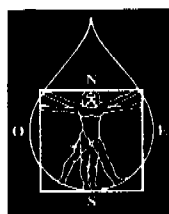


# Indigenous Water Management Systems from Local Practices to Policy Reform

---



Prepared by :

***Gabriel Régallet***

International Secretariat for Water

in collaboration with :

***Corinne Wacker***

University of Zurich

Institute of Ethnology, Research Department

and

***Urs Fröblich***

Ingenieur HTL STV, Wasserbau

October 1997



# TABLE OF CONTENTS

---

INTRODUCTION	5
SYSTEMS ROOTED IN LOCAL SOCIETY AND ENVIRONMENT	6
SYSTEMS FACING MAJOR THREATS AND SOCIAL CHANGE	8
CRITERIA OF SUSTAINABILITY	10
a) Flexibility	10
b) Multi-functionality and adaptation	10
c) Labour availability	11
d) Resilience and reliability	11
MANAGEMENT	12
THE ROLE OF THE STATE	14
a) An enabling legal and regulatory framework	14
b) The need for decentralized water management systems	15
c) Technical and financial assistance	15
WHAT NEEDS TO BE DONE?	16
Indigenous systems and Public Policies	16
Investment needs	17
Technology focus	17
Regulation	17
Strengthening of local IWM institutions	18
Monitoring	19
CONCLUSION	21
CASE STUDIES	23

---

# INTRODUCTION

---

The Water Supply and Sanitation Collaborative Council has endorsed the creation of a Working Group on Community Management and Partnerships with Civil Society. One objective of this group is to foster best practices of community management approaches and to influence governmental and external support agencies to adopt them.

The Working Group has come with a strong message that people living in arid and semi-arid regions still depend on the indigenous water management systems for their water needs.

Since equal partnership with the community is critical to any development process, indigenous water management systems based on local knowledge, social rules, and indigenous institutions provide an excellent vehicle to achieve this goal. These systems have evolved over time, stood the test of time both in terms of technology adaptation and community arrangements for effective operation and maintenance. The purpose of this document is to introduce indigenous water management systems to the development practitioners in water supply, sanitation and irrigation fields and to *illustrate their importance in finding creative solutions to sustainable community water management.*

Many people contributed to this document; first, women and men who participated in the regional workshops of Africa, Asia, Latin America during the course of the Working Group brought their ideas and experiences from the field. Ms. Corinne Wacker and Mr. Urs Fröhlich who contributed the case study on Ladakh with assistance from the Swiss Agency for Development and Cooperation, Mr. Jim Enote, Project leader of the Zuni Conservation Project, USA, Dr Leila Tazi, Amrash, Morocco and the National Irrigation Program of Bolivia (PRONAR) provided necessary inspiration and expertise for the final product.

---

# SYSTEMS ROOTED AND ENVIRON

---

Indigenous water management systems are not only utilized by indigenous peoples, but also by a larger number of people in the world who maintain a traditional way of livelihood that depends on those systems.

In reality the line between indigenous and modern water system in the field is not very clear. Most of the indigenous systems are strongly rooted in the communities that developed and modified them, whenever it was necessary. But other indigenous practices find their origin in water management measures introduced more recently, which evolved according to the local perceptions and needs of farmers and local users.

Indigenous water management systems include (i) community-based institutions consisting of the group of people that uses water and related resources and (ii) bodies of local knowledge generated and transformed through a systematic process of classification, of empirical observation and trial and error method about water and local environment and (iii) systems of self-management that govern resource use. They are accessible, in the first place, to those members of a social group charged with specific water and related resource management and production responsibilities. The distinctive character of «indigenous» refers to a cumulative body of

---

# IN LOCAL SOCIETY MENT

---

knowledge, beliefs, conventions of behaviour and practice related to water management which is generated by these communities and handed down through generations by cultural transmission, in an effort to cope with agroecological and socio-economic conditions. A key characteristic of these societies is their concern to maintain a system of social relations marked by obligations and mutuality. Water resources involved in such systems may be individual or communal property of those which, although not legally owned by the community, are managed in accordance with community-based norms and rules.

The concept of management is defined to cover people's (as against government's) interventions for: (i) livelihood security, (ii) water protection and conservation, (iii) regulation of uses and conflict resolution, and (iv) operation and upkeep of water resources.

This management deals with the various traditional uses for water (drinking and domestic; agriculture; forest; garden; livestock; fishing;) as well as the various practices of detection, extraction, harvesting, transportation, consumption, operation, maintenance and disposal.

---

# SYSTEMS FACING AND SOCIAL

---

*Indigenous water management systems have been facing various threats overtime. The dynamic process of change is linked to various factors, which individually or collectively contribute to the decline or depletion of such systems. Among the main factors, the following should be mentioned.*

---

# MAJOR THREATS CHANGE

---

1. Increased participation in market economies, which encourages the overexploitation of natural resources for export .

---
2. Breakdown of traditional value systems, which often directly or indirectly encouraged resource conservation.

---
3. Population growth, which often produces pressure on natural resource and reduces stocks to meet subsistence needs.

---
4. Technological change, which often allows easier overexploitation of natural resources.

---
5. Erosion of local leadership and indigenous organizations, and

---
6. Application of inappropriate pricing, subsidies, legislation, or other governmental incentives.

---

These factors influence the informal or formal norms and arrangements governing people's approach to indigenous water management systems

---

# CRITERIA OF

---

Water users have specific criteria with regard to investment, improvement, operation and maintenance of indigenous systems. These criteria go beyond the standard qualities such as simple to construct, easily available materials, immediate benefits and cost effectiveness. They clearly distinguish indigenous from many modern, introduced systems.

## **A** FLEXIBILITY

This criteria cover three aspects:

- Time: Indigenous systems measures are constructed step-by-step to provide farmers and users with a chance to experiment and add modifications wherever necessary. For instance, stone bunds in Mali and Burkina can be semi-permanent, remaining 5-10 years on one position before being shifted.
- Space: the location of water points or irrigation channels can be changed. The different configurations found in the field are based on specific field conditions (variations in slope, soil, exposure, water availability), on ploughing arrangements and/or specific functions that need to be fulfilled.
- Dimension: width, length, height of the systems can all be manipulated by users according to specific site conditions and needs.

This flexibility and step-by-step approach enable users to experiment with and subsequently to improve their practices. Their knowledge is very dynamic, rooted in the history of their fields and the environmental setting.

## **B** MULTI-FUNCTIONALITY AND ADAPTATION

Any specific Indigenous system rarely has one simple function. Case studies brought forward at the regional workshops demonstrate the interconnection of functions associating resource conservation, fertility, erosion reduc-

---



# SUSTAINABILITY

---

tion, livelihood security, water quality. Much can be learned from the way users of indigenous systems in dry regions have attuned their farming practices to variations in ecological and economic conditions. For instance, pastoralists in drylands adopt restrictions on water use becoming stricter when water availability is scarce. They lay down a temporary restriction on the use of dams or to certain livestock species in order to limit water to small stock and family members. The cattle and camels are moved to distant water sources. Both rules are preventing measures to extend the time of sufficient water availability.

## C LABOUR AVAILABILITY

Such availability varies from community to community, from season to season. Labour is often in short supply during critical production periods. Therefore the flexibility of construction and operation is of utmost importance in relation to this variable availability of labour. A step-by-step construction offers important advantage to the water user to optimize the use of labour and at the same time it reduces risks of failure. At every moment, the water user is able to assess the functioning of the measures applied and the design can be improved upon whenever needed. Labour availability has also a strong bearing on the upkeep and sustainability of Indigenous systems. Their proper maintenance requires a minimum level of available labour. It is likely that a certain population density is thus required for the sustainability of Indigenous systems and that a decrease in population density may be detrimental, initiating a spiral of degradation.

## D RESILIENCE AND RELIABILITY

Not all Indigenous systems have proven to be resilient and reliable when faced with ecological, social, technical and economic changes. Understanding how water had been used in the past is important to understanding how water should be used in the future.

---

# MANAGEMENT

---

Indigenous systems comprehend five related dimensions, all of which interact towards their sustainability.

□ AN ACTIVE PARTICIPATION OF ALL USERS in decision and O&M processes. Indigenous systems are distinct from modern, introduced measures by:

- social differentiation as to access to labour, land, water, production inputs, ownership and cash incomes;
- community mechanisms to get consensus on major decisions impacting on the village;
- a social system based on rituals, values, community work, mutual help and strong kinship and traditional authorities.

In most systems, traditional authorities coexist with other authorities and facilitate cooperation among users.

Women have considerable social, technical and ecological know-how and experience.

In some systems, they participate to indigenous systems along a gender balanced division of tasks; in some others, they are excluded from decision-making.

□ THE RELIANCE ON STRONG INDIGENOUS INSTITUTIONS

They include systems of rules and rights governing the ownership and use of waters, which can be individual, family related or communal. Security of land and water is essential for any community. Customary arrangements deal also with conflict resolution mechanisms, relations between the community and "foreigners" and among the various groups of users. Strong institutions have been able to build on traditional systems adapting modern ways of organization.

---

- ❑ INDIGENOUS WATER MANAGEMENT TECHNOLOGIES are built, operated and maintained with local materials that the users can afford and knowledge which they can apply. Usually, they are conceived to minimize ecological and social risks with a view to cope with natural disasters (drought, famine....) and conflicts. Rain water harvesting systems for instance are often implemented and operated in conjunction with wells or other indigenous systems using surface and groundwater. In Indigenous system, technologies and practices are most often ruled by community institutions and norms.
  - ❑ INDIGENOUS KNOWLEDGE is a key ingredient of the management. It is based on empirical observation, classification of facts and observations, experimentation about water and other resources which are generated, transformed and transmitted in the field and through oral tradition. Indigenous knowledge of water is shared along gender complementarity of tasks, social differentiation and water uses. Indigenous water managers see themselves as stewards (vs owners) and caretakers in sustaining and enlivening water, considered as a living being.
  - ❑ INDIGENOUS WOMEN'S KNOWLEDGE of water management is distinct and complementary of the men's one. Particularly at the household level, "domestic" water may be used by women for a variety of income-generating activities : keeping of small livestock, brewing beer for sale, brick moulding, vegetable growing. However, the productive uses of domestic water are less easily quantified and therefore are in danger to be neglected when new water schemes or arbitration between water users are at stake.
  - ❑ THE ECONOMICS OF INDIGENOUS WATER SYSTEMS rely on community work, on cash and in kind contribution and conservation of water resources. Indigenous systems do not maximize the use of water and other resources but take into account a more comprehensive set of costs and benefits such as alternative demands on time and equipment, labour inputs, yield increase, lesser incidence of run-off or drought, dependable water supply from dug wells even during the drought years, ongoing access to good drinking water; most are "invisible" gains difficult to assess in modern economic terms.
-

# THE ROLE

---

The government and its agencies have an important role in the sustainable management of indigenous water system. Such a role will entail:

## **A** AN ENABLING LEGAL AND REGULATORY FRAMEWORK

---

The priority reform in regions where customary (communal or not) tenure systems are still in existence is for the state to recognize, and secure through legislation, customary land and water rights and tenure relationships. The participation of women, mobile pastoral groups and minority groups in the decision-making process will assure that further degradation can be halted and better sustainable management implemented.

Governments should also legitimize in legislation the role of local/traditional authorities by guaranteeing them freedom and autonomy in the management of water resources.

Legislative support may also be needed covering the distribution of financial benefits from the use of communal resources. A reasonably fair distribution of wealth, in the form of a share of communal-property resources, is a fundamental principle governing traditional tenure systems. Devising mechanisms to insure responsibility and accountability in allocation of funds and benefits promotes continued equitable resource management, discourages exploitation, and encourages people to work together with their kin in applying their collective knowledge and insights.

---

# OF STATE

---

## **B** THE NEED FOR DECENTRALIZED WATER MANAGEMENT SYSTEMS

---

*International instruments such as the Convention on Desertification and Drought, the Convention on Biological Diversity, the National Environmental Action Plan promoted by the World Bank, National Agenda 21 Programs promote the devolution of responsibility to local communities for the management and protection of their own natural resources as part of a national development plan based on different agro-ecological areas of the country.*

## **C** TECHNICAL AND FINANCIAL ASSISTANCE

---

- Adequate training for field staff of public agencies on indigenous water management must be an integral part of any revitalization.
  - Training of water users can be a precondition for sustained efforts to improve water management. One of the essential contribution of field-workers and other government specialists is the acquisition of new skills by water users, as it makes them more independent of external support.
  - Another important feature is that government agencies can arrange direct exchange of in-village and on-farm experience between water users which is more efficient in getting the message than any presentation by outsiders, such as extension agents, water and conservation specialists.
-

# WHAT NEEDS

---

*From the previous sections, it is apparent that community-level organizations may require support in a number of areas. Key areas where this support may be shown are: public policies, technology, investments, regulation and effective involvement of users.*

## INDIGENOUS SYSTEMS AND PUBLIC POLICIES

---

One of the primary reasons for the decline of indigenous water systems (IWM) is the indifference of public policies and donors towards these resources. To alter this situation, the policy environment needs to be changed. This could happen in three directions:

(i) Positive IWM policies. Policies and programmes are needed to restrict further curtailment of IWM and common-property water tenure, for regulating the use-intensity of water resources, for penalizing violations and for empowering water users to manage these resources.

(ii) Side effects of development interventions. Various welfare and development interventions should be assessed for their potential impacts on IWM.

(iii) General and specific development policies. Many ongoing policies and programmes relating to environmental protection or poverty eradication contain elements which could be more effectively implemented if measures to protect/revitalize IWM would be included as a project component.

While suggesting the above policy approaches, one should be aware of the circumstances which may obstruct the initiation and implementation of such policies, such as populist programs of land distribution or indifference of public policy makers.

---

# TO BE DONE?

---

## INVESTMENT NEEDS

---

The key obstacles to higher investments in IWM rehabilitation include: (i) absence of a fiscal tradition to patronize such community resources; (ii) a long gestation period and complex transaction costs associated with resource allocation to IWM; (iii) "invisibility" of gains. The solution to these problems may lie in a deliberate decision on resource transfers to IWM and in the organization of effective user groups. Donor agencies can play an important investment role in incorporating a IWM perspective in their approach to sustainable development.

## TECHNOLOGY FOCUS

---

To break the vicious circle of impoverishment, improved IWM technologies which can enhance resource regeneration, increase the recycling of biomass, improve water quantity and quality are an important requirement. The technology focus should (i) base improved IWM technology performance upon water user's needs, (ii) design improved technologies with the whole range of local considerations, not only economic and commercial ones.

## REGULATION

---

In a way, rehabilitation of IWM systems is less of an investment and technological problem than a resource management problem. In most arid and semi-arid areas, even natural regeneration can make IWM more productive, provided it is permitted through the locally controlled and regulated use of water. However, this cannot happen unless IWM are reconverted from open access to common-property or private regimes. In practical terms, this would mean re-establishing and enforcing usage regulations and user-obligation. This could be facilitated by some provisions which would not only give legal sanction to adequate (customary) usage practices, but would also empower local communities to implement such provisions.

---

## STRENGTHENING OF LOCAL IWM INSTITUTIONS

---

A variety of activities can be undertaken to strengthen such institutions; they must be based on local knowledge and adopt a long term perspective mastered by local users.

- a) Working with recognized local institutions and decision-making authorities (customary; elected; officials) in interventions (inventory, research, development). IW managers are key people to be involved in any rehabilitation.
- b) Cooperative management arrangements in which local communities and water users share management authority with other governmental units and stakeholders represents an incremental step toward the respect of customary land and water tenure and a greater local autonomy.
- c) Training of extension staff in IWM is of utmost importance.

Training of IWM users (often without formal schooling) may be best achieved through verbal/practical activities involving them in constructing demonstration systems, operation, maintenance activities. This can provide future trainers of local artisans and water users with valuable hands-on experience. It may also be possible to stimulate local contractors to enhance their skills in construction of water harvesting and other upgraded indigenous water systems.

Women are often left out from training; they can be trained in skills for which they have a need, such as tank construction, laying out and construction of runoff farming systems.

---



d) Complementing IWM with tested modern methods is another desirable strategy. Some examples include:

- the use of simplified water quality tests based on the neem tree (India) or other plants;
- the combined use of modern and traditional water systems such as wells, surface catchment, rooftop harvesting, runoff farming to cope with uncertain rainfalls and water availability for local communities.
- the use of neem tree, seeds of nirmali and other plants to purify water.
- water disinfection from solar radiation

#### MONITORING

---

Technical assistance brought to community institutions for the revitalization of IWM systems must also integrate monitoring activities. The main purpose will be to assure that all interveners can learn from the experience and to disseminate the lessons learned to the widest audience possible.

Capitalization of experience for practioners may be facilitated by researchers working closely with extension and support agencies.

# CONCLUSION

---

Indigenous water management systems play an important role in assuring the water needs and livelihoods of the rural population, particularly the poor. The breakdown of these systems thus not only causes environmental harm as these resources are severely degraded under open access regimes, but also social harm as the poor can no longer depend on them. For many villages in dry lands, this has increasingly turned out to be a common tragedy of environmental collapse and pauperization of the already poor. However, there is also a growing recognition that the small, flexible, and decentralized forms of resource management that characterize the well functioning water management systems provide the model of an important development tool.

However adapting traditional indigenous institutions to today's development demands is not a simple question of adapting existing local institutions to a different context. In many areas the social relationships and normative structures that have managed these systems have frayed or snapped; in other, new demands place unfamiliar stresses that they cannot assimilate. If locally managed water systems are to be part of the development process, research and action are needed to discover how adequate forms of social organization can be fortified or revived. There is a need to support extensive pilot activities in the various regions of dryland and semi-arid regions.

Strategies of protecting and revitalizing IWM systems must extend well beyond user groups and grassroots organizations. Identifying and correcting the policies and processes that have brought about their decline is a high priority. These have included development interventions that hand out larger shares of these resources to the rich on the one hand, and populist political programs that are economically inefficient, on the other. Mostly, they have included policies that have eroded and transferred away the strength of social organization patterns suited to Indigenous Water Management regimes over natural resources. Therefore, the role of intermediary organizations (such as NGOs) is crucial not only to help at the local level but also to build alliances and networking advocating for change and creating mutual support to strengthen such approaches.



# **CASE STUDIES**

---

**TRADITIONAL WATER MANAGEMENT SYSTEM  
IN LADAKH - INDIA**

---

**ZUNI SOCIO-ECONOMIC AND CULTURAL  
TRANSFORMATION AFFECTING WATER USE**

---

**COMMUNITY MANAGEMENT  
OF WATER SUPPLY PROJECTS  
IN FOUR VILLAGES  
IN IMILIT VALLEY, MOROCCO**

---

**INDIGENOUS WATER MANAGEMENT SYSTEMS IN  
BOLIVIA AND THE ENABLING ROLE OF THE STATE**

---

# TRADITIONAL WATER IN

*In the North West edge of India, bordering China and Pakistan, a traditional water management system provides a prosper livelihood to a Buddhist minority in India, living in 123 oasis villages in a high altitude cold desert. The traditional water management system of Ladakh is a highly elaborated, complex institutional and social arrangement, based on experience and careful adaptation to the ecosystem, which is managed essentially at village level. With a rainfall of less than 200 mm per year and winter temperatures below 30 degree minus zero, water is the main limiting factor of the ecosystem. The melting water from the winter snow fallen on the Himalayan mountains is carefully collected in summer in irrigation canals to grow in a short period of 4-6 month barley, wheat, apricots, walnuts and vegetables for the subsistence of 120'000 people. The extended families share the agricultural work divided in planting activities at 3-4000 meters altitude and animal husbandry related work in the high altitude pastures above 5000 meters. The Ladakhi have maintained their traditional economy and developed an additional tourism industry in the summer months. They seek to combine their tradition and modern elements to maintain a sustainable, prosper living in their high altitude mountain desert. Compared to modern water management systems, the technology is based on local know how and the institutional arrangements are interesting solutions, which can be inspiring for many cultures and experts beyond the local context.*

## **1. The water yield is the result from a good attitude towards the ecosystem**

From the source to the end of the village the water system is functional as well as aesthetic. Hydraulic prayer mills, holy trees and wild rose bordering the streams express an attitude towards water rooted in the pre-Buddhist philosophy. Consolidated and enforced by the Buddhist religion in agricultural, family and daily ceremonies, people believe that the springs reduce or stop producing if water is polluted. Thus people neither urinate, nor wash themselves in the open streams. Fish, considered as manifestations of the spiritual force which provides water dwell in the streams and water is offered daily by each household and by the monks in every monastery as most precious offering to the deities. In situations of water scarcity additional ceremonies are done, which enforce rules of personal hygiene and minimise possible risks related to environmental health.



# MANAGEMENT SYSTEM

## LADAKH-INDIA

---

### **2. Water rights are managed at village level and enforced by the higher administrative authorities**

Situated in long distances to each other, the villages manage their water rights with little interference from the higher political and administrative authorities. At the beginning of the new year, the villagers distribute the water rights and duties with a balloting system. Every day two families have the right to all the water from the stream, which is stored in reservoirs over night. The users also do the small maintenance works along the canals to ensure maximum use of the precious water. In case of water theft, the culprit has to pay beer for village festivities. The village headman, elected on a yearly base on his post mediates with the advise of his members, a committee of five elders, to solve issues of water theft, which actually hardly ever happen. In case he would fail, he could ask the record keeper of the central government to confirm the water rights in the Bandabas book, written 1908, which is still used to define the taxes each villager has to pay. And he could call the police to enforce the right. However, he never does it. The transparency of the village management system, its democratic, rotating principle maintains the collective knowledge about the water rights which controls effectively the distribution of water among the villagers.

### **3. Irrigation is a women's duty but not management of drinking water.**

Within the families, men, women and children collect drinking water; the rules of keeping the stream clean and a hygienic water use at home are thus known by all and controlled by all. Furthermore a designated youth group of men is in charge of maintaining the environmental cleanness of the stream in case someone misbehaves. Irrigating the fields is however a women's affair. The families send a respected elder woman to the village balloting, where the watering teams are defined for the year. Women water the fields and maintain the secondary canals. They call on their mutual assistance groups for agriculture, called

---

Bez, to assist each other in watering tasks. For the maintenance of the village water reservoirs, two families, designated by tradition on rotating base, brew beer and call the villagers once a year for communal work. The beer, we are told, is provided to assure that the old people who know about water also participate in the task. The maintenance work is done by all men and women from the village before the planting season starts.

#### **4. Water management is integrated in the economy of the villagers**

Subsistence farming generates a great variety of products, some of which are sold at good price by the men in far off towns. Situated on different altitudes and based on a mixed animal husbandry, farming and gardening system with a cycle of interrelated activities, agriculture is based on irrigation and irrigation includes also the provision of drinking water to the households. The operation and maintenance of the water system is thus intrinsically related to the economic activities of the households. Its collective character is enforced through multiple festivities and ceremonies along the agricultural year. Dry latrines exist in every house and provide the manure - a precious element in farming - for the fields in spring. In correspondence to watering, which is women's work, ploughing and bringing manure to the fields is essentially men's work. Together water and manure, women and men create the necessary fertility of the soil to allow the crops to grow.

#### **5. Stones, sand, roots and know how are the technology for hydraulic energy and irrigation**

The carefully traced irrigation canals, overflow systems, terraces and flood control walls have been constructed with local materials by the villagers hundreds of years ago. They are repaired by simply piling fallen stones again at the right place and the canals are fortified by planting willow trees along the water. Their red fine curtains of roots hold the stones and the soil together and enforce the constructions. All trees are private property, used in house construction, for basketry or sold as timber at interesting prices outside the village. Thus to stabilise the water canals with willow trees generates a direct economic benefit. With the same materials the villagers also build water mills to grind wheat and barley. Situated along the main water stream, these privately owned mills are rented out to those, who don't have any. Thus the streams also provide energy and enhance the economic value of water. In case repair work has to be done, the villagers know how to do it and find the necessary material for it on the spot.

## 6. Adaptation to modernity and change

Traditionally water is limited and it was not allowed to build new irrigated terraces to prevent water scarcity. Marriage and inheritance rules maintained joint land properties and water rights. Polyandry contributed to maintain a stable population in Ladakh. In villages exposed to modern developments, these rules have changed. Families divide their land and water rights among their children. To enhance the productivity, the farmers buy chemical fertiliser at subsidised prices. Many men are involved in wage labour and the work load of the women has increased on the farm. The money economy facilitates the emigration from the villages in the peri-urban zones of the modern capital. Modernity allowed here the formerly poorer population segments to become wealthy. Thus they achieved to claim successfully more water and additional land for cultivation from the village authorities. Their wives use modern washing soaps and fertiliser to produce vegetables sold at the main market for income generating. The families employ foreign labourers for repair and construction work, who don't follow the rules related to the pre-Buddhist belief in water purity. Thus they pollute the water streams. How did the traditional water management system adapt to these changes? The village split into a modern and a traditional section. The modernists built their own piped drinking water supply and irrigate new fields from additional ground water. They formed their own water committee and employ a water caretaker paid with a substantial annual salary to operate the irrigation system. It was the women who observed that fish die in the canals used for washing cloth and that chemical fertiliser only increases the yields for a few years. Many returned to the traditional manure from their home latrines and the women prohibit each other today to wash in open streams except in one place at the end of the oasis. Thus in this village, modernity brought new challenges to the villagers who had to learn to cope with. The increased prosperity has enforced rather than undermined the social control over the ecosystem. Compared to it, the water canals in the fast growing capital are dirty. Water born diseases are spreading and the increased prevalence of flush toilets in the town creates technical problems, for which solutions are lacking in this context of a cold desert, where traditionally all elements of nature are recycled and reintegrated in the ecosystem.

### **Prepared by :**

*Corinne Wacker and Urs Froeblich with financial support from the Swiss Agency for Development and Co-operation. The full report of the investigation (30 pages) is available on order from C. Wacker and U. Froeblich, Institute of Ethnology, Zurich University, Mublegasse 21, 8001 Zurich, Switzerland.*

# ZUNI SOCI-ECONOMIC TRANSFORMATION AFFECTING

---

The Zuni tribe is located in the South West of USA in an arid environment. Understanding how water had been used in the past is important to understanding how water should be used in the future. The history of Zuni water use is very interesting because Zuni has experienced much social change as a result of changes to the use of water. Yet water is important in all aspects of Zuni life : social, economic, spiritual and political.

In the early 1900's the United States government introduced changes to the way Zunis utilized water. While rainfed irrigated and dryland fields comprised thousands of acres of farmland, the U.S. decided that several large reservoirs were needed to store water for a new system of irrigated farming on Zuni land. On completion of the construction of several large reservoirs most of the reservoirs failed and caused catastrophic damage to agricultural lands. To compound the damages, after the reservoirs were finally completed, five acres of irrigable farmland were assigned to each Zuni male head of household, but considering the matriarchal society of the Zunis this imposition created much confusion and bad feelings.



# AND CULTURAL WATER USE

---

During the second world war, many Zuni men served throughout the world and returned home with new experiences which began a gradual reducing reliance on Zuni agriculture. Most important of these was the economic change to «value as labor». Concurrently, by the 1950's Zuni handicrafts became highly desirable and many collectors of native arts and crafts began to purchase Zuni silver and turquoise jewelry. Consequently, with the new economy most Zunis no longer relied on subsistence agriculture as a principal source of food. With the wage and cash economy replacing the traditional subsistence economy, Zunis began to purchase food at nearby markets.

In the past 40 years domestic water needs have increased beyond the capability of the equipment used to acquire the ground water Zuni relies on for all its domestic needs.

Fortunately, there is an awareness that economies are always changing and to totally rely on market availability of all foods is risky because of occasional scarcity and price changes.

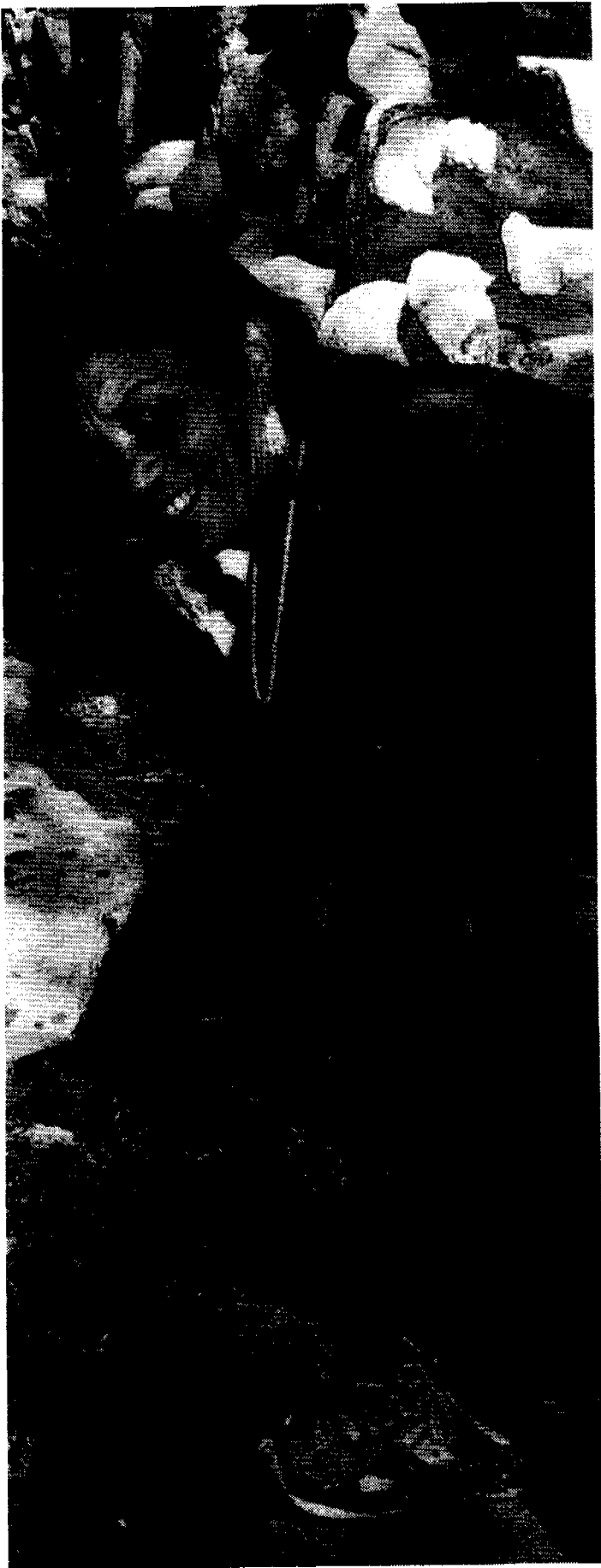
Also, many Zunis adhere to traditional values which involve traditional agricultural attitudes, practices and ceremony.



## PRODUCTION ASPECTS

For the most part, Zuni farmers traditionally moved to small shelters near their fields or to satellite villages in farming districts during the farming season. Today it is important to Zuni farmers that there is enough water and help from family to continue farming these areas. However, teaching younger people the skills for farming is also important for continuing the tradition of family agricultural production. Likewise with livestock producers. Sheep growers and cattle growers rely on water and assistance to maintain their operations as well.

A farmer's market has been proposed for the Zuni community to offer an avenue for Zuni farmers to sell produce locally. While the idea is a plausible one, water is still considered a limiting factor for productivity by most farmers. It has been considered that food vouchers provided for low income families and for child care could be used in the farmer's market. Since Zunis primarily give away much of their produce to immediate families it is a new approach to sell produce for profit. As demand for certain crop varieties grows within the Zuni community, especially for traditionally folk varieties, it is believed that more production will be required to meet the demands. Consequently, water will need to be managed carefully.



The challenge is to develop and apply water-saving technology and management that enables water users to adopt new approaches and revitalize traditional technologies for both rain-fed and irrigated agriculture is enormous. Fisheries are an important source of recreation which will be managed in an environmentally sound manner. Through the new technical capability of the Zuni tribe and with appropriate assistance, Zuni government is implementing the following activities :

1. Integrate measures for the protection and conservation of potential water sources.
2. Develop databases, economic forecasting and planning models, and methods for water management.
3. Solicit public participation in decision making.
4. Promote schemes for wise water use through public awareness education programs.
5. Promote water conservation.
6. Develop flood and drought management procedures, risk analysis and assessment of environmental and social impacts.
7. Develop a water-use Code.
8. Develop measures to assure sustained water quality.

*From: Jim Enote: Water Management Systems of the Zuni, New Mexico, USA*

---

# COMMUNITY WATER SUPPLY VILLAGES IN IMILIT

---

## SUMMARY

The paper presents a case where 4 communities have developed and managed their water resources without any external assistance. These are cases of a fully decentralized water supply systems. The water supply systems use improved traditional technology: water harvesting and gravity canal system, shallow well and motorized borehole pumping systems. The role of traditional village councils (jmaat) in control and distribution of water is well elaborated. All the project funding is raised by the community: who contribute proportionally according to social status. Financial assistance also comes from kinsmen working in the cities or abroad. Technical expertise, when required, is hired from outside. The village water management is strengthened by strong solidarity among the kinsmen. Revenue for O&M is raised from sale of water. However, health and sanitation and gender equity are not well articulated.

---

# MANAGEMENT OF PROJECTS IN FOUR VALLEY, MOROCCO

## THE WATER SITUATION

Table 1

	<b>Aguerseoual</b>	<b>Tamassit</b>	<b>Tadagirt</b>	<b>Tamatert</b>
<b>Number of water points</b>	3 springs + the Oued stream	1 spring + 1 well + the Oued stream	3 springs of which one feeds an underground reservoir	2 springs
<b>Water Transport</b>	Mostly Women and Children			
<b>Water Quality</b>	Good	Good	Good	Good
<b>Steadiness of supply</b>	Insufficient in summer - autumn			
<b>Distance covered to fetch water</b>	100-700m	400m-1Km	100m-1Km	300m
<b>Constraints</b>	resort to the Oued waters during drought	pressure on springs have to draw water at night have to filter water using a cloth	have to resort to the furthest water point	have to queue have to resort to a secondary stream
<b>Sanitation</b>	No proper facility and action; absence of bathroom and toilet			

## **INSTITUTIONAL ARRANGEMENT**

---

The 4 villages still rely on a traditional organization, called Jmaa'a who manages local affairs and encompasses all members of the community. Some village rely on the Jmaa'a, some others, on new associations fostered by the Jmaa'a.

Therefore, an interesting comparison can be made between the villages using the traditional Jmaa'a and the others having formed more recent associations (See Table 2.).

## **MODE OF COMMUNITY PARTICIPATION**

---

Two types of community participation were observed :

- The beneficiaries participated to the financing of the project. This was calculated according to the financial ability of the user and mainly according to generosity of the beneficiaries. This voluntary action has led to the distribution of financial responsibilities among the community. On the contrary, Jmaa'a, established as an association, demands from it's members payment of equal contributions, calculated according needs of the project and partly according to the number of members.

In both situations, the contribution are spread out and paid when money is available. During the fruit harvesting season, the peasants open their purses very easily.

- All the community members participated by surrendering some land for digging wells (in Tamassit) or building reservoirs.

## **REGULATION OF WATER USE**

---

The Jmaa'as and particularly the associations have tried to elaborate on a "water code" in defining the conditions of access to water services by the users. This regulation has taken different forms.

- An 'oral code' : in Aguerseoual priority is given according to use. First is for drinking, then for animal feeding, lastly for washing clothes and irrigation. In case of a ceremony (marriage, baptism) or construction work, exceptions can be made.
- A code written on paper, listing the names of members of the committee charged with the realisation of the project in Tamatert. This code applies in cased of fining where water has been used for irrigation.

- A written code duly signed and authenticated indicating membership. It binds every member to accept the conditions stipulated in his/her contract.

Free service is offered to the mosque and cemetery in Tamassit.

A separate service exists to cater for homes far away from the water network by installing a water point with a meter close to their homes. The poor are exonerated from all contributions. In Tamassit, the association has offered credit facilities.

**This case study demonstrates the need to build on a traditional system.**

The new associations show that it is not the pure reproduction of Jmaa'a, but it's recomposition where there is an emergence of new actors, notably the young, who carry out the new projects without bypassing the elders who possess the powers. A redefinition and new division of responsibilities is required.

## PARAMETERS FOR PROJECT REALISATION

Table 2

Areas	Aguerseoual	Tamassit	Tadagirt	Tamatert
<b>Institutional structures</b>	Jmaa'a + a recent association	Development association	Jmaa'a	Jmaa'a
<b>Technical Solutions</b>	spring + canal digging + drinking water fountain + some individual piping	wells + pumps + canal digging + reservoir + branching water to houses	spring + canal digging + underground reservoir spring + canal digging + drinking water fountains	spring + canal digging + reservoirs + drinking water fountains
<b>Resources Mobilised</b>	self financing	self financing + support from rural community and authorities	self financing + support from rural community	Dutch NGO + sustained by the Jmaa'a
<b>Type of Service</b>	drinking water fountains in major areas + piped water in homes	domestic water : a water distribution network designed according to RADE	a water tank for the mosque + water in homesteads (reservoir)	drinking water fountains in major areas + fountains in homesteads
<b>Secondary Effects</b>	septic tanks + Turkish baths + fit in kitchens + a domestic water project	septic tanks + Turkish baths + fit in kitchens + a waste water evacuation project	drinking water supply project	isolated cases of septic tanks + fit in kitchens + conflicts concerning water

# INDIGENOUS WATER BOLIVIA AND THE

---

Farmers of the Andean valleys, Altiplano and Chaco face constant shortage of water in these highlands.

The situation of water in Bolivia has the following characteristics:

- The prevailing laws and regulations do not respond to the current water demands;
- Government and NGOs continue to have a technical approach with construction of works and do not consider social and cultural aspects. Traditional knowledge and rural community's management capacity are overlooked;
- the small irrigated area of the country is serviced mainly by small community systems, operated and maintained by farmers;
- public investments are limited, spread all over and respond more to emergency situations.

---

A new approach has been adopted by the Government with two complementary concerns :

- the recognition of the State's natural dominion on waters and its role as setting the rules;
  - the acceptance of customary institutions as a source of rights and an equitable system for water management by farmers;
-



# MANAGEMENT SYSTEMS IN ENABLING ROLE OF THE STATE

---

In order to overcome government's weaknesses, a new system has been set up:

- ❑ The strengthening of a national agency dealing with water and irrigation and setting up policies, rules and procedures;
- ❑ the creation of national and departmental irrigation committee as an inter-institutional coordination and harmonization authority on water;
- ❑ the creation of a National Irrigation Program (PRONAR) to coordinate training and support to organizations dealing with irrigation.

---

There is a drastic change in the way the government plays its role : from project design and construction with a strategic planning, the role has now been shifted to facilitate interactions among institutions and the community. The government agency (PRONAR) becomes a service provider which accompanies, facilitates a process of organization and access to technical, institutional know-how, alternative options...

This requires a process of interaction based on negotiation and arbitration on the role of each actor, with a definition of responsibilities.

This approach defined as "accompanying and supporting indigenous communities" has produced several results :

## **ENVIRONMENTAL SUSTAINABILITY**

---

Indigenous methods recognize better protection of springs, conservation of springs and water, reforestation in the watersheds and valleys; farmers are better equipped to find a balance between using water for crops and conservation.

---

### **TECHNICAL, ECONOMIC SUSTAINABILITY:**

---

To satisfy food requirements for the family is the primary objective of the farmer. It is important for any water project to take into account the economic imperatives of farmers: first, the food intake of the family, second additional income from the labour market, third, the possibility for cash crop and export.

Water projects need to be designed with the expected benefits of the food production, and the time and labour inputs required from the farmer.

### **SOCIO-CULTURAL SUSTAINABILITY**

---

The farm plots are linked together by a system of water canals and infrastructures which are managed by communal rules. Rural communities have built over time a system of rules and decision-making processes to allocate water between communities and farmers, prevent and solve conflicts. These arrangements and institutions such as ceremonies, community meetings, community work, election of water manager are very important for the sustainability of water management systems.

The training and assistance provided by PRONAR are built on such knowledge systems and institutions to improve the management of water at the local and regional level. An additional concern is to bring together all actors involved in the river basin to adopt a common approach.

*Prepared by : National Irrigation Programme*