joint meetings, the community health workers are taught extensively about parasites, insects, and how houses can harbour disease. They are

given posters, comic books, and other educational material that will help them in turn to educate the rest of the community.

- A member of the PBCM team visits each community for one week, during which time he or she meets with the community health worker and the village leaders, who in turn hold meetings with the adult members of the community until consensus has been reached, the necessary tools and materials have been assembled, and everyone has agreed to do the necessary work.
- Each village receives matching resources which have been donated by the UK, USAID, and the Chuquisaca Diocese.
- PBCM sends bricklayers to show the villagers how to make their houses *vinchuca*-proof.
- Existing houses are examined before and after improvement. New houses are monitored on a monthly basis.

Housing improvement to reduce infestation

House Improvement Committees (HIC) are the functional units where plans and priorities for housing improvements are decided and where all participatory activities are coordinated. HIC consist of a president and secretary who are responsible for organizing work groups of five to six villagers. The Committees coordinate tasks with members of the community. The groups are assigned different tasks and are supervised by a master craftsman who teaches members basic carpentry, how to lay foundations, tile making, and plastering. Local materials and personnel are used whenever possible. HICs and craftsmen supervise and coordinate the repair and/or construction of houses. They work between the months of May and September, when agricultural work is least demanding and community members are most available.

By way of illustration: in Sucre, Bolivia, for the Proyecto Britanico Cardenal Maurer (PBCM), villagers worked to compensate for roughly half the cost of a house improvement (USD 75.00 per house) and provided supplies worth USD 18.75; PBCM contributed supplies, fumigation, education, and supervision to the value of USD 114.00. Each improved house costs USD 208.00, with villagers providing 45 % and the project the remaining 55 %. Not counting free labour, the project improved a house for USD 114.00 and its total budget was USD 45,614 for 400 houses.

House improvement consists of putting in a solid concrete foundation that does not crack, plastering the internal and external adobe walls to cover existing cracks, whitewashing the walls with lime, installing glass windows and metal screening, tiling the roof, and installing a ceiling in the interior. Bedrooms are first improved, followed by dining and storage rooms. Depending on the condition of their houses, some families may decide to demolish and reconstruct them, sometimes adding additional rooms, especially bedrooms. These improvements eliminate common nesting areas for triatomines. PBCM allotted supplies progressively in order to provide an incentive to complete each task and receive the next supply, thus removing the temptation to misallocate the materials. Households prefer to do the most desirable tasks first and neglect the less desirable, such as improving the surrounding area.

One criticism of PBCM was that, in the first 400 houses, it did not improve peridomicile areas and, when they were evaluated, *vinchucas* were found in these areas. Subsequently, bug-proofing of peridomicile regions became part of the programme. The better strategy is to start with the peridomicile and, once this is improved, supply materials for the house. This ensures both corrals and house are bug-proofed.

Traditional methods and available resources are used alongside more innovative techniques, tools, and materials whenever possible. Sand, earth, and cow dung are collected locally to make wall plaster. Dung serves as an insecticide when mixed with earth and lime into plaster. Workers prepare the lime by heating locally collected limestone rocks in an open kiln for twenty-four hours and then pulverizing the residue with a hammer. After plastering, they apply a white paste of lime and water to the walls to improve the appearance. Wall plastering substantially reduces *vinchuca* infestation, but to be successful it has to be done thoroughly, so as to seal all the cracks and crevices in the house walls. The use of slow-release insecticide paints is another preventative measure. Villagers can be taught to make ceramic tile roofs to replace thatched roofs, greatly reducing a popular infestation area for triatomines. One community in Bolivia mastered tile making and began marketing their tiles to neighbouring villages, thus developing a small local industry. Low-cost roofing material is needed in developing countries to provide a substitute for corrugated galvanized iron roofing, which is very noisy when it rains and heats up when it is hot, both common conditions in

the tropics. Sheet roofing, with its sharp edges, is also extremely dangerous in windy climates when it becomes stripped from the house and is sent hurtling through the air.

A stable concrete house foundation is necessary for each house to prevent water damage to the base of the walls and floor. Cement is expensive in terms of both price and transport costs, but a durable local substitute material can often be used. Soil stabilization can also be achieved by increasing the cohesion of the soil (this is one area where technical assistance is helpful). As an alternative, the mechanical compaction of adobe mix greatly increases its stability. An adobe press with a long handle used as a lever to compress the mud and clay in molds provides more leverage than chest and arm muscles and results in a much harder adobe.

The role of indigenous knowledge

Indigenous knowledge (IK) played a role in many ways. Importantly, most of the community health workers were also their village's traditional medical practitioner. Traditional knowledge of building houses served as the basis for the improvements. The local people already knew that applying dung to plaster walls killed *vinchucas*, for example. IK was also involved in the planning of houses. The local herbalist knew that eucalyptus and certain other plants killed insects. The local people already knew how to mix adobe that would not crack. And finally, indigenous rituals were practised before the houses were built so that Pachamama would not be offended, and prayers were said to keep out *vinchucas*.

Andeans do not take to the outright spray-and-kill techniques generally used by outsiders. This often involves DDT, and beneficial insects are also killed off indiscriminately. The alternative is to practise housing hygiene, which is a very difficult concept even in European countries. But Andeans took to the idea that *vinchucas* rob them of sleep and blood, so why not keep them out. User-friendly insecticides were suggested, and a layer of cow dung beneath the plaster helped to keep the insects out. Moreover, the positive effects seen in new houses helped to overcome many obstacles.

Use of local herbs

Local herbs are used in several ways to treat the symptoms of Chagas' disease. For the treatment of constipation and the accompanying gastric pain,

such as that caused by megacolon in Chagas' disease, or even for congestive heart failure, the Kallawayas of Midwestern Bolivia were using *guayusa* (*Ilex guayusa*), a holly-like shrub, and *sayre* (*Tabucum rustica*) with an enema syringe to purge patients as early as A.D. 400. Sniffing tobacco and guayusa not only cleanses the passageways by causing sneezing, tobacco also stimulates the cardiovascular system when nicotine enters the bloodstream. Thus some of the debilitating effects of chronic Chagas' disease are meliorated. Even today, Kallawayas claim that wild tobacco is an effective vermifuge and parasiticide. The Andean pharmacopoeia features potent parasiticides and vermifuges because of selective aspects or uses of certain plants able to kill predatory organisms. Native plants provide insecticides for eliminating *vinchuca* bugs (*Triatoma infestans*), carriers of the Chagas parasite (*Trypanosoma cruzi*). Compounds including *ruda* (rue*, Ruta chalapensis*), *ajenjo* (absinthe*, Artemisia absinthum*), *andres waylla* (*Cestrum mathewsi*), and *jaya pichana* (*Schurria octoarustica*) are experimentally proven insecticides. Bolivians have learned this and use large quantities of these plants. They cut them into small pieces, smash them, and boil them in water. This is then mixed with dirt and used to fill holes in the adobe to kill infesting *vinchucas*. Another method used is to pound small rocks into the holes of the adobe. Plaster is mixed with coca, an excellent insecticide, and fleshy parts of prickly pear cactus (*Penca de Tuna* or *Opuntia ficus indica*) to form glue that helps the plaster stick to the adobe. A compound called *el paraiso*, made from *muña* (*Satureja boliviana*), is used to kill potato worms and has been suggested for *vinchucas*. Peasants also use spiders and *carpinteros* (small household lizards) to rid their houses of *vinchucas*. The plant *floripondio* (*Datura sanguinea*) gives off a nightly fragrance that discourages *vinchucas* from entering the house around which it is planted. Eucalyptus leaves burned inside the house in the evening have a similar effect. These native remedies and insecticides are all relatively safe and environmentally sound, something that cannot be said for pharmaceutical drugs and commercial insecticides.

Chilean scientists have been testing Kallawaya medicinal plants for the treatment of Chagas' disease. Several of the plants appear to help in curing Chagas' disease. Herbalists in Bolivia regularly use plant extracts with indole alkaloids, which suggest the possibility of medicinal effectiveness without excessive toxicity. Various tropical plant species used by tribal groups contain beta-Carboline alkaloids, and scientists at the University of California, Irvine, tested them and found that they reduce population growth

of *T. cruzi* epimastigote forms. Native herbalists can help in identifying potentially effective drugs from natural sources. Using native lore can reduce the number of empirical tests often conducted on natural plant products. Plant products provide an alternative to toxic synthetic drugs and indicate potentially active structures for chemists interested in synthetic molecular modification.

Bolivian herbal doctor Nicolas Carrasco claims to have cured patients of Chagas' disease with a herbal remedy called 'Regenerator'. Carrasco learned a cure from *curanderos* about the medicinal qualities of a resin from the fruit of the Rotan palm tree (*Calamus drago*), called *Sangre de Drago* (Blood of the Dragon). The plant's seeds are toasted, crushed, added to a small glass of pisco liquor, and drunk daily. This purges the body of toxic fluids, changing cold and wet blood into hot and dry. According to Andean ethnophysiology, it accelerates centrifugal forces in the body. The seeds can be crushed, making a salve that relieves rheumatism. The active ingredients in fresh seeds are acetic acid (like vinegar), butyric acid (like arnica oil), glyceride (like soap), and castor oil, which form a powerful purgative. This is effective against the constipation sometimes caused by the infestation of *T. cruzi* parasites in the lining of the lower intestine, thus inhibiting sphincter muscles from contracting and expanding to remove faeces.

A contemporaneous Bolivian herbalist, Jaime Zalles treats chagasic heart disease with three flowers of *retama* (*Spartum junceum*) in a maté (steeped in hot water), with two leaves of *cedron* (*Lippia triphylla*). The ingredients serve as a tranquilliser for heart attack victims. *Toronjil Melissa officinalis L.* is also used for heart problems associated with 'Chagas'. Carrasco's and Zalles' cures have not been validated by biomedicine.

Andean traditional medicine provides treatments for Chagas' disease as well as insecticides that may even be better than the present products produced by pharmaceutical and chemical companies. Western biomedicine does not have an effective cure for chronic Chagas' disease. Presently, the two prescription drugs used for treating it are nifurtimox (produced by Bayer, recently discontinued) and benznidazole (Roche), used for acute and chronic phases. Bolivians find both costly, unsatisfactory, and painful, and many prefer to go to native herbalists for a cure.

The complexity of Chagas' disease has been addressed by Andean culture in a number of ways. Andeans deal with its symptoms through rituals, community concern, and herbal medicines. *Curanderos* have combined forces with doctors to combat or adapt to *T. cruzi*. They appear to have dealt with Chagas' disease as adequately as biomedicine. Even if this is not so, the possibility necessitates much closer examination of ethnomedical systems for solutions to endemic disease throughout the world. Andean rituals also provide a great service to medical science by indicating the interrelatedness of Chagas' disease and the environment, showing the reciprocal relationship between the human body and the earth and its organisms.

Transmission of new knowledge

At the start of the project, the community members did all the construction work themselves, but they turned out to be insufficiently skilled. Eventually trained builders were brought in and the villagers provided unskilled labour, carrying sacks, preparing materials and cleaning up. But in all cases one or two community members learned the skills, thus ensuring the project's sustainability. One community learned how to make roof tiles and eventually sold tiles to other communities.

Community health workers from all over the province met every month. Whenever a project was completed, the local community health worker invited the others to come and see. Word about the new houses spread. The knowledge has also been documented (see for instance Bastien 1998), and video films and posters about the project have been produced.

Community participation

Project success and sustainability are a function of community participation and indigenous knowledge. As illustrated above, peasants have many adaptive and effective ways to solve their problems. It is important that they take primary responsibility for resolving their problems with the assistance and expertise of NGOs and government workers. Community participation is more cost-effective than purely structured programmes. Housing projects are more readily integrated into other programmes if there is community participation: active rather than passive involvement, with people making their own decisions and carrying them out. Community participation involves community members making decisions about, accepting, and complying with certain behavioural changes necessary for combating Chagas' disease. These

include plastering cracks in the walls, keeping animals outside, and storing objects in containers to keep *vinchucas* from infesting the house.

Problems relating to community participation include the absence of skilled local labour for some tasks. There may be limited cooperation among households because of their distance from each other. Some peasants refuse to cooperate for one reason or another. Certain adults refuse to work with other adults. Poor sanitary conditions persist in many areas. Peasants also have other tasks they consider more necessary, such as planting and harvesting crops. These problems in part indicate a lack of understanding of sociocultural issues and limited skills in cross-cultural communication from project works and NGOs. NGOs sometimes confuse the idea of community participation when they imply that they have the solution to the problem. Technicians should endeavour to educate and activate peasants to participate in finding a solution. They should esteem their indigenous knowledge and use it to remove *vinchucas* and to treat Chagas' disease, for which there is no known biomedical cure. Cross-cultural community participation (CCCP) involves lengthy discussions with all members of the community (including women and children). CCCP has no have simple answers for the prevention of Chagas' disease; it allows people to arrive at solutions after they have been presented with the facts in terms that are meaningful to them. It involves serious discussion as to why peasants behave as they do. Why, for example, do they keep animals in the house? If this is not seriously considered, they will continue to do so no matter how nice their new house. This has been the experience of the housing project in Tarija. CCCP demands that technicians negotiate change only after extensive discussion has taken place and understanding has been achieved about values and why people do what they do. CCCP is a pedagogy based upon an epistemology of exchange: knowledge is mutually arrived at between interested parties. This is essential in the case of Chagas' disease, principally because of its social and cultural complexity that affords no unilineal or vertical approach.

Achievements and results

The project produced significant results. PBCM improved 452 houses between 1987 and 1991, another 400 in 1992, and by 1997 it had improved 2,600 houses. PBCM improved the first 453 houses with a budget of USD 83,256. The community itself had contributed almost half of this amount (USD 37,642). Ruth Sensano predicts that by the year 2005 the project will

have improved another 2500 houses—provided, that is, that it receives assistance from the municipalities. Since new laws were enacted in Bolivia in 1994, the municipalities receive tax revenue for the purpose of regional improvement.

The practice of training peasants to rid their houses of the insects that transmit Chagas' disease is sustainable. Sustainability is guaranteed because an epidemiologist periodically checks the *vinchuca* infestation rate within each community, and then helps to determine what needs to be done. The community health workers play a crucial role by coordinating activity between community members and the PBCM team. *Proyecto Britanico* is no longer involved in the practice but Cardinal Maurer and Ruth Sensano still are.

The practice is cost-effective. PBCM started out with modest funding before USAID entered the picture. Houses were built for a little over USD 100 each. This meant substantial housing improvement at very low cost. USAID saw this as a successful project, well worth a large contribution. This had some drawbacks because USAID wanted fast results that it could present in its reports. Cultural sensitivity declined as the concern for accountability increased.

The practice is locally manageable. Community health workers helped to provide local leadership, and local workers were taught how to construct houses.

Strengths, weaknesses, and room for improvement
One strength lies in the fact that the community health workers are elected for terms of only two years, and they may be re-elected only once. This prevents anyone from holding on to the office and removing it from the bi-annual electoral process. The community takes responsibility for this person. The community health workers organized themselves as groups of practitioners independent of the biomedical profession. This gave them the autonomy to administer their own medicines and traditional forms of treatment while at the same time acting as liaisons with practitioners of biomedicine.

The biggest weakness was that the community health workers sometimes left the group of traditional practitioners to become doctors and nurses. Or they remained in office too long and thus became members of the establishment themselves—either the community establishment or the Ministry of Rural Health. This meant that the community lost control over them. Another weakness was that some of the community health workers began giving injections haphazardly. Andeans have become addicted to the 'magic bullet'. This would not have happened if the diagram for a Culture Context Model had been followed. (See Bastien 1998, which also offers suggestions for improving the PBCM project.)

The practice could be improved by blending it with other indigenous knowledge. There should be more supplies of medicinal plants in the regional pharmacies. In addition to the herbal manuals already published, there is a need for study of Kallawaya medicinal plants and their pharmacological uses.

Community health workers should be given more recognition for the work they do as midwives, *yatiris*, and *curanderos* in clinics and hospitals. The significant role they play in public health should be properly recompensed.

Source of inspiration

The practice can be replicated anywhere in the world where people are living in unhealthy houses. As long as the Culture Context Model is used (see Bastien 1998: 134-157), the practice could easily be transferred to other groups, cultures and land-use systems.

The community health worker project has already been replicated throughout Bolivia, and communities all over Bolivia, Chile and Peru have adopted similar programmes. The suggestions offered in 'The Kiss of Death' (Bastien 1998) have been incorporated into projects throughout Latin America. A community health worker project in the Department of Oruro, Bolivia, is just one example.

The project offers a model for how other regions or countries could tackle the disease in an economic, cost-efficient and effective way. The case certainly provides input for policy-making processes.

If you think that this case could be useful in a different context than the one described here, please get in touch first with the contact person listed below (Administrative data). Intellectual property rights could be an issue.

Additional remarks and information

Bastien, J.W.

- 'Healers of the Andes: Kallawaya Herbalists and their Use of Medicinal Plants', 1987.
- 'The Kiss of Death. Chagas' disease in the 'Americas', 1998.

Administrative data

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5. FINAL REMARKS

Learning process

In contrast to the first phase of the project, the second phase featured a preference for the contextual approach. In this sense, the project proved to be a learning process not only for the authors, but also for Nuffic and UNESCO/MOST. We concentrated more on depth than we did in the first phase, making room for a description of the local context and encouraging the use of local terms (see also the glossary in Section 7.3). But there is still room for improvement. As in the first phase, the focus has been more on technical aspects of IK than on cosmology or worldview. Although worldview and techniques are inseparable in most local cultures, the use of western languages and western styles of documentation forces us to separate what in the western view are different aspects. We lack the terms we would need to do otherwise. This, in fact, points to yet another area requiring further study by scientists in collaboration with local stakeholders.

By publishing these Best Practices, we certainly do not claim that our documentation methods are completely 'IK-proof'. The editors see this publication as contributing to the ongoing process of learning how best to document and use IK, and not as a final stage.

The cases

In this published outcome of the second phase of the Best Practice project, 22 cases from various parts of the world are presented. Come to this point the reader will agree that the cases are all very different in nature and quality. Authors from different backgrounds, with different skills, and from different countries, all submitted cases they thought worth disseminating. As a result, indigenous knowledge is presented in all its diversity of aspects and contexts. The Best Practices described here vary from water-harvesting techniques to information about the marketing of honey and wax, and from the assessment and grading of local fleece quality to the documentation of ecological knowledge for policy-making purposes. Most of the practices described here are communal practices, but others were developed by individuals—individuals working in research institutes, or individuals fulfilling the extraordinary role of innovator within a community. The cases also vary according to the gender involved. While fishing in Nigeria is still a male

activity, the making of clay pots in Kenya is in the hands of women's organizations. Sometimes the practices have a long history; sometimes they are recent adaptations to specific circumstances. Some practices use western techniques in combination with local ones. But regardless of the practitioners' gender and regardless of the continent, country or region, all of the cases show us how much IK is integrated into daily livelihoods in rural areas.

IK is therefore not exclusive to the developing world, nor is it always related to ancient traditions. These 'other ways of knowing' are in fact present everywhere where human beings live. In view of this, it is strange that the importance of IK and the need to document, further develop and improve it do not receive equal recognition and attention everywhere.

It is clear that because IK is linked to so many different aspects of daily life and is thus so firmly embedded within local communities, further research and development of IK will have a broad impact on the livelihoods of rural peoples. Its capacity for improving livelihoods is illustrated nicely by the clay-pot practice. A seemingly simple redesign and technical adaptation of a traditional water container (by placing a tap on the pot) has marked a major improvement in the health of the community-at-large, while at the same time empowering women and creating opportunities for income generation. This case illustrates perfectly how the use of IK can provide practical tools for poverty alleviation, sustainable development and empowerment in general. A completely different practice, a case describing how IK has been documented and integrated into an education system, shows the importance of cultural identity and self-esteem for development and—in combination with knowledge of the surrounding eco-systems—for survival.

From these practices we can conclude that for many people and cultures around the world, IK could be a missing link between neglect and empowerment, between losing and surviving. The cases offer proof that IK is worth studying, documenting and applying, but not without also making a critical assessment of it.

Categories

The remainder of this publication consists of the indexes. Here the Best Practices are categorized by subject and by thematic keyword. Most cases in

this publication fall under the subject category ‘Natural Resources’, followed by ‘Resources Conservation’. Of the thematic keywords, the categories ‘Resources management’, ‘Cultural identity’, ‘Food security’, and ‘Natural resources’ score high, while ‘Community health’ and ‘Community participation’ occur several times.

The high frequency of ‘Natural resources’ and the subjects and keywords related to it, and of ‘Food security’, underscore the prevailing definitions of IK. (See Chapter 1 of this publication.) As mentioned above, IK provide tools that enable local communities to survive in a local environment. And it still does, as this publication makes evident. The communal character of most practices is underscored in this publication by the frequency with which the themes ‘Community participation’ and ‘Community health’ occur.

Finally, ‘Cultural identity’ underlies all initiatives in the field of IK within these rural communities, as it is strongly related to the will to survive in a rapidly changing world.

Part 3

6. INDEXES

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6.1. Geographical index

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Canada	20, 21
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Peru	19
Suriname	18

6.2. Subject category index

Subject category	BP. Number
Agricultural economics	4
Agricultural production	2, 3, 4, 9, 15, 19
Animal production	6, 8, 12, 14, 17
Art. Archaeology	19

Subject category	BP. Number
Biology. Parasitology. Biochemistry	18
Chemical industry	14, 22
Construction industry. Ceramics industry. Glass industry	1
Culture	12, 15, 18, 19, 20, 21
Curriculum. Teaching. Learning	20, 21
Disasters, pollution	4, 22
Ecology	12, 21
Economic conditions	13, 14, 15, 16, 17
Economic policy. Planning	18
Educational development. Educational policy	18, 20, 22
Environmental engineering	2
Ethnic groups	20
Fishery	5, 16
Food industry	10
Food. Nutrition	5, 8, 9, 10, 16
Forests	2, 8, 11, 14, 15
Habitat. Rural areas. Urban areas	8, 11, 12, 17, 20, 22
Hydrology. Water	1, 6, 13, 19
Medicine. Diseases	1, 10, 13, 18, 22
Natural resources	2, 3, 4, 7, 8, 11, 13, 14, 21
Pharmacology. Toxicology	22
Plant production	7, 22
Pollution control. Environmental engineering	21
Population composition	6, 20
Production. Productivity	17
Resources conservation	4, 5, 7, 9, 11, 12, 13, 15
Social services	18
Society	13, 19, 20, 21
Textile industry	17
Working conditions	17

6.3. Thematic index

Keyword	BP. Number
Agricultural development	4
Agroforestry	2, 4, 15
Animal genetics	17
Animal production	8
Apiculture	14
Aquaculture	16
Archaeology	19
Biodiversity	4, 12
Birds	12
Botany	18
Child development	20
Clothing	17
Community development	11, 12, 20
Community health	1, 13, 18, 22
Community participation	13, 19, 20, 21
Composting	2
Consciousness raising	20
Crop yield	9
Cultivation practices	4, 15, 19
Cultural identity	12, 15, 18, 19, 20, 21
Curriculum development	20, 21
Desertification	4
Diseases	18
Domestic animals	17
Drainage	19
Dried food	10
Drinking water	1
Early childhood	20
Ecological research	21
Ecology	12

Keyword	BP. Number
Ecology	21
Ecosystems	21
Education	18, 20, 22
Educational innovations	20
Educational policy	20
Environmental management	21
Ethnic Groups	20
Fish	16
Fish culture	16
Fish production	16
Fishery conservation	5
Fishery engineering	5
Fishery equipment	5
Fishery management	5
Fishery research	16
Fishing	5
Food	8
Food security	5, 8, 9, 10, 16
Forest conservation	11, 15
Forest management	11, 15
Forest products	8, 14
Forestry planning	15
Fruit trees	7
Groundwater	13
Habitat	12
Health	1, 10, 18
Health centres	18
Honey	14
Housing construction	22
Hydrogeology	13
Hydrology	13
Hygiene	22

Keyword	BP. Number
Income generation	14, 15, 16, 17
Insecticides	22
Insects	22
Irrigation systems	6, 13, 19
Learning	20, 21
Malnutrition	10
Medicinal plants	22
Mixed farming	2
Natural resources	2, 3, 4, 7, 11, 14
Nutrition	8
Plant products	22
Pottery	1
Poultry	6
Poverty alleviation	13
Protected resources	15
Quality standards	17
Resources management	2, 3, 4, 7, 8, 11, 21
River basins (UF watersheds)	13
Rural women	6, 8, 17
Self reliance	18
Sheep	17
Silviculture	2
Soil conservation	9, 13
Soil fertility	3, 4
Soil improvement	3, 4
Swamps	19
Teaching	20, 21
Team work	17
Traditional medicine	18
Training	18, 22
Water	13
Water conservation	7, 9, 13

Keyword	BP. Number
Water management	13
Water resources	13
Water storage	1
Water supply	13
Wax	14
Weaving	17
Wool	17

6.4. Index of institutions

This alphabetical list mentions name and address–if available–of all the organizations involved in one or more practices. More information on the organization can also be found under 'administrative data' in the register of best practices. Additional information as well as addresses which are not available here can be gathered from the contact person or the primary organization mentioned at the end of the best practices.

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4211 N. Fairfax Drive
Arlington
VA 22203
USA

Amazon Conservation Team Suriname (ACT Suriname)
Gravenstraat 123 boven
Paramaribo
Suriname

Association Internationale des Six, S‰
B.P. 100 Ouahigouya
Province du Yatenga
Burkina Faso

Association pour la Promotion des Oeuvres Sociales
(APROS)
B.P. 70 Ouahigouya
Province du Yatenga
Burkina Faso

BAIF Development Research Foundation
BAIF Bhavan
Dr Manibhai
Desai Nagar
Warje
Pune 411 029
India

CARE International in Kenya
P.O. Box 88
Kisumu
Kenya

CARE Peru
Av General Santa Cruz 659
Lima 11
Peru

CECODI
01 B.P. 2759
Cotonou
Bénin

Centre for Biodiversity and Indigenous Knowledge (CBIK)
Floor 3, Building A,
Zhonghuandasha
Yanjiadi
Kunming 650034
China

Church World Service
B.P. 5338
Dakar-Fann
Senegal

College of Fisheries
P.B. 527
Mangalore 575-002
Karnataka
India

Committee Science and Technology for Vietnam
P.O. Box 43
6700 AA Wageningen
The Netherlands

Environmental Committee of the Municipality of Sanikiluaq
General Delivery
Sanikiluaq
Nunavut
Canada X0A 0W0

Faculty of Fisheries
Bangladesh Agricultural University
Mymensingh
Bangladesh

First Nations Partnership Programs
School of Child and Youth Care
University of Victoria
Box 1700 STN CSC
Victoria BC
Canada V8W 2Y2

Fish Culture and Fisheries Group
P.O. Box 338
6700 AH Wageningen
The Netherlands

Foodborne and Diarrhoeal Diseases Branch
Centers for Disease Control and Prevention
1600 Clifton Road NE, MS A-38
Atlanta, GA 30033
USA

Institute of Aquaculture
University of Stirling
FK9 4LA Scotland
UK

Instituto de Estudios Indigenas
Universidad Autonoma de Chiapas
Centro Universitario Campus III
San Cristobal de Las Casas
29200 Chiapas
Mexico

Ndi Mgbo Community of Oba
Idemili South Local Government Area
Anambra State
Nigeria

Social Forestry Development Project Song Da
1a Nguyen Cong Tru Street
Hanoi
Vietnam

University of Windsor Earth Sciences
401 Sunset Avenue, Windsor
Ontario
Canada N9B 3P4

Vredeseilanden
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3000 Louvain
Belgium

7. APPENDICES

7.1. Guidelines

For a proposal of a Best Practice related to the use of indigenous knowledge in development.

Introduction

In the summer of 1998, UNESCO's Management of Social Transformations (MOST) programme and Nuffic- launched the Best Practices using Indigenous Knowledge (IK) project. A first phase of data collection on Best Practices using IK has resulted in a compilation of 27 Best Practices; examples of how indigenous knowledge can be put to good use to develop cost-effective and sustainable strategies for poverty alleviation and income generation - in Africa, Asia, Europe and Latin America. The Best Practices have been presented as a 'portal' in the on-line database maintained by UNESCO/MOST (www.unesco.org/most/bpikreg.htm). The Best Practices are also searchable in the on-line database of Nuffic, - the IK-Pages (www.nuffic.nl/ik-pages). In addition, UNESCO/MOST and Nuffic- have produced a joint publication, both on-line (www.unesco.org/most/bpikpub.htm) and in print (no longer available).

UNESCO/MOST and Nuffic invite you to add your material to the existing compilation of Best Practices using IK, and submit a proposal for a particular practice to be described as a best practice, to be included in the joint publication of UNESCO/MOST and Nuffic (hard copy and on-line) and respective databases. The following pages will provide guidelines for such a proposal.

Why IK and why Best Practices?

The last two decades have witnessed growing interest in IK. Research has generated data that show the contributions of IK to sustainable development. The cases were so convincing that social and economic development is no longer seen as the exclusive domain of western science and technology. Unfortunately we are aware of only a fraction of the wealth of knowledge that societies and communities have generated on a wide variety of subjects. IK is very important in the lives of the poor. It is an integral part of the local ecosystem, and therefore the main asset they have to invest in their struggle

for survival–their struggle to produce food, to provide for shelter, and to achieve control of their own lives.

Many cases have already offered valuable insights into how people suffering from impoverishment and marginalisation use the knowledge that they have received from preceding generations in order to manage their natural resources in efficient and sustainable ways–ways adapted to their needs and manageable within the scope of their limited facilities.

However, we need more cases and practices from which development professionals and scientists can learn. We therefore would greatly appreciate it if you could assist us in capturing and documenting new IK Best Practices, and by doing so, to contribute to knowledge-sharing and the promotion of indigenous knowledge in the development and scientific enterprise.

What is a Best Practice?

A Best Practice is an approach or methodology that has proven effective for a particular purpose in a particular context but could also be effective in other contexts if properly adapted and applied. A Best Practice is thus held up as a model worth emulating in other parts of the world. A Best Practice related to IK might be found in a development project or programme, a method of training, or a specific activity or method that has successfully put the knowledge of local people and communities to good use for purposes of sustainable development. Often a Best Practice is the result of articulating indigenous knowledge with modern techniques; a mix that proves more valuable than either one on its own. The interaction between two different systems of knowledge can also create a mechanism of dialogue between local populations and development professionals, which will be meaningful for project designing reflecting people's real aspirations and actively involving communities. Good examples of such practices will help to persuade development professionals and scientists that indigenous knowledge is an invaluable resource that must be taken seriously. This is the reason for documenting as many such practices as possible and making them accessible for a wide spectrum of audiences.

Using the checklist

Experience with collecting data on IK shows that these practices cannot be easily converted to fit into western concepts of data collection. Moreover, a

rigid checklist of issues and questions makes it difficult to obtain information on practices which are so specific, flexible and dynamic in nature. Although we are aware of the methodological constraints, we still would like to use a checklist as an instrument for collecting data on Best Practices. The checklist will allow us to streamline and compare the Best Practices, and to present them in a publication and database in a systematic way.

We therefore ask you to describe your practice according to the checklist. Please note that the checklist is designed for describing different kinds of practices, such as a development project or programme, a method of training, or a specific activity or method. For this reason, some questions may be irrelevant or less applicable to your own practice. Please feel free to skip them.
The description would be preferred in English to another language.

Procedure

When we receive your completed form and the required information, we will review the case. If it meets the criteria for best practices, we will send it to an external referee. These referees will be recruited from the international IK network. You will be informed as soon as possible of the final decision as to whether or not the case you submitted will be included in the joint publication of UNESCO/MOST and Nuffic, and in the respective databases.

CHECKLIST

Introducing the practice

1. What is the name of the practice? (If the title does not explain what the project, programme, method or approach is about, please add a subtitle that does.)

2. To which theme or sector is the practice related?

3. Where is it practised? Please name the country and the specific location within the country if appropriate, and give a brief description on ethnic/socio-cultural features of the community.

4. When does or did the practice take place? (Please give the month and year.) Is it a seasonal practice?

5. Please give a brief description of the practice in about 100 words.

6. Is the practice still in use?
If so,
Why is it still in practice (efficient, cost-effective, manageable and other reasons from the social view point)?
If not,
What is the reason?
Does it still have potential value?
Would it be worthwhile to revive the practice?

7. Did the practice originate within the community?
If so, please explain.
If not, can you indicate its origin?

Content and approach

8. What is the purpose of the practice? What is it meant to achieve?

9. Who is involved in the practice?
Who is responsible for the practice?
Who is meant to benefit from it?
Who else is involved in the practice?
(Please add specific features, such as the number of people involved and their gender and age group.)

10. In what way is the practice carried out? (Please describe the process or strategy used or the approach taken.)

IK aspects

11. How can you best describe the value that indigenous knowledge adds to the practice?

12. How does the practice relate to the socio-cultural values and meanings and the spirituality of the community?

13. Is the knowledge behind the practice known to all members of the community or only to specialists? Are these specialists paid?

14. How is the knowledge behind the practice transmitted within communities (between members, between generations)?

15. Is such knowledge recorded and documented?
If yes, how? (For example in written documents, paintings, drawings, radio broadcasting, audio tapes, drama, video tapes, slides, or databases).

Achievements and results

16. Why do you consider your case to be a Best Practice? (Please describe its success in quantitative and qualitative terms.)

17. Real improvement or development is achieved if the results of the activity are sustainable, cost-effective and locally manageable. Can you describe how the practice scores on these three points? How local peoples get benefits from that approach?

18. Can you indicate the strengths of the practice: i.e. the actual and potential advantages it offers?

19. Can you indicate the weakness of the practice: i.e. any actual or potential negative effect or impact it has?

20. Can the practice be developed (improved)?
If so, how?
By blending it with other indigenous knowledge.
By blending it with modern science and technology (or scientific knowledge).
If not, why not?

Source of inspiration

21. Do you think the practice could be relevant and applicable in other contexts as well? Which of the following best describes its replicability?

a) It would be no problem at all to transfer the practice to another group, culture, land-use system, etc.

b) It would be rather easy to transfer the practice, although some adaptations might be necessary.
c) It would be possible to transfer the practice, but there certainly would be conditions and prerequisites to consider.
d) It would be rather difficult to transfer the practice. It would require a lot of adaptations and even then it would be difficult.
e) It would be impossible to transfer the practice. It is too specific and only possible at this particular place and level.

Please explain your choice. If you chose c), for example, which conditions would have to be met, or which obstacles overcome? The practice might be suitable only in tropical climates, for example. Or its success might depend on social relations of a certain kind.

22.Has the practice been replicated elsewhere?
Where?
By whom?
Please add any other information you think is relevant.

Additional remarks and information

23. Are there any remarks you would like to add, or any additional information or questions you think would be relevant?

24. If you have any additional documentation regarding the practice, please send it along with the guideline!

Administrative data

The organization responsible for the practice:
Name
Address
Tel. number
Fax number
E-mail address (if available)
Website (if available)

Contact person (a person who is directly involved in the practice and can answer any questions):
Name

E-mail address (if available)
Address, and telephone and fax numbers if different from those of the organization

Any other partners involved in the practice:
Names and addresses

Funding:
Total budget (in US dollars)
Period to which the budget applies
Sources of funding

Person who has described this Best Practice:
Name
Organization
Tel. number
E-mail (if available)

If you submit information about a potential Best Practice, you agree that it may be entered in the IK database of Nuffic and in the UNESCO/MOST Best Practices database, and that it may be published online and/or in print.

Please send the information to:
Nuffic
Best Practices Project
P.O. Box 29777
2502 LT The Hague
The Netherlands

For more information you can also contact us by telephone, fax or e-mail:
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Glossary

Agro-forestry	The use of trees on farms, to create a more integrated, diverse, productive, profitable, healthy and sustainable land-use system.
Agro-sylvo-pastoralism	A combination of cultivation, tree farming and livestock keeping.
Acadja	Periphyton-based practices have developed independently and are used to catch fish in open waters in various parts of the world. In West Africa the practice is known as *Acadja*, in Bangladesh it is called *Katha*, and in Cambodia *Samarah*.
Best Practices	Best Practices are initiatives which make or have made outstanding, sustainable, or innovative contributions to improving the the livelihoods of (local) communities.
Biodiversity	The variety of life, including genetics, species, ecosystems and the ecological processes of which they are a part.
Bio-piracy	Activities relating to the access or use of genetic resources that contravene national regimes based on the Convention on Biodiversity (CBD). Also refers to (unauthorised) patenting of genetic resources. [Source: International Chamber of Commerce].
Contour stone bunds	Stones placed against each other along the contour line to reduce the speed of runoff, allowing infiltration.
Curanderos	Healers, Bolivia.
Dahong	Category of rattan, China.
Daldal	A series of check-dams in the seasonal watercourses which are raised and lengthened every year. In this way, step-like terraces are

	created, Tunisia.
Emic/etic debate	The insider/outsider debate; the differing perceptions of reality of different ethnic groups.
Ethnopharmacy	Indigenous, traditional healing (often making use of native plants).
Habitat	An environment providing the food and shelter one needs.
Indigenous Knowledge (IK)	Indigenous or local knowledge refers to a complete body of knowledge, know-how and practices maintained and developed by (rural) peoples with extended histories of interaction with the natural environment. These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview.
Indigenous Knowledge Systems (IKS)	Indigenous knowledge systems refer to the complex set of knowledge and technologies existing and developed around specific conditions of populations and communities indigenous to a particular area.
Intellectual Property Rights (IPR)	Intellectual property rights is a generic term covering patents, copyrights and trademarks. Recent additions to the category of intellectual property include industrial design and integrated circuit topography.
Intercropping	The growing of two or more crops in proximity to each other to promote interaction between them.
Jessour	An ancient system of collecting run-off from long slopes, Tunisia.
Jujubier	Ziziphus lotus, Tunisia.
Lei	Category of rattan, China.
Local knowledge	Refers to the knowledge possessed by any group living off the land in a particular area, for several generations or centuries of time.

Mboum	'The sauce my grandmother used to prepare,' Senegal.
Nyom Pa	A system in Vietnam that guided decisions concerning the location and length of rotation of upland fields, planting and felling of bamboo and timber, and the placement of forest fruit gardens.
Non-formal knowledge	Knowledge developed outside formal education systems; not reflected in for example school diplomas or recorded in specific documents, often handed over orally from generation to generation.
Pastoralists	Livestock keepers.
Periphyton	Small organisms that live on the surfaces of objects under water.
Pharmacopoeia	Book describing drugs, chemicals, and medicinal preparations.
Sangpabawa	Protected rattan forest, China.
Shaman	Person believed to have special abilities and provides healing, therapy, advice, teaching or spiritual meaning.
Silviculture	The science, art and practice of caring for forests with respect to human objectives.
Tabias	Earthen dams, Tunisia.
Tacto visual approach	Subjectively assessing an object (fleece in this particular case) in terms of its volume, staple length, looseness of staples, textile aptitude, softness, colour and cleanness.
Tikung	Honey-board harvest system that is named after the carved hardwood plank, which is convex on one side, Indonesia.
Traditional ecological knowledge	Traditional ecological knowledge (TEK) describes those aspects of indigenous knowledge systems relating to the use, management and conservation of the environment and natural resources. TEK is a cumulative body of knowledge, practices, and beliefs, about the relationships of living

	beings (including humans) with one another and with their environment.
Traditional medicine	The term traditional medicine refers to ways of protecting and restoring health that existed before or beside (the arrival of) modern medicine. As the term implies, these approaches to health belong to the traditions of a particular ethnic group, and have been handed down from generation to generation. Traditional systems in general have had to meet the needs of the local communities for many centuries.
Vinchucas	Triatomine insects, Bolivia.
Waru Waru	An ancient cultivation, irrigation and drainage system, Peru.
Wavli	A tradition protecting the rights of women to have earnings, for example from vegetable cultivation, India.
Worldview	Conception of the world. The context of (individual) significance in a socio-cultural milieu
Zî-peele	Strongly degraded land, Burkina Faso.
Zaï	Planting pits; usually with a diameter of 20-30 cm and a depth of 10-15 cm

7.4. List of abbreviations used

ACT	Amazon Conservation Team
ADDA	Adigrat Diocese Development Action, Ethiopia
ADRK	Association for the Development of the Kaya Region, Burkina Faso
Africadiv	Africa Diversity Mailing list
AGADA	Agir Autrement pour le Développement en Afrique, Senegal
AIDS	Acquired Immune Deficiency Syndrome
APROS	Association pour la Promotion des Oeuvres Sociales, Burkina Faso

BAIF	Development Research Foundation, India
BP	Best Practice
BURCIK	Burkina Faso Resource Centre for Indigenous Knowledge
CAD	Canadian Dollar
CARE	Cooperative for Assistance and Relief Everywhere
CBDD	Centre Béninois de Développement Durable, Benin
CBIK	Centre for Bio-diversity and Indigenous Knowledge, China
CBUD	Centre for Bio-diversity Utilization and Development, Benin
CCCP	Cross-Cultural Community Participation
CECODI	Centre International d'Ecodéveloppement Intégré, Benin
CFA	West African Franc
CID	Centre for Industrial Development, Senegal
CNA	Conservation Needs Assessment
CRDA	Regional Centre for Agricultural Development, Tunisia
CTA	Technical Centre for Agricultural and Rural Cooperation, Senegal
CWS	Church World Service
DALY	Disability-Adjusted Life Years
DDT	DichloroDiphenylTrichloroethane
DSWR	Danau Sentarum Wildlife Reserve, Indonesia
EC	European Commission
ECCD	Early Childhood Care and Development
ECDVU	Early Childhood Development Virtual University; Sub-Saharan Africa
ECE	Early Childhood Education
ECHO	Educational Concerns for Hunger Organization
EVM	Ethno-veterinary mailing list
FNPP	First Nations Partnership Programs, Canada
GDG	Global Development Gateway
GIS	Geographical Information Systems
GTZ	Gesellschaft für Technische Zusammenarbeit, Germany
HIC	House Improvement Committees, Bolivia

HIF-net	WHO mailinglist on health information access in resource-poor settings
HIV	Human Immunodeficiency Virus
ICT	Information and Communications Technologies
IH-L	Indigenous Health (mailing)List
IK	Indigenous Knowledge
IK&DM	Indigenous Knowledge *and* Development Monitor
IKS	Indigenous Knowledge Systems
IKWW	Indigenous Knowledge WorldWide
ILEIA	Centre for Information on Low External Input Sustainable Agriculture
Indknow	Indigenous Knowledge Systems (mailing)List
INEF	International Network on Ethnoforestry
INERA	Institut National d'Etudes et de Recherches Agricoles, Burkina Faso
IPR	Intellectual Property Rights
IRA	Institut des Régions Arides, Tunisia
IRC	International Water and Sanitation Centre, The Netherlands
IIRR	International Institute of Rural Reconstruction, Philippines
ISCO	International Soil Conservation Organizations
ISWC	Indigenous Soil and Water Conservation programme
MD	Medical Doctor
MOST	Management of Social Transformations
MZ	Medical Mission, Suriname
NABARD	National Bank for Agriculture and Rural Development, India
NGO	Non-Governmental Organization
ODA	Overseas Development Administration, UK
OECD	Organization for Economic Co-operation and Development (UN)
PBCM	Proyecto Britanico Cardenal Maurer, Bolivia
Phytomed-L	Mailing-list on Phytomedica
PPEA	Projet de Promotion de l'Elevage dans l'Atakora, West Africa
PP-FRANC	Projet de Promotion de la Filière des Ressources

	Alimentaires Non Conventionnelles
RRA	Rapid Rural Appraisal
SFDP	Social Forestry Development Project, Vietnam
SNV	Stichting Nederlandse Vrijwilligers, The Netherlands
STD	Sexually Transmitted Diseases
TEKMS	Traditional Ecological Knowledge and Management Systems Study, Canada
TSP	Triple Super Phosphate
UCLA	University of California, USA
UN	United Nations
UNACH	Universidad Autonoma de Chiapas, Mexico
UNESCO	United Nations Educational, Scientific and Cultural Organization
UK	United Kingdom
USA	United States of America
USAID	United States Agency for International Development
USD	United States Dollar
VeCo	Vredeseilanden Cooperatie, Belgium