A framework for regenerative river planning in Nakuru, Kenya

LIVING RIVERS



Bouke de Jong
Nico Tillie

Delft University of Technology
Urban Ecology, Landscape Architecture

Content

1 Fascination + problem field

2 Problem statement

3 Objective + analysis

4 Design solutions

5 Design explorations

6 Design vision

7 Implementation

8 Conclusion + reflection

STICHTING N·H·BOS
ter bevordering van de landschapsarchitectuur

TU Delft | Global Initiative
Science for the benefit of people. All people. Worldwide.

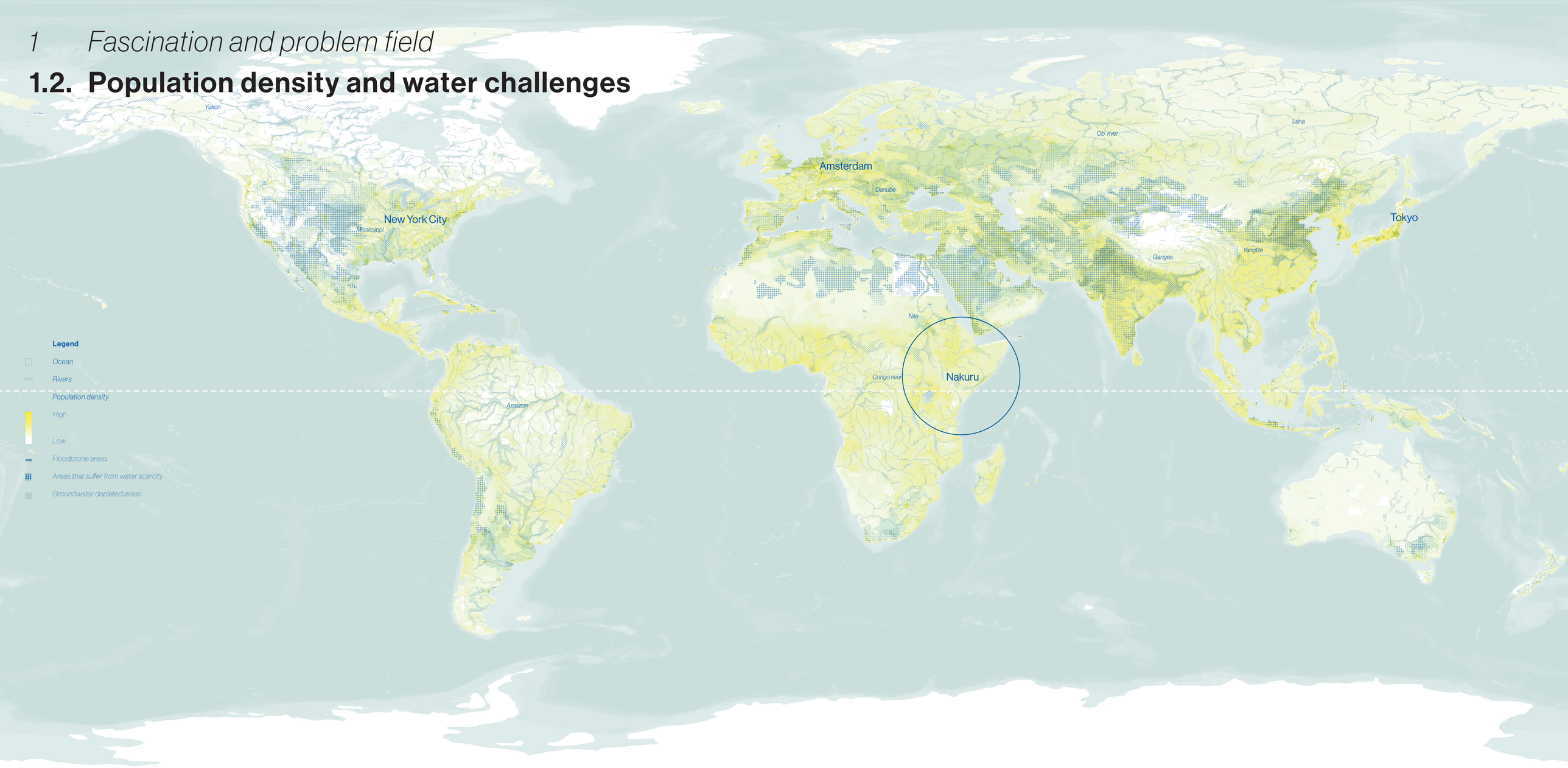
PHILIP·SPANGENBERG·TRAVEL·GRANT

1.1. Fascination

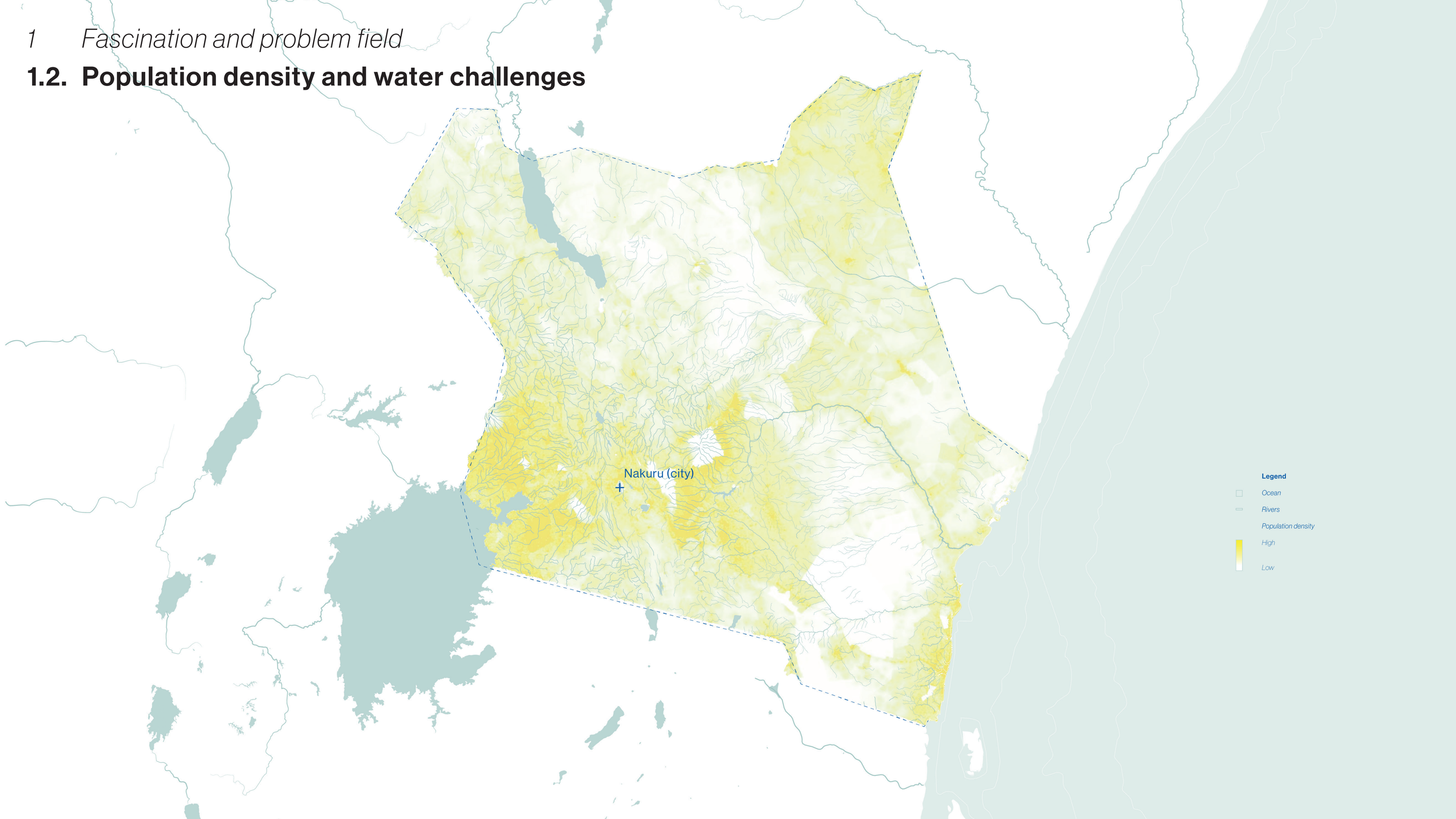


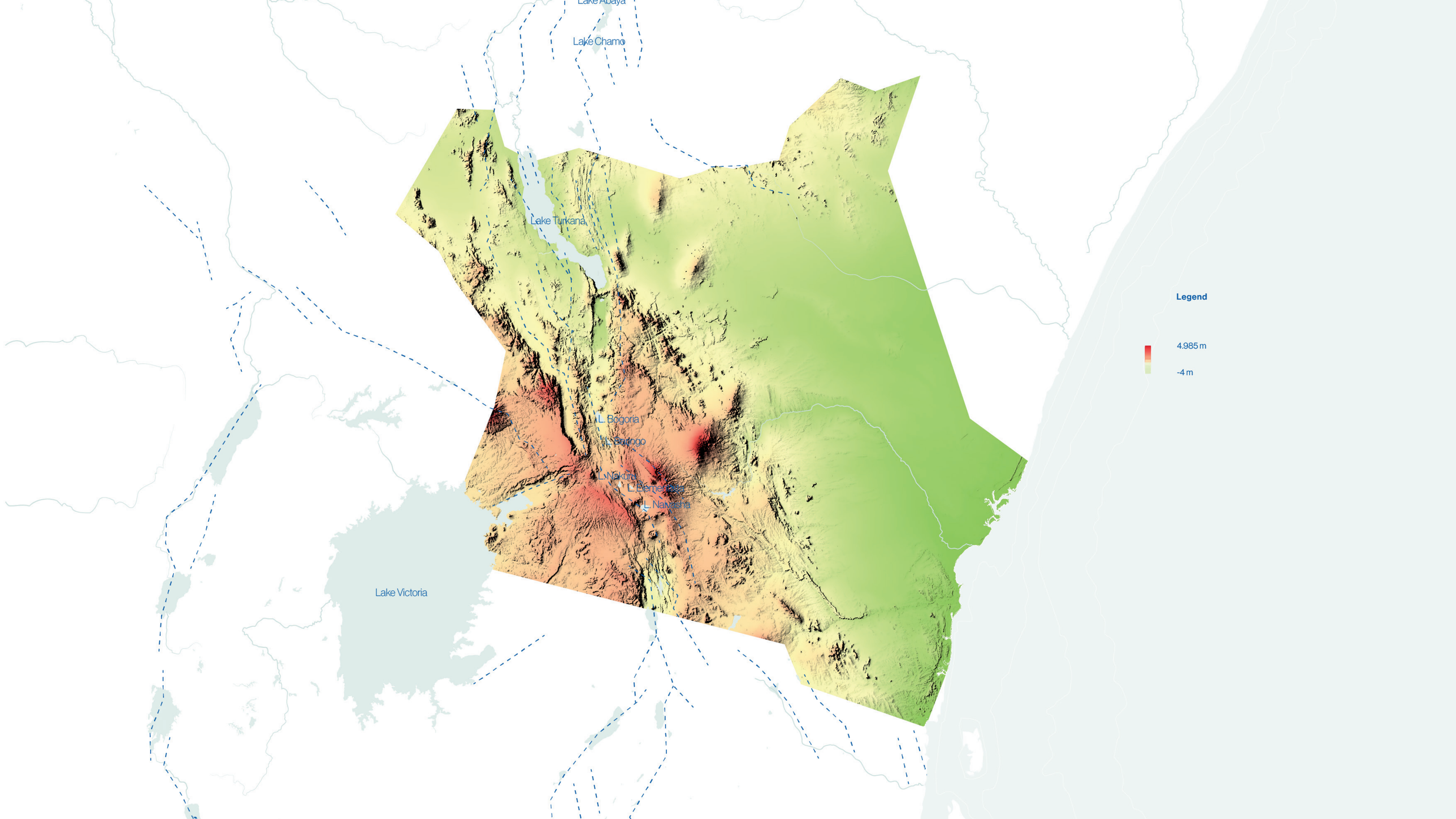
Floodplains of Wageningen (image by author, 2022)

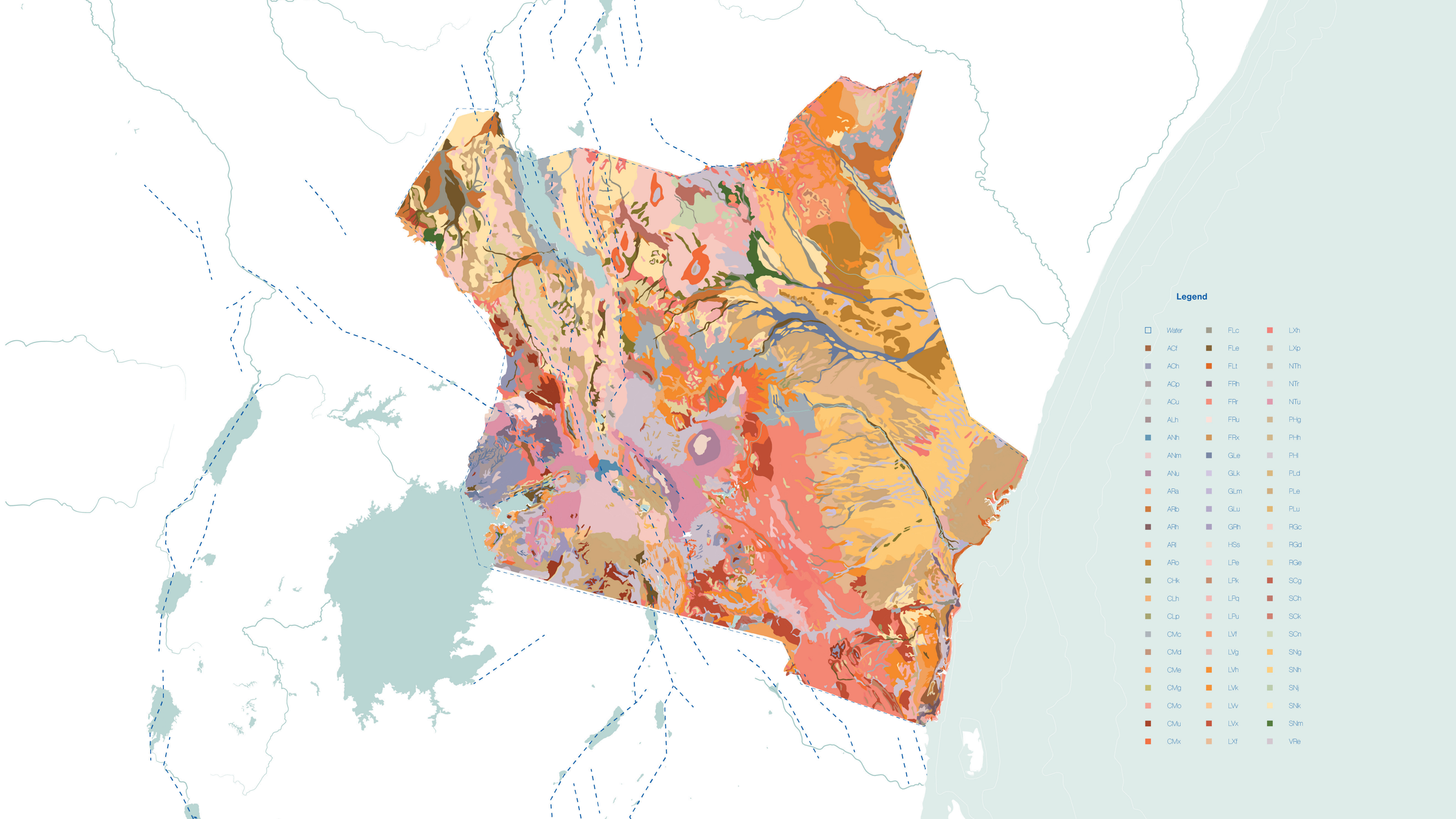
1.2. Population density and water challenges

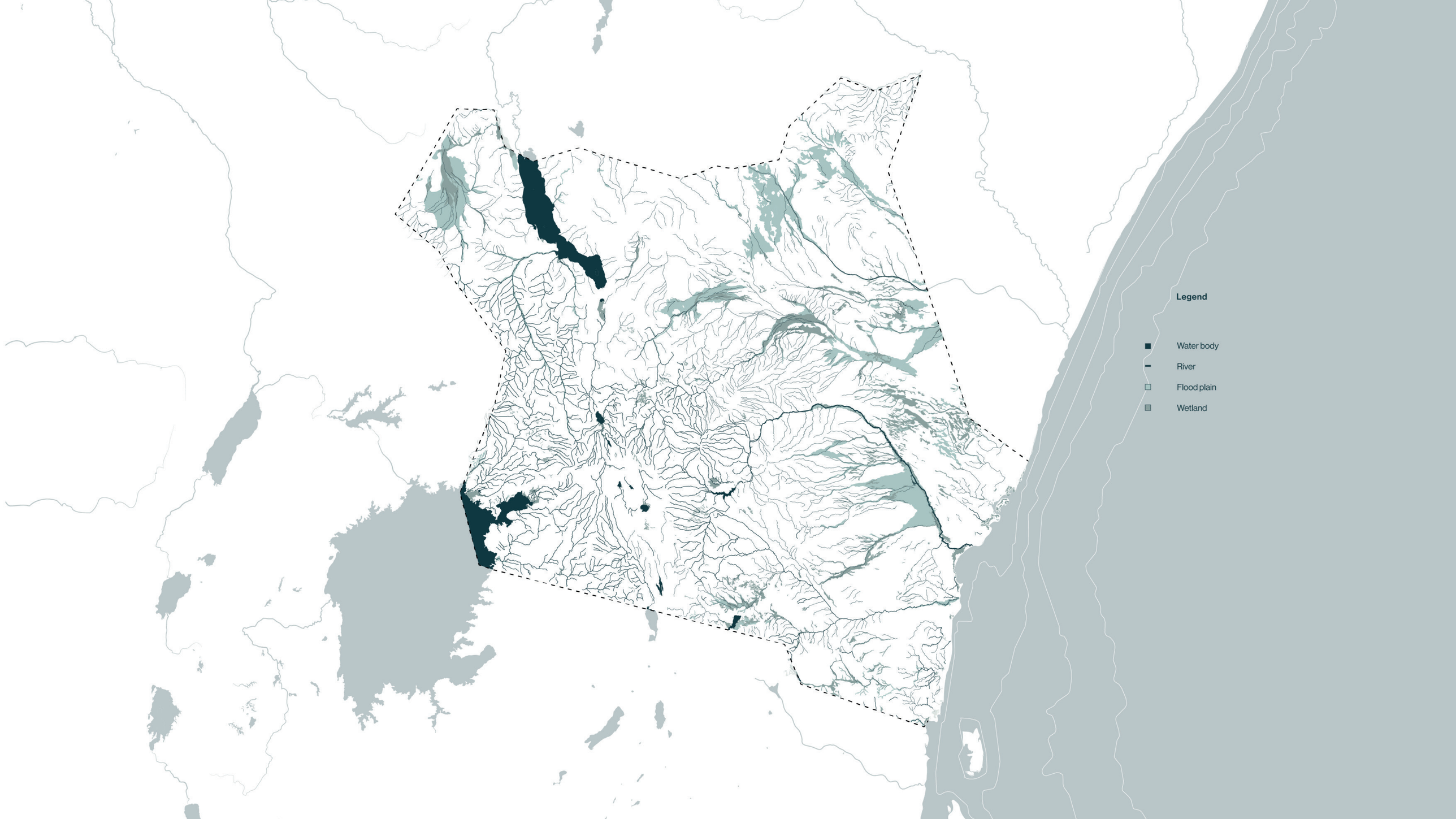


1.2. Population density and water challenges

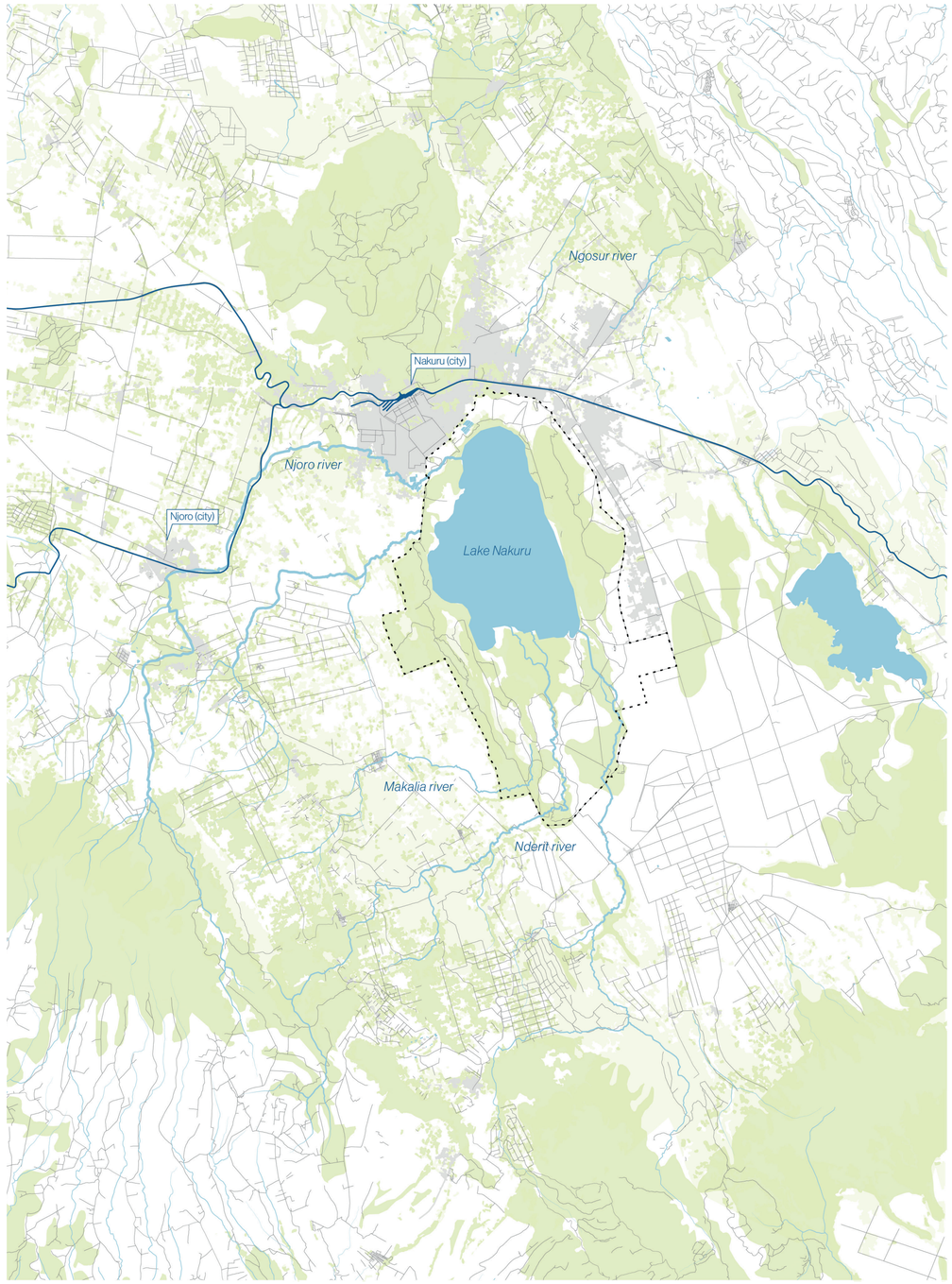


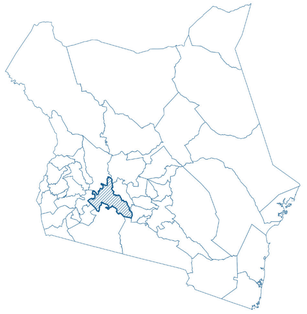

Lake Abaya
Lake Chamo
Lake Turkana
L. Bogoria
L. Baringo
L. Nakuru
L. Elmenteita
L. Naivasha
Lake Victoria
Legend
4.985 m
-4 m


Legend
Water
ACf
ACh
ACp
ACu
ALh
ANh
ANm
ANu
ARa
ARb
ARh
ARl
ARo
CHk
CLh
CLp
CMc
CMd
CMe
CMg
CMo
CMu
CMx
FLc
FLe
FLt
FRh
FRr
FRu
FRx
GLe
GLk
GLm
GLu
GRh
HSs
LPe
LPk
LPq
LPu
LVf
LVg
LVh
LVk
LVv
LVx
LXf
LXh
LXp
NTh
NTr
NTu
PHg
PHh
PHl
PLd
PLe
PLu
RGc
RGd
RGe
SCg
SCh
SCk
SCn
SNg
SNh
SNj
SNk
SNm
VRe


Legend
Water body
River
Flood plain
Wetland

1.3. Site context





Legend

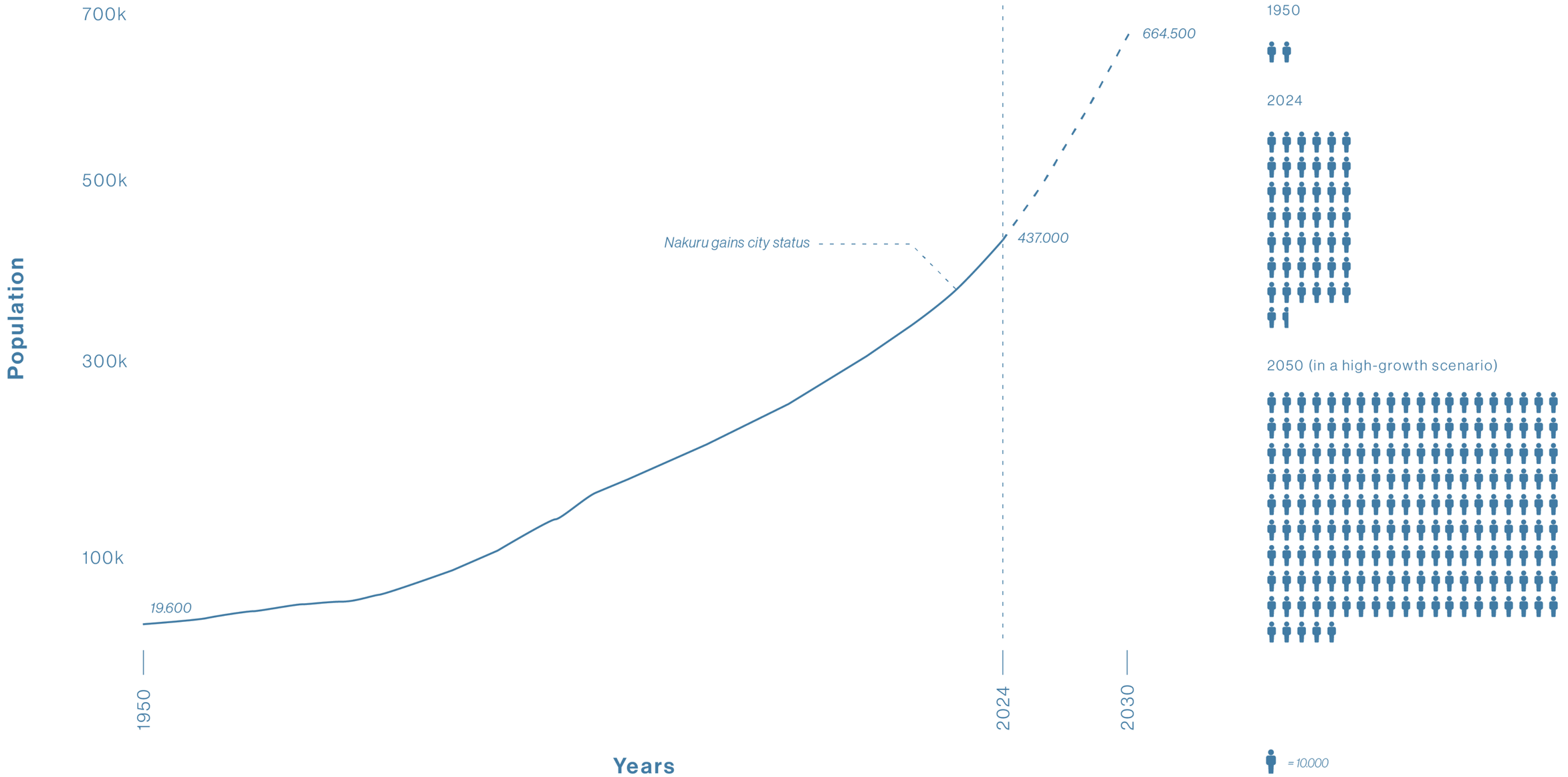
- Surface water
- Rivers
- Urban area
- Roads
- Railway
- Forest
- Shrub
- National Park boundary

N

0 2,5 5 km



Bouke de Jong “Main thoroughfare that leads into the CBD”. Image by Cynthia van Elk (2024). Living Rivers 10/80

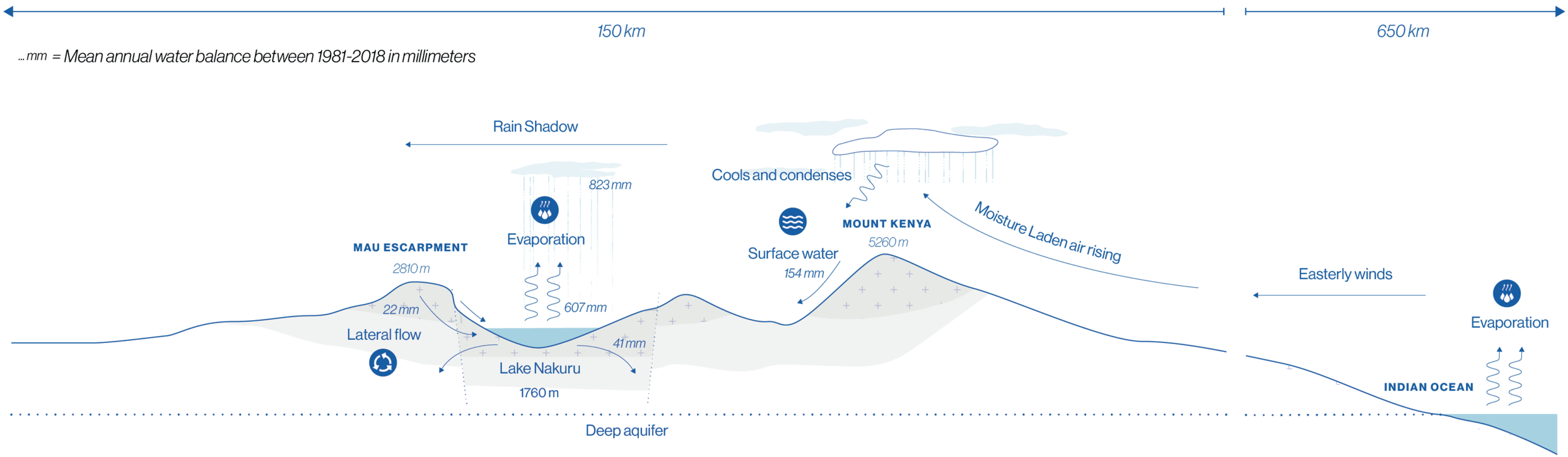

700k
500k
300k
100k
Population
19.600
Nakuru gains city status
437.000
664.500
1950
2024
2030
Years
1950
2024
2050 (in a high-growth scenario)
= 10.000

2

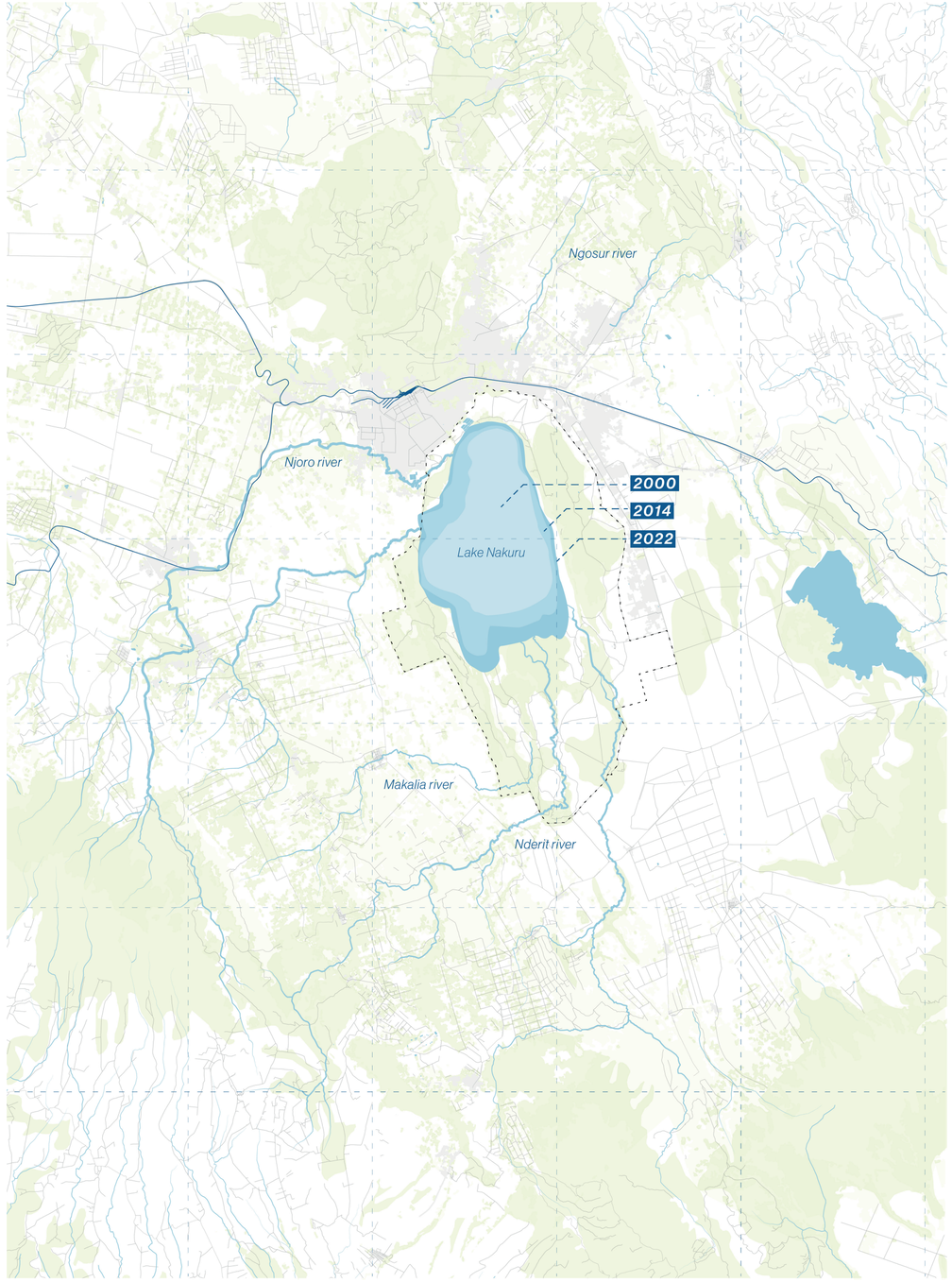
Problem statement


TOP TEN STAG
JOSE ELECT & ELECTRONICS
·T.Vs
·RADIO
·WOOVERS
·SPEAKERS
·AMPLIFIER
ETC

2.1. Hydrological cycle Nakuru



2.2. Lake level rise





N 0 75 150 m




NALOKI SACCO
KBF
192E

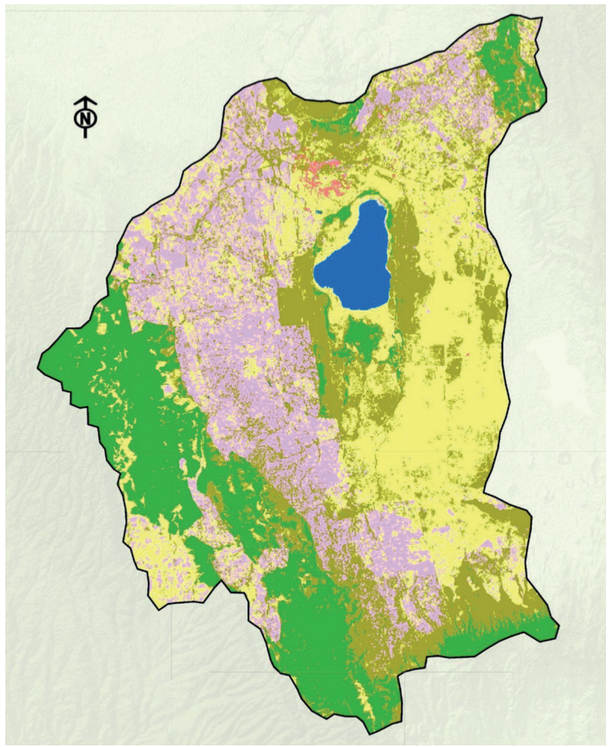



Keep
Water
Clean...

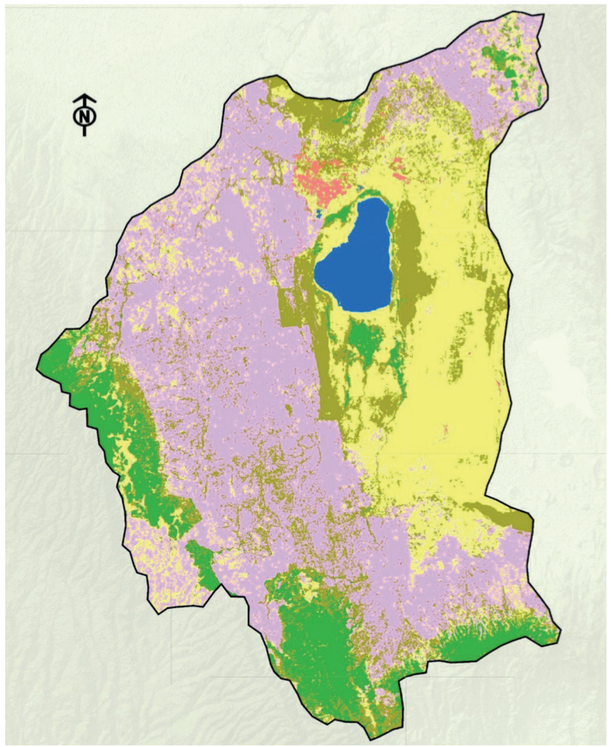
2.3. Deforestation

Cropland

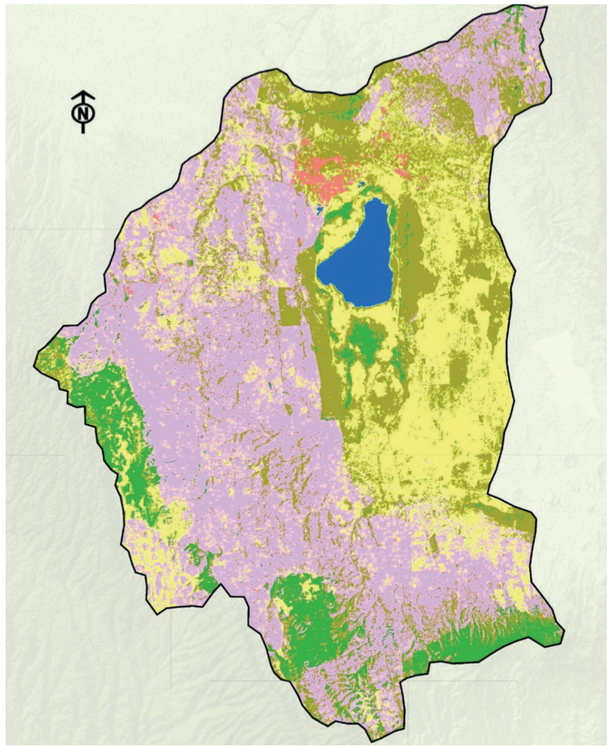
Forestland



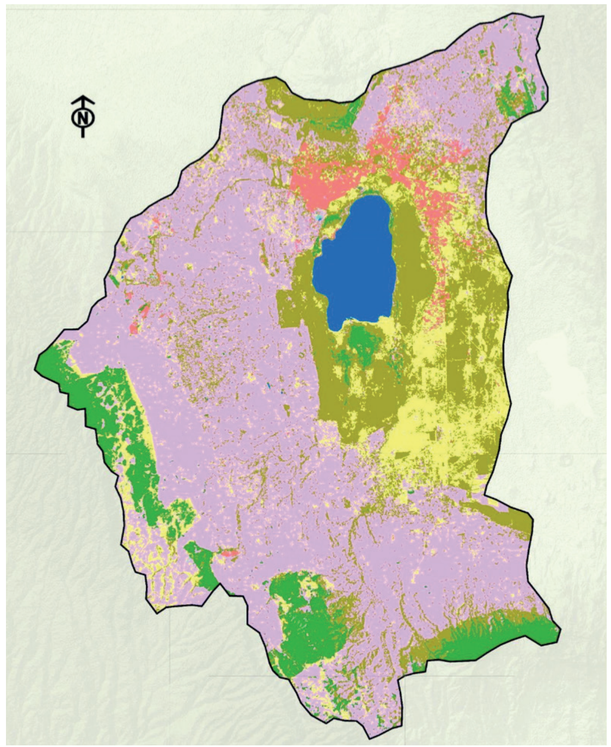
1990



2000



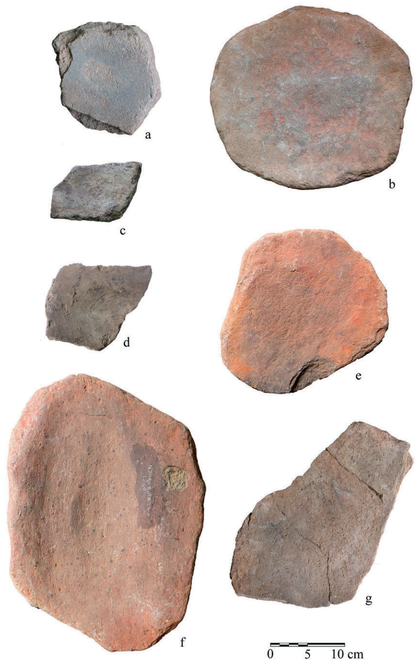
2010



2021

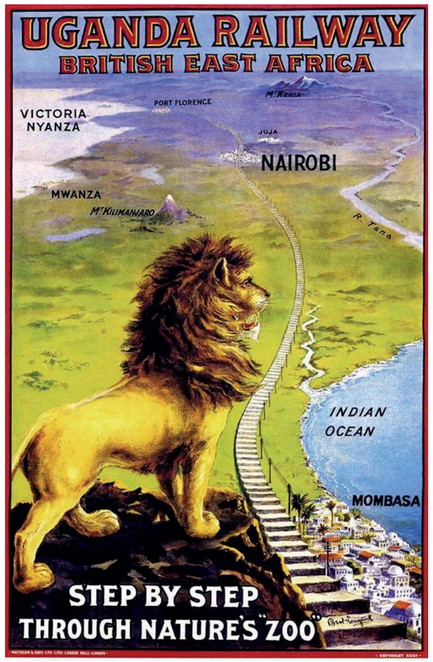
Maps by Kigora, T. et al. (2021) from the report “Report on rising lake levels and beaconing of the highest water mark in Lake Nakuru, Kenya.

2.4. Land-use change: historical events



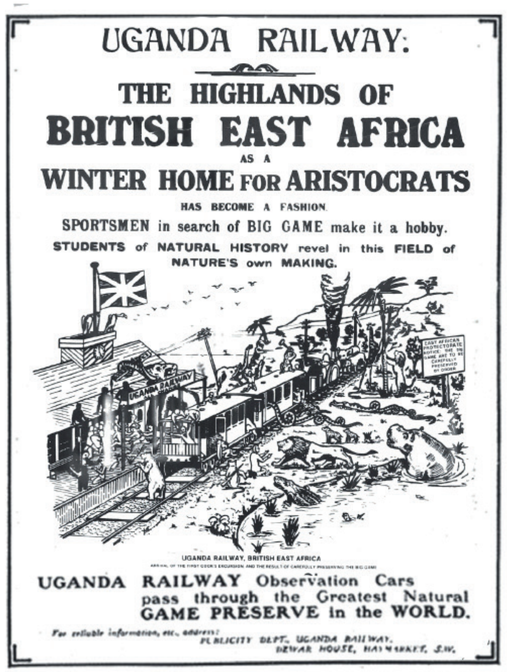
1 10.000 B.C. - 2000 B.C.

Neolithic tools found near the Njoro Caves



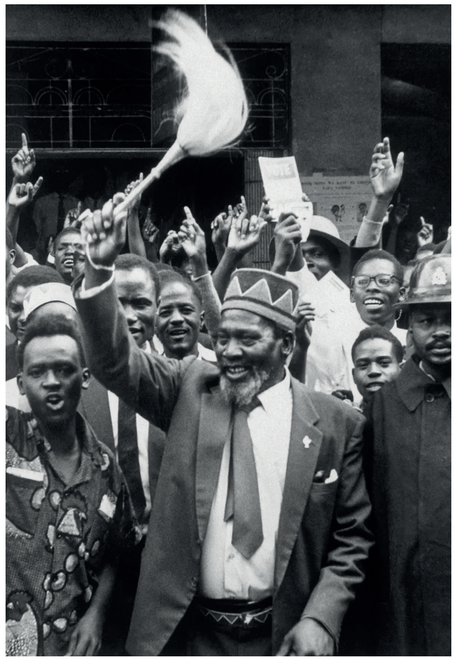
2 1895 - 1901

Construction of the Ugandan Railway.



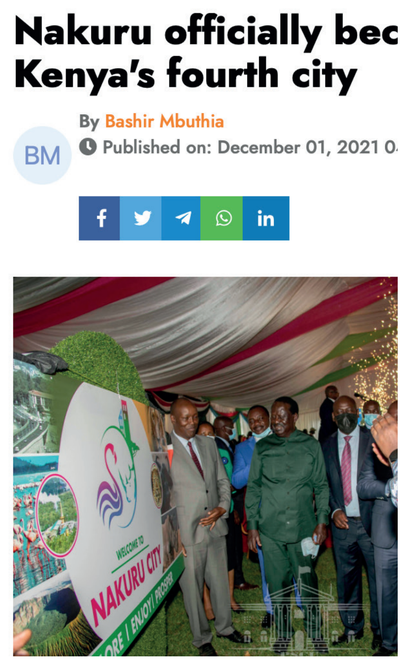
3 1888 - 1963

Colonization of Kenya, implementation of intensive agricultural system, transition from small scale agricultural/ pastoral/hunter-gatherer culture to industrial capitalist society.



4 1963

Kenya becomes independent.



5 2021

Nakuru gains city status and becomes Kenya's fourth city.

2.4. Land-use change

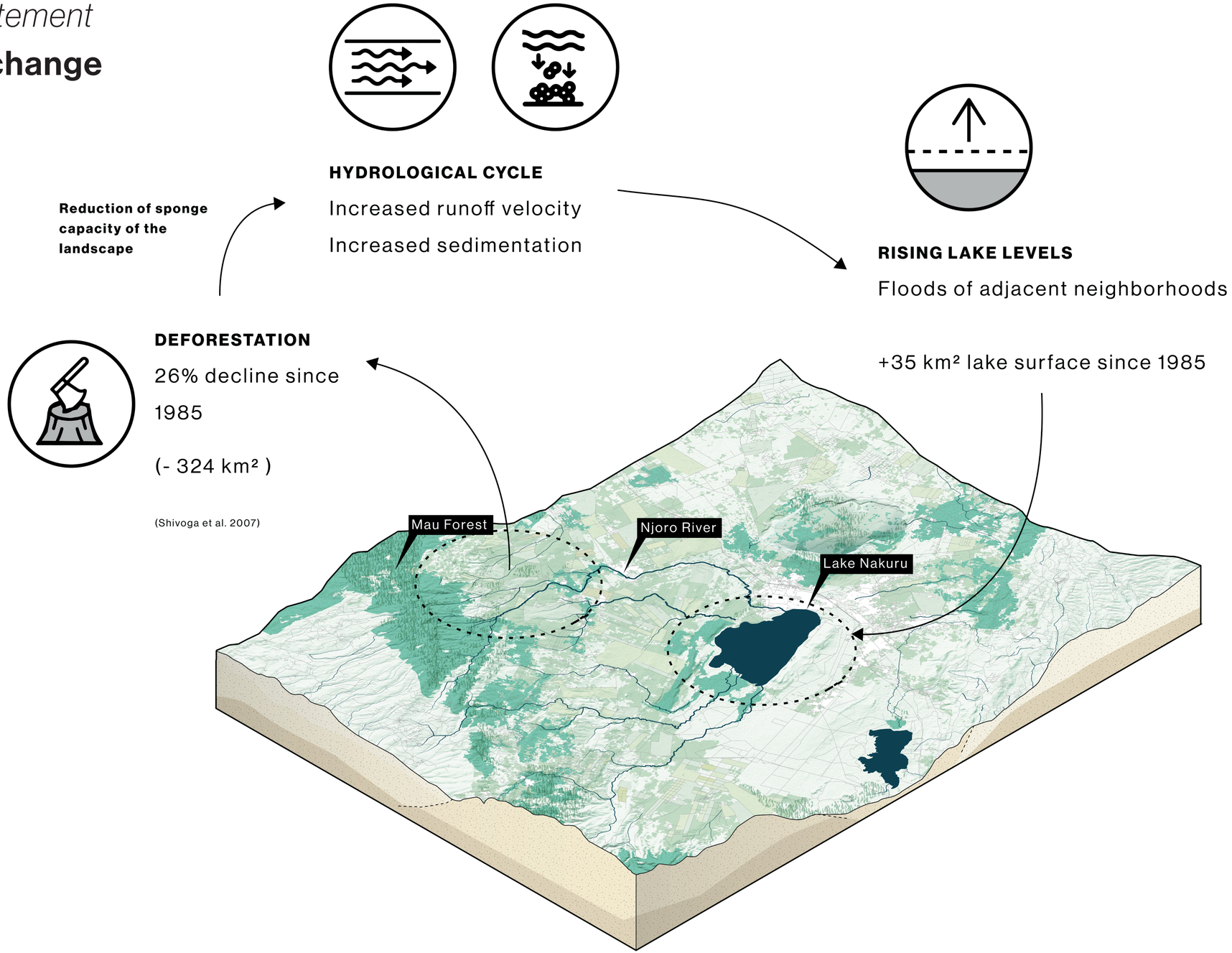


Protected part of the Mau Forest (Image by author, 2025).



Bare carrot field on deforested land (Image by author, 2025).

2.4. Land-use change



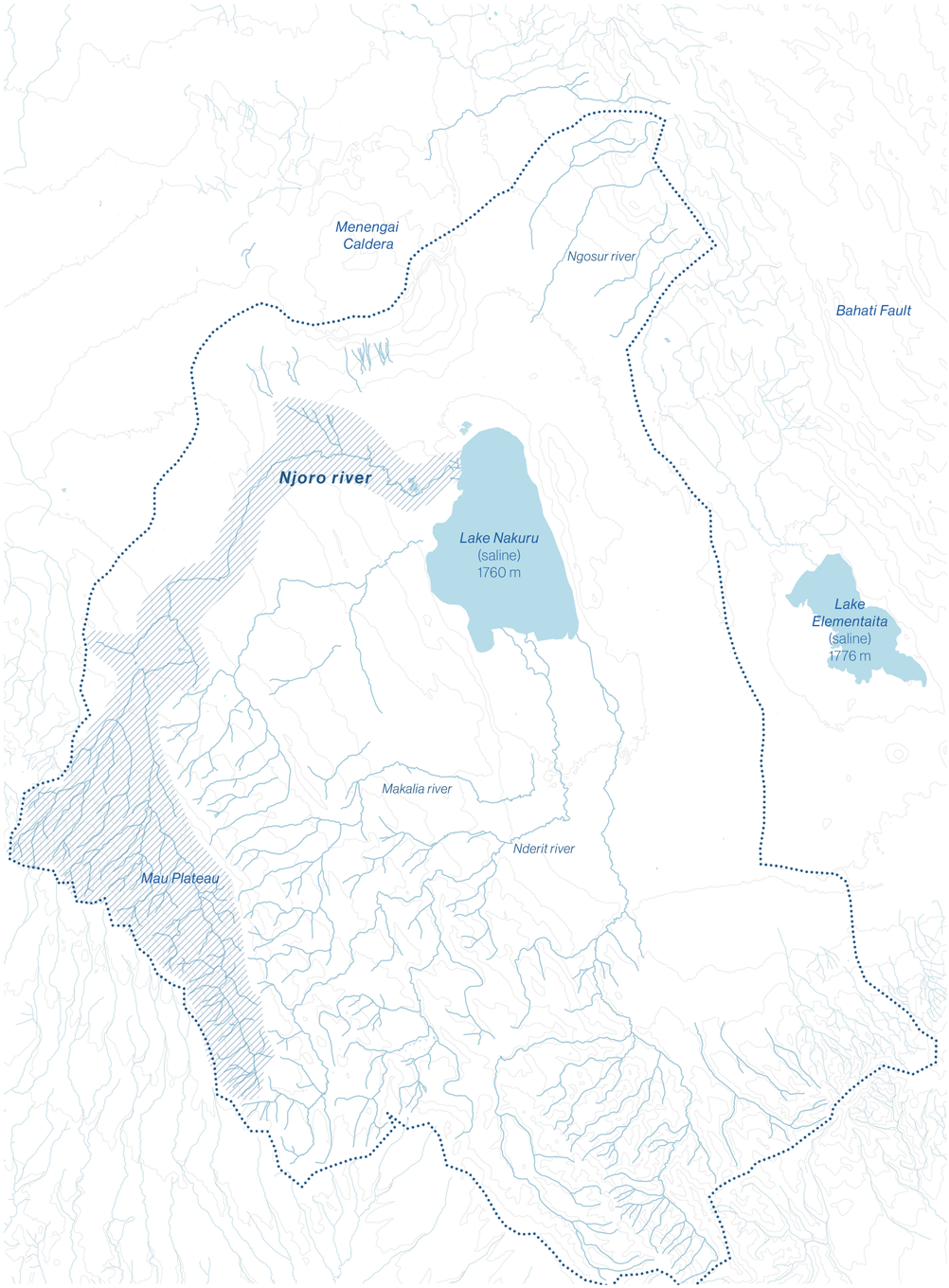
3

Objective + analysis



Bouke de Jong "The Njoro River" (Author, 2025). Living Rivers

3.1. Njoro catchment



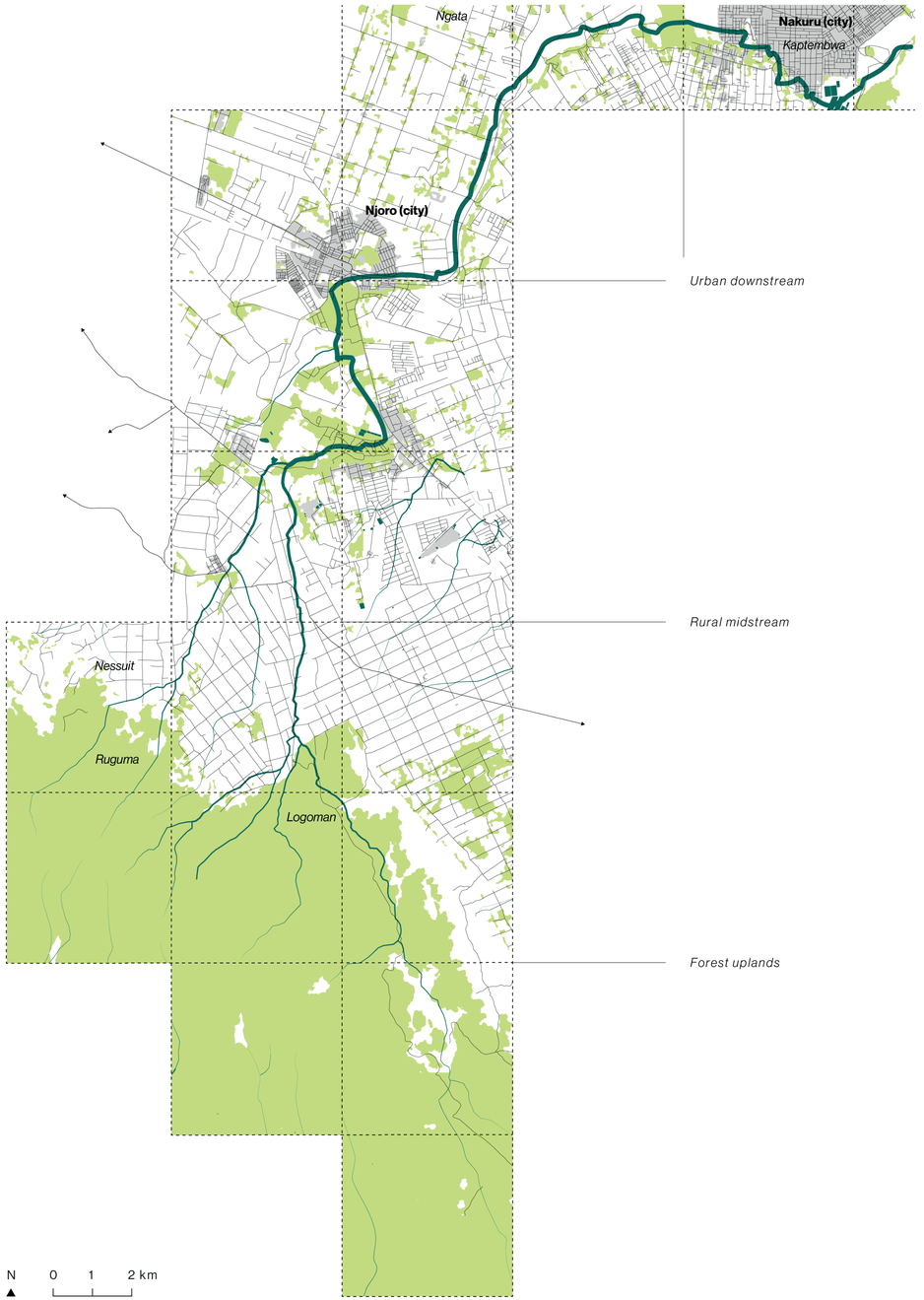
Legend (map)

- *Surface water*
- *Njoro River catchment*
- *Rivers*
- *Lake Nakuru basin*
- *Contourline*

N

0 2,5 5 km

3.1. Njoro catchment



3.2. Along the Njoro

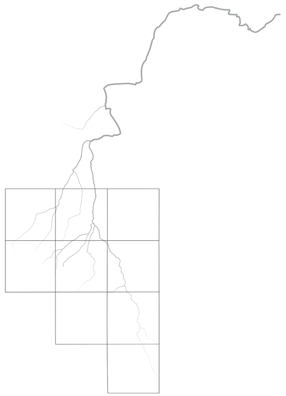


Our car during part one of the site visit (Image by Zeinstra, T., 2025).



The motorbike during our second site visit (Image by author, 2025).

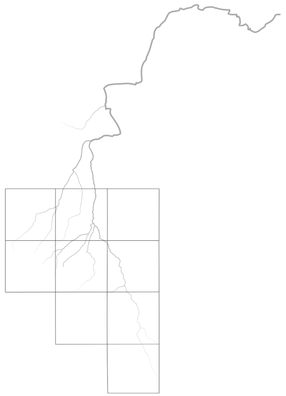
Upstream





Undisturbed riverine landscape in the river headwaters, Mau Forest *(image by author, 2025).*

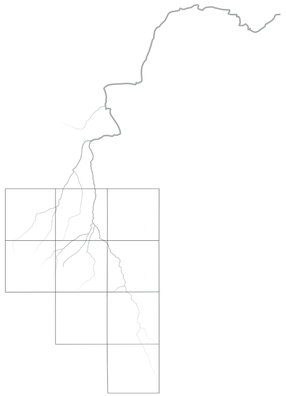
Upstream





Steep riverbanks with indigenous vegetation in otherwise deforested upstream *(image by author, 2025).*

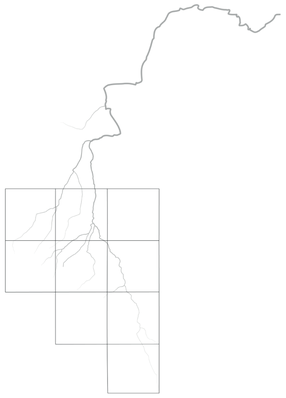
Upstream





Carrot field with sparsely planted eucalyptus trees *(image by author, 2025).*

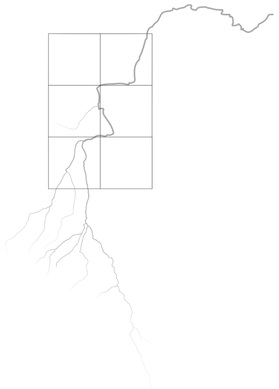
Upstream





Farmers washing carrots using river water *(image by author, 2025).*

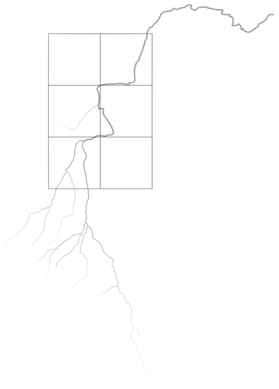
Midstream





Shepherd watering cattle by a bridge near Egerton University *(image by author, 2025).*

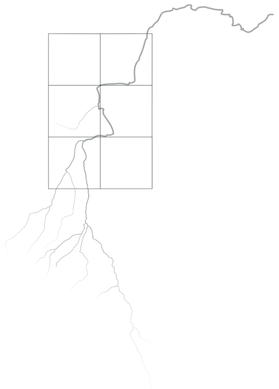
Midstream





Shepherd watering cattle by a bridge near Egerton University *(image by author, 2025).*

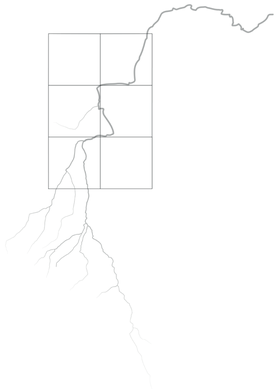
Midstream





Woman washing clothes using river water *(image by author, 2025).*

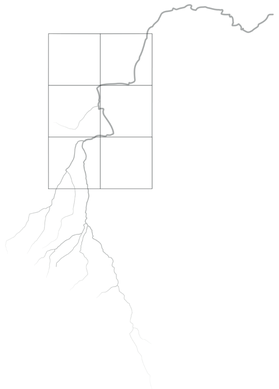
Midstream





Man fetching water from the river *(image by author, 2025).*

Midstream





Eroded river banks in the Midstream *(image by author, 2025).*

Downstream





Encroachment of the riparian zone in Kaptembwo neighborhood *(image by author, 2025).*

Downstream





Neighborhood in the downstream of the river *(image by author, 2025).*

Downstream





Flooded homes in Barut-East *(image by author, 2025).*



Flamingo in Lake Nakuru *(image by Kuipers, J., 2025).*

3.2. Along the Njoro



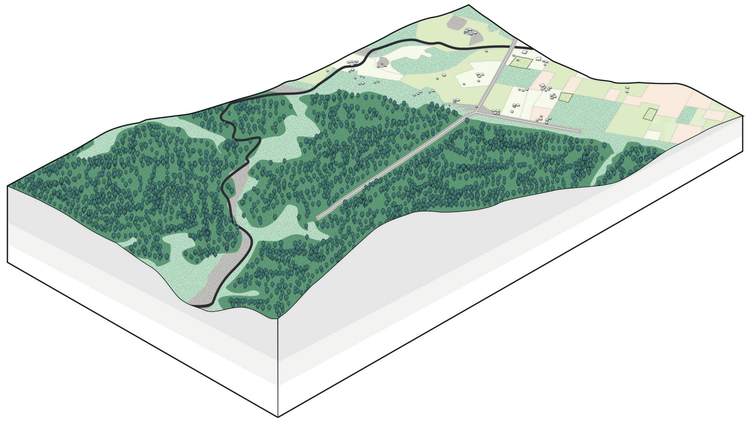
River in its natural state in the protected part of the Mau Forest (Image by author, 2025).



The Njoro river in urban Kaptembwo neighborhood (Image by author, 2025).

3.3. Catchment challenges

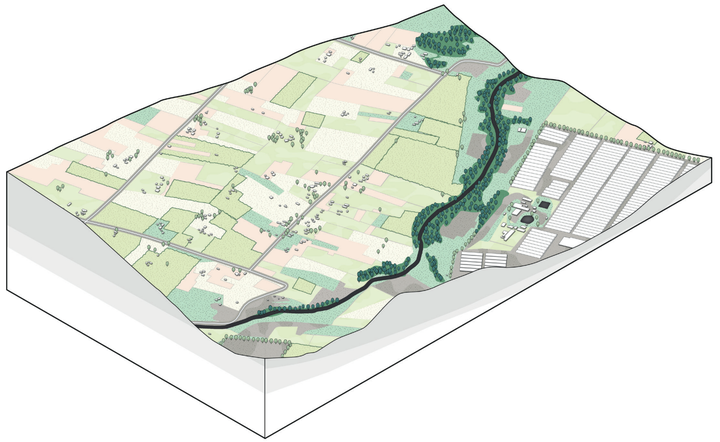
Forest upland



Deforestation

Mono-culture cropland

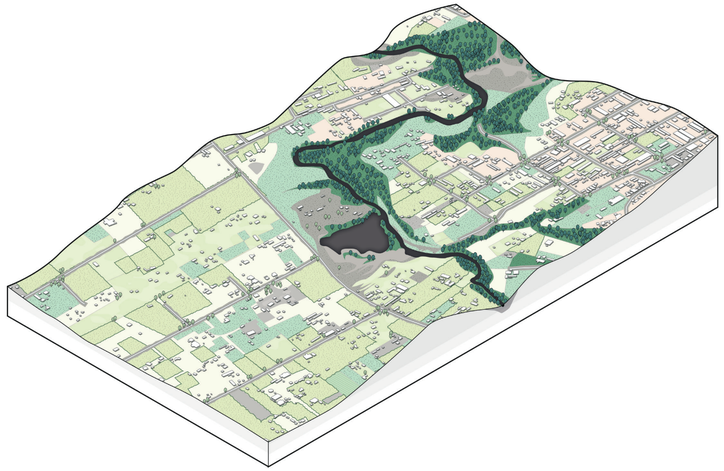
Rural midstream



Pollution from pesticides, washing detergent, manure

Trampling of banks by cattle

Urban downstream



Plastic and waste pollution

Encroachment of riparian buffer

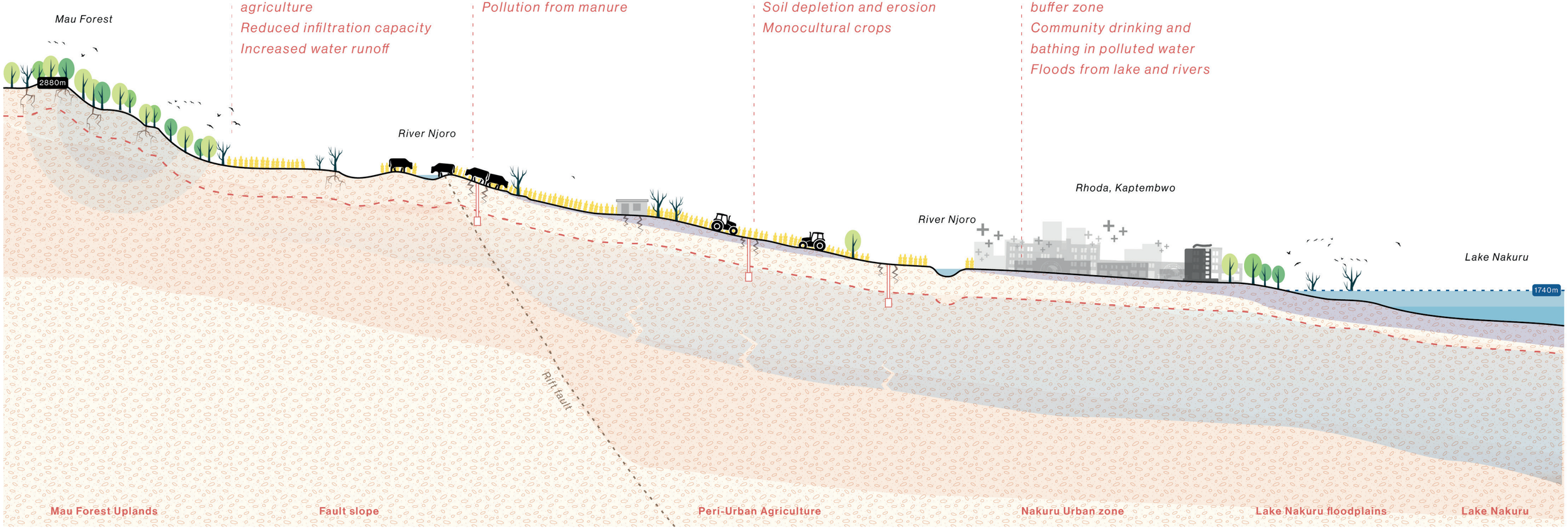
3.3. Catchment challenges

DEFORESTATION
Clearing of trees in favor of agriculture
Reduced infiltration capacity
Increased water runoff

CATTLE WATERING
Livestock trampling river banks
Pollution from manure

INTENSIVE AGRICULTURE
Pollution from pesticides
Soil depletion and erosion
Monocultural crops

URBAN PRESSURE
Informal settlement in riparian buffer zone
Community drinking and bathing in polluted water
Floods from lake and rivers



4

Design solutions

4.1. Co-Designing: learning from locals



Water as Leverage workshop in Nakuru *(image by Chege, J, 2025).*



Water as Leverage workshop in Nakuru *(image by Chege, J, 2025).*



Discussing work (Image by author, 2025).



Co-designing in groups (Image by author, 2025).

4.2. Nature based solutions

big, regional impact

small, local impact



Image by author (2025)

Agroforestry



image via African Hillside Subsistence Farmers (2022)

Terrace farming (fanya juu)

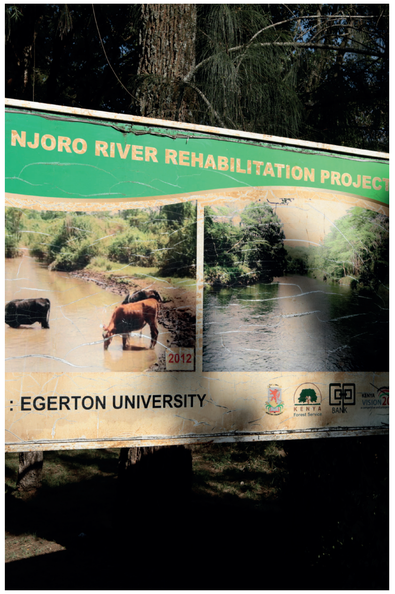


image by author (2025)

Riparian vegetation restoration



Image via Samantha Braid (2016)

(Live) check dams



Image via World Vision International (2023)

Rain water harvesting ponds

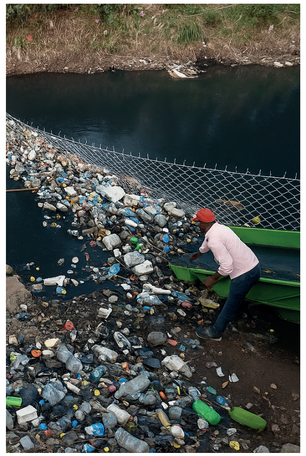


Image via KCIC (2021)

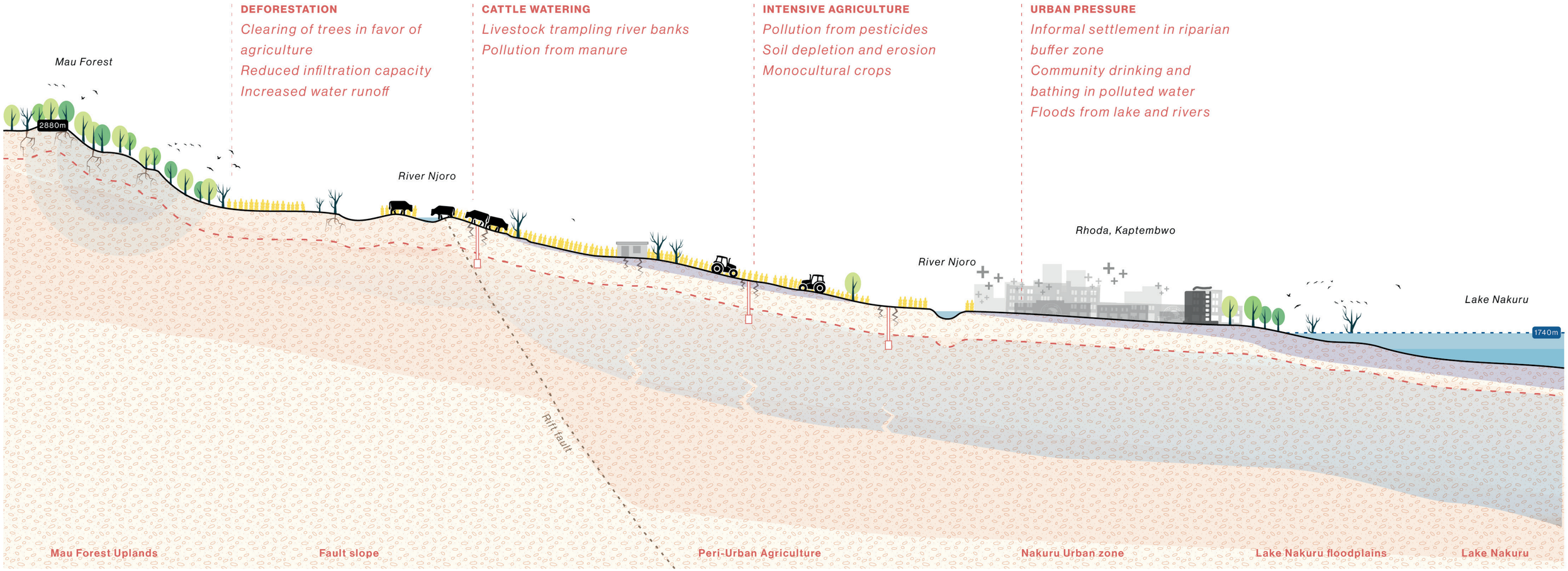
River waste screens



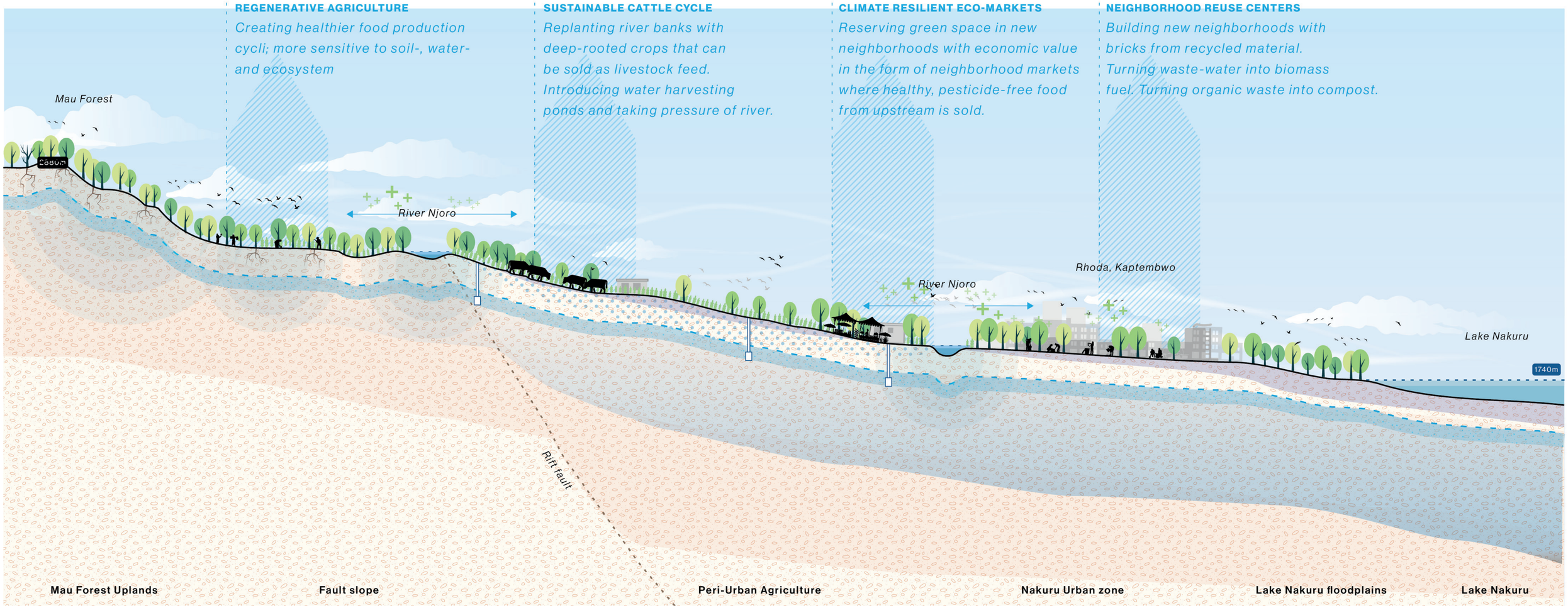
Image via Fischer, E. (2018)

Bioswales

4.3. System in place



4.4. Regional vision: Systemic change




Legend
Framework
Negotiation space
Economic zone
Indigenous forest
Agroforestry
Check dam
Water Harvesting Pond
Live check dam
Terrace farming
Eco-market
Cattle watering center
River waste screen
Briquette production
Neighborhood constructed wetland
Recycling center

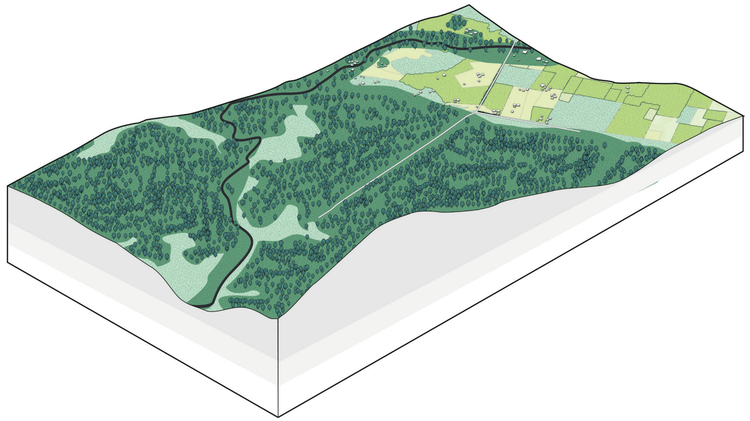
5

Design explorations

5.1. Landscape strategies

Forest upland

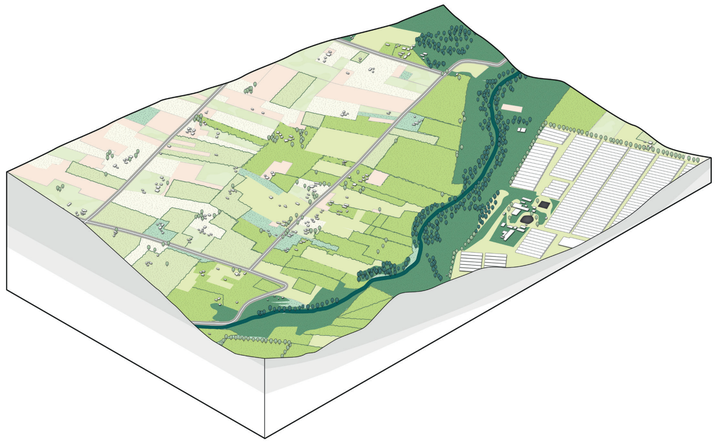
Agroforestry Systems



- Agroforestry
- Terrace farming

Rural midstream

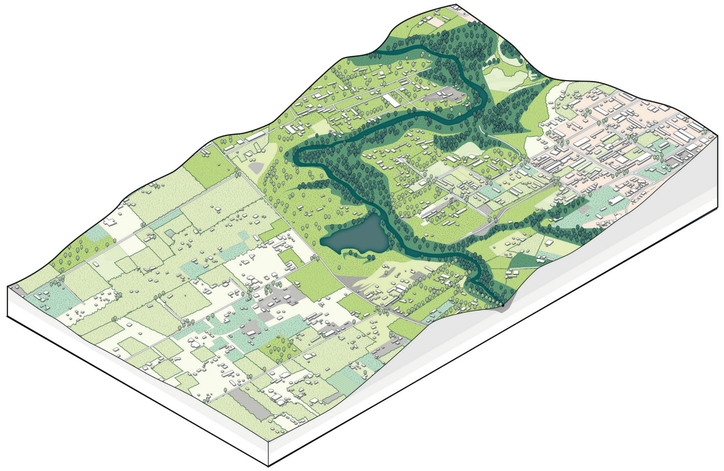
Riparian restoration



- Rainwater Harvesting
- Riparian buffer restoration

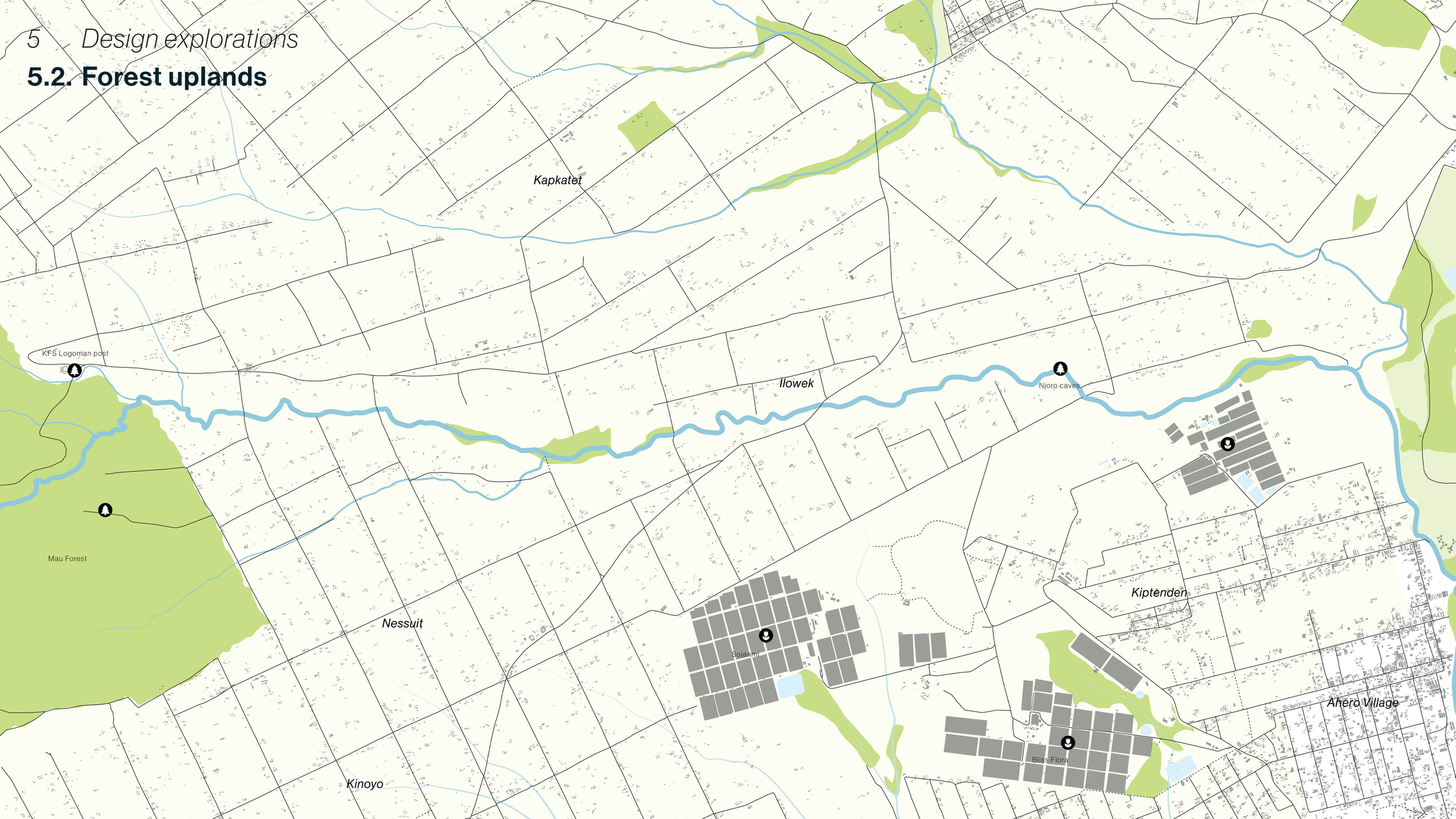
Urban downstream

Fresh markets and reuse



- Briquette production
- Recycling waste into eco-bricks for local construction
- Eco-markets

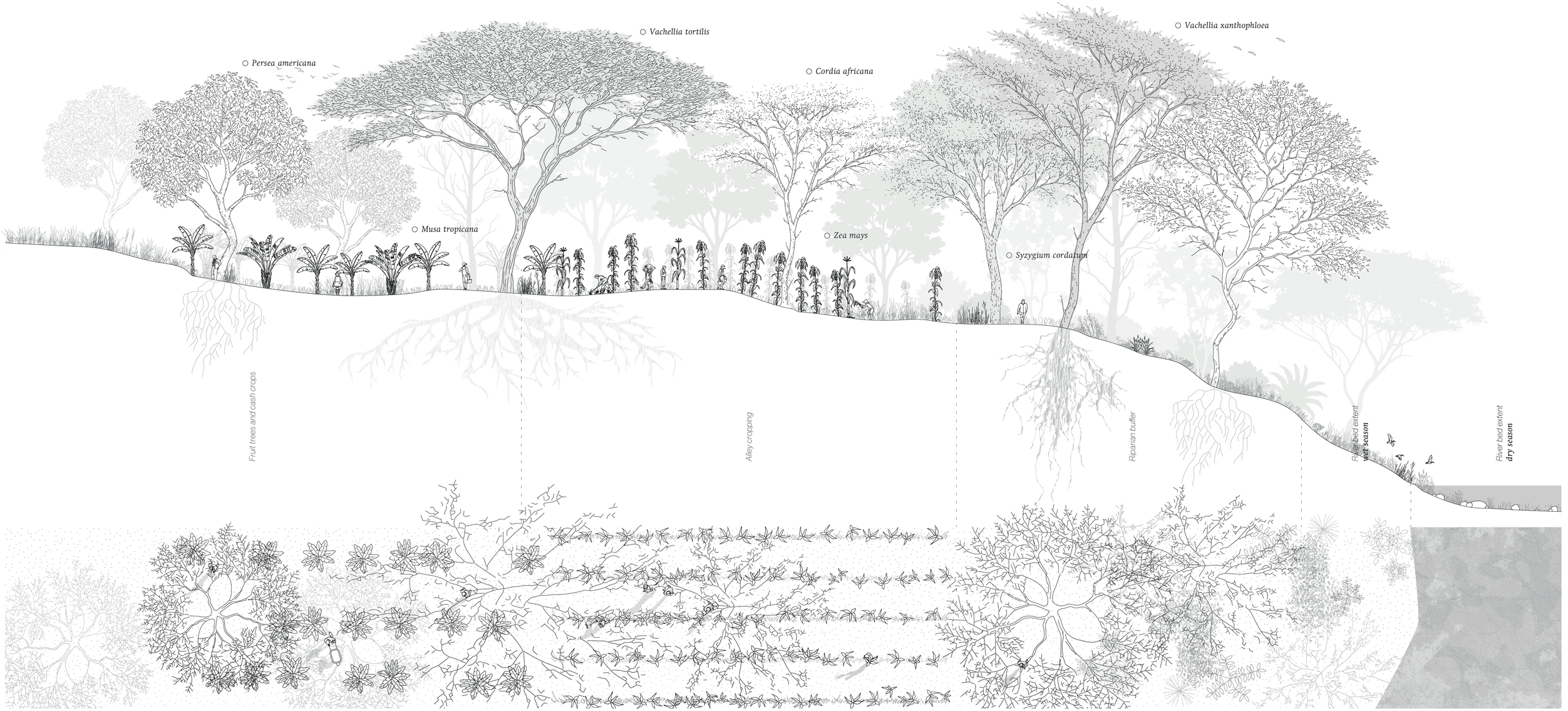
5.2. Forest uplands




Kapkatet
KFS Logoman post
Ilowek
Njoro caves
Mau Forest
Nessuit
Kiptenden
Sojanmi
Ahero Village
Bliss Flora
Kinoyo



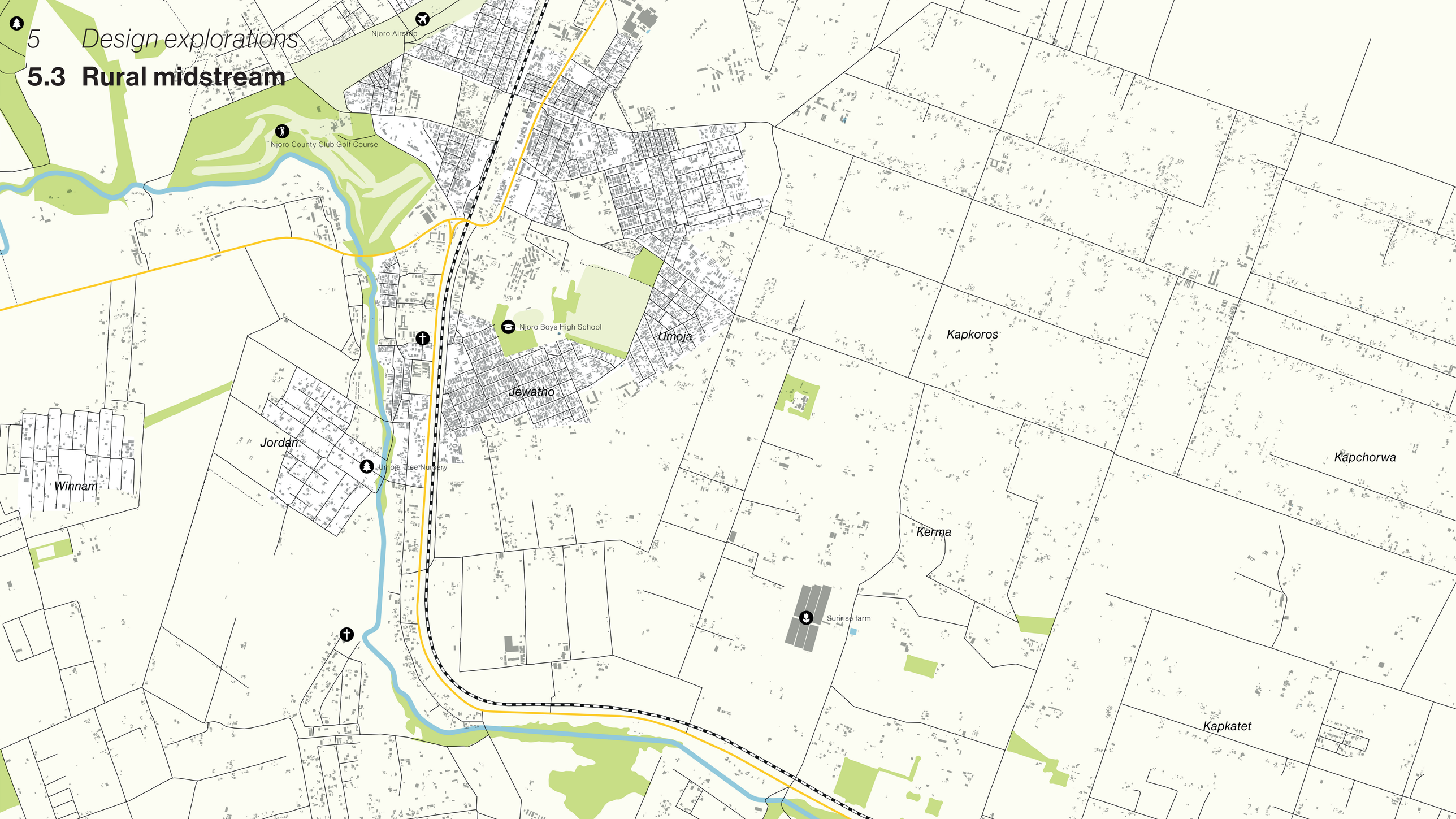
5.2. Forest uplands: Agroforestry strategies



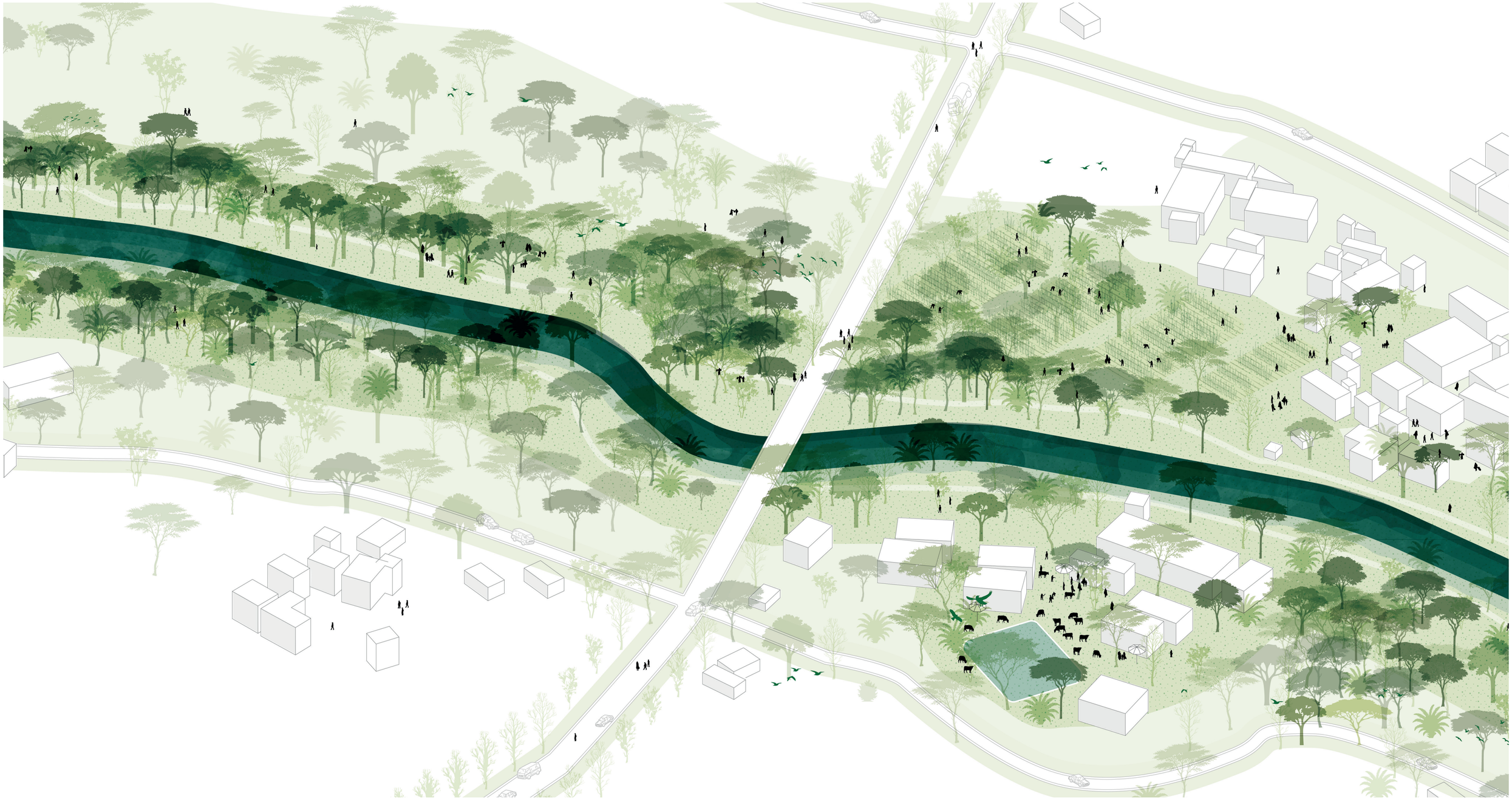
5.2. Forest uplands: Terrace farming



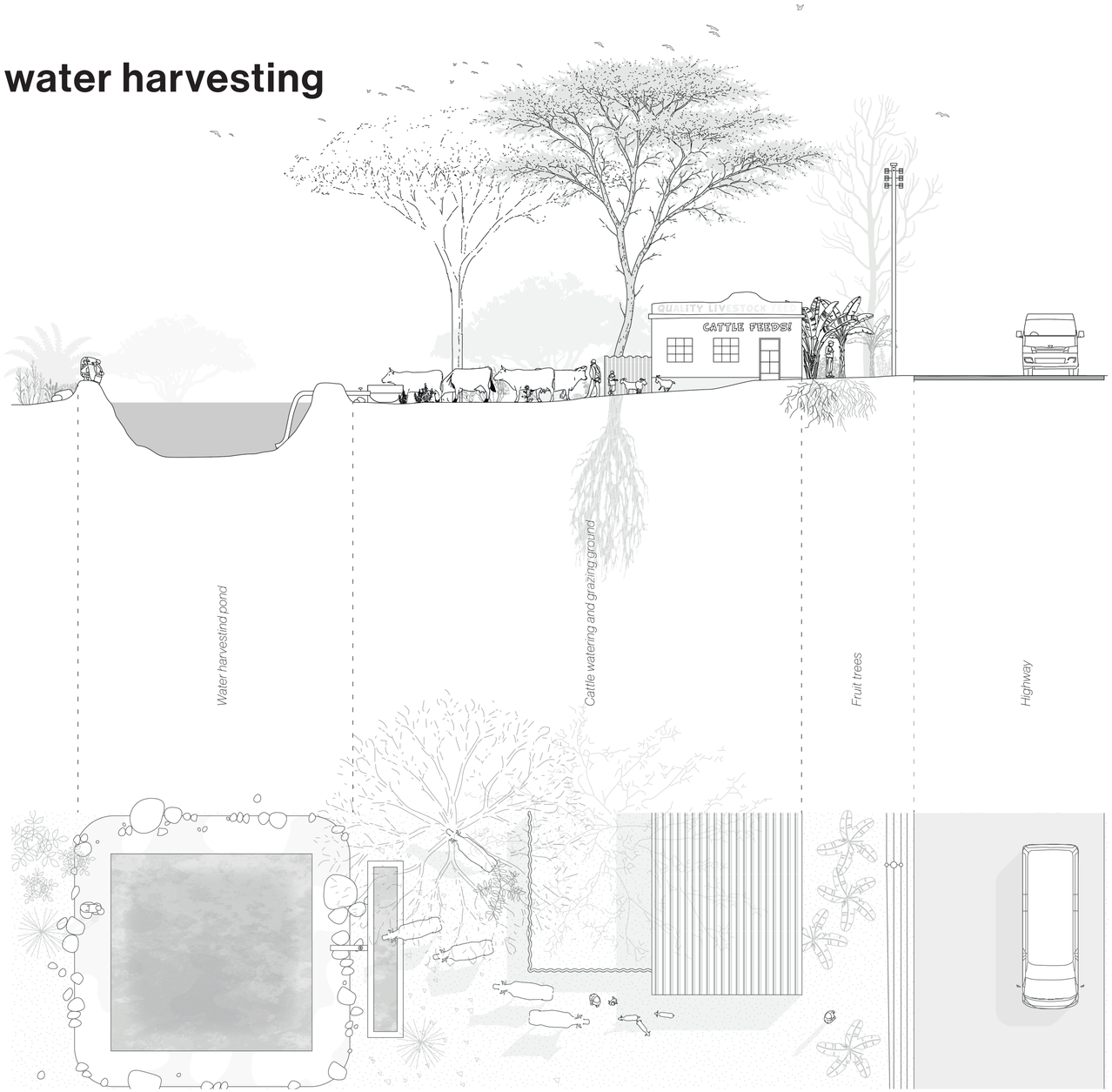
5.3 Rural midstream



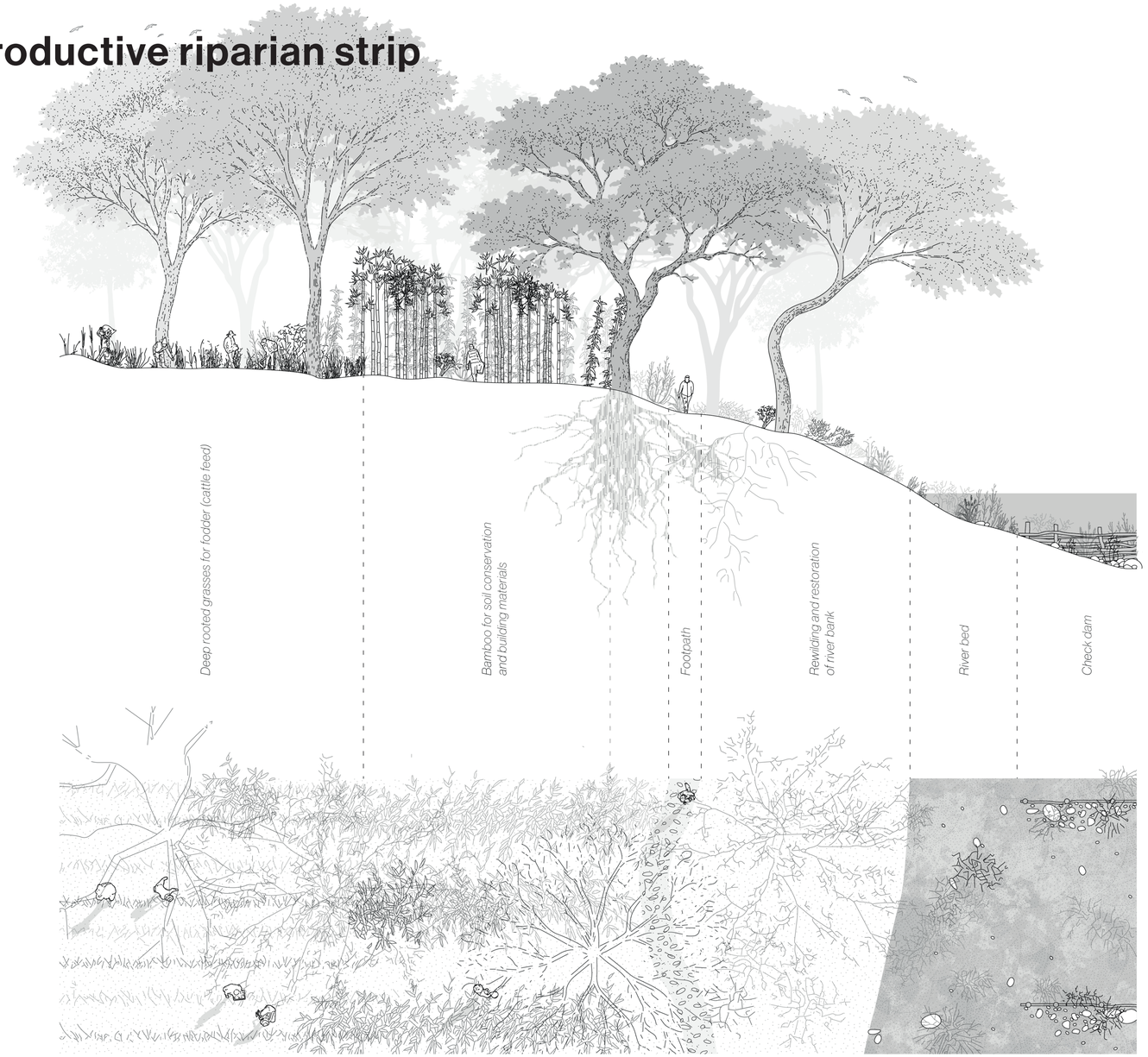

Cattle watering pond
Fodder market
Fodder crop production
Tree nurseries
Agroforestry
Jordan
Winnam
Jewatho
Umoja
Kapkoros
Kapchorwa
Kerma
Kapkatet



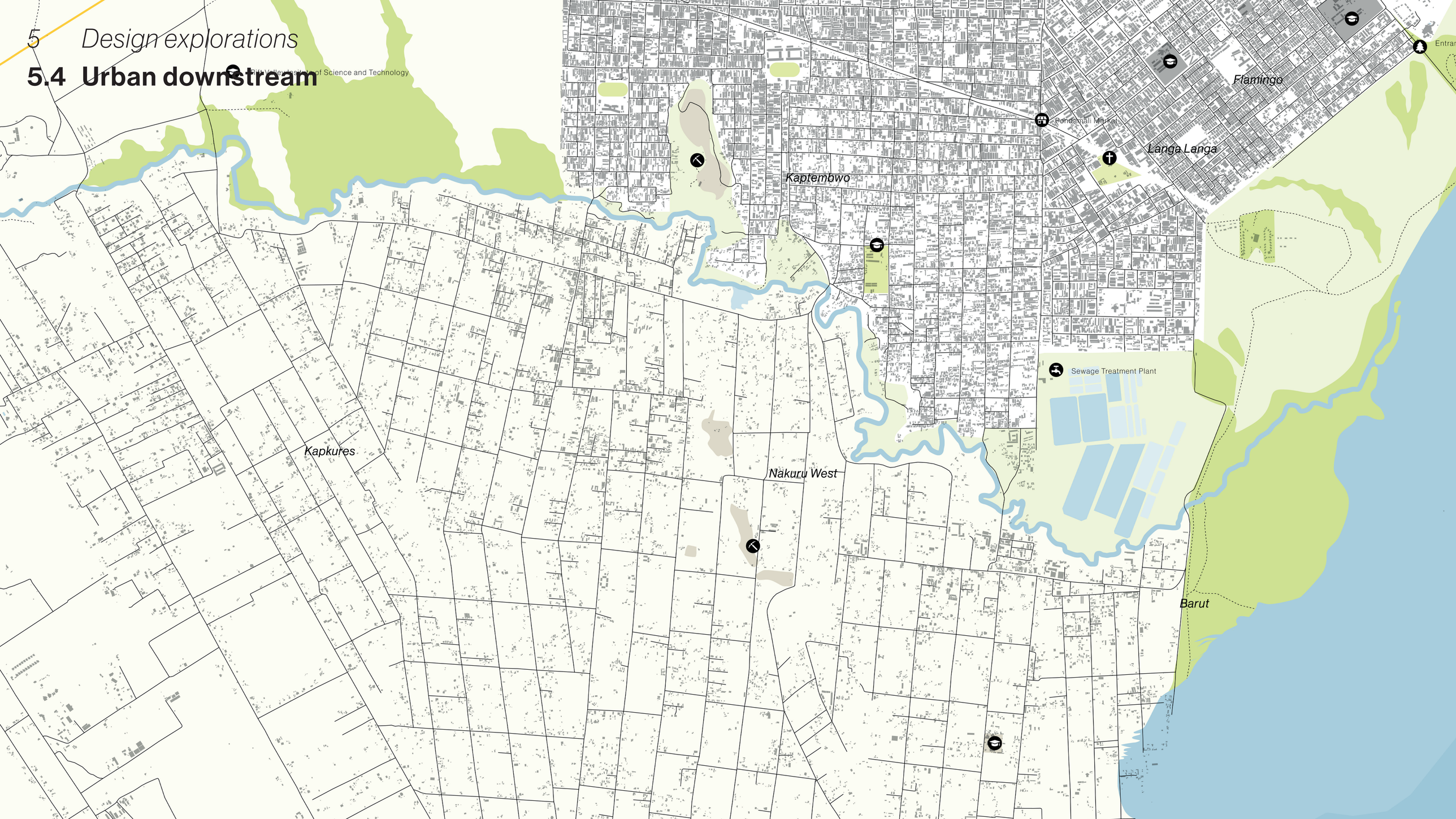
5.3 Rural midstream: Rain water harvesting



5.3 Rural midstream: Productive riparian strip



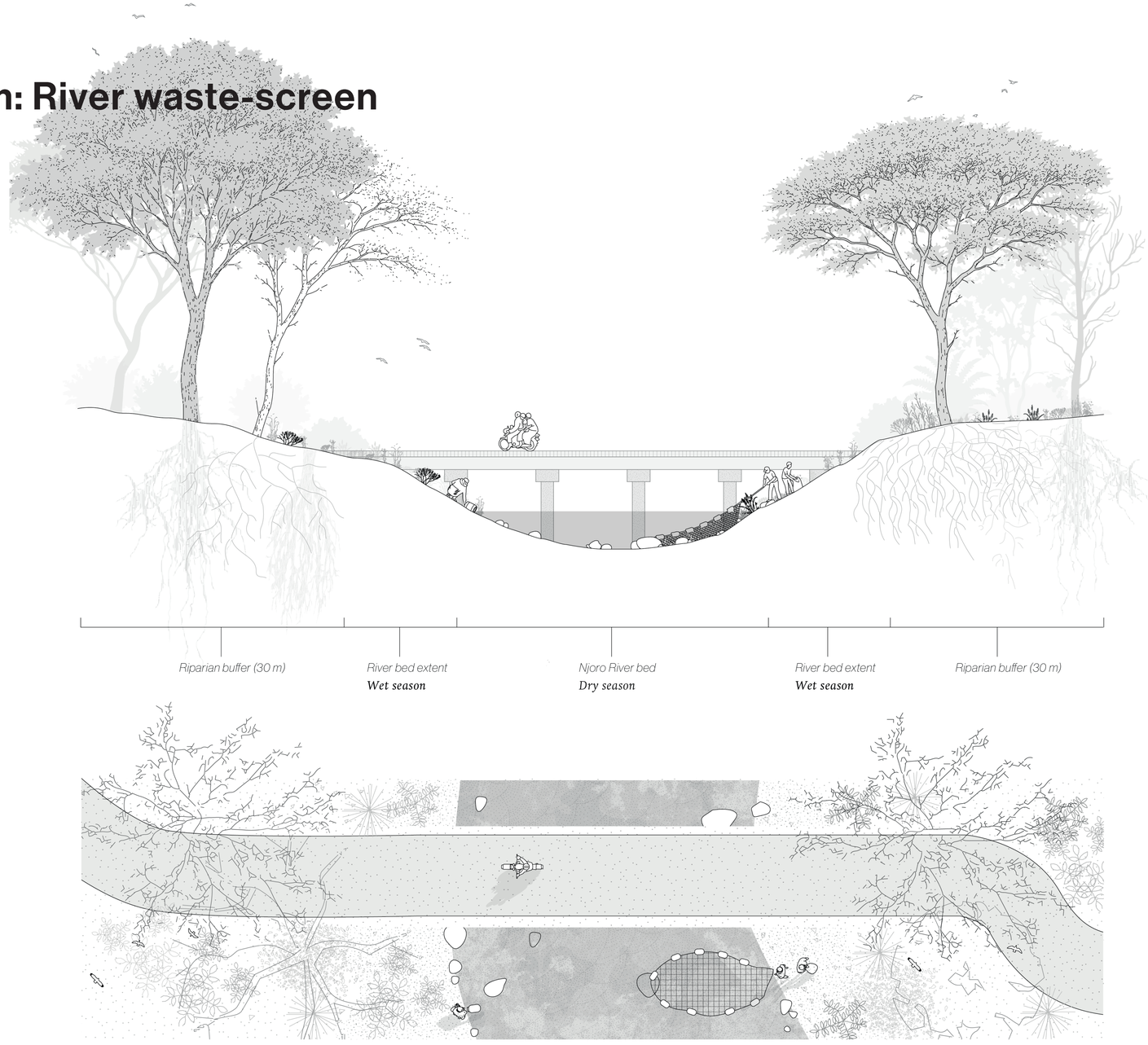
5.4 Urban downstream




Rift Valley Insitute of Science and Technology
Water harvesting pond
City forest
Kaptembwo
Flamingo
Pondamali Market
Langa Langa
Sewage Treatment Plant
Expansion of NAWASSCOAL
Anaerobic wetlands
River waste screen
Plastic recycling station
Kapkures
Nakuru West
Green market park
Barut



5.4 Urban downstream: River waste-screen



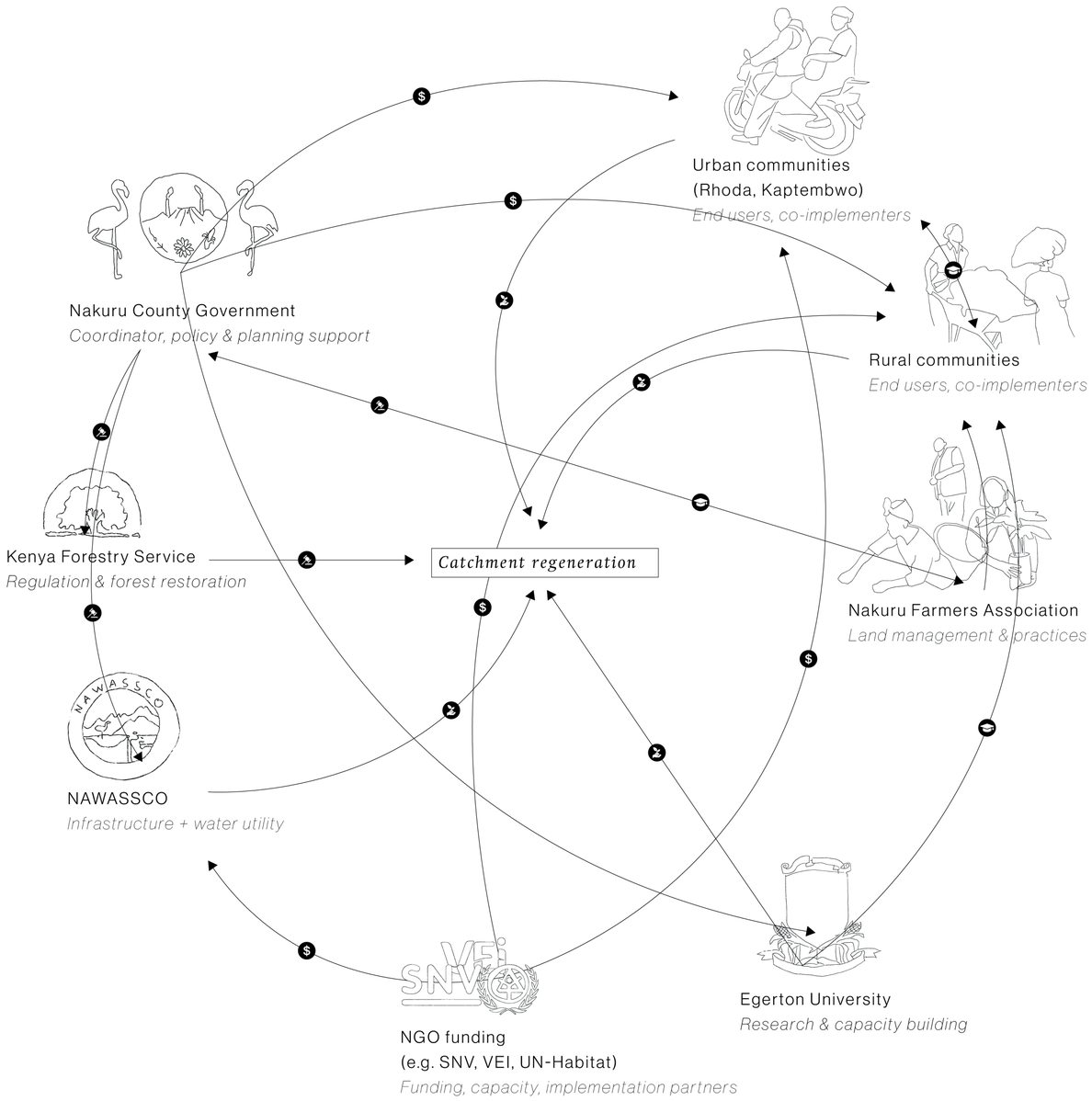
5.4 Urban downstream: Eco-market with bioswale



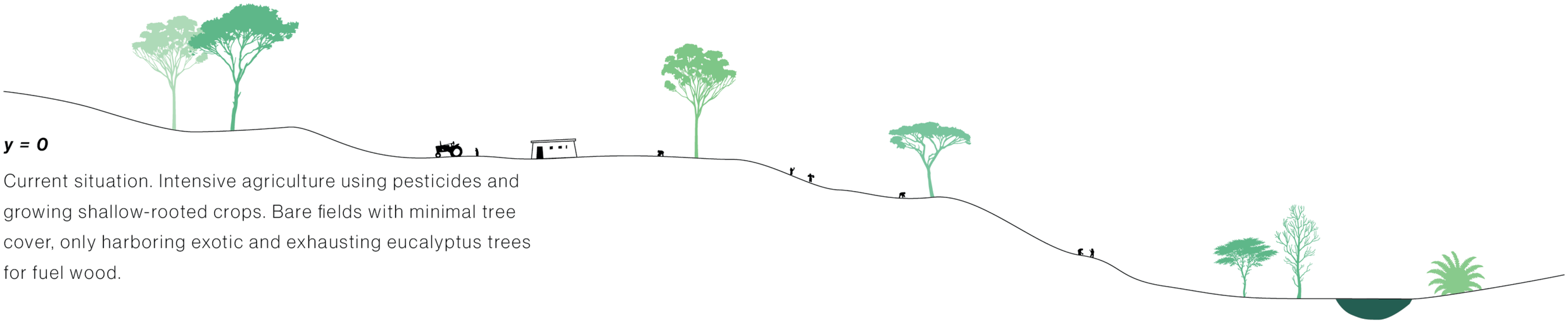
6

Implementation

6.1 Actor networks



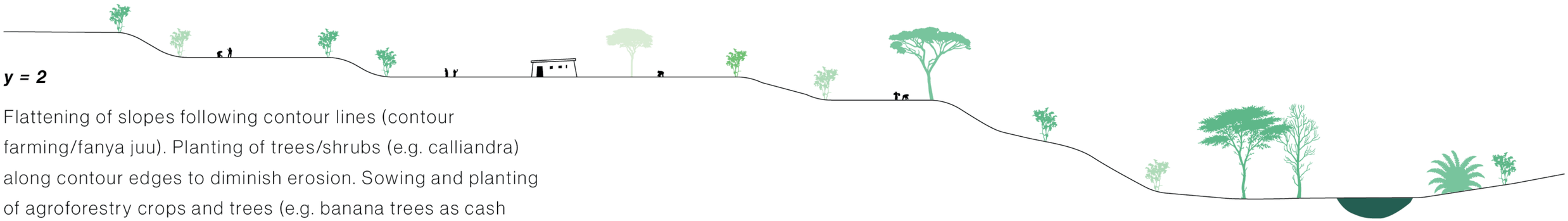
6.2 Phasing



y = 0

Current situation. Intensive agriculture using pesticides and growing shallow-rooted crops. Bare fields with minimal tree cover, only harboring exotic and exhausting eucalyptus trees for fuel wood.

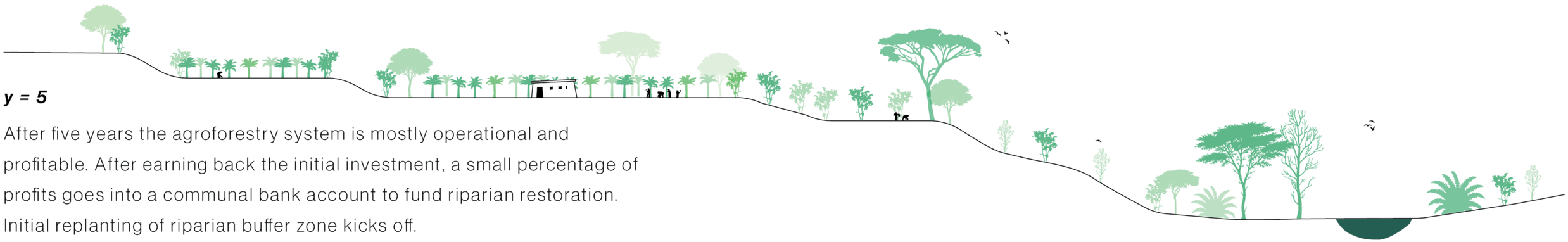
6.2 Phasing



y = 2

Flattening of slopes following contour lines (contour farming/fanya juu). Planting of trees/shrubs (e.g. calliandra) along contour edges to diminish erosion. Sowing and planting of agroforestry crops and trees (e.g. banana trees as cash crops, syzygium as shade/land demarcation tree).

6.2 Phasing



y = 5

After five years the agroforestry system is mostly operational and profitable. After earning back the initial investment, a small percentage of profits goes into a communal bank account to fund riparian restoration. Initial replanting of riparian buffer zone kicks off.

6.2 Phasing



y = 20

Twenty years later, the riparian vegetational buffer is replanted and restored. Erosion is under control through terracing and agroforestry strategies. The water and ecological system is adaptive to climate change and weather extremes. Agroforestry farming creates more

7 Conclusion

7.1. Conclusion + reflection



1. Bottom-up systemic change

Upscaling approach to other rivers (e.g. Makalia) and compounding of interventions increases impact.

2. Limitations

Research and design based on site visit and literature review, but no long-term cooperation with local communities or institutions.

3. Outside perspective

Unfamiliar context, missing depth in cultural and political perspective.

7.1. Conclusion + reflection



Floodplains of Wageningen (Image by author, 2022).



Njoro River, Nakuru (Image by author, 2025).


Thank you!