# UNDERSTANDING PAST AND PRESENT MOUNTAIN BIODIVERSITY TO NAVIGATE THE FUTURE

Rob Marchant

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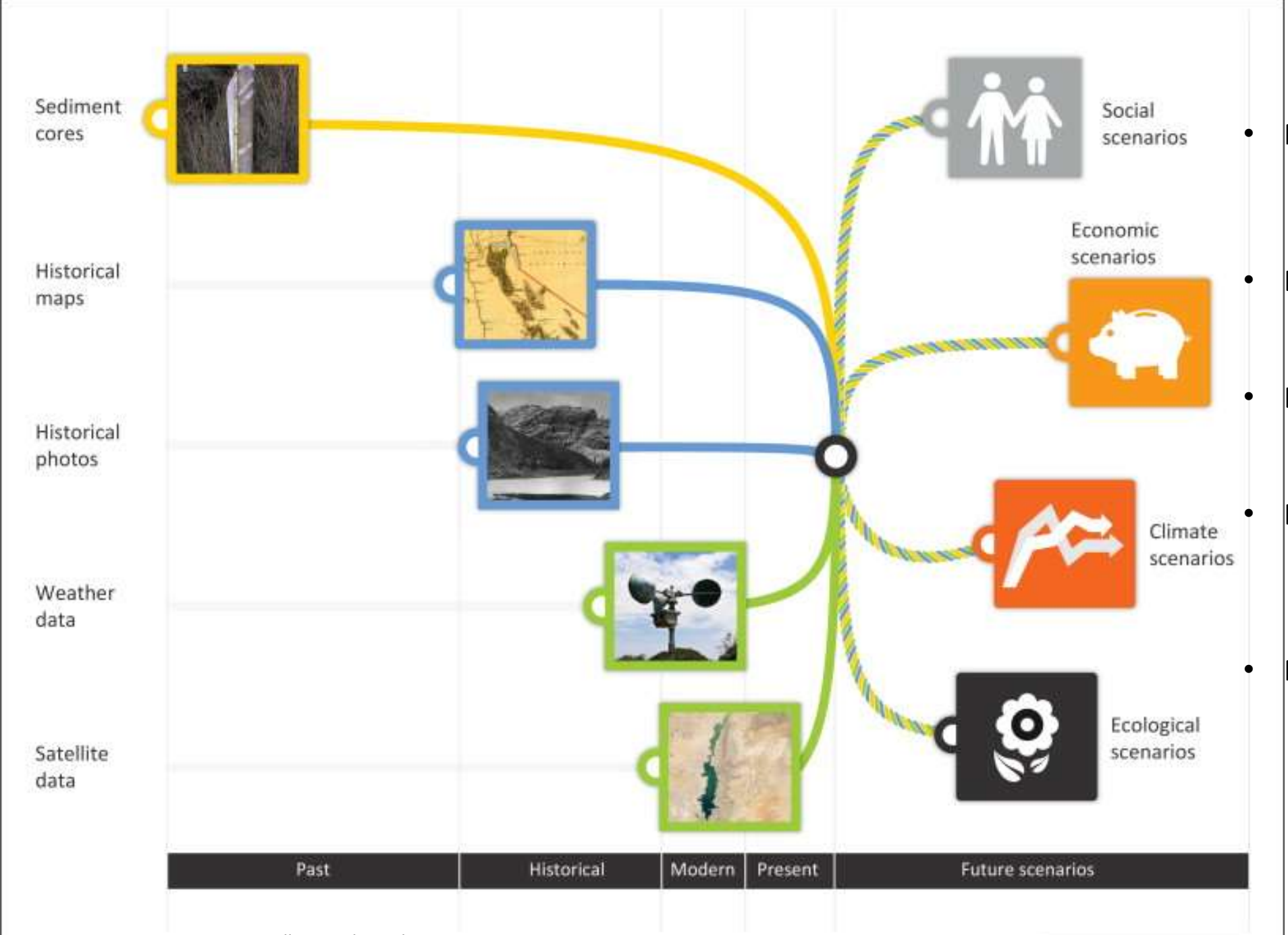
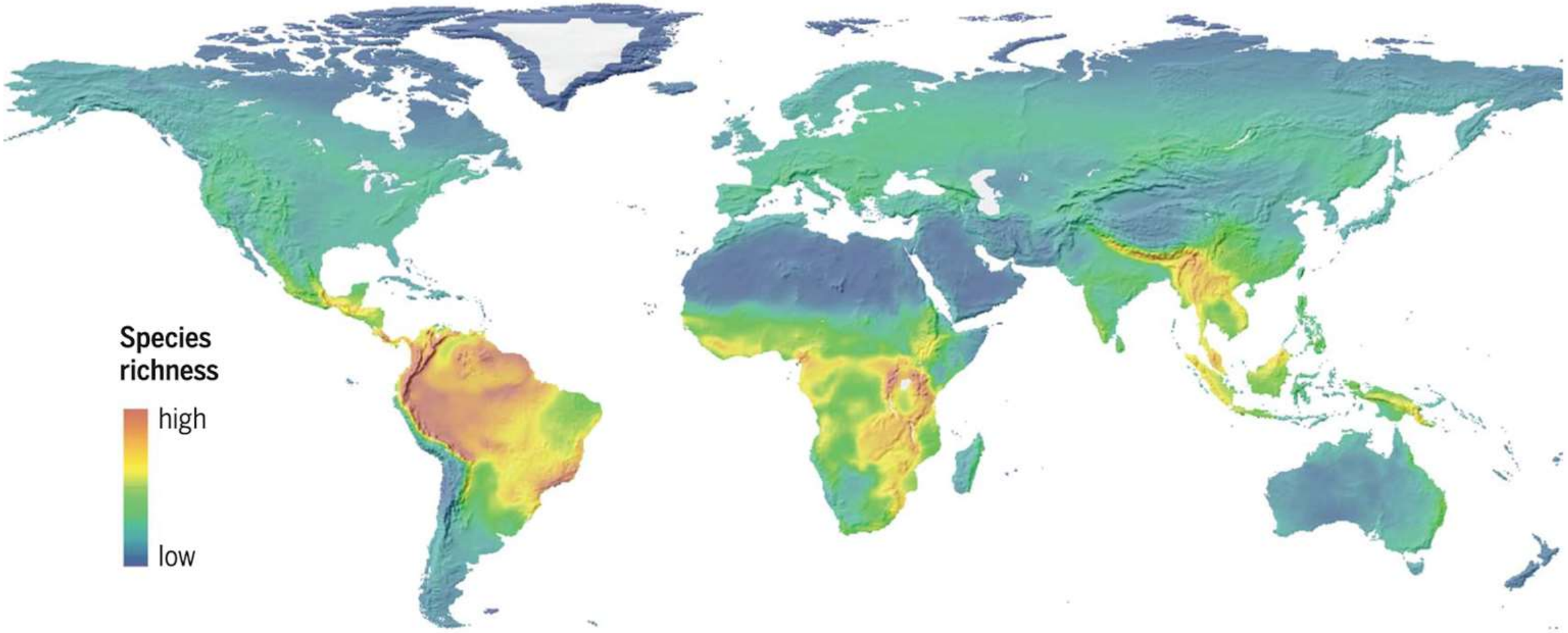
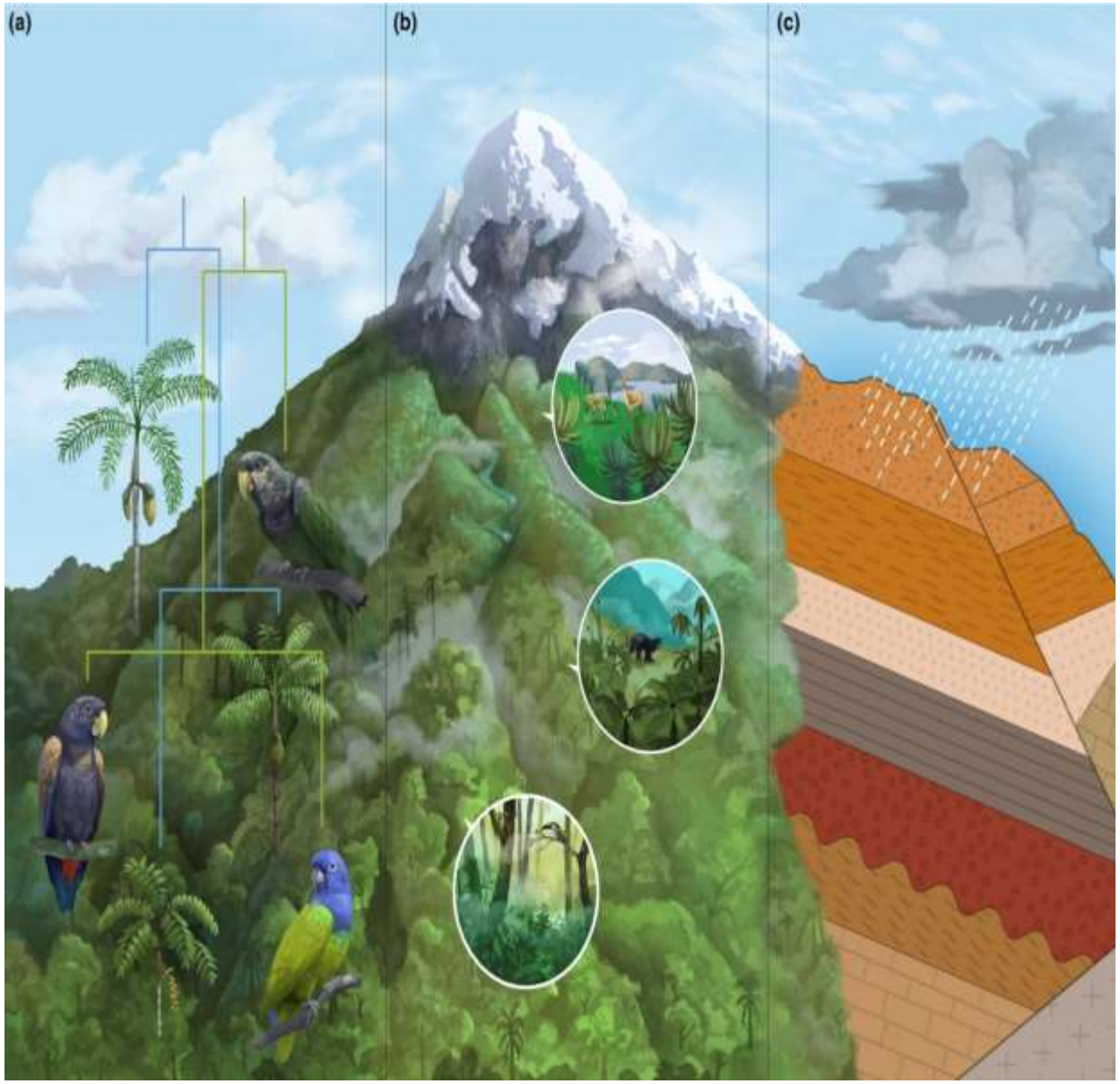



*Gillson and Marchant 2014 TREE*

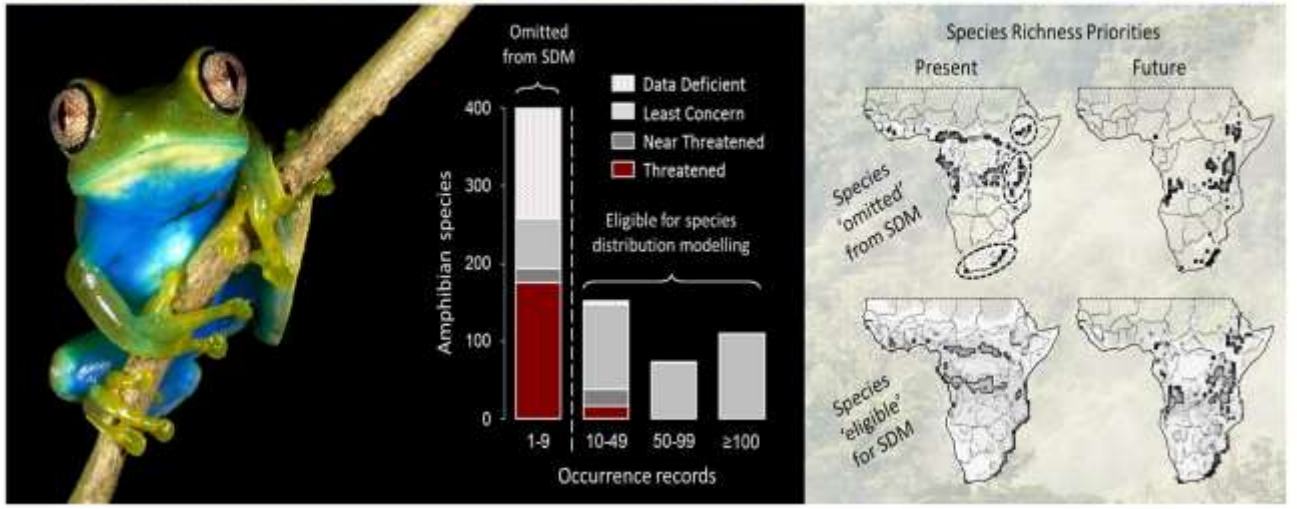
- Mountain bio and env diversity
- Diversity of climate change
- Ecosystem impacts
- Diversity of adaptation
- Mountain futures



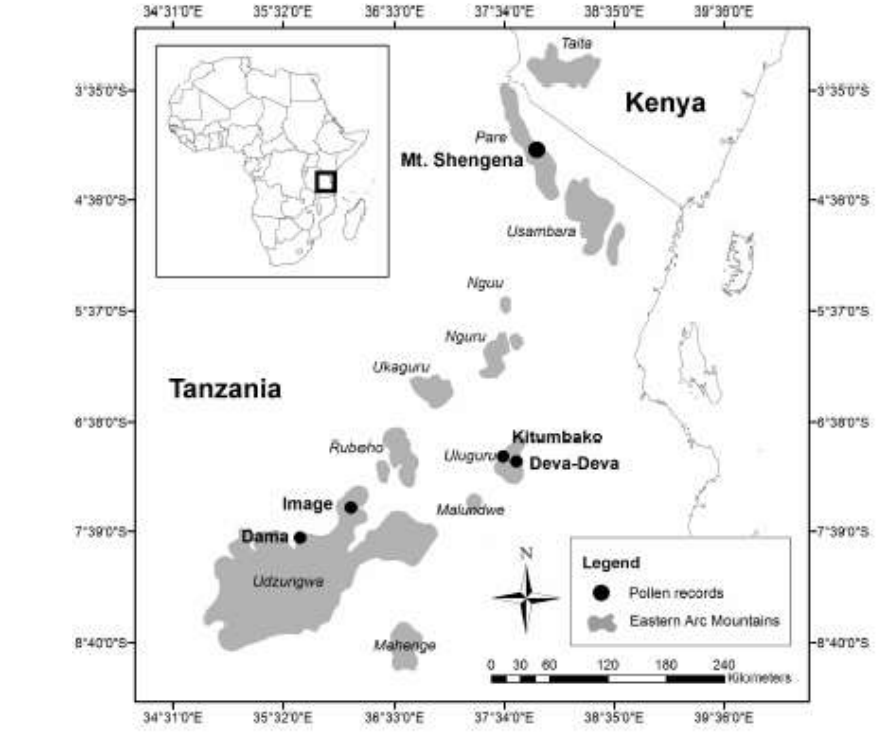

The global pattern of vertebrate richness (birds, mammals, and amphibians)for all land areas (both lowland and highland), super imposed on a hill-shade map showing topographic relief (Rahbek et al., 2019b).

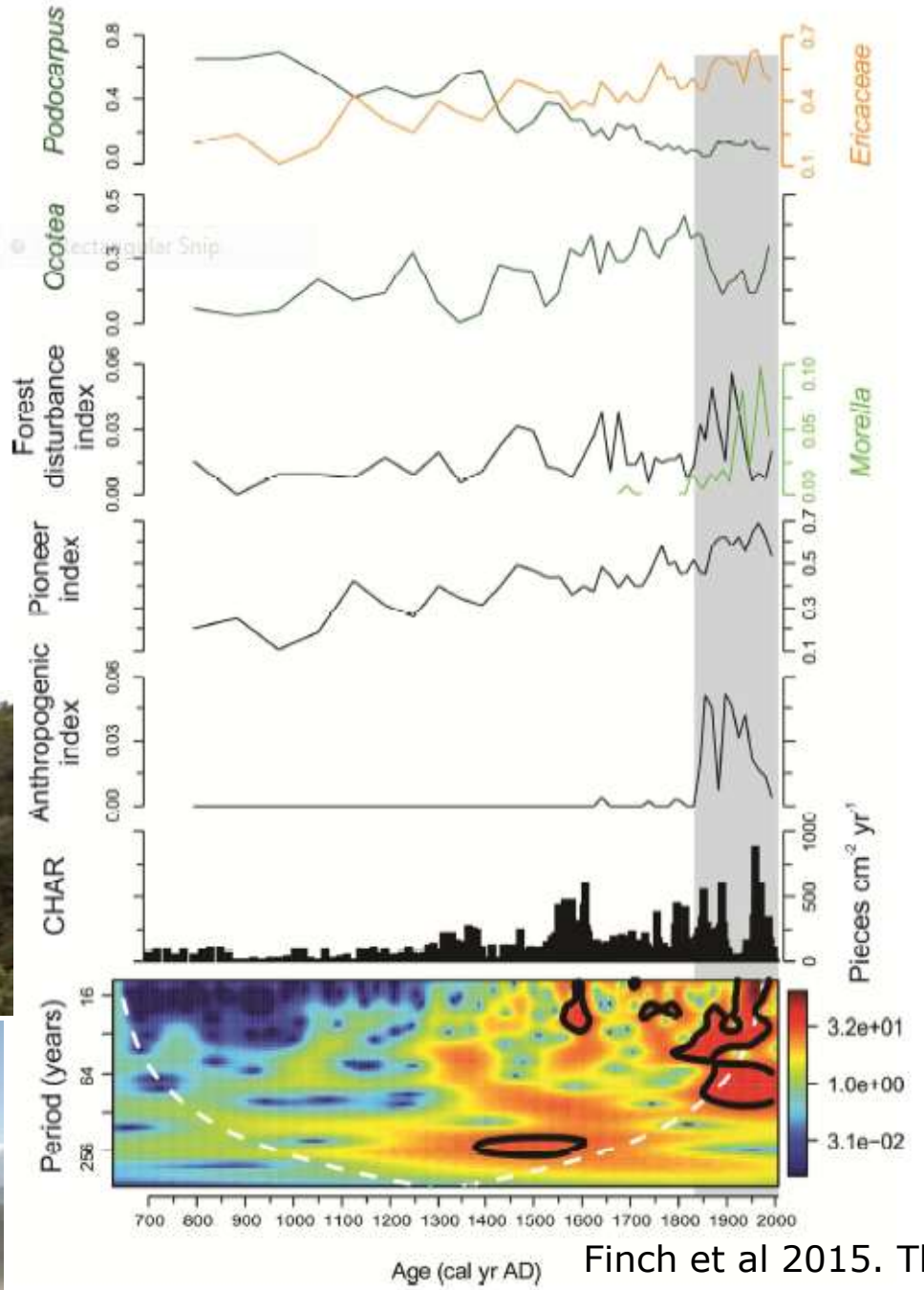



Perrigo et al., 2020 Nature.




*Platts et al., 2016 Diversity and Distributions*





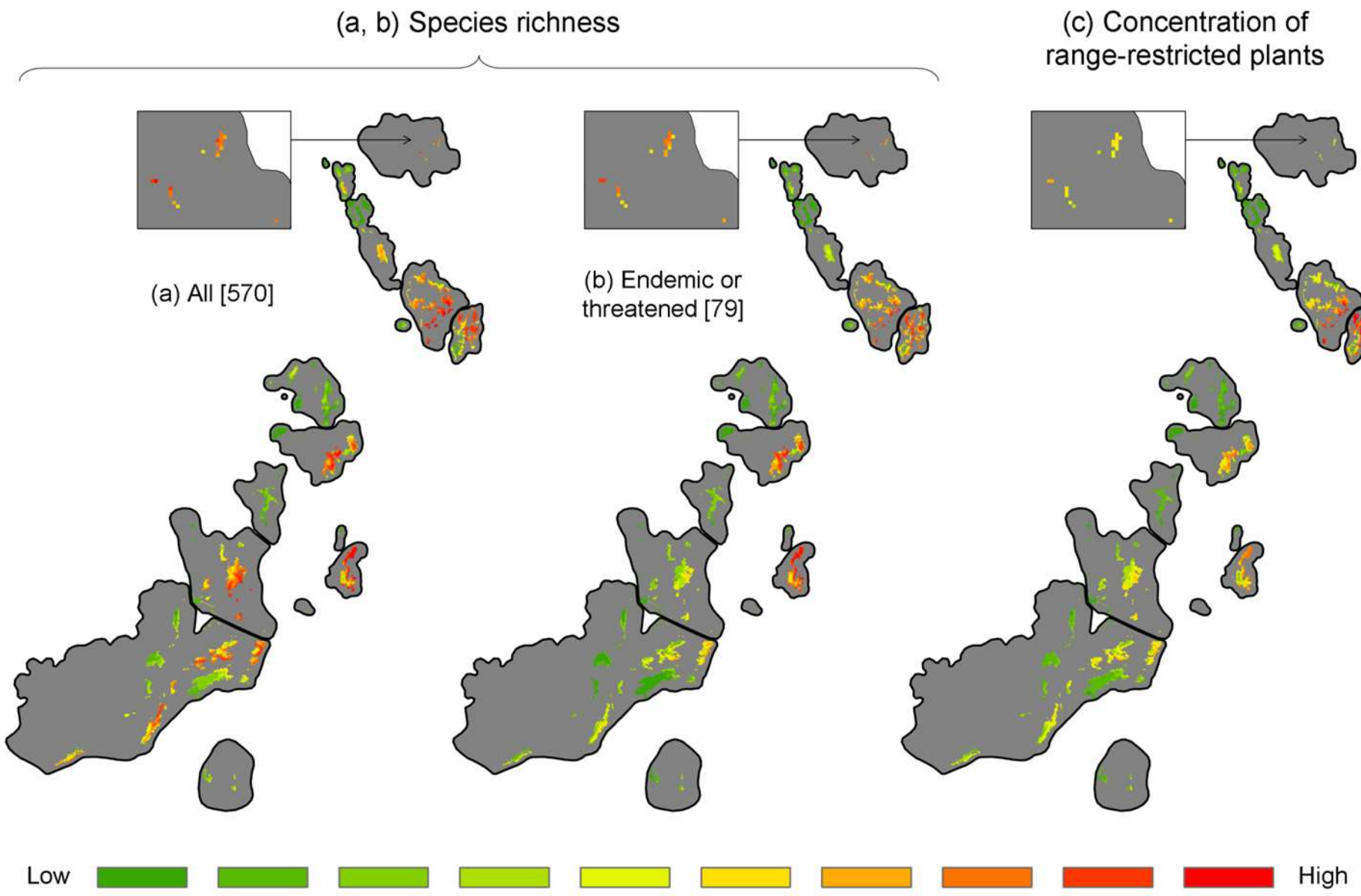

Increasing human modifications with recent pervasive change.

Colonial forest officers cleared large *Ocotea usambarensis*

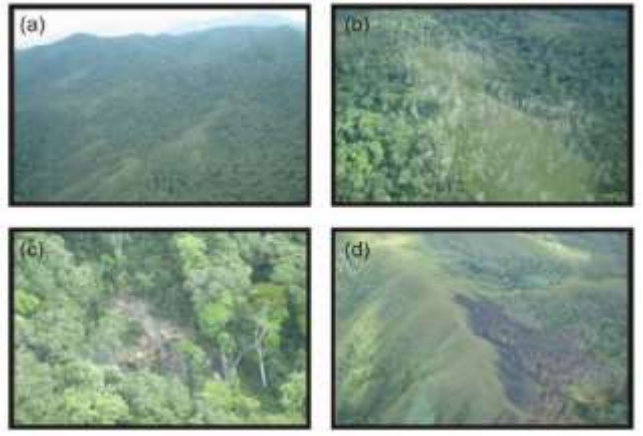
Plantation of exotics – *Eucalyptus*, Pine, *Acacia*

Arrival of Zea maize at 1810AD

Finch et al 2015. The Holocene 2023 Jn Biogeog

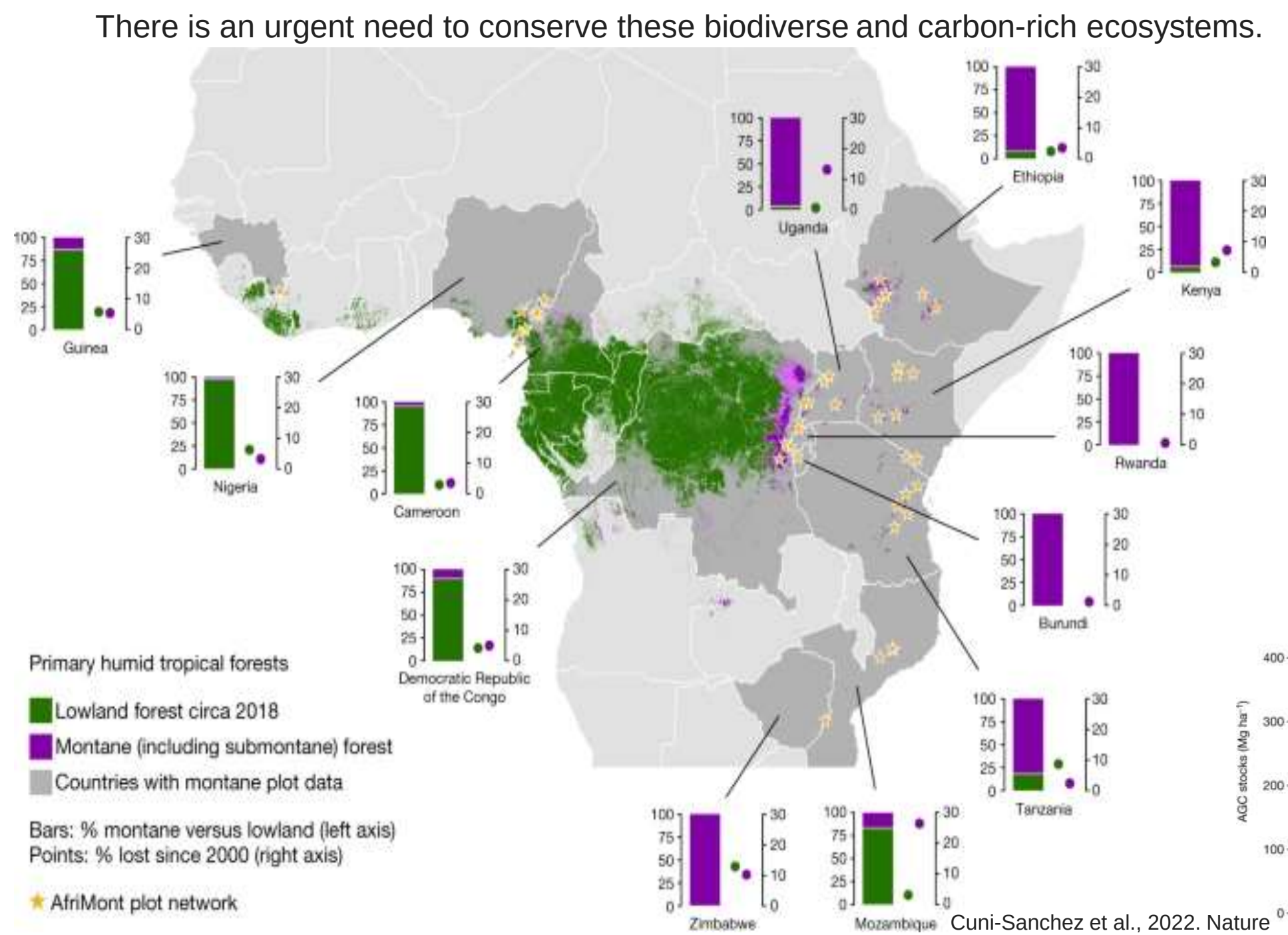


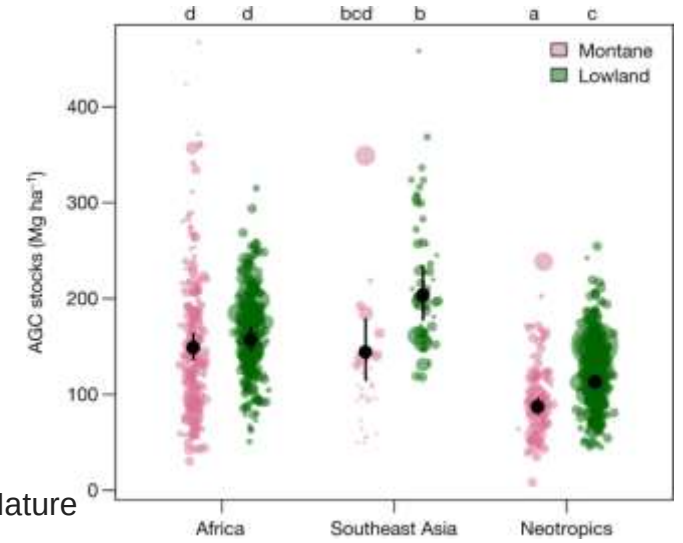

Map of the Eastern Arc Mountains in Tanzania / Kenya showing the original extent (grey outline) and the current forest area (colour) where areas of high diversity / endemism are documented for 700 species of trees.




Platts *et al*. 2015. Diversity and Distributions. Ahrends *et al*., People, Plants and Planet 2021

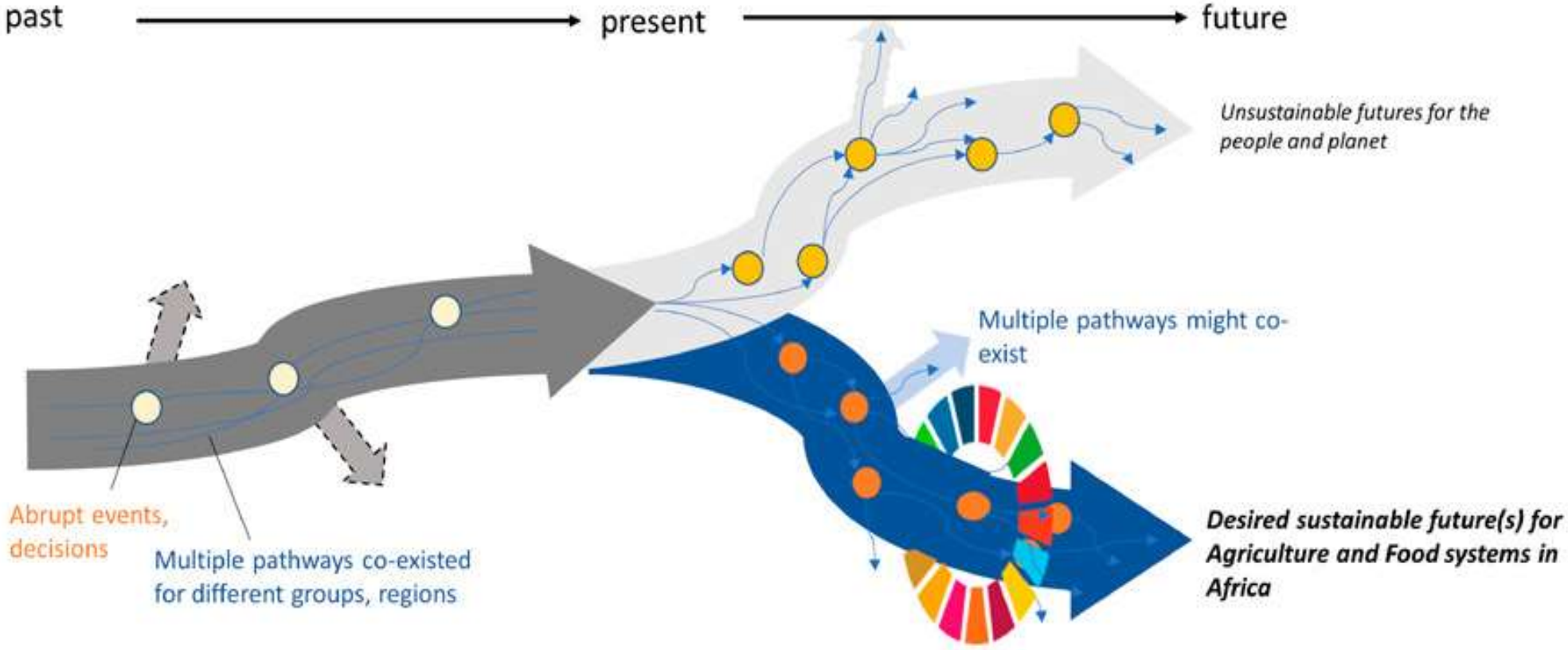
There is an urgent need to conserve these biodiverse and carbon-rich ecosystems.






Cuni-Sanchez et al., 2022. Nature

# Desirable Pathways into a dynamic future?




*Backbone necessary actions to all pathways to the desired futures of agriculture in Africa (Table 1)*

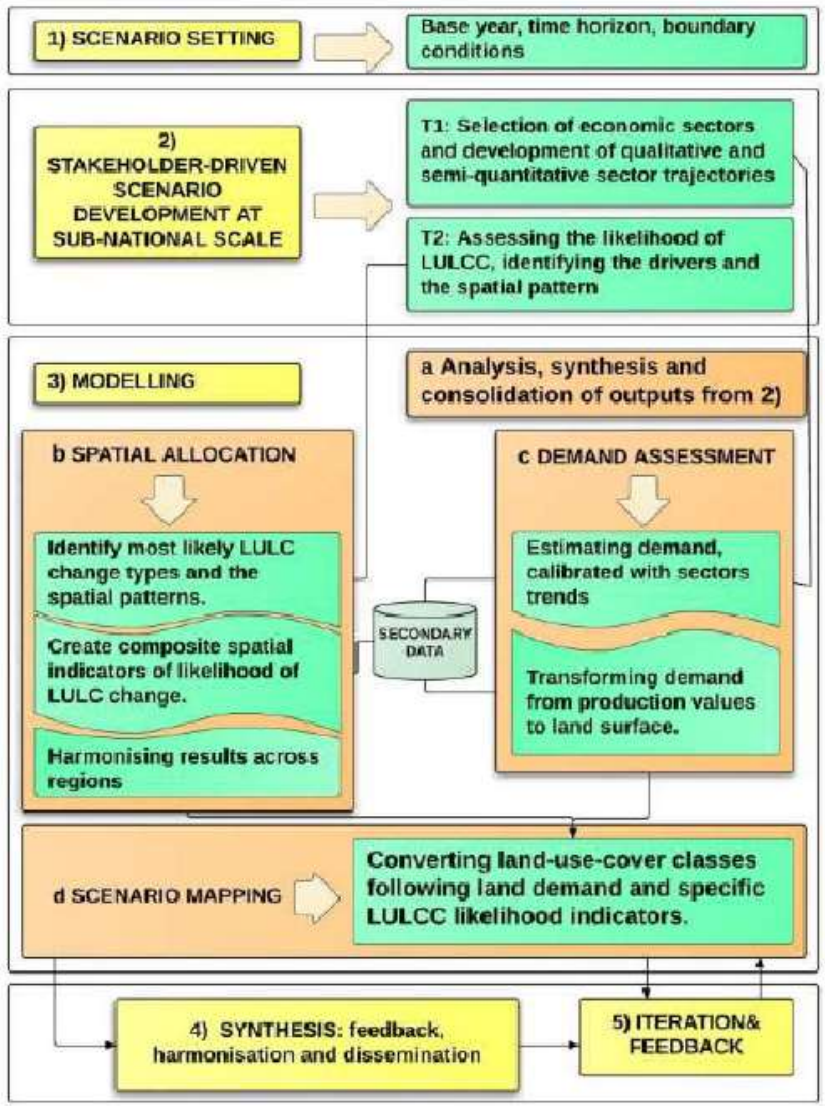
**Empowerment (youth, women and population)**
**Partnerships for change**
**Knowledge, technology and data sharing**

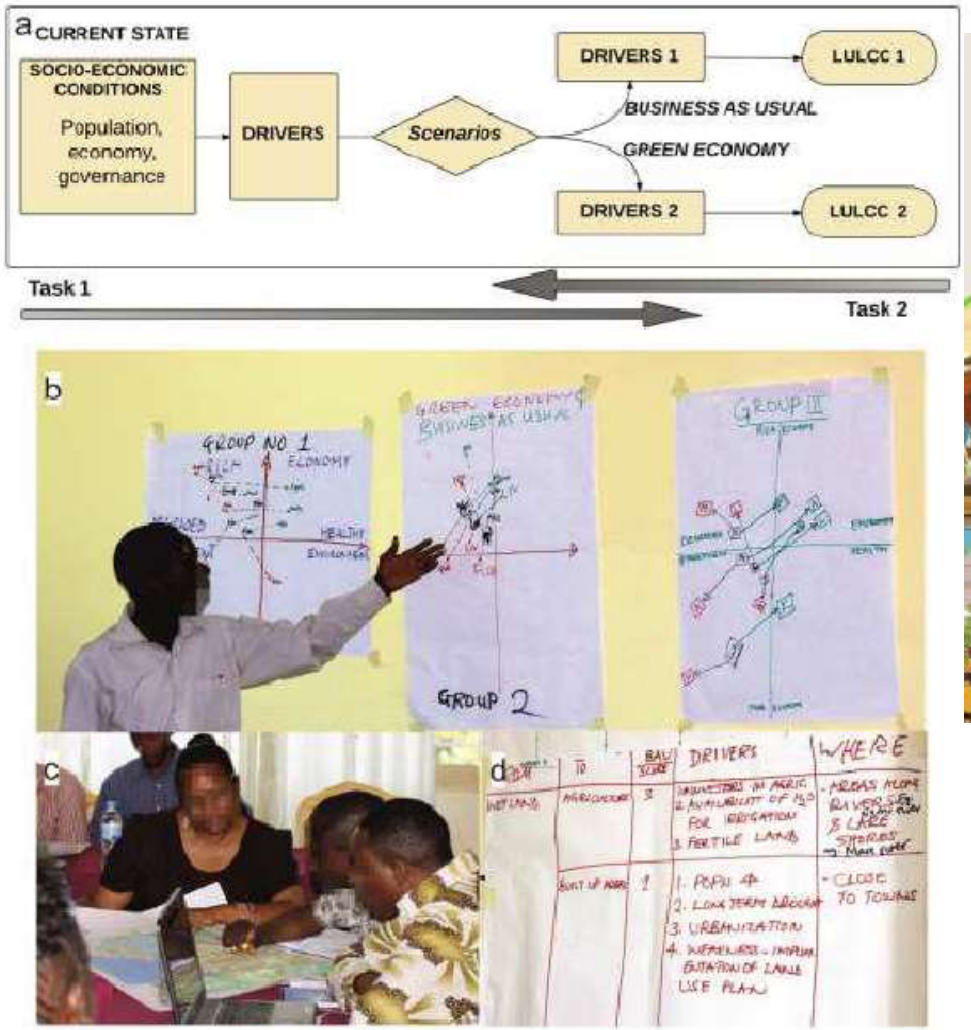
*Decision points /branching points in alternative pathways related to (Table 2)*

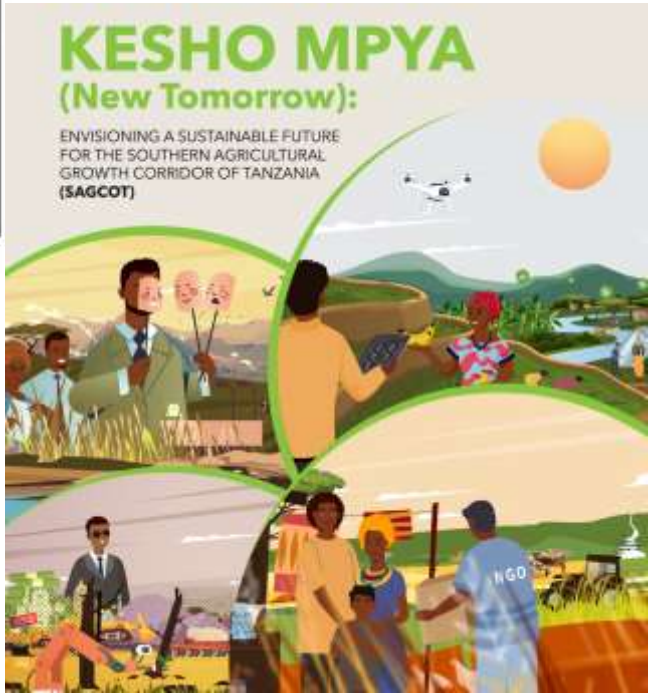
Urbanization: rate and quality
Population growth as a problem or opportunity
Agricultural intensification approach
Actors in agriculture: future of small farmers, cooperatives and role of the States
Alternative diets: meat free or diversified
Local to global production and markets

Aguiar et al. 2018

# KESHO: a participatory scenario modelling tool




Capitani et al. 2016. From local scenarios to national maps: a participatory framework for envisioning the future of Tanzania. Ecology and Society 21(3):4

## SUSTAINABLE DEVELOPMENT GOALS

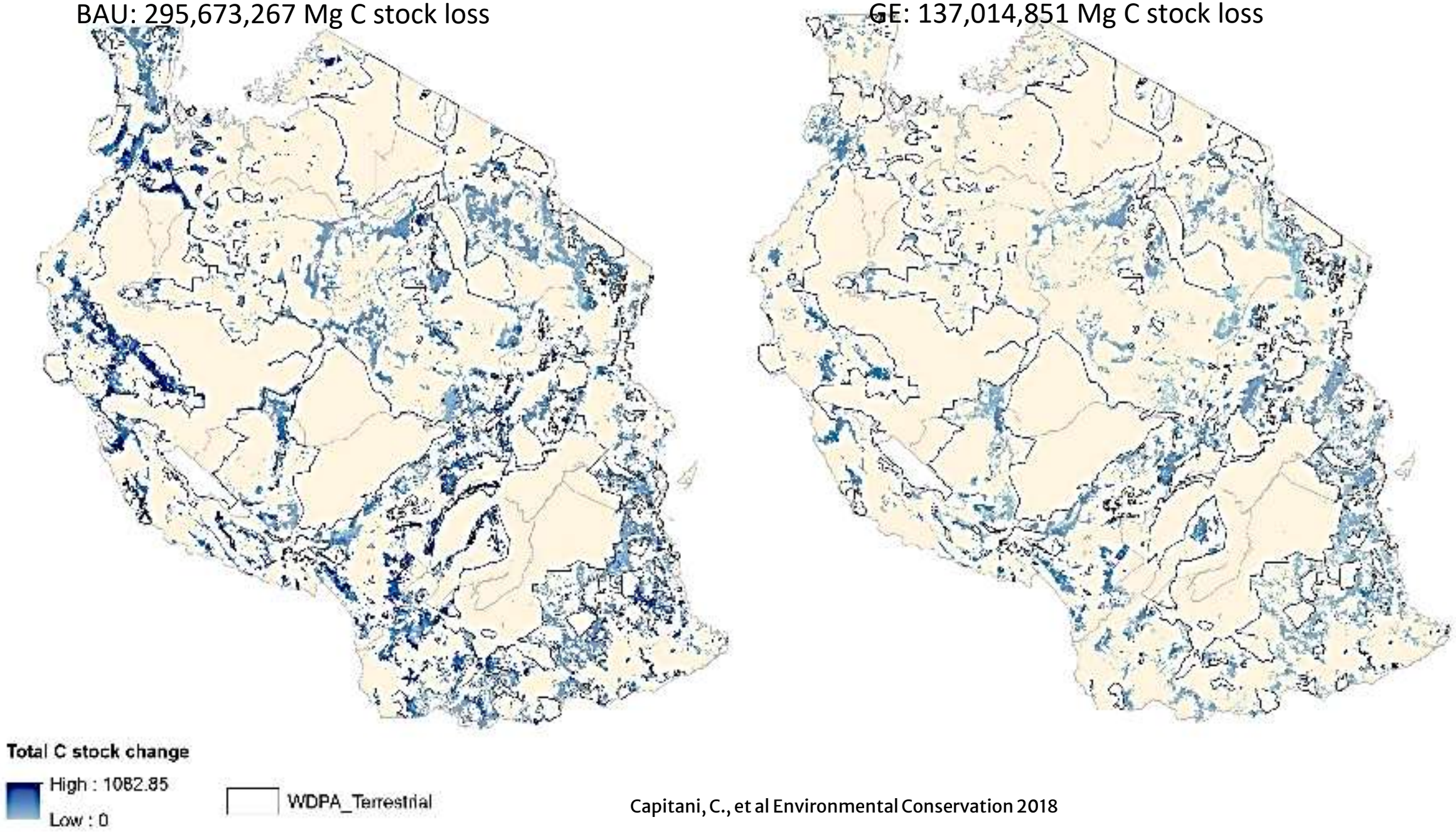
| GOAL | TARGET | INDICATOR |
|---|---|---|
| 13 CLIMATE ACTION | 13.2 INTEGRATE CLIMATE CHANGE MEASURES INTO STRATEGIES AND PLANNING | ACTIONS TAKEN TO COMBAT CLIMATE CHANGE AND ITS IMPACTS |
| 15 LIFE ON LAND | 15.1 BY 2020, ENSURE CONSERVATION, RESTORATION AND SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS ARE ALIGNED WITH OBLIGATIONS UNDER INTERNATIONAL AGREEMENTS | 15.1.1 FOREST AREA AS A PROPORTION OF TOTAL LAND AREA |
| 2 ZERO HUNGER | 2.4 ENSURE SUSTAINABLE AGRICULTURAL PRODUCTION SYSTEMS AND PRACTICES THAT MAINTAIN THE INTEGRITY OF THE ENVIRONMENT | 2.4.1 PROPORTION OF AGRICULTURAL AREA UNDER PRODUCTIVE AND SUSTAINABLE AGRICULTURAL PRACTICES (INCLUDE AGRICULTURE IN PROTECTED AREAS, BIOMARKERS, RIVER BASINS AND FORESTS) |

## AU AGENDA 2063

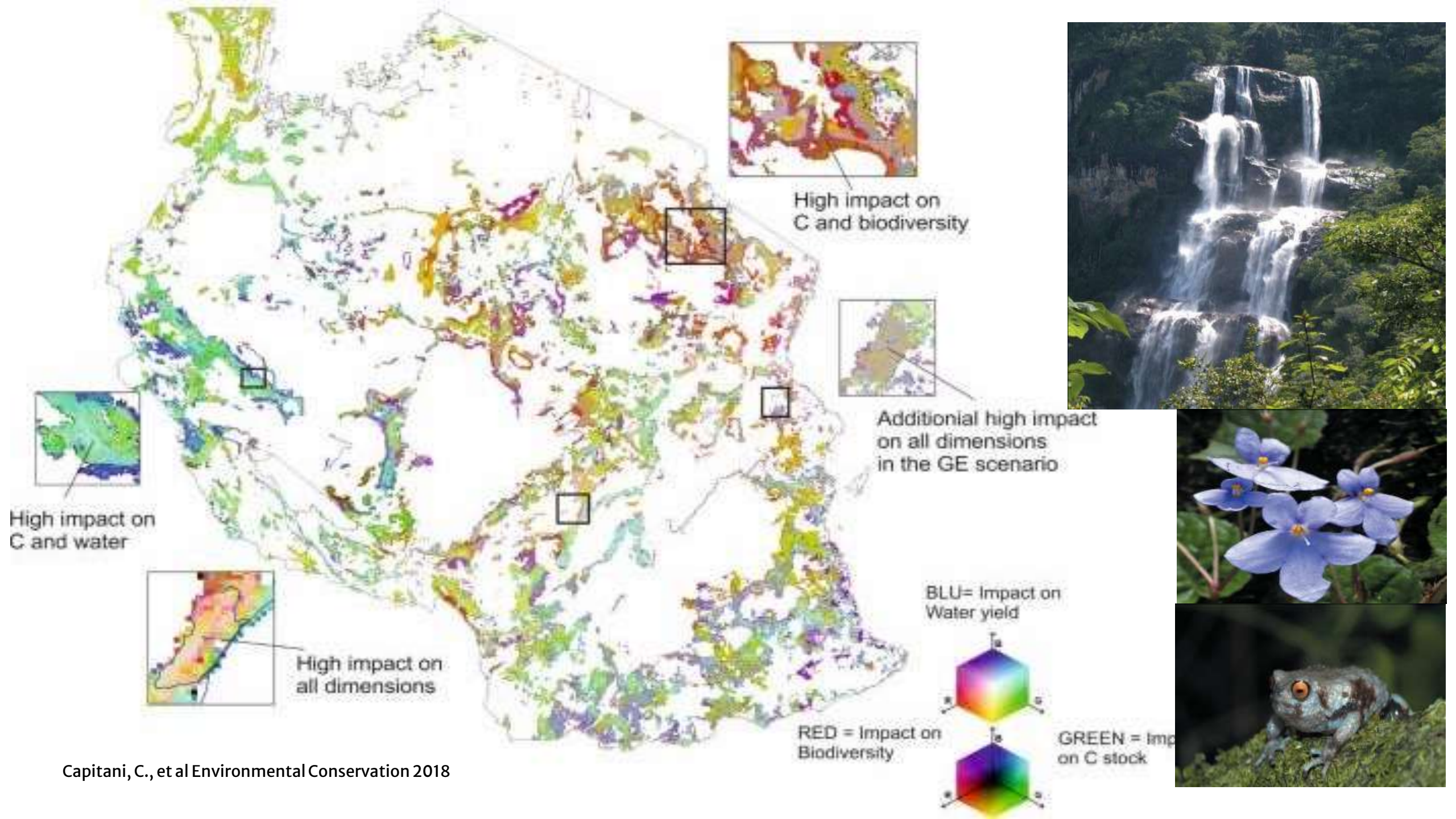
| ASPIRATION | GOAL | PRIORITY AREAS AND TARGET | INDICATOR |
|---|---|---|---|
| 1 A PROSPEROUS AFRICA, BASED ON INCLUSIVE GROWTH AND SUSTAINABLE DEVELOPMENT | 7 ENVIRONMENTALLY SUSTAINABLE AND CLIMATE-RESILIENT ECONOMIES AND COMMUNITIES | 1.7.4. LOW-CARBON PRODUCTION SYSTEMS ARE IN PLACE | 1. CLIMATE SMART AGRICULTURAL PRACTICES BY 2025<br>2. REDUCE TO ZERO EMISSION ARISING FROM BIODIVERSITY LOSS, DEFORESTATION AND LAND DEGRADATION |
| | | 1.7.2. BIODIVERSITY CONSERVED AND USED SUSTAINABLY | 2. REDUCE AND CONSERVE BY AT LEAST 90% LOSS OF BIODIVERSITY AND ALL NATURAL HABITATS |
| | 6 MODERN AGRICULTURE FOR INCREASED PRODUCTION/ PRODUCTIVITY | 1.6.1. INCREASED AGRICULTURAL PRODUCTION | 3. 100% OF AGRICULTURAL GDP IS CONTRIBUTED BY COMMERCIAL AGRICULTURAL PRODUCERS |

BAU: 295,673,267 Mg C stock loss

GE: 137,014,851 Mg C stock loss




Capitani, C., et al Environmental Conservation 2018




Capitani, C., et al Environmental Conservation 2018

'Enduata' scenario
(High population growth and low tourism economy)

Land cover in 2030

## Land cover

- Shrubland
- Grassland
- Cropland
- Built-Up
- Sparse vegetation
- Water
- Forest

0 20 40 80 Kilometers

Kariuki et al ,in prep

'Enduata' scenario
(High population growth and low tourism economy)

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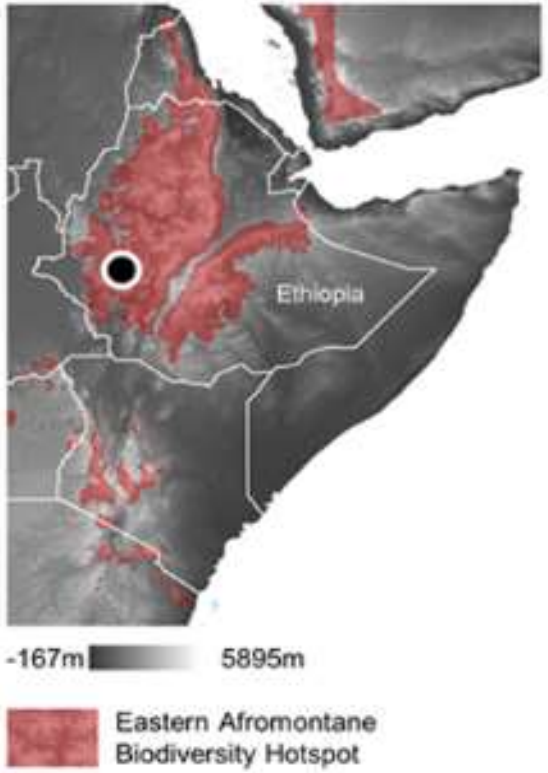
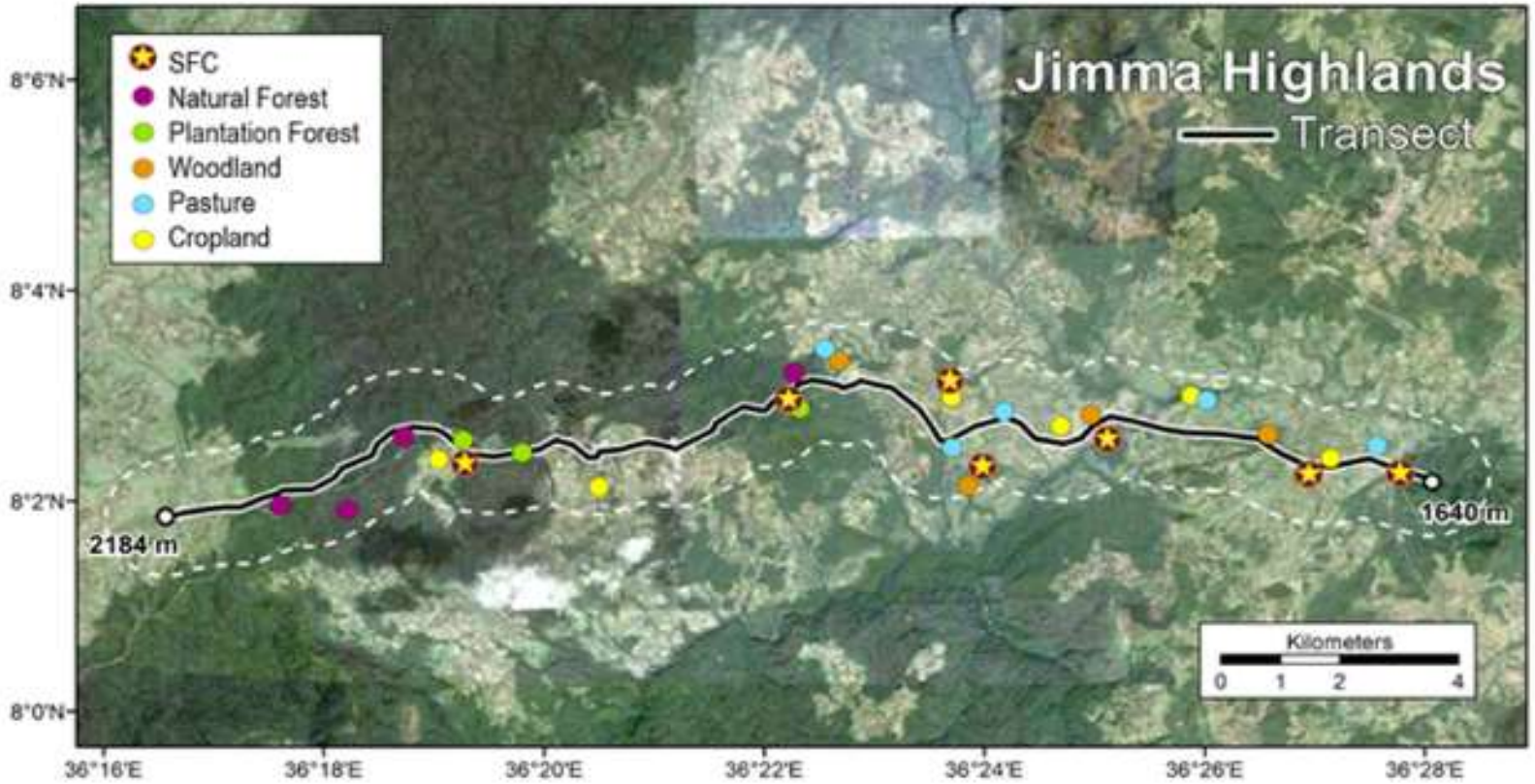
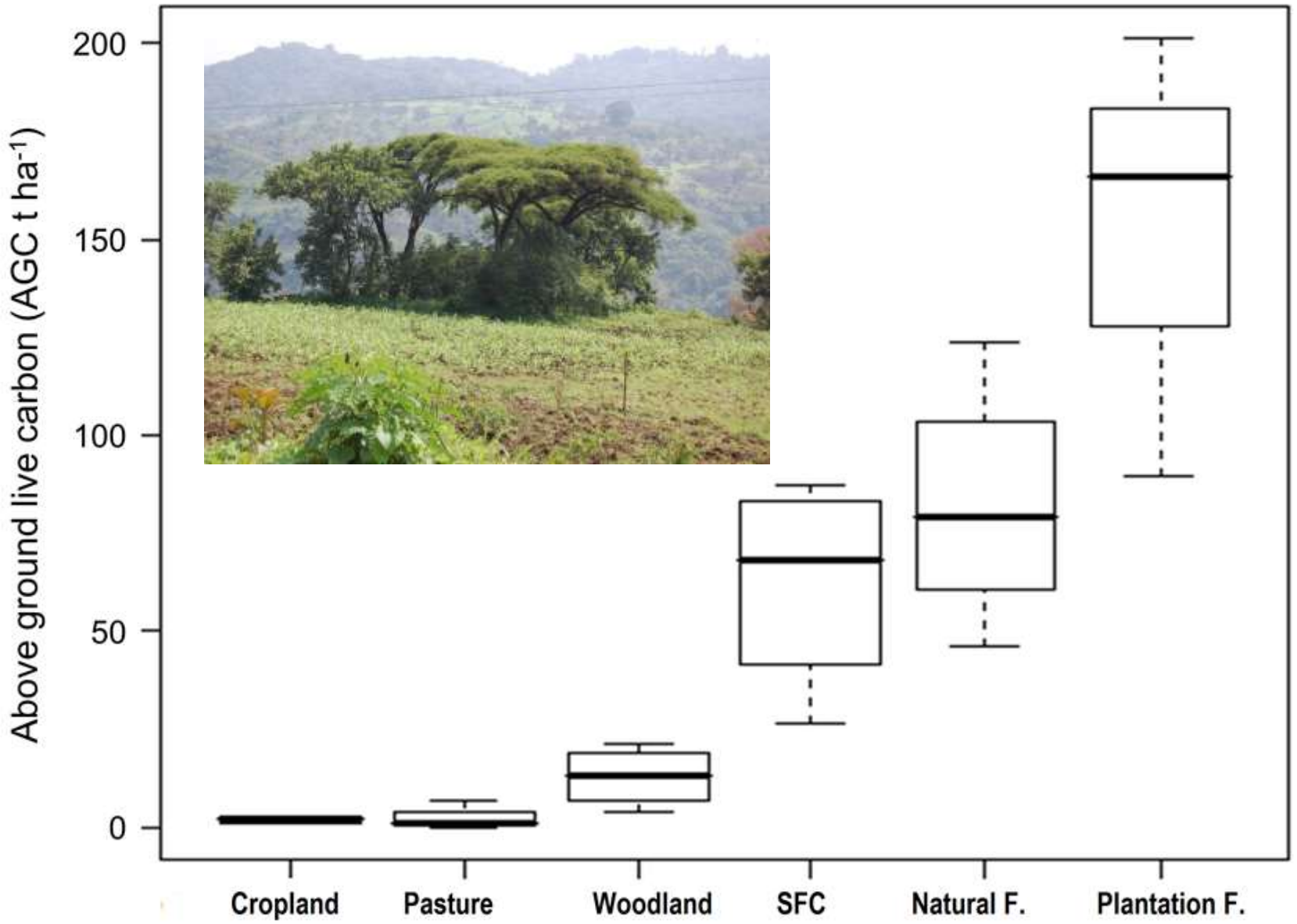
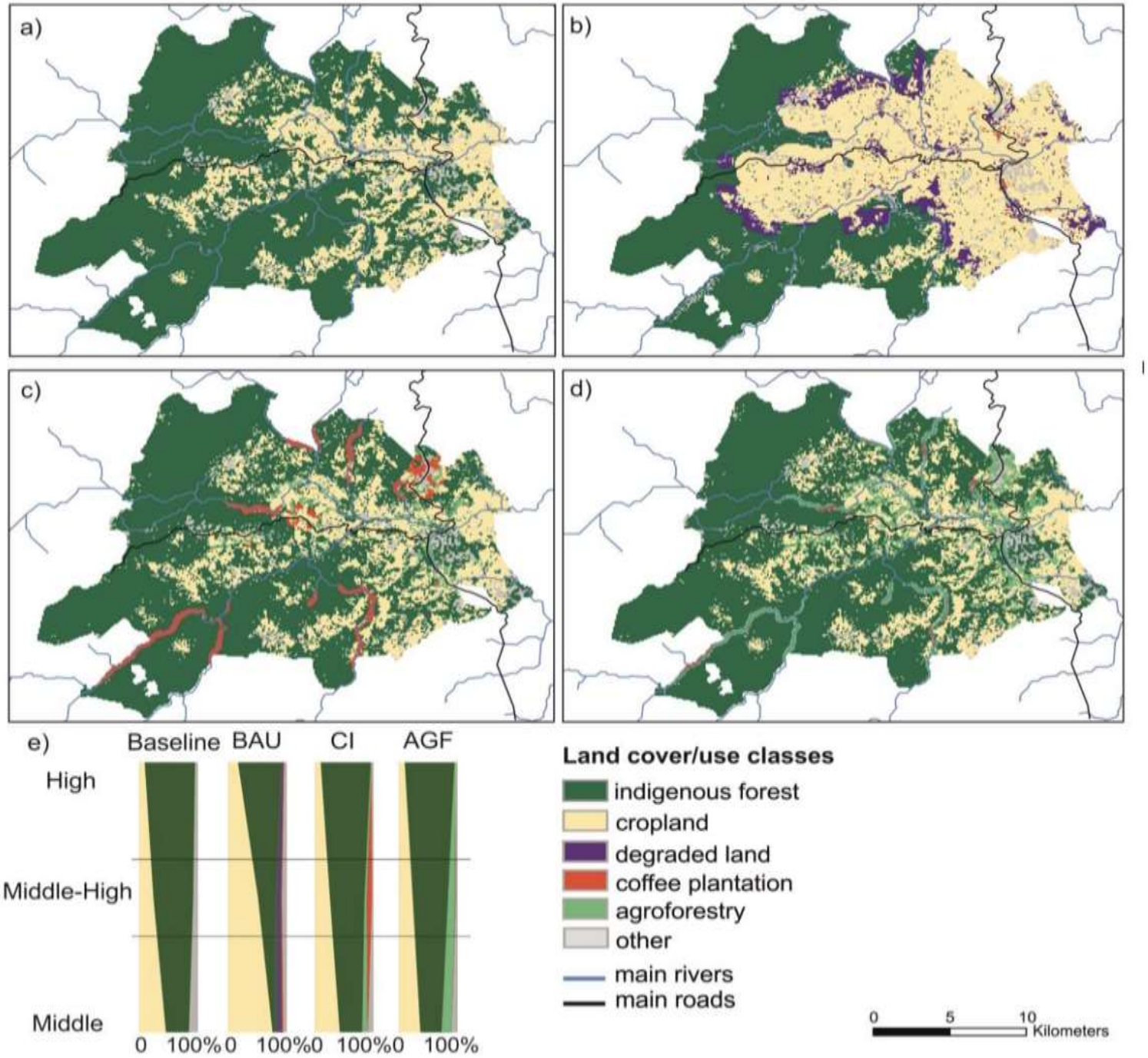

Ethiopia
-167m
5895m
Eastern Afromontane
Biodiversity Hotspot

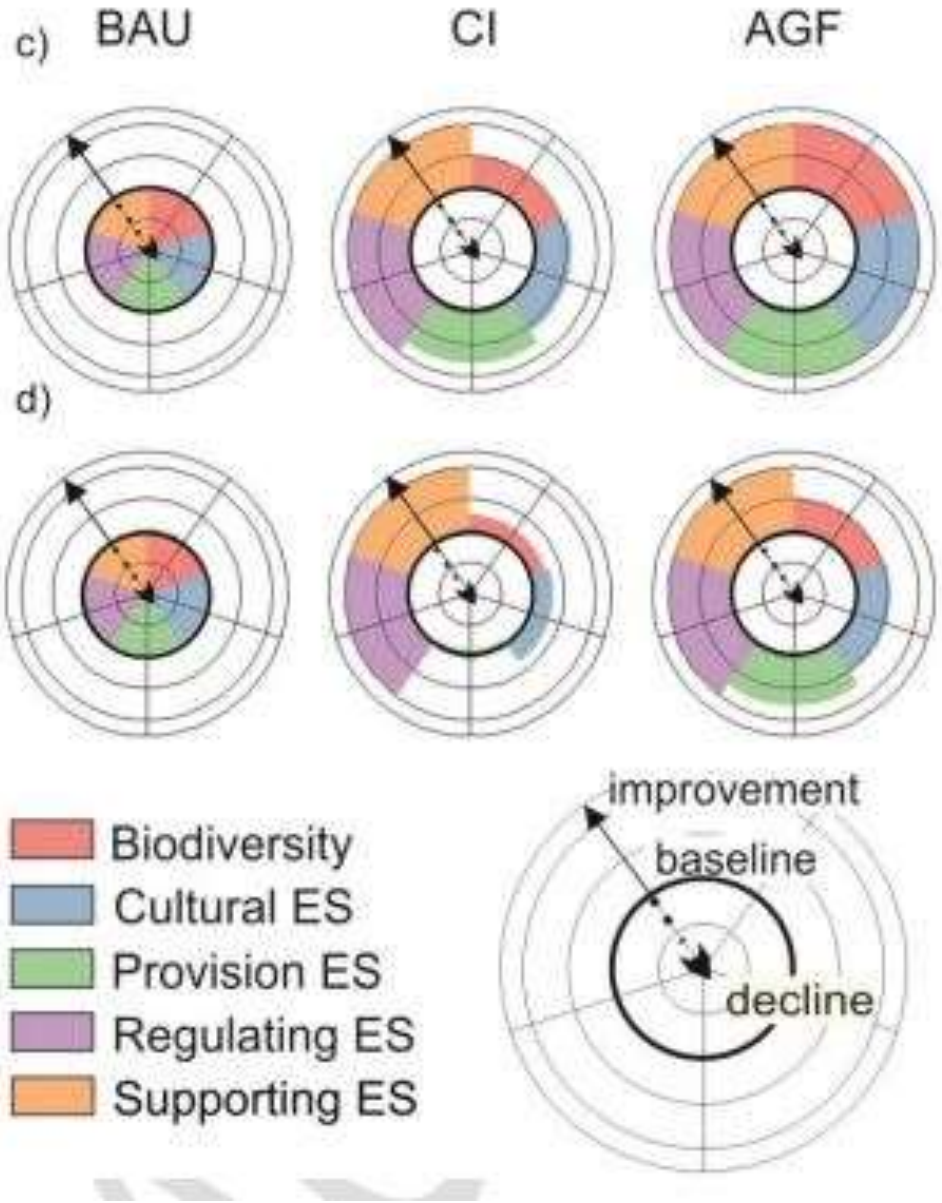

SFC
Natural Forest
Plantation Forest
Woodland
Pasture
Cropland
Jimma Highlands
Transect
2184 m
1640 m
Kilometers
0 1 2 4
8°6'N
8°4'N
8°2'N
8°0'N
36°16'E
36°18'E
36°20'E
36°22'E
36°24'E
36°26'E
36°28'E




Denu et al., 2018 Bio Conser

Scenarios of land cover change at 2030 in the Jimma Highlands at business as usual (BAU, b), industrial coffee plantation (CI, c) and agroforestry with semi-managed coffee production (AGF, d) scenarios.






Qualitative assessment of changes in ecosystem services and biodiversity states expressed by different stakeholder groups under alternative scenarios in Jimma (c, academics and officers, d, men and women farmers; BAU = business as usual, CI = coffee industry, AGF = agroforestry scenarios, respectively). State changes were expressed as improved or depleted or equal compared to the baseline

*Capitani et al., 2016 Ecology and Society*
*Capitani et al., 2018 Environmental Conservation*
*Capitani et al., 2018 Sustainability Science*

# Multifunctional agroforestry for enhancing biodiversity, improving livelihoods, and creating resilient landscapes in Ethiopian highlands

1) Generate evidence on biodiversity and resilience to climate change from traditional agroforestry systems;

2)Generate knowledge on how social drivers and climate change are affecting biodiversity in agroforestry systems;

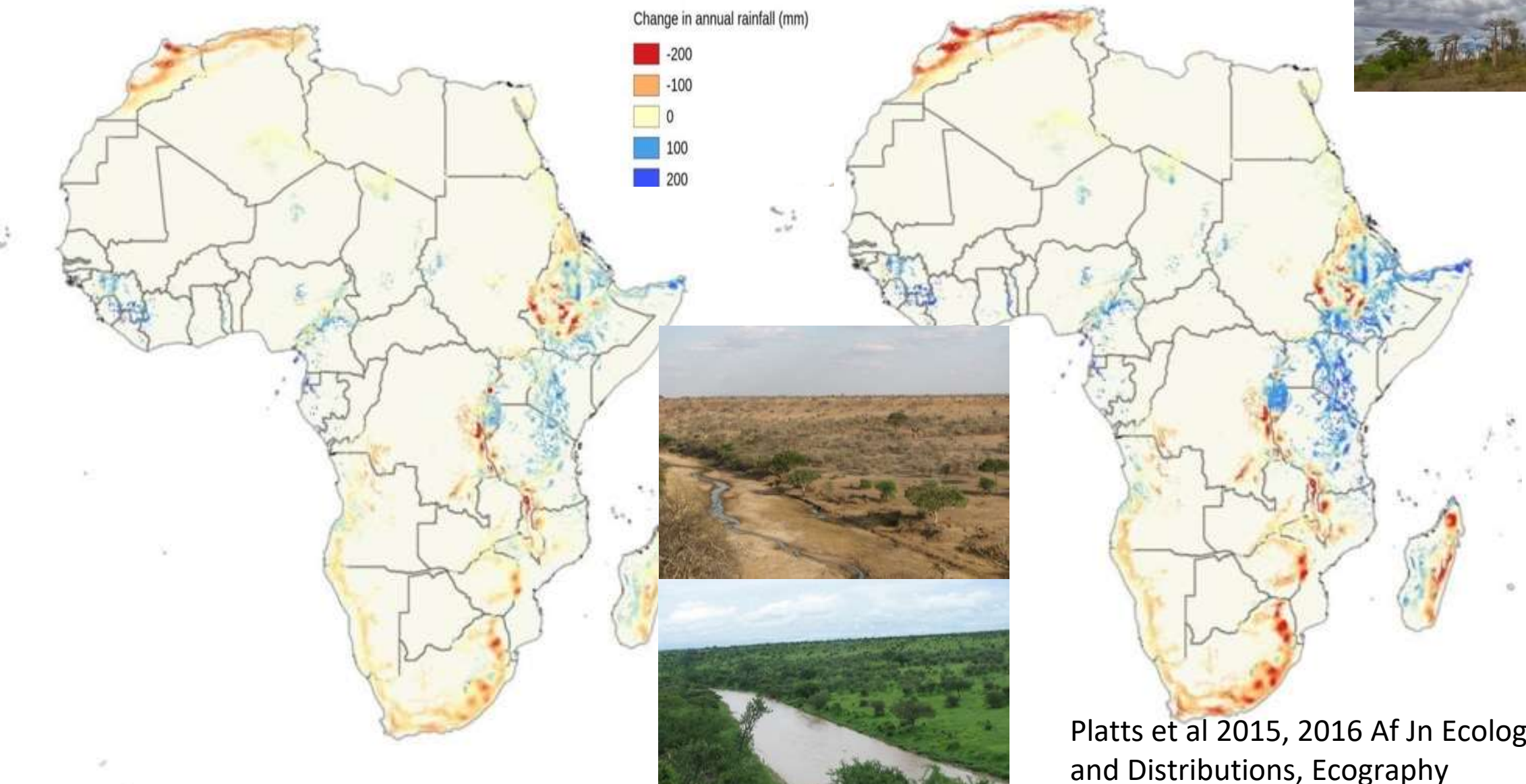
3) Map and communicate the role of people's access, use, and relationships with highland agroforestry resources; and

4) Synthesize knowledge on what effective climate-resilient and biodiversity promoting traditional agroforestry systems already exist and can be scaled and or replicated.

Lessons learned will be used to create and scale up context-specific mosaic agroforestry systems across Ethiopia.

CIFOR World Agroforestry THE UNIVERSITY of York GLOBAL CENTRE ON BIODIVERSITY FOR CLIMATE TREE AID Global Landscapes Forum Resilient Landscapes CGIAR

Change in annual rainfall across the African mountains between a) baseline and mid- 21st century and b) baseline and late 21st century.

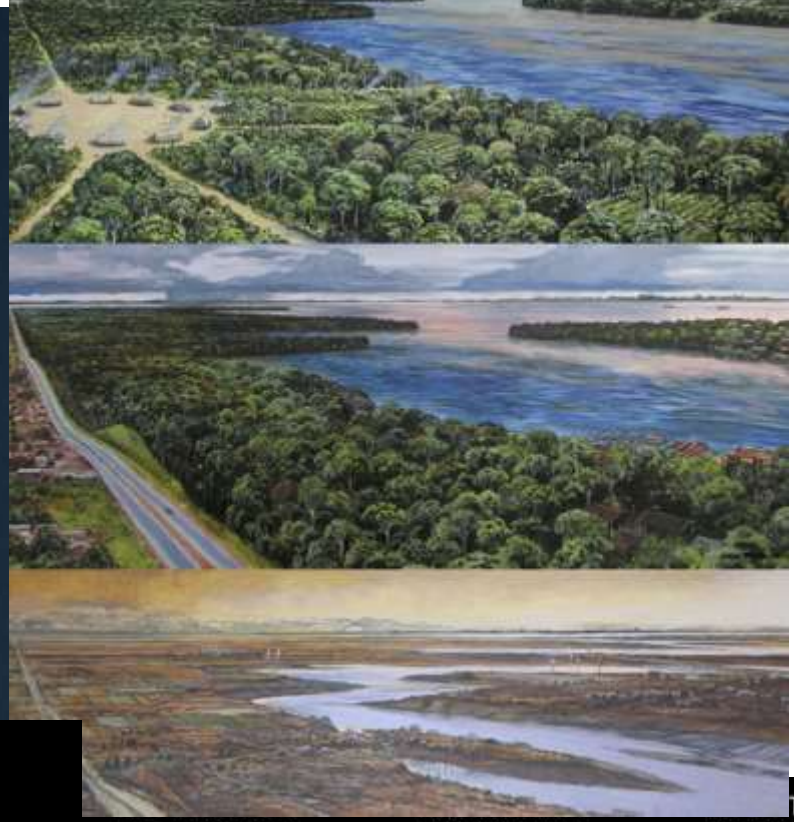







Platts et al 2015, 2016 Af Jn Ecology, Diversity and Distributions, Ecography

# Diverse outreach: Policy, Film, Art



# Mountain Social-Ecological Futures 2023-2026

2022 International Year of SUSTAINABLE MOUNTAIN DEVELOPMENT

11 December International MOUNTAIN DAY

MOUNTAIN RESEARCH INITIATIVE

Mountain Partnership

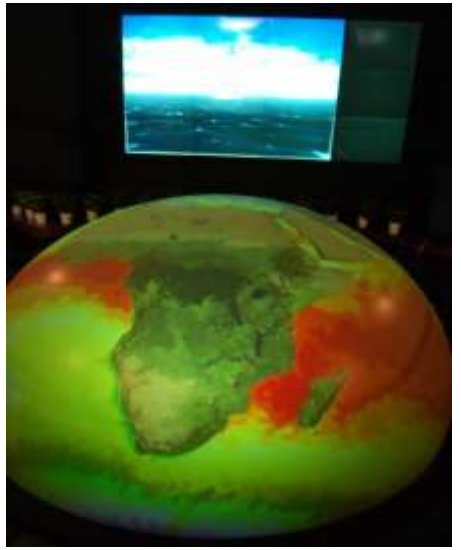
Five Years of Action for the Development of Mountain Regions 2023–2027

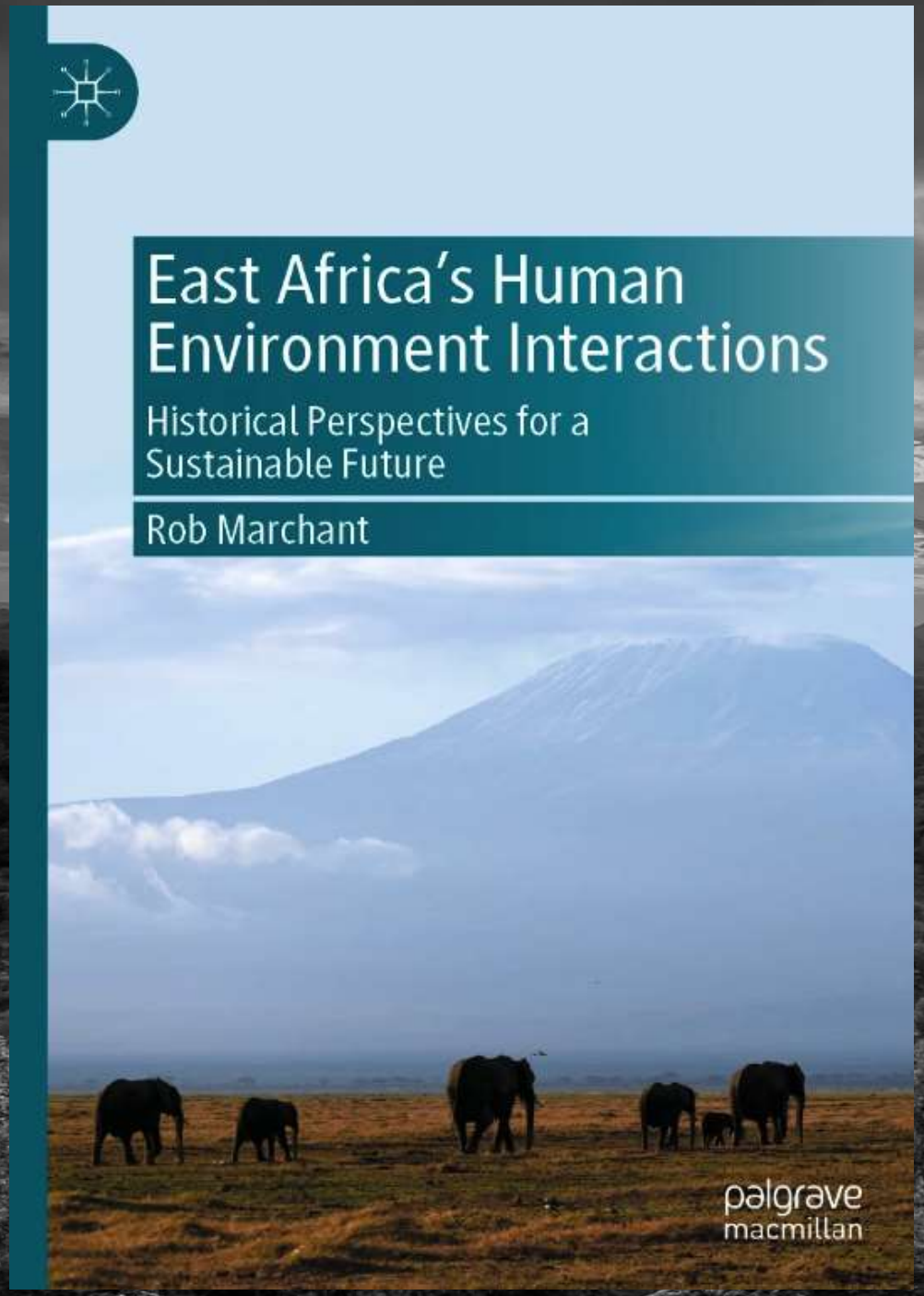
Create an urgently needed community of practice to imagine and shape new responses to the ongoing unprecedented climate-driven social-ecological changes in mountain areas

unesco

# New directions / challenges

- Integrate information to characterise socio - ecosystem dynamics at fine grain size.
- Map spatio-temporal rate and direction of changes in diverse landscapes – cities to HWC, landscape planning to interactions with changing climates, African Mountains to NYM.
- Apply the developing scenario approach to *integrate* environmental, ecological and social interactions such hydrology, biodiversity, carbon, people, health and livelihoods.
- Translation to Nat Capital assessment and co-design Nature Based solutions to get ahead of the challenges.
- Training and dissemination Conservation, Gvt, research and infrastructure
- Educational / learning process – the need to captures this better.
- Participants – who's voice is in the room…..



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