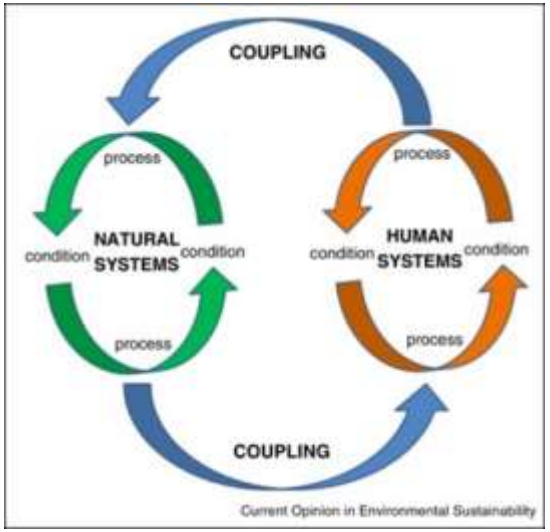
Coupled Human And Natural Systems (CHANS)

Lecture 2 of 16, Dr Marion Pfeifer

25/11/2019

Recap from previous material

1) Define CHANS
2) Provide some context
3) List some key case studies



Outline of this lecture

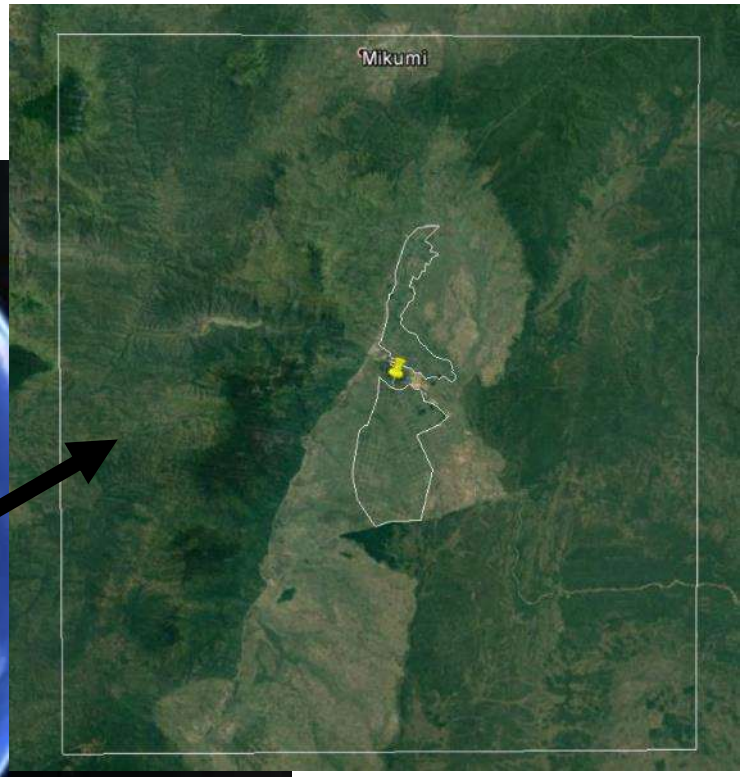
1) Ecological processes in CHANS: using Agrisys Tanzania as a case study

Key papers:

- Johansson & Isgren 2017 Ecology and Society 22:3
- Naeschen et al. 2018 Water 10: 599
- Jones et al. 2012 Tropical Conservation Science.

Ecological processes: a case study

The Agrisys Tanzania Landscape



Ecological processes: a case study

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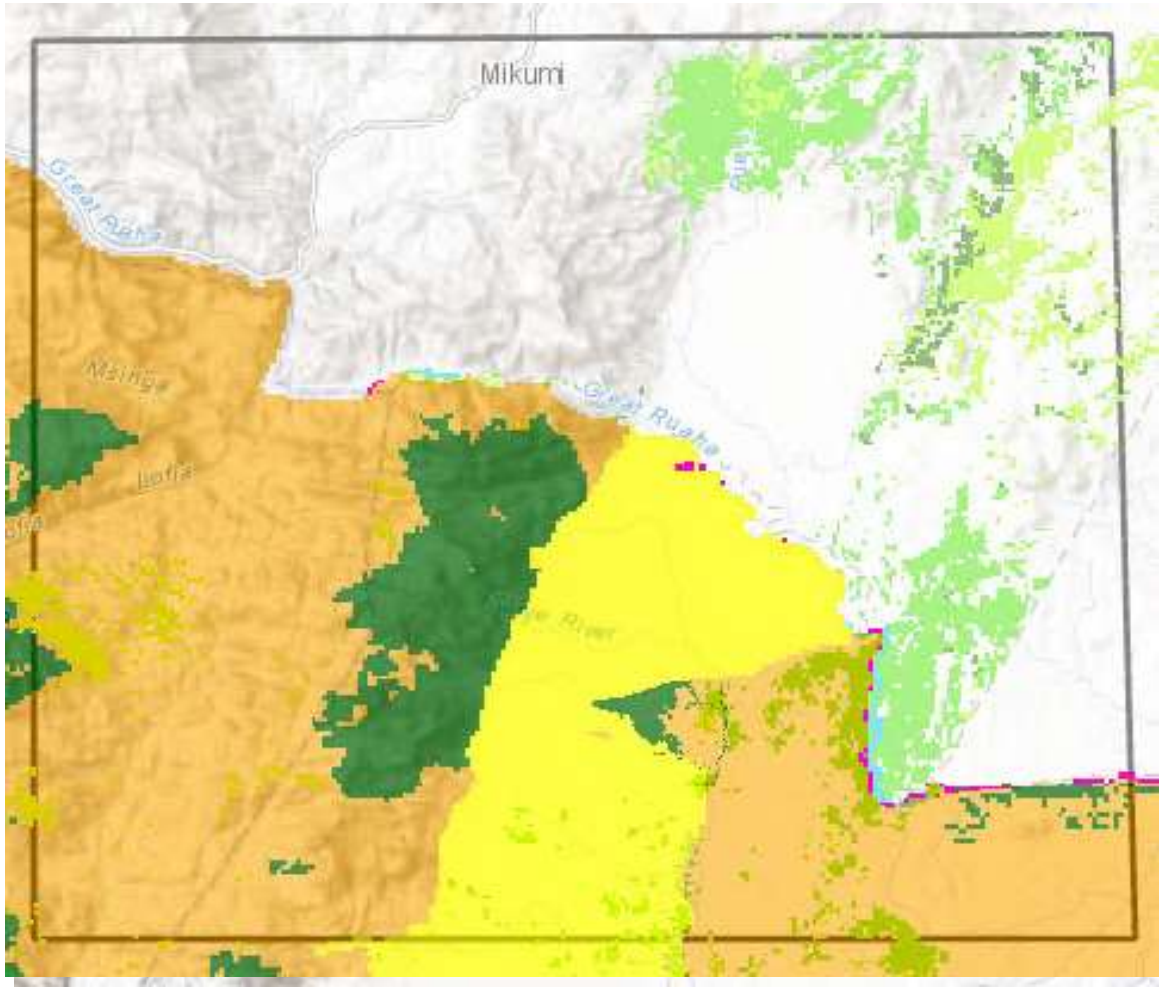


Ecological processes: a case study

Ecological processes: a case study

Mean Annual Temperature

24 ˚ Celsius in the valley

17 ˚ Celsius at higher altitudes

Annual Rainfall

1200 – 1400 mm

(up to 2100 in the mountains)

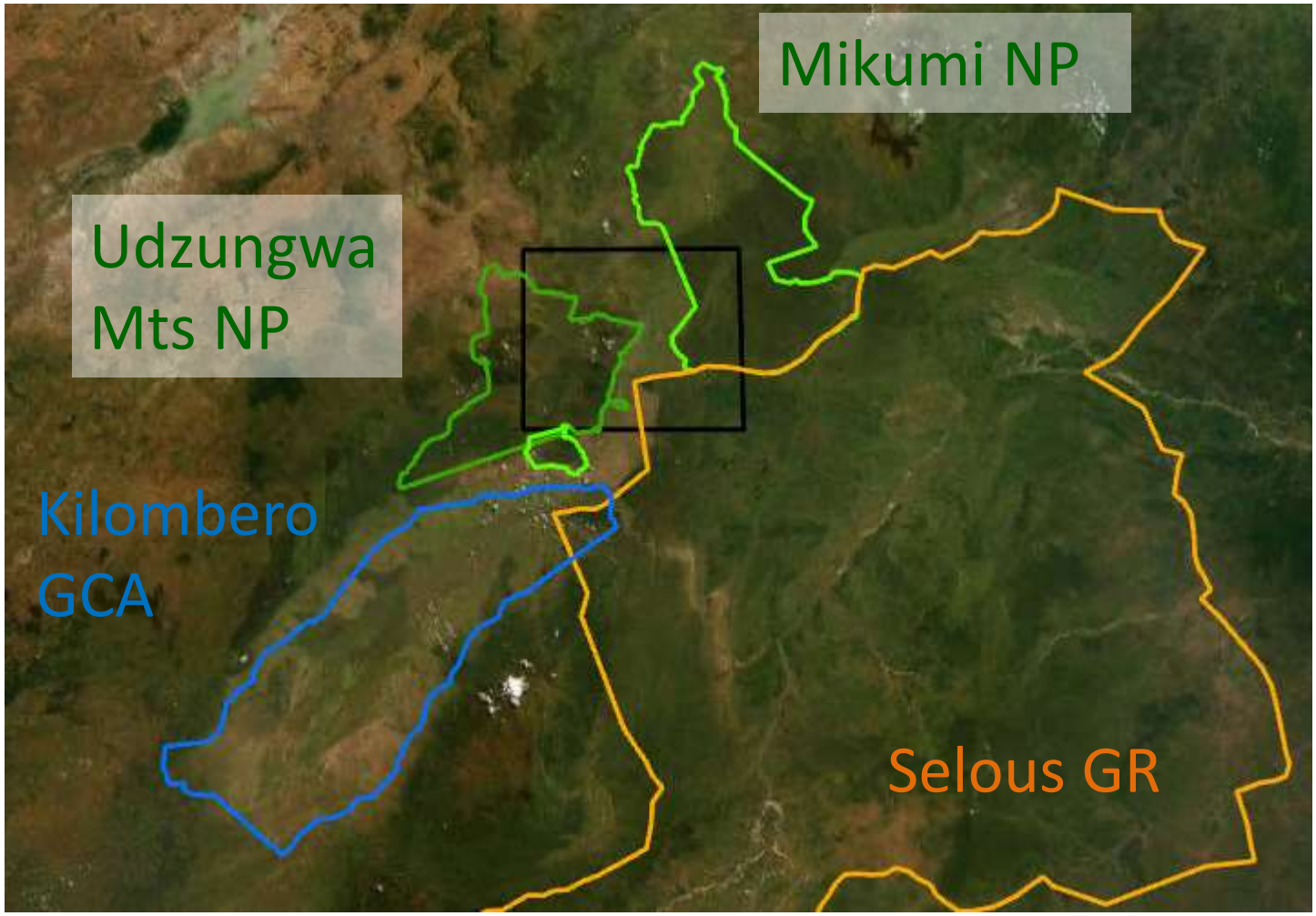
Rainfall seasonality varies between years

Dry season: June – Nov

Rainy season: Nov – May (Short Rains: Nov – Jan; Long Rains: March – May)

Climate change in East Africa: droughts are becoming longer. Inter-annual climate variability has increased in the last decades, resulting in drought periods but also unusual heavy flood events

Ecological processes: a case study



Ecological processes: a case study

Biodiversity: Important wetland for the

- Conservation of antelopes: including Puku (NT, 75 % of its population found in this area); also sable, buffalo, waterbuck, reedbuck, duiker; Habitats at edge of floodplain important during the wet season
- Conservation of birds: rare and endemic species such as Kilombero Weaver (VU) and Kilombero Cisticola (LC)

Ecological processes: a case study

Biodiversity: Mountain biodiversity hotspot

- largest area of moist forest, which support the highest mammalian diversity in the Eastern Arc Mountains
- 1990s/2000s: undescribed vertebrates have been found: a the Udzungwa partridge, the Phillips' Congo shrew, the kipunji monkey; and several amphibians and reptiles

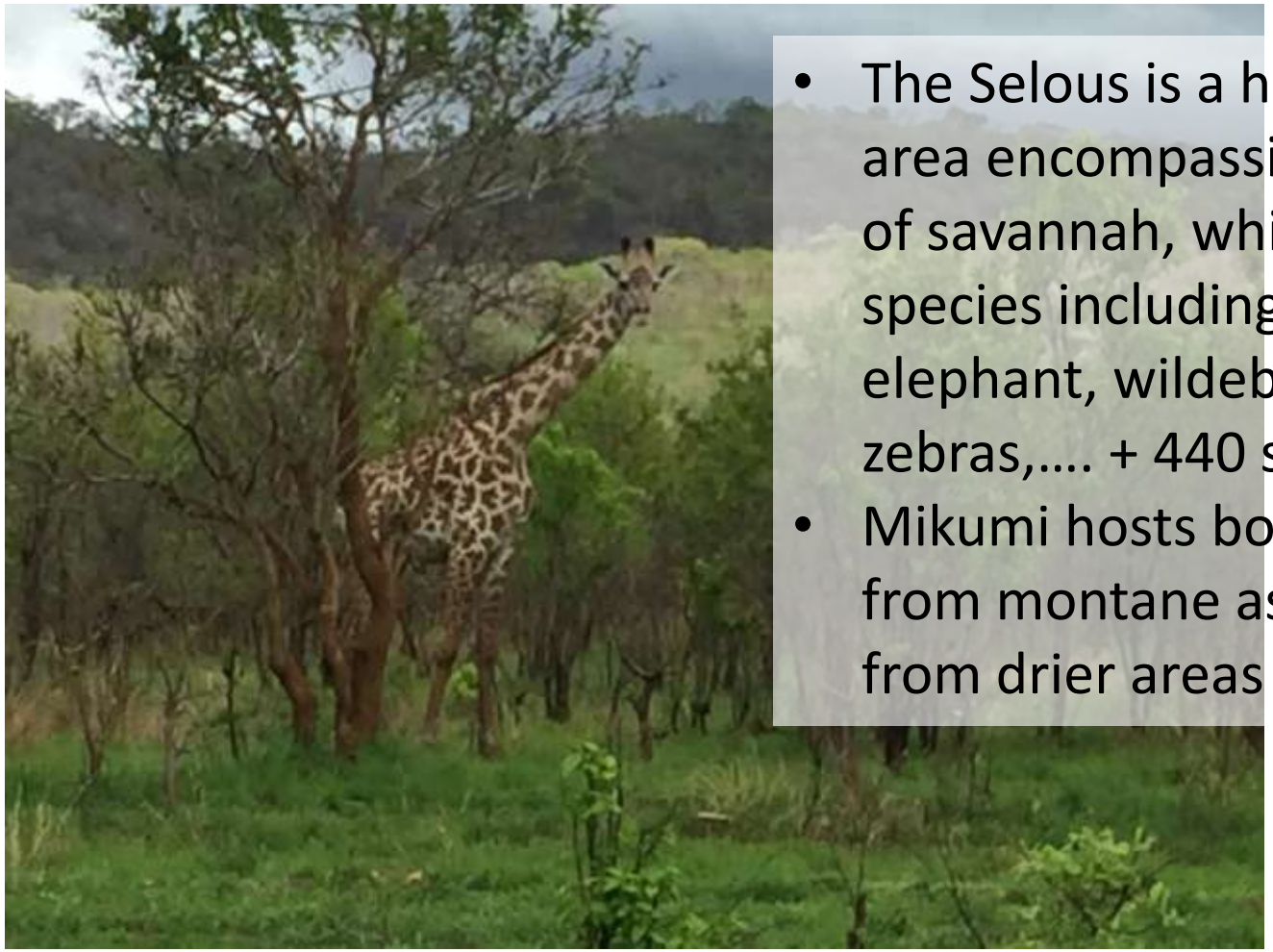
Ecological processes: a case study

Biodiversity: Magombera (Lowland) Forest Reserve

- A diverse forest remain the otherwise cleared landscape with a long disturbance history: 1990s/2000s
- Essential habitat (some grassland patches within) for several vertebrates including red colobus monkey, aardvarks, and hippopotamus
- But low abundance due to hunting with limited chance for re-colonisation from larger forests nearby due to isolation of forest

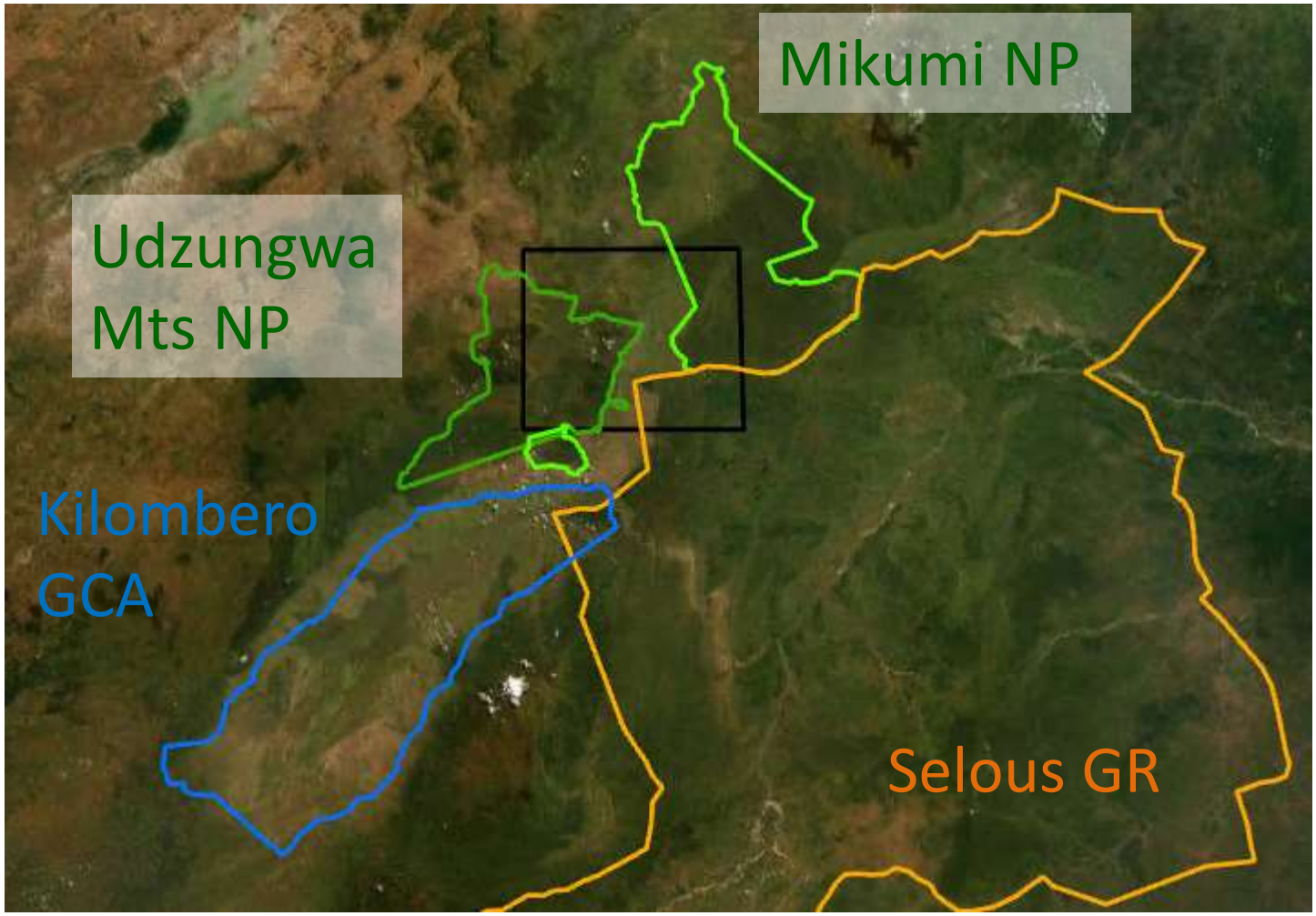
Ecological processes: a case study

Biodiversity: Selous and Mikumi savannah



- The Selous is a huge protected area encompassing vast tracts of savannah, which hosts iconic species including lion, elephant, wildebeests, zebras,…. + 440 species of birds
- Mikumi hosts both species from montane asreas as well as from drier areas

Ecological processes: a case study



Ecological processes: a case study

http://magombera.com/

https://www.youtube.com/watch?v=hd6sBWPe8jg

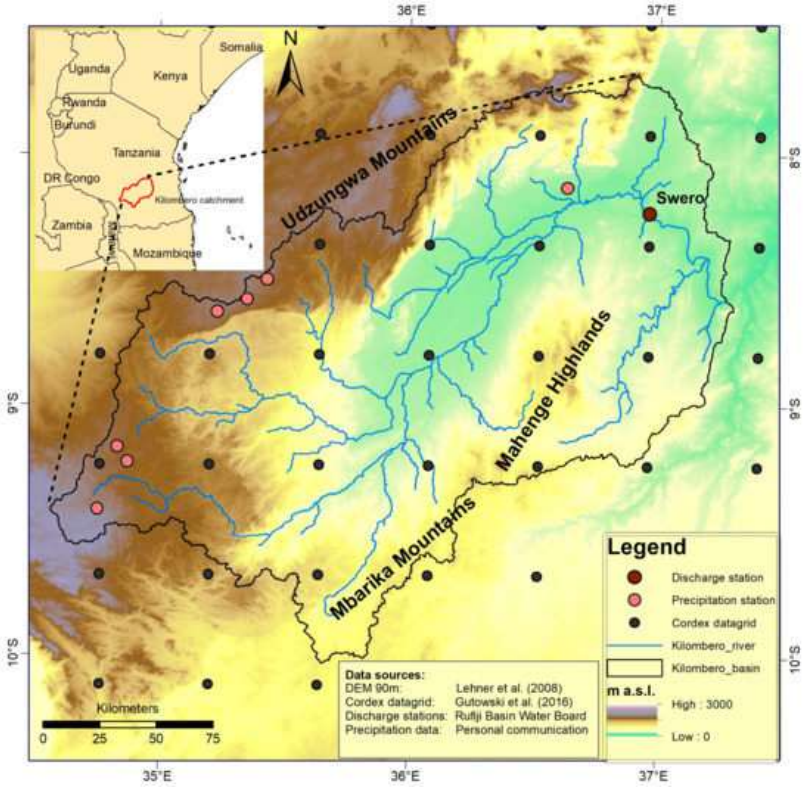
https://www.youtube.com/watch?v=6BvR77Av9yU

Ecological processes: a case study

Aboveground biomass ranging from 0 to 600 t / ha.

- UN-REDD+
- United Bank of Carbon
- The 2015 Paris Agreement on Climate Change: forest regeneration and restoration as key mitigation tool

Ecological processes: a case study



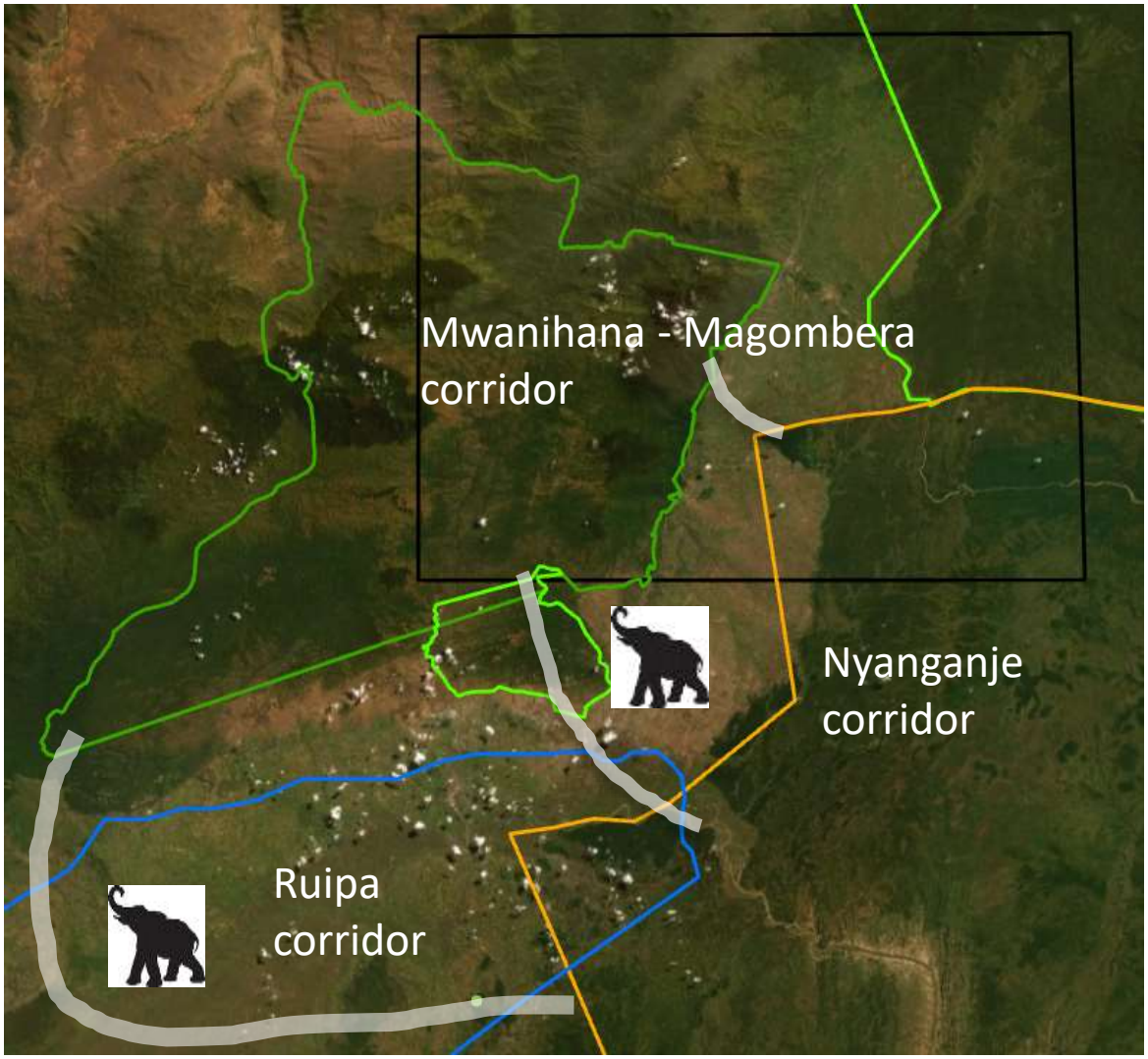
The Kilombero Catchment: water dependency of the wetlands and croplands in the valleys

Total water yield is primarily driven by the northern mountains and the southeastern highlands, which are characterized by steep slopes and a high share of forest and savanna vegetation.

The Kilombero Valley Floodplain is a Ramsar Site, Wetland of International Importance Designated in 2002

Naeschen et al. 2018 Water. https://www.mdpi.com/2073-4441/10/5/599/htm

Ecological processes: a case study

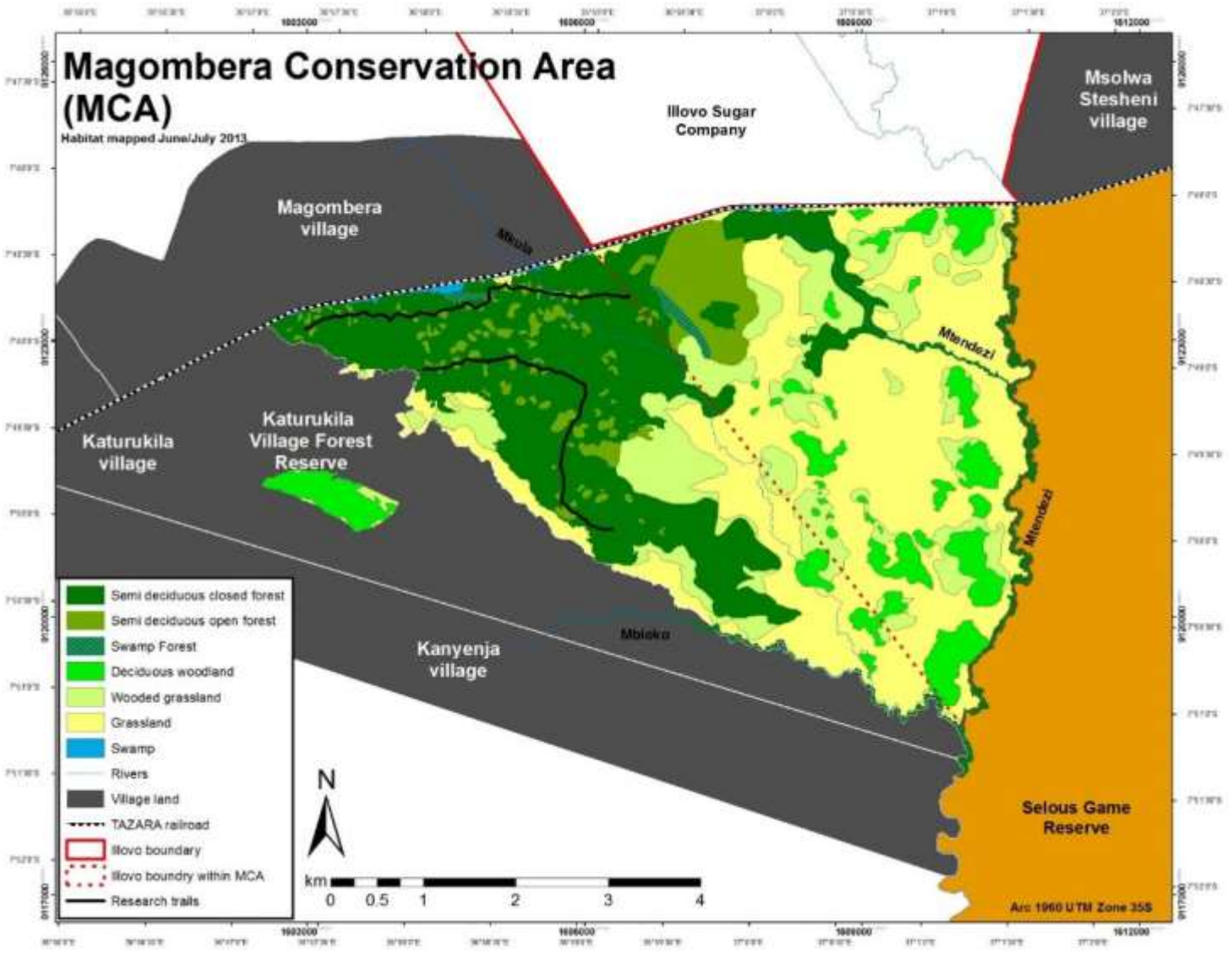


Wildlife corridors linking the Selous to the Udzungwa Forests:

Below two Routes proposed in 2007.

Jones et al. 2012 Tropical Conservation Science. https://doi.org/10.1177/194008291200500405

Ecological processes: a case study



Economic importance of the landscape

Ecosystem Services: the tangible ('goods') and intangible benefits provided by ecosystems that contribute to making human life both possible and worth living.

Examples include:

- Food, fibre, water: **provisioning services**
- Climate regulation, pollination, disease regulation, regulation of soil and water quality: **regulating services**
- Water cycling, primary production**: supporting services**
- Cultural heritage, aesthetic experience, recreation: cultural services (non-material benefits)

Rural communities in the valley

The fate of rural communities and the wetlands is intertwined:

Rural communities in the valley

The fate of rural communities and the wetlands is intertwined:

- Sugarcane, rice
- Fisheries
- Tourism
- Food
- Cattle
- Income

A valley under threat

Environmental degradation in the Kilombero Valley is caused by a range of factors:

- High population growth rate: increased farming & environmental pollution due to use of chemical pest control
- Influx of pastoralists attracted by high quality grazing areas and water supply: large herds of cattle, goats

1989 – 1998: livestock population increased from less than 18000 to more than 45000

A valley under threat

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- Industrial farming and associated management practices

They also use malaria control techniques, benefitting human wellbeing

A valley under threat

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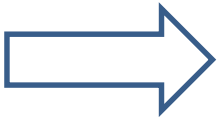
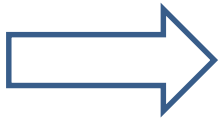


Overharvest of trees for timber, firewood, building
Water pollution and declines in fish stocks
Potential impacts on biodiversity through chemicals
Competition for land

Land use change in the valley

Increasing conversion of natural habitats to crop land

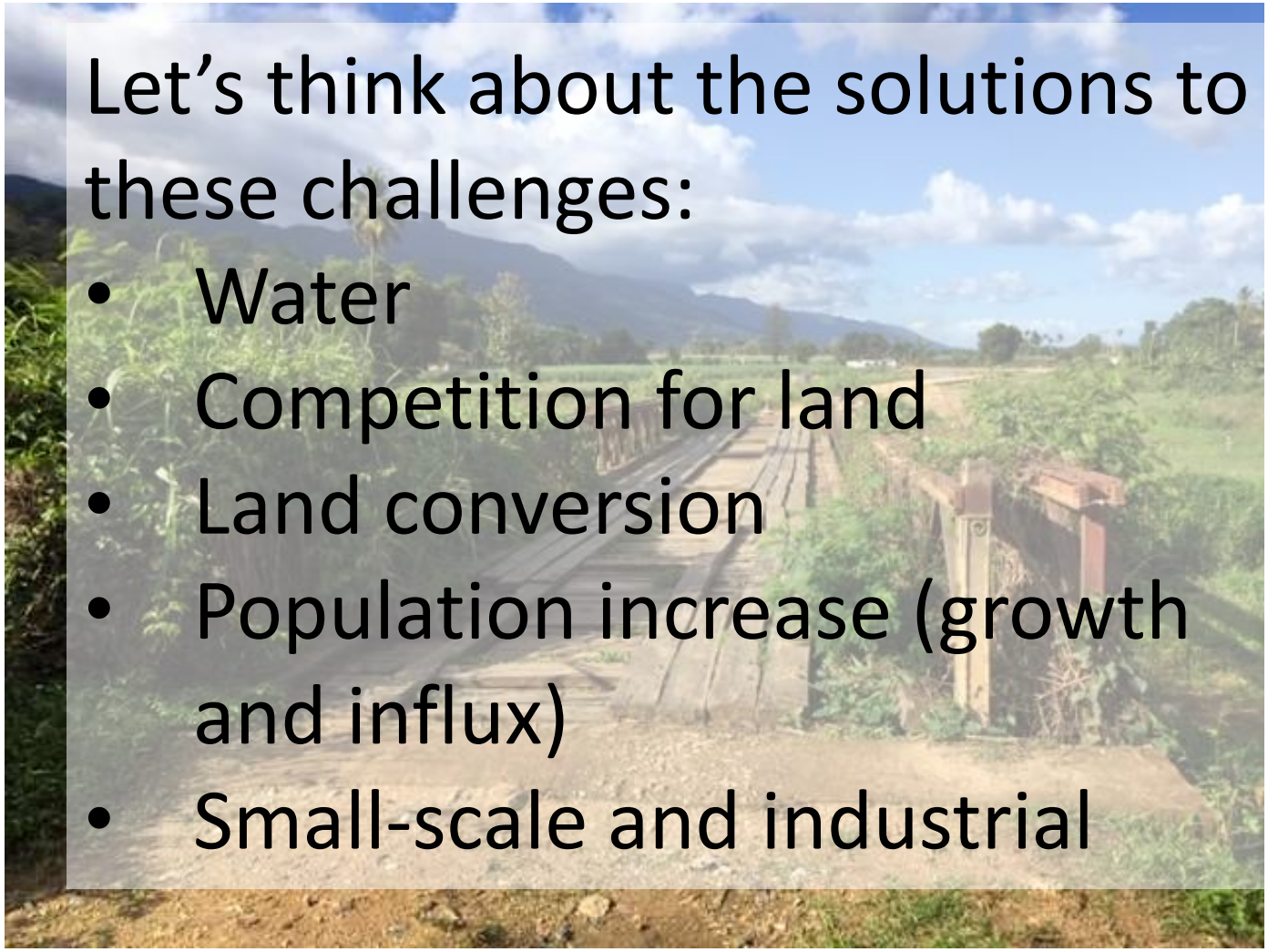


- Surface runoff contribution is increasing in almost the entire valley and in the eastern Udzungwa Mountains by up to 10 mm
- Groundwater contribution is decreasing by up to 20 mm within this area -> Decreasing water fluxes in subcatchments prone to anthropogenic activities in the fringe of the wetland

Models of water flows using SWATs. Input data include Digital Eleveation Model data, Soil data, Land use map, Rainfall station data, Discharge station data, Climate data

A valley under threat

A valley under threat



Let's think about the solutions to these challenges:

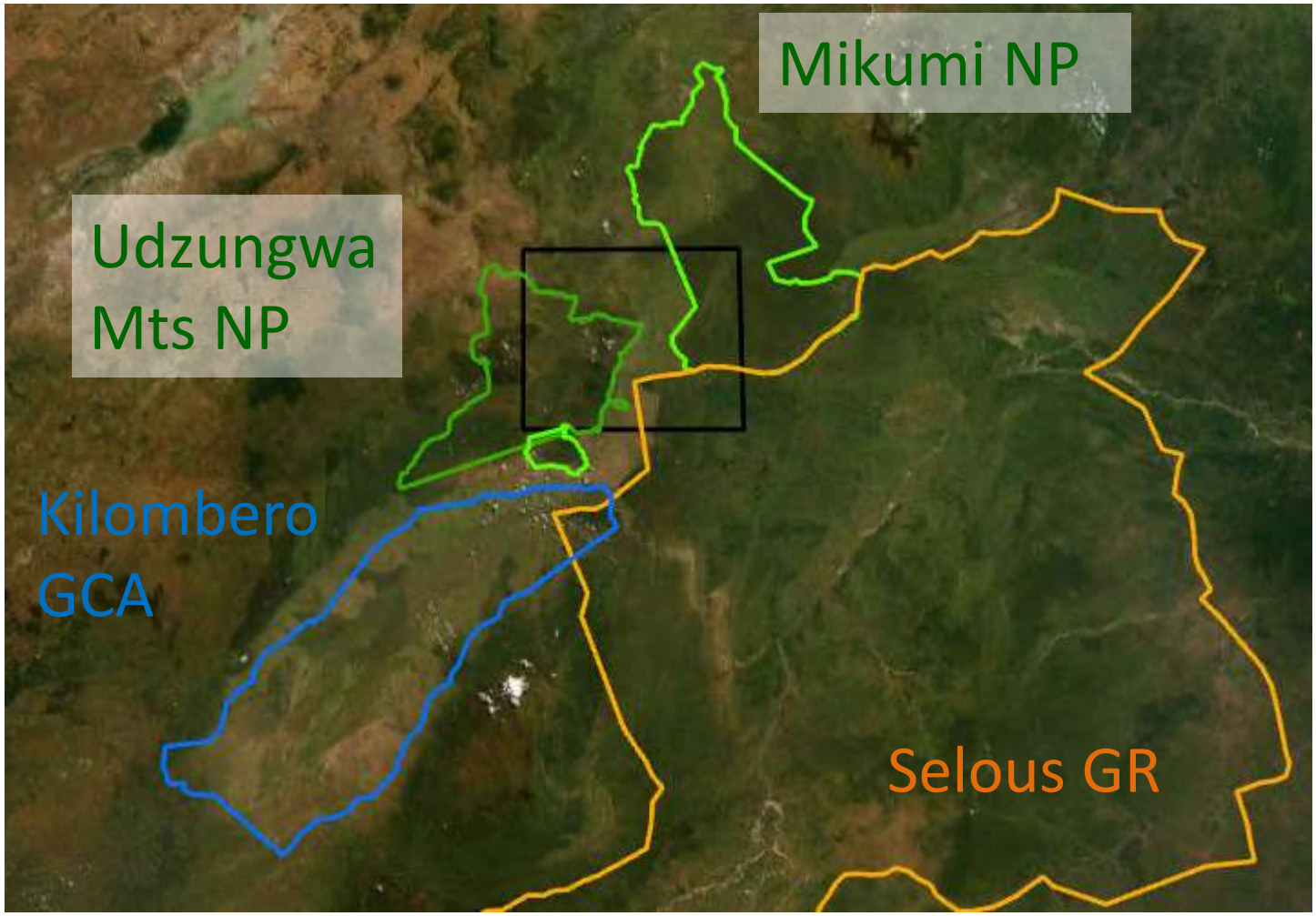
- Water
- Competition for land
- Land conversion
- Population increase (growth and influx)
- Small-scale and industrial

Conservation in the Kilombero Valley

Protected Areas

An in-situ conservation & management tool (the process of protecting an endangered plant or animal species in its natural habitat)

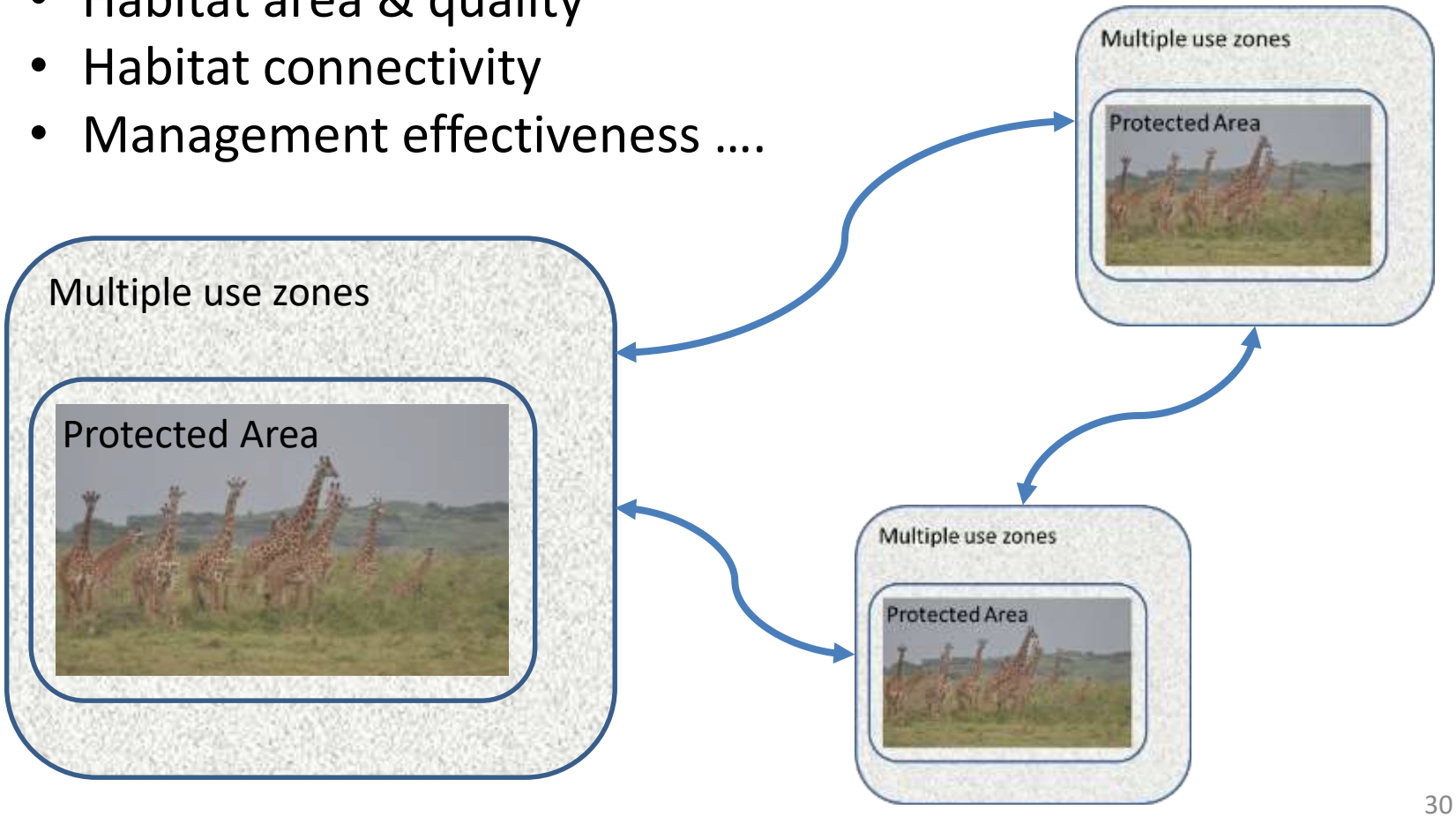
Ecological processes: a case study



Conservation in the Kilombero Valley

Protected Areas have their challenges

- Habitat area & quality
- Habitat connectivity
- Management effectiveness ….



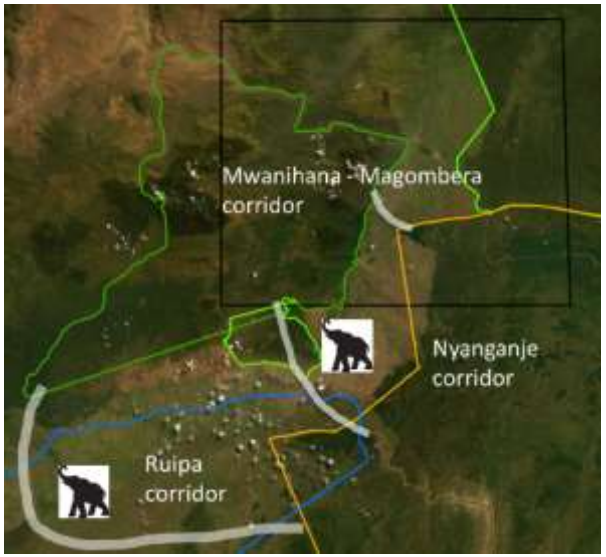
Conservation in the Kilombero Valley

Protected Areas

Laws And Rules

- Reduce illegal bushmeat hunting
- Control resource extraction from reserves
- Enforcement of land management plans & reduce number of livestock

Restoration



- Reopen closed conservation corridors
- Tree restoration programs
- Education programs

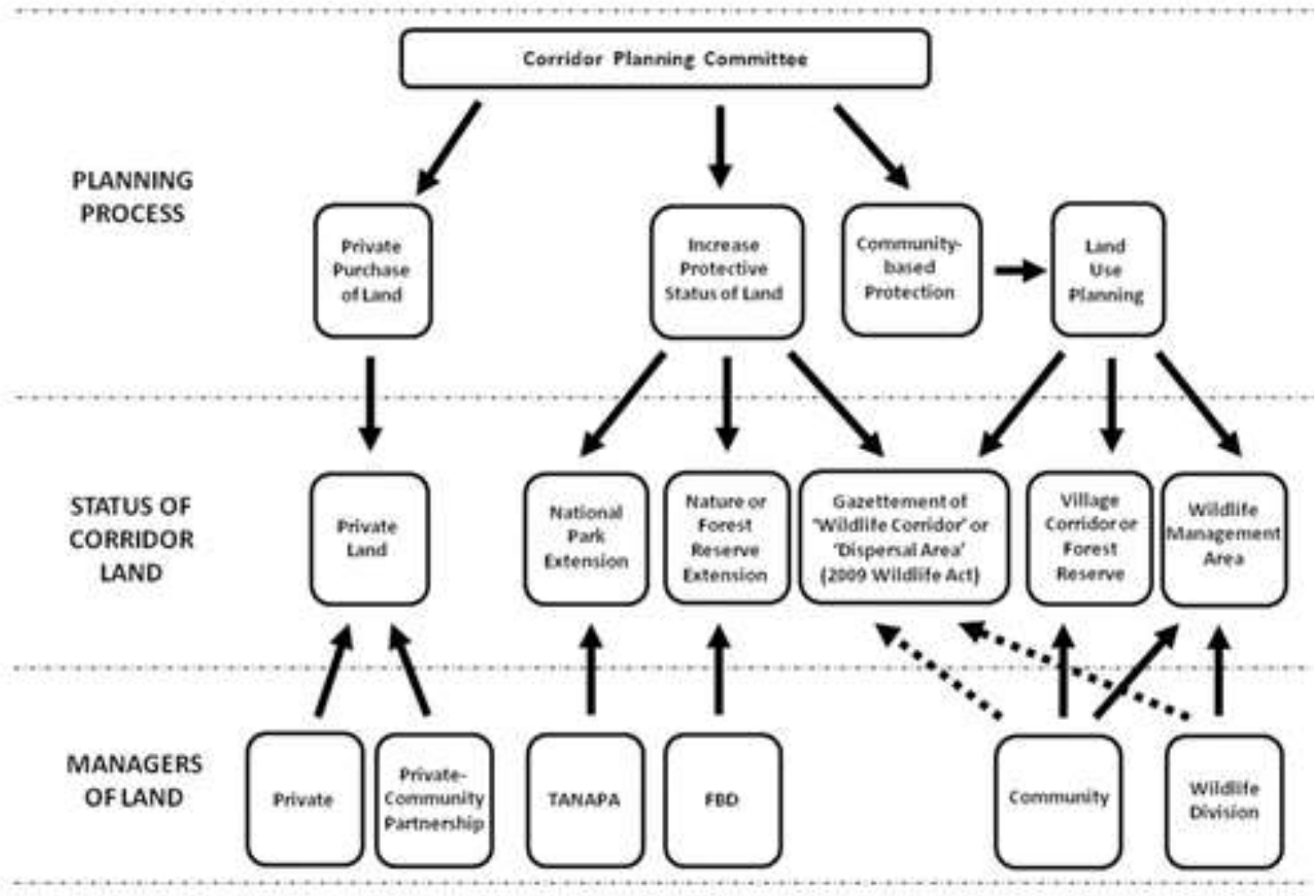
Conservation challenges

SUSTAIN (Sustainability and Inclusion Strategy for Growth Corridors), an IUCN-led initiative, aims to shape the investment and design of these (agricultural growth) corridors so that they are environmentally and socially sustainable.

Community-led land use and management

Payment for ecosystem services. REDD+

Conservation Challenges



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Questions?

You can also post questions on Blackboard.