A market garden located alongside the Nounou installation (Lake Takadji's second installation) (IFAD)

Deepening the channels supplying water to lakes and ponds (Mali)

Surcreusement des canaux d'alimentation en eau des lacs et des mares (French)

DESCRIPTION

The deepening of the channels has made it possible to control pond and lake recharge, optimise yields and crop growing, and increase the area under cultivation.

The water for the lakes and ponds in the lakeland area ('zone lacustre') alongside the Niger River is supplied when the Niger is in spate by means of a system of natural channels. As the water height of the annual flood wave of the Niger has decreased, some lakes and ponds receive little water. The disadvantages of this natural system are: the loss of harvests due to the flooding of fields before the crops have time to mature, and the rapid retreat of waters that inhibits the capillary effect across large areas.
In relation to the building of control structures and the deepening of channels supplying water to ponds and lakes, the projects main objectives are to: restore water supplies to the lakes and ponds previously fed by the Niger River; regularise water supplies to the ponds and lakes; increase the area under cultivation; restart the growing of flood recession crops and other activities in the areas around ponds and lakes; restore the environment and biodiversity around ponds and lakes; raise the water table around the ponds and lakes.

The deepening of the channels has made it possible to recharge lake and pond basins. It is the reason why we are now seeing the resumption of farming, market gardening, animal husbandry and fishing around the lakes and ponds. By building control structures and large dykes it is possible to control pond and lake recharge, optimise yields and crop growing, and increase the area under cultivation. There is a diversification of production and incomes through the farming of small family units and market gardening plots in the lake and pond areas. The installation of bridge crossings with causeways running across marshlands have helped to open up the area and, as such, facilitate the transport of farm produce, the provisioning of local communities and the circulation of road traffic. The development of the dual road/ferry scheme (the Saraféré-Niafunké road and 40-tonne motor ferry) has revived an economic and human activity that was dying out due to extremely high levels of male outmigration, which left women running households and highly vulnerable.

The stages of initiating, planning and implementing works and installations are based on the studies (soil, topographical and socio-economic) carried out by a consultancy and private company recruited through a tender process to deliver the works according to a well-defined timetable. An oversight and control office undertakes the monitoring and control of works quality and the meeting of agreed deadlines.
In principle, works are carried out during low-water periods when most of the floodplains are dry. The swampy nature of the area makes any intervention in the rainy season impossible. Furthermore, the planning of activities must respect the constraints imposed by nature. The Dabi installation on Lake Takadji is a good example of the application of technical standards. The application and modus operandi of this good practice involve the following: the water inlets for the lake and pond basins alongside the Niger River are reopened by deepening the feeder channels; the high waters of the Niger River feed the ponds and lakes; water supply is controlled using a cement structure fitted with gates to prevent: the water flow from reversing when the Niger's water levels are low, water flowing into the ponds and lakes before harvesting is complete; flood gauges to measure annual high water levels.
Various actors are involved in delivering this practice. Their roles are as follows: Beneficiaries are not required to participate in works delivered by contractors (works involving large pond and lakes), but they take charge of the development of VIS plots with support from the World Food Programme (WFP) in the form of supplies. External support from the project/programme finances the installation of facilities, the pump units and the first season's inputs. Consultancies undertake feasibility studies, produce project specifications and plans, and carry out the monitoring and oversight of works. Local authorities, as a general rule, are involved in the planning of activities or, alternatively, make provision for activities in the PDESC. They also handle the upkeep and maintenance of installations.

LOCATION

Location: Timbuktu Region; Niafunké, Diré and Goundam circles; communes of Soboundou, Soumpi, Tonka, Tindirma, Mali, Mali

No. of Technology sites analysed:

Geo-reference of selected sites
- n.a.

Spread of the Technology: evenly spread over an area (332.0 km^2)

In a permanently protected area?:

Date of implementation: 10-50 years ago

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☑ through projects/ external interventions

Installation at Dabi on Lake Takadji (IFÂD)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [ ] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [ ] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Land use mixed within the same land unit: Ja - Agro-pastoralism (incl. integrated crop-livestock)

Cropland

- Annual cropping

Number of growing seasons per year: 1

Grazing land

Water supply

- [ ] rainfed
- [x] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [ ] reduce land degradation
- [x] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

water degradation - Ha: aridification, Hs: change in quantity of surface water, Hg: change in groundwater/aquifer level

SLM group

- irrigation management (incl. water supply, drainage)
- water diversion and drainage
- surface water management (spring, river, lakes, sea)

SLM measures

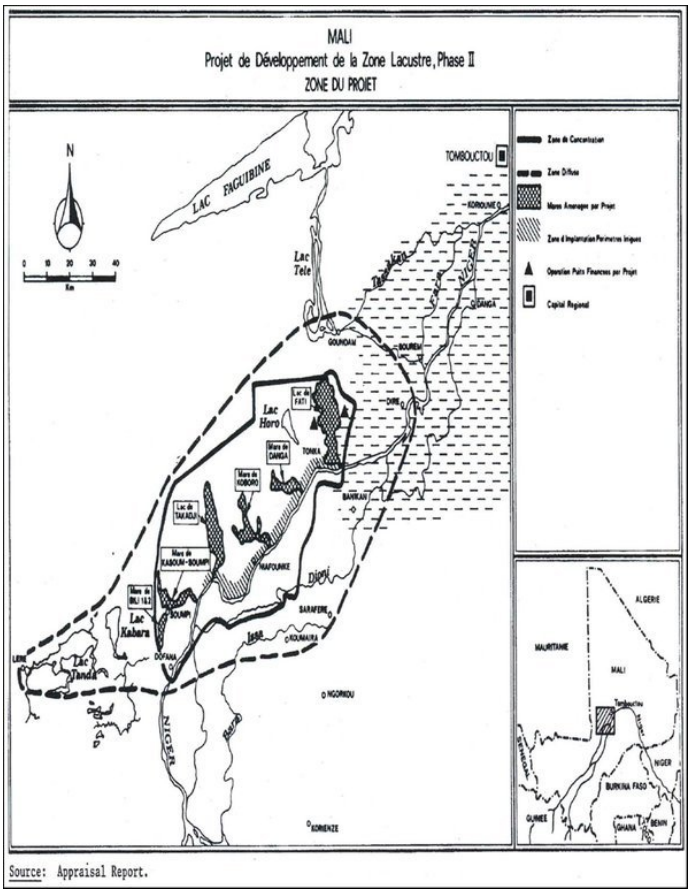
structural measures - S3: Graded ditches, channels, waterways

TECHNICAL DRAWING

Technical specifications

Map of the ZLDP/NKE intervention area, phases I and II

Technical knowledge required for field staff / advisors: high
Technical knowledge required for land users: low
Main technical functions: increase of groundwater level / recharge of groundwater, water harvesting / increase water supply, recharge lake and pond basins
Secondary technical functions: control of dispersed runoff: retain / trap, increase / maintain water stored in soil



Source: Appraisal Report.

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **CFA Franc**
- Exchange rate (to USD): 1 USD = 517.0 CFA Franc
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

The average cost of large ponds is around 300,000 CFA francs per hectare (580 Dollar per hectare). The VIS installation works were conducted using a participatory approach. The project contributed 780,106 CFA francs towards the VIS installation, or 65%, whereas the farmers' contribution was 429,079 CFA francs per hectare, or 35%.

Establishment activities

1. the water inlets for the lake and pond basins alongside the Niger River are reopened by deepening the feeder channels (Timing/ frequency: None)
2. the high waters of the Niger River feed the ponds and lakes (Timing/ frequency: None)
3. water supply is controlled using a cement structure fitted with gates to prevent: the water flow from reversing when the Niger's water levels are low, water flowing into the ponds and lakes before harvesting is complete; flood gauges to measure annual high water levels. (Timing/ frequency: None)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (CFA Franc)	Total costs per input (CFA Franc)	% of costs borne by land users
Other					
total construction	ha	1.0	580.0	580.0	100.0
Total costs for establishment of the Technology				**580.0**	
Total costs for establishment of the Technology in USD				*1.12*	

Maintenance activities

1. upkeep and maintenance of installations (Timing/ frequency: None)

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☑ 751-1,000 mm
- ☐ 1,001-1,500 mm
- ☐ 1,501-2,000 mm
- ☐ 2,001-3,000 mm
- ☐ 3,001-4,000 mm
- ☐ > 4,000 mm

Agro-climatic zone

- ☐ humid
- ☐ sub-humid
- ☑ semi-arid
- ☐ arid

Specifications on climate

Thermal climate class: tropics

Slope **Landforms** **Altitude** **Technology is applied in**

- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [x] valley floors

- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Ja
- [ ] Nee

Occurrence of flooding
- [ ] Ja
- [ ] Nee

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [x] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor ✓	good
education	poor ✓	good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor ✓	good
financial services	poor ✓	good

IMPACTS

Socio-economic impacts

Crop production	decreased	✓ increased
risk of production failure	increased	✓ decreased
product diversity	decreased	✓ increased

production area (new land under cultivation/ use)	decreased	increased
farm income	decreased	increased
development of new farming technologies	reduced	improved
facilitation of transport through the installation of bridges	reduced	improved

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved
conflict mitigation	worsened	improved
contribution to human well-being	None	None

Increases in agro-sylvo-pastoral production, increases in local people's incomes and standard of living. Rice production on a quarter-hectare VIS can increase family income by around 80% compared to traditional means of production involving 1.5 hectares of floating rice grown on the river. The percentage of households that are vulnerable to food insecurity has dropped from 20.4% in 1997 to 5.8% in 2006.

Ecological impacts

water quantity	decreased	increased
harvesting/ collection of water (runoff, dew, snow, etc)	reduced	improved
groundwater table/ aquifer	lowered	recharge
soil moisture	decreased	increased
habitat diversity	decreased	increased
recharge of lakes and ponds	reduced	increased

Off-site impacts

water availability (groundwater, springs)	decreased	increased

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all	very well

Climate-related extremes (disasters)

local rainstorm	not well at all	very well
local windstorm	not well at all	very well
drought	not well at all	very well
general (river) flood	not well at all	very well

Other climate-related consequences

reduced growing period	not well at all	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- 11-50%
- > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- 0-10%
- 11-50%
- 51-90%
- 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- Ja
- Nee

To which changing conditions?

- climatic change/ extremes

changing markets
labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- creates a favourable environment – restoration of the environment and biodiversity around lakes and ponds, the raising of the water table around ponds and lakes, increases in agro-sylvo-pastoral production, increases in local people's incomes and standard of living
- diversification of production and incomes through the farming of small family units and market gardening plots in the lake and pond areas
- plantations growing around 100,000 plants have been developed over the lifetime of the project.
- rice production on a quarter-hectare VIS can increase family income by around 80% compared to traditional means of production involving 1.5 hectares of floating rice grown on the river.
- Management councils for each lake are established. User agreements are drawn up to regulate the management of the scheme (lake or pond) and local authorities are tasked with maintenance.

Strengths: compiler's or other key resource person's view

- The installation of water control schemes has led to increases in the size of areas under cultivation. In Lake Takadji's case, the installation of a second facility opened up a further 1,200 hectares of land for farming. The number of farmers working the lakeland areas has risen from 6.8% in 1998 to 18.5% in 2006, which is due to the growth in land area developed under the scheme and the high concentrations of people living in these areas. This underlying trend in production systems translates as increased agricultural productivity on the ground: per-hectare productivity has grown by 3.8 tonnes over the last eight years in areas using the irrigation and flood recession systems.
- Research carried out with the support of the project team has enabled the development of new farming technologies that have subsequently been provided to households (cropping patterns, improved crop varieties), thereby increasing yields and production.
- the installation of bridge crossings with causeways running across marshlands have helped to open up the area and facilitate the transport of farm produce, the provisioning of local communities and the circulation of road traffic
- the percentage of households that are vulnerable to food insecurity has dropped from 20.4% in 1997 to 5.8% in 2006. The food security index has risen by 2.6 on a 25-point scale for all the households with access to the irrigation schemes.
- migration dropped by 30% between 2001 and 2006.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Difficulties arising from the natural water supply system are: a) loss of harvests due to the flooding of fields before crops have matured, and rapid retreat of waters that inhibits the capillary effect across large areas; b) upkeep and maintenance of facilities

REFERENCES

Compiler
Dieter Nill

Editors

Reviewer
Deborah Niggli
Alexandra Gavilano

Date of documentation: Sept. 24, 2014

Last update: Mei 28, 2019

Resource persons
Dieter Nill - SLM specialist
Bakary Sékou Coulibaly - SLM specialist
Mamadou Nadio - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1635/

Linked SLM data
n.a.

Documentation was faciliated by

Institution
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (GIZ) - Germany

Project
- Manual of Good Practices in Small Scale Irrigation in the Sahel (GIZ)

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