(Wildlife Corridor) Restoration

What evidence is required for restoration interventions in human-inhabited landscapes, and how do we include these in the restoration management process?

Global restoration opportunities and priorities

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RESEARCH ARTICLE | APPLIED ECOLOGY

Global restoration opportunities in tropical rainforest landscapes

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Global priority areas for ecosystem restoration

Bernardo B. N. Strassburg ✉, Alvaro Iribarrem, [...]Piero Visconti

Nature **586**, 724–729 (2020) | Cite this article

26k Accesses | **46** Citations | **1852** Altmetric | Metrics

Global restoration opportunities and priorities

Beyond spatial optimization maps: Incorporating justice and democracy in forest and landscape restoration

Ecosystem restoration priorities must be informed by people on the margins

<u>This project's overall aim:</u>

We want to use tools and data from natural and social sciences to document the realities of planning and implementing tree restoration on the ground.

The objectives are to

1. Highlight critical data and **knowledge needs** to inform restoration planning, research and interventions on the ground
2. **Evaluate opportunities and barriers** for restoration (wildlife and carbon benefits versus human wildlife conflicts)
3. **Co-create restoration plans** with partners in communities, government, conservation and industry
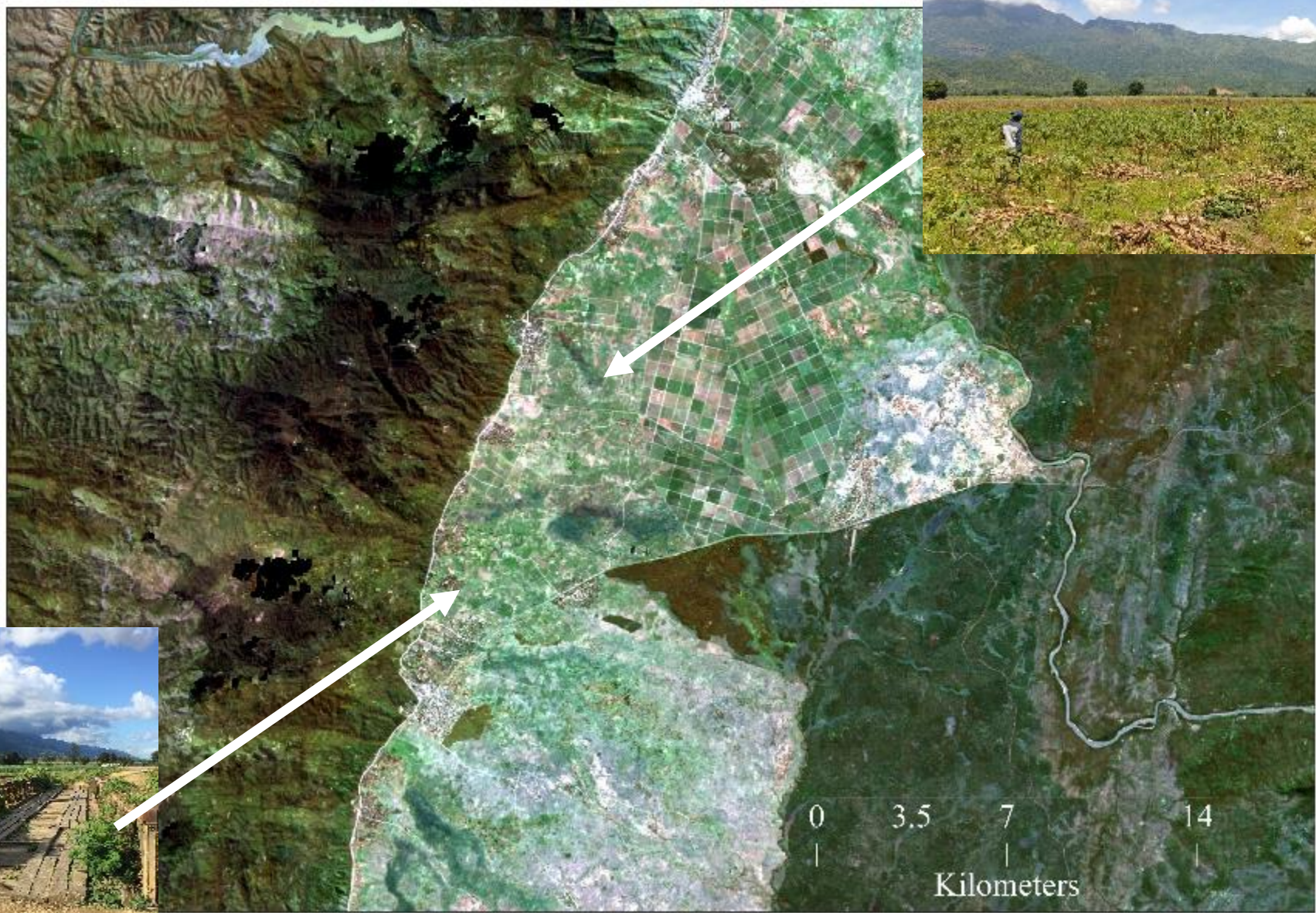
Coupled human and natural systems

One System
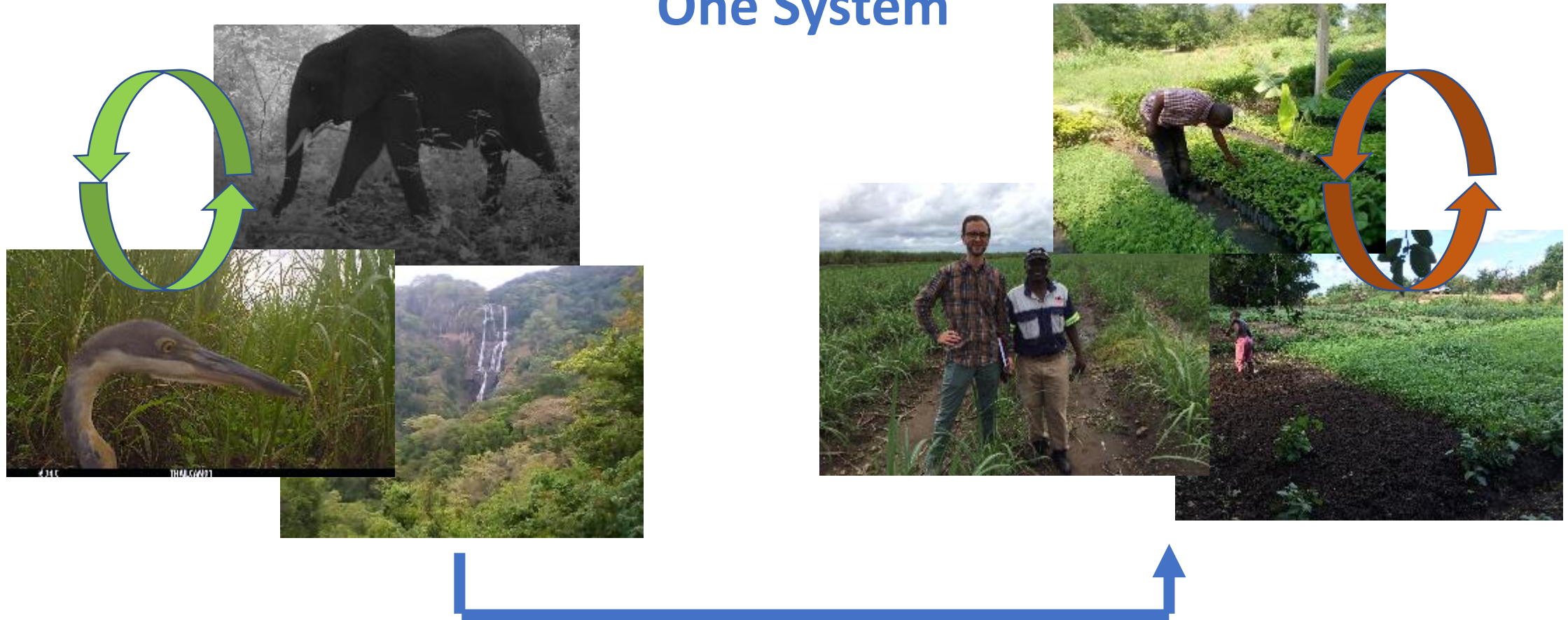
The landscape targeted for restoration on the ground

Correstor timeline: April 2021 – December 2022

15/06/2021	**Introduction – Team, online**
20/07/2021	**Brainstorming workshop**, online
01/02/2022 – 03/02/2022	**Model consolidation workshop. Morogoro – Tanzania:** Discuss data, existing restoration plans and priorities of different stakeholders, models
Suggest 09/2022	**Policy communication / Conservation planning workshop**

1. What processes do we need to consider to predict and manage ecological and wellbeing outcomes from restoring wildlife corridors.

a) different restoration interventions planned

b) Biodiversity and wellbeing outcomes: data, models, maps

Needs

- Identify their spatial layout in landscape, their connectivity objectives, targets and plans for monitoring against targets

- Identify restoration priority projects in landscape
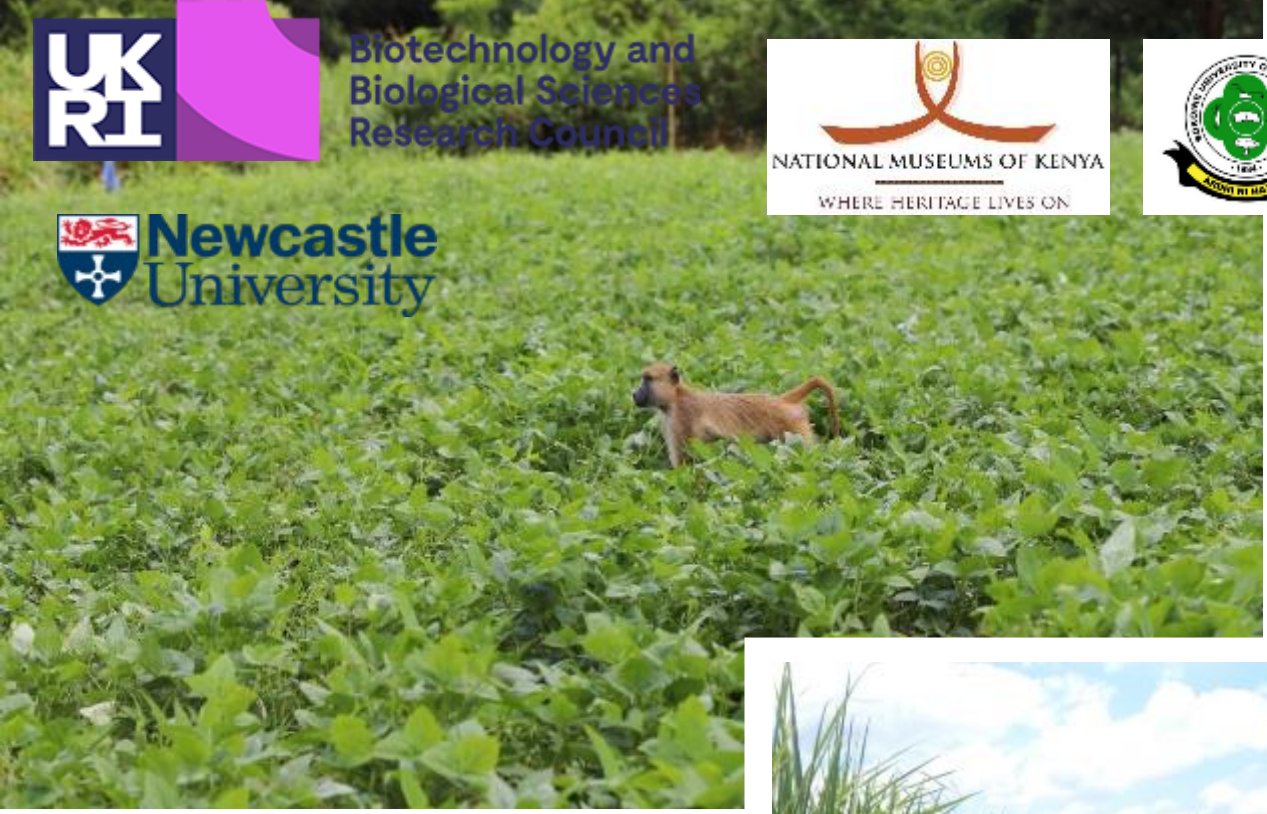
What to plant, when and where – Restoring tropical landscapes for biodiversity and human wellbeing

Assoc Prof Sallu
Sustainability Research Institute
University of Leeds

Dr Esther Kioko
Head of Entomology
National Museums Kenya

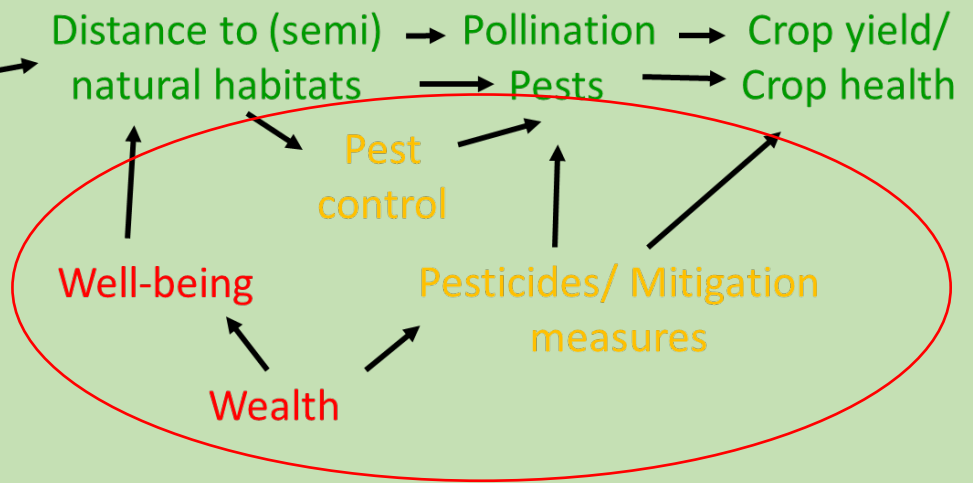**Dr Deo Shirima**
Sokoine University of
Agriculture, Tanzania

Assoc Prof Andy Marshall
USC and University of York

Scenarios — Spatially explicit modelling of removal of trees / restoration of trees

Interventions
- Tree planting
- Wildlife corridors
- Agricultural expansion

Distance to (semi) natural habitats → Pollination → Crop yield/Crop health

→ Pests →

Pest control

Well-being

Pesticides/ Mitigation measures

Wealth

Knowledge exchange workshops, Interviews, Household surveys

UKRI

Biotechnology and Biological Sciences Research Council

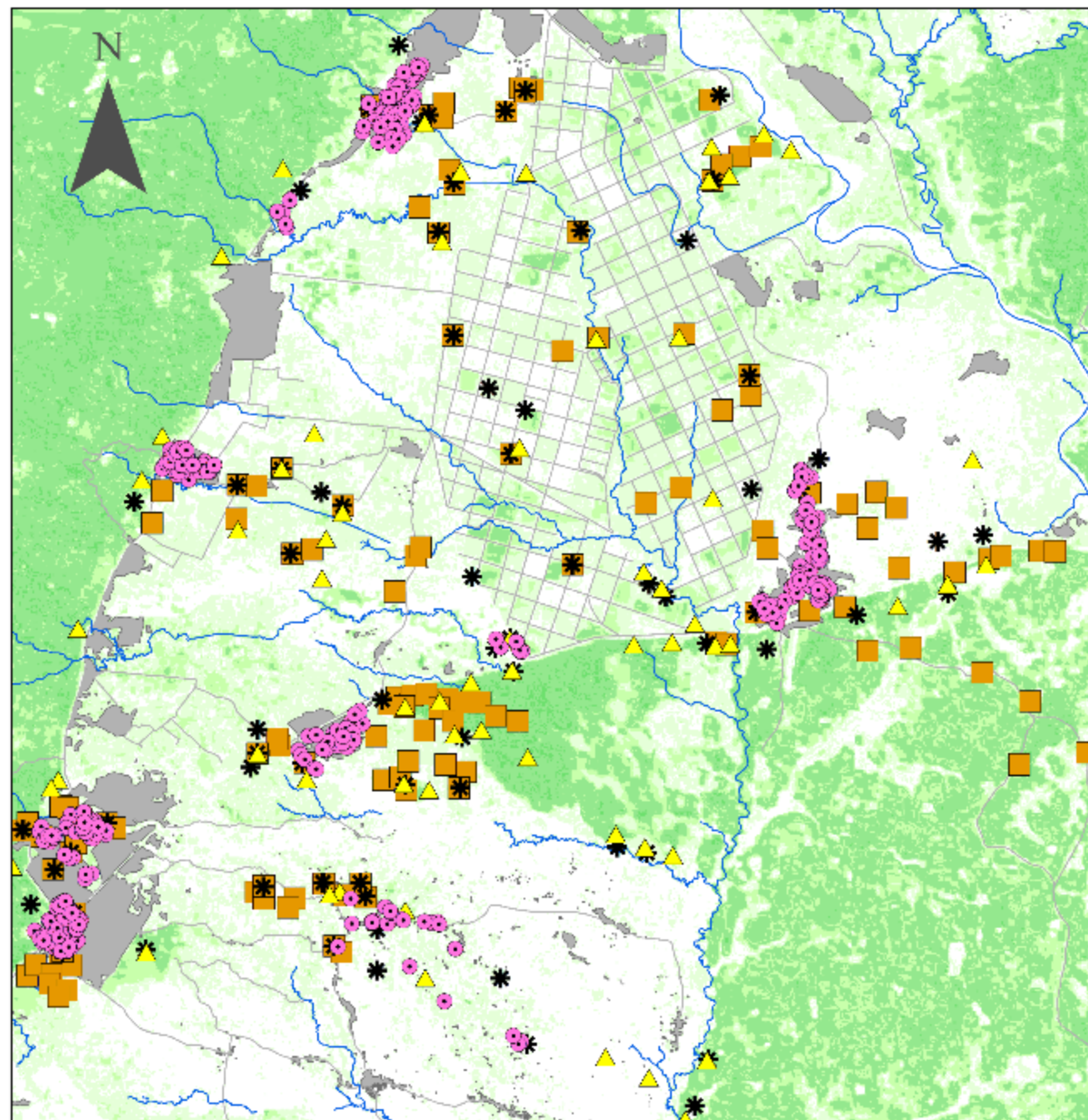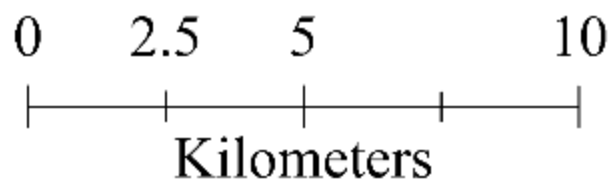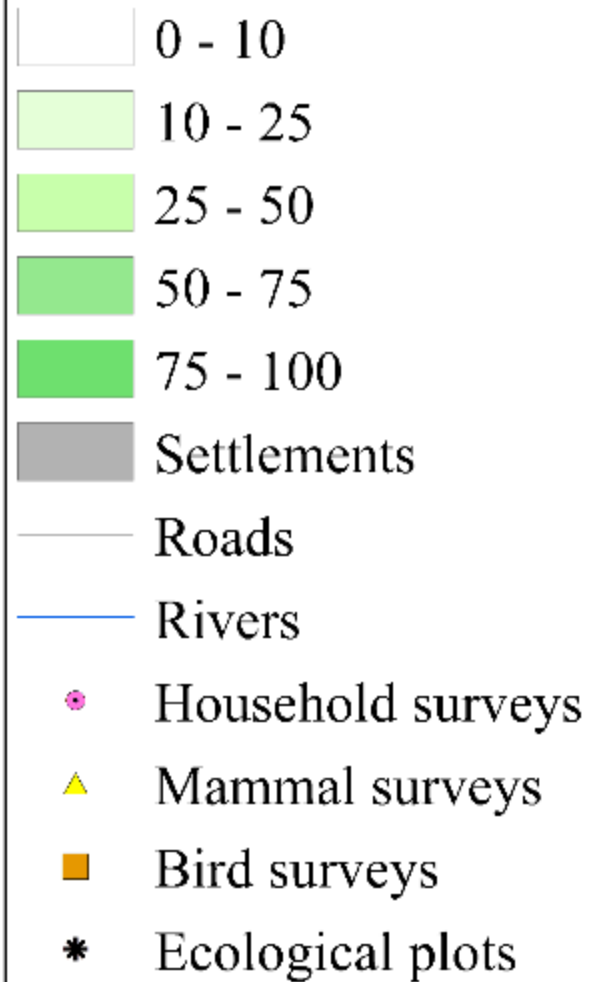1. Highlight critical data and knowledge needs to inform restoration planning, research and interventions on the ground

2019 - 2022

Agronomic potential of natural capital:

- Soil & Insects
- Mammals & Birds
- Crops
- Trees
- People

Tree canopy closure (%)

- 0 - 10
- 10 - 25
- 25 - 50
- 50 - 75
- 75 - 100
- Settlements
- Roads
- Rivers
- ● Household surveys
- ▲ Mammal surveys
- ■ Bird surveys
- ✻ Ecological plots

N

0   2.5   5   10
Kilometers

Agrisys Tanzania

Our landscape provides a diverse mosaic of habitat patches, in particular on land farmed by small-holders.

Trees and tree patches can be found scattered throughout small-holder land, potentially allowing movements of wildlife.

Temperatures of leaves and ground in our study landscape can easily exceed 35 and may at times exceed 50 degrees Celsius. Crops so far are coping.

We recorded 34 mammal species overall, with 6 listed by IUCN as Threatened. We found 148 bird species overall, with 2 listed as Threatened.

Soil Organic Carbon was similar for soils in cropland, forests and grassland. Other soil nutrients still need analysing.

Most mammals, in particular threatened ones, are found in forest and grassland. ~ 50 % of species detected in forests are also detected on cropland. Carnivores use croplands, potentially acting as pest controls.

Croplands, i.e. small-holder farms and tree cover patches, support a higher number of bird species and in particular plant and seed eating birds but also threatened birds. This is compared to forests, in particular.

Insect data coming soon.

We identified some key pests and have started to look for nature based solutions (affordable) -> Leaflets

Crop raiding risks are high in small holder farms close to tree cover habitats, in particular near Magombera Forest Reserve and along the border of the Selous

Landscape configuration -> tree canopy closure -> microclimate -> plant stress

Tree canopies provide shade and prevent heat stress in plants. Important during sunny days

The literature suggests that heat and water stress more strongly reduce yield of many crops, including corn, when acting together. So trees are likely to even more beneficial during drier time periods.

We found no evidence for shade by trees reducing plant productivity for okra, sugarcane, and corn. But low number of data.

- Trained and employed research assistant for data collection
- Built relationships with farmers, industry and agricultural extension officers
- Employed Tanzanian experts
- Produced a set of leaflets for farmers
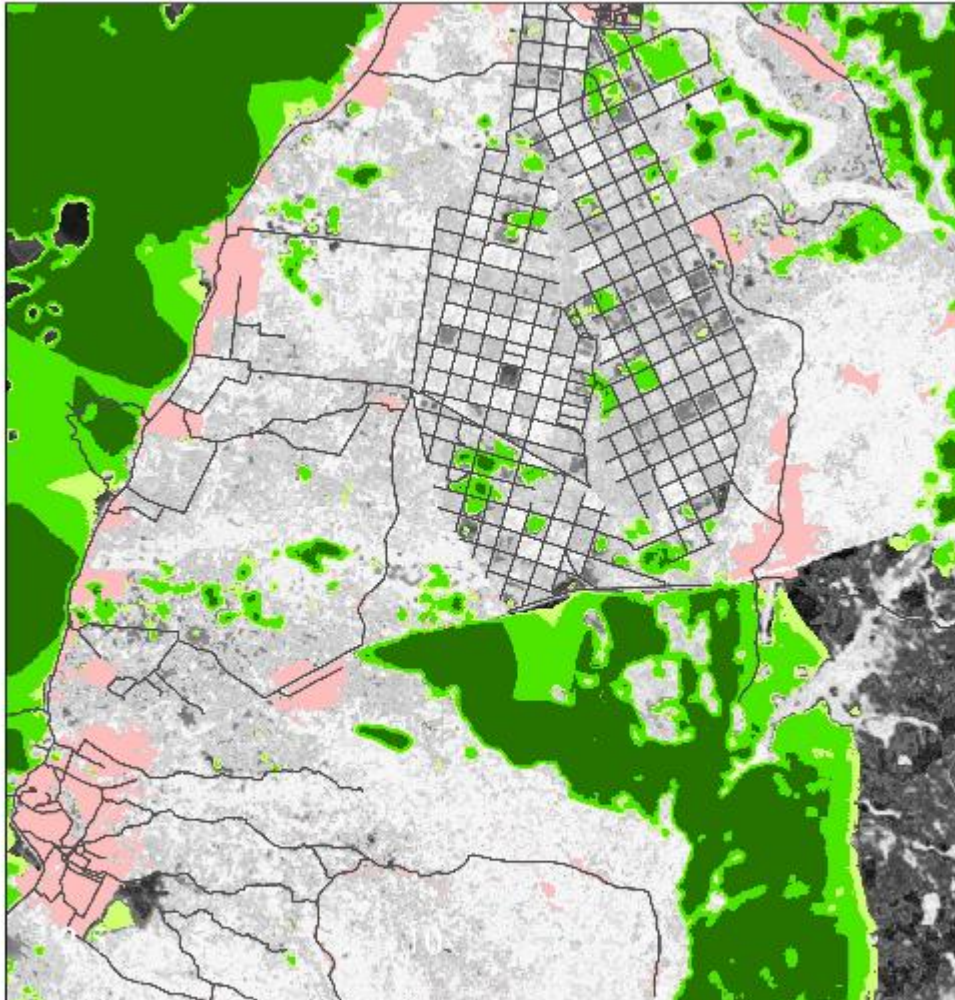
MSc student project

okra leaves @JosephMagwira

Joseph Magwira. MSc student Sokoine University of Agriculture.
Effect of Insect Pollination On Okra Yield, Quality and Growth Along Habitat gradients at Kilombero District, Tanzania.
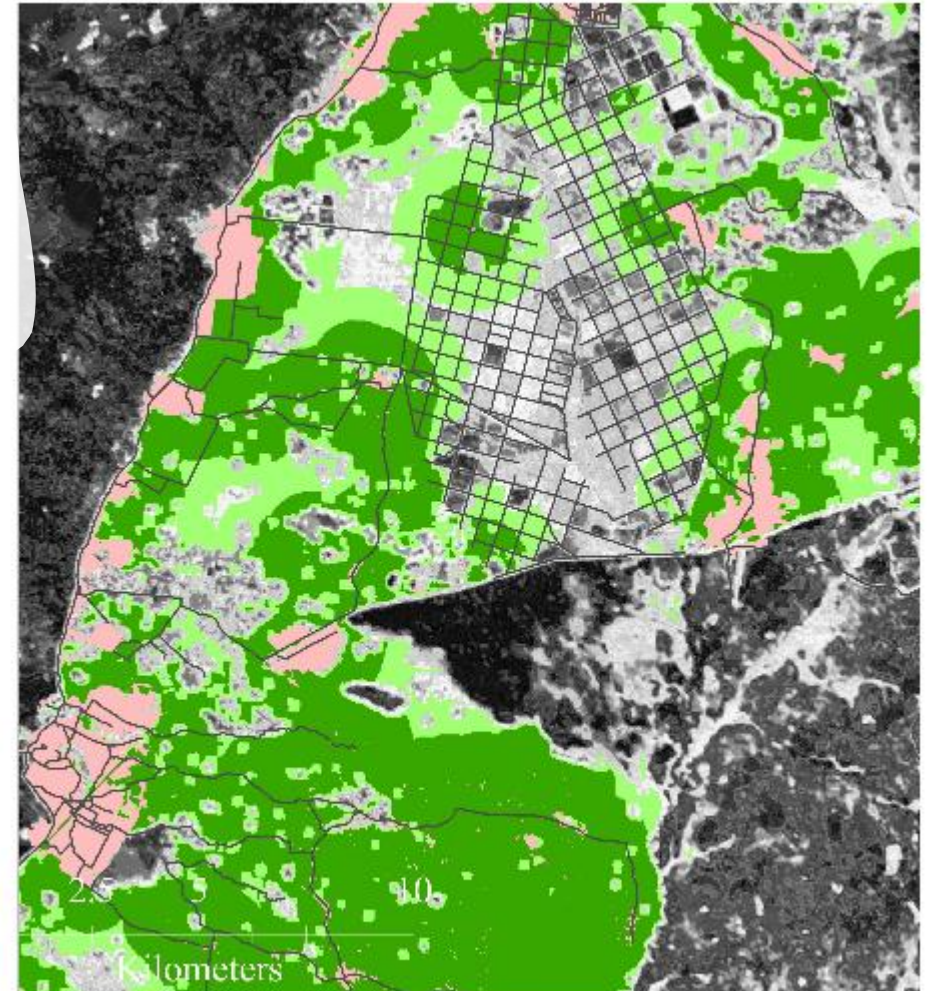
Pathway modelled using linear discriminant analyses. Predictively mapped using covariate raster.

$P > 0.5$
in green

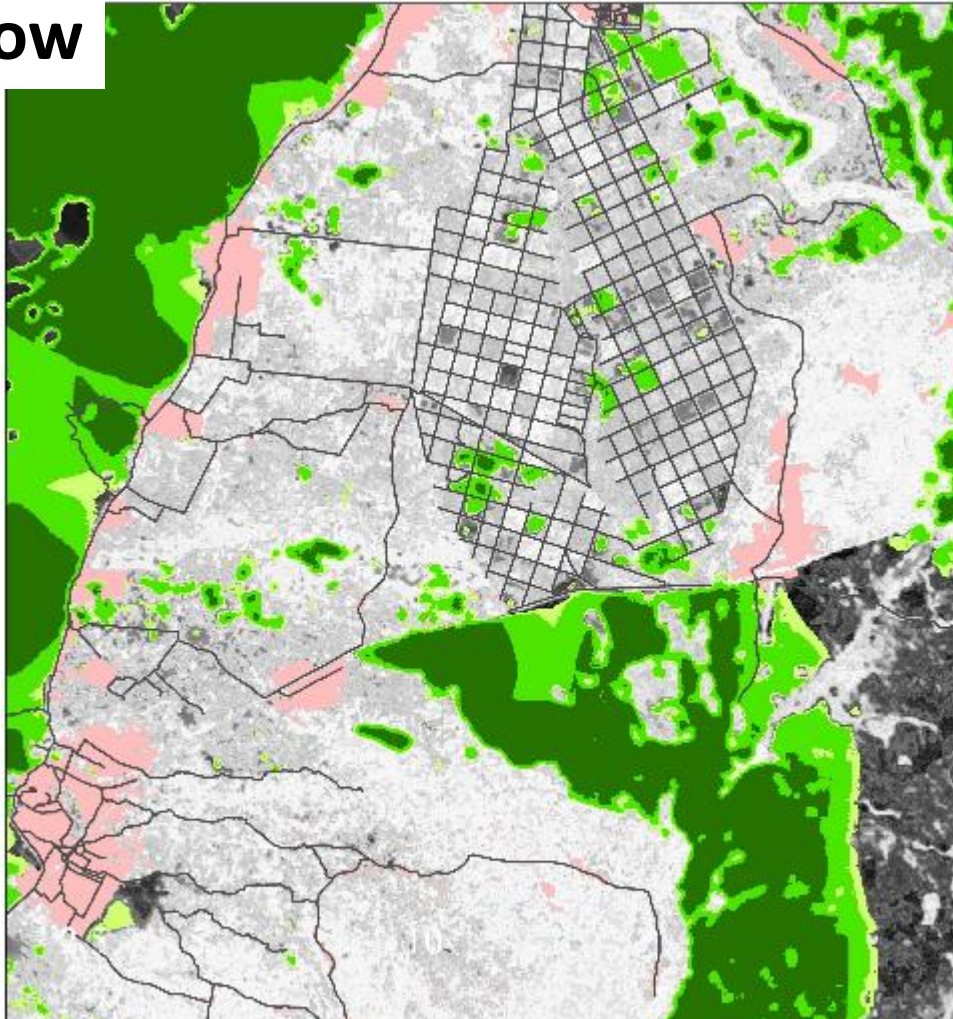Probability of presence of threatened mammal species

Probability of high number of plant and seed eating bird species at given pixel

Predictively map outcomes for restoration scenarios

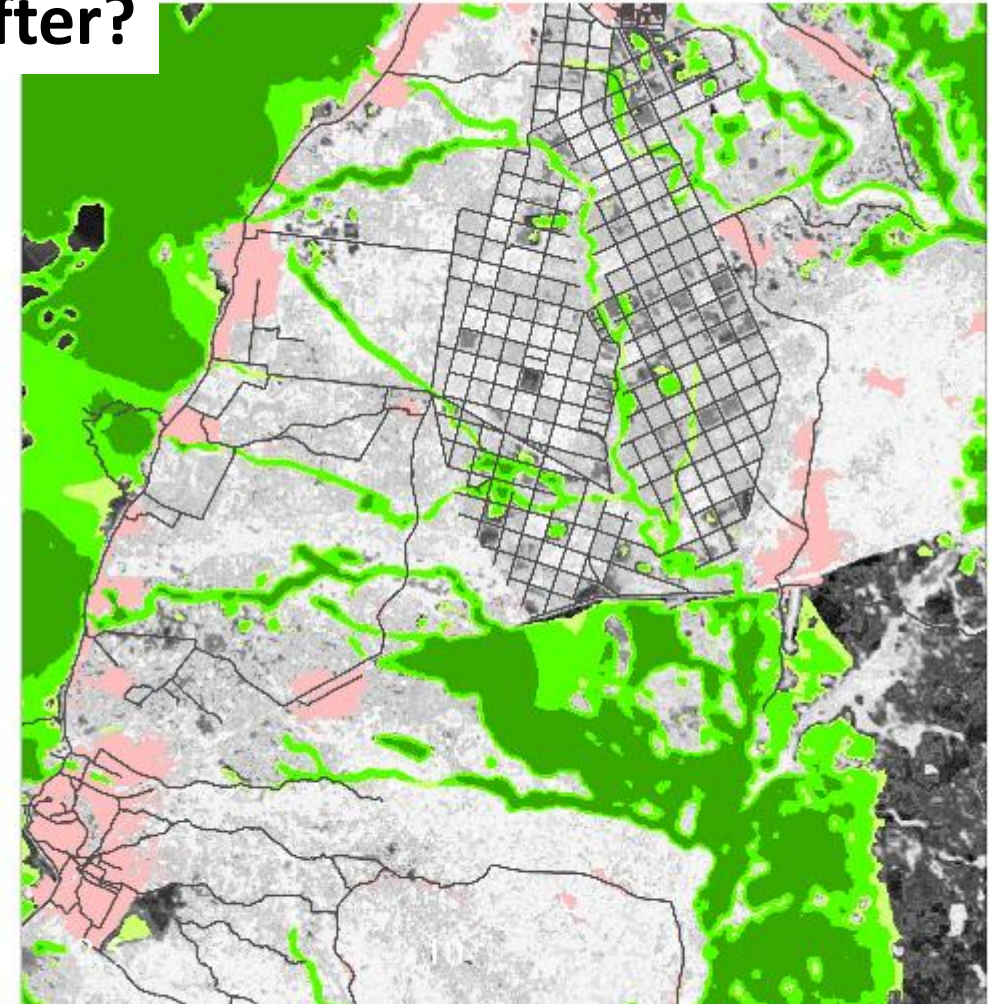Predictively mapped using covariate raster adapted for the restoration scenario.

Now

After?

$P > 0.5$
in green

Probability of presence of threatened mammal species: now

Probability of presence of threatened mammal species: predicted for after

- Eleanor Moore: household surveys & workshop transcript -> crop growth plans
- Lauren Barnes with STEP -> Predictive models and maps for conflict; tolerance & mitigation techniques
- Margherita : Opportunity costs, marginal land and land rights: elephants
- Will/Ben : sugarcane, aphids, and neem trees -> Work with KSC
- Lauren & Chess: policy document analysis. Across different sectors

Workshops with farmers in 2021: Small-holder envisioning of desirable future(s) of farms and surrounding landscape
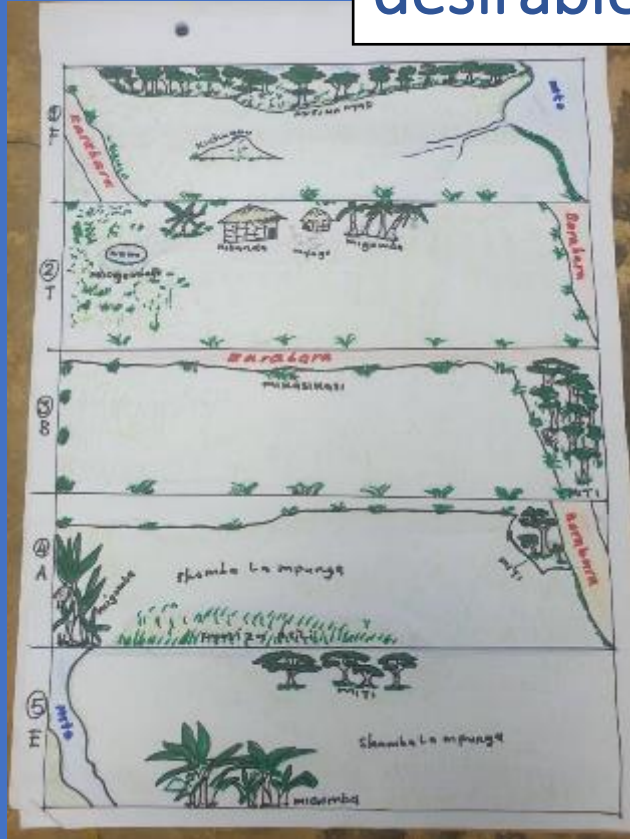
Comparison to present using opportunities, barriers and limits to the desirable farm and surroundings.

Workshops with regional government envisioning desirable future(s) of the landscapes and farms within

Integrating tree planting into agricultural practice and forest conservation to enhance human well-being

30th September and 1st October 2021

Tanzanian Training Centre for International Health (TTCIH), Ifakara

Explore key future threats under alternative land use change scenarios

1. Who are the stakeholders in the restoration process: design, discussion, management

a) IUCN, Reforest Africa, National Park, TFCG: Restoration plans and visions

- Discuss – based on AgrisysTanzania evidence –outcomes for biodiversity and wellbeing

- Discuss positive and negative values of trees/tree species in landscape

- Navigation and mitigation of services and disservices: alternative livelihoods? Carbon incentives and their implementation? Ecotourism?

1. Explore the restoration activities planned in the Kilombero Valley, their alignment in space and time with ongoing wildlife corridor restoration
2. Explore the implications of restoration activities for biodiversity and wellbeing.
3. Compile evidence needs from decision-makers/government -> draft policy brief

- Monitoring ecological health -> importance of trees?
- Sugarcane harvest/air quality during harvest -> importance of management
- Water harvest by industry -> importance of water quality

KSC expansion plans

New roads

Reforest Africa

Trevor mentioned another group

Land use change

Restoration plans

more sugarcane area

More forest area: linear structures? Forest reserves? Where?

Changes in elephant movements through landscape

Changes other wildlife movements: pests, pest controls, pollinators, threatened species?

More crop damage? Where?

Changes in probabilities of corridor use by elephants?

What do people need? Agrisys Tanzania outcomes from household surveys and workshops and future farms and ideal farms and tree planting constraints

What data/outcomes from above are relevant for them in making decisions? Knowledge exchange workshops using predictive maps of likely outcomes from above?

Alternative livelihoods, income generation potential, carbon incentives, fund raisers? Knowledge exchange workshops

context

Sustainable Development Goals are complex interrelated challenges. Nature based solutions could be sustainable solutions to food security, climate change and biodiversity.
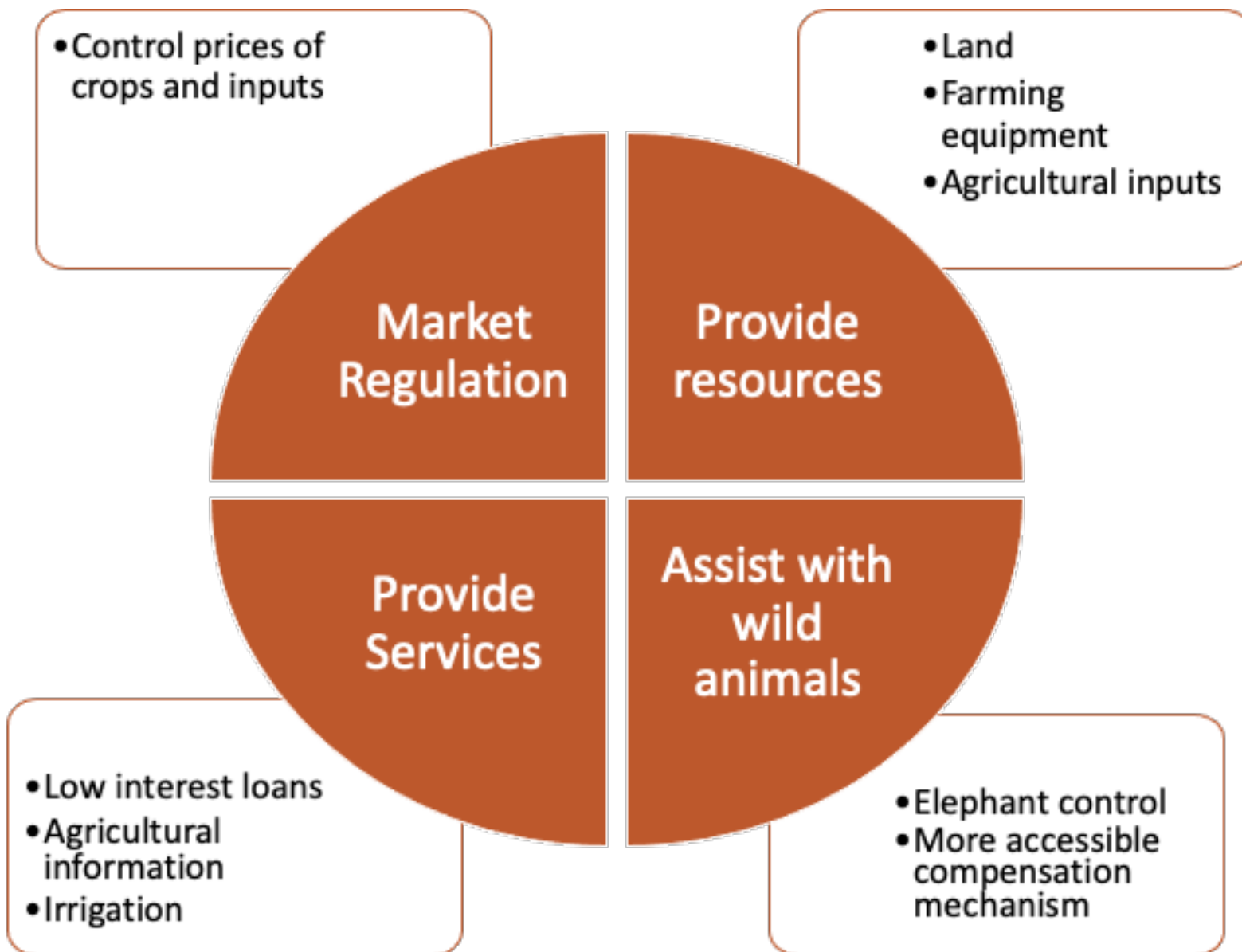
Asante sana for contributing your expertise

Karibuni to this workshop

Control prices of crops and inputs

Land
Farming equipment
Agricultural inputs

Market Regulation

Provide resources

Provide Services

Assist with wild animals

Low interest loans
Agricultural information
Irrigation

Elephant control
More accessible compensation mechanism

Agrisys Tanzania

Previously discussed: Opportunities for tree planting as proposed by farmers

- Consensus finding approach to (corridor) restoration planning. Involvement of DC, TAWA, District level planning. Land purchased. Currently progress has been halted due to personnel changes
- Joseph highlighted that villages and their approach to restoration/land management will differ depending on environmental context: close/way from river.
- Susie highlighted the need to get agricultural specialist / economist involved to inform project and restoration process on landscape scale perspective from economic viewpoint and she also emphasized the need to predict conflicts in landscape that may arise, such as crop damage conflict/people - wildlife conflicts.
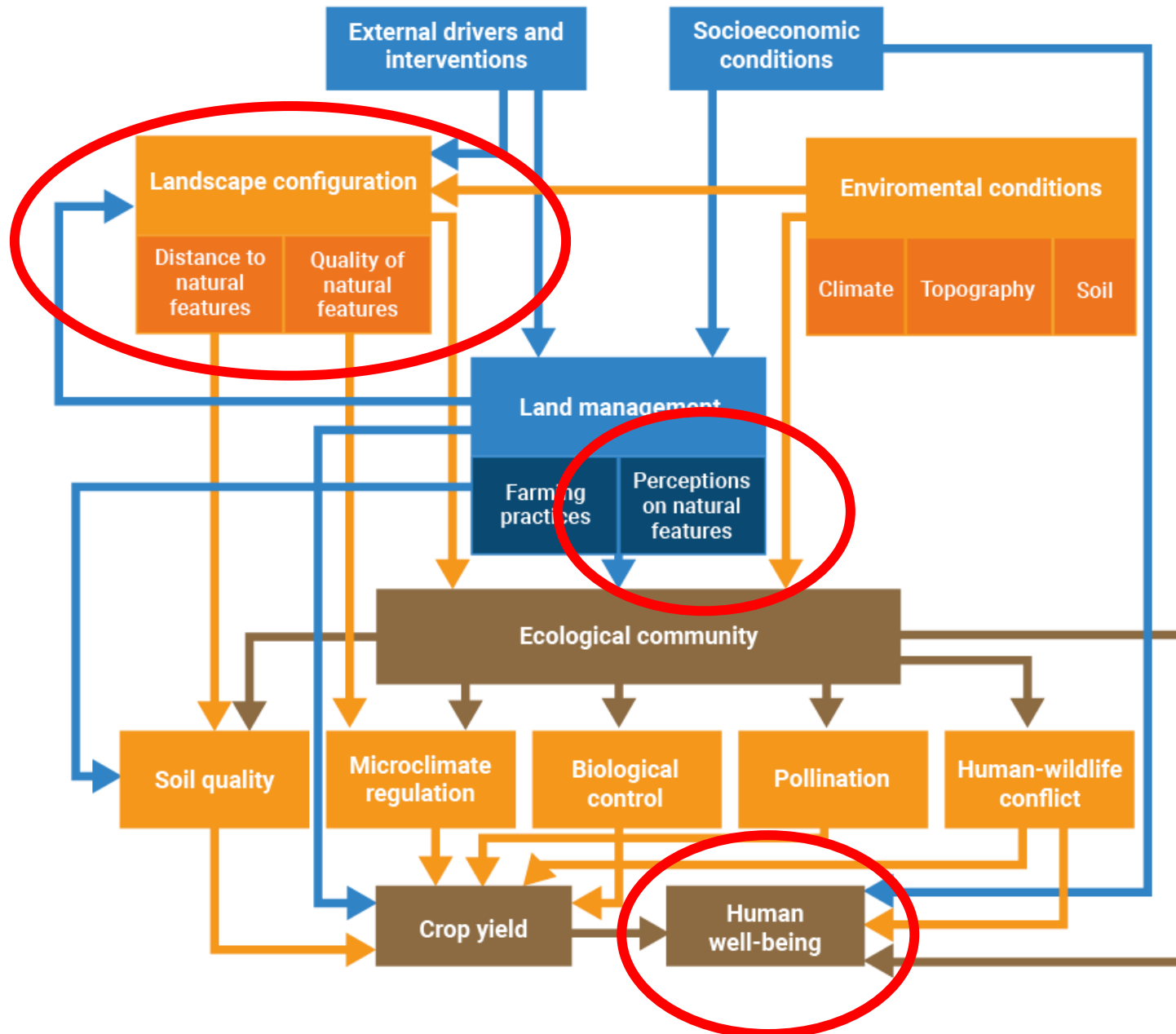
Upscale and test for Commonalities and differences between systems

transfer the approach to crop production landscapes elsewhere, identifying key data required to parameterise the modelled pathways and analysing and interpreting their response to restoration scenarios with stakeholders

Identifying solutions: integrating human wellbeing and ecological wellbeing into the restoration design – a systems approach

Why – should we restore?

- Ecological Benefits
- Wellbeing benefits
- Climate change

Who – do we need to restore for?

- Wildlife
- People
- The earth?

How – can we restore?

- What, when, where
- Trade-offs
- Mitigation

37 C

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