Arabic gum in Niger (Martina Wegner, GIZ)

Assisted natural regeneration (Niger)

Régénération naturelle assistée (French)

DESCRIPTION

Assisted natural regeneration (ANR) is an agroforestry technique, which consists in protecting and preserving tree seedlings growing naturally on cropland or forest/rangeland.

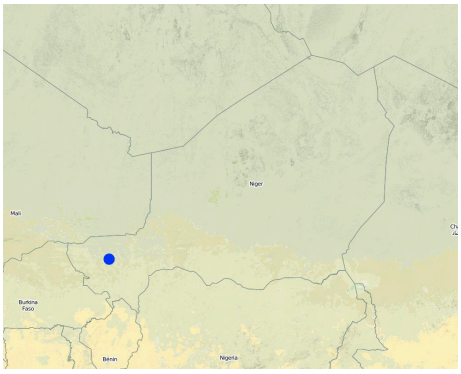
It involves selecting which natural tree seedlings to leave and placing a stake next to them to identify them. The recommended density on cropland is between 60 and 80 trees per hectare. ANR is carried out mainly on individual plots where monitoring and upkeep are easier.

Purpose of the Technology: Tree roots and fallen leaves help to stabilise the soil and thereby reduce water erosion. Some tree species have a fertilising effect on the soil. Legume species (for example, Faidherbia albida) enrich the soil with nitrogen. Other species circulate nutrients from the subsoil into the topsoil thanks to leaf fall. The shade provided by trees lowers soil temperature and reduces the evapotranspiration and thus water stress of plants. They also act as a windbreak and provide protection against wind erosion.
The environmental effect of ANR depends to a large extent on tree density. The reintegration of trees and shrubs into any ecosystem has positive ecological effects and improves and protects the soil. The vegetation provides shelter and forage for animals and contributes to biodiversity. Trees have positive effects on crop yields, when they do not compete with the crops for water. They also provide products and byproducts, such as wood, fruits, leaves, forage, ingredients for medicinal products, etc. Faidherbia albida, for example, has no leaves in the rainy season, which is beneficial for crops. In the dry season, it is green and provides sheltered places for animals to rest. Leaves that fall from this type of tree fertilise the soil. The wood, leaves, pods and fruits provided by trees in crop fields help the owners to meet their family's needs during the lean season.

Establishment / maintenance activities and inputs: In order to implement this technique, there must be a very clear legal framework governing land tenure.
In order to ensure the success of this measure, it is important to protect the tree seedlings and saplings from browsing animals during the first few years. The young trees are pruned regularly to stimulate growth, so that they quickly achieve the height required to make them safe from browsing animals. The choice of tree species depends on the intentions of the farmers (browse for animals, sale of fruits or byproducts such as shea butter, dawa-dawa, medicinal products, etc.). The technique requires no investment, apart from the work involved, and can be implemented by any land owner.

Natural / human environment: The Sahel is a region where the population has always faced a high degree of climate variability, manifested both in terms of time (unexpected dry spells can occur during the rainy season) and in terms of space (rainfall can vary greatly from one area to another). The population is mainly composed of small farmers and livestock keepers.
Over the last two decades, the effects of climate change have exacerbated the already difficult conditions. Accord¬ing to projections made by climatologists, the Sahel will experience a rise in temperatures combined with highly variable rainfall and an increase in extreme weather events.
The Soil and Water conservation and rehabilitation techniques have helped people in the Sahel to manage their ecosystems more effectively and improve their productive land. As a result, communities are better prepared to cope with environmental changes (changes in the climate, land degradation, etc.) and the im¬pact of shocks, particularly droughts.

LOCATION



Location: Regions of Tillabéri, Filingué, Ouallam, Téra and Tahuoa, Niger, Niger

No. of Technology sites analysed:

Geo-reference of selected sites
- 2.2165, 14.25192

Spread of the Technology: evenly spread over an area (approx. 1,000-10,000 km2)

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

Acacia albida in a millet field in NIger (Martina Wegner, GIZ)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [ ] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [x] 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-silvopastoralism

Cropland

- Annual cropping: oilseed crops - groundnuts, cereals - millet, cereals - sorghum, legumes and pulses - peas
- Tree and shrub cropping: mango, mangosteen, guava

Number of growing seasons per year: 1

Grazing land

- Nomadism
- Semi-nomadic pastoralism
- Cut-and-carry/ zero grazing
- Improved pastures

Forest/ woodlands

- (Semi-)natural forests/ woodlands. Management: Selective felling

Products and services: Timber, Fuelwood, Fruits and nuts, Other forest products, Grazing/ browsing

Water supply

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

Purpose related to land degradation

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

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion

soil erosion by wind - Et: loss of topsoil

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)

biological degradation - Bc: reduction of vegetation cover

SLM group

- natural and semi-natural forest management
- agroforestry

SLM measures

agronomic measures - A1: Vegetation/ soil cover

vegetative measures - V1: Tree and shrub cover

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

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

Most important factors affecting the costs

Labour: 5 man-days per ha. • Cost of awareness raising, training and dissemination. • Shears for pruning.

Establishment activities

1. selecting which natural tree seedlings to leave: the choice of tree species depends on the intentions of the farmers (browse for animals, sale of fruits or byproducts such as shea butter, dawa-dawa, medicinal products, etc.). (Timing/ frequency: None)

Maintenance activities

1. protect the tree seedlings and saplings from browsing animals during the first few years (Timing/ frequency: None)
2. The young trees are pruned regularly (Timing/ frequency: None)

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 501-750 mm
- [x] 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
- [x] semi-arid
- [ ] arid

Specifications on climate

Thermal climate class: subtropics

Slope

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

Landforms

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

Altitude

- [ ] 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.

Technology is applied in

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

Soil depth

- [x] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [ ] 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%)
- [ ] 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
- [ ] medium
- [x] low

Habitat diversity

- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation

- [ ] subsistence (self-supply)
- [ ] 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

- [x] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanization

- [x] manual work
- [x] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic

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

Individuals or groups

- [ ] individual/ household
- [ ] groups/ community
- [ ] cooperative

Gender

- [ ] women
- [x] men

Age

- [ ] children
- [ ] youth
- [ ] middle-aged

- [ ] employee (company, government)
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [x] 2-5 ha
- [x] 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
- [x] state
- [ ] company
- [x] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [x] 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 ✓
fodder production	decreased	increased ✓
animal production	decreased	increased ✓
wood production	decreased	increased ✓
risk of production failure	increased	decreased ✓
product diversity	decreased	increased ✓

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved ✓
SLM/ land degradation knowledge	reduced	improved ✓
conflict mitigation	worsened ✓	improved
livelihood and human well-being	reduced	improved ✓

The wood, leaves, pods and fruits provided by trees in crop fields help the owners to meet their family's needs during the lean season. The trees help to improve soil fertility and protect against erosion

Ecological impacts

harvesting/ collection of water (runoff, dew, snow, etc)	reduced	improved ✓
surface runoff	increased	decreased ✓
evaporation	increased	decreased ✓
soil moisture	decreased	increased ✓
soil cover	reduced	improved ✓
soil loss	increased	decreased ✓
nutrient cycling/ recharge	decreased	increased ✓
soil organic matter/ below ground C	decreased	increased ✓
plant diversity	decreased	increased ✓
beneficial species (predators, earthworms, pollinators)	decreased	increased ✓
wind velocity	increased	decreased ✓
competition with crops for water	increased ✓	decreased
stray animals often wipe out ANR efforts	increased ✓	decreased

Off-site impacts

damage on neighbours' fields	increased	reduced ✓

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

The naturally growing trees are maintained during field preparation, some of the side branches may be pruned on the bigger trees, sometimes the Young trees are protected with some thorny branches. No other maintenance needed.

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

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

- Tree roots and fallen leaves help to stabilise the soil and thereby reduce water erosion. Some tree species have a fertilising effect on the soil.
- The shade provided by trees lowers soil temperature and reduces the evapotranspiration and thus water stress of plants. They also act as a windbreak and provide protection against wind erosion.
- ANR contributes to sustainable farming. It is one of the most widely accepted of the land improvement techniques promoted by development projects. The vegetation provides shelter and forage for animals and contributes to biodiversity. Trees have positive effects on crop yields. They also provide products and byproducts, such as wood, fruits, leaves, forage, ingredients for medicinal products. The wood, leaves, pods and fruits provided by trees in crop fields help the owners to meet their family's needs during the lean season.

  How can they be sustained / enhanced? In order to implement this technique, there must be a very clear legal framework governing land tenure. It is important to protect the tree seedlings and saplings from browsing animals during the first few years.
- It does not require a high level of organisation to implement it and it is not costly.

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

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

- During the dry season stray animals often wipe out ANR efforts made by farmers on their land.
- In some places, anyone can collect fruits, leaves and pods from trees, and this discourages farmers from investing in ANR.
- In some places, only the owner of the land is allowed to establish trees on cropland.

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1626/

Linked SLM data
Cbp: Unknown name https://qcat.wocat.net/af/wocat/cbp/view/cbp_6711/

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