

## Good Practices: Natural Resources Management

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**Title of Best Practice:** Opportunities through Agroforestry for Sustainable Development in Haryana, India<sup>1</sup>

**Country:** Haryana, India

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**Category of Practice:** Agroforestry

### Context and Genesis

This paper examines the role of agroforestry in sustainable development, leading to increased farmers income, employment generation, opportunities for value addition by the industries, and environmental benefits in the state of Haryana, India. This state is primarily an agricultural state with only about 3.5% of its geographical area as natural forests. Subsequent to the introduction of a network of irrigation canals, farmers of Haryana have achieved a significant increase in productivity of wheat and paddy following progressive farming system. The Haryana Forest department introduced Poplar and Eucalyptus based agroforestry models in 1970s, which have been well received and adopted, initially by large and absentee farmers. The gradual establishment of backward and forward linkages has made agroforestry an economically viable activity leading to enormous development in the State. Consequently, even the small and marginal farmers have recognized agroforestry as a profitable venture. A facilitating legal policy environment, availability of adequate infrastructure and micro-finance resulted into establishment of 300 veneer mills in the city of Yamunanagar, in Haryana. Today, the daily arrival of wood (grown in agro-forests) in this city alone is worth US\$ 300,000, which after value addition in the form of plywood production becomes worth US\$ 1.2 million. Further, a significant increase in tree cover (8% of geographical area) has also been achieved in the state leading to alleviation of pressure from natural forests. This success story has been well recognized by the Ministry of Environment and Forests, Government of India, which considers this land use system as a means to achieve a tree cover of 33% of nation's geographical area by 2025 as mandated in the Forest Policy of India, 1988.

### The Practice

Agro-forestry means combining tree cultivation with agricultural crops. This practice is not new, as 'Kheti' (agriculture) always used to be with 'bari' (fenced tree grove) under traditional systems of agriculture in India. However, with the advent of commercial agriculture and automation, 'bari' was neglected. The present agroforestry effort is to re-establish this aspect of tree cultivation by making it remunerative to the landowner. Different states of India have evolved their own combination of tree crops with the traditional agricultural and horticultural crops in their respective agroclimatic situations. Some Agroforestry practices that are followed

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<sup>1</sup> IFAD Supported Case Study

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in Haryana, Punjab, western Uttar Pradesh, Delhi and Uttaranchal have shown high potential and because of their higher economic return per unit area, they have acquired national and international recognition as models to be emulated. The timber output generated from agro-forestry substitutes timber grown in natural forests, thereby relieving pressure on natural forests. Economic advantages accrue to land owners and earnings increase synergistically (Rawat, 1988 and 1989). A new industrial sector has come up to utilize agro-plantations-grown timber and add value to it. Employment opportunities are generated in different links of production-chain, leading to improved standard of living. Therefore, agro-forestry is to be perceived as a proven agriculture and rural development strategy.

Haryana is an agricultural state with only 3.5% of its geographical area under natural forests. Till 1970, traditional tree species such as 'jand' or 'Khejri' (*Prosopis cineraria*) were naturally encouraged to be grown in most of the semi-arid sandy agricultural lands that were rain-fed. In rain-fed clayey soil areas, 'Kiker' or 'babul' (*Acacia nitotica*) was grown. 'Shisham' or 'tali' (*Dalbergia sissoo*) was grown in moist areas and also along the existing wide network of canals. This integrated cropping was being adopted as a method of drought proofing the landowners during climatic emergencies. Some of these practices have been improved and continue even today.

Conscious efforts were subsequently made to introduce Eucalyptus cultivation on field boundaries in the then Ambala district of Haryana in early 1970s. In the beginning, landowners were reluctant to plant eucalyptus as they apprehended a subsequent land seizure by the forest department. When the first crop was sold, land owners got very high returns that they had not expected. Demonstration effect led to very large scale plantations (Rawat et al 1994). Subsequently, the seedlings were planted at very close spacing and demand for only one end use viz., paper making was insufficient to give the expected returns to the land owners. Diversification of use did not exist at that time leading to panic harvesting and consequent glut in the market between 1980-90. Revival of interest in eucalyptus occurred after its adoption by plywood industry due to its cost advantage and being a cheaper substitute to poplar wood. Subsequently, poplar plantation was also adopted on a large scale since it fitted well in the existing rice-wheat based cropping system of the area. As on today, every year about 25 million eucalyptus and other seedlings are being planted. To improve productivity, genetically superior seedlings are being mass produced.

## **Assessment and Impact**

### Trade Cycles and Stability

In free trading economy, trade cycles are always present. In a predominantly agricultural economy of India with a very large number of cultivators, there is a mob mentality in following the cultivation practice which gives highest economic returns. This causes cyclic 'lows' and 'highs' in supply and demand, termed as trade cycles. In agricultural crops, the period of adjustment to combat trade cycles is about twice the period of equilibrium and takes at least one and a half that period. Eucalyptus with rotation of 10 years has come back after  $10 \times 1.5 = 15$  years. Similarly, poplar with rotation of 6 years is likely to get fully stabilized after  $6 \times 1.5 = 9$  years, or earlier. Often this phenomenon is held out against advocating agro-forestry as a strategy for rural development. It is worth remembering that most of agricultural crops are

susceptible to this and sugarcane is one of the classic examples of this phenomenon in India. For achieving growth, bulk production has to be supported by bulk utilization. Therefore, the adage “grow your markets before you grow your trees” has much weight in it. However, both of them can grow together as is the case in Haryana, and should be an eye opener.

#### Development of Agro-Forestry Based Industries

River-floated timber from hills viz; deodar (*Cedrus deodara*) kail (*Pinus wallichiana*) and partal (*Abies pindrow* & *Picea smithiana*) used to be collected at Yamunanagar in Haryana and sold in plains. Thus, a flourishing timber trade existed here before 1970. Subsequent to stoppage of felling in hills by government regulations, timber in the form of sleepers stopped arriving in Yamunanagar, which led to a decline in timber trade. Similar decline in the north eastern states of India also led to the flight of capital, equipment and technical manpower. At this crucial point of time, the Indian Council of Forestry Research and Education (ICFRE), Uttar Pradesh Forest Department and West India Match Co. (WIMCO) substituted semal (*Bombax ceiba*) by poplar (*Populus deltoids*) initially for match-splint making. Denial of forest grown timber from the north-eastern states, availability of hassle-free plantation-grown raw material and culture of Yamunanagar as a wood trading city combined to create a ‘Chota Assam’ in Haryana within a quarter century. As on today, about 15000 metric tons of timber is being converted into plywood and panel boards in the 600 factories located in five states viz., Haryana, Punjab, Uttar Pradesh, Uttaranchal and Delhi, mostly centered around Yamunanagar of Haryana. The Yamunanagar district alone transacts a turn-over of up to Rs. 20 million a day in raw material and four times of that in finished product.

#### Increase in Forest and Tree Cover

At present forest cover of India is just over 20% of the area of the country (FSI, 2003). By 2012, the Government of India proposes to bring another 10% area to make forest and trees cover 30% of the geographical area of the country. Haryana state has 3.5% of the state’s area under forest cover and another 4.5% under tree cover i.e., about 8% of the state area is covered under vegetation. By 2012, it is proposed to bring a total of 20% area under vegetation cover. Haryana is thus a unique state that has more tree cover than the forest cover and every seven years the state has brought about one percent of its area under tree cover (Anonymous, 2003). This has become possible because of sustained free supply of seedlings. Every year between 25 to 50 million seedlings are supplied to the farming sector free of cost. Most of the agricultural land utilizes soil and above ground space to an extent not more than 0.5 meters below and 3.5 meters above ground, respectively. Introduction of trees will tap soil below 0.5 m and above ground space of more than 3.5 meters and has synergy with the traditional agriculture system. This is precisely what has happened in the state of Haryana and requires to be extended to other states also.

#### Additional Income to the Farmer

The often asked question is how much difference in income exists between only agricultural crop system and agroforestry crop system?

Initially, the poplar veneer-grade timber was sold for Rs. 350 per quintal, and the net additional income was Rs.8750 per ha. per year. At present, the poplar is being sold between Rs. 175-225,

or average rate of Rs. 200 per quintal. Therefore, the net additional earnings are Rs. 4750 to 5000 per ha per year (Table 1).

On exceptionally well managed poplar agro-forestry farms, an output of 20 metric tons on a ten year cycle is claimed and often realized. Generally, about 20 M3 of wood is harvested per ha/year.

Table 1. Comparison of net annual income per ha of land practicing wheat-rice rotation with and without trees. (All costs are in Indian Rupees (Rs.); Current exchange rate of Rs. 44 per US\$)

System	Expenditure per ha per crop	Income per ha per crop	Net income per ha per crop	Remarks
Wheat	13250	28250	15000	Wheat, 42.5 Quintals x @ Rs. 560=23800 Hay, 30 Quintals x @ Rs. 150=4500 <u>Total = Rs. 28300</u>
Paddy	20750	38750	18000	Paddy, 63.55 quintals x @ Rs.590=37495 Hay, 50.00 quintals x @ Rs. 25 =1250 <u>Total = Rs. 38745</u>
Annual income per ha.	34000	67000	33000	
Wheat	13250	22975	9725	Wheat, 35 Quintals x @ Rs. 560= 19600 Hay, 22.5 Quintals x @ Rs.150= 3375 <u>Total = Rs. 22975</u>
Paddy	20750	27487	6737	Paddy, 45.0 quintals x @ Rs.590= 26550 Hay, 37.5 quintals x @ Rs. 25 = 937 <u>Total = Rs. 27487</u>
Poplar/Eucalyptus	nominal	21250	21250	500 seedlings are planted; about 400 seedlings survive to produce about 20 cubic meter of wood per ha per year. 10 cubic meters = 110 quintals plywood x Rs. 200=22000 & 7.5 cubic meters=75 quintals of pulpwood x Rs. 65 per quintal = 4875 & 2.5 cubic meters=25 quintal of firewood @ Rs. 45 per quintal =1125; a total of Rs. 28000 as gross earning; Cost of logging and transportation @ Rs. 33 per quintal x 210 quintals = Rs. 6930; Net income Rs. 21070.
Additional income from poplars per ha.			37712 (-) 33000 (=) 4712	

### Expansion of Industry and Output

About three decades ago, the peeling of poplar logs was essentially for making match-splints. Subsequent success came through the manufacturing of commercial board for which the low cost of raw material was responsible. With the passage of time, ISO certification and establishment of in-house testing facilities, the quality of ply board products has been upgraded and the products can be compared to the best available in the country. At least ten out of about 400 manufactures have upgraded their facilities considering prevalent international standards. A day may not be

too far before eco-testified green label timber panel products are exported in a large volume from Yamunanagar.

An estimated 600 units are presently using about 15000 tons per day farm grown veneer logs in the five states of India, namely Haryana, Punjab, Uttranchal, Uttar Pradesh and Delhi. About 400 units are concentrated in and around Yamunanagar and 25 units in Bahadurgarh of Jhajjar district adjacent to Delhi. About 50 units are in Ludhiana, Jullundhur and Hoshiarpur districts of Punjab state. About 50 units have come up in each of Uttranchal and Uttar Pradesh states and about 25 units are operating in Delhi. On an average, the consumption of each unit per day is 25 tons of veneer logs.

There is a horizontal and vertical integration in different timber-using industries, where an end product and / or waste product of one unit is an initial product of the other unit. One paper mill is mostly utilizing veneer waste, debarked stumps and pulpwood of poplar and eucalyptus to meet 82 % of its raw material requirements and the rest 18 % is being met from bamboo transported from north-eastern India. The total estimated value of daily raw material that is bought by the 600 units is Rs. 25 – 30 millions at an average of 15000 tons of wood procured at average price of Rs. 175 per quintal.

#### Employment to Loggers, Middle Men, Transporters and Skilled Labour

A large number of persons are engaged in logging and plywood manufacturing industry. The logging labours, instead of being immobile, have started operating in mobile parties even outside the state. Skill acquisition and constant upgradation has led to socially disadvantaged groups becoming economically self reliant even while they do not own land. Every ton of wood harvested generates one man-day in logging operations. Thus, every day 15000 maydays of work gets generated in five states of India, primarily in Haryana.

Transport sector is likewise benefited, both at the time of bringing in raw material and taking out finished goods. At a rate of Rs.30 per quintal as the cost of transportation, the transport industry transacts  $(15000 \times 10 \times 30) = \text{Rs. } 4.5 \text{ million}$  per day through raw material transportation alone.

Six hundred factories provide jobs to not less than about  $600 \times 100 = 60000$  persons in five states that are benefited by this industry.

Plywood industry is machinery intensive, in which imported machines or machines manufactured in other places of India were used earlier. Now more and more machines are getting manufactured in Yamunanagar itself, generating additional employment and income to investors.

#### Tax Earning by the Government

The sales tax earned by government of Haryana was of the order of Rs. 60 million per annum from Yamunanagar district, mostly being paid by paper, sugarcane, metal and plywood industries. After government entered into an understanding as to the tax that is to be specifically paid by plywood industry, there was a three-fold increase in tax collection. While all other industries continued to function at the same level, almost all tax increase can be attributed to

plywood industry alone. Thus, there has been a tax payment spurt to the extent of 120 million from agro-forestry generated products.

### **Factors Contributing to Successes and Failures**

Seedlings are the most important input to sustain the momentum of agro forestry practice. Every year between 50 to 100 million seedlings are used in Haryana for plantations on government and private farmland. More than half the seedlings are used by the agro forestry sector.

The cost of raising trees in forest area is about four times (Rs. 20 per seedling) than that of raising same trees on the farm (Rs. 5 per seedling). Owing to higher fertility status of agricultural land and farmer's personal care, growth rate of trees have been found to be superior on these lands as compared to forest lands. Output from 150000 ha of government forests of Haryana is 400,000 cubic meters (only half is harvested) compared to agro forestry output from estimated 200000 ha of about 1.6 million cubic meters. There is a four-fold increase in production with four times lower cost of seedlings under agro-forestry systems.

At present, there is a general feeling in the country that subsidies on seedlings should be discontinued, as they do not support economic efficiency and competitiveness. Such ideas which may be from international financial institutions can not be applied indiscriminately to every agroforestry situation in India. In the initial stages, the seedlings are to be supplied free of cost to farmers in order to habituate them to grow trees on farmland and to create a raw material base for the industry. Once this linkage is established and the stability of market for agro forestry-grown produce is ensured, there would be greater interest in planting trees on the farm by land owners. The survival of seedlings supplied to farmers in the beginning may not be very high because of lack of experience of the farmer. Unless the farmers harvest and sell a crop of trees profitably, there is a low level of confidence in them, particularly regarding the backward and forward linkages in this system. For sustained agroforestry development, the seedling supply system should also factor in the wastage of some seedlings in the early phases of the efforts. With the experience gains, the seedling wastage becomes low. In areas of unrestricted cattle movement after field crops harvest, the seedling survival has been found very low. Because of longer experiences of farmers in Yamunanagar district, the survival of poplar is more than 80% in comparison to other new areas where it is between 30-60%.

The seedlings that are supplied to farmers also have ecological and economic benefits which more than compensate their cost. The raw material generated from agroforestry sector has substituted forest produce and reduced the pressure on natural forests. The raw material from agroforestry sustains plywood, paper, charcoal and rayon industries. The finished product is taxable from which the government earns more tax compared to the expenditure incurred in supplying free seedlings. Thus, the tax receipt more than offsets the expenditure incurred in free supply of seedlings.

### **Opportunities for Mainstreaming**

Agro-forestry on agricultural lands can be an inexhaustible source of raw material. Every ha. of intensively cultivated land can produce not less than 10 cubic meter of wood per year through



agroforestry systems. Even rainfed and marginal agricultural lands can produce at least 1.25 cubic meters of wood per year under intensive care and management. By harnessing this potential of agro-forestry, timber and firewood can be generated far in excess of the projected requirements of the country. The successful agroforestry models developed in Haryana are being gradually adopted in the adjoining states. With suitable crop combinations, they are also becoming popular in other places. These efforts however seem to be very much dependent on the supply of good planting material, fair market policy and a consistent R&D support. By being a multi-functional land use system, agroforestry seems to be the way forward for the sustainable development of a country like India.

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**Title of Best Practice:** Policy Imperatives in Agri-food Enterprises and Rural Livelihood Resources Management in Unified Global Economy<sup>4</sup>

**Country:** India

**Authors:** M. K. Sinha and Dipankar Saha<sup>5</sup>

**Category of Practice:** Bamboo production and processing linkages

### Context and Genesis

#### *The Jute Industry-a Development Goal*

Jute the 'Golden Fiber' of India, has various inherent characteristics like, high tensile strength, low extensibility, long durability, fire and heat resistance, silkiness, luster and long staple length. India is the single largest jute producer in the world producing around 35% of the world production. Jute is not only a major textile fiber, but is also a raw material for nontraditional and value-added products helping in environment protection and maintaining ecological balance. Besides, it has an enviable market - both local and international. Over the years India has been witnessing the use of petroleum by-products mainly arising out of inadequate supply of jute products. While Polypropylene and High Density Polyethylene woven sacks are slowly eating into the jute sacking market, currently, the demand for jute in India is higher than the supply due to an increase in the consumption pattern and a decrease in the raw jute supply. The govt. of India also offers protection to the jute industry under the Jute Packaging and Materials Act requiring food grains and sugar in the country to be packed in jute bags. This apart, Indian jute products have a tremendous potentiality in the overseas market with USA, UK, South Africa and Belgium being the major buyers accounting for around 25% of India's production.

The Jute Industry occupies an important place in the national economy. It is one of the major industries in the eastern region, particularly in West Bengal. It supports nearly 4 million farm families, besides providing direct employment to, 2.6 lakh in industry sector and 1.4 lakh people in the tertiary and allied sector. The Jute Packaging Materials (Compulsory Use in Packing Commodities) Act, 1987 provides for the compulsory use of jute packaging material in the supply and distribution of certain commodities. On the basis of the recommendations of the Standing Advisory Committee (SAC), the Central Government issued a notification dated 28.09.2004, for mandatory packaging of 100% food grains and 90% sugar, in jute materials during the jute year 2004-05.

Jute prices recovered strongly in the second half of 2004 to around US\$370/tonne, 50 percent higher than prices one year earlier. Demand for jute manufactured goods, in India and in importing countries, helped maintain prices despite higher production and increasing stocks.

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<sup>4</sup> IFAD Supported Case Study

<sup>5</sup> ICAR Central Research Institute for Jute and Allied Fibres, Barrackpore, India

Global output of jute, kenaf and allied fibers is estimated to have increased by 3.5 percent from the previous season to an estimated 3.3 million tons in 2003/04, due almost entirely to a 20 percent increase in Bangladesh. Global exports of raw fiber decreased by 30 percent as mill consumption in producing countries increased to meet domestic and export requirements for manufactured goods. Shipments from India, the world's leading supplier of jute products, were 28 percent higher in 2003 than in 2002, as competitiveness relative to synthetic products improved. Polypropylene prices have continued to rise in 2004, as oil prices increased, and this is likely to maintain the competitiveness of jute products in the near future. However, stocks in producing countries now equaling 46 percent of mill consumption are likely to pressure prices.

Table 1. Facts about production and consumption of Jute in the World and in India

PRODUCTION OF JUTE GOODS QTY : IN 000' M.T. VALUE : Rs / Crores						
(April / March)	Hessian	Sacking	Cbc	Others	Total	Corresponding Consumption Of Raw Jute In '000 Bales
1995 – 96	413.9	676.3	30.5	5312.3	1433	8290
1996 – 97	368.7	666.6	25.2	340.4	1400.9	8023
1997 – 98	392.4	864.6	19.8	401.6	1678.4	9598
1998 – 99	344.1	903.3	18.5	330.3	1596.2	9068
1999 – 00	344.5	909.2	8	328.5	1590.2	9087
2000 – 01	337.9	952.9	6.6	327.5	1624.9	9280
2001 – 02	275.3	1034.3	5	286.2	1600.8	9142
2002 – 03	338.3	1000	5.4	278.1	1621.8	9262
2003 – 04	305.2	979.3	5.7	281.1	1571.3	
% change of 03-04 over 02-03	-9.78	-2.07	12.96	1.44	-3.11	-3.1

Assuming that weather conditions and yield per hectare of jute follow their normal patterns in each of the countries under examination, the world production of jute is projected to expand by 0.33 percent at 3.2 million tons in 2012, well above the average production level of the past decade, as increases in yields per hectare are expected to offset reductions in the area under jute. In the medium term, the area under jute in the Far East is expected to contract by 1.0 percent per annum from an average of 1.5 million hectares in 2000-2002 to 1.4 million hectares in 2012 as producers adjust to market conditions through disinvestment. The area under jute in India is expected to contract by 1.3 percent per annum, although production is expected to expand to nearly 2.0 million tons due to increases in yield. Between 2003 and 2012, yields are projected to increase from 2.36 to 2.50 tons per hectare.

It is projected that global consumption will amount to just under 2.9 million tons in 2012. Consumption of jute and jute products in the developed countries is expected to continue to

decline in the medium term, albeit at a slower rate than in the 1990s. A slowdown in the contraction of the market may reflect the gradual exhaustion of substitution possibilities between jute and competing products or technologies, at least in these countries. In the developing countries, consumption is expected to increase at an annual rate of 0.05 percent from 2.5 million tons in 2000-2002 to 2.6 million tons in 2012, mainly due to relatively stronger demand from China and the Near East.

In India, the largest market in the world, consumption of jute products is likely to remain at approximately 1.6 million tons in spite of the revised administrative regulations that determine the shares of jute and synthetic fibers in food grade sacks for agricultural commodities. The new provisions, introduced in the 2002-03 season, allow a reduction in the amount of food grains packed in jute from 100 per cent to 80 percent and a reduction in the amount of sugar packed in jute from 90 percent to 75 percent. These relaxations of the regulations are expected to weaken demand for jute in India, exert a downward pressure on its price and reduce the growth below that which the Indian jute market experienced during the last decade. However, there are some factors, such as the preference for jute packaging for food grains due to its breathability, as well as jute sacks re-usability that may work to offset the impact of these regulations.

#### *New Initiatives Taken in Jute Sector*

In pursuance of commitment made in the National Common Minimum Programme to give a fresh impetus in all respects to Jute Industry, the following measures have been initiated.

*National Jute Policy:* In view of rising global concern about environmental issues, jute is poised to become favoured products because of its eco-friendly and biodegradable characteristics. The Government is in the process of formulating a Comprehensive National Jute Policy. A conference on Comprehensive Jute Policy was held on November 19-20, 2004 at Kolkata to elicit the views of stakeholders, and it was attended by almost all segments of jute sector. Meetings of the P a r l i a m e n t a r y C o n s u l t a t i v e Committee attached to the Ministry of Textiles were held in Delhi and Mumbai on 25.11.2004 and 20.01.2005 respectively to elicit and incorporate the views of the Members of Parliament on the proposed policy. The National Jute Policy will be announced soon after obtaining the necessary approval.

*Jute Technology Mission:* The Jute Technology Mission (JTM) is proposed to be launched with the following objectives:

- To strengthen existing infrastructure for development and supply of quality seeds;
- To improve the yield and quality of jute fiber through better methods of retting and extraction technologies;
- To increase the supply of quality raw material to the jute industry at reasonable prices and to develop efficient market linkage for raw jute;
- To modernize, technologically upgrade the jute industry;
- To improve productivity and the quantum of diversification;
- To focus on Human Resource Development for jute industry;
- To develop and commercialize innovative technology for diversified use of jute and allied fibers.

Jute Technology Mission would lead to greater research and development in jute, besides providing technology for increasing productivity in the manufacturing sector and expansion of markets for diversified jute products. In addition to industrial sickness lack of industry institute and farmers linkage has severely affected the jute industry. To counter the malaise of sickness, both the quality and quantity of raw jute should be improved. The credit for technological upgradation and modernization of jute units should be provided on easy terms. Vigorous attempts should be made in the direction of R&D to attain high quality fibers, giving emphasis on diversification of jute products and exploration of new markets. Avenues should be searched to extend Technology Upgradation Fund to potential, viable jute units. To give impetus to modernization, duty relief should be provided on import of new and second hand machinery by the jute units. India has achieved a distinction in producing eco –friendly hydrocarbon-free jute bags of international standards. To increase the use of jute bags, the mandatory Jute Packaging Order should be implemented scrupulously and any review of it by Government should take into account the foremost interest of jute farmers and jute industry.

## **Development Practices**

### *Bamboo Cultivation*

Bamboo is ubiquitous in its presence in the region holds a few bamboo clumps in the backyard. The region has enormous potential for cultivation of bamboo which was hitherto very unorganized. The Barak valley for example can be taken as an example which is consisting of 3 districts viz. Cachar, Hailakandi and Karimganj is an area where bamboo forms an important constituent of the economy. A project on cultivation of bamboo in about 1000 hectares in Barak valley through financial support from banks can be implemented. The total financial outlay of the project is tentatively say Rs. 265.00 lakh involving a bank loan of Rs. 238.50 lakh over a period of three years i.e., 2004-05, 2005-06 and 2006-07. The purpose of cultivation is to utilize the wastelands in the district and to provide adequate and uninterrupted supply of raw materials to the Cachar Paper Mill (CPM), Panchgram, Cachar district. The CPM, a unit of Hindustan Paper Corporation Ltd. (HPC) is established in the year 1988 and manufactures writing and printing paper. The paper mill is utilizing bamboo as a raw material for production of paper. The paper mill is therefore keen on encouraging bamboo cultivation in the region. There are vast stretches of wastelands in the three districts which are not put to use by farmers. Further, there has been no or negligible credit flow to the forestry sector in the State for want of viable and bankable projects and poor repayment. The project therefore can envisage extension of technology and assured procurement of raw material by the paper mill, cultivation of bamboo by farmers with financial assistance from banks and repayment of bank loan by farmers through the paper mill. The entire process can be ensured through a tri partite agreement between farmers, paper mill and bankers with specific obligations. The project ensures assured market to farmers, uninterrupted supply of raw material to paper mill and repayment of bank loan by the borrowers. India is one of the richest country in bamboo population with about 75 genera and 136 species out of the total 1250 species of bamboo found in the world. Bamboo covers 8.96 million hectare of forest area equivalent to 12.8 per cent of total forest cover of the country. The growing stock in the country is estimated to be 80.4 million tons. Bamboo development is viewed as a program for eco-restoration, economic development, employment generation and livelihood security. This multipurpose species has enormous potential which has only been partly harnessed. There are at least 1500 recorded uses of bamboo. The important usages are food items mainly edible shoots, building material, tiny and cottage industries, handicrafts, medicinal products, paper industry and

new generation products such as wood substitutes, truck bodies, railway carriages, bamboo boards, etc. In Assam the major use of bamboo is paper manufacture by Hindustan Paper Corporation Ltd. which functions through its units in Panchgram, Hailakandi district and Nagaon. Despite its versatile utilities, bamboo in India is currently faced with a number of problems, especially within forest area, such as poor management, low productivity (about one ton per hectare), over exploitation of the available stock, gregarious flowering, etc. There is also increasing pressure on forest areas for procurement of bamboo as raw material for industrial uses. These difficulties call attention for organized cultivation of bamboo outside the forest area for various purposes. The Planning Commission in the National Mission on bamboo technology and trade development, has suggested raising 2 million ha bamboo plantation in the X Five Year Plan and 4 million ha in the XI Plan period and has estimated fund requirement of Rs.2608 crores for 10th plan period. The estimated demand is 26.69 million ton against the supply of 13.47 million ton. A two pronged strategy is suggested to meet the gap i.e., proper harvesting from forest areas and fresh plantations in 6 m ha. As indicated earlier, the major industrial use of bamboo in the country is paper manufacturing. The current annual consumption of bamboo by paper mills is one million ton which is about 7.4 per cent of the total availability of bamboo. The paper industry requires about 6 million ton of bamboo for improving its capacity utilization. Non availability of bamboo is the main reason for this low consumption which offers scope for increased utilization of bamboo by paper mills which are currently operating at 41% of installed capacity. Paper mills should therefore enter into arrangement with bamboo growers outside forest areas to ensure sustained supply of raw material. It is significant to note that the import of pulp cost about Rs. 3800 crores annually. One of the characteristic features of bamboo is its suitability for cultivation in wastelands. This sample project is expected to be implemented in the districts of Cachar, Karimganj and Hailkandi. The availability of wastelands in the three districts is more than 20000 hectares. Bamboo development in 1000 hectares under the project will not pose any problem so far as availability of land is concerned. The objectives of the project

1. To encourage bamboo cultivation in waste lands in possession of farmers in the districts of Cachar, Hailakandi and Kariganj.
2. To provide continuous uninterrupted supply of raw material to Cachar Paper Mill.
3. To encourage bank finance for the hitherto neglected but potential sector of forestry in Assam

The implementation of the project involves active participation of the farmers, Cachar Paper Mill, banks, NABARD and NGOs. These agencies are expected to work in close coordination for effective implementation of the project. The responsibilities of each of these agencies are explained in the following paragraphs.

#### *Farmers*

The number of farmers identified under the project is 235 covering an area of Rs. 912.41 hectare. The farmers fall in the three districts viz., Cachar, Hailkandi and Karimganj. The land holdings of the identified farmers range from 1.34 hectare to 5.15 hectare. However, for the project, a minimum of one acre wasteland is required for raising bamboo. These farmers were identified by Cachar Paper Mills Ltd. through NGOs in the three districts. Since it will be too ambitious to convert agricultural lands for bamboo cultivation due to food security concerns, the waste lands mainly tilla lands in possession of the farmers were selected. These lands are reportedly backed

with proper land records which are required to be verified by respective financing bank before sanction of loans.

The obligations on the part of the selected farmers are indicated below

- agrees to raise bamboo in his plot
- the plantations will be raised with the nursery raised bamboo seedlings supplied by HPC at subsidized rate which is Re. 1 per seedling at present.
- the farmer agrees to meet necessary cost of labour, manures, fertilizers, insecticides, fencing, etc., on his own through bank loan guidance of HPC.
- the farmer will sell the harvested material to HPC at prices prevailing at the time of supply as fixed by HPC which is Rs. 550/- at present.
- Effect repayment of bank loan through the paper mill by executing a tri partite agreement.

#### *Cachar Paper Mill*

Cachar Paper Mill, a unit of Hindustan Paper Corporation Ltd. started commercial production of printing and writing paper in the year 1988. The unit with an installed capacity of 1,00,000 ton of paper is located at Panchgram on National Highway 53 on Badarpur - Silchar Road and is at a distance of 25 km from Silchar. The procurement of raw material i.e., bamboo and production of paper of the CPM for the last seven years is given in table 2

Table 2. raw material and paper production, cachar paper mill

Year	Raw material (MT)		Production (MT)
	MTG	BDMT	
1996-97	260,686	130,343	59,533
1997-98	288,486	144,243	50,032
1998-99	263,638	131,819	60,009
1999-00	302,876	151,438	65,290
2000-01	369,856	184,928	76,408
2001-02	425,922	212,961	92,065
2002-03	432,404	216,202	94,702

*MTG: Metric ton of green bamboo, BDMT: Metric ton of dry bamboo*

As may be observed from the table, the production of paper is approximately 20% of green bamboo procured. In other words, for one lakh ton of paper production the bamboo requirement is about five lakh ton which can be produced from 10000 ha of land. The paper mill is favourably inclined to encourage farmers of the region to take up bamboo plantations for the following reasons. The paper mill presently procures the raw material from forests by paying a royalty to forest department followed by flotation of tender for contractors to collect from the forests. The raw material is procured from forests of Barak valley and adjoining districts of Tripura, Manipur and Mizoram. Also, the procurement from such distant places is increasing the cost of raw material for the paper mill. The procedures of clearances from concerned

departments, award of contracts to dealers, etc., are also increasing the managerial costs of procurement. Another important factor necessitating organized cultivation of bamboo at the present stage is its gregarious flowering. About 90% of the bamboo procured by paper mill belongs to species *Melocanna bambusoides*, locally called Muli bans. Bamboo is a grass and flowers once in a life time after which the plant dies. Bamboo has a habit of gregarious flowering i.e., vast stretches of bamboo flower during a particular period and the entire stretch dies. The flowering cycle of muli bamboo is 48-50 years and it is estimated that muli bamboo will flower in 2004-07 in an area of 18000 square kilometer in the states of North East India and this bamboo will die after flowering. This would lead to a severe crisis for the paper mill as the availability of raw material is greatly reduced. The decline in the availability of raw material and likely increase in installed capacity of the paper mills including the unit at Nagaon makes it imperative for encouraging farming of bamboo to ensure the units operate at installed capacity. The project therefore relieves the present constraints of the paper mill to a large extent. For the above reasons HPC has launched a forestry scheme through their forestry wing to develop around 10000 hectare of bamboo plantation by 2008-09. The present project though for only 1000 hectares will make a good beginning in this direction.

The HPC has formulated a bi partite agreement one with farmers and the other with the NGO and they have now expressed willingness to enter into a tri partite agreement involving banks also. The obligations of the paper mill in the tri partite agreement are indicated below: HPC will raise seedlings in their nursery and supply to the identified farmers at a subsidized rate which is Re. 1/- per seedling. Coordinate plantation program under technical guidance of its forestry officials from time to time. The HPC will purchase mature bamboo at a price prevailing at the time of supply fixed by the HPC for local suppliers, however, the price shall not be less than the rate as on the date of agreement. HPC will establish collection points for bamboo from farmers. The present rate of bamboo at the mill is Rs. 1000 per ton and the same at these collection points is Rs. 550 per ton. Presently, the farmers sell the material to contractors at Rs. 250-300 per ton. HPC will route the proceeds of the sale to farmers through the financing bank

#### *Other Institutions*

*Banks:* The three districts of Barak valley are served by the following banking network.

Table 3. Bank branches

S.No	District	No of branches					Total
		CBs	RRB	ACAB	ASCARDB	PCARDB	
1	Cachar	50	19	1	1	0	71
2	Karimganj	27	17	3	2	1	50
3	Hailakandi	13	8	2	0	1	24
	<b>Total</b>	<b>90</b>	<b>44</b>	<b>6</b>	<b>3</b>	<b>2</b>	<b>145</b>

The lead bank in the three districts is United Bank of India and the RRB operating is Cachar Grameena Bank with its head quarters in Silchar. The co operative structure is weak and has negligible participation in credit flow in the region. The major banks are UBI, SBI, UCO and CGB. Some branches of Canara Bank, Punjab and Sind Bank also exist. The obligations of the banks under the tri partite agreement are to encourage the farmers to take up bamboo plantations



to extend financial assistance to the identified borrowers to ensure repayment through the proceeds of sale of bamboo from the paper mill.

*NABARD:* NABARD has identified wasteland development as a thrust area for development. NABARD as an apex institution in rural credit structure will act as a facilitator for credit flow by way of preparation of project, enthusing the bankers to extend finance for bamboo cultivation and create awareness among all concerned. Apart from the above promotional activity, NABARD will extend refinance support to banks at 100% of bank loan.

*Non Government Organizations:* NGOs constitute an important link between the paper mill and farmers. All the activities of paper mill will be routed through identified NGOs. In fact, HPC has a bipartite agreement with NGOs as well. The scheme will be implemented by HPC through eight Field NGOs (FNGOs) which were in turn identified through a Mother NGO (MNGO) called Deshbandhu club. These NGOs are responsible for the following items of work. Identifying the farmers/land owners/growers Generating public awareness for bamboo cultivation Assisting CPM in conducting seminars Distribution of seedlings with proper accounts Collecting sale proceeds and consent letter from beneficiaries and remitting the amount to CPM. The NGOs are given technical guidance and support through distribution of seed and polythene bags free of cost. They will also be given training by Rain Forest Research Institute to be conducted at the mill premises. In addition to all the agencies indicated above, the service of Cane and Bamboo Technology Centre, UNIDO, Guwahati will be utilized especially for promotional activities and marketing information for future.

#### *Financial Aspect*

*Unit cost:* The unit cost for one acre of plantation is Rs.9400/- spread over a period of five years. The various assumptions for arriving at the unit cost are given as follows.

Harvesting commences from the sixth year. The sale price per ton of bamboo has been considered at Rs. 550/- (present rate). The income details are given in table 4.

Table 4. Income per acre

Year	Yield (ton)	Income (Rs)
VI	9.6	5,280
VII	11.2	6,160
VIII	12.8	7,040
IX onwards	14.4	7,920

*Financial Analysis:* The project is financially viable at the above expenditure and income levels. The financial indicators for one hectare bamboo plantation are as follows.

NPV: Rs. 6890, BCR: 1.64, IRR: 26%

*Repayment Period:* The bank loan is considered at 90% of the unit cost i.e.Rs.8,460/-. Income generation from the activity commences from the sixth year onwards. The interest accrued during the gestation period will be deferred. The repayment of principal with deferred interest will be for four years i.e., 7-10th year of plantation (Annexure IV).

*Banking Plan:* The project envisages development of 2500 acre of bamboo plantation in three years commencing from 2004-05. A series of discussions were held by NABARD with

commercial banks and Cachar Grameena Bank, Cachar Paper Mill, Panchgram and NGOs. Based on discussions, an area development scheme was formulated and banking plan prepared. The banks involved in the plan are United Bank of India, State Bank of India, UCO Bank, Canara Bank, Central Bank of India and Cachar Grameena Bank.

Table 5. Area development financing plan

Year	Physical program (acre)	Total financial outlay (Rs.lakh)	Bank loan (Rs.lakh)	NABARD Refinance @ 100%
2004-05	750	70.5	63.45	63.45
2005-06	750	70.5	63.45	63.45
2006-07	1,000	94	84.6	84.6
<b>Total</b>	<b>2,500</b>	<b>235</b>	<b>211.5</b>	<b>211.5</b>

*NABARD Refinance:* Wasteland development is identified as a thrust area for directing the financial assistance of NABARD. The refinance will be extended for the entire bank loan i.e., 100% at an interest rate of 6.0% per annum.

#### *Jute and Allied Fibers for Paper*

Currently the paper industry entirely depends on forest perennials and bamboo for the raw material. Demand for paper is increasing with leaps and bounds, while the perennials are unable to keep pace with the demand. The paper industry now recognizes that annual fiber crops like Jute, Kenaf, Roselle etc. may prove to be the alternative or supplementary sources. In the last two decades Kenaf and Jute have been technically identified as suitable. Now, time has come to find if the venture would be commercially feasible. In the last decade a large collection of jute (2600) and kenaf (1233) have been made with the help of IJO and are with NBPGR, New Delhi and with different countries. Now the types that are suitable for pulp making are to be pinpointed. Their characters are to be tested and through breeding, the crop desired, is to be developed. In CRIJAF (India) defoliated mesta (*H. cannabinus*) plants harvested at 50% flowering stage were used for pulping by 'Mechanical' and 'Chemi-mechanical pulping processes'. Out of 10 different strains of mesta tested in the laboratories, MT-150 performed best for all properties i.e. pulp yield, tensile strength in terms of breaking length, double fold and burst factor in both pulping processes. Significantly the newsprint produced from MT-150 paper pulp was found better than Russian and Canadian newsprint in terms of pulp quality. More specifically it is worthwhile to mention that MT-150 newsprint had equivalent BLM but higher fold and burst factor than those of imported newsprint. Thus the variety had been identified for release at national level.

Recently, CRIJAF identified MT-150 (*H. cannabinus*) variety for release at National level for paper pulp as the most promising variety. Newsprint produced from MT-150 is excellent Its quality is even better than the Russian and Canadian newsprints. Furthermore, MT-150 is comparatively the best performer so far as pulp yield and other technicalities of pulping processes are concerned. In the research farm, MT-150 yields around 60 tones of green weight per hectare. Practically, 23-25% of this total green weight will ultimately be converted into dry weight, thereby, achieving a target of 15 tones of dry weight per hectare. On the basis of most conservative estimate, a target of 10 tones of dry weight / hectare in the farmers' fields is pragmatic. Eighty percent of the total dry matter will ultimately be converted into paper pulp.

Therefore, at least 8 tones of paper pulp are expected to be produced from one hectare of mesta cultivation. This will, in turn, culminate into a profit range in the vicinity of Rs. 15,000/-, which is much bigger, a margin when compared to Rs. 2,000/- gained from fiber sale as such. The simple economics of Mesta paper pulp and fibers are enumerated in following Table. However, it is necessary to mention here that no such linkage mechanisms have yet been established in jute and allied fiber cases like that of tea and bamboo described above.

Table 6. Economics of mesta paper pulp and fibers

Item	Amount/ha	Price(kg or man days)	Cost/profit for Fiber/ha	Cost or profit for Paper Pulp/ha
i) Seed	15kgs	12.00	180.00	180.00
ii) Ploughing & Laddering	20 pair of bullocks with plough man.	15.00	300.00	300.00
iii) Intercultural Operation				
a) Sowing:				
b) Thinning:				
c) Weeding: and				
d) Hoeing:				
iv) Fertilizer:	20 kg. N	7.00	140.00	140.00
v) Insecticide & Pesticide	1.5 lit. Hilden	100.00	150.00	150.00
vi) Harvesting; Retting; Drying; Bundling etc.:	100 labourers	12.00	1200.00	-
vii) Harvesting & chipping :	74 labourers	12.00	-	900.00
Total Cost			Rs. 3410.00	Rs. 3110.00
<b>Production &amp; Profit</b>				
i)	F: 20 quintal/ha P: 8 tonnes/ha	Rs. 250.00/q. Rs. 5000.00/t.	Rs. 5000.00 -	- Rs. 40000.00
ii) Cost of carriage and paper pulp production/ton	-	-	-	Rs. 2500.00/t (Rs.2500.00 x 8 = Rs.20000.00)
iii) Benefit /hact.	-	-	Rs. 1590.00	** Rs. 16890.00
* (Rs. 5000.00 – 3410.00)				** ( Rs. 40000.00 – 20000.00 +3110.00)

## Factors Contributing to Success

### Linkage Mechanisms

The policy should promote backward linkages:

- establishment of a sustained and lasting linkage between the farmers and the processors based on mutual trust and benefits by utilizing the existing infrastructure of cooperative, village panchayats and such other institutions.
- development of futures market in the best interest of both the farmers and the processors ensuring a minimum price stability to the farmer and a sustained supply of raw material to the processor.
- mechanism to reduce the gap between the farm gate price of agroproduce and the final price paid by the consumer.

- d) setting up of an equalization fund to ensure sustained supply of raw material at a particular price level and at the same time to plough back the savings occurring in the eventuality of lower price to make the Fund self-regenerative.

The policy should promote forward linkages

- a) establishment of a strong linkage between the processor and the market to effect cost economies by elimination of avoidable intermediaries.
- b) establishment of marketing network with an apex body to ensure proper marketing of processed products.
- c) development of marketing capabilities both with regard to infrastructure and quality in order to promote competitive capabilities to face not only the WTO challenge but to undertake exports in a big way.

#### *Export-led Growth and Linkage*

Exports are supposed to enhance economic growth. There is considerable evidence supporting the *export promotion hypothesis* as a development strategy. The “success” stories of some countries like Hong-Kong, Singapore, South Korea and Taiwan need no further elaboration. The basic hypothesis is that growth in real exports leads to growth in real GNP. Trade theorists pinpoint a number of factors causing this link. Thus, we may postulate that most developing countries’ growth has been influenced by their dependence on primary commodities export. The relevant economic theory underlying this primary-export-led growth is the *staple theory of growth*. The staple theory emphasizes three kinds of benefits to a trading country –

- improved utilization of existing resources,
- expanded factor endowments and
- linkage effects.

We can state the staple theory in the form of a disaggregated multiplier-accelerator mechanism. The domestic investment resulting from the increased activity of the export sector can be disaggregated into three linkage effects: backward, forward and final demand linkage as follows:

- *Backward linkage* measures the induced investment in the home-production of inputs, including capital goods, for the expanding export sector. The most important example of backward linkage is the building of necessary infrastructure to enable exportation. Facilities established to serve the staple industry, such as roads, electric and water supplies, will lower costs in other potential industries and may stimulate further investment.
- *Forward linkage* measures the induced investment in industries which use the export industry’s output as an input. The most obvious and typically most important is the further processing of the output from the export sector. The output from the processing industries may be used domestically or exported. The processed exports increase the value added from the export sector in foreign markets.
- *Final demand linkage* measures the induced investment in domestic industries producing inputs (both consumer and intermediate as well as services) for the export sector. Its prime determinant is the size of the domestic market, which is in turn dependent on the level of income - aggregate and average - and its distribution. Final demand linkage will tend to be higher, the higher the level of income and the more equal its distribution.

Institute-industry linkages, though growing, are still very poor. The IITs have the strongest linkages with industry, and the involvement drops dramatically in other institutes. If the IITs have a score of 70 on the linkage with industry whilst other institutes have a score of 18. In the chemical sciences, only a fourth of the curricula are decided along with industry, through the figure goes up to around 50 in other disciplines like biology and physics. In agriculture it is still poorer than chemistry. There is very little institutionalized relationship between industry and institutes, and even today, personal relations are the most preferred medium of interaction. Tripartite relations between industry-institutes and farmers are far away.

### **Opportunities for Mainstreaming and Scaling-Up**

The main purpose of this paper is threefold. The first is to present sustainable development as both a vision for a better world and an obligation to realize it. The second is to argue that the UN's Millennium Development Goals (MDGs) provide the road map for achieving sustainable development as of by our common minimum programme of Government of India. And the third is to propose that the successful implementation of the MDGs requires action on three fronts, namely (a) defining what must be done if the MDG are to be met; (b) agreeing on and effectively applying the partnerships needed to achieve the MDGs; and (c) resolving the challenges facing developing countries, especially those within the South East Asia in implementing the MDGs and GOIs action plan

It was noted that the overarching objectives of and essential requirements for sustainable development are poverty eradication, changing unsustainable patterns of production and consumption, and protecting and managing the natural resource base of economic and social development. It was further noted that at the domestic level, the basis for SD were sound environmental, social and economic policies, democratic institutions responsive to the needs of the people, the rule of law, anti-corruption measures, gender equality and an enabling environment for investment.

Social complexities have made agriculture a politically important subject in post independence India. Govt. intervention in agriculture is considerably higher than other sectors of the economy, considering that most of India's farmers do subsistence farming and not commercial farming unlike in several developed nations.

The Govt. encourages and promotes organization of agriculture and processing through the development of farmer co-operatives. There are 353,000 co-operatives with 175 million members involved in agro-processing units, sugar factories, dairy, cotton spinning, and oilseeds processing, besides 6,000 primary co-operative marketing societies in India. Despite a favourable Govt. policy, co-operatives have performed rather poorly. Barring few exceptions, notably the Gujarat Milk Marketing Federation, they have been unable to sustain their operations profitably, and are dogged by financial problems besides excessive bureaucratic and political intervention.

Agriculture is not considered an industry in India. Therefore, commercial or industrial development credit is not available to this sector unlike other industrial activity. As a result, there has been limited involvement of organized private sector in primary agriculture and marketing activities. However, recent policy announcements to promote integrated food processing as a key focus area, have seen some states enact legislation to allow contract farming schemes and also

leasing of state-owned holdings for integrated food processing industries in the private sector. PepsiCo, Unilever, Seagram, ConAgra and McDonald's have successfully established contract procurement systems for fruits, vegetables and oil seeds even though long gestation periods were involved in their endeavors. Contract farming by the corporate sector faces major procedural hurdles in import of foreign planting materials, due to India's complex phytosanitary regulations and post entry quarantine procedures.

The imperatives of market liberalization under the WTO influence India's agriculture significantly. India has committed to opening up all agriculture products including products that were initially restricted for imports only by Govt. agencies. The increased privatization of agriculture and mechanisms for price protection to farmers in the post-QR regime are an important part of government's strategy for agricultural growth, as embodied in the New Policy announced in 2000. The new policy has targeted a 4% annual growth rate by addressing the following aspects:

- Efficient use of resources and technology
- Making available credit to farmers,
- Protecting farmers from seasonal and price fluctuations
- Private sector participation to be promoted through contract farming and land leasing
- Institutionalization of farm credit
- National agriculture insurance scheme
- National livestock breeding strategy

However, the policy needs to be translated into actionable programmes to give effect to the vision and that is the reason why the present discussion is meant for to analyze the potentialities and problems of agro-industries in eastern India. While diversifying the farm sector to promote employment opportunities, we will have to identify thrust areas such as agriculture, sericulture, aquaculture, poultry, dairy and forestry; evolve appropriate processing and preserving methods for the produce; and develop post-harvest technology and communication facilities for transporting it to markets. In this regard, establishment of a proper linkage between the industrial and agricultural sectors to produce agricultural equipment or tools becomes essential.

**Title of Best Practice:** Pasture Rotation for Cattle<sup>6</sup>

**Country:** Kyrgyzstan, Issyk-Kul region

**Authors:** Abdybek Asanaliev and Talant Sydykbaev<sup>7</sup>

**Category of Practice:** Soil and Water Conservation, Natural Resource Management

### **Context and Genesis**

The production system concerns milk production and training of farmers the social, economic and institutional context comprises Groups of poor farmers was organized for conservation of mountain natural pasture. Farmer's group is NGO. Farmers rent of pasture from local government and sale of milk to local population. The problems that gave rise to this case study were: poverty of farmers, soil erosion and pasture degradation. The organizations and stakeholders who were involved were farmers, NGO's and local government.

### **The Practice**

#### Innovations or Changes Introduced

Pasture rotation for the reduction of pasture degradation was implemented. Before farmers have no experience to use pasture rotation. Massive of mountain pasture was divided to 5 sectors. Chart of grassing was done. The responsibility of farmers was determined. Monitoring of pasture rehabilitation was developed.

#### Main Activities

Social researches was conducted. Farmers were trained for pasture management. Farmers were organized to initiative group (NGO). NGO work in association with Local government. Under assistance of the authors they developed project and took grant.

Farmer's contributions were 20 cattle, salary for cowboy, construction of cowhouse and reservation plot for monitoring of pasture.

The main stakeholders in implementation were: farmers, Local government (LG), local people of village, NGO, Soil and Water Conservation specialists, and Rural Advisory Service (RAS). The main target groups were poor farmers and NGOs.

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<sup>6</sup> IFAD Supported Case Study

<sup>7</sup> Central Asia Mountain Program (CAMP), Bishkek, Kyrgyzstan.

## **Assessment and Impact**

The project was considered successful because individual farmer could not rent pasture, but in according to law local government was able to give pasture for rent for organizing group of farmers to improve natural resources.

Members of NGO (farmers) have a good possibility to get more production from cattle. Local government has benefited from improve of pasture over which they have responsibility. Rural people have possibility to buy milk with cheaper prices then commercial market.

Poor farmers pay symbolic price for rent. The productivity of cattle was improved. Poor people's livelihoods were improved. The number of poor people's cattle has grown. The milk supply was improved.

Collective use of mountain pastures under support of local government was demonstrated. All contributions are small.

## **Factors Contributing to Successes and Failures**

The problem encountered in implementing the practice was that unorganized farmers overgraze the pastures. Rotation roles and border of pasture developed by NGO addressed this problem.

The key driving forces in managing change were the three persons elected to manage the farmer groups. They take some agricultural education.

Main reasons identified contributing success were:

- Farmers were trained using methodology of Partnership assessment of rural locality (PRA) and On Farm Research.
- Management group are very creative, farmers are working amicably
- Local government support to protect farmer's interests. NGO got some agreements with non organized farmers to protect their pasture. Social stability was achieved.
- National law allows rent for long term period. The democratization of use of natural resources is achieved

## **Opportunities for Mainstreaming and Scaling-Up**

The practice is suitable for scaling up as there is also experience of this in Kazakhstan. The risks associated with scaling up are that large milk producers can increase prices for milk might force the NGO and farmers to increase prices too. To promote this practice elsewhere requires promotion in other villages by RAS, LG and the CAMP programme.

## **References**

Report on independence monitoring in Central Asia Mountain Program (CAMP), Bishkek, Kyrgyzstan.



**Titre:** Développement de l'agro-pastoralisme dans la zone de Touicha<sup>8</sup>

**Pays:** Tunisie, Région de Kasserine

**Auteurs:** Rym Ben Zid<sup>9</sup>

**Catégorie Pratique:** Appropriation d'innovations techniques

## Contexte et sa Génèse

### Description du Système de Production ou du Service

Système agraire présentant des zones de culture (plantations en irrigué (pommier) ou en pluvial (amandier et olivier) et cultures annuelles (orge et blé)), une zone proche des habitations où est concentrée la réserve fourragère (cactus) et des zones de pâturage (couvert végétal constitué d'alfa, d'armoise...). Des systèmes d'élevage ovin et caprin dont l'alimentation est basée sur le pâturage ou bien conduits en hors sol sont associés à des systèmes de culture jachère/orge ou blé et plantations d'oliviers/amandiers

### Description des Contextes Social, Économique et Institutionnel

Il y a une forte différenciation entre les exploitations agricoles puisqu'il existe, d'une part, une catégorie d'exploitants sans terre dont le capital d'exploitation est limité et, d'autre part, des exploitants disposant de superficies relativement étendues et d'un capital d'exploitation appréciable (quelques dizaines d'ovins et/ou caprins). Il n'y a pas à proprement parlé d'organisations paysannes dans la zone.

Le contexte économique est un contexte dans lequel le prix des céréales aux producteurs est fixé. De plus, l'orge destinée à l'alimentation des animaux est subventionnée notamment durant les années de sécheresse. Le prix du bétail est fixé par le jeu de l'offre et de la demande sachant que les tunisiens sont de grands consommateurs de viande ovine et qu'il existe un marché pour cette production. Quand au prix des pommes, il est fixé par le jeu entre les producteurs, propriétaires de chambres froides et transporteurs. Généralement les agriculteurs sont à la merci des deux dernières catégories citées étant donné qu'ils sont dépendants d'eux pour le transport et l'entreposage des fruits.

La zone rentre dans l'aire d'intervention du Commissariat Régional au Développement agricole (CRDA): il n'y a pas eu à proprement parler de projet réalisé par le CRDA dans cette zone et la vulgarisation dont a également la charge le CRDA reste limitée.

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<sup>8</sup> Étude de cas soutenu par IFAD

<sup>9</sup> Consultante, Tunis, Tunisie

### Problème ayant Permis l'Adoption de ces Pratiques

Réduction de l'aire de pâturage et changement des circuits de pâturage (mécanisation de l'agriculture dans le Nord du Pays) durant le 20<sup>ème</sup> siècle suite à la colonisation. Désagrégation des systèmes agraires au niveau national suite à la colonisation et fracture des complémentarités régionales en terme de gestion des ressources pastorales et de l'approvisionnement en céréales.

### Organisations et Parties Prenantes qui ont Participé à sa Conception

Différentes catégories d'agriculteurs, éleveurs, Ministère de l'agriculture et Office de l'Elevage et des Pâturages, négociants.

## **La Pratique**

### Description Spécifique des Innovations ou Changements Introduits

Développement des cultures irriguées notamment la culture de pommier grâce à des sources d'eau existantes près d'un certain nombre d'exploitations. Le développement du pommier en irrigué a eu lieu, également, dans la zone grâce à l'installation d'un forage profond par le Ministère de l'agriculture : les agriculteurs ayant des disponibilités financières suffisantes s'approvisionnent en eau à partir de ce forage pour irriguer leur culture de pommier. La superficie de pommier en irrigué au niveau de chaque exploitation ayant bénéficié de l'eau du forage est limitée (moins de un hectare). Un nombre réduit d'exploitations a pu bénéficier d'eau d'irrigation.

Il y a eu développement de la culture de figuier de barbarie ou cactus (Opuntia). Le figuier de barbarie s'est développé suite à une série de politiques et projets réalisés dans la région par l'état tunisien. Le figuier de barbarie est une plante locale et rustique qui était à l'origine cultivée par les agriculteurs de la zone car résistante à la sécheresse. A l'origine, elle servait de clôture. Mais sous l'impulsion du Ministère de l'agriculture, la culture de cette plante s'est développée notamment car l'Office de l'élevage et des pâturages donne une subvention (montant par hectare) aux agriculteurs acceptant d'étendre la superficie plantée en figuier de barbarie. Donc, le figuier de barbarie est devenu une plante cultivée à part entière puisque dans la zone, il existe des parcelles plantées en figuier de barbarie. De plus, l'Office de l'élevage et des pâturages a introduit une autre variété de cactus, le cactus inerme. Cette innovation a été réalisée dans le but de limiter la pression sur les ressources ligneuses, les femmes les utilisant comme combustible pour brûler les raquettes de cactus pour les débarrasser de leurs piquants avant de les donner aux animaux. De plus, et il y a eu développement d'élevage ovin hors sol.

### Principales Activités Réalisées et en Particulier Étapes et Séquences,

- En ce qui concerne l'élevage ovin hors sol, les éleveurs achètent et engraisent des agneaux de lait qu'ils revendent après 3 ou 4 mois. Cette opération est répétée trois ou quatre fois par an. L'alimentation des agneaux est basée sur l'orge subventionnée. Ces élevages font l'objet de contrat d'associations, le négociant fournissant le capital (pour l'achat des agneaux) et les disponibilités financières (pour l'achat des aliments) et l'éleveur fournissant la main d'œuvre; le bénéfice est partagé à part égale entre les deux associés.
- En ce qui concerne la culture de figuier de barbarie, il y a plantation de raquettes de cactus et quelques irrigations sont réalisées au début de la plantation pour aider le

démarrage des boutures. Il n'y a pas à proprement parlé d'entretien de la culture. Les raquettes de cactus sont collectées au fur et à mesure des besoins des animaux sur l'exploitation et notamment pendant les périodes de soudure (quand il n'y a pas d'herbe disponible) ou pendant les années de sécheresse. Dans le cas du cactus, les femmes passent au feu les raquettes avant de les découper pour les donner aux animaux. Sinon, dans le cas du cactus inerme, ces raquettes sont découpées directement avant d'être données aux animaux.

- En ce qui concerne les plantations de pommier, il y a eu installation de la culture. Les principales opérations culturales effectuées sur la culture du pommier en irrigué sont : l'opération de la récolte en septembre, l'opération de la taille au mois de janvier et l'irrigation (il y a 4 irrigations qui sont conduites du mois de mai au mois d'août). La culture du pommier telle que conduite dans la zone est assez sommaire étant donné que l'expérience des agriculteurs est limitée et qu'ils n'ont pas eu accès aux conseils des vulgarisateurs en terme de conduite de la culture.

### Ressources Utilisées

Concernant l'élevage ovin hors sol, les différentes ressources utilisées sont la force de travail des paysans sans terre, le capital et les disponibilités financières apportées par le négociant: pour l'engraissement de 20 agneaux<sup>10</sup>, le capital s'élève à 2000 DT (1227 Euros), les consommations intermédiaires à 2600 DT (1595 Euros).

Concernant la culture de pommier, les consommations intermédiaires s'élèvent à 765 dinars tunisiens (469 Euros) par hectare.

Concernant les plantations de figuiers de barbarie, les consommations intermédiaires s'élèvent à 0 car il s'agit de plantations rustiques qui ne sont pas entretenues.

Autant dans le cas de la culture du pommier en irrigué que dans le cas des plantations de figuier de barbarie, c'est la force de travail familiale qui est utilisée pour effectuer les différentes opérations culturales. Les femmes sont très impliquées dans l'activité agricole étant donné que l'émigration est importante dans la zone : il y a une émigration temporaire des chefs de famille dans les zones où il y a des opportunités d'emploi et une émigration de plus longue durée des jeunes hommes célibataires. L'émigration est d'autant plus importante selon que l'on se trouve dans un cycle d'année sèche et de ce fait, l'implication de la femme dans le travail agricole est d'autant plus importante.

### Les Principales Parties Prenantes et Acteurs qui étaient Impliqués dans la Réalisation et qui ont Bénéficié des Résultats

Les principales parties prenantes sont l'Office de l'élevage et des pâturages, le CRDA, les différentes catégories d'agriculteurs impliqués, les négociants en bétail, les propriétaires de chambres froides qui achètent la production de pommes.

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<sup>10</sup> Les agriculteurs qui s'adonnent à cette activité engraisent 4 bandes de 20 agneaux par an.

### Les Principaux Groupes Bénéficiaires

Les principaux bénéficiaires sont les agriculteurs de la zone:

- concernant le développement de la culture du pommier : les agriculteurs disposant de parcelles proches de sources d'eau ou disposant de disponibilités financières suffisantes pour acheter de l'eau et la transporter,
- concernant le développement de la culture de figuier de barbarie : la plupart des agriculteurs de la zone notamment ceux pouvant justifier d'une taille de troupeau importante,
- concernant le développement des ateliers d'élevage ovin hors sol : les négociants en bétail disposant du capital mais également les petits paysans sans terre ne disposant que de leur force de travail et du savoir faire.

### **Evaluation de l'Impact de la Pratique**

#### Considéré comme un Succès

Les agriculteurs dont les parcelles sont proches des sources d'eau ont développé la culture du pommier car cette culture est plus rentable que les cultures annuelles (blé et orge). De plus, c'est une culture de vente qui procure des disponibilités financières aux agriculteurs. Les agriculteurs ont développé cette culture car la culture de pommier en irrigué existe dans une zone voisine où elle est une des principales activités. De plus, les conditions de développement de la production de la pomme étaient réunies : existence de chambres froides, existence d'acheteurs, existence du savoir faire... Compte tenu que cette culture est irriguée, elle permet de procurer un revenu régulier même en année de sécheresse : les agriculteurs arrivent ainsi à maîtriser une partie des aléas naturels.

Les agriculteurs ont adhéré à la culture du figuier de barbarie car l'utilisation des produits et sous produits de cette plante sont multiples : collecte des fruits pour la consommation humaine, utilisation des raquettes comme combustible, utilisation des raquettes comme aliment de bétail. Les agriculteurs de la zone ont développé cette culture car les raquettes de figuier de barbarie sont des réserves fourragères qui permettent de combler le déficit fourrager en année de sécheresse (7 à 8 années sur 10), de ce fait de stabiliser la taille des troupeaux ovin et caprin et d'éviter une décapitalisation massive.

L'élevage ovin hors sol a été développé dans la zone car les conditions de développement de cette activité ont été réunies : il existe un marché pour les agneaux engraisés, il existe des négociants disposant du capital pour l'achat des très jeunes agneaux et il existe un savoir faire local pour engraisser les ovins.

#### Evaluation des Bénéfices pour les Parties Prenantes

Le groupe le plus vulnérable au niveau de la zone est le groupe des paysans sans terre qui ont développé les élevages ovins hors sol. La valeur ajoutée procurée par cette activité est de 600 dinars Tunisiens (368 Euros) pour 4 bandes d'agneaux engraisés durant une période d'une année.

Les exploitations ayant développé la culture de pommier en irrigué sont des exploitations disposant d'un capital d'exploitation important puisqu'elles ont pu investir pour la mise en place

de cette culture (20 à 30 brebis, superficie de 10 à 15 hectares). Ces exploitations ont une valeur ajoutée annuelle qui varie de 4000 à 6000 dinars tunisiens (2450 Euros à 3680 Euros). Le rapport de la Valeur Ajoutée Brute en cas d'année sèche par rapport à celle en cas d'année pluvieuse varie de 1 à 1,5). C'est à dire que la culture du pommier permet de stabiliser le revenu de l'exploitation. La valeur ajoutée procurée par la culture du pommier en irrigué est de 7645 dinars tunisiens par hectare (4690 Euros).

Dans le cas des exploitations qui ont investi dans la plantation du cactus (épineux ou inermes), les exploitations qui ont tiré le plus de bénéfice de ces plantations sont les exploitations disposant déjà d'une superficie suffisante pour le développement de ces plantations, disposant de ressources fourragères alternatives (notamment les exploitations disposant de ressources alfatières importantes ou proches de la zone de montagne où le couvert végétal est plus développé que dans la plaine). La superficie consacrée aux plantations de cactus est supérieure à 5 hectares. Ces exploitations ont pu développer leurs élevages ovins et caprins (superficie de 40 à 50 hectares et troupeau ovin de 30 à 40 brebis et troupeaux caprins de 15 à 20 chèvres). Les ressources fourragères procurées par les plantations de cactus ont permis à ces exploitations de stabiliser la taille de leurs troupeaux même lors d'un cycle d'années sèches: la valeur ajoutée est de 8000 Dinars Tunisiens en année sèche et de 16000 Dinars Tunisiens en année pluvieuse. Le rapport de la Valeur Ajoutée en année sèche par rapport à celle en année pluvieuse est de 1 à 2 pour ce type d'exploitations.

La deuxième catégorie d'exploitations qui a investi dans les plantations de cactus se caractérise par le fait que la superficie est limitée (10 à 15 hectares) ainsi que la taille du troupeau (15 à 20 brebis et 10 à 15 chèvres). Ces exploitations se caractérisent par le fait qu'elles ne disposent pas de ressources fourragères alternatives comme dans le cas des exploitations décrites ci-dessus. De plus la couverture végétale (alfa, armoise, romarin) est très dégradée sur les différentes parcelles. La superficie consacrée à la plantation de cactus est beaucoup moins importante que dans le cas précédent (de l'ordre de 1 à 2 hectares). La ressource fourragère procurée par les plantations de cactus a également permis dans ce cas là la stabilisation des troupeaux pendant les cycles d'années sèches: ces plantations sont vitales pour les exploitations appartenant à cette catégorie car, en année sèche, étant donné qu'il n'est pas possible de semer du blé et de l'orge, il n'y a pas de disponibilités financières pour l'achat d'aliments concentrés. Les raquettes de cactus sont le seul aliment qui permet de maintenir les troupeaux. La valeur ajoutée par exploitation est de 370 Dinars Tunisiens/an (227 Euros) en cas d'année sèche et de 2220 Dinars Tunisiens/an (1362 Euros) en cas d'année pluvieuse: le rapport de la Valeur Ajoutée Brute en cas d'année sèche par rapport à celle en cas d'année pluvieuse varie de 1 à 6.

Pour évaluer l'importance de la plantation du figuier de barbarie dans la zone, il est nécessaire de dire que les raquettes de figuier de barbarie font l'objet d'achat et de vente pendant les cycles d'années sèches: les agriculteurs qui ne disposent pas de ressources fourragères sur leurs exploitations achètent des raquettes de figuier de barbarie pour alimenter leurs troupeaux.

#### Les Impacts les plus Significatifs

L'effet le plus significatif des plantations de figuiers de barbarie est la limitation de la décapitalisation en cheptel durant les années de sécheresse. Du fait de l'existence de cette ressource fourragère, la plupart des exploitations de la zone disposent d'une ressource fourragère

pendant la période de sécheresse : les figuiers de barbarie évitent donc qu'il y ait une vente massive d'animaux pendant les années sèches (6 à 8 années sur 10 sont sèches).

L'effet le plus significatif de l'activité d'engraissement des ovins en hors sol est le fait que des agriculteurs<sup>11</sup> sans terre et sans capital d'exploitation mais disposant d'un savoir faire s'adonnent à une activité rémunératrice qui leur procure des disponibilités financières régulièrement tout au long de l'année : ils peuvent ainsi acheter des biens de première nécessité.

L'effet le plus significatif en ce qui concerne l'activité de culture du pommier en irrigué est l'augmentation du revenu au niveau de l'exploitation et de ce fait une amélioration du niveau de vie : cependant, un nombre limité d'exploitants au niveau de la zone sont en mesure de cultiver du pommier en irrigué et les superficies allouées à cette culture sont encore très limitées (de l'ordre de 0,25 ha)

### Les Résultats les plus Significatifs

En ce qui concerne, les plantations de figuier de barbarie, il y a eu attribution d'une subvention par hectare de figuier de barbarie planté. Cette subvention est attribuée par l'Office de l'Élevage et des Pâturage qui est un office national. Ainsi, tous les agriculteurs tunisiens pourraient bénéficier de cette subvention. En réalité ceux qui en ont le plus bénéficié sont les petits agriculteurs des régions arides et semi-arides. Cette politique est d'autant plus importante que ces agriculteurs étaient à l'origine des pasteurs qui se sont sédentarisés et que l'élevage reste l'activité économique la plus importante au niveau de la zone : l'élevage est le moteur du développement de la zone puisque les animaux constituent le capital sur pied.

### **Facteurs Contribuant aux Succès et Échecs**

#### Problèmes Rencontrés et Solutions Trouvées quand la Pratique a été Réalisée.

Concernant, les plantations de figuier de barbarie, étant donné que les raquettes étaient données aux animaux, les femmes les passaient au feu pour les débarrasser de leur piquant. Cela a occasionné une grande pression sur les ressources ligneuses de la zone et notamment les ressources alfatières. Ainsi, l'OEP a introduit une variété de cactus inerme pour diminuer la pression sur les ressources naturelles.

En ce concerne la culture de pommier en irrigué, il n'y a pas de points d'approvisionnement en intrants, les agriculteurs sont obligés d'aller acheter les intrants (pesticides et engrais) dans des localités éloignées ce qui engendre des coûts supplémentaires de transport. Les services de vulgarisation ne sont pas très présents sur le terrain et les agriculteurs ne disposent pas de suffisamment d'informations sur la culture du pommier. Ils se sont informés auprès des arboriculteurs de la zone de Sbiba dont une forte proportion de la superficie est consacrée à la culture de pommier en irrigué.

#### Principales Raisons ayant Contribué au Succès

Il n'y a pas eu à proprement parlé de formations réalisées dans cette zone. Concernant la plantation de cactus, cette technique était connue dans la zone depuis très longtemps puisqu'à

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<sup>11</sup> C'est la catégorie d'exploitants la plus marginale.

l'origine les agricultures plantaient autour de leur habitation une ou deux rangées de figuier de barbarie en guise de clôture.

Concernant l'engraissement hors sol, il y a un savoir faire dans la zone en terme d'engraissement et les agriculteurs ont été appuyé ponctuellement par les agents de terrain de l'Office de l'Elevage et des Pâturages.

Concernant les plantations de pommier en irrigué, les agriculteurs de la zone n'ont pas eu droit à des formations mais se sont formés sur le tas au contact des agriculteurs de la zone voisine de Sbiba où les cultures de pommiers en irrigué sont très développées. Ils n'ont pas eu accès aux conseils des vulgarisateurs notamment en ce qui concerne l'itinéraire technique, les traitements à apporter.

#### Organisations ou Champions qui ont été Déterminants pour le Succès

Les agriculteurs ont été les premiers champions qui ont permis la réussite de ces trois innovations (plantations de figuier de barbarie, engraissement et développement du pommier en irrigué) malgré leurs moyens limités. Le Ministère de l'Agriculture a mis en œuvre des politiques appropriées notamment en subventionnant le prix de l'orge et en prenant des mesures d'urgence lors des cycles d'années sèches et en attribuant des subventions pour les plantations de figuier de barbarie.

#### Local ou Raisons Externes

Les plantations de figuier de barbarie se sont développées car les ressources fourragères naturelles de la zone ne suffisaient plus à couvrir les besoins alimentaires des animaux. La dégradation de la nappe alfatière dans la zone est avancée. Bien que l'exploitation de l'alfa est régie par le code forestier (les agriculteurs<sup>12</sup> n'ont pas le droit de défricher les parcelles couvertes d'alfa au-delà d'un certain seuil), la nappe alfatière est réduite à une peau de chagrin. De plus, compte tenu de la rupture des anciens circuits de transhumance de la sédentarisation des pasteurs et de l'augmentation de la pression démographique, la pression sur les ressources naturelles a énormément augmenté ce qui a amené les habitants de la zone à trouver d'autres alternatives: élevage hors sol, plantations de figuier de barbarie, développement de la culture de pommier en irrigué.

#### Conditions plus Globales

Ce qui a permis l'émergence de cette activité d'engraissement en hors sol est la politique de l'Etat de subvention de l'orge (aliment de bétail) notamment pendant les cycles d'années sèches. De plus le programme d'attribution de subvention pour la plantation de figuier de barbarie a joué un rôle certain dans le développement de cette culture.

### **Opportunités pour la Généralisation de cette Pratique**

#### Possibilité de Généralisation au Reste du Pays et d'Extrapolation dans d'Autres Pays,

La pratique des plantations des figuiers de barbarie est largement reproduite dans les régions voisines situées dans le même étage bioclimatique.

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<sup>12</sup> Les agriculteurs ont seulement un droit d'usage sur la nappe d'alfa c'est à dire qu'ils peuvent faire pâturer leurs animaux librement et de manière privative sur leurs parcelles couvertes d'alfa).

La culture du pommier peut être développée y compris dans la zone de Tiouicha. La pratique de l'engraissement des ovins hors sol est également une pratique largement répandue en Tunisie où elle s'est développée notamment dans les zones arides à semi-arides.

#### Les Risques Associés à la Généralisation

Les risques liés à la généralisation de la culture du pommier en irrigué sont:

- la saturation du marché et donc la chute des prix,
- le manque de capacité de conservation qui entraînera une perte des produits,
- les effets négatifs sur l'environnement dus à l'utilisation des pesticides et engrais,
- l'épuisement des ressources souterraines en eau qui sont des ressources fossiles c'est-à-dire non renouvelables.

Les risques liés à la généralisation de l'engraissement des ovins:

- la saturation du marché et donc la chute des prix,
- l'autre risque majeur encouru par les éleveurs et ayant un effet majeur sur la durabilité de la pratique est le fait qu'une fois la vérité des prix rétablie et la subvention sur l'orge levée, une telle pratique ne sera plus rentable.

Les risques liées à la plantation du figuier de barbarie: il n'y a pas à proprement parlé de risque lié à la plantation du figuier de barbarie. Le seul risque est que cette culture puisse concurrencer les autres cultures en terme de superficie mais étant donné que l'élevage est l'activité principale dans la zone, ce risque est limité.

#### **Pour Promouvoir cette Pratique**

En ce qui concerne les plantations de figuier de barbarie: elles pourraient être généralisée dans d'autres pays présentant des zones agro-écologiques analogues à celles où sont situées les plantations en Tunisie.

En ce qui concerne la culture du pommier: elle peut être développée autre part à condition que toutes les conditions soient réunies: agriculteurs disposant de la technicité nécessaire, présence d'une source d'eau d'irrigation, conditions édaphiques et climatiques adaptées, présence d'un débouché commercial pour la production... Cette culture existe déjà dans d'autres pays.

En ce qui concerne la pratique de l'engraissement des ovins : ce qui fait la spécificité de cette pratique, c'est la possibilité d'engraisser les animaux avec un aliment acheté à bas prix, la présence d'un débouché commercial et la présence de négociants disposant d'un capital. Si ces conditions sont réunies (politique de prix adaptée, débouché commercial et acteurs disposant de capital), il sera possible de développer cette pratique dans d'autres pays.

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**Title of Best Practice:** Agro-pastoralism in the area of Tioucha

**Country:** Area of Tiouicha, Governorate of Kasserine, Tunisia

**Author:** Rym Ben Zid

**Category of Practice:** Adoption of technical innovations that have induced major changes in agrarian and production systems in an evolving political and economic context

### **Context and genesis:**

- Zone I : highest zone, forested, Vegetative cover degraded (Pinus Halepensis and Junyperus), grazing area and collection of plants (for sheep and goats feeding) and firewood
- Zone II : intermediary area, alternation of cultivated areas (30%) (fruit tree crops/cereals) and of non cultivated areas (70%) (dense vegetative cover : alfa, rosmarinus, artemisia), plantations of cactus nearby the habitations
- Zone III : lower area, alternation of cultivated areas (60-70%) and non cultivated areas (30-40%), vegetative cover more degraded than in the zone II, area of swelling (rivers with irregular flows according to the season)

- **Brief description of social, economic and institutional context**

There is a differentiation between farmers because on one hand there is landless farmers and on the other hand there are landowners (20 to 30 hectares) who also have substantial herds (30 to 40 sheep and/or goats).

The cereal price is controlled. There is a subsidy on the price of barley especially during droughts. Meat pricing depends on the demand and the offer on the market. Apple pricing is done according to the agreements reached between farmers, traders and storage facilities owners.

This area is under the supervision of the regional branch of the Ministry of agriculture : extension services are limited and there are no development projects implemented.

There is no farmer organization in the area.

- **Problem/issue or circumstances that gave rise to it or was to be tackled**

After the colonization started (1881) : the nation-wide pastoral system disturbed ( system based on inter regional complementarities (North/South) of pastures). Between 1930 and 1950, the mobility of tribes have been restricted and pasturing allowed on limited areas. The cropping areas have been extended to the low lands (Cereals/fruit tree crops), there has been an increase of the cultivated areas from 5% to 20% to 40%. Between 1930 and 1970, cactus plantations have been pulled up during the colonization and in the beginning of the independence (plantations on deepest soils)

- **Organizations and stakeholders who were involved in its conception and design.**

Farmers, herders, Regional branch of the Ministry of agriculture, Livestock and pasture

agency (office de l'élevage et des paturages)

## **The Practice**

The development of irrigated crops (apple tree crops) was possible because water sources are located near the farms. Apple tree areas per farm are limited (less than one hectare) and very few farms have developed apple tree cropping.

Opuntia cropping has been developed thanks to a series of Government projects and programs. Opuntia is an indigenous species grown because of its resistance to drought. It was originally used as a fence. Then subsidies (per hectare) have been given to farmers willing to grow Opuntia and it has become a cultivated species.

### Main activities

*Development of lamb fattening* : farmers fatten lambs during 3 or 4 months. They fatten 3 or 4 lots of lambs per year. Feeding is based on subsidized barley. There is a form of association between traders who provide the capital and cash in order to buy lambs and feed them and farmers who provide labor. Both farmers and traders get 50% of the benefits

*Development of Opuntia cropping* : Opuntia cuttings are planted and a few irrigations are carried out right after planting to make cuttings develop. Opuntia cuttings are cut and given as feed to sheep and goats according to their needs and especially to bridge the gap in summer and fall or during droughts. Opuntia cuttings are burnt in order to remove spines before giving them to sheep and goats.

*Development of irrigated crops* : the main activities carried out are the harvest in September, pruning in January and irrigation (from May to August).

### Resources required

For the development of lamb fattening, the main resources used are labor of landless, capital and cash provided by the trader : in order to fatten 20 lambs, capital needed is 1227 Euros and expenses are about 1595 Euros

For the development of Opuntia cropping, there are no expenses because they are indigenous plantations : there is no need for fertilizers.

Family labor is used to develop Opuntia cropping as well as irrigated crops. Women are involved in agriculture as men are working off farm because they can not make a living with the resources available. Migration is more important during drought periods and then women are more strongly involved in agriculture.

### Main stakeholders and actors

The main stakeholders involved are the regional branch of the Ministry of Agriculture, the Livestock and pasture agency, farmers, landless farmers, traders, owners of storage facilities.

### Main intended target groups

The main intended target groups are :

- for the development of irrigated crops : farms located nearby water sources,

- for the development of Opuntia cropping : most of the farmers in the area, mainly those owning the most important herds (sheep and goat),
- for the development of lamb fattening: traders who have got the capital but also landless who have got the know how and labor.

### **Assessment and impact**

Apple tree cropping is more profitable than annual crops (wheat and barley). It is why farmers who had access to irrigation water went for it. It is also a cash crop and there were in the area all conditions to develop apple tree cropping : storage facilities available, know how, market. Farmers can get an income even during drought periods.

Farmers adopted Opuntia cropping because there are many products and by-products : fruits, rackets can be used as combustible, rackets can be used as feed for livestock. By developing Opuntia cropping, farmers could t stabilize their herds size even during the drought periods (7 or 8 years per 10 years).

Farmers developed lamb fattening because there were adequate conditions to do it : fattened lambs can be easily , marketed, there are traders who have got capital to buy young lambs and there is the know how in lamb fattening.

The value added induced by lamb fattening is 368 Euros per year for 4 lamb lots. Apple tree cropping has been developed on farms owning 10 to 15 hectares with a 20 to 30 ewe herds. Their annual value added varies according to rainfall and it is range is between 2450 to 3680 Euros (the value added in a rainy year is 1.5 time the one in a drought year). There is stabilization in the family income from one year to another because of the irrigated crop. The value added of the apple tree crop is 4690 Euros/hectare. By developing Opuntia cropping, major benefits have been made by farms owning a substantial area and accessing to alternate fodder sources. These farms developed livestock (30 to 40 ewes and 10 to 15 goats). These farms planted more than 5 hectares of Opuntia. They maintained their herd size even during drought periods. The value added induced by these farms in drought periods is about 6153 Euros and in rainy periods 12308 Euros. Farms from another category have been planting Opuntia. Their area is limited (10 to 15 hectares) as well as their herd size (15 to 20 ewes and 10 to 15 goats). These farms do not have alternate fodder sources. These farms could stabilize their herd size during drought periods through planting Opuntia. Opuntia is vital for these farms as they do not have cash in drought periods to buy concentrates. The value added induced these farms is 227 Euros in drought periods and 1362 Euros in rainy periods.

In order to assess the importance of Opuntia, we should mention the fact that Opuntia rackets are sold and purchased during drought periods.

The most significant impact is that herd sizes are maintained even in drought periods. There is fodder resource available even in droughts. Then, there is no massive sale of sheep and goats in drought periods.

The most significant impact is that landless get an income from lamb fattening. They then get cash all the year and are able to buy goods to cover their primary needs.

Apple tree cropping has increased farm income and improved livelihoods.

In terms of significant institutional changes and policies, subsidies have been given in order to develop Opuntia. It has been allocated by the Livestock and Pasture agency. All Tunisian farmers

can get this subsidy. Small scale farmers in dry lands are the ones who benefited from this subsidy. Those farmers were, in the past, pastoralist and have now settled down and livestock is still the main activity in the area.

Some solutions to traditional problems were found and implemented. For example women used to burn Opuntia rackets to remove spines before giving them as feed to sheep and goats. Then forest resources have been put under a high pressure. Because of that the livestock and pasture agency introduced in the area spineless varieties of Opuntia.

There is no input supply locally and farmers have to go to the closest cities in order to buy fertilizers and pesticides. Transportation to these cities generates additional costs. Extension services are weak so farmers do not have information on apple tree cropping and essentially on pest management. Generally, they get some information from apple tree growers located in nearby areas.

The key driving forces in managing change have been the subsidy put on Opuntia growing, the existence of a market for apple and of local knowledge in apple tree growing and the existence of a market for lamb meat and a local knowledge in lamb fattening.

There has not been any training in the area. Opuntia growing technique is well known in the area and it is very old as farmers used Opuntia bushes as fences. There is local knowledge of lamb fattening and farmers have been assisted by agents from the livestock and pasture agency.

Farmers did not get any training in terms of apple tree growing but they have been trained through contacts with apple tree growers in another area (Sbiba). They did not get any assistance from extension services neither in apple tree cropping nor in pest management.

Farmers were the ones who made these activities successful although with limited resources. The Ministry of Agriculture implemented adequate policies by subsidizing the price of barley, by implementing emergency measures in response to droughts and by subsidizing Opuntia cropping.

Opuntia plantations developed because fodder resources available in the area could not cover livestock needs. There is a depletion in Alfa resources. Ancient roaming itineraries have been disturbed, pastoralists have been settling down, and there is a population growth : all these elements made farmers look for other options as fattening lambs, planting Opuntia and developing irrigated crops.

The subsidy put on barley made the development of lamb fattening possible especially in drought periods as the subsidy put on Opuntia cropping contributed to the extension of areas allocated to that species.

## **Opportunities for mainstreaming and scaling-up**

Opuntia cropping has been scaled up in neighboring regions located in the same bio climatic zone. Apple tree cropping can be developed else where, including in the area of Tiouicha. Lamb fattening is wide spread in Tunisia especially in dry lands.

The main risks associated with scaling up are in the case of apple tree growing: surpluses, low prices, lack of capacity for storage and loss of products, negative effects on environment because of the use of pesticides and fertilizers and depletion of non renewable resources (water). The main risks associated with lamb fattening are : surpluses, loss of profitability if the subsidy on barley is removed. The risks associated with Opuntia growing are : the only risk is that this crop can compete with other crops in terms of area.

Opuntia plantations can be adopted in other countries with similar bio climates. Apple tree cropping and lamb fattening can be adopted wherever all conditions of success are available.

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**Titre:** Les mutations récentes du système de production oasien dans la vallée de Oued-Righ<sup>13</sup>

**Pays:** Algérie

**Auteur:** Salaheddine Ben Ziouche<sup>14</sup>

**Catégorie Pratique:** Développement du système de production oasien

## **Introduction**

Depuis toujours, les régions sahariennes ont constitué une source de richesse économique, de diversité naturelle et d'échanges sociaux, construite sur un système de production dont l'examen s'avère fort intéressant. La phoeniciculture occupe une place prépondérante dans ce système constitué de différentes strates, elle subit une large et profonde évolution des contraintes et est soumise à une dynamique provoquée par la mise en œuvre des différentes politiques depuis l'indépendance de l'Algérie à nos jours.

La vallée de Oued Righ (cadre spatial de notre étude) est l'une des régions sahariennes caractérisée par un système de production oasien en perpétuelles mutations. A travers cette communication, nous tenterons de présenter les atouts et les contraintes de la production agricole de la région, l'analyse de la dynamique des systèmes de culture et des techniques culturales, l'étude des stratégies des agriculteurs et du savoir-faire local. En outre, nous ferons le bilan des retombées socio-économiques, techniques et environnementales de la mise en application du Plan National de Développement de l'Agriculture (PNDA) sur cette même région.

## **Méthodologie et Constitution de l'Échantillon d'Enquête**

Pour réaliser ce travail, une étude bibliographique a été menée sur l'agriculture oasienne afin de préciser la problématique du sujet de l'étude, de formuler des hypothèses de recherche et de collecter les données relatives à l'agriculture dans la région. Plusieurs contacts ont été établis avec des personnes directement ou indirectement concernées par le thème de recherche afin de collecter le maximum de données nécessaires à la réalisation des investigations. En deuxième étape, nous sommes passés au travail pratique sur le terrain c'est-à-dire auprès des agriculteurs désignés préalablement. Le choix de l'échantillon d'étude a été réalisé sur la base des listes des phoeniciculteurs fournies par l'administration agricole locale qui dénombrent une population de 8407 agriculteurs. Devant la dominance de la phoeniciculture dans la région, il n'a été retenu que le nombre de palmiers comme seul critère de classification des enquêtés. La classification de la base de sondage en fonction de ce critère à l'aide de l'outil informatique, a fait ressortir 3 classes différentes d'exploitations selon le nombre de palmiers possédés:

- Petits exploitants: phoeniciculteurs possédant entre 1 et 100 palmiers.
- Moyens exploitants: phoeniciculteurs possédant entre 101 et 300 palmiers

<sup>13</sup> Étude de cas soutenu par IFAD

<sup>14</sup> Faculté d'économie, Université de Biskra, Alger



- Grands exploitants: phoeniculteurs possédant un nombre de pieds supérieur à 300 palmiers

A partir de cette base de sondage classée, nous avons tiré aléatoirement notre échantillon pour l'étude; il se compose de 169 phoeniculteurs choisis à partir d'un taux de sondage de 2%. Cet échantillon représentatif regroupe et touche plusieurs catégories d'agriculteurs repartis sur tous les points géographiques de la région d'étude. Par la suite, nous avons procédé à l'exécution de l'enquête proprement dite, par la passation des questionnaires auprès des agriculteurs de l'échantillon.

Tableau N°1: Caractéristiques des exploitations enquêtées.

	Exploitations		Superficies totales des exploitations enquêtées		Propriété moyenne des palmiers par exploitation enquêtée		Propriété totale des palmiers de toutes les exploitations enquêtées	
	Nombre	%	ha	%	Nombre	%	Nombre	%
Petites	27	16	28	4	74	4	1973	4
Moyennes	90	53	236	31	188	37	16870	37
Grandes	52	31	494	65	515	59	26691	59
Total	169	100	758	100	270	100	45534	100

Source : Données de l'enquête.

### Présentation Sommaire de la Région d'Étude.

Située à 600km au sud-est de la capitale, la région d'étude de par sa situation géographique, fait partie de l'une des zones sahariennes du pays et se présente comme l'une des plus importantes régions phoenicoles en Algérie. Elle s'étale sur une superficie de 874480 ha, et se situe entre les latitudes nord 32°54 et 34°9; Elle est comprise entre les isoyetes 100 et 150. Les oasis de la vallée de Oued Righ, regroupées sur 150 km de long au sud des Aurès et le long Ouest du grand erg oriental; représentent de fait, comme une vaste dépression sud nord, bordée à l'ouest par le plateau du M'Zab et à l'est par le grand erg oriental. L'orientation sud nord de cette cuvette est marquée par la présence de 2 oueds fossiles; Oued MIYA venant du Tassili et oued Gharghar qui viendrait du massif de l'Ahagar. Ces deux oueds confluent sur une trentaine de km au sud de Tougourt et sont prolongés par l'Oued Righ, qui connaît une pente très nette vers la cote du Chott Merouane (MUNIER P., 1981).

### Conditions Pédoclimatiques.

Selon un diagramme tracé suivant la méthode WELTATLAS de Walter et Lieth, le climat de la région est caractérisé par un hiver froid et un été chaud et sec. La température moyenne relative enregistrée, varie de 21 à 22.5°C et de très hautes températures de 30 à 40°C. En revanche, les précipitations sont rares et irrégulières avec un nombre de jours de précipitations ne dépassant pas 34 jour/an. Ces précipitations sont réparties d'une manière assez anarchique au cours de l'année. Cependant, la moyenne annuelle des pluies tombées sur cette zone avoisine les 68mm.

On outre, la région se trouve exposée à des vents de directions dominantes sud-ouest et vers le Nord-Est. La vitesse moyenne est de 3.4 m/s avec un maximum de 4.4 m/s au mois d'avril. Ces vents représentent un danger pour les cultures par le sable transporté en provoquant de gros amas dunaires entraînant parfois l'immobilisation des gens pendant plusieurs heures. Le climat de la région joue un rôle très important sur la physiologie des sols. La région d'étude est identifiée pédologiquement par différents types de sols où se retrouve une alternance de sable et d'argile (limoneux) d'une profondeur de 70 à 120 cm, le plus souvent traversés par des encroûtements, ou de lits gypseux en bloc ou en graviers. (TOUTAIN. G, 1977)

#### Situation Hydraulique dans la Région d'Étude.

Compte tenu de l'aridité de son climat, l'agriculture de la région n'est rendue possible que grâce à l'irrigation; néanmoins, les ressources hydriques de cette région, sont limitées aux ressources souterraines. (PERENNES. J, 1981). Ainsi, il faut noter que seuls les complexes intercalaires (CI) et terminaux (CT) sont destinés à l'irrigation, alors que les puits dispersés dans le désert, sont utilisés par les nomades. Dans notre étude, nous nous sommes intéressés uniquement aux CI et CT; en effet, sur un débit total de 7838 l/s dans la région, seuls 561 l/s soit 7.15% du total, sont destinés à l'alimentation en eau potable (AEP) alors que la part la plus importante est accaparée par l'irrigation avec 92.84% du total. La situation hydrique dans cette région est délicate eu regard à l'importance du déficit enregistré soit 9219.62 l/s dans toute la région. Les différentes nappes dont bénéficie la région d'étude, lui donnent une importante ressource hydrique. Néanmoins, ces ressources qui sont en totalité souterraines, sont mal exploitées (le taux d'exploitation ne dépasse pas les 40%). Parallèlement, le taux d'utilisation des ressources mobilisées reste aussi relativement faible dans la mesure où il ne dépasse pas les 60%.

### **Définition et Objectif du PNDA**

#### Définition du PNDA

Pour faire sortir le secteur de l'agriculture Algérien de l'état de somnolence dans lequel il s'est retrouvé et afin de lui permettre d'emprunter dorénavant une démarche résolument économique, l'idée de le doter en septembre 2000 d'un Plan national de développement agricole (PNDA) qui s'est élargi en juin 2002 à la dimension rurale, se confirme, au fil de la mise en œuvre du PNDA sur le terrain de l'exécution, comme étant la solution idoine. Le PNDA qui est également venu parachever et conforter les réformes engagées dans le secteur est appuyé - outre l'administration agricole et les instituts techniques (les organisations interprofessionnelles, les partenaires sociaux, les Chambres agricoles, Générale des concessions agricoles, Mutualité Agricole, ainsi que par un système coopératif rénové). Ces institutions restent le partenaire privilégié de l'Etat dans l'élaboration et l'exécution du plan National de Développement Agricole. Tous les agriculteurs ont le droit de bénéficier du PNDA en suivant une démarche administrative et selon des conditions déterminées par le ministère de l'agriculture, dont la propriété d'une terre agricole et l'Adaptation du projet au système de production locale et aux conditions des milieux physiques et climatiques de la zone de plantation du projet sont les principales conditions exigées. Ainsi l'éligibilité au soutien de tout projet est fondée sur trois critères: la durabilité écologique, l'acceptabilité sociale et la rentabilité économique. Le taux de financement du PNDA de chaque projet arrive jusqu'à 75% et le montant de soutien arrive parfois à 5000000 DA ; Alors que la part d'autofinancement ne dépasse pas les 25% en moyen du coût total du projet . Les projets les plus soutenus par ce programme sont généralement ; le système d'irrigation (goût à goût et

l'aspersion) , la réalisation des forages et des bassins de stockage d'eau, des plantations arboricoles, la plasticulture la phoeniciculture, les chambre froid...etc . En plus des principales filières de production, l'Etat encourage aussi toutes les activités liées à la valorisation des produits agricoles telles que la collecte, le conditionnement, la conservation, la transformation.

### Les Principaux Objectifs du PNDA

Dans son essence même, le PNDA s'est voulu, pour ceux qui l'ont initié, un instrument qui pourrait assurer au pays une amélioration du niveau de la sécurité alimentaire qui vise l'accès des populations aux produits alimentaires, selon les normes conventionnellement admises, une meilleure couverture de la consommation par la production nationale et un développement des capacités de production des intrants agricoles et du matériel de reproduction ainsi que la promotion de l'agriculture biologique et la préservation et l'utilisation rationnelle des ressources naturelles (eau et sols) pour promouvoir un développement harmonieux et durable .

En d'autres termes, le Plan s'est fixé comme principaux objectifs de sortir de la vision aléatoire d'autosuffisance alimentaire pour s'inscrire dans une logique de sécurité alimentaire et d'aller vers un seuil minimal de production pour les produits de base. Adapter les systèmes de production aux conditions des milieux physiques et climatiques des différentes zones de production car, dans la logique du PNDA, la reconversion n'en est pas moins un facteur de meilleure rentabilité des terres arables et de diminution de l'érosion. Augmenter la surface agricole utile (SAU) par l'entremise d'une approche adaptée de mise en valeur des terres mise en valeur dans les zones Nord et Sud du pays. D'autres objectifs du PNDA qu'il est bon de rappeler, à savoir l'amélioration des conditions de vie et de revenus des agriculteurs, la promotion des productions à avantages comparatifs avérés pour leur exportation, Moderniser les exploitations agricoles et l'amélioration de la compétitivité de l'agriculture et son intégration dans l'économie mondiale, et également la libération des initiatives privées au niveau des approvisionnements en intrants, de l'écoulement et du conditionnement de la production et de la dissémination du savoir et du savoir-faire. La reconstruction de l'espace agricole et la réhabilitation des vocations naturelles des différentes régions du pays et en fin La sauvegarde de l'emploi agricole et l'accroissement des capacités du secteur agricole en matière d'emploi par la promotion et l'encouragement de l'investissement. Le plan national de développement agricole vise aussi, l'accroissement de l'investissement et l'extension des Oasis dans le sud. La reconversion des systèmes de production et utilisation rationnelle et ciblée des soutiens de l'Etat).Développer les productions adaptées aux zones naturelles et aux terroirs dans un but d'intensification et d'intégration agro-industrielle par filière (céréales, lait, pomme de terre, arboriculture, viandes rouges et blanches...) Et enfin, l'immensité des besoins des populations rurales et l'avancée de la pauvreté et de l'exclusion, ont mis en évidence la nécessité d'une stratégie forte et résolue de revitalisation des espaces ruraux et de réduction des disparités existantes.

### Dispositif de Financement

Le soutien à l'investissement agricole dans le cadre du PNDA au niveau national de 2000 à 2004 est de l'ordre de 94 milliards de dinars. Ce qui représente 6 à 7% de la valeur de notre production agricole. 80 % de ses dépenses sont orientées vers le soutien à l'investissement. Ces chiffres montrent que nous sommes loin du compte, comparé à d'autres pays à l'exemple de ceux de l'OCDE qui soutiennent leur agriculture à hauteur de 30%, l'UE avec 48%, la Suisse qui réinjecte 70% et le Canada qui a plusieurs formes de soutien.

Pour encadrer la mise en oeuvre du PNDA, une instrumentation de financement spécifique est mise en place, elle s'appuie sur :

- Le crédit agricole mutuel.
- Le fonds national de régulation et de développement agricole .
- Le fond de mise en valeur par les concessions (FMVC)

### **Le Système de Production de la Région.**

La vallée de Oued Righ se caractérise par un système de type oasien qui consiste depuis l'antiquité, en une association de trois strates végétales. Cet agro-système se localise essentiellement, sous forme d'oasis, le long de Oued Righ, aux voisinages des sources d'eau et dans les endroits où les niveaux des nappes phréatiques sont peu profonds.

#### Diagnostic des Composantes du Système de Production dans la Région.

Le système traditionnel oasien dans cette région, comporte trois strates: celle du palmier, celle des arbres fruitiers divers et celle des cultures annuelles. Le micro-climat favorable créé par le palmier, favorise une polyculture vivrière (maraîchage, fourrages, céréaliculture) en association avec un élevage, surtout caprin mais aussi ovin, de type familial et en conduite traditionnelle. (BELLA BACI . H ,1986). L'association des trois strates végétales traditionnelles est présente dans 53% des exploitations (cf. tableau 02). En supposant que les exploitations ayant à la fois des palmiers et d'autres cultures que les arbres fruitiers, puissent être considérées comme intensives, il reste que 30% des exploitations pratiquent un système de production plutôt extensif. Le système extensif est relativement plus présent dans les petites exploitations (52% le pratiquent) et dans les moyennes exploitations (30% le pratiquent). Cela s'explique sans doute par le fait que la force de travail des petites exploitations est davantage affectée à l'emploi extérieur à l'exploitation, celle-ci ne pouvant subvenir aux besoins de la famille à cause des modestes revenus qu'elle procure.

Tableau N° 2. Répartition des exploitations enquêtées selon les systèmes de culture.

	Total des exploitations enquêtées		Exploitations avec uniquement des palmiers		Exploitations avec les 3 strates		Exploitations avec palmiers + autres arbres		Exploitations avec palmiers+autres cultures	
	Nbre	%	Nbre	%	Nbre	%	Nbre	%	Nom bre	%
Petites	27	100	6	22	9	33	8	30	4	15
Moyennes	90	100	13	14	42	47	14	16	21	23
Grandes	52	100	2	4	38	73	8	15	4	8
Total	169	100	21	12	89	53	30	18	29	17

Source : Données de l'enquête.

#### Le Palmier Dattier.

La phoeniciculture premier étage de ce système, a connu un important regain d'intérêt au cours

de ces dernières années avec plus de 2.2 millions de palmiers couvrant au total une superficie de 20000 ha. Cette région est la plus importante du point de vue patrimoine phoenicicole du pays. La part du lion du patrimoine est accaparée par la variété Deglet Nour dont la qualité est reconnue tant sur le marché algérien que sur les marchés extérieurs. Si l'on compare le nombre de palmiers et leur production répertoriée en 2004, aux données équivalentes de 1980, on s'aperçoit qu'un effort considérable de plantation ait eu lieu au cours de ces dernières années et qu'une grande part du verger est de plantation récente. En effet, le total du palmier dattier est passé de 1.8 millions de pieds à 2.2 millions de pieds (dont 200 mille est plantée dans le cadre du PNDA), avec une nette réorientation de la production vers la Deglet Nour. Cette variété qui ne constituait que 30% de la palmeraie locale il y a 20 ans, en forme aujourd'hui plus des deux tiers bien qu'une grande partie des nouvelles plantations ne soit pas rentrée en production (âgée de moins de 5 ans), notamment celles plantées dans le cadre du programme national de développement agricole (PNDA) à partir de l'année 2000. Néanmoins, la production de dattes a augmenté au cours des quinze dernières années. Cette amélioration dans la production indique globalement une amélioration des rendements qui passent pour la Deglet Nour à 53 kg / pied.

Structure de propriété: Le palmier dattier est la culture dominante dans la région (99% des exploitations enquêtées). La propriété moyenne en palmiers peut aller jusqu'à 270 pieds (dont 250 pieds en rapport), la majorité des arbres étant du type Deglet Nour avec 73%, suivie par une faible part des variétés Ghars et Degla beida avec 14% et 10% du patrimoine total respectivement. Par contre, les variétés dites secondaires ne représentent que de 4% du total. Il est important de signaler que la tendance vers la Deglet Nour est surtout accélérée avec le PNDA.

Tableau N° 3 Répartition des exploitations enquêtées selon la structure et variétés de palmiers cultivées.

	Total des palmiers		Palmiers Deglet nou		Palmiers Ghars		Palmiers Degla beida		Autres variétés	
	Nombre	%	Nombre	%	Nombre	%	Nombre	%	Nombre	%
Petites	1973	10.0	1267	64.21	362	18.35	291	14.75	53	2.69
Moyennes	16870	10.0	12020	71.25	2307	13.68	1933	11.46	610	3.62
Grandes	26691	10.0	19979	74.85	3594	13.47	2155	8.07	963	3.61
Total	45534	10.0	33266	73.06	6263	13.75	4379	9.62	1626	3.57

Source : fait par nous à partir des données de l'enquête.

D'autre part, les rendements observés dans cette région, bien qu'ils soient supérieurs à ceux avant le PNDA (45kg /pieds) et à ceux enregistrés au niveau national et à ceux enregistrés à Tozeur en Tunisie (31 kg/pied), restent néanmoins, très faibles par rapport aux rendements raisonnablement possibles (100 Qx/ha) et par rapport aux rendements enregistrés dans les oasis de la vallée de Coachella en Californie où ils dépassent les 91 kg/pied. Ainsi, ces rendements sont de 53 kg/pied, 38kg/pied, 44kg/pied et 28 kg/pied respectivement pour la Deglet Nour,

Ghars, Degla Beida, et les variétés communes successivement et en moyenne. Cette faiblesse des rendements est surtout enregistrée dans les oasis où les arbres ont un âge avancé; et dans les oasis où la nappe phréatique est superficielle et la salinité excessive ainsi que dans les palmeraies plus ou moins abandonnées. (MESSAR .M,1996)

#### Importance de l'Arboriculture.

Avant le PNDA, l'arboriculture fruitière (deuxième strate de culture) restait marginalisée et pratiquée à très petite échelle avec quelques sujets de différentes espèces destinées uniquement à la consommation familiale. La proportion des agriculteurs qui pratiquaient l'arboriculture ne dépassait pas 15%. Ces arbres amandiers, vignes, abricotiers et oliviers sont dispersés entre les palmiers avec une faible densité (4 arbres/ha). Actuellement, l'arboriculture se pratique par 70% des exploitants, notamment dans les grandes exploitations, avec une densité de plus de 50 arbres/ha en moyenne. Les arbres sont majoritairement rustiques, adaptés aux conditions pédoclimatiques de la région et le type de plantation, contrairement à la période avant PNDA, se fait généralement dans des parcelles limitrophes des palmiers et rarement entre pieds, avec une conduite intensive dont le but essentiel, est la commercialisation et l'amélioration du revenu des agriculteurs. La production fruitière bien qu'elle reste faible, suite non seulement à la mauvaise conduite des anciennes plantations mais aussi, du fait que les nouvelles plantations ne soient pas rentrées en production dans la majorité des cas; ne être négligée dans la mesure où 119 agriculteurs ont un deuxième étage de production soit 70% des enquêtés. L'importance relative de cette fréquence est remarquable dans la classe 3 avec 88.46% du total de cette classe. Dans la classe 1, seuls 62.96% des enquêtés ont quelques arbres dans leurs palmeraies. D'autre part, la totalité des arbres relevant de tous nos enquêtés, ne dépasse pas les 5909 arbres soit 50 arbres par enquêté en moyenne relative et 35 arbres en moyenne absolue. Ce nombre donne un caractère très marginal à l'arboriculture fruitière compte tenu des grandes superficies dont disposent ces exploitants. Le ratio du nombre d'arbres par hectare ne dépasse pas actuellement les 8 unités (par rapport à la superficie totale du panel) et les 50 (par rapport à la superficie destinée à l'arboriculture du panel) en moyenne. L'analyse par région permet de constater que la plus grande part de ce patrimoine arboricole, se localise dans la région de Mrara et Barkhadja caractérisées par une faible salinité des sols et des conditions pédoclimatiques différentes de celles des autres zones de la région d'étude. En second lieu, viennent les oasis récentes rentrant dans les périmètres de l'APFA et du GCA ainsi que les exploitations bénéficiaires du PNDA dont les propriétaires ont tendance ces dernières années à introduire et développer l'arboriculture dans les palmeraies. Toutefois, certains propriétaires limitent volontairement l'importance de ces sous-cultures (arboriculture sous palmier) afin de se consacrer exclusivement à l'entretien des palmiers. Cette situation n'est valable que dans les grandes exploitations; certains avancent comme argument négative l'influence de l'arboriculture sur le palmier et sur le microclimat oasien et l'insuffisance d'eau d'irrigation. Il convient de rappeler que les variétés locales sont le résultat d'une longue sélection pratiquée empiriquement par les oasiens. Bien que ne pouvant plus à elles seules être à la base d'une arboriculture rentable, elles représentent un patrimoine génétique diversifié et adapté aux conditions pédoclimatiques locales qu'il convient de connaître, de préserver et d'améliorer. (HAJJI. A ,1994)

### Les Cultures Maraîchères

A l'instar des deux étages précédents, les quelques chiffres de l'enquête prouvent que l'on assiste à un phénomène tout à fait nouveau pour la région saharienne, il ne s'agit plus de jardinage d'autosubsistance comme avant le PNDA dont le maigre surplus s'écoulait tant bien que mal sur le marché local, mais bien d'une production spécialisée destinée au marché national. Cette production s'articule autour de deux systèmes de culture:

- les cultures abritées dont le centre le plus actif est à Djamaa et qui produisent, entre octobre et mars, des tomates, des piments et des poivrons. Les tunnels sont installés dans les palmeraies et appartiennent souvent à des phoeniculteurs.
- Les cultures d'hiver de plein champs se font en grand partie à M'rara ; on produit des fèves, de l'oignon et l'ail. Les régions de M'rara et Barkadjia sont devenues l'un des principaux bassins de production du pays. Quand l'eau est disponible, la campagne d'hiver est suivie par des cultures d'été, principalement de melons et pastèques.

La part des agriculteurs pratiquant des cultures maraîchères a augmenté de 30% après l'avènement du PNDA, jusqu'à 66.27%. L'importance de la fréquence de cette catégorie d'agriculteurs est encore plus grande dans les moyennes et grandes exploitations avec 71.11% et 67.31% du total de ces deux classes respectivement. On assiste également, grâce à ce programme à une génération des serres semble gagner en importance dans toute la région. Avant le PNDA seul 2.36% (4/169) des enquêtés de l'échantillon (dont 3 sont implantés dans la commune de Mrara et l'autre à N'Sigha), cultivaient du maraîchage sous serres, chacun d'eux disposant de 4 serres en moyenne, les productions obtenues étant destinées à la commercialisation. Cependant et grâce au PNDA, le nombre de serres est devenu très important est dépasse les 250 serres dans la région, certains agriculteurs en ayant parfois plus de dix. Le plus remarquable dans cette expansion des cultures maraîchères est la spécialisation géographique qui l'accompagne; certaines localités deviennent des pôles de développement de produit précis: tomates sous abri et poivron comme Barkhadjia et M'rara. Le fait est d'autant plus important à noter qu'au Sahara, la tendance traditionnelle est plutôt à la diversification des produits et au mélange des cultures dans une même parcelle. Avant, la production de cultures maraîchères de cette zone, se destinait à l'autoconsommation et, en cas de surplus, à la commercialisation sur les marchés des chefs-lieux des communes les plus proches; seule la production de primeurs sous serre, encore très peu développée et localisée dans la région de Mrara et Barkadjia, avait accès aux marchés des villes de Nord. Sur les 112 enquêtés pratiquant ce type de spéculation dans leur palmeraie, uniquement 8 (7.14%) destinaient les cultures maraîchères au commerce alors que la majorité (78.57%) la consacre à l'autoconsommation soit 78.57% du total des concernés. Alors qu'actuellement, plus de 50% des agriculteurs ont comme principal objet la commercialisation de leur production et l'amélioration de leur revenu agricole. Comme pour toute situation économique, le succès ou l'échec tient souvent à des facteurs multiples; néanmoins, il semble que trois types d'explications se mettent en avant; elles tiennent pour une bonne part aux conditions naturelles qui offrent un bioclimat favorable et des ressources en eau suffisantes, mais également au dynamisme démographique et à la proximité des marchés de consommateurs. Ainsi, les potentialités sur le plan de précocité offertes à cette région pour les cultures maraîchères sous palmiers ou hors palmerais, constituent un axe privilégié dans le développement de l'agriculture locale dans cette région. A cela s'ajoute la possibilité d'utilisation du géothermisme des eaux albiennes dans le chauffage des serres dans certaines zones. Néanmoins, sur le plan des performances les cultures maraîchères restent très

loin des effets escomptés suite à plusieurs contraintes notamment la mauvaise conduite et l'absence de savoir-faire.

#### Les Cultures Fourragères.

Les cultures fourragères sous palmier, bien qu'encore faiblement maîtrisées et malgré les multiples contraintes sont partout présentes. En effet ; seuls 22 enquêtés parmi les 169 de l'échantillon soit 13.02 % ne les pratiquent pas dans leurs palmeraies. L'importance et la progression des pratiquants de cette culture notamment avant le PNDA, sont certainement à mettre en parallèle avec l'augmentation du nombre d'éleveurs nomades et de la forte demande de bottes de luzerne à des prix très rémunérateurs émanant des "éleveurs urbains" (chèvres pour le lait) mais aussi avec la sensibilisation pour utilisation rationnelle de l'eau. Les principaux fourrages cultivés dans cette région se limitent à la luzerne et à l'orge qui sont très résistants à la salinité. L'orge semée en automne à la volée, est irriguée en même temps que le palmier dattier et récoltée en vert entre février et avril. La luzerne quant à elle, est plus soignée, le sol est mieux préparé et reçoit des amendements de sable et de fumier. Par la pratique de ces techniques, certains producteurs arrivent à faire jusqu'à 12 coupes par an, et les rendements moyens enregistrés chez nos enquêtés avoisinent actuellement les 8 à 10 Qx/ha pour l'orge en vert et 20 à 25 Qx/ha pour la luzerne en vert. Si la quasi-totalité des agriculteurs dans cette région soit près de 86.98 % pratiquent cette culture sous-jacente pour améliorer leurs revenus et alimenter leur cheptel, notre enquête a permis de constater que 33.33 % d'entre eux déclarent que la production est destinée uniquement à l'autoconsommation de leur cheptel. 12.92 % des enquêtés bien qu'ils soient des éleveurs, vendent la totalité de leurs productions fourragères au marché et alimentent leurs bêtes à l'aide des déchets des oasis et les déchets provenant de tri des dattes. Alors que 77 enquêtés parmi les 147 pratiquant les cultures fourragères (soit 52.78 %), qui développent une stratégie mixte puisqu'ils utilisent principalement les quantités produites pour l'alimentation de leur cheptel, le surplus est vendu sur le marché à un prix de 15 à 20 DA par unité (botte de 10 kg).

#### Les Contraintes du Système de Production

Tout le poids des contraintes rencontrées explicatives de cette faible importance des strates arboricoles et des cultures sous-jacentes dans la région, ( bien que la mise en application du PNDA) est lié à l'insuffisance et/ou à l'inadaptation des actions logistiques et techniques (apports en intrants et équipements, vulgarisation de nouvelles techniques, commercialisation des produits) , la non adaptation de certaines espèces aux conditions pédoclimatiques de la région, l'exposition importante aux vents de sable, la salinité excessive des eaux et des sols à laquelle s'ajoute le faible niveau du savoir-faire des agriculteurs dans la conduite des vergers et des autres cultures. Enfin, le déficit aigu en eau et le problème de drainage ont souvent conduit les exploitants à occulter ces cultures pour consacrer plus d'eau aux palmiers. D'autres contraintes sont à signaler freinant le développement des cultures sous palmiers: le vol des récoltes et, surtout, le pullulement des sangliers qui provoque des dégâts importants aux palmeraies. En revanche, certains propriétaires (particulièrement des grandes exploitations) limitent volontairement l'importance des sous cultures afin de se consacrer exclusivement à l'entretien des palmiers et pour éviter la dispersion de la force de travail sur une superficie trop importante. Par contre d'autres agriculteurs ne s'intéressent pas aux autres cultures et laissent généralement les ouvriers bénéficier de la totalité de la récolte provenant du maraîchage dont la pratique a pour but essentiel de motiver et encourager leurs ouvriers.



### L'Élevage

L'élevage dans les oasis de la région peu soutenu par les programmes du PNDA, n'ait pas connu une grande dynamique et parfois on a enregistré même une régression du cheptel ; cet élevage reste caractérisé par la dominance de très petits troupeaux de caprins de 2 à 8 têtes par éleveur en moyenne, pour la production de lait, avec la présence de quelques têtes d'ovins (2 à 5 têtes) pour l'autoconsommation à l'occasion des fêtes, caractérisés par des paramètres zootechniques médiocres, particulièrement ceux relatifs à la prophylaxie. Cet élevage est d'autre part, disséminé à travers les parcours sahariens ou quelquefois en stabulation entravée. La situation trouve sa justification dans le fait que les bénéficiaires du PNDA étaient poussés à apporter leur contribution au financement de leurs propres investissements.

Notre enquête a permis de constater que 131 enquêtés sur les 169 de l'échantillon, sont des éleveurs soit 77.51 % du panel. Le reste ne s'est jamais appliqué à l'élevage pour une raison ou une autre. Dans le type d'élevage urbain, les bêtes sont élevées en stabulation entravée sur le lieu d'habitation. La base de leur alimentation est fournie par l'oasis qui procure les mauvaises herbes, les fourrages verts et les déchets des dattes sèches de qualité non marchande. Un complément en orge et en grains (achetés) est généralement fourni. Le deuxième type d'élevage pratiqué dans cette région, est de type pastoral. Mais, il n'est pratiqué par aucun des individus du panel

Tableau N° 4 Répartition des exploitations enquêtées selon la pratique de l'élevage.

Type d'exploitations	Total des exploitations enquêtées	Fait l'élevage		Exploitations avec ovins et caprins		Exploitations avec caprins seulement		Effectifs du Cheptel dans chaque strate			Effectifs moyens dans chaque strate		
		Nbr	%	Nbr	%	Nbr	%	Caprins	Ovins	Total	Caprins	Ovins	Total
Petites	27	18	66.67	1	3.7	15	55.55	91	9	100	5	0.5	6
Moyennes	90	68	75.56	23	25.55	45	50	508	414	922	7	6	14
Grandes	52	45	86.54	21	40.38	22	42.3	430	312	742	9	7	16
Total	169	131	77.5	45	26.62	82	48.52	1029	735	1764	8	5	13

Source : fait par nous à partir des données de l'enquête.

enquêté. Cet élevage est généralement pratiqué par des éleveurs qui se sont récemment sédentarisés dans les zones de Oum-El-Tiour, Stil et Mrara.

Ces régions conservent d'importants troupeaux qui arrivent quelque fois à 100 têtes par éleveurs. L'alimentation de ce cheptel est assurée en proportions variables par le pâturage sur les parcours, par la luzerne et l'orge produit ou achetés et par les sous-produits de la palmeraie. Contrairement au premier type d'élevage, le troupeau est à dominance ovine avec quelques têtes de caprin. Il faut noter aussi, que dans cette région, se révèle une absence de politique efficiente en matière de

préservation et de développement des races locales camelines en particulier; ainsi que l'absence de modèles concrets d'intégration de l'élevage aux grands périmètres.

#### Les Impacts Socioéconomiques du PNDA.

Après quatre années d'application, le PNDA a réussi en grande partie à atteindre son objectif et à élever la production en quantité et en qualité ainsi qu'à impulser une dynamique de relance dans le secteur. Les résultats enregistrés parlent d'eux-mêmes et témoignent de l'efficacité de cette politique et que le retour au travail de la terre n'est plus une chimère mais bien une réalité indéniable et ouvre à l'optimisme. A titre d'exemple, on peut citer que, dans le cadre du PNDA, la superficie plantée en arbres fruitiers et rustiques dépasse largement celle comptabilisée depuis l'indépendance du pays. Et près de 850 000 emplois créés, et la superficie agricole irriguée a doublé au niveau national. Dans notre échantillon d'étude nous avons constaté le long de cette étude que la mise en oeuvre du PNDA dans cette région a beaucoup des impacts socioéconomique et environnementale positives et négatives dont:

- D'abord le visage de l'agriculture de cette région est particulièrement changé, le premier changement tangible concerne l'implication de plus en plus importante par le bénéficiaire du PNDA de la main-d'œuvre salarié et plus particulièrement la main-d'œuvre saisonnière ; et le nombre moyen d'ouvrier recruté par bénéficiaire enquêté et de 4 ouvriers. De même, les bénéficiaires du PNDA annoncent qu'ils ont besoins de recruter encore plus d'ouvriers saisonniers.
- La SAT et la SAU du panel ont connu une grande modification et elles gagnent plusieurs hectares. les changements les plus visibles concernent les superficies réservées à la phoeniciculture , à l'arboriculture et au maraîchage qui sont évoluées de 25%, 100% 70% respectivement pour chaque exploitant enquêté.
- Le PNDA a permis aux bénéficiaires d'améliorer l'itinéraire technique suivi dans ses cultures, dans la mesure où on assiste à la généralisation de l'utilisation des produits phytosanitaires, et des fertilisants, l'introduction des techniques d'irrigation les plus économiques d'eau et modernes tels que le gout à goutt et l'aspersion, l'introduction de la mécanisation agricole ce qui a diminué le coût de la main-d'œuvre.
- L'influence du PNDA est plus visible chez les forages puisque on enregistré la réalisation de 60 nouveaux forages en plus de 40 déjà existant dans notre échantillon soit une évolution de 150% . Le débit moyen des forages a légèrement régressé de 11 m<sup>3</sup> à 9 m<sup>3</sup> et la profondeur moyenne des forages est passé de 70 m à 100 m. un autre impact du PNDA non négligeable, en l'occurrence la capacité de stockage des eaux qui a quadruplé de 1000 m<sup>3</sup> à 5000 m<sup>3</sup> au niveau de notre échantillon ; C'est à dire une variation absolue de 4000 m<sup>3</sup> et une progression de 400% entre les deux périodes (avant et après le PNDA).

Ainsi ce programme de développement de l'agriculture a d'autres avantages tel que:

- L'émergence d'une nouvelle catégorie d'agriculteurs et des véritables professionnels capables de relever les défis de la mondialisation. 002E
- Grâce au PNDA, l'agriculture est en train de reprendre la place qui est la sienne en tant que moteur du développement dans l'économie nationale.
- Amélioration de la valeur ajoutée dégagée par le secteur agricole.
- La disponibilité de ces produits hors saison, pendant la période hivernale, est relativement

récente et a été rendue possible et à des prix raisonnables à la portée des couches vulnérables grâce aux PNDA.

- La réduction de la pauvreté au milieu rural suite à l'amélioration des salaires versés dans l'agriculture à ceux qui ont la chance d'avoir un emploi permanent ou saisonnier sur les terres agricoles.
- La réduction des disparités existantes entre les zones rurales elles-mêmes et entre ces dernières et les villes par la promotion, le développement et l'élargissement au sein du monde rural des activités à caractère à la fois économique, social, culturel et environnemental.
- Une augmentation de la production des produits de large consommation.
- l'amélioration des conditions de vie et de revenus des agriculteurs, la promotion des productions à avantages comparatifs avérés pour leur exportation
- Le PNDA a encouragé les bénéficiaires de faire d'autres investissements (investissements induits) réalisation des hangars, achats du matériels agricoles et des veuleries , réhabilitations de leurs maison...etc

### **Un Environnement en Enjeux**

Le PNDA a des effets néfastes sur l'environnement dans la région d'étude ; tel que l'aggravation du problème de remonté du sel ce qui a influé sur les caractéristiques pedo-climatiques des sols; ce problème est enregistré au niveau de 43 % des exploitations enquêtés. L'apparition d'insectes est le deuxième problème déclaré par 40% des enquêtes de l'échantillon, tan disque 39% des enquêtés déclarent comme inconvénient du PNDA, l'apparition de nouvelles mauvaises herbes. Et enfin le problème du rabattement de la nappe qui est remarqué que dans 25% des exploitations enquêté de notre échantillon. Tous ces problèmes réunis provoquent des dégâts sur la production agricole en quantité et en qualité par conséquent sur la rentabilité des exploitations. Pour notre échantillon, le montant moyen du manque à gagner suite à ces problèmes est de 100000 DA en moyen.

### **Problèmes Rencontrés durant la Réalisation du Programme PNDA.**

Plusieurs contraintes ont empêché la réalisation du PNDA dans la région d'étude selon nos enquêtés dont les principales sont:

- Le problème du foncier agricole: L'absence d'acte de propriété des terres (généralement en indivision ) empêche une grande part des agriculteurs de la région d'étude à l'instar de d'autres au niveau national de bénéficier du programme du PNDA .
- Les contraintes bureaucratiques constituent un grand obstacle pour ceux qui n'ont pas eu la chance de bénéficier de ce programme.
- L'indisponibilité de certains entrants agricoles sur le marché local favorise l'augmentation de ses prix suite aux forte demande.
- La mauvaise qualité des arbres et des semences existantes sur le marché a provoqué l'échec des projets de plantation de certaines bénéficiaires du PNDA.
- La non maîtrise des techniques de production pour certaines agriculteurs bénéficiaires suite à l'absence du savoir-faire.
- Le rabattement de nappe a induit certaines bénéficiaires d'abandonner leurs investissements à cause d'insuffisance d'eau d'irrigation.

- Les rendements, et par conséquent les revenus des paysans, ne cessent en effet de diminuer en raison du morcellement continu de leurs terres, du mode de faire-valoir resté archaïque et de la poussée démographique sur ces terres qui ont peu de choses à donner.

## **Conclusion**

La principale conclusion à laquelle nous aboutissons à travers notre analyse révèle que le système de production dans cette région, ayant traditionnellement pour finalité une agriculture de substance, a connu un recul permanent et qu'il est même menacé de disparition. Le regain d'intérêt enregistré pour l'agriculture durant les deux dernières décennies a introduit une transformation structurelle puisqu'on assiste à une relance qui s'exprime non seulement à travers l'extension des périmètres phoenicicoles mais aussi par le développement et la mutation des systèmes de production. Ainsi, le passage de la monoculture à la polyculture, la réalisation de grands canaux d'irrigation, l'extension de la plasticulture, l'amélioration des itinéraires techniques manifestent, chacun à sa manière, le renouveau de cette agriculture. Le développement de cette dynamique s'est accéléré avec l'avènement de la loi portant APFA (1980) et avec l'application du pnda (2000). Mais, ce regain d'intérêt s'explique aussi sans aucun doute par l'évolution tendancielle à la baisse des cours de la datte sur les marchés ainsi que par les menaces des maladies pesant sur le patrimoine phoenicicole d'une part, et d'autre part, les conditions climatiques favorables durant les quatre saisons pour certaines zones. La dynamique de ce système est aussi le résultat du changement de stratégie des producteurs qui, pour se procurer un niveau de revenu élevé et afin de minimiser les risques liés à l'activité, préfèrent de plus en plus la combinaison de plusieurs types de productions. Mais, malgré cette stratégie de minimisation des risques par la diversification des activités, le système de production oasien demeure en équilibre fragile et peu productif au niveau de ses différentes strates de production par comparaison aux rendements potentiels techniquement réalisables avec le même matériel biologique disponible dans les oasis. Cette situation délicate résulte essentiellement de la conjugaison d'une série de contraintes d'ordre techniques, socio-économiques, naturelles, agronomiques et administratives.

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**Title of practice:** Role of the national agricultural development plan in the recent change in the farming system of the oasis of Oued Righ (Algeria)

**Country and region where developed:** Algeria, Region of Oued Righ, South Eastern Algeria

**Author:** Salahedine Ben Ziouche

**Category of Practice:** Impacts of an investment project on farming systems in the oasis context

### **Context and Genesis:**

#### Brief description of the production or service system

Since antiquity, there is a farming system in Oued Righ characterized by the association of 3 levels of vegetation cover: date palm trees, fruit trees and annual crops (forage, vegetables). Integrated to that system, there are family owned livestock systems (goats and sheep). This farming system was to disappear. Thank to the national agricultural development plan which is a five year program, there has been a major change : irrigation schemes are extending and farming systems are evolving , in the same time, from ,mono cropping systems towards multi cropping systems .

#### Brief description of social, economic and institutional context

There is skilled labour available in the valley of Oued Righ although the rate of unemployment is high. There are no job opportunities except in agriculture as there is not another sector of activity developed in the region. Farmers are still very keen on working in agriculture and young people very much motivated.

There is a high demand locally and regionally on agricultural products especially early vegetables and dates (Deglet Nour). There is no constraint on input supply as all kinds of inputs are available. Government agencies are willing to provide assistance to farmers.

Major objectives of the national agricultural development plan are :

- to improve food security
- to better national production marketing,
- to promote organic farming,
- to better manage natural resources for a sustainable development,
- to increase the level of income of farmers,
- to improve livelihoods,
- to promote productions for export and,
- to improve the competitiveness of agriculture in order to be integrated in the world economy.

Problem/issue or circumstances that gave rise to it or was to be tackled

The main problem that gave rise to this project is the decline of agriculture since Algeria became independent. The rate of unemployment is increasing as well as migration flows from the countryside to urban areas. Dates price is going down. So, farmers are adopting a strategy in order to reduce risks : they try to develop several productions.

Organizations and stakeholders who were involved in its conception and design.

The Ministry of agriculture and its different directorates, technical institutes, agricultural chambers, professional organizations, agricultural concessions, mutual benefit society;

**Assessment and impact:**

Problems encountered and solutions found in implementing the practice

The main constraints encountered have been :

- land tenancy : farmers have not got certificates of property and there are not, thus, eligible to the project,
- constraints related to agricultural services (bureaucracy),
- Inputs are sometimes not available so their prices go up because of the demand,
- Plantlets and seeds available in the market are not viable and it led to the failure of some of the projects (plantations...)
- There is a lack of knowledge (cropping patterns)
- Depletion of ground water resources has led to the failure of irrigation projects,
- Salinity, lack of mineral elements in the soil, warm under ground water, winds, pests

What were the key driving forces in managing change

Many mechanisms have been set up to alleviate these constraints :

- Import of equipments and inputs,
- Pest and technical control carried out by experts,
- control of drilling carried out by experts in hydraulics in order to avoid ground water depletion,
- Extension actions carried out by extension agents in order to better farmers knowledge,
- An initiative has been taken to alleviate quickly the constraint related to land tenancy,
- Chemical fertilizers have been spread on depleted soils
- Sensitization of farmers in order to adopt adequate cropping systems and to set up drainage systems to avoid soil salinity,
- Pesticides are available in the Market in order to better the pest management system,
- the financial return on capital has been quite high,
- Liberalization of agricultural products prices, Government has not been interfering anymore in price regulation in wholesale markets (fruits and vegetables) and ,
- Subsidies have been available : it helped people not willing to take loans for religious reasons to invest.

## **Opportunities for mainstreaming and scaling-up**

### Suitability for scaling up to others in rest of country, or for extrapolating to other countries

The National Agricultural Development Plan has been implemented in specific regions and only one type of farmers benefited from it. The plan has been successful so it has been scaled up to the whole country including our region : lessons learnt from the first stage have been taken into account. It is possible to scale up this plan in other regions with the same climate and social and economic features as long as agricultural products can be marketed.

### What are the risks associated with scaling up (i.e. flooding markets from over production)?

The major risks are :

- negative effects on environment as salinity which is affecting the chemical and physical characteristics of soils,
- New species of weeds and insects can be introduced in the region,
- Depletion of ground water resources because of non adequate water management,
- Surpluses may exceed the demand and thus, prices may go down,
- Lack of processing and packaging facilities.

### What has to be done to promote it elsewhere successfully

- To alleviate the constraint related to land tenancy,
- To try to slow down land fragmentation in order to maintain a level of profitability on large and medium scale farms,
- To regulate commodities and to reduce middle men interventions who are getting most of the value added and making prices to consumers go up,
- To regulate inputs import in order to control importers' benefits and to reduce farmers' expenses,
- To carry out extension actions in order to improve farmers knowledge and to make them adopt adequate techniques,
- To enhance exports,
- To set up processing and packaging units as well as storage facilities in case surpluses are exceeding the demand in the market.

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**Titre:** Adoption d'un nouveau mode d'organisation pour la gestion de l'eau d'irrigation<sup>15</sup>  
(Adoption of new mode of organization for irrigation waer management)

**Pays:** Village Toufesalt; Commune Rurale d'Ain Leuh; Moyen Atlas, Maroc.

**Auteur:** Lahssan Bekkari<sup>16</sup>

**Catégorie pratique:** Appropriation collective d'une innovation institutionnelle, à savoir, l'Association des Usagers des Eaux Agricoles (AUEA)

### Contexte et sa Genèse

#### Description du Système de Production ou du Service:

Dans la région du Moyen Atlas, l'agriculture de subsistance est largement dominante. Des exploitations dites «modernes» se sont développées sur d'anciennes terres collectives suite à des mouvements d'appropriations individuelles de la terre, elles demeurent minoritaires.

En dépit de différentes formes de dynamiques locales, la vie économique reste tributaire de la production animale. Un élevage ovin et caprin, fortement dépendant des ressources sylvopastorales, constitue une source de revenu principale pour la majorité des familles. Malgré une tendance à la sédentarisation de l'élevage, le mode transhumant continue d'exister et permet à de nombreux éleveurs d'exploiter la complémentarité des milieux.

L'agriculture pluviale est à base de céréales; les agriculteurs disposant de l'eau d'irrigation investissent de plus en plus en arboriculture.

En effet, à une échelle locale (Commune Rurale d'Ain Leuh), les systèmes de production sont en cours de mutation suite à l'adoption massive du cerisier. Cette culture, tout en valorisant les ressources en eau disponibles, a permis une augmentation substantielle du revenu des agriculteurs.

#### Quelques caractéristiques du réseau d'irrigation

<i>source</i>	<i>Superficie Irriguée</i>	<i>Superficie Irrigable</i>	<i>Longueur totale</i>	<i>Débit</i>	<i>Nombre d'irrigants</i>
Akadous	270 ha	338 ha	1942 m	120 l/s	72

#### Description des Contextes Social, Économique et Institutionnel

A l'origine, l'élevage pastoral (transhumant) constituait la base de l'activité économique locale. Il régulait la vie sociale. Celle-ci était rythmée par les mouvements des troupeaux entre la plaine et la montagne.

<sup>15</sup> Étude de cas soutenu par IFAD

<sup>16</sup> Institut National de la Recherche Agronomique, Centre Régional de Meknès, Maroc.

Actuellement, le contexte global reste marqué par une agriculture peu productive. Les terres cultivées ne représentent que 20 % de la superficie totale. La forêt (23% de la superficie totale) offre 20 à 30% des besoins alimentaires des troupeaux. On observe également une faiblesse du réseau urbain régional et des activités non agricoles (UrbaPlan International, 2002).

Le contexte institutionnel reste dominé par la forte présence de l'Etat. Néanmoins, les sociétés locales s'organisent pour gérer les ressources communes. Aussi, les terres collectives, propriété commune des tribus et placées sous la tutelle de l'Etat (Ministère de l'Intérieur) sont gérées par des «nouab» (représentants) choisis par les ayants droit. Les réseaux d'irrigation sont administrés par les communautés locales souvent selon des modes dits «traditionnels». Il est à souligner que l'augmentation de la population engendre une pression de plus en plus forte sur les ressources naturelles.

#### Problème ayant Permis l'Adoption de cette Pratique.

L'étroitesse des terres irriguées et leur occupation par les cultures peu exigeantes en eau étaient deux caractéristiques des espaces irrigués dans cette montagne. L'eau était donc abondante et largement supérieure aux besoins.

Cependant, l'eau est entrain de prendre de nouvelles dimensions suite à l'introduction massive de cultures plus exigeantes. Aussi, l'ancien mode de gestion n'est plus adapté pour répondre aux nouveaux besoins en irrigation. En effet, le principe de distribution de l'eau selon un tour d'eau établi indépendamment de la situation géographique des parcelles à irriguer peut engendrer des pertes énormes.

En plus, dans le cas du village en question, le gérant du réseau d'irrigation était seul à connaître les détails de l'organisation de la gestion. Il profitait alors de son savoir faire pour imposer sa façon de faire.

Au-delà de l'aspect production, la gestion de l'eau fait l'objet d'enjeux politiques. Tout candidat aux élections locales se devait d'avoir l'appui du responsable du réseau pour avoir une chance d'être élu.

C'est donc cette augmentation des besoins en eau conjuguée à une gestion individuelle qui a conduit les irrigants à s'approprier l'Association des Usagers des Eaux Agricoles et à mettre en place un nouveau mode d'organisation de l'irrigation.

#### Organisations et Parties Prenantes qui ont Participé à sa Conception

C'est un groupe de jeunes qui a pris l'initiative de mettre en place le nouveau mode d'organisation de l'irrigation. Faisant partie des ayants droit, ce groupe a pu, sur fond de conflit politique et profitant de la maladie de l'ancien gérant, mettre en place une nouvelle organisation de la gestion de l'eau en fonction des droits d'eau et de l'ordre de succession des champs.

## La Pratique

### Description Spécifique des Innovations ou Changements Introduits

Pour comprendre la nouvelle pratique, il faudrait la situer par rapport à un processus de changements qui a duré quelques années.

En fait, le réseau d'irrigation est très ancien. L'eau est une propriété individuelle. Cela suppose qu'à l'origine, les parts d'eau d'un propriétaire ont été acquises en fonction de sa contribution à la construction de la seguia. La communauté des irrigants délèguait une personne pour s'occuper de la gestion du réseau (une sorte d'aiguadier).

Le passage d'un mode de gestion traditionnel à une organisation dans le cadre d'une association s'est opéré en plusieurs étapes. Dans le cadre de cette nouvelle organisation, l'eau est gérée selon des tours d'eau consignés par écrit dans un livret mis à la disposition de tous les irrigants. C'est le bureau de l'Association qui assume la fonction de gestion.

### Principales Activités Réalisées et en Particulier Étapes et Séquences.

L'AUEA comme mode d'organisation a été imposée par les services étatiques comme préalable à l'aménagement du réseau d'irrigation. Un aménagement qui vise, comme indiqué dans le rapport du Projet (D.P.A., 1996), une utilisation rationnelle de l'eau par une meilleure exploitation de cette ressource et une amélioration de l'efficacité du réseau d'irrigation, estimée d'ailleurs à 50%. Il est important de noter au passage que c'est le même modèle qui est proposé partout au Maroc, sans prendre en compte les spécificités locales.

Mais ce changement des règles n'a pas eu d'impact direct sur les règles pratiques de gestion. Longtemps après cette création, datée du 17 octobre 1996, le système de gestion est resté inchangé. C'est l'aiguadier qui s'en occupait. Le rôle des membres du bureau était réduit à celui d'interlocuteur pour les travaux d'aménagement du réseau. La nouvelle institution n'était donc pas adoptée par les irrigants.

L'Association des irrigants n'était pas fonctionnelle. Elle ne s'occupait que des aspects formels comme organe représentatif auprès des intervenants extérieurs (services techniques étatiques).

Avec l'introduction massive du cerisier, l'eau est devenu un élément capital dans les systèmes de production agricole. On est passé d'une eau pour le maïs (graine des pauvres) à une eau pour les cerises (« graine des rois » en arabe). L'eau étant devenue plus précieuse, on ne pouvait se permettre une gestion non transparente.

Dans le but de mettre en place une nouvelle structure pour la gestion de l'eau, plusieurs tentatives ont été conduites. Les premières initiatives entreprises échouèrent. En cause, un manque d'appui de la part de l'État pour certains ; mais c'est surtout la crainte de l'échec renforcée par un manque d'information et une représentation négative de l'association comme forme d'organisation qui expliqueraient ces fortes réticences.

La gestion de l'eau paraissait tellement compliquée pour les différents irrigants que même le président de l'Association avoue qu'il était convaincu de l'impossibilité du changement. Les irrigants s'opposaient alors à toutes ces tentatives. Ils refusaient en conséquence de payer les cotisations. Cependant, un concours de circonstances va conduire, début 2004, à la mise en place d'une nouvelle gestion de l'eau sous le contrôle de l'Association.

### *Le Conflit Politique au Service de l'Association*

Après des années de cohabitation, l'appropriation de la nouvelle institution a eu lieu dans un contexte assez spécial, celui des élections locales de 2003.

Ce changement est qualifié par les jeunes de « révolution sacrée de l'eau ». Il s'est opéré sur fond de frictions politiques. Mais c'est l'état de santé de l'ancien responsable du réseau qui a permis, très probablement, l'amorce de ce changement.

En effet, en 2003, à l'occasion des élections communales, un groupe de jeunes a pris l'initiative de soutenir un jeune candidat ; mais le parti pris de l'Amghar en faveur d'une autre personne ne lui a pas laissé de chance. Ici également, l'eau est l'ami du puissant. Ainsi, un groupe de jeunes a déduit que le changement politique ne peut pas se faire sans changement de la gestion de l'eau. L'Association devient donc une arène pour le conflit politique local.

### *L'Opérationnalisation de l'Association*

Pour l'opérationnalisation de l'Association, une longue procédure a été suivie d'après les membres du bureau. La démarche s'est basée sur la liste des ayants droit dressée par l'aiguadier (suite à une demande formulée et appuyée par l'autorité locale). Un travail d'équipe a été conduit, les principales étapes ont été les suivantes :

- les parts sont recensées en fonction des canaux d'irrigation ;
- une enquête est réalisée auprès de l'ensemble des ayants droit pour connaître le nombre de tours d'eau désiré par cycle d'irrigation ;
- un travail de conception est réalisé pour la répartition des parts d'eau sur une nouvelle base, à savoir l'heure et pour une organisation de l'irrigation par « enchaînement » afin de mieux économiser l'eau (l'ordre d'irrigation est fonction de la succession géographique des champs).

On prévoit même la création d'une nouvelle part d'eau à louer au profit de l'Association. Ainsi le projet a été ficelé avant d'être proposé aux irrigants.

Lors de l'assemblée générale, tenue quelques jours avant le début du cycle d'irrigation, les adhérents se sont retrouvés dans l'obligation d'adopter le projet. L'état de santé du responsable de la gestion ne lui permettait plus de continuer à assumer ses fonctions. La forme associative n'est adoptée qu'à travers un très long processus de négociations entre les différents acteurs.

### Ressources Utilisées.

La mise en place de ce nouveau mode d'organisation a nécessité des préparatifs importants. Les coûts ont été supportés par le groupe de jeunes qui a pris l'initiative d'instaurer une nouvelle gestion de l'eau d'irrigation basée sur des tours d'eau consignés par écrit.

### Qui Sont les Principales Parties Prenantes et Acteurs qui étaient Impliqués dans la Réalisation et qui ont Bénéficié des Résultats,

Le souci de garantir la durabilité de l'accès à l'eau est devenu une préoccupation majeure des irrigants suite à la maladie de l'ancien responsable de la gestion. Ainsi, un groupe de personnes (beaucoup sont fonctionnaires en ville) avait pris l'initiative de consigner par écrit les droits d'eau de chacun ainsi que les tours d'irrigation. C'est sur cette base que le groupe de jeunes a pris l'initiative d'instaurer une nouvelle organisation de la gestion de l'eau garantissant ainsi à chaque membre de l'Association son droit d'eau.

## **L'Évaluation de l'Impact de la Pratique**

### Qu'est qui a été Considéré Comme un Succès et Pourquoi les Gens ont Adhéré à cette Pratique?

En l'absence d'une autre alternative, l'adhésion à l'AUEA a été presque totale. En témoigne le fort taux de participation aux cotisations annuelles.

### Evaluation des Bénéfices pour les Parties Prenantes

D'une façon globale, les irrigants sont satisfaits des services de l'Association. Ceux qui profitaient illégalement de l'ancien système sont mécontents. En plus, certains membres disent ne pas être informés de leur tour d'eau. Avant, l'aiguadier prenait en charge l'information de tous les irrigants. Pour les membres du bureau de l'Association, une solution est envisageable. Ils pensent engager des ouvriers pour s'occuper de l'irrigation des champs et informer alors chacun des irrigant de son tour d'eau. Certaines réticences persistent encore. Ceux qui ont des ouvriers permanents s'y opposent.

L'aboutissement de cette dynamique institutionnelle peut être appréhendé comme le résultat d'une dynamique locale amorcée dans le souci d'un accès continu à l'eau. Les plantations ne peuvent supporter une rupture d'irrigation. C'est par rapport à un contexte spécifique, qu'il faut situer cette dynamique institutionnelle. L'AUEA comme structure d'organisation doit répondre d'abord aux besoins de la population et non pas à ceux de l'État. Le bureau de l'Association assure une gestion transparente de l'eau au profit de l'ensemble des irrigants (ayants droit).

### Quels Sont les Impacts les plus Significatifs en Terme de Réduction de la Pauvreté, de la Sécurité Alimentaire et du Niveau de Vie des Catégories les Plus Marginales?

Il est difficile de déduire l'impact direct de cette nouvelle pratique en terme de réduction de la pauvreté. Néanmoins, on peut supposer que le nouveau mode d'organisation, en renforçant la sécurisation des droits d'eau pour la catégorie des ayants droit, encouragerait l'intensification agricole. Les nouvelles plantations de cerisier engendrent des offres de travail non négligeables pendant la période des récoltes. Les revenus de cette culture pourraient améliorer la situation des groupes vulnérables s'ils sont réinvestis localement.

Le nouveau mode d'organisation permet également de garantir le droit de ceux possédant des parts d'eau faibles (les petits propriétaires). C'est également cette catégorie qui bénéficierait le plus de l'économie de l'eau réalisée au niveau du réseau d'irrigation.

### Quels Sont les Résultats les plus Significatifs Comme par exemple ceux qui ont Entraîné un Changement au Niveau Institutionnel, des Politiques Différentes qui Pourraient Avoir un Impact Réellement Positif sur les Pauvres ?

L'Association comme forme organisationnelle permet à chacun de participer lors des différentes réunions et d'exprimer ses besoins. Les catégories marginalisées retrouvent ainsi le droit de prendre la parole.

Cependant, pour les personnes sans droit d'eau, l'Association renforce leur exclusion de l'espace commun. En effet, depuis sa prise en charge de l'irrigation, l'association tente une sorte de réappropriation du terroir. Sur le terrain, elle s'occupe, en plus de la gestion du réseau d'irrigation, de divers aménagement au niveau du village. Cependant, les membres du bureau empêchent la participation des non ayants droit à certains travaux communautaires. En effet, toute contribution (consolidation des ouvrages de protection contre les inondations par exemple) peut servir de base pour une revendication de parts d'eau de la part des non irrigants.

## Facteurs Contribuant aux Succès et Échecs

Changer un mode de gestion ancestral n'est pas chose facile. En effet, les réticences des irrigants ont été fortes.

Un concours de circonstances a conduit à une forme d'appropriation collective de l'Association et au changement du mode d'organisation de l'irrigation. En effet, après la maladie de l'ancien responsable, la relève n'était pas assurée. Lui seul connaissait les détails de l'organisation. Les irrigants se voyaient contraints à trouver une solution.

Cependant, l'élément le plus important est ce travail de concertation initié par un groupe de jeunes. Une préparation minutieuse d'un nouveau mode de gestion s'est basée sur la prise en compte des besoins spécifiques de chacun des irrigants. Aussi, l'association comme cadre légale d'organisation a favorisé cette dynamique institutionnelle.

L'utilisation de l'écrit a permis à chacun d'avoir sa part et son tour d'eau consignés dans un livret.

## Opportunités pour la Généralisation de cette Pratique

La réussite du processus de passage d'un mode de gestion de l'eau d'irrigation à un autre doit être considérée en relation avec les conditions locales ayant favorisé cette dynamique.

Ailleurs, force est de constater que les Associations des Usagers des Eaux Agricoles, souvent créés par l'initiative des services techniques étatiques, sont rarement fonctionnelles. Les irrigants continuent de gérer l'eau selon le mode dit « traditionnel ». La généralisation d'une forme organisationnelle à l'échelle de tout le pays n'est pas possible. Le plus important est de pouvoir saisir les dynamiques locales en relation avec les nouveaux enjeux des ressources en eau. Il faudrait donc accompagner ces transformations et aider les acteurs locaux à mettre en place les formes organisationnelles adaptées.

Grille de comparaison entre deux systèmes de gestion de l'eau d'irrigation

	La gestion dite traditionnelle	La gestion par l'Association
La gestion	Souplesse, arrangement entre irrigants (échanges informelles des parts d'eau)	Tendance rigide ; respect formel des tours d'eau
La prise de décision	Le pouvoir est centralisé par l'aiguadier	Pouvoir « démocratique »
Service	Un salaire pour l'aiguadier	Bénévolat
Les règles	Orales	Écrites (le statut de l'association ; tableau de distribution des tours d'eau...)
Sanctions	Empêcher l'accès à l'eau	Amendes ; recours aux autorités locales
Relation avec l'État	Faible	Forte (L'État s'invite dans les réunions de l'Association)
Gestion des tours d'eau	L'organisation est fonction des tours d'eau, indépendamment de la situation des parcelles	L'organisation est circulaire, pour une rationalisation de la gestion de l'eau

Source: L. Bekkari, 2005

## **Référence**

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**Title:** Adoption of new mode of organization for irrigation water management

**Country:** Toufesalt village, Rural community of Ain Leuh, Middle Atlas, Morocco.

**Authors:** Lahssan Bekkari<sup>17</sup>

**Category of Practice:** Collective appropriation of institutional innovation in water management

## Context and Genesis

### Brief description of the production or service system

In the Middle Atlas zone, the agriculture of subsistence is largely dominant. In spite of various and local dynamic forms, the economic life remains dependant on the livestock production.

Sheep and goat breeding, largely dependent on natural resources, is a main source of income for most of the families. Rainfed agriculture is based mainly on cereals, farmers with irrigation water are investing more and more on fruit tree (cash crops).

Indeed, at a local scale (Rural Community of Ain Leuh), the production systems are changing following the massive adoption of cherry Tree. This production uses efficiently the available water resources and allowed a substantial increase in the income.

### Brief description of social, economic and institutional context

Since the beginning, the rangeland (transhumant) constituted the basis of the local economic activity. It regulated the social life. The latter one is paved by the movements of the herds between the plain and the mountain.

Currently, the context remains marked by a very poor and low productive agriculture. The cultivated land represents only 20 % of total area. The forest (23 % of the whole area) offers 20 to 30 % feed needs for the herds. We also observe a weakness of the regional urban network and non agricultural activities.

The institutional context remains dominated by the strong presence of the State. Nevertheless, the local societies establish a common agenda to manage the common resources. Also, the collective land, common property of the tribes is placed under the supervision of the State (Ministry of Interior) and they are managed by representatives usually chosen by the community. The irrigation schemes are managed by the local communities often according to traditional mode. The increase in the population generates an increasingly strong pressure on the natural resources.

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<sup>17</sup> New organization of irrigation, set and proposed by a young group from the Village.



Problem that gave rise to it:

Before, the water was abundant and the supply was greater than the needs. However, this resource is put under pressure because of the massive introduction of more water demanding cultures.

Also, the old management mode is any more adapted to meet the new requirements in irrigation. Moreover, in the Village studied, the person in charge of the irrigation scheme was the only one to know the details of the organization management. The takeover was hardly assured. The management of water is also a key in the local political life. The increase in water needs combined with an individual management has led the water users to adopt the Association of Users of Agricultural Water and set up a new way for the organization of irrigation.

Organizations and stakeholders who were involved in its conception and design

It is a group of young people which took the initiative to set up the new mode of organization of the irrigation. As right owners, this group could, under political pressure and benefiting from sickness of the former manager, set up a new management way according to the water rights and the cropping systems.

**Description of the Practice**

Specific description of the innovation

The irrigation scheme is very old. Water is an individual property. It means that in the beginning, the water shares of an owner were obtained according to his contribution during the establishment of the irrigation scheme. The community of water users delegated a person to be in charge of the management of the irrigation system (aiguadier).

Some of irrigation system characteristics

Water spring	Irrigated land	Potential irrigated land	Total Length	Flow	Number of farmers
Akadous	270 ha	338 ha	1942 m	120 l/s	72

The shift from a traditional mode of management to a management by WUA took place in several steps. This has led to a management according to water turns' recorded in a booklet and placed under authority of all the water users. It's the Bureau of the Association that takes care of the management.

Main activities undertaken

The WUA as an organization mode was imposed by the official services as a prior condition for the management of the irrigation system. But this change in rules did not have direct impact on the management of the system. A long time after this creation, October 17, 1996, the system of management remained unchanged. It is the manager (aiguadier) who takes care of everything. The role of the Office members is confined to give their point of view during restoration of the irrigation system. The new institution was thus not adopted by the water users.

*The political conflict has worked in the favor of the Association*

After years of cohabitation, the appropriation of the new institution took place in a rather special context, that of the local elections of 2003. This change is qualified by the young people as "sacred revolution of f water". It took place under political frictions. But it is the sickness of the former person in charge for the scheme which allowed, most probably, the starter of this change.

Indeed, in 2003, at the time of the communal elections, a group of young people took the initiative to back up a young candidate; but the party taken by "aiguadier" in favor of another person did not leave him a chance. Therefore, this group of young people deduced that the political change cannot be done without change in the management of water. The Association has become an arena for the local political conflict.

*Operationalization of WUA*

For the Association to be operational, a very long procedure was followed by the bureau members. The step was based on the list of right owners established by the «aiguadier».

A team work was carried out, the principal stages were as follows:

- the shares were listed according to the irrigation canals;
- a survey was carried out with the all water users in order to know water turns in a given cycle of irrigation;
- a conception work is designed for the distribution of the water shares on a new basis, namely the hour and for an organization of the irrigation based on geographical position of each field.

They predict even the creation of a new water share to be rented: the outcome will go to the Association. Thus the project was tied up before being proposed to the water users.

During the general assembly, held a few days before the beginning of the cycle of irrigation, the members found themselves in the obligation to adopt the project. No other alternatives were possible at that time.

Used Resources:

The implementation of this new mode of organization requires preparation. The costs were supported by the group of young people which took the initiative to set up a new mechanism for the management of the irrigation water based on water turns recorded.

**Impact of the practice:**

In the absence of another alternative, the adhesion to the WUA was almost total. This is shown by the strong rate of participation when paying the annual shares.

In a general way, the members were satisfied by of the services of the Association. But people who took advantage illegally from the old system are unsatisfied. The result of this institutional dynamics can be understood as a local dynamics started in order to have continuous access to water. The plantations cannot stand a shortage in irrigation water. This institutional dynamics should be considered according to a specific context.

The WUA as structure of organization must answer initially to the needs of the population and not to those of the State. The Bureau of the Association ensures a transparent management of water: it will profit all farmers.

It is difficult to deduce the direct impact of this new practice in terms of poverty reduction. Nevertheless, we can say that the new mode of organization, by securing the water rights for right owners, would encourage the agricultural intensification. The new plantations of cherry trees generate considerable opportunities for employment during the period of harvest. The incomes coming from this crop could improve the livelihood of vulnerable groups if it is locally reinvested. The new mode of organization also should guarantee the right for those having the smallest water shares (small holders). This category would profit the most from the economy of water achieved at the level of irrigation system.

The Association as a form of organization should make each one be involved in the whole process and participate in meetings in order to express their needs. The marginalized categories should find the way and the right to speak.

#### **Factors contributing to failure and success:**

The most important element for the success of this practice is the work initiated by a group of young people. The second factor is the meticulous preparation of a new mode of management taking into account the specific needs for each member. Also, the Association as a legal representative has enhanced this institutional dynamics. Records have helped to strengthen the process as everyone has its shares and water turn consigned in a booklet.

#### **Opportunities for scaling up**

The success of the process shifting from one mode of irrigation water management to another must be considered in relation to local conditions that supported this dynamics. The generalization of an organizational process at the level of the whole country is not possible. The most important is to be able to understand the local dynamics in relation to the new challenges in irrigation. These transformations are important and can help the local actors to set up the adapted organizational forms.

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**Titre:** Récupération Manuelle Intégrée des Terres Dégradées dans Le Sahel Burkinabé

**Pays:** Burkina Faso: Région sahélienne

**Auteurs:** Ouedraogo S. and Sylvain Hervé <sup>18</sup>

**Domaine:** Accès/Gestion des Ressources Naturelles

### **Contexte et historique**

Les systèmes de productions les plus répandus au sahel sont l'agriculture (généralement la culture de céréales ou combinés à des légumineuses le plus souvent le niébé) et l'élevage dont les principaux acteurs sont de plus en plus concernés par la pratique à une petite échelle de l'agriculture. Selon les études de caractérisation socio-économiques des sites de Recherche/Développement du programme DMP, les populations manquent d'alternatives génératrices de revenus et la production de pomme du sahel pourrait être une alternative intéressante.

Le Burkina Faso est divisé en quatre grandes zones agro climatiques. La plus sèche est la zone nord sahélienne dont la pluviométrie moyenne est inférieure à 600mm. La forte pression humaine et animale dans cette région combinée à l'effet des changements climatiques a entraîné une dégradation accrue des terres. Il s'en est suivi une baisse progressive des revenus des populations locales dont les deux principales activités sont l'agriculture et l'élevage.

La confection de demi-lunes est une pratique ancienne au Burkina Faso notamment au Nord. Il en est de même de la protection par les cordons pierreux. Le Zizyphus est une espèce locale mais la technique de son greffage qui en fait une espèce améliorée est issue des recherches de l'ICRAF, de l'ICRISAT avec des tests d'adaptation en milieu réel au Burkina par l'INERA.

Les populations rurales ont été impliquées dans les tests d'adaptation en milieu réel du Zizyphus qui ont été effectuées par les chercheurs de l'INERA. De plus elles le sont en ce qui concerne la mise en place de demi-lunes protégées.

### **Description de la technologie**

La Récupération Manuelle Intégrée des Terres Dégradées est une combinaison des techniques de récupération manuelle à travers la confection de demi-lunes renforcées par des cordons pierreux à l'intérieur desquels sont mis des plants de Zizyphus mauritiana améliorée. Les terres dégradées sont récupérées et l'action est pérennisée par les cordons pierreux et les plantations.

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<sup>18</sup> INERA, Desert Margins Program, Burkina Faso



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mi-lunes en région sahélienne faites par le Projet SA/RTD

La technique des démi-lunes est une technique bien connue dans le Sahel dans la mesure où plusieurs projets de lutte contre la désertification l'ont déjà préconisée et testée. De plus une des techniques de Conservation des Eaux et des Sols (CES) est la mise en place de cordons pierreux pour éviter l'érosion des sols et accumuler du même coup un peu d'eau. La principale innovation de ce projet est la combinaison de ces deux technologies en vue de mettre l'eau et des substances organiques recueillies à la disposition des plants de *Zizyphus mauritiana*, toutes choses qui pourraient accroître le rendement de ce dernier. Notons que *Zizyphus mauritiana* est un arbre fruitier identifié par la recherche comme une plante à haut rendement et à fort potentiel économique. En effet, le Sahel présente des conditions agro écologiques favorables à la culture du jujubier qui préfère les climats chauds et secs et tolère des températures atteignant 50°C. Aussi la plante présente des possibilités d'association de cultures en dessous de la plantation car les plantes créent un microclimat favorable à des cultures sous-jacentes notamment maraichères. La disponibilité relative de déjections animales pour la fabrication d'engrais par compostage est effective. En terme de rendement, notons que la production en région sahélienne est de 0 à 7 kg de fruit par plante dès la première année de plantation pendant les mois de novembre à décembre. Avec une valeur allant de 500 à 700 FCFA le kilo, le pommier du Sahel présente des avantages certains. Le programme d'action dans les marges du désert (DMP/GEF/CNRST) au Burkina Faso a permis la récupération mécanique des terres dégradées sur plus de 400 hectares et a effectué des tests sur l'efficacité de la technique dans ses sites de Recherche/Développement. C'est ainsi que les résultats ont montré une nette différence entre les espaces récupérés et les espaces témoins aussi bien en terme de biomasse que de diversité biologique. SOHORO (2005) indique que «Sur le sol aménagé à l'aide de la charrue delphino, la raie et ses voisinages immédiats ont un recouvrement du sol plus élevé et une production en phytomasse plus fournie que les inter-raies». Cependant, la méthode de récupération des terres dégradées avec la charrue Delphino présente une limite à sa vulgarisation qui est son coût qui

demeure très exorbitant (45 000 FCFA à l'hectare). Dans le contexte particulier du sahel ou les populations présentent un niveau de revenu très bas, l'adoption de cette technologie sur le long terme peut être mise en doute. C'est dans ce sens que nous proposons une technologie qui devrait présenter les mêmes avantages mais aussi qui devrait être moins onéreuse et vulgarisable à très grande échelle. Il s'agit ici d'une intégration de trois technologies à savoir les demi-lunes, les cordons pierreux et le Zizyphus amélioré.

Les populations dans les villages de Banh, Tougouri, Oursi et Katchari (qui sont les sites DMP) ont déjà une organisation à même de permettre d'assurer la promotion de cette technologie au niveau des villages voire des départements. Cependant, des actions de concertations et de sensibilisations seront menées avant la mise en œuvre du projet dans la mesure où le foncier est un problème délicat. C'est ainsi que l'activité, pour une pérennisation doit requérir l'avis des propriétaires terriens dans les villages concernés.

Le projet, pour sa mise en œuvre doit disposer de moyens pour appuyer les populations dans:

- l'achat de petits matériels pour la confection de demi-lunes;
- la récolte de moellons pour la mise en place des cordons pierreux;
- la production de sauvageons (plants de zizyphus sauvage);
- le renforcement des capacités pour le greffage du Zizyphus;
- le suivi de l'activité.

Le groupe cible du présent projet est composé de propriétaires terriens villageois et/ou de paysans ayant des droits d'exploitations arboricoles dans les villages de Banh, Tougouri, Katchari et Oursi.

### Impact du projet

L'impact de la récupération des terres a déjà été analysé pour la récupération par la charrue delphino dans le cadre du programme DMP. Cependant, il s'agit d'un impact environnemental, de restauration de la biodiversité et de l'accroissement de la productivité des terres dans les espaces concernés.

Tableau N°1: Impact de la récupération des terres dégradées par la charrue delphino à Tougouri

Terre dégradées avant récupération	Terre pendant la récupération à la charrue delphino	Terre après la récupération et régénération naturelle du couvert
		
Mars 2005	05 Avril 2005	29 décembre 2005

Une analyse du niveau des revenus au niveau des 4 villages (Banh, Tougouri, Katchari et Oursi) a déjà établie en 2004. elle sera la base d'une analyse d'impact au niveau village mais au niveau des paysans une base de donnée sera établie portant sur le niveau des paysans et elle sera actualisée une année après de sorte à faire une analyse avant et après. L'analyse des coûts bénéfiques sera également faite au niveau du projet de vulgarisation.

### **Eléments à prendre en compte qui pourrait contribuer au succès ou à l'échec du projet**

Le principal élément à prendre en compte dans le présent projet est le foncier. En fait, les améliorations et aménagements effectués sur les terres sont d'un apport considérable pour accroître la productivité. Cependant, force est de constater que ces aménagements pourraient être causes de conflits sociaux si les paysans qui les mettent en œuvre ne sont pas propriétaire. C'est pour pallier cette problématique que nous suggérons que soient impliqués les propriétaires terriens.

Le projet saura compter sur un appui institutionnel de par le fait que la lutte contre la désertification et la promotion d'alternatives d'accroissement des revenus sont des secteurs prioritaires au niveau de la politique gouvernementale dans la mise en œuvre du «Cadre Stratégique de Lutte contre la Pauvreté (CSLP)».

Le projet privilégie le partenariat et l'encrage institutionnel. En effet, pour accroître les chances de succès, le projet:

- impliquera les chercheurs et les agents de développement dans le renforcement des capacités des paysans;
- mettra à contribution l'administration aussi bien que les services étatiques décentralisés qui seront des partenaires privilégiés dans l'exécution du projet. Par exemple les activités de production de plants et de greffage impliquent les agents du Ministère de l'Environnement et du Cadre de Vie.

### **Potentialités et contraintes**

La vulgarisation d'une telle technologie est fortement tributaire du niveau d'implication des populations concernées. De plus, du fait qu'il s'agisse d'une plantation il est nécessaire que les questions de propriété foncière et/ou de droit d'usage soient clairement abordées. La production de plants de *Zizyphus mauritiana* greffée est pour l'instant peu maîtrisée par les pépiniéristes villageois mais elle le sera à travers le renforcement des capacités entreprise dans ce domaine par le programme d'action dans les marges du désert (DMP) ainsi que d'autres projets et programmes. Les potentialités sont légions du fait des nombreuses activités de sensibilisation et de restauration des terres dégradées par ledit programme.

Le risque pourrait être la surcharge du marché mais elle pourra être levée si la pomme du sahel trouve une promotion sur le marché externe.

**Budget prévisionnel**

Budget prévisionnel du projet de Récupération Manuelle Intégrée des Terres Dégradées dans Le Sahel Burkinabé

Tableau N°1. Budget prévisionnel

DESIGNATION	Quantite	Prix Unitaire	Prix Total
1. Animations/Informations/Sensibilisation			500.000
Identification et choix des terres dégradées à récupérer en rapport avec les statuts fonciers			
2. Acquisition de petits matériels			2.000.000
Charrettes + ânes			
Brouettes			
Pioches; Pelles; Barre à mines			
Fût pour transport eau pour arrosage			
3. Renforcement capacités des acteurs en techniques de greffage du Zyziphus mauriana			750.000
4. Réalisations des plantations			1.250.000
5. Réalisations des cordons pierreux			2.000.000
6. Déplacements			1.000.000
Location de véhicule			
carburant			
7. Installation d'une pépinière			750.000
Forage			
Arrosoirs			
Fût			
Seaux			
Pôts			
Produits de traitement			
Semences			
8. Suivi-Accompagnement			1.000.000
Déplacement sur le terrain			
Perdiems techniciens			
Perdiems chauffeurs			
Carburant			
9. Production de documents, Photos,...			500.000
10. Divers+Imprévis (5%)			350.000
<b>TOTAL GENERAL</b>			<b>7.350.000</b>



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**Title:** Integrated manual restoration of degraded lands in the Sahelian area of Burkina Faso

**Country:** Burkina Faso : Sahelian area

**Authors:** Ouedraogo S., Sylvain Hervé

**Category of Practice:** Access to and management of the natural resources

### **Context and genesis**

Well known production systems in the Sahel are agriculture (generally the culture of cereals combined with legumes, most of the time niébé) and livestock production whose main actors are more and more concerned by the practice of agriculture. According to studies of socioeconomic characterization of the Desert Margins Program (DMP) benchmarks in Burkina Faso, populations don't have alternative incomes and the production of the "apple of the sahel" could be an interesting alternative.

Burkina Faso is divided into four big agro-climatic zones. The driest one is the north sahelian whose rainfall average is lower than 600mm. The strong human and animal pressure in this area combined with the climate change makes the lands degradation increase. So, it follows a progressive decreasing of incomes of the local populations whose two main activities are agriculture and breeding.

Building half-moons is an old practice in the Burkina Faso mainly in the north. It is the same with the protection of soils with the stone dikes. *Ziziphus mauritiana* is local specie but the transplantation that improves it comes from researches of ICRAF, of ICRISAT with adaptation tests in the real middle in Burkina made by the INERA.

The rural populations have been involved in adaptation tests in real middle of *Ziziphus mauritiana* that have been done by researchers of INERA. Besides, it's the case concerning setting up protected half-moons.

### **Description of the practice**

Integrated manual restoration of degraded lands is a combination of manual restoration through building half-moons enforced inside by the stone dikes in which we plant transplanted *Ziziphus mauritiana*. The degraded lands are recovered and this action is perpetuated by the stone dikes and plants.



Building half moons is a very well known technique in the Sahel because several projects of combating desertification already tested it and recommended it. Besides, a technique of Water and Soils Conservation that is stone dikes building avoids erosion of soils and helps to accumulate water at the same time. The main innovation of this project is to combine these two technologies in order to make water and organic substances available to *Ziziphus mauritiana* trees, which could increase its production. Let's note that *Ziziphus mauritiana* is a fruit tree identified by research as a plant with high level of production and a strong economic potential. Indeed, the Sahelian zone has good agro ecological conditions to grow *Ziziphus* that prefers hot and dry climates and can tolerate temperatures up to 50°C. As well, this plant offers possibilities to do culture in association because trees create a pleasant microclimate for underlying cultures such as market garden production. The animal evacuations for making manure are relatively available. In term of production, we can mention that in sahelian region it is about 0 to 7 kg of fruit by plant from the first year of plantation. It produces from November to December. With a value of the kilogram going from 500 to 700 FCFA, the sahelian apple tree presents real advantages. The Desert Margins Program (DMP) of Burkina Faso has made mechanical restoration of degraded lands on more than 400 hectares and did tests on the efficiency of this technology in its Research/Development benchmarks. Results showed a real difference between the recovered spaces and witnesses spaces as well in term of biomass that of biological diversity. SOHORO (2005) indicates that «on worked with delfino plow soil, the stripe and its immediate neighbourhoods have a more elevated soil recovery and a phytomasse production more than in the space between stripes». However, the method of restoration of degraded lands with delfino plow presents a limit to its scaling up that is its very expensive cost (45 000 FCFA by hectare). In the particular context of the Sahel where populations have a very low level of income, the adoption of this technology on the long term can be in doubt. It is in this sense that we recommend a technology that should present the same advantages but also that should be cheap and easier to scale up at very big scale. We talk about an integration of three technologies that are half moons, stone dikes and improved ziziphus.

Populations in villages of Banh, Tougouri, Oursi and Katchari (that are the DMP's benchmarks) are already so organized that they can assure the promotion of this technology at the village level or even at a department one. However, dialogues and sensitizations will be led before the implementation of the project in regard to the fact that land tenure is a delicate problem. For a sustainable action, it requires the opinion of landowners in the concerned villages.

The project, to be implemented should help populations in:







- small material to build half moons;
- looking for rubbles for setting up stone dikes;
- production of wild plant (plantations of wild ziziphus);
- increasing their capacities in transplanting ziziphus;
- following up the activities.

The target group of this project is composed of landowners in villages and/or producers that have rights to make plantations in the village of Banh, Tougouri, Katchari and Oursi.

1. Assessment and impact,

The impact of the lands restoration has already been analyzed for the case of the one made by “delfino plow” during DMP implementation. However, it is about an environmental impact of restoration of the biodiversity and the gain of productivity of the restored lands.

Picture 1: Impact of the land restoration degraded by plow delfino to Tougouri.

Degraded lands before restoration	Same land during restoration by delfino plow	Degraded lands after restoration
 March 2005	 April 5 <sup>th</sup> 2005	 December 29 <sup>th</sup> 2005
 March 2005	 July 3 <sup>rd</sup> 2005	 December 29 <sup>th</sup> 2005

An analysis of the level of incomes in these 4 villages (Banh, Tougouri, Katchari and Oursi) has already been done in 2004. It will be the basis of an impact assessment at a village level but another one will be done at a farmer level and it will be actualized one year later way has make an analysis before and after. The cost/benefit analysis will also be done for the whole vulgarization project.

### **Factors to be understood contributing to successes and failures**

The main thing to be taken in account in the present project is the land. In fact, improvements and amenities done on lands are a considerable contribution to increase the productivity. However, it's important to note that these amenities could be reasons for social conflict if peasants who implement them are not real owners. It is to solve this problem that we suggest to involve landowners.

The project will be able to have an institutional support as far as the combat of desertification and the promotion of alternatives incomes are very important sectors of the governmental policy in the implementation of the "Strategic Plan to Fight against Poverty (CSLP)" in Burkina Faso.

The project counts on partnership and institutional support. Indeed, to increase odds of success, the project:

- will involve researchers and development agents to increase producer's abilities;
- will make use of administration as well as public agencies which will be the main partners in the implementation of the project. For example activities of plants production and transplanting involve agents of Ministry of the environment.

### **Opportunities for mainstreaming and scaling-up**

Scaling up such a technology depends strongly of the level of involving populations concerned. Besides, because it's about plantation it is necessary that questions of land owning or rights to use it are clearly mastered. The production of transplanted *Ziziphus mauritiana* plantations is nowadays a little bit mastered by nurserymen of villages but it will be better by building abilities in this domain by the Desert Margins Program (DMP) as well as other projects and programs. There are a lot of opportunities because of numerous activities of sensitization on land restoration by aforesaid program.

The risk could be the overcharge of the market but it will be able to solve it if the "apple of the sahel" finds a promotion on the external market.

### **Budget**

Estimated budget of the project of integrated manual restoration of degraded lands in the Sahelian area of Burkina Faso

Table 1. Provisional Budget

Designation	Quantity	Prix Unitarian	Prix Total
1. Sensitization			500.000
Identification and choice of degraded lands to restore related to the land statutes			
2. Small material			2.000.000
Carts + donkeys			
Picks; Shovels; Rod to mines			
3. Building technical abilities of actors en transplantations of ziziphus mauritiana			750.000
4. Plantations			1.250.000
5. Stone dikes			2.000.000
6. Moving between villages			1.000.000
7. Nursery			750.000
8. Follow up			1.000.000
9. Documents Production, Pictures, ...			500.000
10. Unforeseen (5%)			350.000
General			7.350.000

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**Title of Best Practice:** Dilemmas in building local institutions for natural resources management: the case of the Mkoji Sub-catchment in Tanzania

**Country:** Tanzania, Mbarali and Mbeya

**Authors:** L.M. Hermans, G.E. van Halsema<sup>19</sup>, C.S. Sokile and H.F. Mahoo<sup>20</sup>

**Category of Practice:** Local resource management institutions

### Context and Genesis

Policy reforms in Tanzania place more and more emphasis on local stakeholders for managing natural resources, shifting authority and responsibility from national to local levels. For the water sector, these reforms are in line with the paradigm of integrated water resources management (IWRM), which is currently the dominant paradigm for water resources management. IWRM emphasizes among others the need for participatory approaches, a gender balance and the value of water resources.

In this stage of the reform process in Tanzania, the appropriate institutional environment to enable participatory approaches that pro-actively involve users, planners and policy makers at all levels are still in their infancy. Institutions that adequately incorporate gender aspects - reflecting the vital role that women play in the provision, management and safeguarding of water - are lacking. Furthermore, the existing institutional structures are not always adequately designed to ensure that water is managed in a way that reflects its full economic and social values. The ongoing policy reforms offer an opportunity to address these imperfections, but the question remains how this should be done. How can one begin to move towards a process of integrated water resources management, even though some requirements for doing so are not yet met? The importance of finding ways to cope with imperfections should not be underestimated, as in practice such imperfections prove to be the rule rather than the exception.

### The Practice

In the Mkoji sub-catchment, a rural area in the southwest of Tanzania, a project has been executed to support the local stakeholders in starting up a new process towards the implementation of IWRM principles. It is evident that in moving towards IWRM, setting up new local institutions and implementing participatory approaches, one is likely to encounter some difficult choices or dilemmas that require a practical solution. Generally, these dilemmas seem somewhat underrepresented or at least scattered in the existing literature on institution building for IWRM.

The “practice” reported here consists of the identification of five of these institutional dilemmas, as they emerged from practice during the process in the Mkoji sub-catchment.

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### New Versus Existing Institutions

Existing institutions are usually not equipped to facilitate participatory water resources management on hydrological boundaries, which means that working towards IWRM requires new institutional structures. However, this new institutional structure will have to function within the context of an existing institutional structure, which often emphasizes centralized planning on the national level, combined with traditional arrangements on the village level. Although these existing institutions may or may not be working to the satisfaction of all the stakeholders involved, they do provide a basis that can hardly be ignored in designing and implementing new institutions for IWRM.

### Neutral Reforms versus Actively Reshaping Power Relations

Institutional development is all about allocating and distributing power among stakeholders. Institutions channel power and are a source of power, for instance through administering formal authority or granting parties access to the official circuits where policies and regulations are developed. Changing institutions will therefore also affect the existing balance of power. The full implications of this “power-factor” are rarely discussed in IWRM literature, although at the same time there seems to be an ideologically motivated drive among IWRM practitioners to empower local stakeholders. However, the latter will be only possible if one is consciously aware of the power factor in institutional reforms.

### Long-Term versus Short-Term Objectives

Establishing effective IWRM, including institutional reform, requires a long-term perspective. It takes time to establish new institutions, to ensure that they are properly functioning and to allow both new and existing institutions to find new roles and working modalities in the changed institutional landscape. Furthermore, sustainability in IWRM essentially implies a long-term perspective, ensuring that IWRM strategies do not have negative impacts on future generations. However, existing water problems may be pressing and may not allow one to wait until new institutions are in place and functioning well. Focusing only on long-term institutional processes and the needs of future generations, while ignoring the immediate problems, is likely to leave local stakeholder disappointed. It would mean asking them to invest precious time and energy into processes that they cannot see the benefits of. Therefore, tangible results are necessary on the short-term to ensure long-term commitment of stakeholders.

### Incremental Changes versus Visionary Master Planning

Water resources management has a history of “master plans”, “comprehensive strategies” and “blueprints” that aim at the implementation of encompassing packages of measures. Such comprehensive strategies and blueprints are easily associated with far-reaching changes and large scale infrastructures, such as privatization of water services, dam construction and associated large-scale reservoirs or irrigation schemes. However, in the policy sciences, it is common knowledge that the implementation and formulation of policies and plans is characterized by incremental changes rather than drastic new steps. This seems even more applicable to the local level, where there is often little room for dramatic changes and visionary master plans. Resources to realize them are simply not available and the resistance to far-reaching measures is often more felt on the local than the national level. Therefore, focusing on a comprehensive strategy, a blueprint or a master plan is likely to result in a disappointing

experience by designing plans that look good on paper but bad in practice. However, without such strategies or master plans, one is left with an incremental process of “muddling through” based on the existing situation. For rural communities in developing countries this would provide a rather grim outlook when it comes to realizing sustainable and significant improvements.

#### Centralized versus Decentralized Management Structures

IWRM requires integration across scales, meaning that it needs to carefully balance the roles of water governance bodies at different administrative levels. In most cases this implies further decentralization, as the majority of the existing water management institutions can be characterized as centralized, hierarchical and technocratic. Subsidiarity and decentralization thus have become an important part of the new approach to water governance under IWRM. However, one should not be blinded by the need for more subsidiarity or decentralization, only to find out that the integrative roles of centralized institutions have been neglected. On the one hand, decentralization is often needed to improve the functioning of existing institutions, but on the other hand, an important part of the water management problems may be the result of national level developments, which require a national rather than a local solution.

These dilemmas are discussed in more detail by Sokile et al. (2004). Although there is no easy way out of these dilemmas, their mere identification can already help water professionals and policy makers to avoid certain pitfalls in future institutional reform processes.

#### **Assessment and Impact**

Using these institutional dilemmas as a basis for reflection, certain lessons can be drawn from the experiences in the Mkoji sub-catchment. New institutions for IWRM are not formed in a vacuum but have to fit in with the existing institutional structures, both in the water sector and in other sectors. To increase the chances of a sustainable transition towards new IWRM institutions, the institutional development should be connected to existing institutions, using opportunities that are there within the existing arrangements. Furthermore, it requires efforts to define new roles for existing institutions and to support both new and existing institutions to take up these roles. In Mkoji therefore, a conscious effort is being made to link activities to the existing River Basin Water Office and to support the establishment of new local Water User Associations, while also working with the District authorities for instance in the preparation of District Agricultural Development Plans.

The “subsidiarity principle” is an important guiding principle for IWRM institutions, meaning that water resources should be managed at the lowest appropriate level. In practice, this translates into more emphasis on decentralized management institutions such as local Water User Associations, catchment-level WUA Apex organizations and River Basin Water Offices. Implementing such a decentralized structure requires specific attention and support for the “middle-level” institutions, both new and existing. In Mkoji, this means that national level organizations have an important role to support and strengthen the River Basin Water Office and the Districts administrations, which in turn should support the establishment and adequate functioning of local WUAs and their Apex organization. In this chain, the middle-layer of RBWOs and District administrations proves to be a crucial link.

Building new water institutions requires a long-term process, but in this process, attention for concrete problems and short term visible results are as important as the long-term institutional strengthening. Institutional development needs to build on the existing water problems in order to retain the support of the local stakeholders for institutional reforms. In fact, linking immediate water problems to long-term institutional development is likely to result in institutions that are better adapted to their local tasks. In the Mkoji sub-catchment, this link has been incorporated for instance in the stakeholder workshop, where short-term actions were identified that were within the reach of participating stakeholders, in addition to a discussion of long-term needs and challenges.

It is clear that there are no easy ways to tackle the dilemmas identified here for the Mkoji sub-catchment and probably each situation requires another approach to balance the two extremes of a dilemma. However, simply pinpointing these dilemmas can already be very useful for the implementation of IWRM processes; before one can define strategies to cope with dilemmas, one should first identify them. Pinpointing dilemmas helps to identify pitfalls that should be consciously addressed rather than ignored to make IWRM a success.

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**Practice:** Linking the frameworks for integrated water resources management and sustainable livelihoods analysis to support local water resources management

**Country:** Tanzania, Mbarali and Mbeya

**Authors:** L.M.Hermans, G.E. van Halsema<sup>21</sup> and H. Mahoo<sup>22</sup>.

**Category of Practice:** Integrated water resources management

### Context and Genesis

The Mkoji sub-catchment (MSC) is a rural sub-catchment located in the south-west of Tanzania, close to the city of Mbeya. It contains 146,000 people and covers 3400 km<sup>2</sup>. Administratively, most of the area resorts under the Mbeya Rural and the Mbarali Districts, while water management is coordinated by the Rufiji Basin Water Office. The MSC is one of the upper sub-catchments of the Rufiji River basin, which covers a considerable part of the country and which includes wetlands and nature reserves, agricultural lands as well as reservoirs for power-generation. Water shortages in the Rufiji River basin result in increasing attention for the upstream sub-catchments - such as the Mkoji sub-catchment - to allow more water to flow out of the sub-catchment to meet downstream requirements. A location map of the Mkoji sub-catchment is shown in Figure 1.

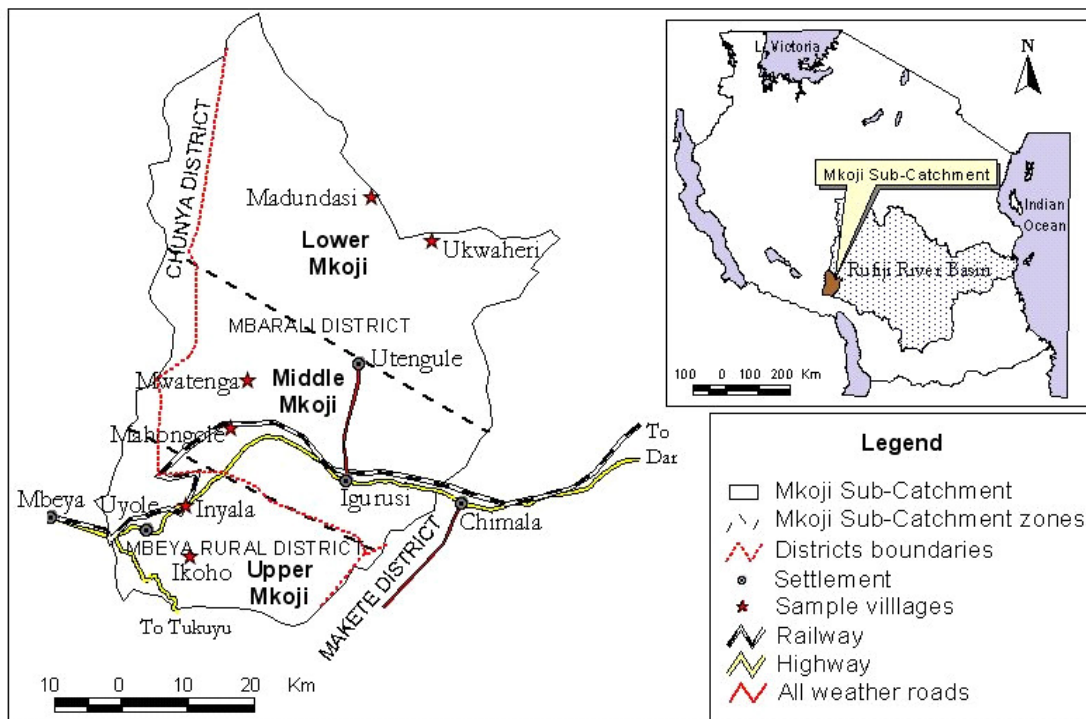


Figure 1

1 Location map of the Mkoji sub-catchment

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The water resources of the Mkoji sub-catchment are used mainly for irrigated and rainfed agriculture, including rice cultivation, and to sustain agro-pastoral livelihoods in the lower plains. Immediately downstream of the MSC, there are important wetlands: the Ihefu wetlands that are part of the Usangu plains. In the Mkoji sub-catchment, water demand and supply are more and more diverging, resulting in serious shortages during the dry season. Among the causes are increased irrigation activities in the upper parts of the sub-catchment.

Some of the additional challenges and trends that the stakeholders in the Mkoji sub-catchment (MSC) are facing are summarized below:

- The MSC is generally a poor region with low household incomes that are well below the national average for Tanzania and households are relying mainly on traditional rural livelihoods
- Within the MSC, the water demands are growing due to increased irrigation activities and due to the immigration of livestock keepers
- Water courses run dry about halfway through the MSC during the dry season, leaving the lower zone without water for basic domestic needs, livelihoods and environment. As a result lower zone households have to spend a considerable time to fetch drinking water in the dry season and there is only marginal economic activity in this part of the year. Downstream wetlands are shrinking in size and more and more floodplains are reclaimed for cultivation.
- Institutional reforms in the water sector drive changes in water resources management in the MSC as the Rufiji Basin Water Organization and Water User Associations are starting to take up their new roles as decentralized water institutions.
- Institutional reforms in the agricultural sector (notably the Agricultural Sector Development Programme), result in a trend towards more decentralization, participatory decision making and increased private sector involvement. This translates into important changes on the level of Districts.

### **The Practice**

To address the growing concerns over water within the MSC, a new process has been started to promote the implementation of IWRM principles to help the local stakeholders to cope with the various trends and problems they are facing. This process has been following a participatory and iterative planning approach. It consisted of a comprehensive baseline assessment which included a household survey as well as data collection on water availability, focus group discussions with key stakeholders and a three-day stakeholder workshop, while specific attention has been paid to water valuation and to institutional development.

This process was supported through the use of an integrated water resources management (IWRM) framework and a sustainable livelihoods analysis framework, in order to facilitate a participatory analysis of water related problems and a discussion of possible directions for future improvements. These two frameworks were thought to be complementary, as an IWRM framework supports the analysis of water scarcity problems, but framework offers little specific guidance for the analysis of the implications of water scarcity for local farmers. A sustainable livelihoods analysis framework helps to focus on local farmers, but has not been designed for a specific focus on water scarcity concerns.

#### Description of the Used IWRM Framework

The IWRM framework was based on the framework proposed by the Global Water Partnership (2000). This framework seeks to integrate the natural and human systems that together determine the use and availability of water resources. The natural system describes the natural processes that determine resource availability and quality, based on the hydrological cycle, and consequently, it takes a catchment or river basin as its unit of analysis. The human system described the human activities and their impacts, which determine the resource use, waste production and pollution, and which also sets the management and development priorities (GWP, 2000). This human system is guided by three overriding criteria, along with some important complementary elements that support an effective water resources management (see Figure 2). The three overriding criteria were used as entry to identify priority needs for water resources management in the MSC and possible directions to address those needs and to ensure that water resources would be managed in a way that balanced the different key criteria within the human system. These three dimensions were covered in the project in the following manner:

- *Economic efficiency criterion*: the contribution of current water uses to economic welfare, assessed in monetary terms
- *Social equity criterion*: the contribution of current water uses to social equity and social goals, including food security and social stability
- *Ecological sustainability criterion*: the contribution of the current water uses to a sustained availability of and access to the natural resource base.

#### Description of the Sustainable Livelihoods Analysis Framework

A sustainable livelihoods analysis (SLA) framework, based on the frameworks described by Ellis (2000) and Nicol (2000), was adopted to complement the IWRM framework. Together, the elements in this framework describe the impacts and dynamics of rural livelihoods within a farming system, which determines the availability and use of water resources and their associated values (Figure 3). Whereas the IWRM framework and its three overriding criteria were expected to help in developing priorities and providing guidance for management interventions, the SLA framework was expected to enable the project team to gain more understanding of the various factors that determined the activities of the main water users in the MSC, the local farming communities.

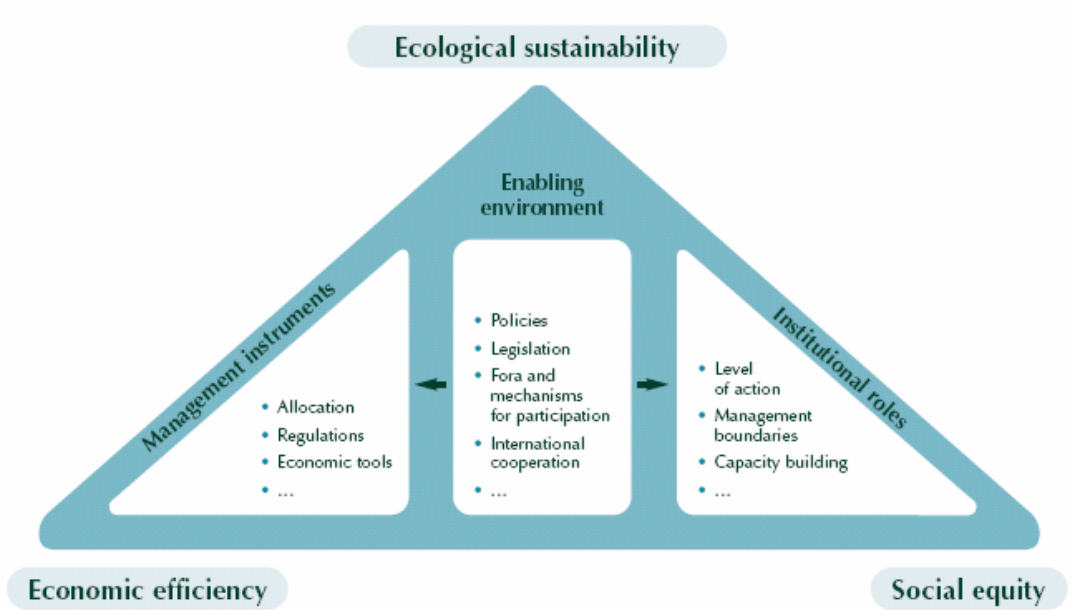


Figure 2. IWRM Framework (GWP)

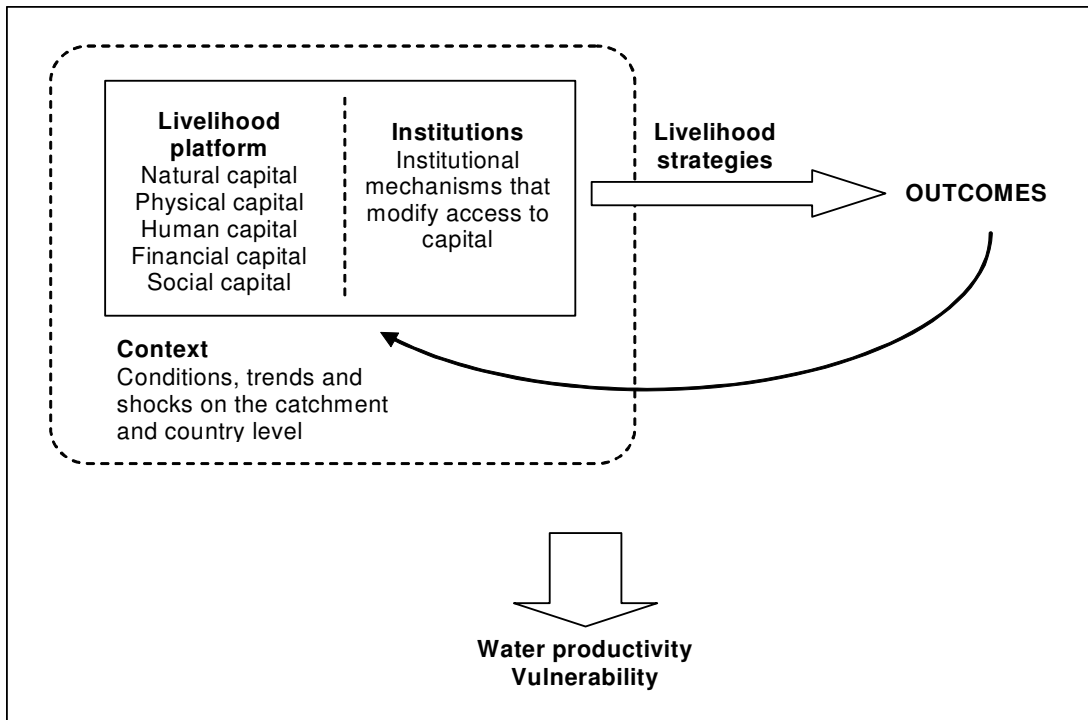


Figure 3 Sustainable livelihoods analysis framework – adapted from Ellis (2000) and Nicol (2000)

## Assessment and Impact

Both frameworks were used to support a participatory analysis of water productivity and vulnerability in the MSC. The results of this analysis are reported in FAO (2005), which shows how both frameworks offered room to combine the available pieces of information in the MSC into a coherent and quite comprehensive analysis. Without repeating the discussion of these analytical results here, it is worthwhile to make an effort to assess the benefits and drawbacks of the combined use of these two analytical frameworks in the MSC. Linking the combined use of these analytical frameworks, or even the outcomes of the participatory analysis they supported, directly to observable impacts on the ground is difficult – as is often the case with (policy) analysis studies – and therefore some modesty is required in making claims as to the practical contributions of the practice. Nevertheless, we believe that the combined use of IWRM and SLA frameworks has been useful to generate a better understanding of the role of water resources in local farming systems, that it has been instrumental to initiate a dialogue among stakeholders and that it has supported the identification of possible directions for future action.

The application of the SLA framework to natural resources management issues is not new and it has already been evaluated for its usefulness for focusing on the rural poor (see FAO, 2002 and other activities under FAO’s Livelihood Support Programme). Among its reported benefits are its values as a tool for diagnosis and as a device for facilitating interdisciplinary dialogue and analysis. These benefits also appeared in the MSC project, where the SLA framework provided a useful structure to analyze local livelihood problems, by identifying the key factors that influence livelihood strategies as well as some of the key linkages among them. However, its effectiveness as tool for strategy development is subject to debate. In fact, one of the (three) over-arching challenges to the use of the approach in natural resources management is related to the lack of support in prioritizing actions, as the holistic analysis resulting from SLA “does not always result in clear directions on priority actions to improve livelihoods” (FAO, 2002, p.35)<sup>23</sup>.

The IWRM framework offers little insight in presumed causal relations, but does offer a useful categorization of the overriding criteria that any “good” IWRM process or strategy should meet. Thus, for the MSC project, it offered the directions for strategy development that were more difficult to obtain with the SLA framework. In the MSC project, the IWRM criteria were used for the identification and categorization of various indicators, which were used to assess the value of water resources in the MSC in its various dimensions. This offered a wide-ranging insight in the current state of affairs in the MSC, as well as directions for possible alternatives and ways to assess their expected impacts. The indicator-based approach based on the IWRM framework proved very useful to deal with the data limitations, while making most use of the data that were available and addressing the specifics of the local situation. The different graphs and tables allowed for a relative quick overview, while providing useful information on some of the trade-offs among value-dimensions.

Using the IWRM framework alone would have provided less insight into the mechanisms that drive stakeholders’ behavior in using and managing water resources. Water problems are easily framed too narrowly by focusing predominantly on water, which excludes important solutions

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<sup>23</sup> The other two over-arching challenges for livelihoods analysis identified in the cited document are “unpacking policies, institutions and processes” and “changing the way organizations work”.



from the picture. Using a livelihoods framework made it easier to focus on stakeholder values and helped to clarify that problems might manifest themselves in water resources management, but that some of the root causes were likely to lie elsewhere. As such, the use of a sustainable livelihoods analysis framework led to the identification of additional solutions that are not water centered but livelihoods centered.

As a closing note, it should be mentioned that, although the combined use of an SLA and IWRM framework offers useful support for analyzing water problems in relation to rural livelihoods and for identifying directions for possible solutions, still several limitations remain. All analytical frameworks have their limitations and while a combination of two complementary frameworks is likely to have fewer limitations, some limitations are likely to remain. These are for instance related to an analysis of implications of power and politics, as well market-chain analysis. However, in cases where these aspects are of primary importance and require further analysis, there will most probably be other frameworks that can offer useful support in focusing on these aspects, if deemed appropriate for the specific situation at hand.

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**Title of Best Practice:** Recovering degraded soil and establishing agroecological seed networks in Venezuela<sup>24</sup>

**Country:** Venezuela

**Author:** Miguel Angel Nuñez<sup>25</sup>

**Category of Practice:** Participatory natural resources management

### Context and Genesis

The economic situation in Latin America, and particularly in Venezuela, has caused a substantial change in the political, environmental, and social conscience of small-farmer producers. Evidence of this is the research and development of the “participation process”-type collective, of “cayapa” (everyone working together), of the use of barter (“the returned hand”), etc., which seek to improve production results and diminish production costs.

These two considerations have served as the premise for the effective synergy between the Institute for the Production and Investigation of Tropical Agriculture (IPIAT) and small producers in different federal organizations.

For about four years, IPIAT has been obtaining important and significant results in the development of agroecological practices in some states of the Venezuelan West. This has led to a considerable number of producers becoming interested in changing their means of production and deciding on a production model which eliminates the use of agro-chemicals to improve farm activity, as this relates to the quality of the product and also production costs.

But one of the problems which the agroecological producers face, and in general all Venezuelan producers, is the almost zero production of seeds in the country to fill the needs of each growing cycle. Because of this, many of the producers have agreed on the necessity to establish networks of agroecologically-produced seeds; the necessity to initiate a process of soil recovery; and also the necessity for independence and autonomy when it comes to the acquisition of seeds.

It is for this reason that this work proposal aims to consolidate several networks of seed production and to expand the base of agroecological technology that IPIAT has already jointly initiated and developed with some producers.

IPIAT considers it fundamental to approach this task as a problem of sovereignty of the mother country, of Venezuela, because the opposite would be to continue the dependency on foreign seed. This is always tied to an expensive technological package (chemicals, fertilizers, etc.)

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<sup>24</sup> IFAD Supported Case Study

<sup>25</sup> Institute para Production y Investigacion de la Agricultural Tropical (IPIAT)

which in general is a predator of the soil and the atmosphere. Secondly, this proposal will increase the benefits that the producers obtain from their productive activity.

### **The Practice**

Since its foundation eighteen years ago IPIAT's work mainly has been done with the poorest peasants, farmers and rural people. In this case study the peasants share the vision to upgrade their social productive relationship, helping those who need to recover their land and establish a seeds agroecological network.

#### Participatory Methodology

Our collaborative methodology enables the peasant to share a common vision in the process of “learning by doing”. This process has several phases:

First phase: Socialization of Knowledge and Collective Work. This means to share knowledge among the farmers and their families. The educational process is informal and formal. It will depend on the productive activities that they choose in their participatory methodology, which we apply in the field work and in our interactions with the farmers.

The participatory methodology allows the farmers to explain their land and field problems. We look at the physical limitations that are commonly found in degraded soil. For example; some that usually are found are:

1. soil erosion
2. High acidity
3. low organic matter in the soil
4. low or no microbiologist activity present
5. Agrochemical contamination of the soil.

To overcome these ecological problems, the farmer will receive training on agroecological techniques, which he is invited to apply and to evaluate the results. Some agroecological techniques used are:

- v- polycrops
- w-green manure
- x- agroecological soil management
- y- dry mulching
- z- terrace-bench techniques.

The second phase: A systematic process is done in the following way:  
Systematized Process in Degraded Soils

<b>Producers</b>	<b>Limitations</b>	<b>AgroecoPractices</b>
A	2, 3 and 5	W, X
B	3	W,X
C	5	V,X
D	5,3	Y,X,Z
E	1,2,3	Y,Z

This process is also accomplished by growing several crops to provide the family with the staple food required and to produce their seeds.

The third phase: This phase involves the organization of agroecological meetings when required for the evaluation of the productive process or when the groups of farmers ask for it.

Those meetings have the following objectives:

- a) The exchange of knowledge and working experiences
- b) The exchange of seeds and seed histories
- c) The dissemination of the results, achievements, and benefits in different types of communities.

Routinely since Christmas 2002, agroecological producers have organized the Christmas Parrounm (parradon navideño) which is a party where the farmers get together to exchange their learnings and receive new agroecological producers who are coming to be involved in learning new agricultural practices. This coming December 2005 the Christmas Parraunm will be held in the mountains of Paramos (2000 masl). IPIAT is helping to organize 52 new agroecological vegetable producers who are in the transition process of recovering their degraded land.

### **Assessment and Impact**

One of the important benefits has been that during 2003 and 2004 quantities of agroecological seeds were offered for sale to the program by the Ministry of Superior Education, as well as the Mission “Vuelvan Caras”: Quantities of 10,000 kilograms of black bean seeds; 2,500 kilograms of red beans (frijol bayo); and 13,000 kilograms of agroecological corn. Several producers organized by IPIAT have proposed offers to producers in other states of the possibilities to be involved in a participatory process of networks of agroecological seeds. This has integrated new producers who will be working on agroecological seed production and exchange.

Table 1 shows the number of sensitized producers and the numbers of hectares that are involved in the participatory bank of agroecological seeds in the states of Barinas and Portuguesa. At the

moment, these networks have to initiate activities for the agroecological production of black beans and red beans.

Most of the farmers are working in this case study mainly due to the following:

- 1) Their need to improve the capacity of the organization, production, and productivity of small agricultural producers, especially in the production of seeds (with an emphasis on black beans).
- 2) To foster the agroecological organization of small-farmer producers using their knowledge and the natural resources from their own reality.
- 3) The integration of the farmers and agroecological trainers.
- 4) To elevate their capacity to negotiate the conditions of life.

Table 1. Networking Agroecological Seeds of Black and Red Beans

Community	State	Farmers / Cooperatives	Acres black bean	Acres red bean
Remolino	Barinas	Roberto Colmenares	½	½
		Oswaldo Jiménez	½	½
La Raya	Barinas	Judith Gómez		5
Los Rastrojos	Barinas	Oscar Orta	20	
		Ernesto Orta	6	4
Araucuita	Barinas	Ana Varela	4	2
San Hipólito	Barinas	Cooperativa San Hipólito	10	
Los Pajales	Barinas	Carlos Jiménez	5	
		Gregorio Herrera		
La Herrera	Barinas	Carmen Matera	2	
		Víctor Díaz	1	
		Zenaida Pavón	1	
La Barinesa	Barinas	Curso Vuelvan Caras (80 lanceros)	4	
Cacao-Paguey	Barinas	Alberto Bencomo	5	
Ballaca	Barinas	Angel Ramiro	1	
Altamira De Cáceres	Barinas	Anibal Ramírez	1	
		Alfonso Valencia	2	
		Lilian Leal	2	
Aguada	Barinas	Rosa Briceño	2	
Nde:	Portuguesa	# total de Lanceros:		
La Morena		19	12	
Doña Elvira		19	15	
Los Hermanos		20	13	
Carrizal		25	10	
Ospino	Portuguesa	Víctor Pietrogrande	2	
		Alonso González	1	
		Pausides Márquez	1	
		Carlos Freites	1	
		Juan Meza	1	
		Alexis Díaz	1	
		Manuel Peralta	1 ¾	
		Félix Martínez	1	
Chabasquén	Portuguesa	José Fernández	1 ½	
		Cosme Pérez	10	
San Genaro De Boconoito	Portuguesa	Juan Montilla	1	
		Alirio Montilla	1	
Gato Negro	Portuguesa	Carlos López	1	
Papelón	Portuguesa	Pablo Matute	1	
Sucre	Portuguesa	Miguel Hernández	2	
		Juan Colmenares	1	
		Douglas Escobar	1	
Santa Inés De La Montaña	Portuguesa	Herry La Cruz	1	
		Javier Morillo	1	

## Impacts

We expect to establish in the western areas of Venezuela in a period of three years the first network of black bean agroecological seeds. It will be an important achievement due to the fact that the black bean is a staple food of the Venezuelan diet and that this area is historically well

known for producing black beans. This will contribute in the struggle to diminish the demand for the import of this staple food.

Other results and that we are obtaining:

- 1) So far we have 123 producers working in agroecological techniques, and we are counting on having between 300 and 350 farmers in a period of two more years.
- 2) 60 to 95 technicians working on agroecology.
- 3) Establishment of several networks of agroecological seeds and recovered traditional seeds.
- 4) With Via Campesina, IPIAT is joining the World Seed Peasant Campaign Program
- 5) Establishment in one of the main areas of staple food, the black beans network. Up to now we have approximately 200 acres full recovered.
- 6) Application in several acres of the agroecological soil recovery process.
- 7) With MST- Brazil we are elaborating some guidelines for the re-establishment of certified agroecological seeds.

In this case study it is important to consider that agroecological productive activities always were supported financially by the farmers and peasants. Lack of money has been one of our main problems. Another difficulty is the lack of land. Some farmers must rent or share land to engage in the activities and gains. One action that we are doing is to create cooperatives in order to demand local government for a land reform working from an agroecological perspective.

The achievements presented in this case study encouraged the Venezuelan Central Government, especially from the Presidential Office, to call for agroecological activities. The Venezuelan Government started to realize that not only is land tenure one of the main problems in our agricultural policy, but also that we must learn how to work the land in a sustainable and agroecological way. This approach will improve the quality of life of the small farmers and peasants.

From the Presidential Office we have organized the following activities:

1. Campaign Against Transgenic Food:  
[www.biodiversidadla.org/article/articleview/6271/1/15](http://www.biodiversidadla.org/article/articleview/6271/1/15)
2. Workshop on Recovering Soil and Water River Basin. Dec. 2004.  
[www.rebellion.org/noticia.php?id=11317](http://www.rebellion.org/noticia.php?id=11317) -
3. Participation in World Social Forum Porto Alegre Brasil 2005 promoting the International Seed Banks among MST and Vía Campesina.  
<https://www.ecoportal.net/content/view/full/41027>.
4. Organizing and Coordinaton of the Campesino Workshop in the III Meeting of Solidarity of the Venezuelan Revolutions. April 2005.  
[www.circulosbolivarianos.org/proceso/eventos/ponencias\\_centrales/conclusionescbp.pdf](http://www.circulosbolivarianos.org/proceso/eventos/ponencias_centrales/conclusionescbp.pdf) -
5. Organization of six workshops on Agroecological Coffee Public Policy. July-August 2005.  
[www.inmotionmagazine.com/global/man\\_cafe.html](http://www.inmotionmagazine.com/global/man_cafe.html) - 68k -  
[www.funmrd.gov.ve/webfunmrd/ConsultaPopularPlanCafe.pdf](http://www.funmrd.gov.ve/webfunmrd/ConsultaPopularPlanCafe.pdf)
6. Among the Ministry of Sciences and Tecnology, Fundacite Merida organized four workshops on agroecological management.
7. Participation in the First Congress of The Frente Nacional Campesino Ezequiel Zamora, (FNCEZ) Sept. 2005.

[www.pan.gob.ve/view/galeriaList.php](http://www.pan.gob.ve/view/galeriaList.php) - 28k -

8. Organization of the III Meetings on Preserving the Biodiversity among those NetWorking on CBDAL Barinas Sept.15 to 18th 2005.
9. Conferences on Agroecological Endogenous Development have been presented in some Venezuelan States; including Aragua, Carabobo, Yaracuy, Lara, Barinas, Merida, Tachira y Monagas.

### **Opportunities for Mainstreaming and Scaling up**

The IPIAT process during the last 18 years reveals that in order to advance and consolidate SARD initiatives as agroecological, we have to consider the following reflections:

- 1) The communication issue is crucial to disseminating SARD and agroecological practices.
- 2) From the consolidated SARD and agroecological practices we must create new social productive organizations, with a new vision of food sovereignty.
- 3) Having a SARD good practice and strong social productive organizations must lead to social political pressure for the right to develop agroecological and SARD practices, being financed by the local governments.
- 4) From the social political actions we must try to define some SARD agendas which we will be able to discuss and articulate with political actors within the science and technological arena. Science must be integrated in the farmers' work
- 5) Defining SARD working agendas among the peasants and the political actors will help us to engage in social control work (contralorias social) to assure that the agenda of activities are accomplished.
- 6) Some of the social political pressure for the advancement of SARD comes from seminars, workshops, the fight for land reform, different types of mobilizations, especially peasants being mobilized.
- 7) Finally one important reflection for us is:
  - a) everyone does politics.
  - b) political actions means to drive different types of social relations forces.
  - c) any type of issue, interest, objectives as agroecology, SARD initiatives, seeds, biodiversity will help to dynamize the field of social relations forces.
  - d) in our work at that stage we must ask what our vocational personal attitudes and aptitude are and how they are fixed in our political relationships
  - e) we must create collective references, methods, concepts and criteria which will be incorporated into the social movement.
  - h) the SARD local initiative is one of the best ways to manage and integrate some of our efforts.
  - i) we might able to find and establish activities which will give to the networks as main components of the political action. Here we are taking about gestation of ideas and how to fix local agriculture agendas which will give ideas to define more global agendas. The process is coming from the bottom to the top.

Finally, the concepts must be incorporated, analyzed and discussed in order to improve our political actions. Remember that social political actions belong to the society, the people, the



peasants, the farmers and others. The social political action does not belong to the politicians and is not exclusively their domain.

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**Title of Best Practice:** Conservation of forest biodiversity through sustainable production systems that increase the use of (agro)biodiversity by local communities: lessons learned in a Humid Montane High Andean Forest in Ecuador<sup>26 27</sup>

**Country:** Ecuador, Province of Carchi, Municipalities of Montúfar and San Pedro de Huaca

**Authors:** Kaia Ambrose, Luis Ordóñez<sup>28</sup>, Kelvin Cueva and Luis González

**Category of Practice:** Sustainable use of natural and agricultural biodiversity

## Context and Genesis

### Description of the Production or Service System

The current practice has three components: research, agro-biodiversity and institutional environment. In the first one, we examined the existing and potential use of (agro) biodiversity, both in the forests as in the agricultural systems, of the *ceja andina* life zone. It was taken into account the heterogeneity of communities and ecological, social, economic and historical factors. The research component helped to understand the relationship between people and their life spaces (forest and cultivated land) and to describe the present situation of the agro-biodiversity and the critical variables that influence it. This was validated through of social learning platforms among strategic project partners (Plataforma Ceja Andina).

The second component of the study was focused on gaining experience with the use of (agro)biodiversity by supporting existing experiences, and helping local groups to establish 'learning centers' where different experiences and learning processes were tested, adapted, and shared with local farmers. Alternative production systems were developed and established. This component emphasized the need for fomenting endogenous learning processes where people have different tools to experiment and make decisions. Facilitation of agro-ecological knowledge and behavioural changes is vital. The CEAPs approach is to test ideas and evaluate outcomes in a small scale and then disseminate it to a wider scale.

The institutional component aimed to support local decision-makers, mainly the environmental units of the Municipalities of Montufar and Huaca, to jointly identify, develop and promote policy instruments around natural resources management and biodiversity-rich production systems. To this end, the PCA facilitated the creation of social learning platforms. The Plataforma Ceja Andina is social learning space where different actors are able to engage in dialogue and debate to engage in dialogue and debate in order to achieve consensus and concerted actions regarding the sustainable use of agro-biodiversity. The PCA presents relevant

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<sup>26</sup> IFAD Supported Case Study

<sup>27</sup> This project was financed by the Internacional Developmet Research Center (IDRC) of Canada and executed by the EcoPar Corporación, and Ecuadorian NGO (Corporation for Research, Training and Technical Support for the Sustainable Management of Tropical Ecosystems - Corporación para la Investigación, Capacitación y Apoyo Técnico para el Manejo Sustentable de los Ecosistemas Tropicales .

<sup>28</sup> Corporacion EcoPar, Ecuador.

information to community members, urban citizens, other local government entities, about research and issues of interest related to natural resources and provides a space for facilitated discussion and making decisions among different stakeholders. Collaborative actions include the strategic planning of these environmental units.

#### Description of Social, Economic and Institutional Context

The study was carried out in a Humid Montane High Andean Forest and classified as “Bosque Siempreverde Montano Alto” (reference). It has an area of 27578 hectares in an altitudinal range that varies between 2200 and 4400 meter above sea level (masl). The topography is rugged, with slopes that vary between 0 and 171% which has allowed the formation of *quebradas* and then form the river Minas and Apaqui. Huaca and Montufar have a mean annual precipitation of approximately 800 and 2000 mm and an annual mean daily temperature of about 12°C. There are two wetter seasons occurring from February to May, and from October to December (Hofstede et al. 1998). Soils in Carchi are derived mostly from volcanic ash and are deep Andean black soils, classified as Andepts (Crissman et al, 1998). Soils are rich in organic matter.

The population of the area is made up mainly of mestizo people, Spanish-speaking population. Most of adults have at least a primary school education as reflected by a nearly 90% level of literacy. The study was carried out in the communities of Mariscal Sucre and Jesus del Gran Poder in the Cantons of San Pedro de Huaca and Montufar, respectively. According to the National Institute of Statistics and Census (INEC 2001), the Canton Montufar and San Pedro de Huaca have 28 576 and 6856 habitants, respectively. 64,5% of population live in the rural area. Access to education is limited and agriculture is the main economic activity. Rural areas show low yields because of lack of technology and research. The level of education plays an important role in people interested in conserving. Results of ECOPAR research show that about 60% of people who did not have access to education, do not have interest in conserving. This percentage varies according the education level.

Most of population economically active is engaged in agricultural activities (20,60%) and in those activities that do not require high level of qualification (44,43%). The average income of farmers in the zone is \$97,36 by month. This amount is inferior to the national minimal wage (\$135,6 for agricultural workers)

The local economy is based on the production of potatoes and dairy cattle, which allows a family income that covers basic education and health costs. Most of farmers are resource poor who had a lack of knowledge of alternative production practices. Farmers have good agronomic conditions but face severe pest problems and are highly dependent on pesticides. Their production is market orientated. The commercial production in the zone is dominated by smallholder households that average approximately six hectares and typically consist of several plots (Barrera, Norton and Ortiz, 1999). This is a high input and intensive production system that requires high economic, social and environmental investments.

This situation has forced farmers to clear forest in order to expand of the agricultural frontier. People have also destroyed the ceja andina forest for wood extraction (1-2 hectares monthly), charcoal (200 sacks monthly) and firewood. However, 25% of people have interest in reforestation activities. Other landowners have already begun to conserve the forest for water

protection, use of medicinal plants, quality of habitat for wildlife, and for the beauty of landscape. The increasing interest in forest conservation is related to the loss of goods and services from the forest. Land and forest have multiple uses for different actors with different perceptions that originate a complex relationship between them and sometimes conflicts.

Finally, the current context of modernization of Ecuador implies changing roles of actors and new responsibilities for local governments, communities and citizens in general, in regard to, among other things, natural resource management and responsible community development. Under this context, the responsibility for managing resources has been passed to communities. However, local governments, mainly environmental units face several constraints in terms of lack of budget and personnel (two or three people by unit). These units have to be strengthened (capacity building) in order to face their new responsibilities.

#### Problem/Issue or Circumstances that Gave Rise to it or was to be Tackled

The northern Andes Mountains of South America are home to a broad variety of ecosystems and to some of the world's most unique plant and animal species. Years of deforestation have reduced forest cover and biodiversity, and continued pressure by small-scale agriculturalists threatens remaining forest remnants. But increasingly cash-poor smallholders in the Carchi province of northern Ecuador face a series of economic, social, environmental and health problems that leave them few options to converting remaining forests to cropland.

At present, this deforestation trend is not likely to change because the economy of the region is driven by an intensive, high input potato-milk system. People are forced to continue clearing old-growth Andean forest to replace the impoverished and intoxicated soils where potato crops were established. Likewise, they are forced to increase the investments on fertilisers and pesticides to increase the crop's yields. However, these strategies have not been very successful because of some factors such as: potato prices are highly variable throughout the year because of overproduction, lack of political will, over production and potato production from Colombia and Peru, among others.

Migration of family members to cities and flower producing zones, loss of biodiversity, severe health problems due to use of highly toxic pesticides, depletion of land, and expansion of land under cultivation, and reduction and contamination of water are only some of the consequences of this situation.

Fortunately, farmers and other local stakeholders recognize the problems and have showed interest for developing new conservation strategies and the need for alternative e innovative production systems.

#### Organizations and Stakeholders Involved in its Conception and Design.

This initiative was the result of developing the Management Plan for the parish of Mariscal Sucre in 1999 ECOCIENCIA, an Ecuadorian NGO, in collaboration with local governments, community of Mariscal Sucre and the Jatun Sacha Foundation were involved in this effort in order to conserve the *paramo*. Subsequently, ECOPAR wrote a proposal in favor of protecting the *ceja Adina* forest and *paramo* through the sustainable use of natural and agricultural

biodiversity. Changes in stakeholder perspectives and attitudes about forest need to shift and move quickly. In this context, collective efforts are crucial.

## **The Practice**

### Description of Innovations or Changes Introduced

The big challenge during this project was to combine scientific research and participatory research (development initiatives). Investigations were based on communities concerns in order to meet their needs.

A social learning space was created, the Ceja Andina Platform, to bring together different actors who were able to engage in dialogue and debate in order to achieve consensus and concerted actions regarding different issues, principally conservation and development of the ceja Adina life zone. The Ceja Andina Platform is one such space, where relevant information and research results have been presented and shared. It also became in a space to train and strengthen capacities, mainly the environmental unit staff and County Assembly of Montufar.

The learning centers, CEAPs, are platforms to involve local farmers with the development of alternative production systems. Farmers test productive ideas and innovations and exchange and share its knowledge with facilitators. The CEAPs are based on participatory methodologies such as FFS and CIALs that promote the learning by doing principle. Four pilot learning centers with organic production were established. Production is selling in a stand in the local market in San Gabriel, Canton Montufar. This was an excellent opportunity to meet a felt need of farmer: the lack of markets for their products.

The Outcome Mapping methodology was used as a following-up and evaluation tool of the project outcomes. This methodology is based on measuring and evaluating changes in attitude of the important stakeholders involved in a project instead of only measuring tangible products. The outcome methodology provided a space for social learning among strategic project partners, as well as institutional learning within the executing organization of the project.

### Resources Required

This project required material and human resources. The budget was \$250,000 over two and half years. For the execution of this project, a local research team (*Equipo Ceja Andina*) was established with a coordinator for each component. In addition, students who were doing their BS thesis and consultants also collaborated.

### Main Intended Target Groups

The main target group are the following:

#### 1. Communities

Group of young farmers “Jesús del Gran Poder”, Association “Jesús del Gran Poder”, Association “Sembrando Futuro” (Mariscal Sucre), Club Ecológico (Mariscal Sucre), Salvemos el Bosque de Arrayanes Group, Communities of Monteverde, Solferino, Pizán, Jesús del Gran Poder, El Rosal, Athal, San Cristóbal Bajo y Alto, Tanguis y Calpaz;

## 2. Local Governments

Municipalities of Huaca and Montúfar, Provincial Council of Carchi, Parish Council, and water users' association in Mariscal Sucre

## 3. Non-Governmental Organizations

Alianza del Norte (Grupo Randi Randi, Red MACRENA, Jatun Sacha Foundation), Proyecto Eco-salud;

## 4. Research institutions and universities

Rural schools of Huaca y Montúfar, Escuela Superior Politécnica Ecológica Amazónica "ESPEA", Universidad Técnica del Norte "UTN", y Universidad Central

## **Assessment and Impact**

### Why was it Considered Successful

A baseline has been generated that allow knowing the actual status of the natural resources (water, soil, biodiversity) in the study area. This baseline is useful for different stakeholders (decision-makers, communities, NGOs) to plan and manage natural resources in a sustainable way. A new approach and renewed interest in forest conservation is being taken in the area. Environmental awareness is increased resulting in biodiversity conservation.

At local level, individual and collective capacities have been built and strengthened: students, teachers, local governments and communities in general. Through this, they started influencing local decision-making concerning the importance of promoting new agricultural practices. Changes of behavior, perceptions and attitudes of different stakeholders have been achieved.

Different spaces of training and exchange of experiences have also allowed the organizational strengthening for production and commercialization. Farmers are testing productive ideas and innovations. Value-added products are a viable alternative.

Development of strategies of conservation should be developed jointly with development initiatives. They require an understanding of human values and perceptions in order to ensure that policies and management strategies are effective and justified. In the present practice, conservation was linked with clean production alternatives and a market strategy (stand in the local market) generating a good demand at local level. Any conservation and development initiative should consider the changing economic context in order to be successful.

### Evaluation of Benefits

Quantitative benefits have been achieved through the Red APRONOR. This farmer association directly sells their organic products (about \$60 daily) on Saturdays in a local market. This is an extra income.

On other hand, several quantitative benefits are also achieved. For example, communities know about the actual status of their natural resources, agro-biodiversity has been increased at farm level, greater food security, awareness and interest for protecting watersheds, exchange of

experiences between farmers and extension workers in the learning centers, native crops have been valued and protection of natural biodiversity.

In general, participatory processes have been promoted in different spaces such as the Ceja Andina Platform, participatory budgeting and Municipal Assembly. All of this information has allowed making-decisions based on data (e.g. water) engaging strategic actors from local governments, action agencies, and research institutions.

#### Most Significant Impacts

The productive alternatives linked to markets have showed to be a viable strategy to conserve the ceja Adina forest. It has allowed generating extra income, diversifying crops and improving food security of families. Early evidence from this experience is promising with farmers appearing highly motivated.

Results investigations have generated about water have helped take actions based on data to improve its quality. Information has showed that drinking water is chemical and bacteriological contaminated.

The different spaces of dialogue have also facilitated to bring together different stakeholders from multiple organizations to support this kind of initiatives. A collaborative approach has been taken to strengthening individual and collective capacities. Communities and local governments are changing their roles and now are responsible for managing its own development.

#### **Factors Contributing to Successes and Failures**

##### Problems Encountered and Solutions Found in Implementing the Practice

The political environment, mainly during the election time, made communities were reluctant to be involved in the project. This situation was overcome after elections period and with dissemination of information about the Ceja Andina project, its vision, goals, and approaches.

The current farming system potato-pasture has implied severe social and environmental problems, especially related to pesticide overuse (highly toxic-red level) with serious health impact and lost of soil fertility. Consequently, farmers continue clearing forest to replace the impoverished and intoxicated soils where potato crops were established. Likewise, they are forced to increase the investments on fertilizers and pesticides to increase the crop's yields. This situation encouraged seeking viable alternative and cleaner production systems with other crops than potatoes linked to small-scale markets with progressive and innovator farmers. Next, the goal is reach a wider market.

The development of a provincial decree for protection of the *ceja Adina* forest by the provincial government created a severe conflict between authorities and landowners. Because of a top-down approach used, this initiative was not as effective as though. They complained because they were not involved during the entire process, felt that this decree was imposed from above and restricted their freedom of land use. There were misunderstandings and lack of accurate information and Municipal and provincial authorities had to deal with and clarify this situation.

### Key Driving Forces in Managing Change

- Political and economic support from the Municipality of Montúfar in order to create a baseline, promote several initiatives and provide follow-up to such activities
- Political stability (the mayor of Montúfar was reelected)
- A participatory approach (learning by doing)
- Progressive and innovator farmers
- ECOPAR playing a facilitation or support role rather than being a leader.
- Research that takes into account community concerns in order to meet their needs.
- Strategic alliances and organization of communities
- Social learning
- Planning, monitoring (following up), evaluation and self-assessment using innovative methodologies such as Outcome Mapping
- Donor flexibility to make changes during the process

### Main Reasons Contributing to Success or Failures

The openness and political will of Municipality of Montúfar allowed supporting new initiatives, working in strategic alliances and investing significant human and material resources. This collaborative approach did not allowed duplicating efforts; on the contrary, it helped to take advantage of the spaces gained by them. In addition, the local authority involvement during the project facilitated continuity in the planned activities during the participatory budgeting that the Municipality of Montúfar carries out every year.

There is a local market in San Gabriel (Canton Montúfar) where farmers of the learning centers have a stand to sell their products (vegetables, medicinal plants, jams, handicrafts, etc.). This helped to complete the productive chain and continue this process with innovator farmers and other people.

Research was focused on meeting farmers' needs which allowed making proposals based on specific results. In most of cases, farmers were directly involved during investigations. This fact makes farmers know the process and feel ownership of the study. Information was used by farmers to better making-decision and promotion of awareness of conservation of their natural resources.

The application of new methodologies in the learning centers, such as Farmer Field Schools (FFS) and Local Agricultural Research Committees (CIALs) has allowed strengthening farmers' capacities. Farmers are willing to experiment and adopt new sustainable production alternatives.

Instability of potato prices has caused that farmers seek to diversity their crops.

### **Opportunities for Mainstreaming and Scaling-Up**

#### Suitability for Scaling-Up

The cultural diversity of the population is a very important factor to consider in replicating this exercise; some of the elements to consider are: that communities are not homogeneous, that there are various different interests in conservation and sustainable use of biodiversity, and that systems of cultivation are specific to each site. In this sense, its feasible to replicate



investigations (base and participative investigations), the CEAPs with different productive alternatives, market strategy, Outcome mapping, and different locations for social training and internal development, which always value the characteristics of each site and the participators in general.

#### Risks Associated with Scaling-Up

The risks that may present themselves include the following: On a large scale, production costs can increase significantly and competition with traditional or mainstream production can not be matched. Political instability will not permit the inversion long term, nor the support and protection to national production. Another risks is the lack of demand that may exist for organic and non traditional products; the population buys based on prices and not quality, there is still little acknowledgement for clean agriculture.

#### What has to be Done to Promote it Elsewhere Successfully

To generate a base line of the scenario where the exercise will be replicated, to achieve the backing of the local governments, to generate strategic alliances, to begin the development of pilot projects with the most innovative agriculturalists, and push for political backing on a local and national level.

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Systematization of the investigation and training implemented by the Ceja Andia Project to know the real life systems, and their relation with the state of conservation of high Andean forests (in elaboration)

**Title of Best Practice:** Territorial ordering, interinstitutional joint around the environmental management in the river basin of La Miel: From the restrictions to the opportunities<sup>29</sup>

**Country:** Colombia, Province of Caldas,

**Authors:** Andrés Felipe Betancourth López<sup>30</sup>.

**Category of Practice:** Inter-institutional collaboration about policy design with community support.

## Context and Genesis

### The Production System

As far as the productive thing, in the altitudinal strip from 1200 to 1600 meter above sea level, main the agricultural activity is small plantations of coffee (90% of them of less than 2 ha of extension), while in the marginal zones high and low the extensive operation of bovines constitutes the main source of income, and is complemented with the sale of panela, and in some cases with extractive activities of biological resources. The studies of categorization of producers from the characterization of their productive systems, have allowed to identify 8 types of rural homes (Table 1) (Agudelo *et al.*, 2003; Arias *et al.*, 2002):

Table 1. Kinds of producers of La Miel and their socio-economic index

Kind of producer	Monthly Net Incomes (US\$)	People / family	Daily Income/ person (US\$)	Poverty Line
“Pequeños cafeteros”	123.3	3.0	1.37	3.0
“Medianos diversificados”	132.9	6.0	<b>0.74</b>	<b>-16.8</b>
“Jornaleros”	154.8	6.8	<b>0.76</b>	<b>-16.2</b>
“Grandes cafeteros”	441.1	5.9	2.51	38.8
“Paneleros”	260.3	5.7	1.52	7.7
“Marginados”	189.1	6.0	1.05	<b>-7.1</b>
“Ganaderos en compañía”	164.4	5.2	1.05	<b>-6.9</b>
“Grandes ganaderos”	315.1	7.3	1.43	4.9

<sup>29</sup> IFAD Supported Case Study

<sup>30</sup> Fundación Eduquemos, Colombia

### Social, Economic and Institutional Context

The river basin of La Miel is located to the east of the department of Caldas in the Eastern slope of the Central mountain range, draining towards the Magdalena river. The high precipitations of the high part of the river basin (superior to 7000 mm per year) generate an immense hydric net that has allowed the identification of at least 14 hydroelectric projects, for that reason determines the existence in the region of 2 water bodies of considerable magnitude: The Amaní embalse of the hydroelectric project “Miel I” and the San Diego lake. The distribution of rain throughout the year, that determines the absence of dry periods, constitutes the comparative advantage of the region for the development of the hydroelectric projects. In that same measurement, the wooded bodies of the high part of the river basin are strategic for the regulation of the volumes. But the strategic importance of the river basin and its forests not only are in the hydric regulation and the sediment control, but also its enormous biological wealth. In the high part of the river basin is Florencia’s rainforest, which has been declared as Natural National Park on March 10<sup>th</sup>, 2005. This Park has 67 species of mammals and 233 of birds in an extension of 10 thousand hectares; it has the most diverse and rich herpetus from Colombia: 65 species of amphibians and 18 of reptiles, that represent approximately 25% of the totality of amphibians and reptiles reported in the Colombian Central mountain range (Corpocaldas, 2004). Of the registered species, an important proportion is endemic or is declared in some degree of extinction threat (at least 11 species of amphibians, 7 of mammals and 6 of birds. Rueda *et al.*, 2004). By virtue of this, the necessity of its conservation has been emphasized in the declaration like Natural National Park, after that it was been declared Important Area for Conservation of Birds (AICA), figure that is promoted by the Institute of Biological Resources Alexander von Humboldt and Bird Life International. Nevertheless, with the wealth in natural resources it resists the vulnerability of the social events: The socioeconomic indicators of the east of Caldas are less to the average of the department. For example, Samaná is the poorest municipality of the department, according to the Index of Basic Necessities (62% of the families) and the Stollbrock’s Index of life quality of 27, is lower than the departmental level (50) and the national average (37). The institutional activities in the zone are few and its location concern to the market centers, it is considered marginal. Leaving of the countryside in the last years becomes giving like a tendency attributed to the violence, the institutional marginalization, the decomposition of the peasantry and the new forms of use and appropriation of the productive zone, with a disordered growth of the cattle ranch that demands little manual labor, promoted by the crisis of the land to which it has come to add the presence of helping actors in the concentration of the property, as the armed groups and the drug trafficants (Betancourth, 2002). Many of the paths of the river basin lack the service of electrical energy and practically no one of them has services of aqueduct and sewage system. In education terms, most of the rural communities only have the service of primary basic education. A great proportion of the settlers still leave before finishing their primary studies, demotivated by the lack of opportunities and the conditions of poverty from their families. The young people are joined quickly to the labor market like agricultural workers, and others are enlisted in the rows of the armed groups that reign in the zone. The desertion appears by multiple factors like low economic income, minimum awareness of the parents towards educative processes, and early incorporation to familiar productive workings. The lack of educative infrastructure, the desertion, and the approach that occurs in the countryside to the education are even factors which they limit the social development of the population and therefore they force it, to use of inadequate way the natural resources and to demand other nonpresent resources in the market.

### Problems to be Addressed

Without doubt, the deterioration of the natural resources and the low educative level of the individuals are conditions of most of the rural settlers of mountains, in the river basin of La Miel, the country and the south of the continent in general. First, it limits the possibilities of use and productive advantage on the part of the rural families, and triggers conflicts of interest, scene in which weakest politically they have minors comparative advantages in agreement spaces and negotiations. The second problematic frame, related to the low educative level, conditions the rural settlers to have minor elements of judgment for the intervention in its states, it restricts the decision making and it increases the breach between the generation and the adoption of technology. Both conditions know clearly bonds with the conditions of poverty, and although there is a controversy in the causality between the poverty and the deterioration (Tapasco *et al.*, 2003). The producers pushed by the population growth and the poverty, are forced to use fragile marginal grounds with the consequent degradation and, as well, the poverty level is accentuated by the low productive potential of its resources. The deficiencies in the formal education and the disarticulation of this one and the productive sector, are serious limitants of the scientific and technological development in the country. In Colombia, it is reversed only 2,8% of the GIP in education, in comparison with countries developed like Canada, whose investment surpasses 7,4% of the national GIP (Corpoeducación, 2002). As far as investigation and development, 0,10% of the GIP is only reversed, and there is a researcher by each 25000 inhabitants. Education constitutes the main means to surpass so much the poverty as the structural causes that reproduce it: low productivity, socio-cultural marginality, vulnerability; but to optimize this impact it is necessary also to count on an educative system that tends to the fairness, that is to say, to one better social distribution in the quality and the profits of their beneficiaries. The educative policy forgot the farmers, and the few young people who do not emigrate of the field are condemned to the most severe cultural margin. In order to promote the innovation and the change of articles of incorporation the organization of the rural community is required, the arranged management of a development plan with the different actors and the qualification from the local human talent (Rivera *et al.*, 2002).

### Organizations and Stakeholders Involved

The river basin of La Miel was selected like site pilot of the Partnership for the Sustainable Development of Andean Ecorregión CONDESAN in regard to its strategic importance for the conservation of the biodiversity, its hydric wealth, the dynamics of power development that it has and the low quality level of life of the population. From the "Factory of planning of actions for the sustainable development the river basin of La Miel", in 1995, was created an Interinstitutional Committee Ad-hoc like dialogue scene to the democratic participation and the agreement of actions between the different sectors. This interinstitutional effort, led initially by the University of Caldas with the support of CONDESAN, and the participation of the Ies-cinoc, Fundación Eduquemos, Hidromiel and CORPOCALDAS, it has favored the institutional action in the region, in spite of the difficulties of political violence, it has caused the joint management of research and development projects, in the areas of environmental management, conservation of the biodiversity and establishment of sustainable farming systems. Under the initial leadership of the academic institutions, important processes of investigation were produced directed to the evaluation of the forms of use of the natural resources, the systems of intervention and farming production and the impacts of these in the ground, the water and the biodiversity, as far as the social and economic biophysicist, as well as impacts. The evolution of the works of research has

come together in two important processes: The operation of the project "Andean River basins" (Condesan-GTZ) and its methodology proposal of Analysis of River basin, and the declaration of the river basin in process of Environmental Arrangement.

## **The Development Practice**

### The Innovations or Changes Introduced

The model for capture and integration of information used by the initiative is the documented methodology design like "Analysis of River basin" (Estrada, 1999), which allows to identify, to evaluate and to predict the environmental impact and the development of sustainable productive alternatives (Escobar, 2003). According to the methodological model, to be centered in the river basins as analysis unit (with intentions of agroecology development) has several advantages: a) The river basins allow to calculate the water unloading and the erosion of grounds on a landscape scale, two of the main criteria to measure the sustainability of the existing or new production systems in zones of mountains; b) the funds for the handling of the natural resources (in the Andes) are limited, for these reasons to prioritize the interventions and to calculate the index of cost/benefits within a river basin would have to be advantageous to attract the necessary financing for its development; c) If in a river basin agriculture in the low parts is lucrative, but simultaneously one is threatened by the activities that are made above, would be possible to be designed equitable tributary systems that allow to finance investments in ground conservation and water handling in the high zones; and, d) Often small river basins are under the jurisdiction of a municipality, which can be related to local units of decision making. Of the application of the ArcView GIS 3.1/SWAT tool, takes control simulations to evaluate the sedimentation and the run-off that take place in the different units from ground of the river basin, according to the established cover, to slopes and to the precipitation regime that exists in the region. From this information Hydrologic Response Units are obtained (URH), like basic units of analysis. According to the results thrown by the model, it was possible to be established which are the scenes in which greater impact is generated on the resources of ground and water. Before this situation, it is required to define relevant criteria from the environmental perspective. As far as the social events, the criteria to define susceptible social groups of intervention are sent to those types of producers that are located below the line of poverty, assuming that a program of social investment in the river basin must offer guarantees for the insertion of the rural families in regional economic dynamics (Tiled, 2003). In the same way, the biophysics information, thanks to the model, can be discriminated in four covers: Forests, Grass, Coffee and Generic Agriculture. According to the exits provided by the model, at level of sub river basin, URH or cover, the volume of sediments thrown to the river basin and the hydric contribution to the volume can be quantified. The decision making at sub river basin level becomes difficult in as much as the distribution of covers and ground units is heterogeneous throughout these. In this way, if it is prioritized according to the covers, the differences as far as the geographic location and the geologic properties of the site, restrict the efficiency of the propose intervention. At the URH level the information is more precise, it considers the impacts of the activities according to the environmental dowry on which the producer counts. As far as the ground, they are considered of negative impact, and therefore high-priority for the intervention, those URH that contribute to the greater intensities and amounts of sediments. The information of the URH was ordered by descendent way for the intensity and amount of ground. This hierarchical structuring allowed to identify the possible changes of cover for the same ground units of each URH, and to

calculate the differences as far as the contribution from ground and water to the river basin if such change is made. In order to diminish the negative impact on the resource ground, the high-priority URH of intervention turned out to be those that are in table 2.

Table 2. Prioritization of URH and its impact on sedimentation

URH	Actual cover	% area	Recommended cover	% grounds	% accumulated area	% accumulated grounds
3	AGRL	1,38%	FRST	6,31%	1,38%	6,31%
5	AGRL	3,19%	PAST	11,12%	4,58%	17,43%
6	AGRL	4,23%	PAST	12,65%	8,81%	30,07%
2	AGRL	1,23%	PAST	2,96%	10,04%	33,03%
1	AGRL	1,62%	PAST	2,66%	11,66%	35,69%

As a result of this prioritization, it is considered efficient to take part the URH 3, 5 and 6, that correspond to 8.81% of the area of the river basin (9,063 ha), every time executing actions on a percentage smaller to 10% of the river basin would be managed to reduce the present sedimentation in more than 30%. Change proposed towards cover forest, that would be less attractive for the producers, represents percentage smaller of reconversion (1,38%), where the greater changes would be around the establishment of cover of Grass, on which still greater proposals can be done of technological changes which they aim to still more reduce the environmental impacts of the cattle activity and increase the productive benefits, like the exploitation systems on agroforestral models. These last ones were not modeled because it is still not counted on the biophysics and physiological information required to feed the model. If it is decided to take part on the following URH, the increase in the cover of the intervention would be of 1.23% of the area, where it would contribute a 2,96% sediment reduction. Although the relation continues being progressive, the increase in 1.254 ha of the cover represents stops costs for the programs, in contrast to the every time smaller environmental benefits.

#### Innovative Integration of Research Activities:

- Watershed analysis to identify negative externalities - location, magnitude and who is causing them
- Determination of hydrological response units as the minimum hierarchical level required to integrate hydrological watershed dynamics and the behavior of production systems
- Valuation of natural resources for which any market price has been assigned. Shadow prices are determined in order to find that value
- Communitarian support to make decisions and designing policies

#### Resources Required

The project "Sustainable land use in the river basins of the Andes", tries that the actors in the selected hydrographic river basins, 10 in the ecoregion (from Colombia to Bolivia), they use the environmental externalities identified in the prioritization and execution of projects of sustainable development, and establish mechanisms of negotiation for the implementation of schemes of payment by environmental services as new form of institutional adjustment in the

handling of the river basins. In the river basin of La Miel, resources from hydro-electrical energy sold, are sending to the municipalities, in order to their environmental contribution. In addition, resources from projects as same as “Andean watersheds”, support the initiative and the activities of researchers, NGO’s and Universities. In the same way, co-investment schemes are designed to promote alternatives that are not currently supported by rural entrepreneurs given the consideration of economic criteria only. This scheme finances options where ex ante evaluation demonstrates that environmental and social benefits compensate low economic profitability.

#### Main Stakeholders and Actors in Implementation and in Outcomes

In the advances of each one of the present organisms in the river basin and the interinstitutional cooperation, and application of the Law 1729, that orients the environmental arrangement at river basin level, constituted the Consultative Council of the river basin La Miel and an Advisory Technical Committee, as instances in charge to support the design and management of the Plan of Ordering and Handling of the River basin (POMCA), to coordinate the processes of planning, evaluation, and pursuit of the use of the natural resources, and to orient the required investments and the pursuit of the decisions that are adopted. The Council has representation of the Mayors of the municipalities of the River basin, the civil organizations, the Universities, Corpocaldas, the productive sector and the ONGs. At the present time, several processes in march exist, like the one of the environmental management in the municipality of Pennsylvania, a financed project to Fundamaya and Ies-cinoc by the Found for Ambiental Action (FPAA), which must as objective reconvert the use of the ground the river basin of the Pennsylvania river, one of the subriver basins of La Miel, conciliating the vocation of grounds with the interests of the community, and fortifying the organization and the processes of local management. Its utilities obey to the typical situation of Andean slopes: lack of territorial planning, expansion of the agricultural border in damage of the forest areas and practical unsustainable agriculturists environmental and economically.

#### **Assessment and Impact**

##### Why was it Considered Successful

Because the territorial ordering of the river basin of La Miel (POMCA) is a pluri-participative strategy, in which local and regional authorities are opening the doors to the design of policies, by the way of holistic analysis, education, co-investment and democratic scenes.

- Evaluation of benefits (quantitative and qualitative) for stakeholders, e.g. who gained most, who gained least, who lost? Describe in terms of specific poor and/or vulnerable group and sub-groups where possible.

The community in general has won because it has the space to contribute in the efficient allocation of the public investment resources, and has the opportunity to structure its own productive projects and of infrastructure dowry of services, counting on the support of the institutions (NGO’s and universities) that contributes solid and forceful arguments so that the management proposals are structured suitably. The municipal mayors have gained because the planning at municipal level has been participative, which legitimize the management and fortify the democracy, and in addition, opportunities of management through the integration and the vision of a common territory have been identified, that it is the river basin.

### Most Significant Impacts

At this time the results are not evident, but the previous studies allow to prioritize the investment, every time it is had identified where are the poorest producers and which their environmental dowries, to identify more pertinent are the productive proposals.

### Significant Outcomes

Regional integration, participation of the communities, conformation of local technical committees and support for the elaboration of projects

### **Factors Contributing to Success or Failure**

#### Problems Encountered and Solutions Found in Implementing the Practice

Conflicts of soil use, that generates more environmental deterioration and more poverty. The ordering of use of the territory and the prioritización of the investment resources constitute the main alternative implemented

#### Key Driving Forces in Managing Change

The consolidated communitarian organizations and the credibility and legitimacy of the local academy has facilitated all the made processes to date

#### Main Reasons Identified Practices Contributed to Success

As much the internal conditions as external have been fundamental and scaling-up has been conjugated in the process of territorial ordering at level of river basin

### **Opportunities for Mainstreaming and Scaling-Up**

#### Suitability for Scaling-Up

The application of law 1729 about ordering and handling of hydrographic river basins is executing in 5 pilot river basins in Colombia (one of them is the river basin of La Miel). The generated experience, as much in profits as in difficulties, will be used by the national environmental authorities to advance similar processes in the rest of the country. The actions of the project "Andean River basins" are talked back in 10 river basins of Andean countries, and the project promote permanently events for interchanges of experiences.

#### Risks Associated with Scaling-Up

The heterogeneity and the little level of advance in the design of economic instruments to fortify the application of policies

#### Promoting the Practice Elsewhere

To support the communitarian base, to improve the registry of information at local level and to enable or to advise technically to people in charge to make decisions and to design policies.



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**Title of Best Practice:** Using Environmental Externalities to Generate Equity in Rural Income: From Theory to Practice<sup>31</sup>

Country: Fuquene Watershed (Colombia)

Authors: Estrada, Ruben<sup>32</sup> and Quintero, Marcela<sup>33</sup>

**Category of Practice:** Environmental services management

## Context and Genesis

### Description of the Production of Service System

This Colombian study case is focus on the development of a financial mechanism to enhance small farmers' capacity for implementing conservation farming practices in the Fuquene watershed. The purpose of promoting changes in crop and soil management practices is aligned to the main objective of CONDESAN and GTZ (Andean Watershed Project-AWP) that is to reduce negative impacts caused by environmental externalities as the small farmers' income is increased. Specifically, the designed financial mechanism aims to incorporate the use of green manures (oat and turnip), reduced tillage and/or direct drilling in the existing production systems. This practices where selected because of the favorable impacts on productivity detected on pioneered experiences lead by GTZ (Environmental Project in Colombia -EPC) and the regional environmental authority -CAR in the watershed. Also, positive impacts on reduction of erosion and fertilization and on the improvement of water retention and net income are insinuated by an ex ante analysis. The expected impacts are important in the watershed since as it will be explained further, the Fuquene Lake located downstream is suffering an eutrophication process. GTZ(EPC)-CAR have been working jointly in the extension of these activities and adjusting the required equipment to implement direct drilling and reduced tillage. The financial mechanism presented here was developed to increase the adoption of this management practices by incrementing the financial capacity of small farmers that is required to make the technological change. To reach this objective CONDESAN-GTZ (AWP) made an agreement with GTZ(EPC)-CAR to assure the technical assistance needed for the implementation of the practices. Also, two farmers associations were introduce to the partnership acting as direct beneficiaries of the financial mechanism and also as intermediaries between CONDESAN and the smallest farmers who do not belong to the associations. This mechanism is structured on the basis of previous research activities developed by CONDESAN-GTZ and support by the Water and Food Challenge Program of the CGIAR.

The financial mechanism consists in providing credits to farmers committed to incorporate the proposed practices in their production systems, who in regular conditions are not able to apply for credits. Although, production costs and productivity surveys shows that by incorporating farming conservation practices the net income is increased, the technological change is not reach

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<sup>31</sup> IFAD Supported Case Study

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readily since it is required an initial investment higher than with conventional tillage since it is necessary the introduction of green manures prior to the conventional crop sow. The mechanism was installed in 2004 and since then, it has been immersed in two phases. In the first phase a fund was created by CONDESAN-GTZ and managed directly by the farmers associations. The fund resources were used as capital for credits with a low interest rate. In the second phase (2005), the funds have been used as guarantee of the 10% of the farmers contracted debt. The resources are deposited in a commercial bank, who guarantees other 10% of the debt. The remaining 80% is covered by a national guarantee fund (FAG) that was designed by the Colombian government to support the farming sector in the country. With the new scheme developed in the second phase, CONDESAN- GTZ aims to multiply the existing resources for investments and also, to incentive the use of existing governmental guarantee facilities that are not widely used by the small farmers because of: 1) the lack of commercial banks willingness to lend money to producers that can not offer own guarantees and 2) the lack of motivation of the farmers to apply for guarantees to the FAG due to the transactions costs and the time needed for the preparation of requirements and the respective approval. With the guarantee fund provided by CONDESAN-GTZ, the process for accessing to the FAG and to the bank credit is accelerated as the farmers are supported now with resources deposited directly in the bank.

CONDESAN-GTZ expects to determine the biophysical ex post impact of these practices on the improvement of the lake conditions. If the results are positive, this practices will be incorporated as an alternative that can be compensated by a payment for environmental service scheme also promoted by the project.

#### Description of Social, Economic and Institutional Context

The Fúquene Lake provides potable water to more than half a million people downstream. Huge amounts of organic matter are being released into the water by at least five different actors. In the agricultural sector there are potato growers on very steep slopes (above 2900 m elevation), cereal crop growers at lower altitudes, and cattle producers on the flat landscape around the lake. The urban sector has two main actors: Those dumping wastewaters into the lake and those located downstream where water is used for consumption.

Fúquene Lake is located in the valleys of Ubaté and Chiquinquirá, north of Bogotá, the capital of Colombia. Concern for the lake's conservation began in the latter part of the twentieth century when the environmental authority target change toward a better understanding of the lake role in the ecological and socioeconomic processes in the region. The lake has deteriorated extensively due to excessively high levels of phosphates and nitrates and the proliferation of aquatic plants, which have accelerated eutrophication. The surface covered by water has been reduced in more than 50% during the last 60 years. The downstream municipalities, whose aqueducts depend partially or totally on waters from the Suarez River, which begins at the outlet of the lake, are concerned about the future of their water-supply systems.

A systematic study using secondary data was contracted by the regional environmental authority CAR. Results suggest that cattle producers are responsible for 80% of the pollutants that flow into the lake. Fertilizers from the pastures manure and urine wastes infiltrate the waters permanently (CTI et al., 2000). However, cattle ranchers did not accept these results since there are other important pollutants such as the industry and population around the lake with an

inappropriate treatment system for residual waters, and the upstream potato growers who used high amounts of fertilizers. The annual contribution of total loads including point and non-point sources is estimated at 48,123 kg/day of total N and 6,156 kg/day of total P (CTI et al., 2000).

The area lacks sound environmental management, both in the upper parts of the watershed where paramo ecosystems are practically replaced by potato crops and in the valley bottom where cattle ranchers overexploit land and destroy the wetlands. From a socioeconomic standpoint, inequity is characteristic, with the most productive areas in hands of large landholders owning big dairy farms, while in the hillsides there are smallholders growing potato and cereals.

Although the CAR efforts are focused on the lake restoration and the adoption of conservation farming practices, its results have not yet reached the levels expected by national authorities and the civil society. The lack of a widely strategy to promote the technological changes in the production systems in order to reduce their effects on the lake deterioration could be one of the causes.

#### Problems to be Tackled

The Fuquene Lake has been progressively invaded by aquatic vegetation. Nowadays, about 80% of the original lake surface is entirely covered by these plants and some of these parts are fully filled with sediments. Due to the high degree of degradation, the restoration and conservation of this lake has become one of the main objectives for the Colombian environmental authorities since it can affect 27 aqueducts that are supplied by the lake. Regarding this environmental concern, CAR accepted CONDESAN-GTZ support to conduct research and development actions in order to identify the point and non point sources of pollutants, to prioritize areas according with their responsibility in the lake eutrophication and to design actions to modify the environmental externalities affecting it. During this work CONDESAN-GTZ conducted ex ante analysis to determine the impact of changing conventional tillage practices by farming conservation practices. An environmental and socioeconomic evaluation showed that implementing farming conservation practices in the prioritized areas could reduce the negative environmental externalities by about 50% as the net income and employment opportunities are increased.

#### Organizations and Stakeholders Involved

After ex-ante evaluation of this alternative CONDESAN-GTZ decided to invest some development funds to promote conservation farming widely and also to evaluate ex post the expected impacts. The conception and design of the financial mechanism, the ex-ante analysis based on a hydrological analysis of the watershed and the application of isotopes techniques to identify non point pollutants was led by CONDESAN-GTZ (AWP). Those research activities have been conducted by members of the research team posted at the International Centre for Tropical Agriculture (CIAT). Seed resources have been provided to CONDESAN by GTZ (AWP) and the Ford Foundation.

In addition, GTZ(EPC) has played an important role by participating in the design of regulations for the use of the fund resources by the farmers associations. CAR role has been crucial in the extension activities that are essential for implementing conservation farming practices in the field. Both institutions, GTZ (EPC) and CAR, jointly with two farmers associations

(ASOAGROALISAL and CORPOMORTINO) and CONDESAN (AWP) are part of a credit approval committee, which is in charge of guarantee that the funds are used by small farmers.

## The Practice

### Innovations and Changes Introduced

The innovations introduced in this case study are based in the kind of strategic alliances built in order to achieve specific objectives, the methods employed for ex ante analysis and the methods for biophysical impact verification.

*Innovative Partnerships:* This project has initiated with a partnership between research and development as a requirement to evaluate and demonstrate that environmental externalities have an important potential to mobilize economic resources to the poor population in the Andean watersheds. Once this kind of partnership was consolidated between CONDESAN and GTZ, pilot sites were selected. One of those Fuquene Watershed, where GTZ (EPC)–CAR were developing extension activities to introduce conservation farming practices in the agricultural areas. However the impact on lake restoration, employment generation and net income was unknown since there was not ex ante analysis and methods to measure those impacts. The research team of the AWP is playing an important role by contributing to that analysis. Once an ex-ante analysis was conducted the development component of the AWP was oriented to design and implement a financial mechanism for promoting farming conservation. In order to guarantee that the funds were to be used directly by the producers, and alliance with the farmers associations was created. These associations were in charged of manage and used the resources.

Recently, a bank has been incorporated to this network of partnerships. Such an effort is a quiet important innovation because it has been feasible in the practice to incorporate the banking sector into financial schemes for small farmers. In table 1, the roles of partners are described.

Table 1. Partnerships created for promoting crop and soil management practices in Fuquene watershed.

Partner	Role
CAR	To provide technical assistant to the small farmers interesting in incorporating green manures, reduced tillage techniques and direct drilling in their current production systems.
GTZ Colombia	To assist in the design of credits regulations. To advise in the implementation of farming conservation practices in the field.
Farmers associations	To manage and use the funds provided in the first phase of the financial mechanism. To apply for credits in the bank during the second phase of the financial mechanism. Some of those credits are to be used by the farmers belonging to the associations, and other part of the credits are managed by the associations but disbursed to non-associated small farmers in the watershed.
Bank	To provide credits using the National and CONDESAN cash guarantees. To control the amount of contracted debts and the respective pay offs.
CONDESAN-GTZ (AWP)	To analyze socioeconomic and environmental benefits of land use and management practices scenarios. To provide scientific evidence of impacts produced by favorable land use scenarios. This information is given to development partners (CAR, bank, GTZ, Ford Foundation) as input to consolidate strategic alliances.

*Innovative research methods:* The methodological approach has permitted not only to measure the impact but to prioritize the areas that have a higher potential in the watershed to modify the negative externalities and produce higher social benefits. Thus the credits are disbursed according with some criteria in order to achieve the environmental and socioeconomic expected impact. For prioritizing areas it is used the concept of Hydrological Response Units (HRU), which are spatial units with similar climatic characteristics, soils, land cover and topographic conditions. In practical terms, it means that each HRU has a quantifiable contribution to the levels of sediments yield, water yield and N and P deposited in the lake. For HRUs identification an analysis of the whole watershed was conducted followed by an integrated evaluation of land uses or management practices alternatives. Thus hydrological, edaphic, topographic and climatic information must be integrated with socioeconomic data of production systems existing in the watershed. It allows the assessment of effects produced at the farm scale as at the watershed scale, specially those affecting third parties (externalities) such as aqueducts.

The main contributions of the research approach are:

- Watershed analysis to identify negative externalities: Location, magnitude and who is causing them.
- Incorporation of isotope techniques for tracing non-point water pollutants used as a means for understanding land-use impacts on water resources
- Determination of HRU as the minimum hierarchical level required to integrate hydrological dynamics and performance of production systems
- Valuation of natural resources, for which any market price has been assigned. Shadow prices are determined in order to find that value
- Ex ante evaluation of alternative land uses through trade off analysis in order to understand the relations among rural income, environmental externalities and employment generation
- Pilot implementation of the selected alternatives (farming conservation practices) to detect potential constraints of massive implementation and verify the achievement of the expected impact
- Verification of the impact of minimum tillage and green manures measuring in the field soil physical characteristics that are related with the water retention (e.g. Soil shear strength, penetrability)

*Innovative Financial Mechanism:* The purpose of the credits is to improve the access to the financial system by small farmers located at the HRU prioritized and that are willing to implement farming conservation practices. As was described above, the second phase of the implemented financial mechanism for promoting green practices has make emphasis in including a bank in the scheme. The main purpose of this is to increased the available capital for credits, to transfer management responsibilities from the farmers associations to the bank, to incentive the use of existing governmental guarantees for small farmers and finally to establish a financial mechanism sustainable in the long term, which is possible if the small farmers enter to the financial system and get used to apply for governmental guarantee facilities.

Thus, the implementation of this kind of financial mechanism has contributed to:

- Promote alternatives that are not currently supported by rural entrepreneurs.

- Create strategic alliances for R&D promoted by CONDESAN-GTZ and allowing face-to-face dialogue between local organizations, national authorities, international cooperation and international research centers.
- Promote crop and soil management changes that contribute to reduce the production of sediments and deposits of N and P into the Fuquene Lake.

### Resources Required

The required costs include research, extension, financial and transactions costs. The important of creating and maintaining the strategic alliances among research donors, international cooperation, environmental authorities, farmers associations and banks is in part for reducing the costs required to develop the steps mentioned above.

Thus research costs are covered by the Water and Food Challenge Program (CGIAR) who is supporting the AWP for developing case studies focus on the implementation of water-related financial mechanisms. Thus, a multi-disciplinary team is supported to conduct research related to hydrological balances, trade off analysis, experimental economics, isotopes techniques, and soil characterization.

The extension costs are equal to the time of two technical assistants and three local promoters sponsored by CAR, in order to guarantee the proper technical implementation of green manures, reduced tillage and / or direct drilling. Also the time of a technical assistant of GTZ (EPC) with broad experience in conservation farming practices.

Financial costs are equal to the capital provided by CONDESAN-GTZ to tackle the financial mechanism. During the first phase US\$20.000 were used as capital for credits benefiting about 40 smallholders. In the second phase, US\$35.000 was deposited in a bank account to be used as guarantee. This amount is covering the 10% of the debt contracted by farmers.

Transactions costs consist in the costs of a certified public accountant that was contracted to assist farmers associations with the accounting of the disbursed credits. In this section are also included some travel costs of CONDESAN- GTZ coordinators to visit the different partners.

### Target Group

The main target group is the small farmers located upstream the Fuquene Lake, whose lands are susceptible to erosion and where the use of fertilizers is part of the causes of the eutrophication process. The small farmers that are benefited by the credits are those that are willing to implement potato and cereal crops with reduced tillage/direct drilling and incorporate green manures in their crop rotations.

### **Assessment and Impact**

#### Why was it Considered Successful?

The successful of the ongoing project is related to the methodological process itself and with the implementation of the financial mechanism.

In the methodological aspect, this process is considered successful since research is closely linked with a development objective. Also, with the methodological approach it was possible to demonstrate that environmental externalities can be the engine to activate collective action for research and rural investment through the establishment of strategic alliances that are motivated by the actual positive impact on environment and rural incomes. The Fúquene case illustrates an ongoing implementation of the methodology, but the scheme can be applied widely as it is running in other parallel watersheds in Peru and Ecuador.

The methods, techniques and approaches have contributed to the main research questions stated at the beginning of the process, and related to:

- The role of land uses leaching nitrates and phosphates into the Fúquene Lake by using isotope water analytical techniques combined with geographic information and hydrological models.
- Hydrological analysis at the watershed level to prioritize, on a more detailed scale, the sites where land-use changes could have a major impact on externalities.
- Integration of hydrological variables with the production systems characteristics, making possible the evaluation of land-use scenarios and the valuation of environmental services in function of production systems capacities.
- Tools designed for the scenarios analysis to determine the cost of changing land uses and shadow prices of environmental services.

Although the financial mechanism could required additional adjustments, it is considered that the ongoing process of its implementation is successful since: i) During the first phase, all the provided capital has been used for conservation farming credits with about 40 small farmers, ii) the capital provided in the first phase of the mechanism has been recovered, iii) the target group has accepted the second phase as it will increase their debt capacity, and iv) the participation of a bank for small farmers credits is consolidated.

#### Evaluation of Benefits

In Fuquene case, the opportunity cost of reducing sediments is high since the farmer must reduce the crops area to achieve that environmental target. However, conservation farming practices are an alternative for avoiding this cost since the technological change improves or maintains the levels of income. Based on the ex ante analysis net incomes of potato growers increased by 16% while cereal growers net incomes remains the same. Evaluation of benefits was done with productions costs obtained in farms already implemented with these practices in the Fuquene watershed (Rubiano et al, 2005)

Regarding benefits for society, sediments yield (ton) can be reduced in a period of five years by 40%, and therefore it is expected that the N and P deposited in the lake will have an important reduction. In another hand, social benefits calculated with value chain analysis demonstrated that those benefits increase by an average of 42% due to higher amounts of day laborers employed and the income increase in potato production systems. (Rubiano et al, 2005)

An additional beneficiary of the financial mechanism and the subsequent incorporation of new areas practicing soil and water conservation practices is the CAR, because it contributes to the recuperation of the Fuquene Lake, one of its main responsibilities.



### Outcomes and Positive Impact on Poor People

The main outcome obtained with this research-action process has been the incorporation of banks to a credit mechanism focus on small farmers. By joining the FAG and the CONDESAN-GTZ guarantee fund, the bank accepted to guarantee the remaining 10% of the contracted debt.

Moreover, CONDESAN-GTZ has passed to the bank an additional proposal consisting in demonstrate to the bank that farming conservation is an environmental sound alternative that is worthy to be supported by the bank existing ecological credits. The advantages of using those credits are the lower interest rate and the important implications that could have the consideration of farming activities into the environmental programs. Therefore, it could demonstrate that environmental actions could bring to the farming sector additional benefits. All research behind this proposal offers a guarantee to the bank due to CONDESAN-GTZ ongoing activities for measuring impact are making possible the demonstration of positive effects of conservation farming on the lake restoration process.

### **Factors Contributing to Success and Failures**

The main constraints have been identified in the costs of basic biophysical data (climatic data) and the transaction costs of involving most of the key stakeholders in the process. The main information constraint was encountered with the accessibility to daily climatic data bases because of its prices and the low access that institutions offer to them. Fortunately, the cost of this information was reduced during the last year and the project could buy it. However, while every watershed has its own particular characteristics, the transactions costs can be reduced or increased depending on the level of local organization and potential of strategic alliances for investment and information sharing.

Additional research is needed to produce basic information inexistent in remote or marginal areas. From experiences in other Andean catchments, the AWP expects to arrive at the point in which strategic alliances are identified among the different stakeholders involved. Work with funding schemes supported by CONDESAN has identified various parties interested in investing in the agreed alternatives. What is attractive is the availability of capital that acts as a magnet for other public and private investors in the area of concern. In this way, creation of those strategic alliances are enabled by the existence of a negative environmental externality which constitutes the engine to attract multisectorial partners, such as those belonging to the farming sector as those representing the environmental and financial one.

The Fúquene case illustrates an ongoing implementation of the methodology, but the scheme can be applied widely as it is running in other parallel watersheds. Thus, this methodological approach is being applied in Ambato (Ecuador) and Altomayo and Jequetepeque watersheds (Peru). In other places, the only potential limitation in its application is the absence of negative externalities causing significant costs for the society. This is considered the engine to activate collective action for research and rural investment through the establishment of strategic alliances that are motivated by the actual positive impact on environment and rural incomes.

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