

CATCHMENT AREA / IRRIGATION SCHEMES AND SOIL CONSERVATION PROJECT

REGIONAL ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

Itasy, Lake Alaotra, Andapa and Marovoay

Executive summary

Executive summary (non-scientific)

This environmental and social impact assessment covers the introduction of a new approach to integrate catchment area protection in development actions at irrigation scheme level. It is an integrated approach for catchment area improvement as well as support to development on irrigation schemes in the frame of a project known as the **National Programme for Catchment Areas and Irrigation Schemes (NP CAIS)**. It is one of the programmes designed to implement Poverty Alleviation Strategy and aims to **combat rural poverty by sustainably improving both the living standards and the income of the rural populations settled in catchment areas thanks to irrigation schemes and better use of natural resources**.

The project comprises four main components which group together all the activities that can be envisaged. The environmental and social impact assessment is structured around these four main components.

- ← Component 1 : Development of Commercial Agriculture
- ← Component 2 : Irrigation Development
- ← Component 3 : Watershed Development
- ← Component 4 : Project management and post-monitoring and evaluation

Initial state of the Environment

PHYSICAL ENVIRONMENT

ITASY

The catchment areas in the study area, especially those in metamorphic soils, are subject to intense *Lavaka* erosion as well as sheet and river erosion, which were already active well before the arrival of human beings. Agro-pastoral methods based on land clearing and burning did nothing but accelerate the damage, consequently penalising both hydroagricultural facilities and roads.

Ampary pilot zone (FAO program) stands out from the study area with the use of several different methods to protect the *Tanety*: surrounding trenches, grassed strips between crops, protective walls, strips of trees, preservation of small woodland zones... It is a showcase that also illustrates the improvements in terms of landscape and the ecological advantages of such methods.

On the schemes, the inflows of silt from the slopes affect infrastructure and scheme functioning and accentuate the effects of flooding. The state of the network and the increased pressure on resources make scheme management a very precarious, random affair.

This is a source of strong discouragement which helps explain why the farmers do not contribute or contribute so little to the cost of maintenance of the infrastructure and networks and why the networks have been abandoned.

In the region as a whole, agricultural activities occupy an important place among all economic activities. The area offers favourable agro-climatic conditions for a large range of crops. Overall, food crops account for the greatest proportion of cropland. The main crops are rice, cassava, maize, sweet potatoes, beans, potatoes and tomatoes. Livestock as well as fishing on Lake Itasy or on the flooded rice fields in the cluster of points on the lake are important activities which generate income and additional food for the households. Silk farming is beginning to be modernized and is now one of the most promising production channels in the region.

LAKE ALAOTRA

There is a very high level of erosion in the Sahamoloto and Anony catchment areas (*Lavka* and sheet erosion). It generates great amounts of sediments that accumulate in reservoirs, dams and irrigation structures, gradually filling them in. Such an intense level of erosion, mainly linked to the presence of sensitive soils and severe runoff, especially during the cyclone period, is worsened by burn methods and wood-cutting as well as by range pasture customs (cattle grazing itineraries).

Flooding caused by the main rivers (Sahamaloto and Anony) and the rise in water level in Lake Alaotra as well as the large amounts of sediment inflow are leading to a real decrease in water resources which in turn affects the cropping schedule and increases the risk of young plants being submerged if they are replanted too late.

The degradation of the infrastructure due to discouraged users and the lack of regular maintenance is causing:

- ← Reduced cross-sections in irrigation canals due to landslides caused by fast emptying, unauthorized withdrawals and zebus crossing the canals.
- ← Deliberate damage to hydraulic control equipment (gates),
- ← Presence of great amounts of vegetation in secondary and drainage canals which proves the lack of maintenance,
- ← Construction of “unauthorized” structures on drainage canals by the users.

In addition to these purely technical aspects, the situation is worse due to conflicts and disagreement within the WUAs and WUA Federations on subjects such as:

- ← how water resources should be shared while structures are being abandoned or in some cases control devices damaged (gates, stop-logs, etc.),
- ← the amounts to be paid as contributions (which are insufficient to cover the upkeep of the network and infrastructure, for example) which are directly related to farmers' income (generally low).
- ← collecting financial contributions, which show such low levels of success that the result is obviously linked to the previously mentioned elements.

ANDAPA

The catchment areas in Andapa still have relatively dense plant cover but it is gradually being eaten away as *Tanety* cropping spreads: —cash crops (vanilla, coffee), cassava, rainfed rice and other food crops— but there are also amethyst and topaz quarries. These extensions are causing gradual deforestation (burn areas, “tavy”) and wood cutting, which accentuate soil erosion and sediment deposits on irrigation schemes in certain places (the loss due to land clearing is estimated at 270 hectares per year, *WWF report, 1997*).

For the moment, this type of erosion is limited in scope compared to river erosion, but it is locally more severe erosion on slopes that causes coarse materials to be deposited, especially during cyclone periods. The resulting rise in river bed level leads to flooding and severe changes in the course of the rivers as well as considerably invading spaces that would otherwise be used to grow rice, and it is difficult to prevent these effects.

The high cost of maintenance for large irrigation infrastructure and the very low income of the peasant-farmers have greatly discouraged the users; this has led to the disuse of some of the largest infrastructure and preserved traditional farming schemes.

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- ← collecting financial contributions, which show such low levels of success that the result is obviously linked to the previously mentioned elements.

MAROVOAY

There is a very high level of erosion in the catchment areas in Marovoay area. It generates great amounts of sediments that accumulate in reservoirs, dams and irrigation structures, gradually filling them in. Such an intense level of erosion, mainly linked to the presence of sensitive soils and severe runoff, is worsened by burn methods and wood-cutting as well as by range pasture customs (cattle grazing itineraries).

Floods caused by the main water-courses locally shift river beds but accentuate even more the amounts of sediment moved and the erosion of the banks.

Sediment flows and their effects on irrigation infrastructure, the shortage of water resources and a lack of maintenance, together with the meagre finances of the farmers make it impossible to keep the irrigation schemes in satisfactory condition. Only traditional schemes (reduced number of facilities) are in fairly good working condition if water is available.

Rice is the predominant crop, among other accompanying food crops (cassava, maize, beans, sweet potatoes). Cattle-farming is very widespread in the area. It is range-type production with herding or shifting during the rainy season. Nevertheless, there is a lot of theft and health conditions are delicate, hence a number of limiting factors for the development of cattle-raising.

NATURAL ENVIRONMENT

ITASY

Regarding natural habitats, there are practically no more of the original formations left (rain forest in the centre), except for a few remains of *d'Uapaca bojeri (tapia)* on the western slopes. Reforested areas and plantations, mainly eucalyptus, pine trees and fruit trees, including jackfruit, papaya and loquats, etc., are a bit like compartment gardens. They are not legally protected but they seem to be spared when it comes to the usual wildfires in the uplands.

Aquatic ecosystems, alluvial valleys, swamps and lakes, offer the most interesting diversity in fauna and flora but they are subject to strong pressure. This is particularly the case on Lake Itasy where there is a lot of pressure on birds and fish and where sediments carried by the erosion of the slopes are gradually silting up the lake (forming floating islands).

LAKE ALAOTRA

Terrestrial habitats are of little interest in terms of flora and fauna. The receiving environment, Lake Alaotra, contains a wealth of flora and fauna. It is also used for different purposes (rice growing, fishing, aquatic plants used for wickerwork...). It is nevertheless under a strong threat of *lavaka* erosion due to damaging activities in the catchment areas affected, i.e. marshland fires and poaching. There are no efficient measures to protect the environment.

ANDAPA

Forest ecosystems are by far predominant and are of marked interest. There are **two reserves** in the study area:

- ← Marojejy National Park. It covers the north-north-eastern part, overlapping the communities of Sambava and Andapa at altitudes ranging from 75 to 2 133m. The flora there is 35% generic species and 85% specific species. The fauna is very rich (23 mammal species, 17 amphibian, 22 reptile and 102 bird species) and famous for its high rate of endemic species (90%).
- ← Anjanaharibe-South special reserve. It is in the south-western part of the Andapa basin, 14,42° South and 49.26° East, the altitude ranging from 500 and 2 064m. The vegetation there is similar to Marojejy but not so high, while the wealth of lemurs characterises the fauna.

Although they are listed protected areas, there is a certain amount of invasion in these reserves. In Anjanaharibe-South, the rate at which the land is being cleared is evaluated at 29 hectares per year inside the reserve and 270 hectares per year outside.

Other outstanding habitats :

- ← In Andapa, there are two gazetted forests out of ten in northeast Madagascar: Besariaka – 36 000 ha and Ambodimirahavavy – 28 000 ha. The flora is composed of the same types as Marojejy but less thick because the riparian populations have the right to use these forests. They are generally exploited in an uncontrolled manner for timber and fuel wood production.
- ← Betaolana forest corridor. It is between two protected areas. It is necessary to protect this corridor is due to its location as a corridor therefore used by animals when there is pressure on the sites they originate from. It also hosts genetic stocks that have been disturbed by the fragmentation of the forest.
- ← Aquatic habitats (swamps, lakes and watercourses) contain diverse flora and fauna where the proportion of specific endemic species is less striking than that of the forests (62%). These habitats are intensely used: plants are used to make wickerwork articles and there is a lot of fishing. The use of fine netting and poison is reducing the catch.

Apart from these outstanding areas, the Savoka —secondary plant formations resulting from abandoned forest land converted into fields to grow rainfed crops— is increasing. This can be seen on all the *Tanety*, often just above rice schemes. These formations are the cause of gully erosion and/or landslides.

MAROVOAY

Ankarafantsika National Park, including the gazetted forest and Ampijoroa Forestry Station, are probably the most valuable item of heritage in the study area. They have been what is known as an “Integral National Reserve” since 1927, reviewed in 1966. The park covers some 65 520 ha and Ampijoroa Forest 20 000 ha. The flora there is distinctive with a vast shrub stratum and numerous lianas; it registers 41% generic endemic species and 90% specific endemic species. The fauna includes:

- ← 38 species of reptiles, among which two are endemic to the region: *Chamaeleo angeli* and *Pygomeles petteri*,
- ← Fresh water turtles, also endemic species and highly endangered,
- ← About a hundred different bird species,
- ← Lemurs, in particular *Avahi laniger occidentalis*, *Propithecus verreauxi coquereli* and *Lemur mongoz*.

Ankarafantsika Forest is a vital protecting catchment area for the rice fields in Marovoay Plain. But like all other protected areas, it is perturbed by grazing, medicinal plant-picking, fuel wood/timber cutting and encroachments onto the edges of the woodland, etc.

Relic forest species can only be found in humid valleys and along rivers.

Along the rivers, there is gallery forest or riparian forest where mango (*Mangifera indica*) and tamarind (*Tamarindus indicus*) trees are predominant. These places are highly feared as crocodiles are often present. It is nevertheless important to note that crocodiles tend to be more and more endangered by hunting.

The most widespread type of habitat in the study area is savannah, especially shrub and grass savannah. The plant life is generally poor but well adapted to edaphic drought and the frequent occurrence (too frequent) of fires. It shelters the similarly poor fauna present, i.e. a few reptiles, insects, ants and termites. The savannah is also used for grazing and is sometimes crossed by alluvial rivers.

The aquatic ecosystems include coastal habitats containing mangrove, marshland, *baiboho* and lakes. In the mangrove, there are some considerable resources which stimulate local socio-economic life. It also acts as coastal protection against the swell, but the intensity of inland erosion on sandy soils is likely to wipe out the mangrove due to the high amounts of crude sediments which many mangrove species cannot bear.

The swamps and lakes are natural formations in the delta zones which are predominant in the plain. They contain a great many water plants (*Cyperus spp.*, *Phragmitis communis*, *Typhonodorum lindleyanum*, *Pandanus sp.*) as well as reptiles and fish. However, drainage to reclaim these areas and the introduction of invasive species such as water hyacinths is changing the habitats. As time goes by, they will become a genuine threat to hydric and hydrological regulation, which is an important role played by such wetlands.

SOCIAL ASPECTS

Generally speaking, the social and economic facets of agricultural development suffer many a blocking factor, in addition to those already mentioned in relation with catchment areas and irrigation schemes.

- ← Problems obtaining land. First come, first served is the general rule despite current efforts to redress the situation and the relatively secure form of ownership on irrigation schemes. But it is still difficult to decide either way when customary recognition, which is still in effect, is confronted with land ownership by positive law.
- ← Reticence to invest. This is the result of the land being insecure and to a lesser extent, the more general lack of security at catchment area scale. It largely explains the low level of investment and the low rate at which micro-finance systems have penetrated rural areas (4 to 5% penetration rate against 9% in the rest of the world).
- ← Lack of security in catchment areas. This encourages the presence of farms in the close vicinity of the villages, i.e. in areas that are easy to supervise (not more than one hundred metres or so away). Beyond, people and property are not guarded, which means that few people dare build farms further away.
- ← Farms are not run to controlled budgets. It is quite exceptional in the present state of affairs to find a farm which plans its budget and accounts in advance. Farmers deal with financial matters at sight, especially at harvest time. A lot of spending that is not always justified soon eats away the season's income, which encourages peasant-farmers to turn to and stay in the vicious circle of debt and its money-lenders.

But also the specific causes to the various sites.

- ← Lake Alaotra :
 - No attempts to obtain technical support. No organised management and leadership in farming sphere ; this is partly responsible for the low yields and productivity. The farmers usually renew seed and cross-breed livestock themselves. Regarding actions at catchment area scale, the personnel and financial resources available are largely insufficient to deal with the problems encountered; in fact, only punctual actions are carried out.

- The problem of water resources. There is not enough water to meet the needs. The current impossibility of cultivating the whole of Sahamaloto Scheme in one agricultural season is visible proof of the fact. The farmers are forced to scale out the season according to their distance from the reservoirs.
 - The age of the hydroagricultural networks means that large-scale rehabilitation is necessary.
 - A large proportion (70%) of non-reclaimed usable farmland,
 - A low level of agricultural intensification: traditional single cropping, the low percentage of use of fertiliser, the high cost of improved seeds, the insufficiency of the equipment and tools,
 - Low level of soil fertility (*tany kotra* or *tany reraka* are gaining ground).
 - The stagnation of the average yields due to fertility problems and the poor performances of the methods used.
- ← Andapa :
- Variable income. Cash crop fluctuations can be alarming for villages mainly depending on this area of the economy (the case of 3 communities out of 12).
- ← Marovoay :
- Diseased plants (fungus type diseases),
 - Flooding from the Betsiboka with large-scale propagation movements and destruction of infrastructure.

Impacts of the project

The actual implementation of the project is substantial to attain the initial goals set, i.e. increasing income and alleviating poverty. The following are the principle impacts to be retained (i.e. the positive effects the project activities actively seek to develop).

Impacts on the physical and biological environment

- ← Improving water resource and network management,
- ← Flood prevention and control,
- ← Long term reduction of erosion in the catchment areas and diminished sediment inflows,
- ← Maintenance of soil conservation and fertility, reduced runoff,
- ← Increased biomass (manure, higher fertility, etc.),
- ← Less grazing land fires with the promotion of fodder plants,
- ← Increase in housing areas.

Impacts on the human environment

- ← Creation of new jobs
- ← Possible immediate effects (agricultural diversification, intensification and the integration of livestock rearing)

- ← Greater diversity in production and in farmers' income
- ← Development of partnerships with the private sector
- ← Increase in production, yield and farmers' income
- ← Greater diversity in production, food balance
- ← Attraction of operators and investors (sale of inputs, farming tools)
- ← Development of supporting commercial structures
- ← Creation of production and distribution centres

Risks and mitigation measures

The project entails a number of risks which vary in scope and type. The greatest ones or those which require more precise assessment concern:

- ← Human health risks related to the use of pesticides and chemical fertilisers,
- ← Production and treatment of waste,
- ← Water contamination risks,
- ← Risk of increasing AIDS,
- ← Increased water-borne diseases.

The other risks affecting the physical, biological and human environments are not likely to have such severe effects on human health and on the human environment:

- ← Risk of polluting the soils due to inappropriate use of weedkiller and pesticides
- ← Increased erosion risks due to greater use of mechanized equipment
- ← Increased herding itineraries and erosion risks
- ← Greater presence at water points
- ← Risk of extending grazing land in protected areas without a clearly defined zoning system for land use
- ← Increased pressure on water resources
- ← Increase in the number of inhabitants attracted by the economic opportunity (increase: saturation, faster dissemination of disease-carrying factors, accident risks, etc.)
- ← Risk of conflicts in relation with access to water
- ← Risk of competition to take over new areas suitable for development
- ← Risk of stronger, "leader" groups taking over the rehabilitation works
- ← Risk of transferring the population
- ← Risk of seeing new technical methods rejected because they are difficult to integrate
- ← Inflation in the demand for land and increased prices for land
- ← Possible tensions within communities

- ← Negative criticism from elders (feeling left out)

For each of the components, the mitigation measures proposed are the following. Globally:

Component 1 : Soil and water management

Extension services on methods, accompaniment and guidance for farmers. This measure has two goals:

- ← To reduce pollution risks for humans and for animals
- ← To manage water resources and soils

Studies to be carried out to improve knowledge or pre-define the main development trends. The absence of or gaps in existing data impose specific studies on some themes in order to make truly relevant development proposals. This component also includes all the legally required studies.

Preparing zoning plans of the area with the consent of the local stakeholders defining the functions of the land according to its environmental potential.

Performance of the development works. This includes all the specific works that analysis has proved useful: erosion protection works, flood prevention, cattle watering places, land enclosures in basins, and also drinking water supply and building latrines.

Definition of legal measures and/or incentive, for instance regulating certain usages or inciting communities to deal with fire control.

Setting up a monitoring (measurement) program. Specific monitoring of key components of the environment (fish, water quality) and structure functioning.

Component 2 : Agricultural and environmental support services

Strengthening of State control and assistance, which not only means accentuating the use of the State's supreme powers in certain cases but also coming back to a financial incentive system (bank loans).

Strengthening the private sector especially by setting up partnerships between farmers and companies, but also by creating private banking organisations and input distribution centres.

Component 3 : Institutional capacity building and political reforms

Definition of the role played by the State. It is necessary to define and present to the local stakeholders not only the sharing of responsibilities between the State and its divested and decentralised powers, but also the sharing of responsibilities in the frame of project implementation.

Adequacy of technical and financial resources to implement the project. With its increased missions and responsibilities, the various bodies/departments (State, divested or decentralised powers) will probably need to strengthen their human and financial capacities.

Component 4 : Project management and post-monitoring and evaluation

Extension and guidance/organisation methods Detailed study of appropriate methods for training and guiding the farmers will be necessary. This is vital if the project is to be a success.

Post-monitoring and evaluation, i.e. synthesis of the monitoring indicators defined under the Environmental Management Plan.

