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FACTS Reports

How to restore dry forest ecosystems

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Abstract. AIDER is a Peruvian non-governmental organization working since 1992 on forest management activities, watershed management and urban forest management on tropical humid and dry forest at a national level. AIDER and the José Ignacio Távara Pasapera rural community have been working on dry forest management and recovery since 1992.

This paper summarizes the activity of AIDER in the dry forests for the purpose of recovering degraded forest areas and conserve existing forests by developing sustainable economic activities, all geared to help improve the standard of living of the peasant population.

The actions reported here were conducted under a research methodology called research-action, where AIDER professionals raised possible technical solutions to problems affecting the community (hypothesis), which were then contrasted with reality through the implementation of projects development, and were finally accepted or rejected based on improved results obtained.

From 1992 to date, AIDER has worked in the sustainable management of around 3,000 hectares of dry forest. Additionally, the genetic quality and livestock management techniques are being improved, and have established vegetable crops at the household level to ensure food security. Now the community is fully committed to achieving sustainable management of their lands and forests, realizing that sustainable management is a key issue to improve their quality of life.

Keywords. Forests, natural resources, sustainable development, agriculture

1 INTRODUCTION

AIDER (Asociación para la Investigación y Desarrollo Integral) carries out forest management and biodiversity conservation projects in dry forest regions of Piura, Tumbes and Lambayeque.

With funding from multiple sources, AIDER manages 3,420 hectares of dry forest: 2,220 hectares in the Piura region and 200 hectares in the Lambayeque region. Its central goal to preserve and restore the dry forest involves: sustainable use of forests and grasslands, based on a cattle and forest management plan incorporating forestry and livestock activities, supplemented by the development of other productive activities which together help improve the population's living conditions and avoid desertification of the habitat.

It should be mentioned that this goal is in line with the country's commitment to the Convention on Biological Diversity, and the Climate Change and Fight against Desertification agreements.

This report summarizes the AIDER experience in dry forest management in the Piura region.

1.1 Peru's dry forest

Peru's dry forests cover 3.2 million hectares and are mainly located on the north coast, in the Lambayeque, Piura and Tumbes regions. They are located between 0 and 1,000 meters above sea level, with average temperatures between 17 and 24 °C, annual rainfall below 1400 mm, and extended droughts lasting 6 to 9 months.

The dry forests are linked to mankind from times immemorial and have been a source of food, wood and energy for the native Tallán, Mochica and Chimú prehispanic cultures primarily based respectively in Piura, Lambayeque and La Libertad.

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The dry forest species have various uses: the Prosopis pallida (algarrobo) is used for burning wood, coal and rural constructions; the Capparis scabrida (sapote) for craftswork; the Loxopterigium huasango (hualtaco), Tabebuia chrysantha (guayacán) and Alseis peruviana (oreja de león) are used for hardwood floors; and the Eriotheca ruizii (pasallo) and Bursera graveolens (palo santo) for fruit crates. The palo santo is also burned as incense in religious festivals and activities.

The use of the fruit of the algarrobo tree is also inherited from the ancient cultures that lived in the dry forests. The first Spanish chroniclers report that the natives ground it into flower used to make a kind of bread.

Today, the rural populations continue to gather the algarroba fruit to eat and to feed their animals. However, a large part of the crop is earmarked for marketing, generating revenue for the precarious family economy.

The herbaceous pastures currently feed the low-productivity livestock that the rural families raise extensively, the herds usually being made up of sheep and goats.

The dry forest covers 24% of the Peruvian coastline; and guaranteeing its survival by ensuring it produces sustainably will have a considerable economic, social and ecological impact, considering that 69% of the coastal region is occupied by unproductive deserts, crossed by narrow valleys, making up 7% of its surface.

1.2 The rural families of the "Ignacio Távara" community

This project was carried out with the rural families of the hamlets of Santiaguero, San José, Santa Rosa, Sausal, Casaraná, Ñómala and La Rita of the José Ignacio Távara Pasapera Rural Community. This is not a traditional rural community but was started by some 800 families of small cattle-breeders and farmers, settled on the less-productive lands of the former farms of Malinguitas, Ñómala and part of Huápalas, who did not benefit from the Agrarian Reform of 1968. These families joined forces to form the José Ignacio Távara Pasapera Rural Community, which obtained official recognition from the Ministry of Agriculture in 1986.

This rural community is closely linked to the history of AIDER, since one of the first 2 projects executed by AIDER was developed in this rural community in 1992, thanks to the efforts of its President at the time, Mr. Francisco Bayona. The friendly welcome extended and the commitment of the population at work, led to continued support and technical assistance provided by AIDER through the years.

1.3 Historical background

In the eighteenth century, agricultural activity is focused on "haciendas" (large estates). In Piura, haciendas controlled almost all of the depopulated large areas adjacent to agricultural lands and forests of carob around cultivated fields or in the basins of the rivers.

These environmental conditions, of Piura, helped develop a new set of relationships between landowners and laborers. The landowner offered to their farmers an access to grazing in the depopulated areas (lands without population) and in the forests of carob on his property. Its obvious motivation was to reduce the pressure of the laborers by large areas of fertile land or higher wages, providing to them a supplementary economic activity. Note that the depopulated areas played a minimal role in the income of the haciendas.

At that time, breeders of goats that used the resources of the hacienda were required to pay rent in proportion to herd size. For example, in the Pabur hacienda, breeders of goats living on the grounds of the estate paid 8% of annual production of their herds, for rental of pasture. They were also required to collect 575 kg of carob pods to the stables of the hacienda.

This arrangement between landowners and farm laborers is the precursor of the mixed system of subsistence farming and breeding goats, is now so common in Piura.

In the mid-nineteenth century, dramatic changes occurred in Piura. The growing international demand for cotton caused many landowners Peruvian redirect their agribusiness, and they replaced their crops of local and regional consumption for commercial and export crops.

In the early twentieth century, 70% of cultivated land of Piura was cotton fields. This condition stimulated technological development. The impact meant a significant increase in the production and pressure to increase the amount of farmland.

Suddenly the land of large farms became a limiting factor for economic growth and the contracts that had previously been so advantageous to the landlords, became an obstacle for further development, and the arable land given to the peasants was worked in small individual batches and less productive. These were the times of conflict between the haciendas and yanaconas[1]: the hacienda trying to "get their land" and the yanaconas trying to hold on to their only source of livelihood.

But the cotton plantations had a crucial problem: the temporary labor. The task force was constituted of a small core group of skilled workers and a large group of unskilled workers hired for short periods, mainly for pest control of campaign and the collection of cotton seasons. For the landowner it was a big problem finding workers to work only two or three months a year and for low pay.

The peculiar ecological conditions of Piura[2] and the existence of an independent pastoral sector helped create a new arrangement between farmers and goat herders. The essence of this arrangement was that the goatherds temporarily work in the cotton plantations in return for access to the stubble fields after the harvest.

The mutual benefit of this arrangement was obvious. Breeders ensured the access of their herds to the cotton stubble, which was vital in the dry season and could earn an additional salary. The farmer, meanwhile, assured labor nearby, who preferred temporary employment without increasing demands for high wages, because the livestock was their source

[1] Yanacona is a word that in the Inca language, means "servant."

[2] The climate in Piura is characterized by average temperatures of 25 degrees Celsius (in summer reaches 37 degrees Celsius) and one or two years with summer rains (consequence of El Niño phenomena), followed by 2 or 3 years of drought.

of income.

Given the success of this arrangement, free and exclusive access to agricultural stubble was also extended to farmers living in villages near the hacienda. However, the shepherds living in the property of the hacienda continued to pay an annual rent, even if they had migrated and worked in the cotton fields.

This was the situation up to 1968. In October of that year, the Military Board that ruled the country, enacted the Agrarian Reform Law. This law expropriated land from landowners and delivered it to the rural workers. In this way it changed the structure of the land, and the haciendas disappeared.

Uncultivated land became the property of the Peruvian State, among them, less productive lands of: Malinguitas, Nomala and Huapalas, whichis where now stands the Rural Community Jose Ignacio Távara Pasapera.

In 1984, eight hundred families of small farmers and peasants who had settled there since the beginning of the century and who were not beneficiaries of the Agrarian Reform of 1968, organized and formed the Rural Community Jose Ignacio Tavara Pasapera[3]. It was officially recognized by the Ministry of Agriculture by Executive Resolution No. 0137-86-AG-II-Piura, dated February 27, 1986, allocating 52,269 hectares of uncultivated land.

2 METHODS

2.1 Localization and limits

The area is located in the districts of Chulucanas (Morropón Province) and Tambogrande (Piura Province), with the following geographical limits:

To the North: land owned by various farmers on the left bank of the Piura river.

To the South: land of the San Juan de Catacaos Rural Community.

To the East: land of the former farms Huápalas, Vicús and Km 50, projected in a straight line due South, to the limits of the San Juan de Catacaos Community.

To the West: land of the Cruz de Caña de Castilla and Apóstol San Juan Bautista de Locuto Rural Communities.

The communal land covers 52,269.13 hectares in total, and is recorded in the Piura public register.

2.2 Demographic aspects

It has an estimated population of 9,772 inhabitants, distributed in 16 annexes. The population is predominantly young, since 44.7% are age 15 years or less and 73.4% are age 30 years or less. Overall, the male population is higher than the female population.

3 Jose Ignacio Távara Pasapera, was a teacher, a native of Frias town, in Morropón Province, Piura department. He was elected Provincial mayor for two consecutive terms (1981-1983 and 1984-1986), in which he made clear his concern about rural poverty in the province of Morropón. He died in 1985 without completing his second term. The rural community adopted his name, in gratitude for the strong support and selfless efforts provided to the peasant organization to achieve recognition.

Table 1. Population estimates for the José Ignacio Távara Rural Community

Annexes	Male	Female	Total	Number of families
San Martín	220	204	424	113
Santa Rosa	130	141	271	83
San José	332	336	668	195
Km 44	77	72	149	35
Km 48	151	155	306	92
Km 50	400	463	863	156
Km 2	132	141	273	59
Sausal	562	485	1,047	201
Ñómala	457	420	877	190
Rinconada	334	300	634	143
Nueva Esperanza	113	86	199	42
La Rita	1,313	1,131	2,444	670
Callejones	445	385	830	209
Chuicas	171	142	313	83
Casaraná	94	114	208	58
Dios nos mire	156	110	266	67
Total	**5,087**	**4,685**	**9,772**	**2,397**

SOURCE: Pre-feasibility study for the project "Reforestation, sustainable production and carbon sequestration in the dry forests of José Ignacio Távara, Piura, Peru". AIDER, 2008.

2.3 Organization

The maximum authority is the GENERAL ASSEMBLY OF DELEGATES, the communal organization being assigned to a Community Council, with the following associated secretariats: Training, Natural Resources, Social Welfare, and Machinery. The Community Council is assisted by a Treasurer and a Secretary, a Community Coordinating Committee and a Technical Consultancy.

At the same time, each Annex has a Local Development Committee and the Delegates elected every two years to represent it before the General Assembly of the Community. The General Assembly meets every month.

2.4 An alternative to existing problems

Working together, the population and AIDER professionals determined the need to work on 3 fronts:

a) Forest management, to recover it, preserve it and obtain sustainable production from it, because the forest is the

setting where they live and carry out their economic activities, that provides food for the cattle and various products used by the peasants. During the project it was observed that recovery of the forest could generate additional revenue through carbon sequestration, and thus activities were integrated for this purpose.

b) Improving the cattle (sheep and goats), because these activities provide meat for food and revenue to pay for their basic necessities.

c) Introducing new farming techniques for year-round production, of vegetables mainly, because malnutrition is generalized, affecting children in particular.

2.5 Forest and grasslands management

Forestry inventories were carried out which guided the Forest and Grasslands Management Plan to recover the forest of the José Ignacio Távara Pasapera Rural Community, which through felling and poor use of pastures is degraded, as shown by its very low tree density (23 trees/ha) and poor tree coverage (5%).

However, considering there is a need to obtain wood for burning and construction, the plan contemplates the controlled extraction of wood from pruning, thinning and selective logging, in areas where the density and coverage allow it.

In addition, the Plan considers planning and optimizing use of the associated grasslands (grass and fodder plants), with the aim of providing food for cattle, ensuring the adequate provision of seeds for the grasslands to regenerate annually.

The following activities are considered: Land planning, Tree Replacement, Forestry Treatments, Grasslands Management and Algarroba fruit harvesting.

2.5.1 Land planning

Four management units were set up:

Control areas: they represent the forest's natural state. They are left unmanaged and serve as controls to compare the benefits and impact of the project's proposed forest management.

Areas of forest management for productive ends: dedicated to forest production. The forestry activities of tree replacement, pruning, thinning and selective logging are applied in these areas, as well as Algarroba fruit harvesting and gathering of grass for hay-making.

Regeneration areas: areas where tree replacement is being carried out since their low tree density and coverage allow no productive activity. They are protected by fences to keep cattle out until natural regeneration or the planted seedlings take root. The grass in these areas is cut for hay-making and storage.

Grazing or corral areas: Intended for rotation grazing of the cattle, with controlled numbers being allowed in, according to the load the area can carry, to avoid overgrazing and ensure adequate seed production for the following season.

2.5.2 Forestry treatments

Shape pruning was applied in the production areas, grazing fields and regeneration areas. This pruning was intended to obtain an ample and well-developed tree crown to promote the production of the algarroba fruit.

Pruning for clearing was carried out in grazing and regeneration areas, with a view to eliminating dead or diseased branches or those with mechanical damage, liable to be attacked by fungi and insects.

In areas with high rates of natural regeneration, selective logging was performed to promote the establishment of the most vigorous species and those with desirable productive characteristics (straight stems for wood production and abundant branches for fruit production).

2.5.3 Tree replacement

Initially the project stressed Natural Regeneration Management, so it was protected using rustic fences formed by branches piled up to a height of 1.20 meters surrounding each sapling or group of young saplings.

Although remarkable success has been achieved in protecting natural regeneration in the managed area, it is important to note that natural regeneration following the rains is not always abundant and its distribution is very irregular; these factors combined make it unfeasible that the forest will be properly renewed relying only on natural regeneration, and reforestation is obviously required to achieve densities suitable for sustainable wood production.

In 2005 a reforestation method through direct planting was tried, using a small-scale drip irrigation system, reusing plastic soda bottles. This system has produced very good results and is the reforestation methodology AIDER proposes for the Reforestation, sustainable production and carbon sequestration project for the dry forests of José Ignacio Távara, Piura, Peru, which was approved and registered in 2009 with the Comité Ejecutivo del Mecanismo de Desarrollo Limpio.

This project's PDD states that, considering 20-year growth periods, each reforested hectare sequesters 108 metric tons of CO2 equivalent. If 30% of the community were reforested (approximately 15,600 hectares), the average annual income from the sale of carbon certificates could amount to US$ 84,645, generating 2,038 permanent jobs for the inhabitants.

2.5.4 Harvesting burning wood

Originally the intention was to extract a volume of wood equivalent to the annual volumetric growth of the tree species, calculated based on the tree stem, which on average is approximately 0.5 cubic meters per hectare. However, as the project unfolded 0.7 cubic meters/ha of wood were obtained by pruning the algarroba, sapote and overo trees, leaving in the forest the 0.5 cubic meters initially scheduled, because the tree stem's wood was not touched and this volume of wood can be extracted without affecting the ecosystem.

2.5.5 Harvesting and selection of algarroba fruit

The algarroba tree's flowering and fructification are not constant over time, and depend on many factors such as the amount of rainfall, when it happens.

Over a period of two years during our project, in the first

year production was not significant due to unseasonable rainfall, and in the second year, the average amount of algarroba fruit collected was 33.5 kg/ha, equivalent to approximately 0.73 cwt/ha, which is considerable given the low tree density.

2.5.6 Hay-making and storage of grass

The grass for hay-making and storage was cut in the forest regeneration areas and production areas. The opening and maintenance of firebreaks was a further source of grass for hay-making. In all, 1.49 metric tons/ha of grass were collected.

2.5.7 Marking out grazing fields

Grazing fields are squares 500 meters along, i.e. they cover 25 hectares. On average, 405 animals can feed on a field during three months.

2.5.8 Cattle management

The husbandry activity had poor results as regards production and reproduction, mainly due to the low genetic quality of the native cattle. In addition, there were high rates of mortality, consanguinity, inadequate facilities and deficient health controls, making the activity barely profitable. The activity had a negative impact on the ecosystem through overgrazing which contributed to desertification.

Faced with this situation, the Cattle Management Plan set two targets:

- to improve the genetic quality of native cattle until a pure breed is obtained through crossing.
- to improve on traditional cattle-raising methods, switching extensive to semi-confined farming and raising the health conditions by setting up veterinary medical supplies and health calendars.

As a result of the application of the cattle management plan, from 49 pure-bred ewes, 26 pure-bred rams and 624 native ewes, 1440 half-bred and 93 pure-bred progeny were obtained in just two years.

2.5.9 Genetic improvement of native sheep

In 1993, AIDER introduced 4 sheep of the breed "AssBlack" (cross of Assaf and Black Belly breeds). The results were not as good as expected because the animals did not adapt to the local weather and breeding conditions. After that the improving breed selected was the Black Belly hair sheep, characterized by its high precocity, rusticity, prolificacy, polyestrous nature, and low food conversion rate.

Modules were formed with the animals introduced. The modules were basically made up of one ram and one ewe of reproductive age, and they were assigned as revolving assets.

Each beneficiary managed two production lines:

- Commercial line, comprising all rams obtained from the cross.
- Breeding line (pure-breed) obtained by mating the rams with the pure-bred Black Belly ewes.

Due to the existing animal husbandry conditions, grading up or back-breeding was considered the most appropriate breeding system. In this way, after the fourth or fifth generation the Black Belly improving breed would replace a high percentage of the native breed. Animals thus obtained are considered "pure through cross-breeding" and their genotype and phenotype are similar to those of the improving breed.

The following proportion of sexes was used: 1 ram for every 25 ewes; confined mating was considered the best choice for the local type of husbandry, as well as guaranteeing the success of the genetic improvement program.

This type of mating confers the following advantages:

- Dams to be served can be selected
- Serving can be controlled
- Lambing can be scheduled
- Progenitors can be easily identified
- Breeding ram use is more rational
- Allows adequate traceability

3 RESULTS

The results obtained are shown below:

Table 2. Results obtained for Genetic Improvement with Black Belly Sheep

Parameter	Native sheep	Improved sheep 1st generation	Improved sheep 2nd generation
Age at puberty	10 to 12 months	9 months	8.5 months
Number births/year	1	1.7	1.6
Number lambs/birth	1	2.1	1.9
Birth weight	1.25 kg	1.95	1.95
Weight at 90 days	9.5 kg	10.9 kg (60 days)	10.9 kg (60 days)
Weight at 6 months	22.5 kg	rams: 33.5 kg ewes: 28.4 kg	rams: 32.2 kg ewes: 27.6 kg
Food conversion	8.0	4.4	4.7

SOURCE: Demonstrative Pilot Units for the development of rural populations of the dry forest, AIDER 2004.

3.1 Improved husbandry

3.1.1 Newborn lamb care

- Observing normal breathing at birth, disinfecting navel stumps, supervising colostrum nursing and sheltered penning.
- Castration of cross-bred rams at 15 to 30 days of birth. The project promoted the use of knife or open wound castration, a tool available to the farmers.
- Identification to facilitate production records and line of descent.
- Weaning at 13 months, possibly delayed one or two months in times of poor food availability.

3.1.2 Lamb fostering

Applied in the following situations:

- The ewe died giving birth
- The ewe rejected the lamb
- The ewe had insufficient milk
- The ewe had more than two lambs

3.1.3 Care of young animals

- Trimming hooves, every 3 months, because they are painful and cause limping if too long, affecting the search for food. In rams it may cause pain during mating.
- Determination of puberty:
- The rams were separated in a special facility because they are more precocious than ewes. They are kept there until 10 months and 35 to 40 kg of body weight. For the ewes, the first estrus was observed, avoiding mating because it is best to mate them from the second cycle and at a minimum weight of 30 kg.

3.1.4 Care of adult ewes

- Mating period: the ewes were given extra feeding (usually algarroba pods) with to promote release of more eggs and achieve multiple births.
- Gestation: lasts 5 months; in the last third, fetuses do 70% of their growing, so in this period ewes were given special feed (algarroba fruit) to ensure the lambs achieve a reasonable birth weight and reduce the risk of mortality at birth.
- Lambing: must take place in a special enclosure (lambing jug) with extreme hygiene to reduce the risk of infection in ewes and lambs. This practice was adopted by the cattle breeders because it drastically reduces ewe and lamb mortality during lambing.

3.1.5 Care of breeding rams

- Breeding rams were housed in individual stables. This practice is still not completely accepted, but those applying it achieve better mating control and avoid wounds and lesions resulting from fights when there is more than one breeding ram.
- Mating period: additional feed was provided to counterbalance the physical toil and to obtain fruitful cover.
- The appropriate ratio of ewes to breeding rams was preserved and a record of covers kept.
- Breeding rams were checked periodically for early detection of infections and to avoid infecting the ewes.

3.1.6 Animal husbandry

The extensive cattle farming traditionally used by the community caused overgrazing, so it was recommended to progressively replace it by semi-confined breeding.

With this system, the cattle is led to the fields in the morning and returned to the corrals at noon, remaining corralled until the next morning. The hay and algarroba pods obtained under the Forest and Grasslands Management Plan made this change viable by providing food for the animals while they are in the corrals.

3.1.7 Feeding

The adequate use of existing pastures was rationalized and optimized. The Forest and Grasslands Management Plan designed 25-hectare grazing fields or enclosures that can support 405 sheep for 3 months. Once the pasture in a grazing sector is depleted the animals are led to another, thus avoiding overgrazing.

Hay was stocked for periods of grass shortage, to cover the food requirements until the next rainy period.

3.1.8 Animal health

There are many possible health problems but many can be avoided through adequate hygiene.

Veterinary medical supply kits were set up with the main medicines and vaccines to ensure proper cattle health. On average each supply kit served 12 families.

In addition, a health calendar was determined, as follows:

Table 3. Health Calendar (by month)

	J	F	M	A	M	J	J	A	S	O	N	D
CD-T toxoid vaccination						X						
Enterotoxemia vaccination				X						X		
Internal and external deworming					X						X	
Vitamin doses						X						X

3.1.9 Facilities

The switch to semi-confined cattle farming can be done using existing facilities, with recommendations to improve hedges and arrange some sectors.

For the construction of new corrals non-flooding high ground should be chosen, avoiding wind and damp, on easily-draining dry land. To determine the dimensions, it is considered that each adult animal requires 2.5 m2. Ewing jugs must cover 10% of the total corral area.

3.1.10 Culling

- Cross-bred rams intended for market were castrated within the first month of life and culled after weaning as this is when the meat achieves the best price.
- The ewes not retained for breeding were culled.
- Adult animals with breeding problems were also culled.

3.1.11 Family orchards

Traditionally farming activities are carried out on temporary plots, making use of the rainfall, and producing zarandaja (Dolichos bean), common bean, cajan pea, maize and watermelon. They do not plant any vegetables.

Initially hydroponics was considered as an alternative to grow vegetables in all seasons. The El aim of this activity was not to generate income but rather to counter the vitamin deficiencies of the family diet.

Although hydroponics culture was successful, it was observed that it would be difficult for them to continue with this activity once the funding was gone because the centers selling the necessary supplies are distant. For this reason, the proposal was changed to incorporate supplies available in the forest, switching to family orchards using organic supplies.

The species most planted initially were tomato, carrot, beet, cilantro, onion, lettuce and radish, but depending on the results a selection was made of those with the shortest growing season and most resistant to pests and disease, as well as the local ambient conditions.

4 DISCUSSION

4.1 Specific implications of the project

A feature of interest of the proposal for sustainable harvesting of the dry forest, based on a cattle and forest management plan, is that due to the slow returns from forest management, it appears that the main result of the various activities carried out is the farming of a greater number of heads of cattle.

Although this perception does not do justice to the importance of forest management itself and the total benefits its generates, it is useful to reinforce the idea of cattle production closely linked to the forest's condition, because the farmers can see their flocks grow and the activities in the forest provide ever more and better products from it, including hay to cover the needs of the growing flocks.

This is why, supported by intense social promotion, the rural communities very quickly saw forest management as a necessary activity, but more importantly, this conviction was based on an issue that is highly sensitive for them, since cattle breeding is a sure source of food and revenue to meet their basic requirements, and anything promoting this activity will be well-received by the rural families.

The cattle breeding component of the proposal provides higher revenue than that obtained traditionally, meat production from sheep and pigs provides the rural families with periodic income to cover their basic requirements and the improvements achieved in sheep breeding ensure better income than traditional breeding, with the added benefit of not damaging the forest and grasslands. In addition, some farmers sell pure-bred breeding rams, a further source of income.

This is happening while the forest reaches the time of harvesting, at the end of the season: the time when the main contribution from the forestry activity will be obtained and from which point crops will be harvested annually. A first estimate obtained by projecting the increments observed on growing plots, shows that at the end of year 38 there will be sustained crops of at least 23.5 cubic meters of wood, which, added to the volume obtained through thinning, gives a total commercial wood yield of 64.75 cubic meters per hectare of managed forest (Palomares et al, 2004).

However, there is a non-wood forest product which can be obtained from the very start: the algarroba pods, the current production of which is 33.58 kg/ha and which will rise as tree density and coverage increase (AIDER, 2000).

To this we must add the acquisition of revenue through carbon sequestration, estimated on average to be USD 27/ha per

annum (AIDER, 2009).

On a social plane, it is also important to mention that the activities proposed for the project help generate permanent jobs in the cattle and forestry activity.

As regards the family orchards, we are certain that what motivated the rural families to adopt this activity into their home economics was the indisputable proof that it is possible to produce vegetables without depending on rainfall, even in such severe conditions as those of the dry season.

Another aspect to be noted is the possibility of giving new use to buckets, pots, boxes, old suitcases, and in general any container capable of holding some soil for vegetable production.

Despite the fact that the best part of the vegetable production was intended for home consumption, it should also be stressed that this activity has allowed the families to save:

- less money spent on vegetables, which can be used to meet other needs
- to get vegetables the families need no longer travel to the cities of Piura, Chulucanas and Tambogrande, saving travel time and money
- less money spent on medicines to fight deficiency diseases and their sequels, in particular on children.

5 Conclusions

- Dry forests can be devoted to production and their survival ensured to their full potential if they are exploited under a Forest Management Plan.
- For adequate tree replacement, natural regeneration management must be supplemented by management of regrowth, plantation, seed dispersion and/or direct sowing, with irrigation.
- The wood obtained as a subproduct of the forestry activities was used by the families as building material and burning wood for home consumption.
- The main impact observed at this time is the genetic improvement of cattle; a random tour of the community will show a large proportion of cross-bred animals (native with Black Belly).
- Genetic improvement shows positive results as regards number of young per births, number of births per year, precocity, lower food conversion and greater weight gain at 6 months of age.
- The family orchards, independent from rainfall, have played an important part in promoting the growing and consumption of vegetables.
- The vegetables grown in the family orchards have improved the nutritional diet of beneficiary families.
- No industrial pesticides are used in the family orchards, so production causes no contamination.
- The family orchards allow the recycling of bottles and containers, placed near the home, and requiring no felling of trees.

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7 References

AIDER, 1995. Seco Bosque. Problemas y Alternativas de Manejo de los Bosques Secos del Noroeste Peruano. Medio Ambiente, Revista Peruana de Ecología y Desarrollo. Edición 64, Abril –Mayo.

AIDER, 2000. Recuperación y Producción Sostenida de Bosques y Praderas, un medio de Lucha contra la desertificación y la pobreza. Sistematización de un Proyecto Demostrativo Ambiental. Lima.

AIDER, 2001. Recuperación y Producción Sostenida de Bosques y Praderas, un medio de Lucha contra la desertificación y la pobreza. Programa APGEP – SENREM, Convenio USAID – CONAM.

AIDER, 2009. "Reforestation, sustainable production and carbon sequestration project in José Ignacio Távara´s dry forest, Piura, Peru" Project Design Document For reforestation and afforestation project activity. CDM-ARR-PDD. Date of the document: 18th June 2009, Version 4

Asencio, F., 1997. La producción de algarroba de los bosques secos. Economía y medio ambiente en la Región Grau. Centro de Estudios Regionales Andinos "Bartolomé de Las Casas" y Central Peruana de Servicios – CEPESER.

Cieza de Leon, P., 1973. La Crónica del Perú. Ediciones PEISA. Colección Biblioteca Peruana. Lima, Perú.

FAO/PNUMA, 1996. Principios de Manejo de Praderas Naturales. Serie: Zonas Áridas y Semiáridas Nº 6. Oficina Regional de la FAO para América Latina y el Caribe. Santiago de Chile

Ferreyra, R., 1987. Estudio Sistemático de los algarrobos de la costa norte del Perú. Ministerio de Agricultura, Instituto Nacional Forestal y de Fauna. Dirección de Investigación Forestal y de Fauna. CONCYTEC. Lima, Perú.

INRENA, 1998. Mapa de los Bosques Secos de Piura. Ministerio de Agricultura. Lima, Perú.

Merino, V., 1999. Contribución de la Silvoganadería a la recuperación ecológica de los Bosques Naturales de Algarrobo. Documentos del I Congreso Forestal Latinoamericano. Tomos I y III, Colegio de Ingenieros del Perú, consejo departamental de Lima. Capitulo de Ingeniería Forestal. Lima.

Merino, V., 2003. Proyecto "Fondo Rotatorio Comunal: Una Contribución al Desarrollo Económico de las Familias Campesinas de los Bosques Secos". Documento de Sistematización. Piura, Diciembre.

Palomares, M., 1994 Manejo del Bosque seco y Desertificación. Revista Regional Bosques y Desarrollo Nº 12.

Palomares, M., 1994 Una experiencia de desarrollo rural contra la desertificación. Revista Regional Bosques y Desarrollo Nº 12.

Palomares, M., 1995. Estimación del crecimiento volumétrico en Bosques Naturales de Algarrobo. En: V Congreso Nacional Forestal. Exposiciones y Resúmenes. Colegio de Ingenieros del Perú, Consejo Departamental de Lima, Capítulo de Ingeniería Forestal, Noviembre.

Palomares, M., 1996. La deforestación encubierta. Artículo periodístico, publicado en la Revista Suceso, del diario Correo, Piura 10 de Noviembre.

Palomares, M., 1996. Manejo del bosque seco del noroeste del Perú. En: Tablero, Revista del Convenio Andrés Bello. Septiembre, Año 20 Nº 53.

Palomares, M., 1998. Desertificación o Desarrollo Sostenido: Opciones para hoy y el Nuevo Milenio. Boletín de la RAP. Red Ambiental Peruana, Nº 8, Octubre.

Palomares, M., 1998. Manejo del bosque seco del noroeste del Perú. En: El Desarrollo Sostenible para Sectores Marginales. Experiencia y Modelos. ITACAB. Convenio Andrés Bello, Lima, Perú, 1998.

Palomares, M, et al 2004. Unidades Piloto Demostrativas para el Desarrollo económico de las poblaciones campesinas del Bosque Seco. Documento de Sistematización. Fundación Interamericana. Piura, Perú.

Palomares, M., 2009. Cálculo del carbono secuestrado. Proyecto Reforestación y Secuestro de Carbono en los bosques secos de Ignacio Távara, Chulucanas – Piura.

PROYECTO ALGARROBO, 1993. Mapa e Inventario Forestal de los Bosques Secos de Lambayeque. Chiclayo.

Recavarren et al. 2009. Determinación de los límites del proyecto y estimación de la línea base de Carbono. Proyecto Reforestación y Secuestro de Carbono en los bosques secos de Ignacio Távara, Chulucanas – Piura.