Tanga Watershed Investment Program

Nature-based solutions for water security, livelihoods, climate resilience & biodiversity in Tanga, Tanzania

Presentation of Business Case to GIZ – February 2024

Nature for Water FACILITY Local solutions. Global impact.

The Nature Conservancy

PEGASYS CHANGING LIVES CHANGING WORLDS

TANGA URBAN WATER SUPPLY AND SANITATION AUTHORITY

EAMCEF

Watershed Investment Program in Tanga

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Watershed Investment Program in Tanga – Executive summary

A clear case for nature-based solutions to address Tanga's water security challenges

The port city of **Tanga depends almost exclusively on the Zigi river for its water needs.** The Zigi headwaters emanate from the East Usambara Mountains, which are globally recognized for their **exceptional biodiversity and species endemism**

Ecosystems and water sources are under heavy pressure from the rapid expansion of human activities. Forest degradation, and poor agricultural practices have severely **deteriorated water quality** and increased sediment exports to the Mabayani dam from which all of Tanga's potable water is produced. With demand expected to outstrip supply, there are also **concerns about reduced water flows** during the dry season

For the same reasons, the neighboring Mkulumuzi catchment is now the source of significant sediment runoffs to the Tanga bay, affecting port activities

Nature-based solutions can play a critical role in addressing Tanga's water security challenges while improving livelihoods and tackling the dual challenge of biodiversity loss and climate change

The N4WF and TNC have identified, with their local partners, **no-regret options for the implementation of NbS in the Zigi and Mkulumuzi catchments**

The assessment of their economic and social impacts clearly demonstrate their relevance for Tanga through

- ✓ Lifespan expansion of potable water storage dam
- ✓ avoided social cost of carbon
- ✓ increased income for subsistence farmers

Each dollar invested in NbS can generate more than 4 dollars in benefits

Water security challenges & potential solutions

Tanga is graced with unique ecosystems and water assets

Maintaining the health of the Zigi catchment is crucial

99%
of Tanga's water supply comes from surface water sources

Zigi headwaters emanate from the East Usambara Mountains
Exceptional biodiversity and species endemism

They provide ecosystem services that are critical for Tanga's people and economy

Biodiversity
E.g., pollination: translates directly to higher yields and improved revenue

Sediment control
Improved water quality
Reduced sediment export to Mabayani dam and Tanga port

Regulation of water flow

The problem: Tanga's exceptional natural resources are at risk

Human population expansion is increasing the pressure on the remaining natural forest and water sources in the area

406,000 people by 2030 in the Tanga region (+32% vs. 2019)

Deforestation and degradation

Unsustainable farming practices

Climate change
Increased intensity
& frequency of storms,
floods, and droughts

Water quality degradation
Water flow deregulation (quantity)

Degradation of habitat and loss of biodiversity

Soil erosion & increased sediment yield
Leaching & reduced soil fertility

The solution: nature-based solutions for Tanga's water security

NbS can contribute to secure water security, while improving livelihoods and supporting biodiversity

AGRICULTURAL BEST MANAGEMENT PRACTICES

1. **Agroforestry**: cloves, cinnamon, black pepper, avocado, cocoa and timber trees
2. **Cover crops**, filter strips, terraces and water bunds
3. **Woodlots** for timber trees (cedar, African teak, silky oak)

- ✓ Relieve pressure on existing ecosystems
- ✓ Avoid soil erosion for improved water quality
- ✓ Capture carbon
- ✓ Conserve water, fertility and soils in farms
- ✓ Create new income sources for smallholders

FOREST RESTORATION

Planting of native species in degraded forest areas - 500 trees/ha
Giant yellow mulberry, East African Newtonia, East African mahogany, peacock flower, Cape fig

- ✓ Restores habitats and supports biodiversity
- ✓ Avoids soil erosion for improved water quality
- ✓ Water flow regulation
- ✓ Captures carbon

RIPARIAN RESTORATION

Combination of **planting native species and creating agroforestry buffers** in degraded riparian areas. Napier grass could also be considered

60 meters on each side of main water courses

- ✓ Restores habitats and supports biodiversity
- ✓ Supports riverbank stability
- ✓ Retains agricultural runoffs and protects water courses for improved water quality
- ✓ Captures carbon and create new income sources

FOREST PROTECTION AND IMPROVED MANAGEMENT OF PROTECTED AREAS

1. **Protect community forests** by training community rangers and raising awareness
2. **Improve the management of existing protected areas**: enforcement capacity, training and monitoring

- ✓ Standing ecosystems provide multiple ecosystem services and are key for water and biodiversity
- ✓ Create jobs
- ✓ Maintain carbon stocks
- ✓ Reduce illegal activities

The Tanga Watershed Investment Program

A Collective Action Mechanism for Tanga’s water security

Tanga WIP partners

Key local stakeholders, supported by N4WF and TNC, are promoting collective action mechanisms to secure Tanga's water security

TANGA URBAN WATER SUPPLY AND SANITATION AUTHORITY

- **Local public water supply and sewerage authority**. Serves 98% of the urban population with clean water (sewerage to 17%)
- 16,000 domestic, commercial and industrial customers
- Water treatment plant of 42,000m^3/per day, sourcing 98% of the water from the Mabayani dam, located 26 kms upstream of Tanga
- Interested in avoiding water quality degradation and maintaining the dam´s lifespan

EAMCEF

- **Eastern Arc Mountains Conservation Endowment Fund.** Trust Fund that functions as a long-term and reliable funding mechanism to support community development, biodiversity conservation and applied research projects
- **Promotes the sustainable use of natural resources** in the Eastern Arc Mountains of Tanzania
- **TNC's partner on the ground** and implementer of pilot projects with local farmers organization known as UWAMAKIZI

Nature for Water FACILITY

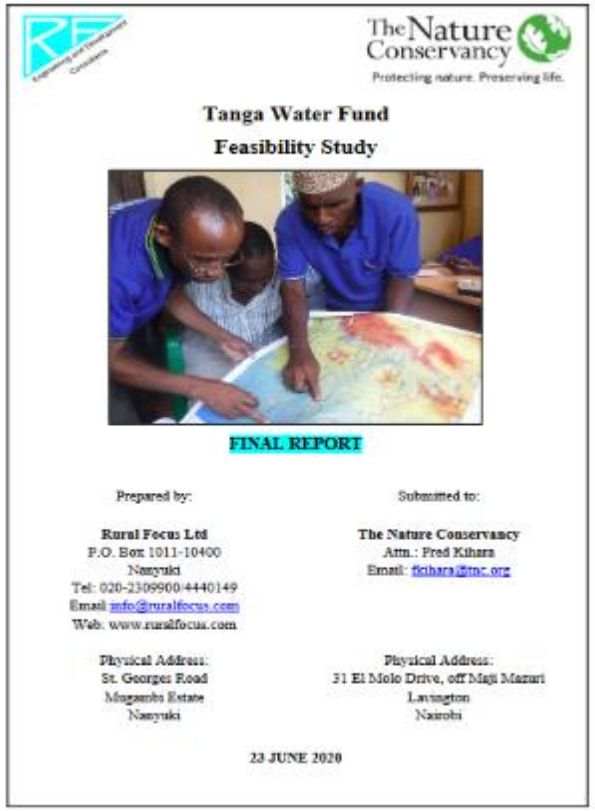
The Nature Conservancy

PEGASYS

- **The Tanga Watershed Investment Program is supported by the TNC Africa team**
- **The Nature for Water Facility** (partnership between TNC and Pegasys) provides additional support to prioritize interventions and build the business case

The Tanga WIP in action

A lot of work has already been done, leading to the Tanga WIP business case



Tanga Water Fund

Feasibility Study

FINAL REPORT

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23 JUNE 2020

Study by Rural Focus for TNC
2020

Pilot projects
Since Dec. 2021

Steering Committees
Tanga UWASA
Tanga Regional Administrative office
EAMCEF
Uwamakizi
Tanga Cement
Tanga Fresh
Muheza District
Amani Nature Reserve

The Tanga WIP in action

Focus on pilot projects

Objective: combat land degradation, deforestation and deterioration of water quality and quantity in Zigi Catchment

Activities: sustainable land use and agricultural best management practices - Agroforestry: avocado, clove & cocoa

Funding: 55,000 USD TNC grant to EAMCEF in December 2021

Implementation: UWAMAKIZI with local communities

Area of intervention: 3 villages of the Muheza District - Potwe Ndondondo, Potwe Mpirani, Kwemwewe, 1 village in the Korogwe district - Ubiri

Target: 500 farmers trained

Achievements:

- Establishment and management of 3 trees/spices nurseries
- 14,000 trees planted / 281 farmers trained
- Baseline survey to track progress, soil analysis for strategy to increase yields
- On-farm training on seedlings handling, planting and management, as well as establishment of contour lines

Timeline and strategy for the implementation of the Tanga WIP

A phased approach to gradually expand interventions in the watershed

The Tanga WIP will leverage on EAMCEF's experience and on the ground implementation partner UWAMAKIZI to gradually expand interventions from TNC's pilot projects to the whole watershed

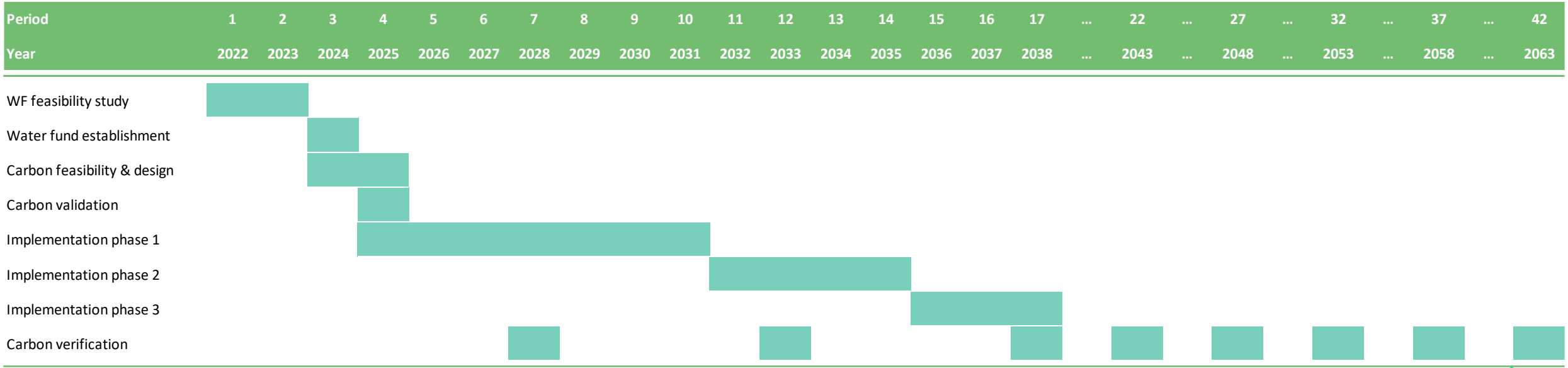
Phase 1
Scaling of TNC pilots in 5 UWAMAKIZI villages located in the Kihuhwi sub watershed (Zigi)
2,690 ha. of agroforestry and woodlots – 700 ha. restoration – 6,230 ha. protection

Phase 2
Expansion to 16 other UWAMAKIZI villages in the upper Zigi and upper Mkulumuzi watersheds
5,480 ha. of agroforestry and woodlots – 2,440 ha. restoration – 14,050 ha. protection

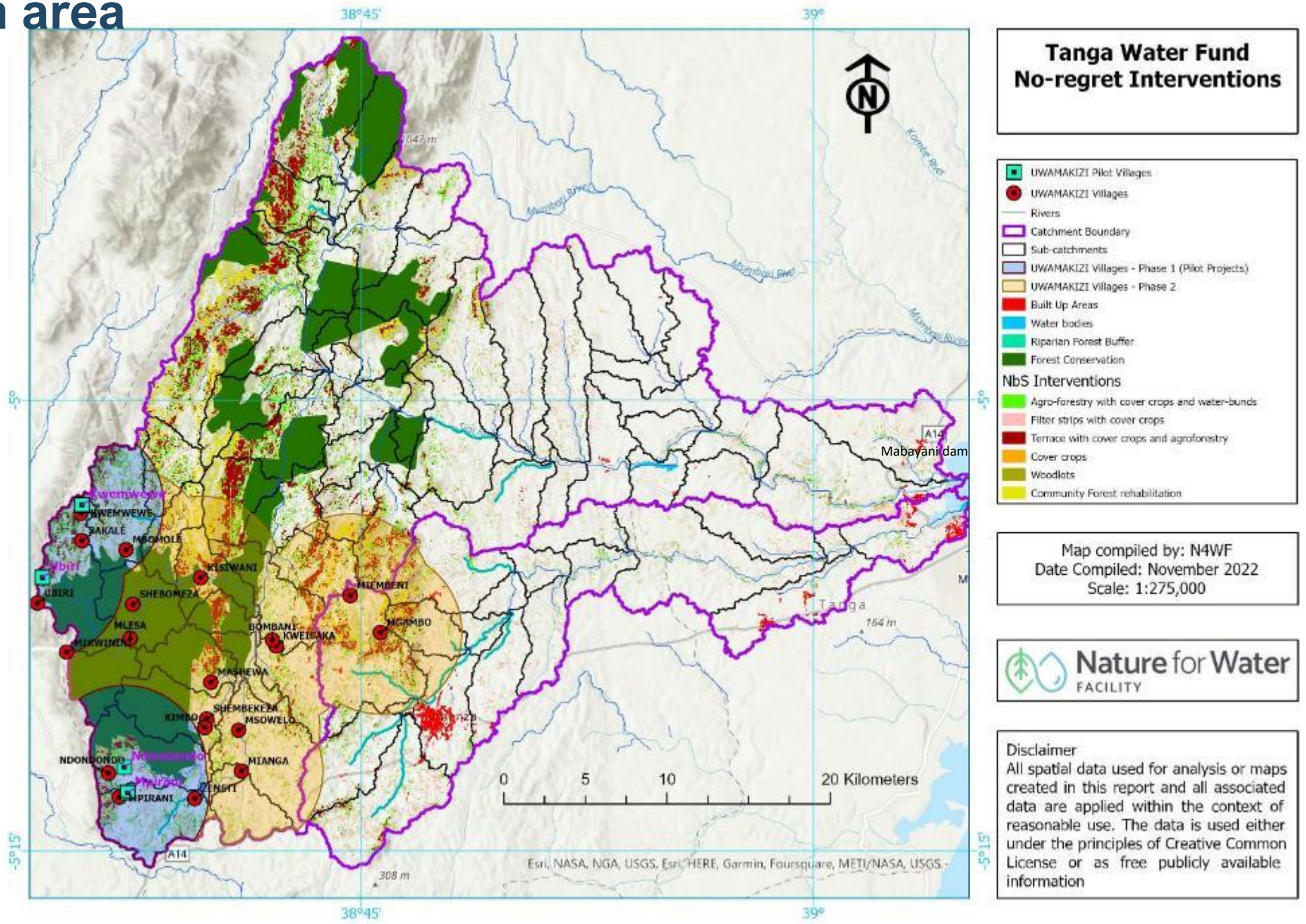
Phase 3
Full catchment roll-out (Zigi + Mkulumuzi)
11,840 ha. of agroforestry and woodlots – 4,130 ha. restoration – 38,050 ha. protection

Contemplated timeline for the Tanga WIP

- The **Project spans over 42 periods**, starting from 2022 (start of N4WF feasibility study)
- **Implementation starts in 2025**, after the carbon project has been validated
- **Phase 1 is scheduled to last for 6 years. Subsequent implementation phases are shorter (3 years each)** as the proportion of high time-consuming activities (agroforestry, restoration) decreases with each phase
- **First carbon verification for sale of Verified Carbon Units occurs 3 years after start of implementation** to generate early cash-flows
- **Verification periodicity is then set at 5 years** to find balance between costs and revenue generation



Intervention area



Tanga Water Fund
No-regret Interventions

- UWAMAKIZI Pilot Villages
- UWAMAKIZI Villages
- Rivers
- Catchment Boundary
- Sub-catchments
- UWAMAKIZI Villages - Phase 1 (Pilot Projects)
- UWAMAKIZI Villages - Phase 2
- Built Up Areas
- Water bodies
- Riparian Forest Buffer
- Forest Conservation

NbS Interventions

- Agro-forestry with cover crops and water-bunds
- Filter strips with cover crops
- Terrace with cover crops and agrofonestry
- Cover crops
- Woodlots
- Community Forest rehabilitation

Map compiled by: N4WF
Date Compiled: November 2022
Scale: 1:275,000

Nature for Water FACILITY

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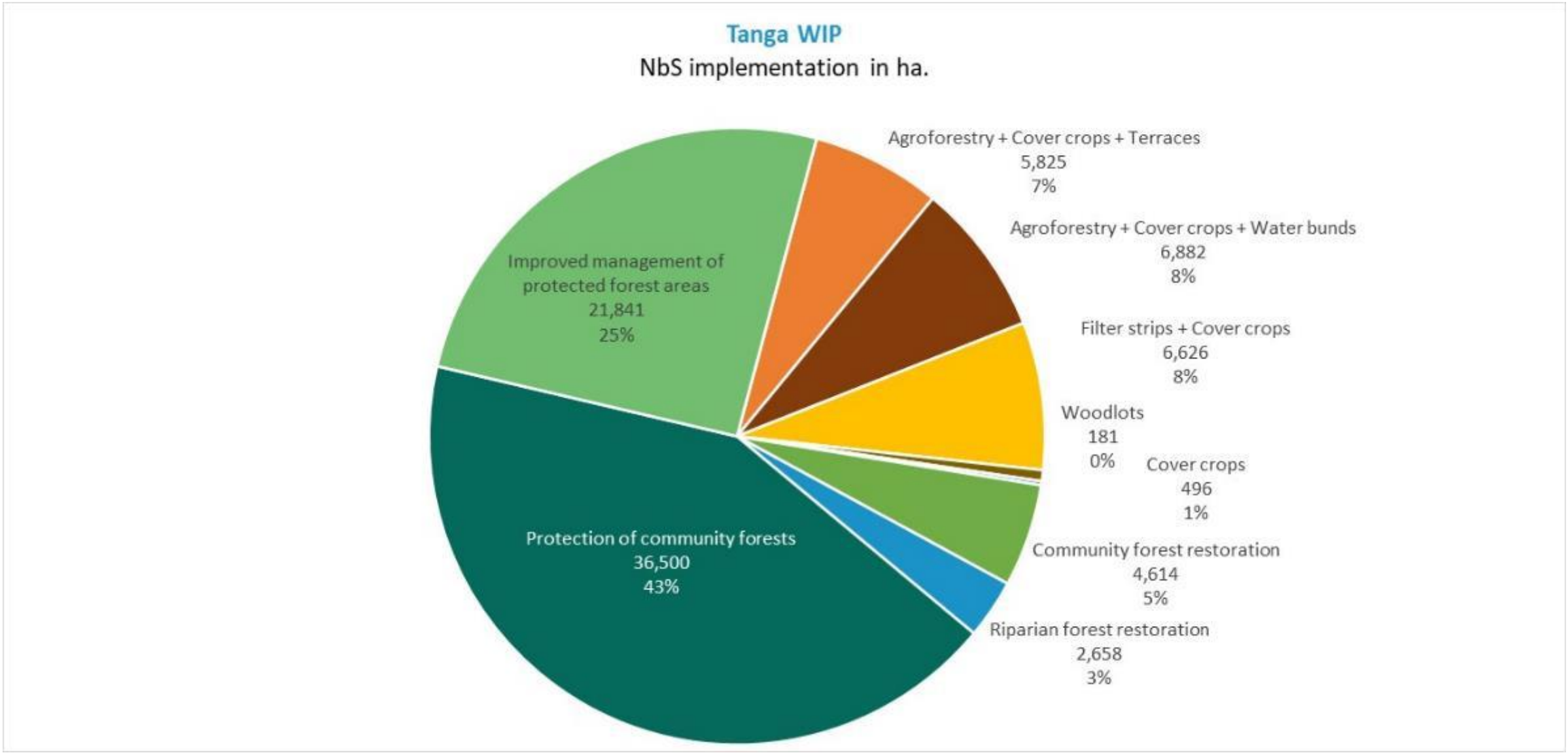
Summary of nature-based solutions interventions



A compelling case for nature-based solutions

Cost benefit analysis of proposed no-regret interventions

The Tanga WIP business case at a glance

The Zigi & Mkulumuzi catchments are key to the Tanga region

Water supply
99% of Tanga's consumption

Sediment control
Avoided sediment runoffs to water courses

Regulation of water flow
Maintain base-flows and limit the impact of extreme events

Biodiversity
Pollination translates to higher agricultural yields & revenues

Threats and challenges include

Climate Change
Increased intensity of droughts and rainfalls

Unsustainable farming practices
Erosion & pollution

Deforestation & degradation
Erosion, habitat & biodiversity loss

The Tanga Watershed Investment Program

A collective-action mechanism that supports nature-based solutions for water security and resilience

Agricultural BMPs
Agroforestry, cover crops, terracing

Woodlots

Riparian restoration

Forest restoration

Forest protection & improved management of protected areas

4x CB ratio

5 million tCO2e sequestrated

270 MUSD avoided social carbon costs

11.4 MUSD revenues

79 communities involved

87.3 MUSD additional farmers revenues

197,200 tons of avoided sedimentation (**25%** reduction)

10 years of additional Mabayani dam lifespan generating **2.9 MUSD** revenues

7,270 ha. of restored ecosystems & improved habitats

3.1 million Trees planted

58,340 ha. of maintained ecosystems

26.6 MUSD Investment need

91 MUSD Total cost

Climate

Water

Livelihoods

Biodiversity

*USD values are NPV

Tanga WIP business case overview

No-regret NbS prioritization criteria
(same weight for each)

- Sediment export (t/ha./year)
- Carbon potential (tCO2e yr-1/ha.)
- Livelihood benefits (USD/ha.)
- Biodiversity benefits (habitat preserved or created)

Package of NbS

1. Riparian forest restoration
2. Agroforestry + Cover crops + Terraces
3. Woodlots
4. Agroforestry + Cover crops + Water bunds
5. Community forest restoration
6. Filter strips + Cover crops
7. Cover crops

Protection activities performed in parallel

9. Protection of community forests
10. Improved management of protected forest areas

X

Implementation capacity

Packages of NbS implemented successively depending on priority order

Implementation capacity depending on farmers and casual labor availability in communities

Phase 1: Scaling of TNC pilots in 5 villages (Zigi)
3,390 ha. planting – 6,230 protection

Phase 2: Expansion to 16 other priority villages (Upper Zigi + Upper Mkulumuzi)
7,920 ha. planting – 14,060 protection

Phase 3: Full catchment roll-out (Zigi + Mkulumuzi)
15,970 ha. planting – 38,050 protection

Project duration: 41 years (7 carbon verification cycles)

Economic benefits

Avoided social cost of carbon, additional farmers revenues & increased Mabayani dam lifespan

Phase 1	Phase 1+2	Phase 1+2+3
68.3 MUSD	188.8 MUSD	367.3 MUSD
+1.6 y lifespan	+3.5 y lifespan	+10.3 y lifespan
3.2x B/C ratio	3.9x B/C ratio	4.0x B/C ratio

Project Revenues

Sale of carbon offsets

Phase 1	Phase 1+2	Phase 1+2+3
0.8 M offsets	2.4 M offsets	5 M offsets
2.1 MUSD sales	6 MUSD sales	11.4 MUSD sales
0.2x R/C ratio	0.3x R/C ratio	0.3x R/C ratio

Funding needs

Phase 1	Phase 1+2	Phase 1+2+3
20.3 MUSD total investment	45.8 MUSD total investment	85 MUSD total investment
8.5 MUSD funding gap	15.5 MUSD funding gap	26.6 MUSD funding gap

Main Tanga WIP indicators

Project shows a robust business case for NbS

- The WIP generates **significant livelihoods opportunities for subsistence farmers** through high-value agroforestry production
- It can **increase the Mabayani dam lifespan by up to 10 years, improving the resilience of the city's only water storage option**
- It has an **important role to play in reducing the global social cost of carbon** (valued at 185 USD/tCO_2e) through agroforestry, forest restoration and protection
- All of this on top of other ecosystem services that could not be monetized (**biodiversity, improved water quality, maintained base-flows for downstream users and ecosystems, avoided operating costs for the Port Authorities**…)

Main Tanga WIP indicators

Project shows a robust business case for nature-based solutions

Each dollar invested can generate 4 dollars in benefits
(more than 8 dollars if in-kind contributions are taken into account)

Cost-benefit analysis		Phase 1		Phase 1+2		Phase 1+2+3	
1. Without accounting for in-kind contributions from communities for maintenance of some nature-based solutions							
Total project costs	**MUSD (NPV)**	**21.4**		**48.9**		**90.8**	
Administrative costs		3.2	15%	3.2	6%	3.4	4%
Program costs		18.2	85%	45.7	94%	87.4	96%
Total project benefits	**MUSD (NPV)**	**68.3**		**188.8**		**367.3**	
Avoided social cost of carbon		49.5	73%	141.1	75%	270.1	74%
Investments in conservation activities from carbon revenues		1.3	2%	3.6	2%	7.0	2%
Livelihood benefits		17.2	25%	43.5	23%	87.3	24%
Expansion of Mabayani dam lifespan		0.2	0%	0.6	0%	2.9	1%
Benefits to costs ratio	**Multiple**	**3.2x**		**3.9x**		**4.0x**	
2. Including in-kind contributions[(1)]							
Value of in-kind contributions	MUSD (NPV)	10.5		27.2		52.7	
Total project costs	MUSD (NPV)	10.9		21.7		38.2	
Total project benefits	MUSD (NPV)	57.8		161.7		314.6	
Benefits to costs ratio	**Multiple**	**5.3x**		**7.4x**		**8.2x**	

(1) In-kind contributions reduce total project maintenance costs. They are also impact the calculation of net livelihood benefits (additional income minus cost for farmers)

Note: NPV values are calculated based on a social discount rate of 4,9%

Main Tanga WIP indicators

Cost benefit waterfall

Focus on Carbon

Carbon is a cornerstone of the Tanga WIP strategy and will generate additional opportunities for local communities and ecosystems

- A combination of REDD+ and ARR projects is expected to generate **5 million verified credits and 11.4 MUSD in revenues**
- **60% of these revenues is, by law, to be dedicated to local conservation activities**

Carbon							
		Phase 1		Phase 1+2		Phase 1+2+3	
Social cost of carbon							
	USD/tCO_2			185			
	MUSD (NPV)	49.5		141.1		270.1	
Sale of Verified Carbon Units (VCUs)							
VCUs sold	#	759,571		2,441,073		5,012,161	
Unitary VCU price at beginning of project							
Afforestation, reforestation, revegetation	USD/VCU			10			
REDD+	USD/VCU			10			
Revenues from VCU sales	MUSD (NPV)	2.1		6.0		11.4	
	USD/VCU	2.8		2.4		2.3	
Carbon revenues to cost ratio	Multiple	0.2x		0.3x		0.3x	
Taxes paid to central government	MUSD (NPV)	0.2	9%	0.5	9%	1.0	9%
Carbon revenues redistributed for conservation activities	MUSD (NPV)	1.3	61%	3.6	61%	7.0	61%
Carbon revenues for Project Developer	MUSD (NPV)	0.6	30%	1.8	30%	3.4	30%

Other key WIP indicators

- Up to **79 communities in the catchment could be involved and benefit from 87.3 MUSD of additional revenues from agroforestry** (35 MUSD net of in-kind contributions)
- **The Mabayani dam lifespan could be increased by 10 years, thanks to a 25% reduction in erosion**, which is key given the lack of water storage alternatives
- Our study suggests that **interventions in the Mkulumuzi catchment during phases 2 and 3 could generate a 36% reduction in sediment export to the Tanga bay**, greatly benefiting the Tanga port authority (not monetized)
- **Important biodiversity benefits will be derived from the protection of more than 58,000 ha. of standing forests and restoration of 7,200 ha. of forests and riparian areas**

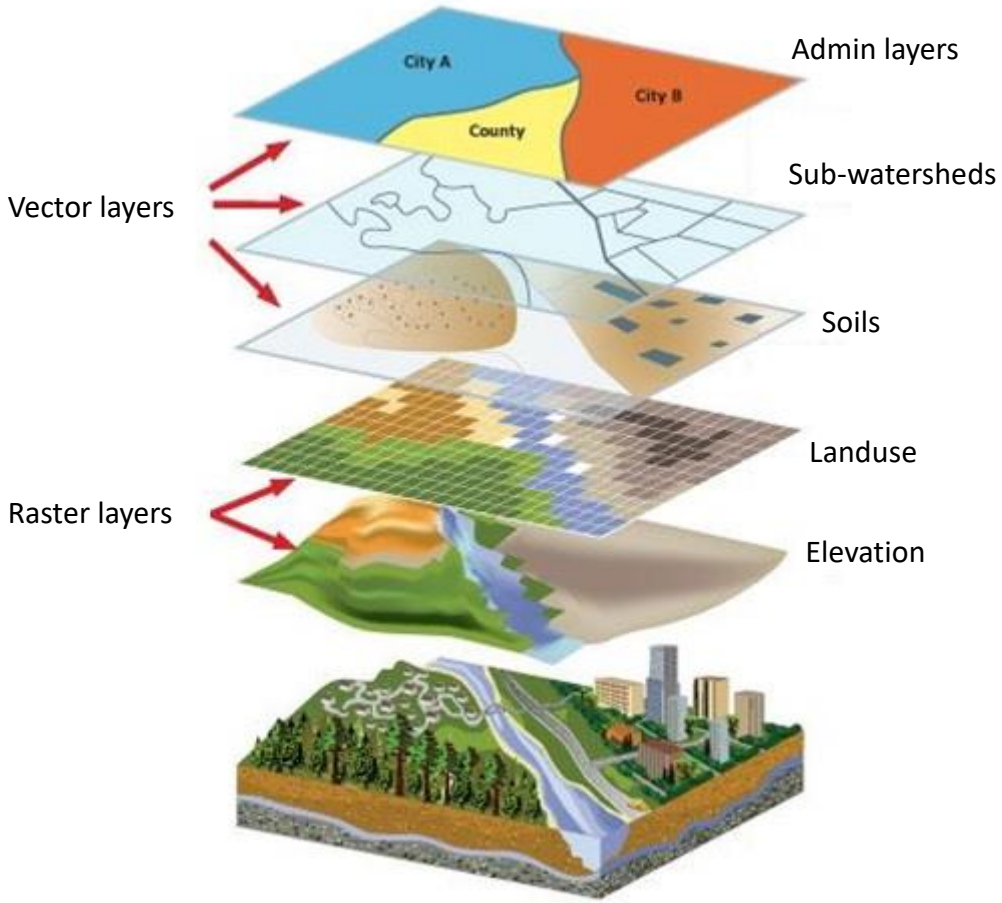
Livelihood benefits				
		Phase 1	Phase 1+2	Phase 1+2+3
Communities involved in project	#	5	21	79
Farmers involved in project	#	4,750	19,950	75,050
Additional net farmers revenues from NbS	MUSD (NPV)	6.7	16.4	34.6
Livelihoods benefit to cost ratio	Multiple	0.8x	0.9x	1.0x

Impact on Mabayani dam lifespan				
		Phase 1	Phase 1+2	Phase 1+2+3
Reduction in sediment export to dam from NbS portfolio	m^3	41,062	85,908	197,203
	%	5%	11%	25%
Additional Mabayani dam lifespan	year(s)	1.6	3.5	10.0
Benefits from additional lifespan	MUSD (NPV)	0.2	0.6	2.9

Habitats and biodiversity				
		Phase 1	Phase 1+2	Phase 1+2+3
Maintained ecosystems	ha.	6,229	20,288	58,341
Restored ecosystems	ha.	698	3,140	7,272

Deep dive on technical topics

GIS data preparation and mapping



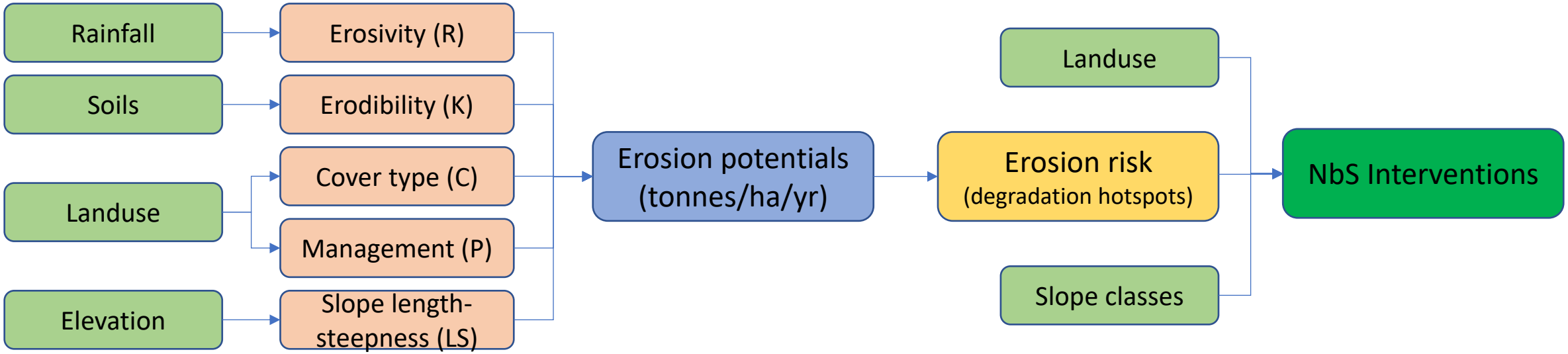
Tanga Watershed

1) Assuming 100ft width.

Methodology for degradation hotspots mapping

High level Analysis from existing datasets/GIS analysis complemented with sediment hotspot modeling

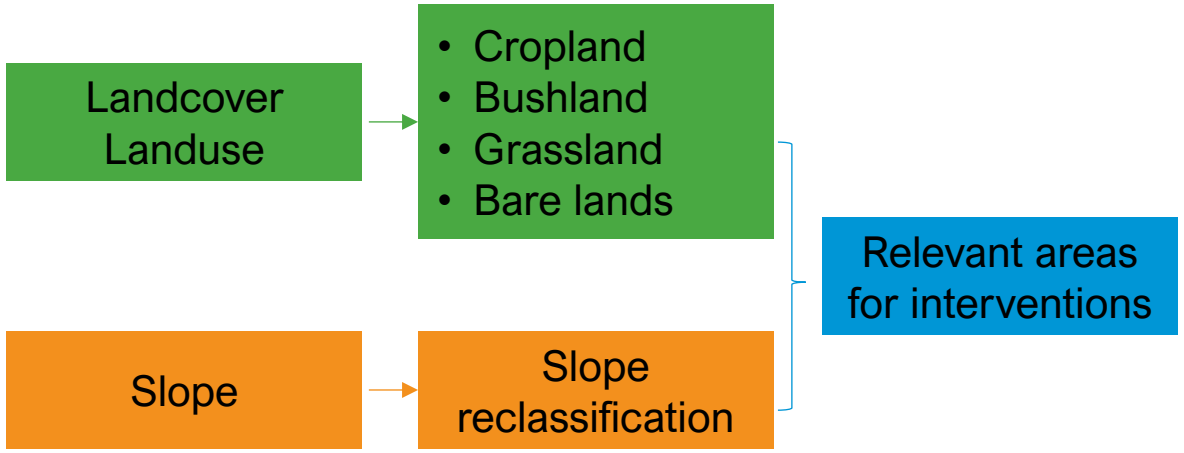
Sediment hotspot modeling using RUSLE model



Prioritization of interventions: methodology to identify no-regret options

High level Analysis from existing datasets/GIS analysis complemented with sediment hotspot modeling

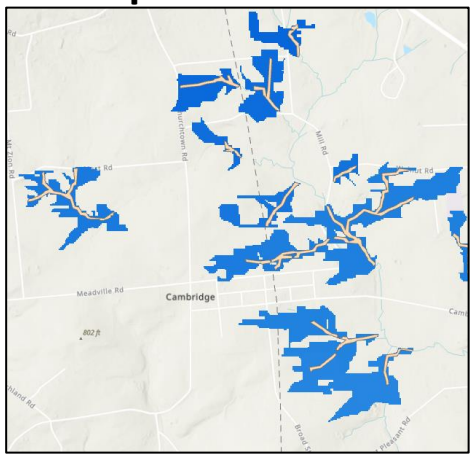
Refining Tanga's No-regret Opportunity Areas

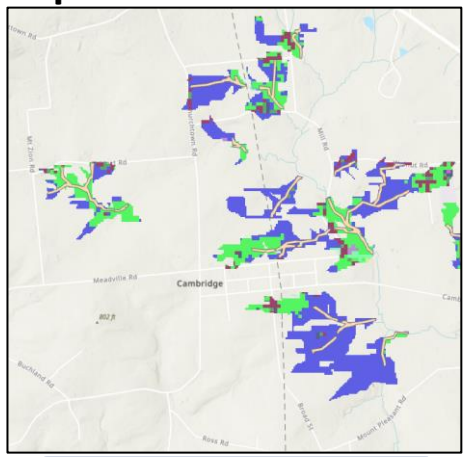


Landuse	0 - 6%	6 - 16%	16 - 30%	30 - 60%	>60%
Bare areas	Woodlots	Woodlots	Woodlots	Woodlots	Woodlots
Bushland	Woodlots	Woodlots	Woodlots	Woodlots	Woodlots
Croplands	Cover crops	Filter strips with cover crops	Agro-forestry with cover crops and Water-bunds	Terraces with cover crops and agroforestry	Woodlots
Grasslands				Woodlots	Woodlots

GIS mapping progress

Biophysical modeling of NbS impacts and GIS analysis outputs for commercial model





Cropland NbS

Forest/woodlot NbS

Riparian NbS

NbS Impact area

NbS Impact area Land use info.

RUSLE model

Sub-basin level loads & loads per landuse

NbS Impacts

Individual NbS Benefits (load reductions)

Commercial Model

Key assumptions – Delivery model

Prioritization of activities for implementation

- Activities implemented by communities are prioritized based on water quality (biophysical outputs), livelihoods (from agricultural practices), biodiversity (type of habitat preserved or created), and carbon (offset generation potential per ha.)
- Each criteria has the same weight
- Packaged activities are implemented in sequence based on overall ranking
- Protection activities are implemented in parallel

Priority for intervention	Criteria	Livelihoods	Water quality	Carbon	Biodiversity	Sum	Rank
	Weight	1	1	1	1		
Agroforestry + Cover crops + Terraces	#	2	1	4	4	2.8	1
Agroforestry + Cover crops + Water bunds	#	2	4	4	4	3.5	5
Filter strips + Cover crops	#	4	5	7	6	5.5	6
Cover crops	#	4	7	7	7	6.3	7
Woodlots	#	6	3	1	3	3.3	4
Community forest restoration	#	7	2	2	1	3.0	3
Riparian forest restoration	#	1	6	3	1	2.8	2

Protection of community forests	Not applicable (done in parallel through separate community process)
Improved management of protected forest areas	Not applicable (done in parallel with local protected area administration)

Key assumptions – Delivery model

Implementation capacity

- **This is a big question mark**. Need additional perspective on implementation requirements/workload and vision on what could be achieved if sufficient funding would be made available (scale up from pilots)
- Mix of inputs from EAMCEF and Nairobi WF. Overall timing does not look off albeit uncertainty
- Key consideration: bottleneck in terms of production of vegetative material, especially for native species
- For protection of community forest, model assumes recruitment and training of 5 community rangers (1 ranger = 500 ha. as per IUCN recommendation)
- For protected areas, assumes 3 years to get to 100% improved management for total area

Implementation capacity of communities participating to the project		Estimate by EAM	Input
Agroforestry + Cover crops + Terraces	ha./year/community	721	144
Agroforestry + Cover crops + Water bunds	ha./year/community	817	163
Filter strips + Cover crops	ha./year/community	1,750	350
Cover crops	ha./year/community	6,125	1,225
Woodlots	ha./year/community	1,021	204
Community forest restoration	ha./year/community	415	83
Riparian forest restoration	ha./year/community	415	83
Protection of community forests	ha./year/community		5,000
Improved management of protected forest areas	ha./year		7,326

Directly impacts B/C and cash flows

The sooner NbS are implemented, the sooner they reach their full potential both for carbon and livelihoods

		Phase 1	Phase 2	Phase 3	Total Project
Starts	date	1-Jul-25	1-Jan-32	1-Jan-36	1-Jul-25
Ends	date	14-May-31	15-Jun-35	17-May-38	17-May-38
Duration	year(s)	5.8	3.4	2.3	12.8
1st year implementation capacity		50%	100%	100%	

Key assumptions – Implementation and maintenance costs

- Mix of inputs from EAMCEF and Nairobi Water Funds + N4WF estimates

Activity		Investment costs			Maintenance costs			Maintenance duration		Maintenance starts		In-Kind contribution
Agroforestry		312	312	USD/ha.	273	273	USD/ha.	41	year(s)	1	year(s) after implementation	100%
Cover crops	30% area in 1 ha.	83	83	USD/ha.	83	83	USD/ha.	41	year(s)	1	year(s) after implementation	100%
Terraces	(bench)	183	183	USD/ha.	64	64	USD/ha.	41	year(s)	1	year(s) after implementation	100%
Water bunds	(Fanya juu - gradual terraces)	166	166	USD/ha.	34	34	USD/ha.	41	year(s)	1	year(s) after implementation	100%
Filter strips		166	166	USD/ha.	34	34	USD/ha.	41	year(s)	1	year(s) after implementation	100%
Woodlots		1,569	1,569	USD/ha.	386	386	USD/ha.	25	year(s)	1	year(s) after implementation	75%
Community forest restoration		395	395	USD/ha.	138	138	USD/ha.	3	year(s)	1	year(s) after implementation	0%
Riparian forest restoration		498	498	USD/ha.	142	142	USD/ha.	41	year(s)	1	year(s) after implementation	70%
Protection of community forests												
Engagement with community and local authorities		5,000	5,000	USD/community								
Administrative costs		2,000	2,000	USD/community								
Area assigned to community forest rangers		500	500	ha./ranger								
Salary community forest ranger		10,577	10,577	USD/ranger/year								
Training of community forest ranger		321	321	USD/ranger/year								
Equipt and material for community forest ranger		500	500	USD/ranger/year								
Motorcycle for community forest ranger		1	motorcycle/ranger									
Protection of community forests maintenance		13	13	USD/ha.	2	2	USD/ha.	41	year(s)	1	year(s) after implementation	0%
Improved management of protected forest areas		30	30	USD/ha.	30	30	USD/ha.	41	year(s)	1	year(s) after implementation	0%

- Maintenance duration corresponds to project lifespan for agricultural BMPs, including riparian restoration for the part that will be agroforestry
  => Used for CBA analysis. However, assumed to be an in-kind contribution from communities for funding needs
- Woodlots are maintained 15 years until harvest. Assumed to be an in-kind contribution from communities
- Protection of community forests is done through the capacitation of community rangers + beacons (no fencing)
- Improvement of protected area management: based on African Parks estimates + 50% buffer given lack of knowledge on current management status

Key assumptions – Carbon

Activity	Composition	Tree density	Carbon storage potential	
	%	#/ha.	tCO2e yr-1/tree	tCO2e yr-1/ha.
Agroforestry	**100%**	**215**	**0.04**	**8.38**
Clove	20%	43	0.08	3.35
Cinnamon	7%	16	0.09	1.49
Avocado	4%	8	0.05	0.42
Cocoa	19%	40	0.02	0.84
Black pepper	50%	108	0.02	2.27
Woodlots	**100%**	**1,111**	**0.05**	**53.56**
Spanish cedar	0%	0	0.07	0.00
African teak	100%	1,111	0.05	53.56
Silky Oak	0%	0	0.05	0.00
Community forest restoration	**100%**	**500**	**0.04**	**21.95**
Giant yellow mulberry	20%	100	0.02	2.27
Peacock flower	20%	100	0.04	3.94
East African Newtonia	20%	100	0.05	4.67
East African mahogany	20%	100	0.08	7.78
Cape fig	20%	100	0.03	3.28
Riparian forest restoration	**100%**	**280**	**0.04**	**11.34**
Giant yellow mulberry	6%	17	0.02	0.38
Peacock flower	6%	17	0.04	0.66
East African Newtonia	6%	17	0.05	0.78
East African mahogany	6%	17	0.08	1.30
Cape fig	6%	17	0.03	0.55
Clove	14%	39	0.08	3.07
Cinnamon	5%	15	0.09	1.37
Avocado	3%	7	0.05	0.39
Cocoa	13%	37	0.02	0.77
Black pepper	35%	99	0.02	2.08

REDD+ (improvement of existing protected area and new protected area)		
Deforeation Rate	0.95%	per year
Delta C in deforestation	101	
CO2 Impact	0.96	tCO2e ha-1 yr-1

Key assumptions – Carbon

Process for evaluating discounted carbon net sales

Type of activity, tree species + density + sequestration potential

Activity	Composition	Tree density	Carbon storage potential	
	%	#/ha.	tCO2e yr-1/tree	tCO2e yr-1/ha.
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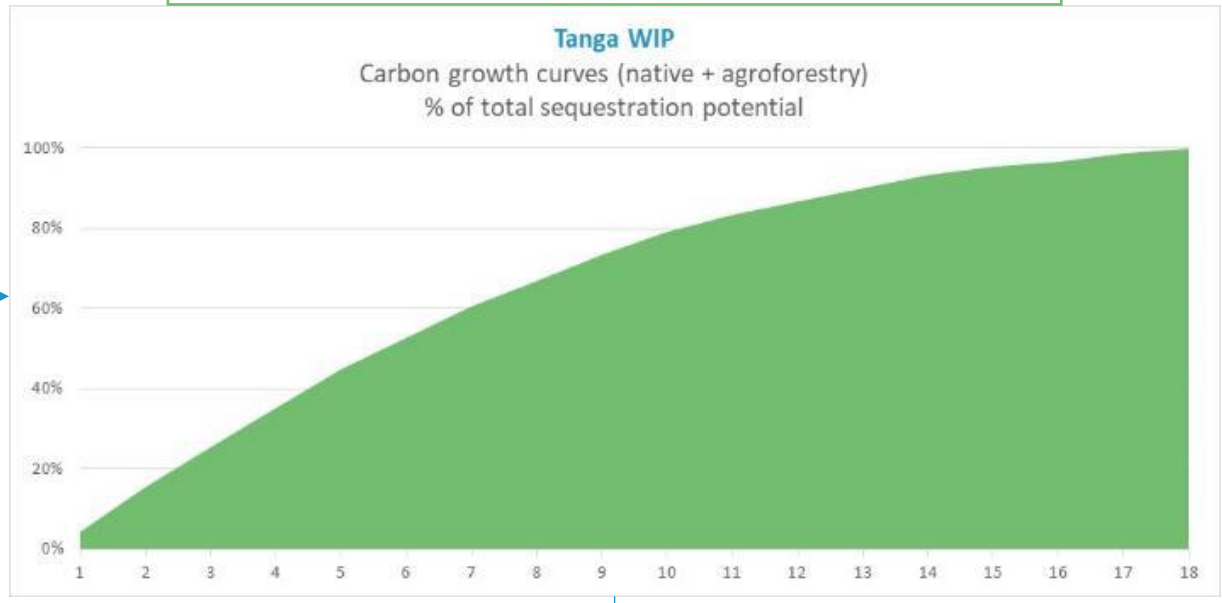
Deforeation Rate	0.95%	per year
Delta C in deforestation	101	
CO2 Impact	0.96	tCO2e ha-1 yr-1

For project involving planting: tree growth curves



For REDD+ project -> CO2 impact/ha.

VCU after leakage, uncertainty & non-permanence
7.8 millions units

X

VUC price
10 USD/unit

=

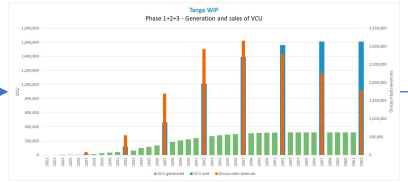
Gross sales
77.8 MUSD

Issuance fees
0.9 MUSD

Commissions (7% of gross sales)
Taxes (19% of net sales)
19 MUSD

Net sales
57.9 MUSD

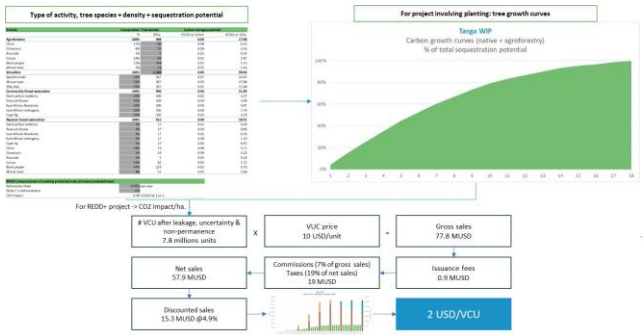
Discounted sales
15.3 MUSD @4.9%



2 USD/VCU

Key assumptions – Carbon

Sales of VCUs over project lifespan



Note: model assumes payment of 20% of gross sales prices to communities as project cost to guarantee permanence