River training dam with gabion reinforcement built in Obishur watershed, Southern Tajikistan (Margaux Tharin)

River training dam (Tajikistan)

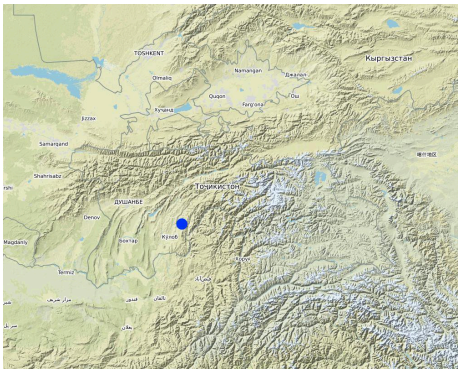
Дамбаи Обпартоб

DESCRIPTION

The river training dam is a disaster mitigation structure protecting downstream areas from flash floods and mudflows. It consists of a channel dug and wire net gabions built to train the river and is hence cheap to establish and maintain. There is a substantial community contribution as labour is an important part of the input costs. The dam enables the rehabilitation of unproductive land in the downstream catchment areas, reduction of crop pests, increase in crop diversity and land productivity, and an overall improvement of livelihoods for downstream communities through reduced vulnerability to disasters.

The river training dam is a disaster mitigation structure constructed in the middle zone of the watershed of Obishur (Southern Tajikistan), at 1400 metres above sea level. It is diverting the water from the river fan naturally flowing through Kulchashma village into a different direction and river outlet (Yakhsu river). The dike is a simple structure consisting of a 400m-long and 4m-high channel dug by bulldozer consolidated by a 60m-long and 3m-wide gabion protecting a sharp curve of the river. The material needed is limited to stones and wire net, and the construction as well as maintenance costs are hence low and don't need a too high amount of labour, provided by the communities as in-kind contribution. The structure is built to resist a pressure of up to 72 m3/sec. Given the annual frequency and strength of the local floods, the Kulchashma river training dam has an estimated life expectancy of 30 years. The land users proposed to establish the dam in order to protect the 250 households and 270 ha of land downstream being regularly affected by the floods. In particular, people, houses, roads and other infrastructure, crop and pasture land as well as animals and other assets were highly exposed to the risk of flood. The agricultural production, constituting the main part of people's income was hindered by the regular occurrence of disasters. The establishment of the river training dam resulted in the rehabilitation of unproductive land in the river fan and its use as pasture and arable land which the community mainly uses for agroforestry. The occurrence of crop pests decreased, the crop diversity was increased, the crop and land productivity improved, thereby enhancing the land users' food security and overall income. The dam also allowed vulnerable community members to access land and build houses. The construction of buildings behind the dam is however risky and communities tend to forget or ignore that a risk of failure of the dam persists, and that its life expectancy is limited. But first of all, the personal safety of the community members is now improved and they are happy to be able to sleep without the fear of regular floods.

LOCATION



Location: Kulchashma Jamoat, Kulchashma village, Khatlon Region, Muminabad District, Tajikistan

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 70.07526, 38.15724

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?:

Date of implementation: 2014

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

Deepening the water channel with bulldozers before building gabions to reinforce the riverbed (Sa'dy Odinashoev)

Wire net gabions constructed to reinforce the dam infrastructure in the sharp curve of the river. (Margaux Tharin)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

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

Land use

Grazing land

- Semi-nomadic pastoralism

Water supply

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

Purpose related to land degradation

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

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying, Wr: riverbank erosion, Wo: offsite degradation effects

biological degradation - Bc: reduction of vegetation cover, Bh: loss of habitats, Bq: quantity/ biomass decline, Bl: loss of soil life, Bp: increase of pests/ diseases, loss of predators

water degradation - Hs: change in quantity of surface water, Hp: decline of surface water quality, Hq: decline of groundwater quality

SLM group

- water diversion and drainage

SLM measures

structural measures - S3: Graded ditches, channels, waterways, S5: Dams, pans, ponds

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **Dam** volume, length: **400m-long dug channel and 60m-long gabion**)
- 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

- Geography (steep hills to dig a diverting channel increases the establishment costs) - Geology (quality/type of soil affects the time needed for digging)

Establishment activities

1. 400m-long channel digging (bulldozer) (Timing/ frequency: August-October)
2. Stone collection (Timing/ frequency: October (10 days))
3. Construction of gabions (Timing/ frequency: November (15 days))

Establishment inputs and costs (per Dam)

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Construction of wire net gabions	person-hours	1400.0	1.5	2100.0	100.0
Bulldozer driving	person-hours	150.0	1.5	225.0	
Equipment					
Bulldozer rent	day	15.0	63.0	945.0	
Fuel for bulldozer	litre	2250.0	1.35	3037.5	
Diesel oil for bulldozer	litre	68.0	2.13	144.84	
Spindle oil for bulldozer	litre	45.0	2.0	90.0	
Construction material					
wire net (diametre 4mm)	m2	625.0	1.6	1000.0	
wire (diametre 3mm)	kg	26.0	1.6	41.6	
Other					
Gearbox oil for bulldozer	litre	22.0	2.5	55.0	
Solid oil for bulldozer	litre	22.0	3.0	66.0	
Gas for bulldozer	litre	22.0	1.4	30.8	
Total costs for establishment of the Technology				**7'735.74**	
Total costs for establishment of the Technology in USD				*7'735.74*	

Maintenance activities

1. Fixing of wire net gabions (Timing/ frequency: March, annually)

Maintenance inputs and costs (per Dam)

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Fixing wire net (by Self Help Group)	hour	40.0	0.8	32.0	100.0
Construction material					
wire net	kg	7.0	1.0	7.0	100.0
Total costs for maintenance of the Technology				**39.0**	
Total costs for maintenance of the Technology in USD				*39.0*	

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 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

Varies very much from year to year.
Name of the meteorological station: Muminabad meteo station (1200 m a.s.l.)
Average temperatures:
Spring:10-32°C
Summer: 20-35°C
Autumn: 10-32°C
Winter: -5-+5°C
Average yearly temperature: 11.1°C

Slope

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

Landforms

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

Altitude

- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [x] 1,001-1,500 m a.s.l.
- [x] 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
- [x] 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)

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

Soil texture (> 20 cm below surface)

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

Topsoil organic matter content

- [ ] high (>3%)
- [ ] medium (1-3%)
- [x] low (<1%)

Groundwater table

- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m

Availability of surface water

- [x] excess
- [ ] good
- [ ] medium

Water quality (untreated)

- [x] good drinking water
- [ ] poor drinking water (treatment required)

Is salinity a problem?

- [ ] Ja
- [x] Nee

- [x] > 50 m

- [ ] poor/ none

- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Occurrence of flooding
- [x] Ja
- [ ] Nee

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

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

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

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

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

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

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

Gender
- [x] women
- [x] men

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

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 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
- [ ] small-scale
- [x] medium-scale
- [ ] large-scale

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

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

Water use rights
- [ ] open access (unorganized)
- [x] 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

Quantity before SLM: No production
Quantity after SLM: Self-use + surplus sold on market
6000 kg onions/ ha

crop quality

decreased ✓ increased

35-40% increase

fodder production

decreased ✓ increased

On average 50% increase of fodder. Additionally, fodder crop seeds (lucerne) can be sold; increases land users' income.

fodder quality

decreased ✓ increased

animal production

decreased ✓ increased

risk of production failure

increased ✓ decreased

One of the main and most important impact

product diversity

decreased ✓ increased

production area (new land under cultivation/ use)

decreased ✓ increased

25-30% increase in production area in lowlands (downstream) through rehabilitation of unproductive land which was previously regularly flooded and covered by sediments.

land management

hindered ✓ simplified

Trees newly planted are used for riverbed protection and fuelwood production

drinking water availability

decreased ✓ increased

Floods do not contaminate spring drinking waters with sediments

drinking water quality

decreased ✓ increased

irrigation water availability

decreased ✓ increased

Irrigation channel not destroyed by annual floods anymore.

expenses on agricultural inputs

increased ✓ decreased

Pests decreased.

farm income

decreased ✓ increased

Through rehabilitation of unproductive land in river fan.

diversity of income sources

decreased ✓ increased

orchards

None ✓ None

Socio-cultural impacts

food security/ self-sufficiency

reduced ✓ improved

Cultivation of wheat plots and vegetables for self-use and sale

health situation

worsened ✓ improved

land use/ water rights

worsened ✓ improved

Previously unused land in the river fan is now registered as pasture land with a land certificate for the use of the community, and new houses where also built on this land.

recreational opportunities

reduced ✓ improved

community institutions

weakened ✓ strengthened

Taxes can be collected with the registration and certification of pasture land and with the authorisation of house construction.

SLM/ land degradation knowledge

reduced ✓ improved

situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)

worsened ✓ improved

With dam constructed, economically disadvantaged people have space for building a house on the rehabilitated land.

Ecological impacts

surface runoff: increased ✓ decreased

excess water drainage: reduced ✓ improved

soil cover: reduced ✓ improved

soil loss: increased ✓ decreased

soil accumulation: decreased ✓ increased

nutrient cycling/ recharge: decreased ✓ increased

soil organic matter/ below ground C: decreased ✓ increased

vegetation cover: decreased ✓ increased

plant diversity: decreased ✓ increased

pest/ disease control: decreased ✓ increased

flood impacts: increased ✓ decreased

landslides/ debris flows: increased ✓ decreased

Off-site impacts

reliable and stable stream flows in dry season (incl. low flows): reduced ✓ increased

downstream flooding (undesired): increased ✓ reduced

downstream siltation: increased ✓ decreased

damage on neighbours' fields: increased ✓ reduced

damage on public/ private infrastructure: increased ✓ reduced

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns: very negative ✓ very positive

Benefits compared with maintenance costs

Short-term returns: very negative ✓ very positive

From the land-user perspective, the benefit assessment of the establishment costs could only be done in relation to the land-users' contribution (i.e. 10% of establishment costs in cash or USD 600 , plus labour). Because the dam was constructed less than 10 years ago, the long-terms returns cannot be assessed yet.

CLIMATE CHANGE

Gradual climate change

annual rainfall increase	not well at all	very well	
seasonal rainfall increase	not well at all	very well	Season: spring

Climate-related extremes (disasters)

general (river) flood	not well at all	very well
flash flood	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%
- [x] > 50%

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

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Number of households and/ or area covered

250 households and 270 ha covered, i.e. 50% of Kulchashma village's population.

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

- [ ] Ja
- [x] 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

- The construction and maintenance of a river training dam prevents further land degradation caused by floods, allows the rehabilitation of unused land to create new pastures, and above all increases people's and livestock's safety.

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

- General improvement of life quality, including life safety and opportunities to protect assets and improve livelihoods.

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

- None n/a

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

- Downstream communities feel safe behind the dam and tend to ignore the risk of failure in extreme conditions (beyond the coping capacity of the dam). As a consequence, people build houses in places still at risk in the river fan. Strengthened governance (no authorisation of construction in the river fan/behind the dam in the risk zone).

REFERENCES

Compiler
Margaux Tharin

Editors

Reviewer
Alexandra Gavilano
Alvin Chandra
Rima Mekdaschi Studer

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Resource persons
- land user

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_698/

Linked SLM data
n.a.

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Project
- Book project: where people and their land are safer - A Compendium of Good Practices in Disaster Risk Reduction (DRR) (where people and their land are safer)

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