Landscape restoration via food security interventions can deliver resilience and climate-change mitigation co-benefit in Sub-Saharan Africa:

Lessons from Ethiopia's Productive Safety Net Program (PSNP)

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Addis Ababa, Ethiopia
October 24, 2017

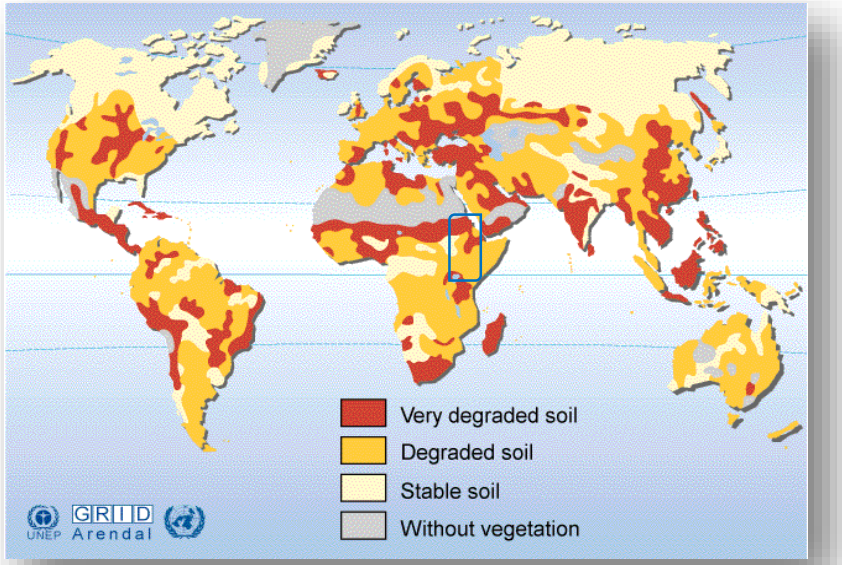
PSNP
Productive Safety Net Programme

Cornell University

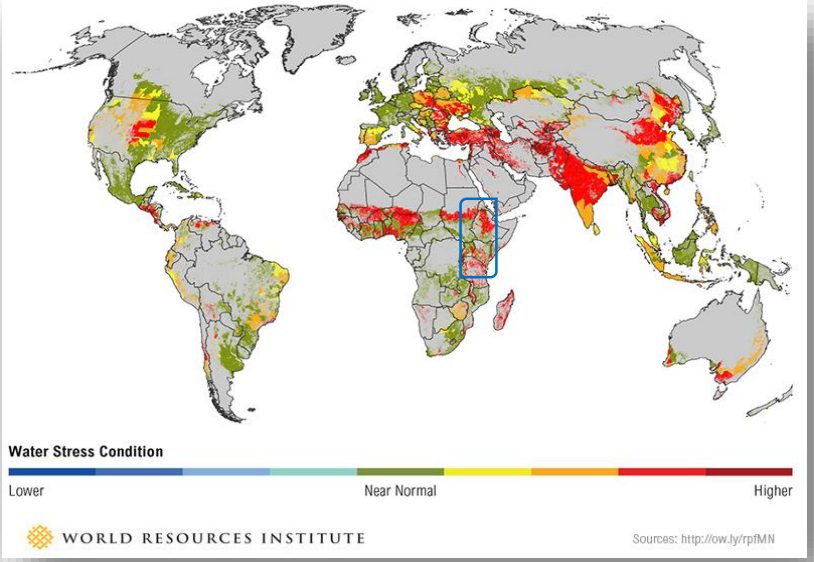
CLIMATE CHANGE
AGRICULTURE AND FOOD SECURITY

Rationale behind Ethiopia's landscape restoration via food security interventions

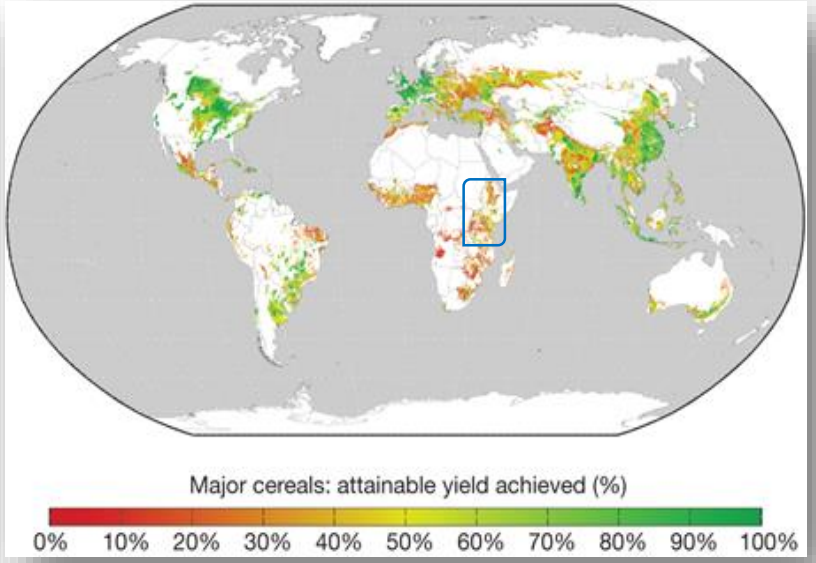
- Rampant soil degradation and loss of fertility



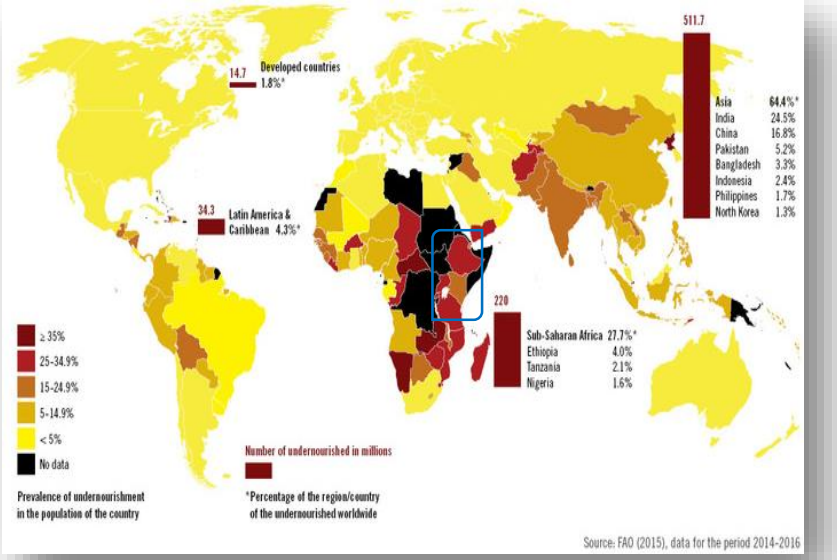
- Widespread water stress



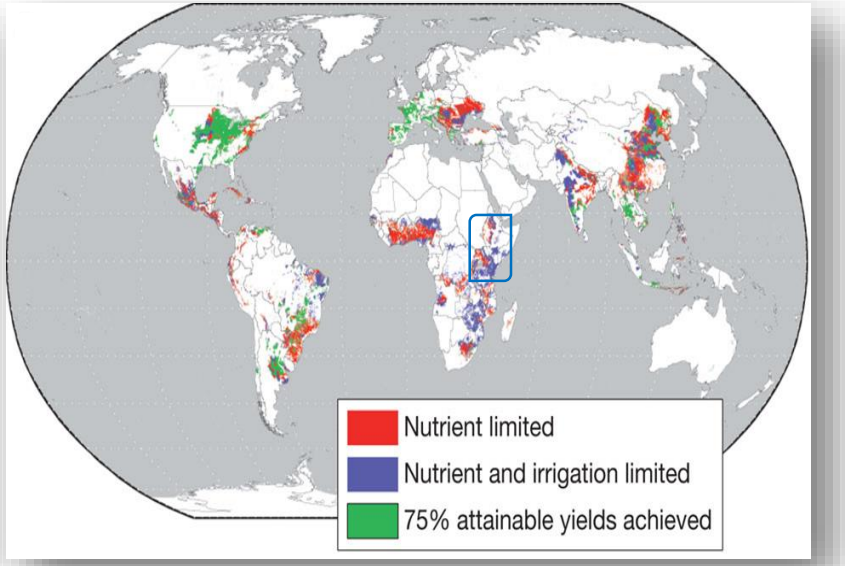
- Significant crop yield gap



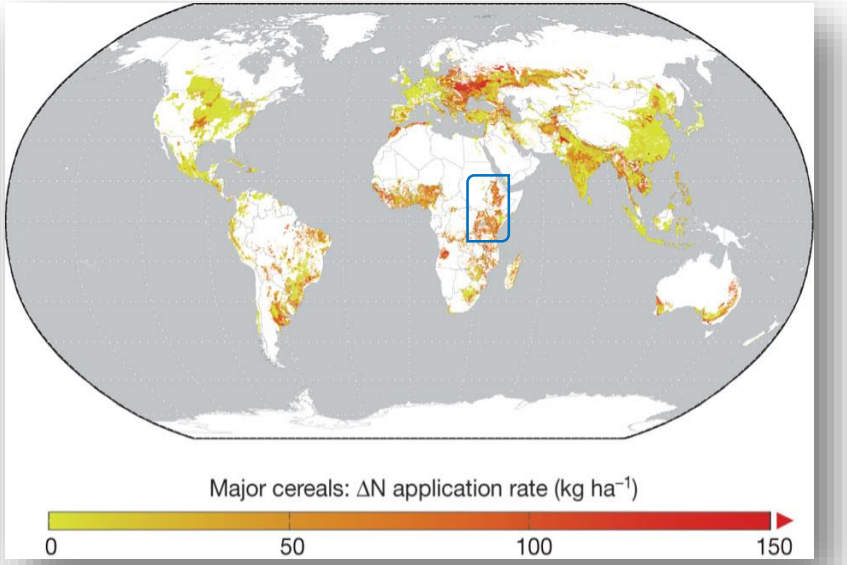
- Prevalent chronic food and nutrition insecurity



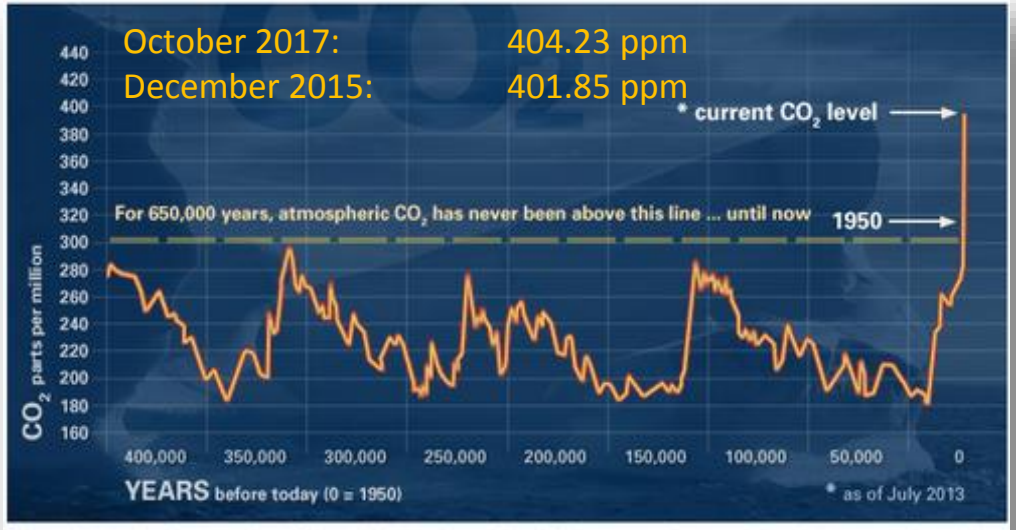
- Major limitations for yield-gap closure



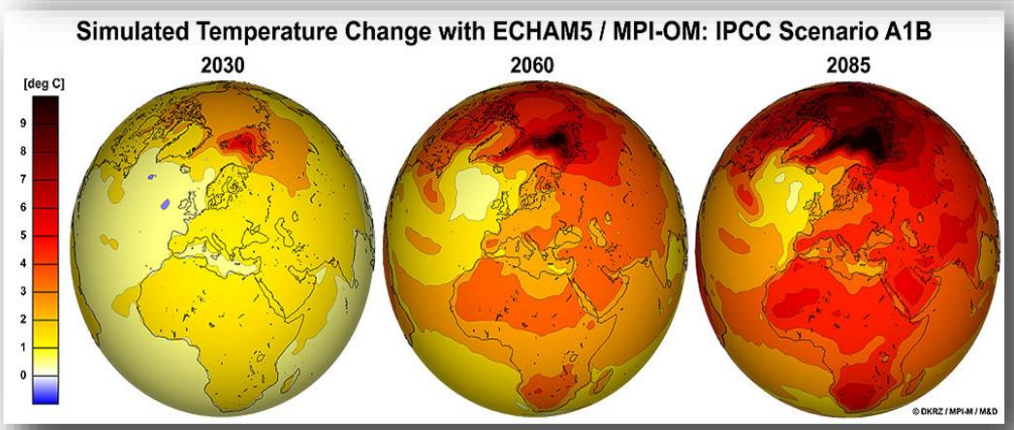
- Environmental and climate change impacts?

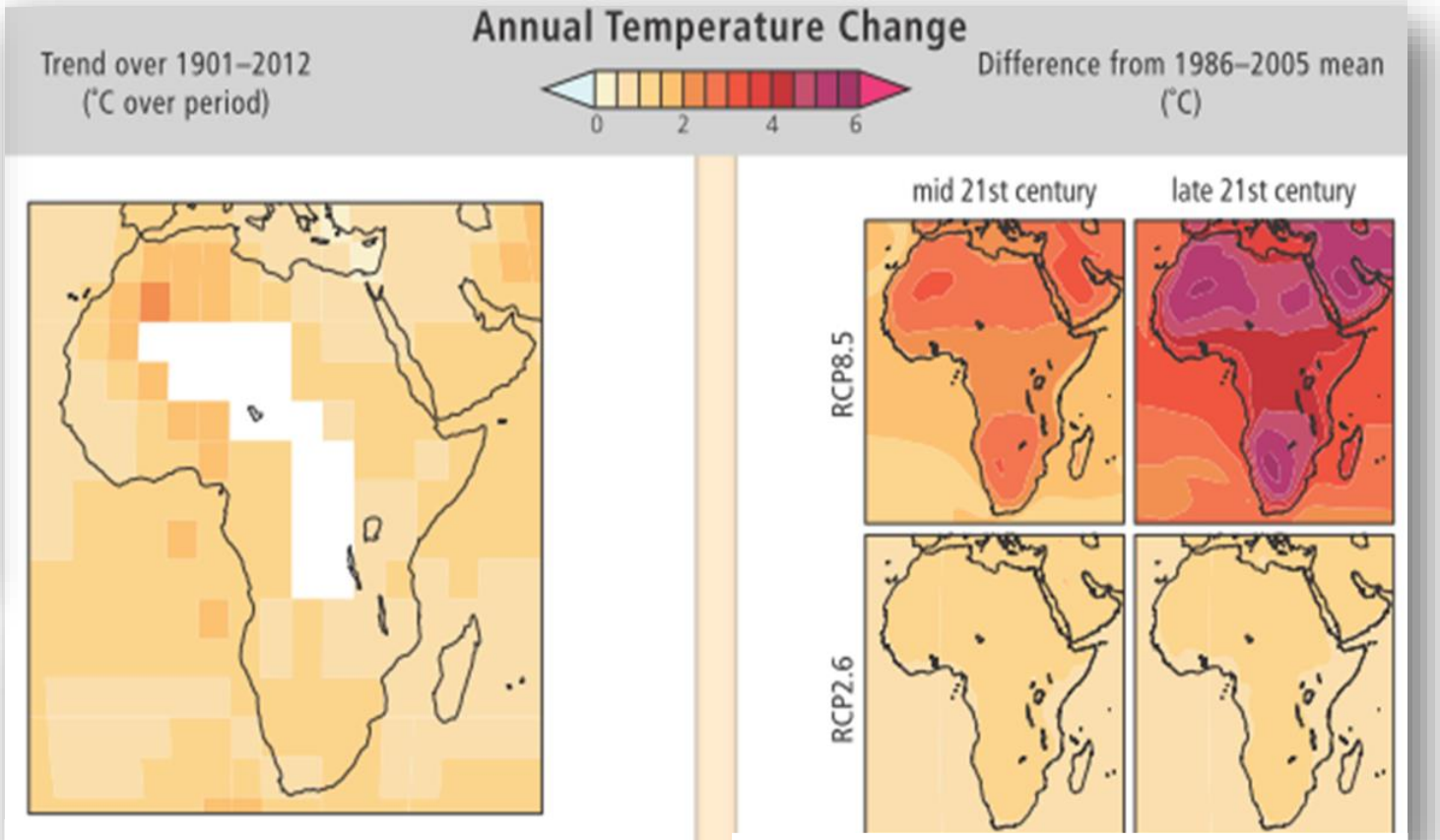


Rationale behind Ethiopia's landscape restoration via food-security interventions



This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO_2 has increased since the Industrial Revolution. (Source: NOAA)





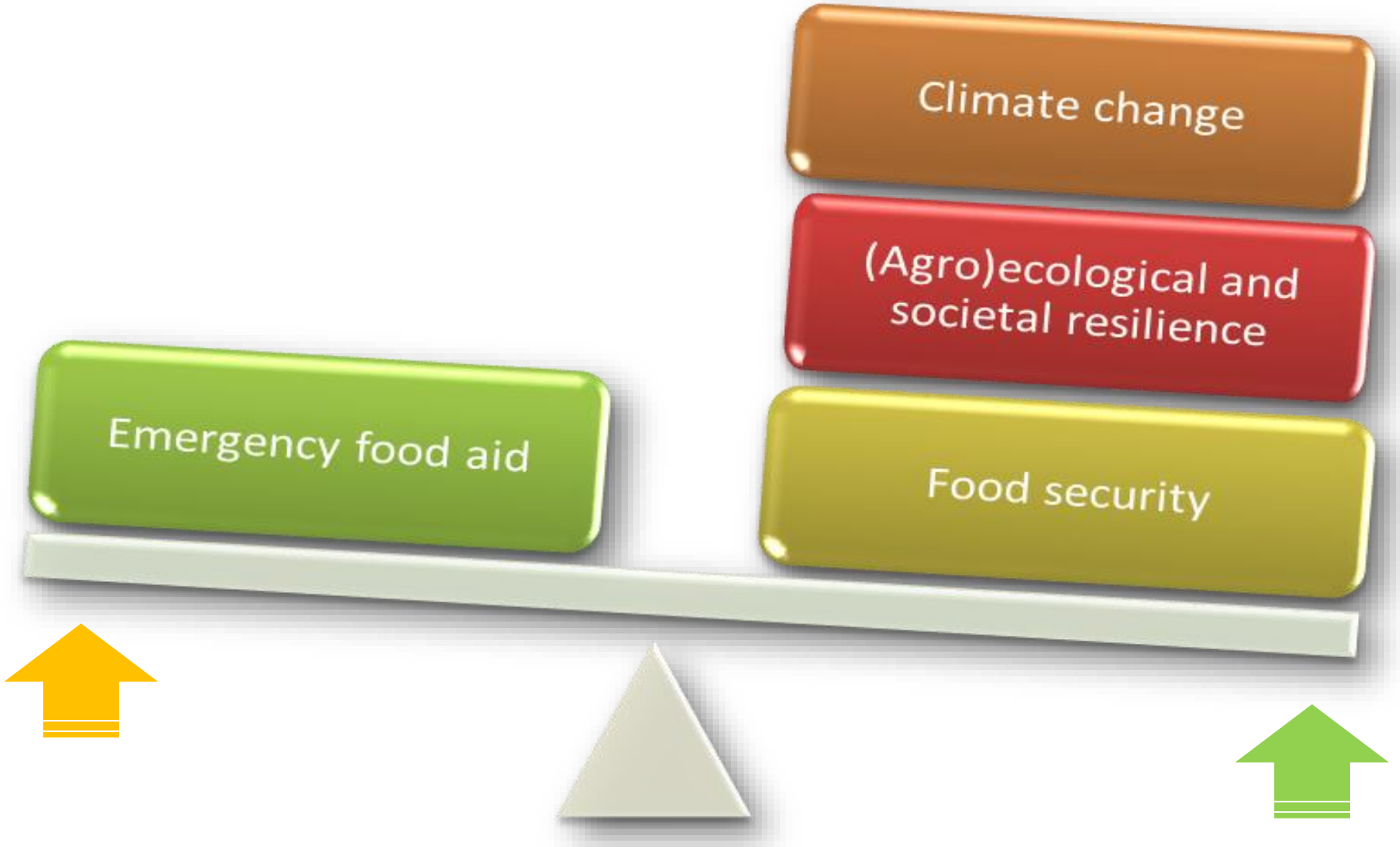
- Historical trends in Africa show 1.3°C increase

- > 2° C by mid-century
- 3 - 6° C by the end of the century

- Global average temperatures are likely to increase because of GHGs

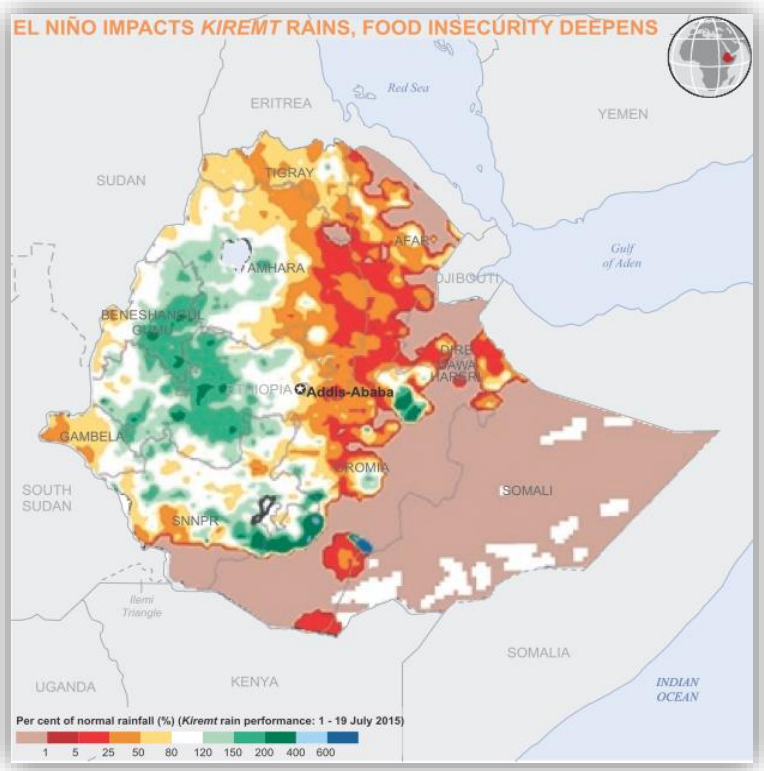
- **Climate change is predicted to increase frequency and severity of extreme weather events** (droughts and flooding) across Africa

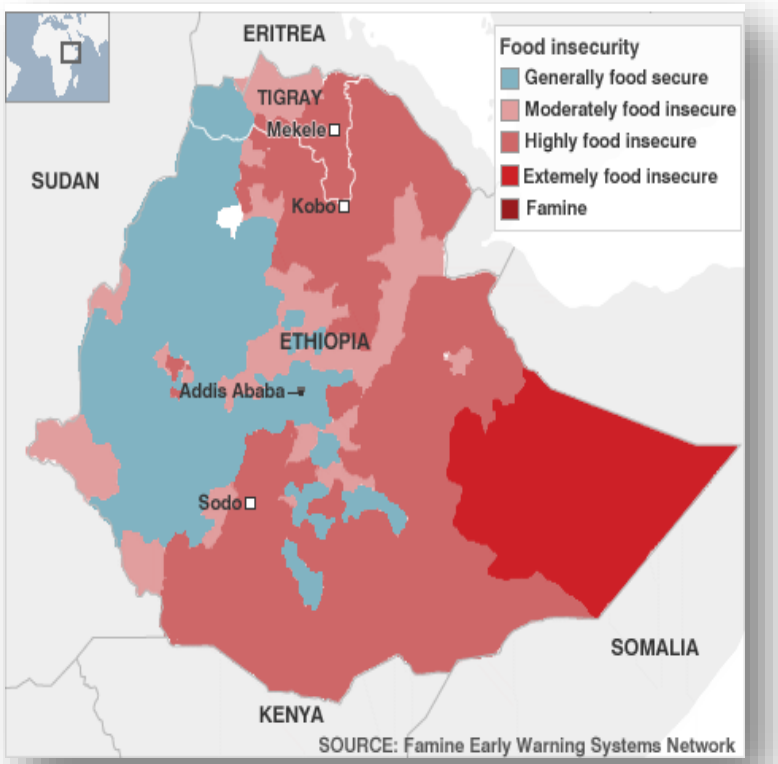
Past and current response to food insecurity in Ethiopia

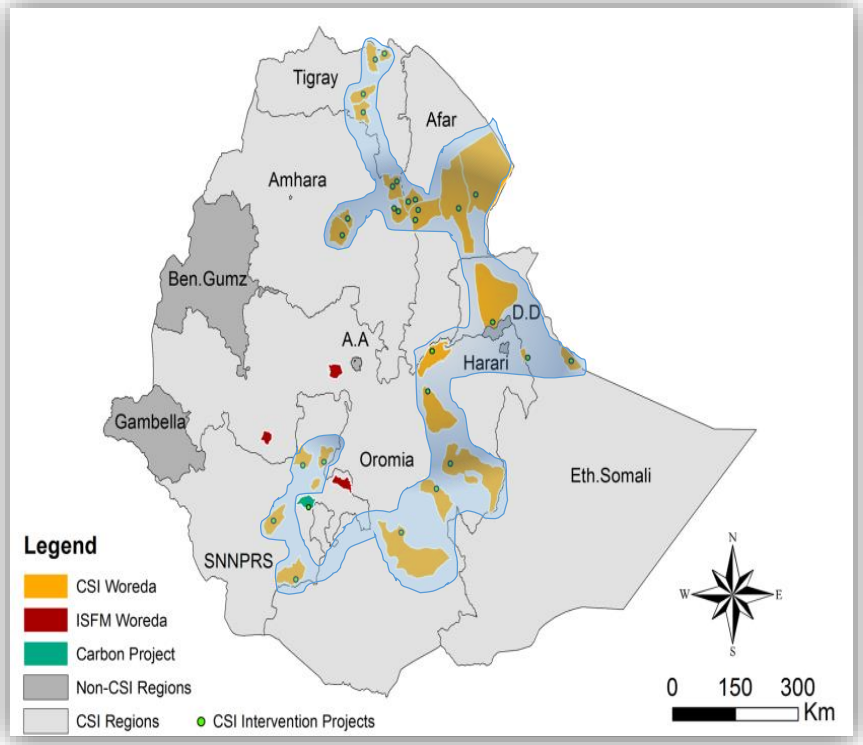


- Historical responses to chronic food insecurity
- Ethiopia's Productive Safety Net Program's (PSNP) climate smart initiative (CSI)

Ethiopia's PSNP landscape restoration sites







- Areas marked in red received <80% of expected rainfall in 2015
- Severe drought which affected crop production in the country

- Over 10 million people needed emergency food aid
- Extreme events are among key barriers to successful food production, food and nutrition security and stability

- PSNP project areas (implemented across six regions in **Ethiopia's food insecure and vulnerable corridor**)

Ethiopia's PSNP landscape restoration interventions

PSNP

- Food and cash transfers
- Disaster risk management
- Infrastructure
- Rehabilitation of degraded landscapes in watersheds

Soil and water conservation

- **Terraces**
- **Embankments**
- **Water-infiltration trenches,**
- **Wells and ponds**
- **Irrigation**
- **Drainage**

Climate-smart agriculture

- Organic amendments
- Improved varieties
- Diversified cropping systems
- Multi-purpose leguminous cover cops
- Multi-strata agroforestry systems

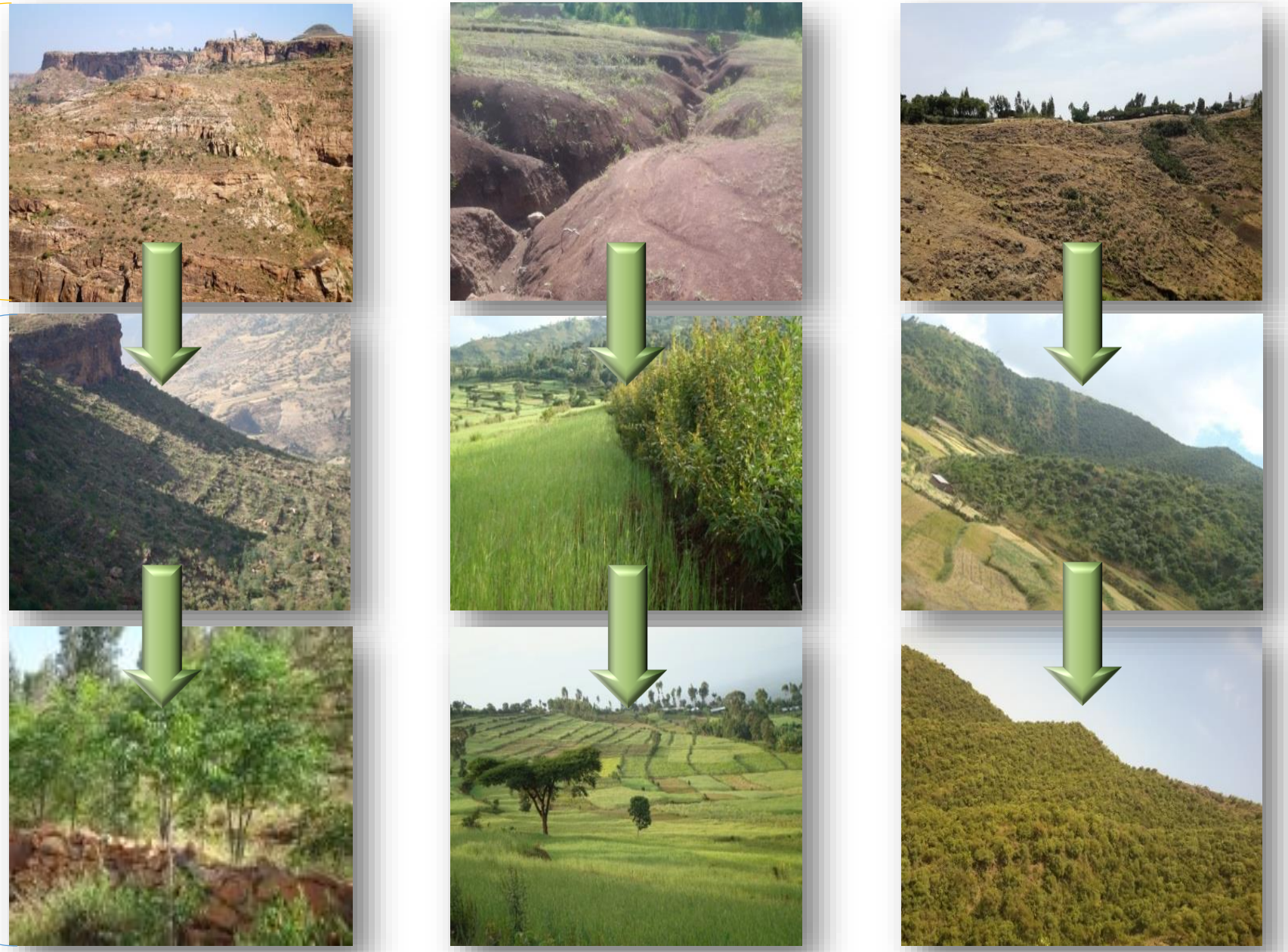
Sustainable land management

- **Land rehabilitation**
- **Area enclosures**
- **Natural regeneration**
- **Woodlots and forests**

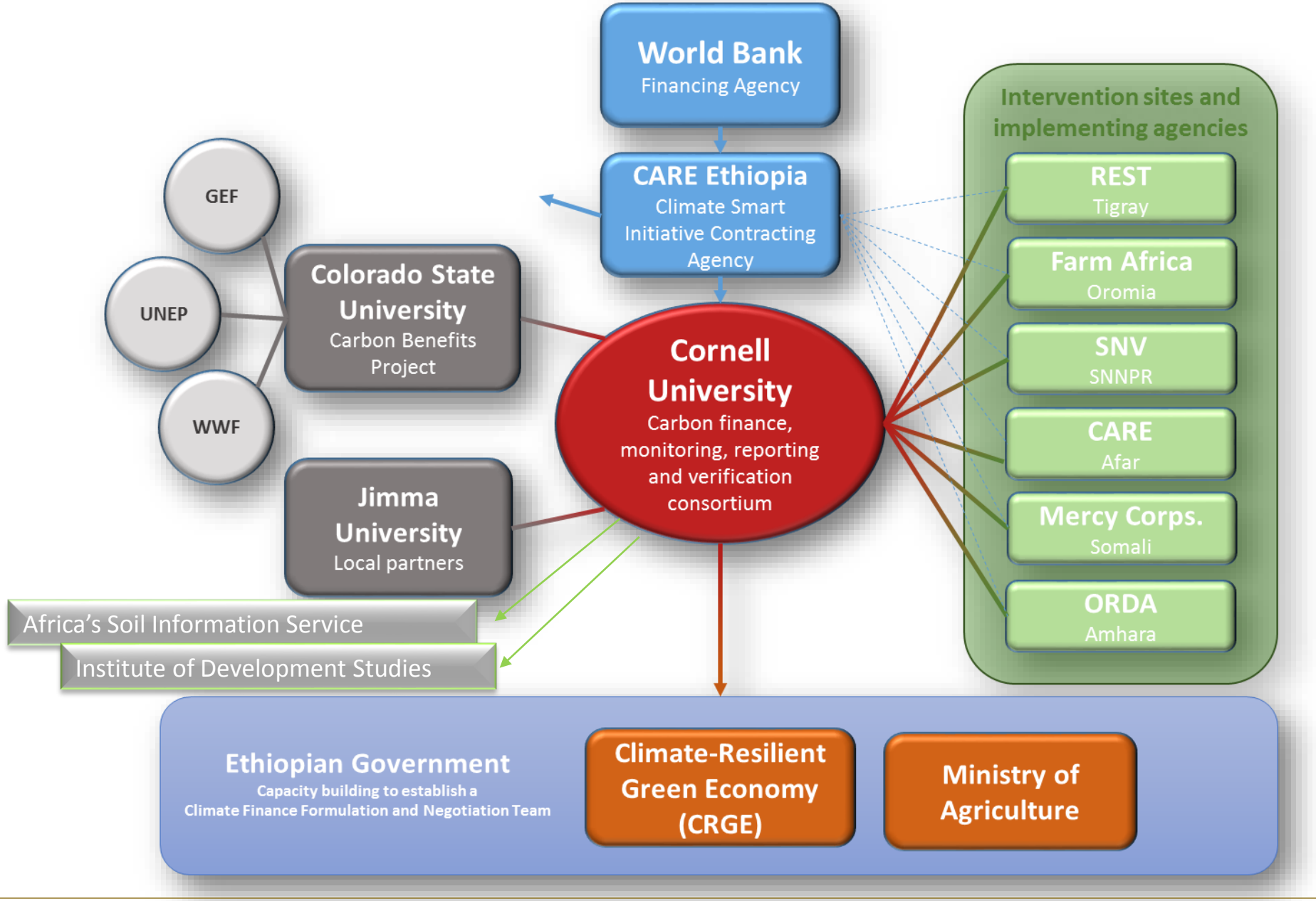
Ethiopia's PSNP landscape restoration sites

Business as usual

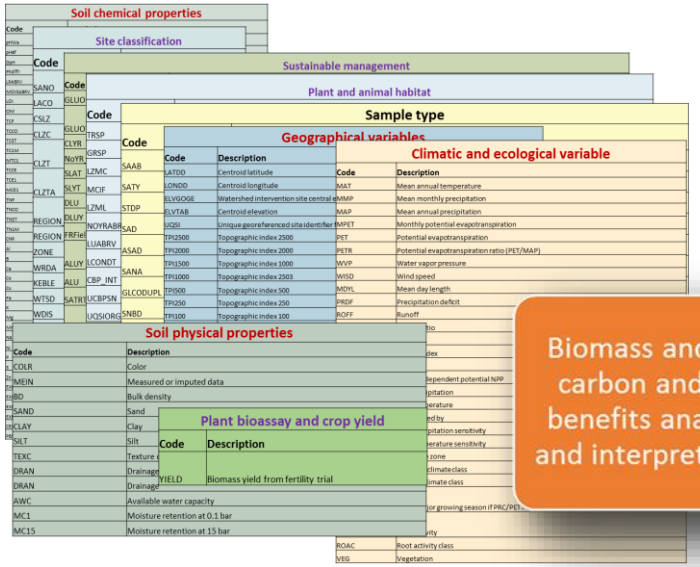
Project scenarios (ecosystem and eco-region specific implementation strategies and durations)



Strategic partnership – to evaluate resilience and climate-change mitigation co-benefit of Ethiopia's PSNP

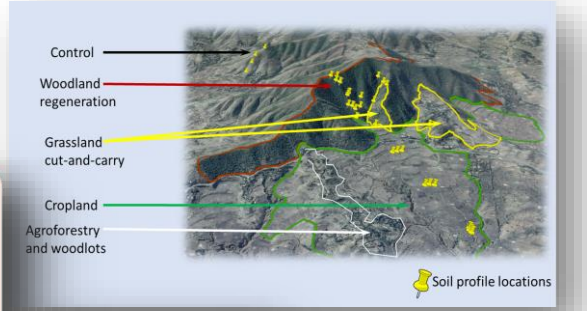


Strategic approaches – to evaluate resilience and climate-change mitigation co-benefit of Ethiopia's PSNP

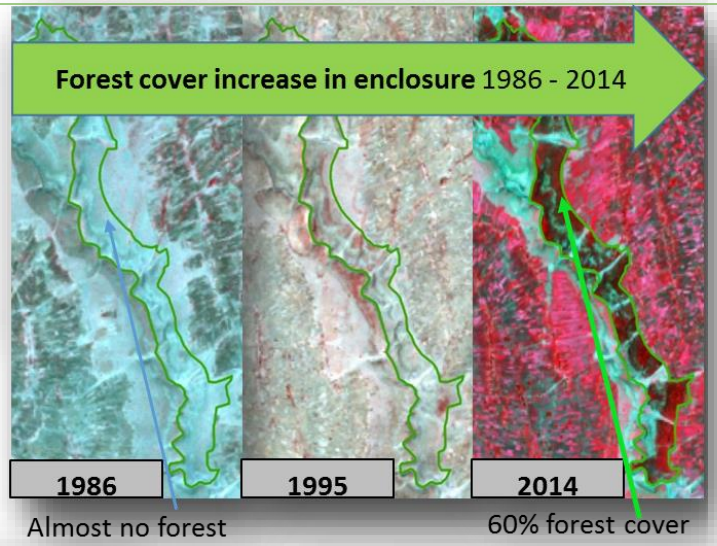


Biomass and soil carbon and co-benefits analysis and interpretation

Land management and biophysical survey and sampling

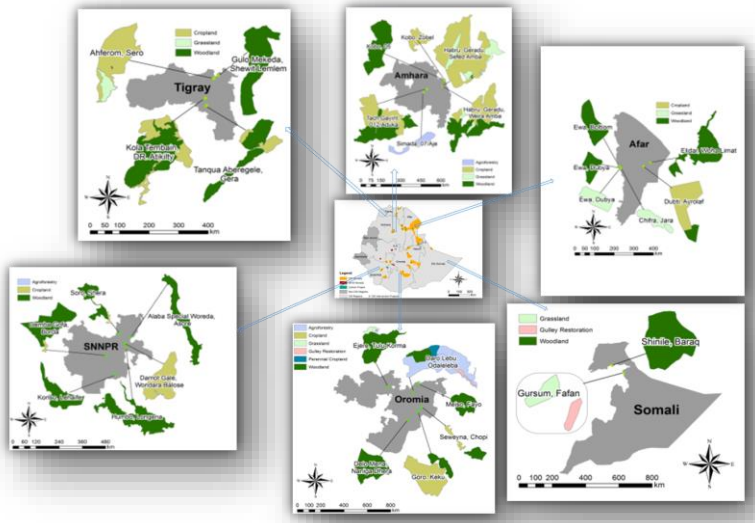


Geospatial analysis and interpretation



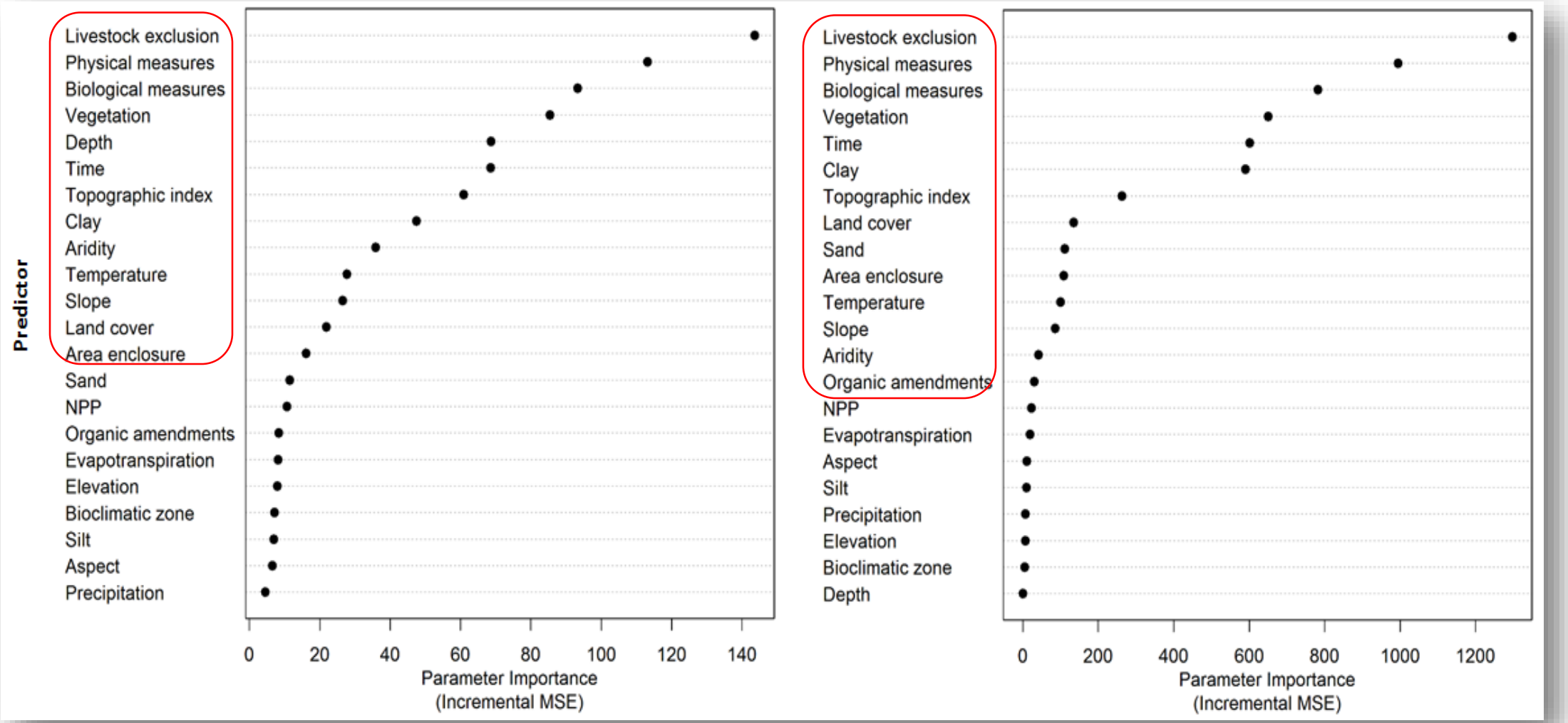
Modeling and verification of climate mitigation impacts

Carbon market analysis



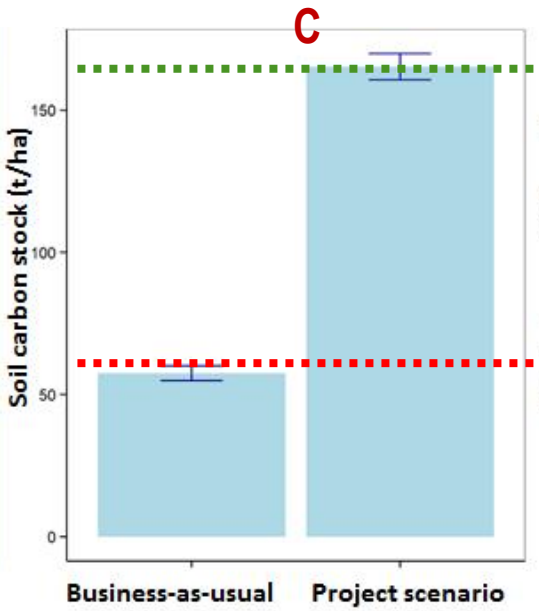
Policy

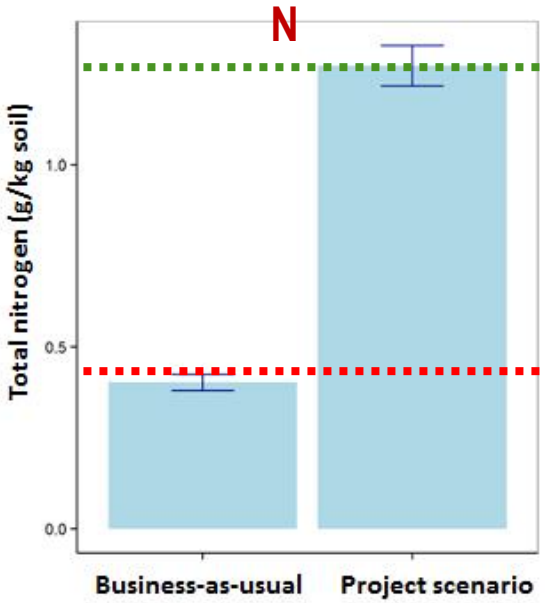
Predictors of carbon stock (sequestration - mitigation) and resilience co-benefits across land cover typologies

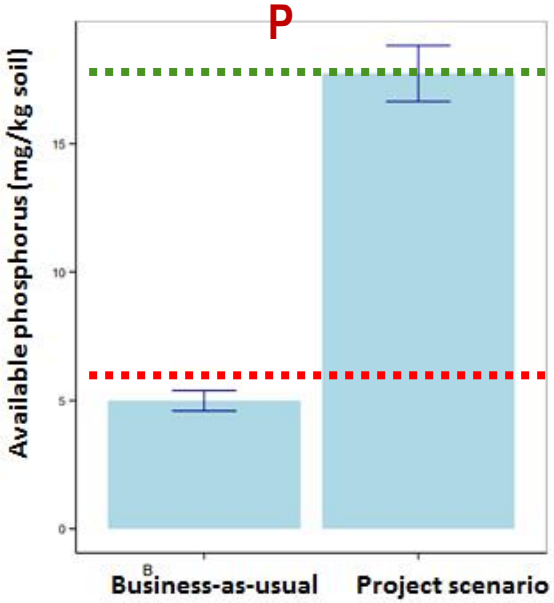


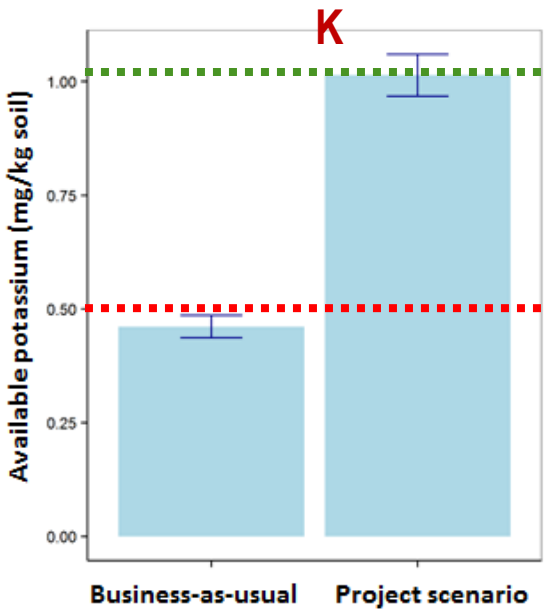
- **Relative importance** of parameter in surface layer (0-15 cm) and soil profile (up to 100 cm depth) soil carbon stocks
  - **Physical and biological soil and water management**
  - **Vegetation cover**
  - **Duration of management/implementation**

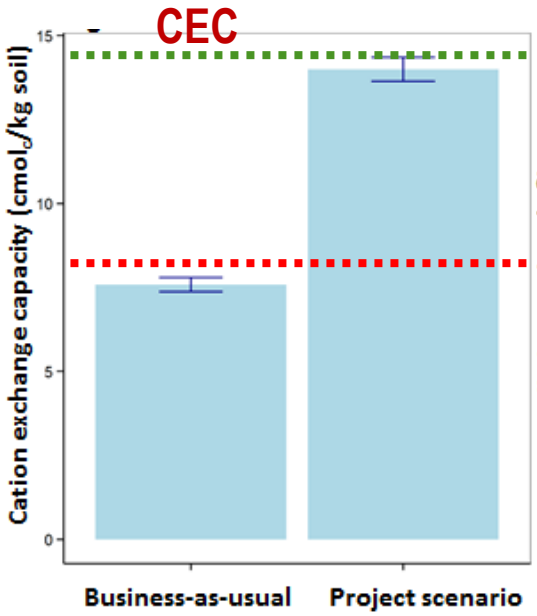
Soil carbon stock and soil fertility co-benefits under business-as-usual and project scenarios

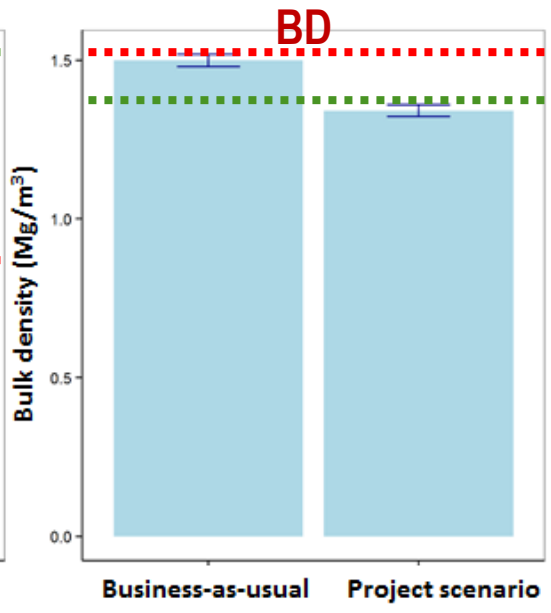


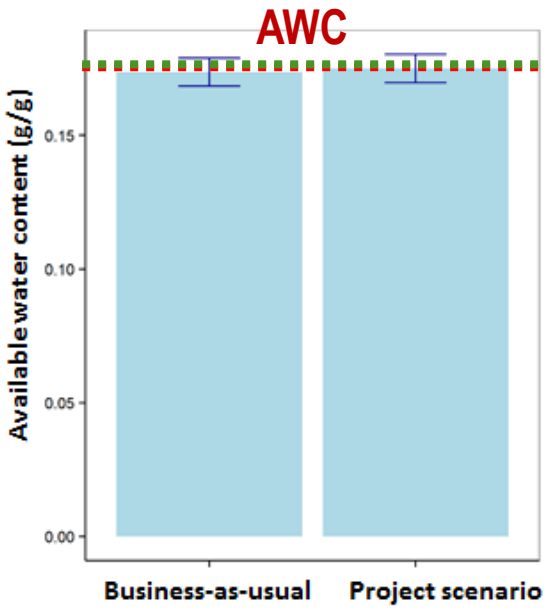




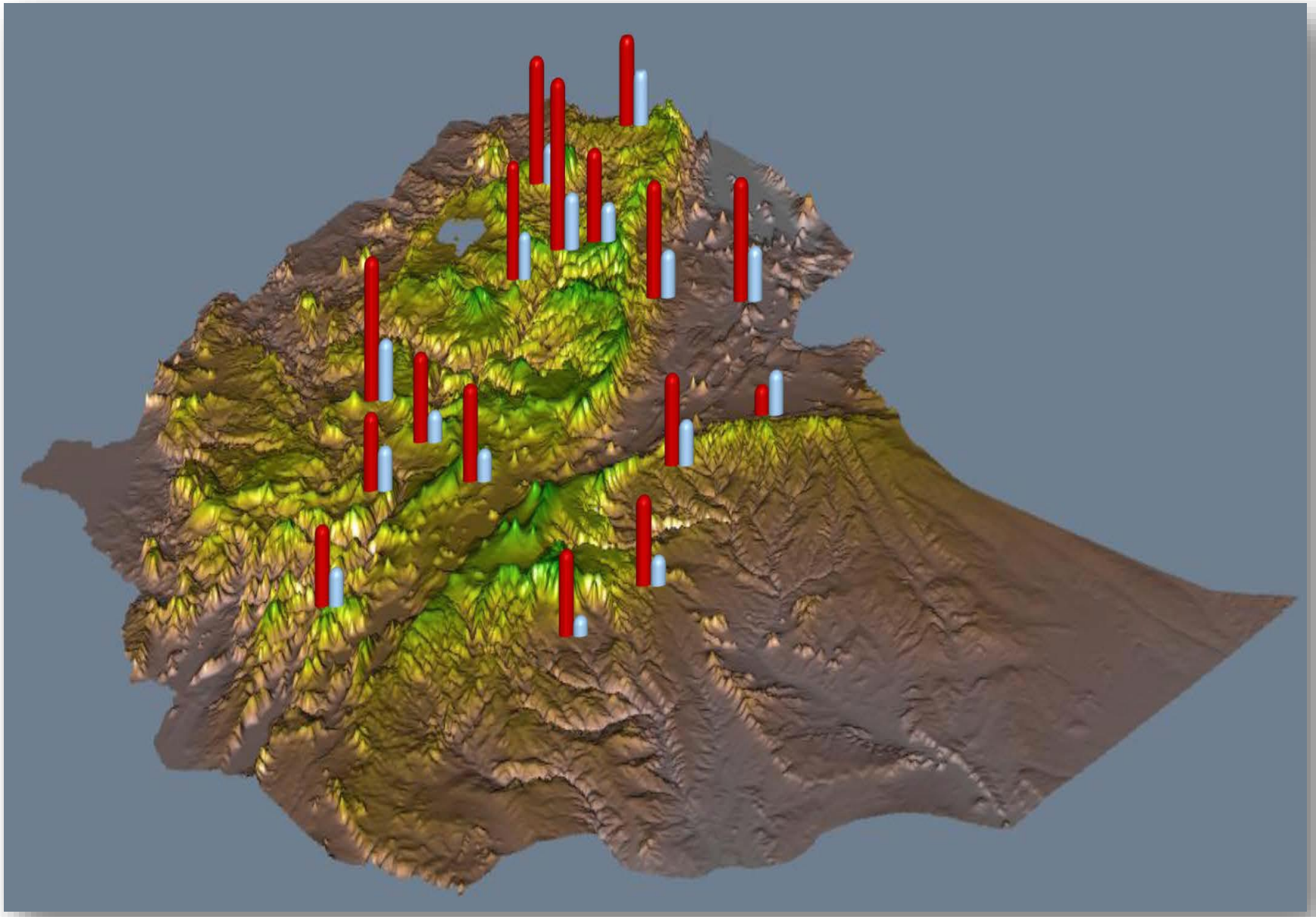








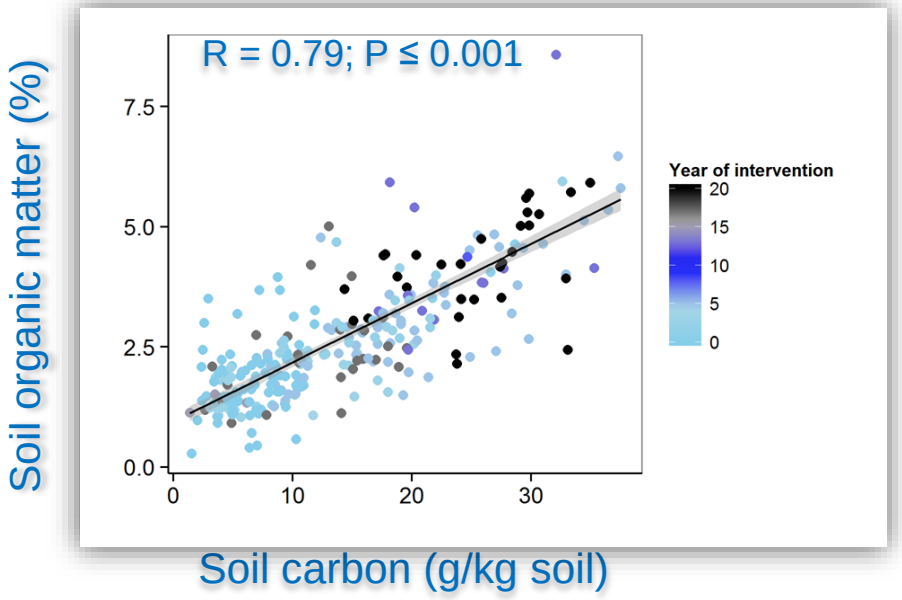
Soil carbon stocks co-benefits under business-as-usual and project scenarios

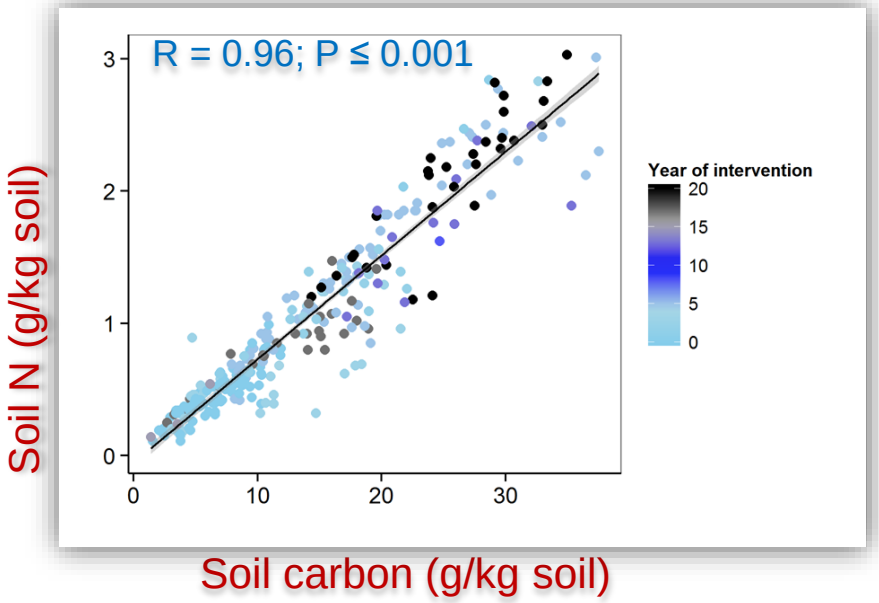


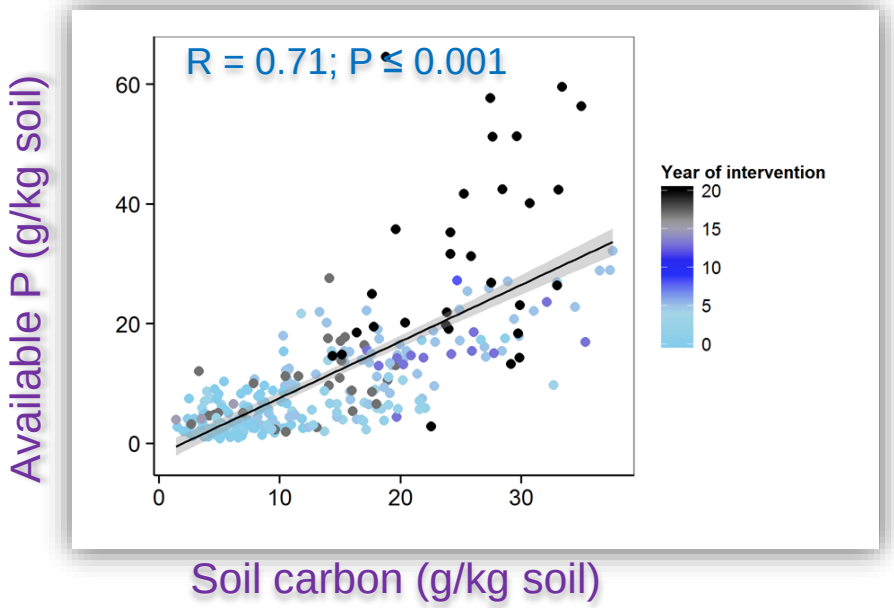
Project scenarios (PSNP sites) with up to 300% more soil carbon sequestration

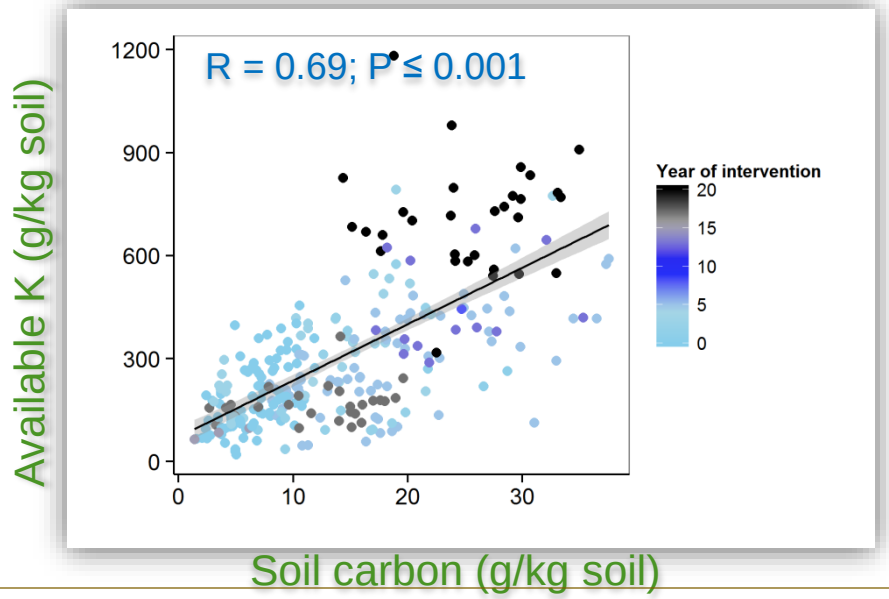
Business-as-usual (BAU)

Role of carbon stock for soil fertility co-benefits and resilience

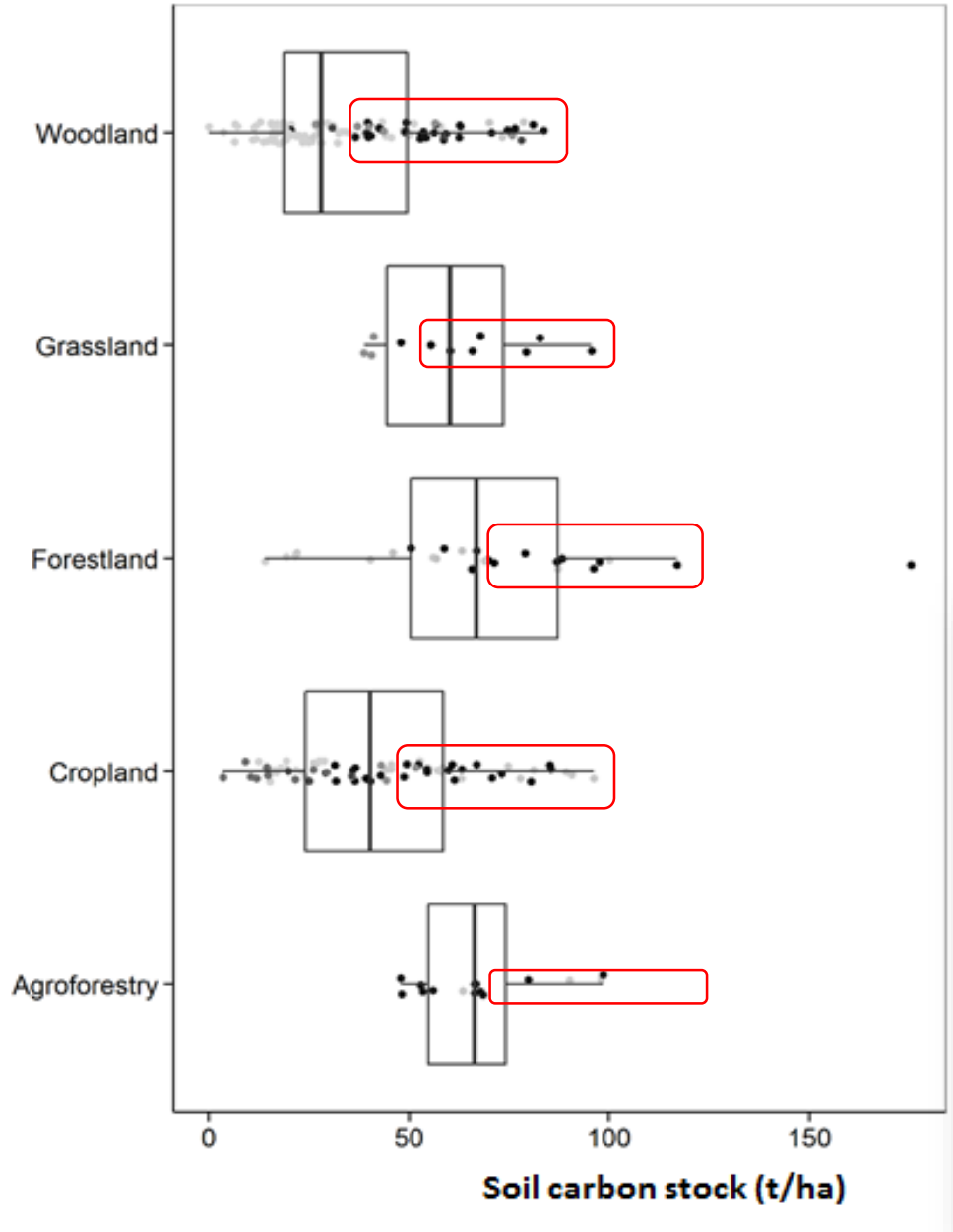




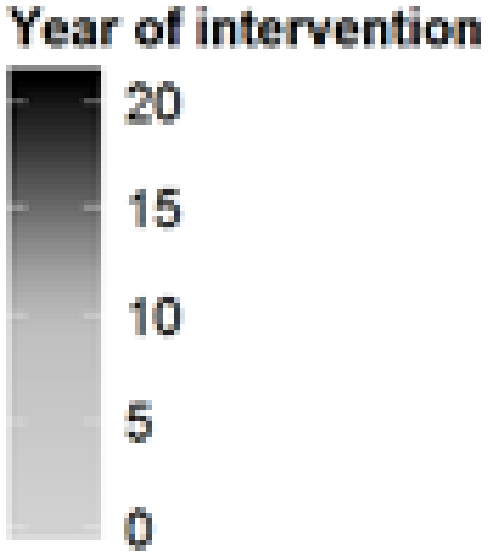




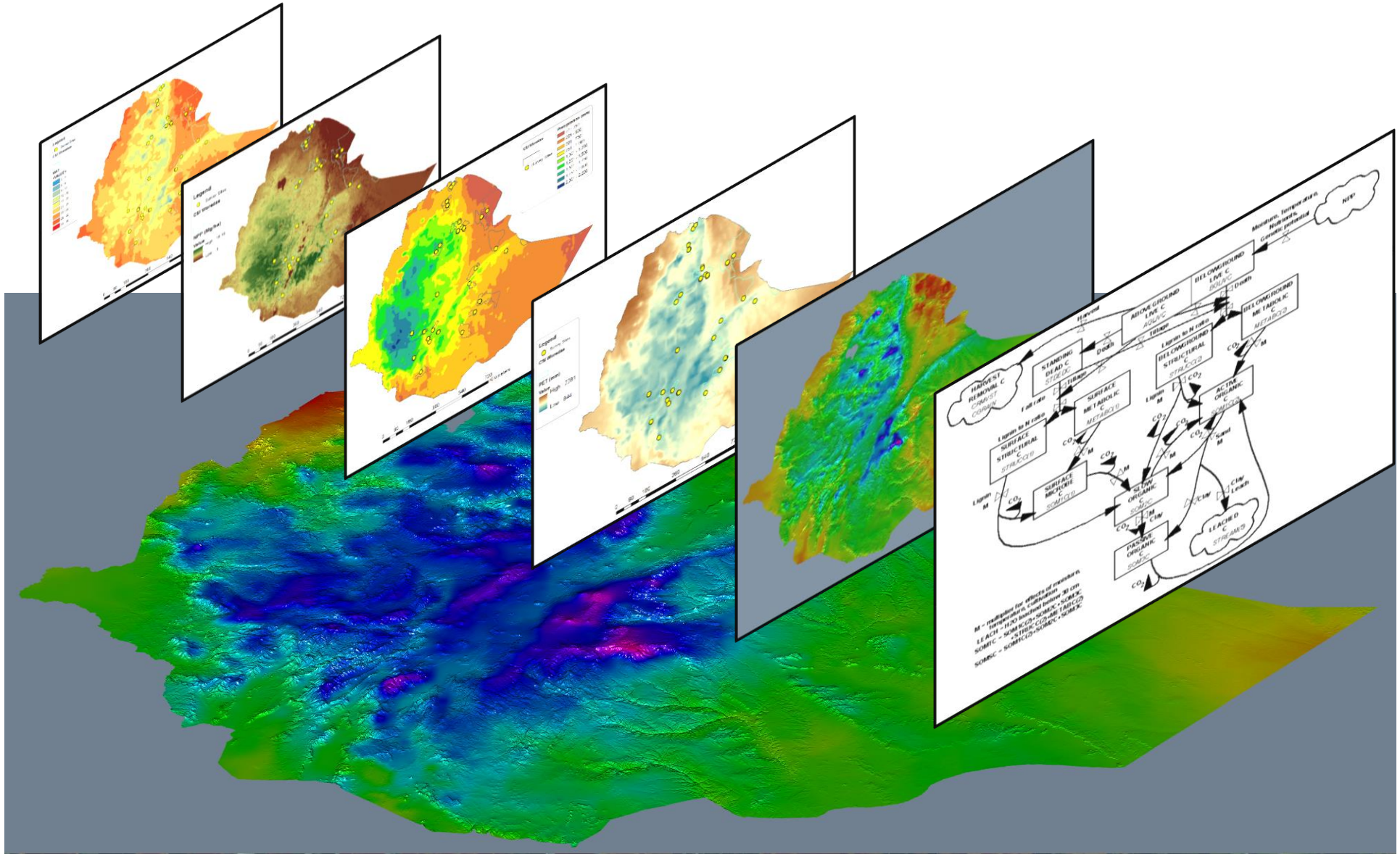
Soil carbon stock co-benefits across land cover typologies and duration of interventions



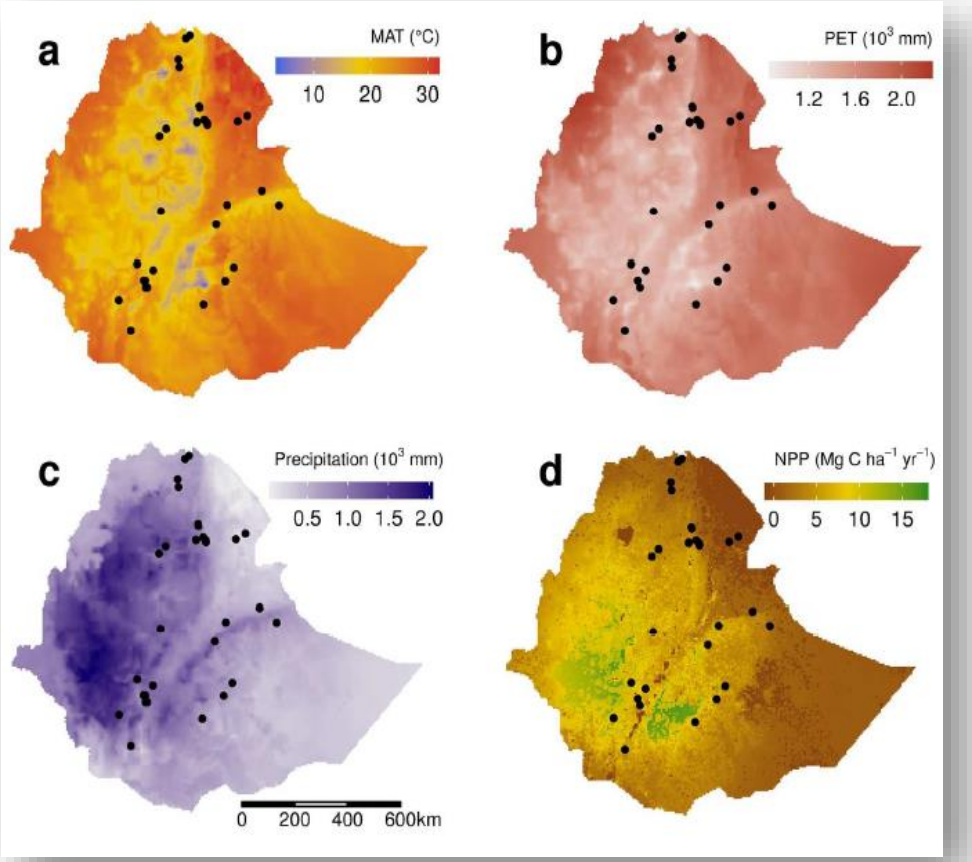
- Duration of implementation across each land cover typology is significant for enhancing soil carbon stock and sequestration
- **The longer the site is under land-based climate-smart integrated watershed management the more the benefits to mitigation and resilience building**
- **Projects and interventions need to morph into programs**



Geospatial data layers generated and related to carbon model



Emissions by land cover type ùnder business as usual and project scenarios



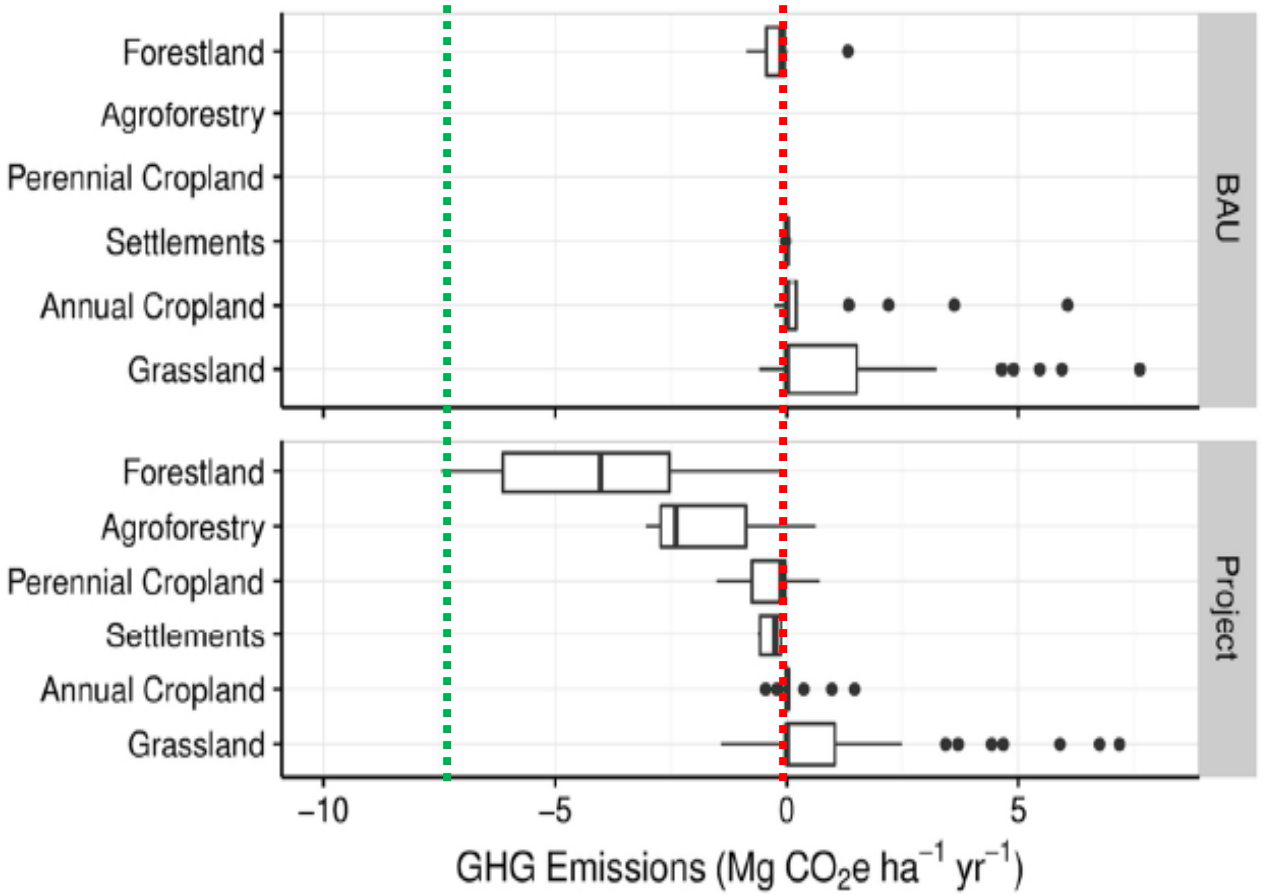
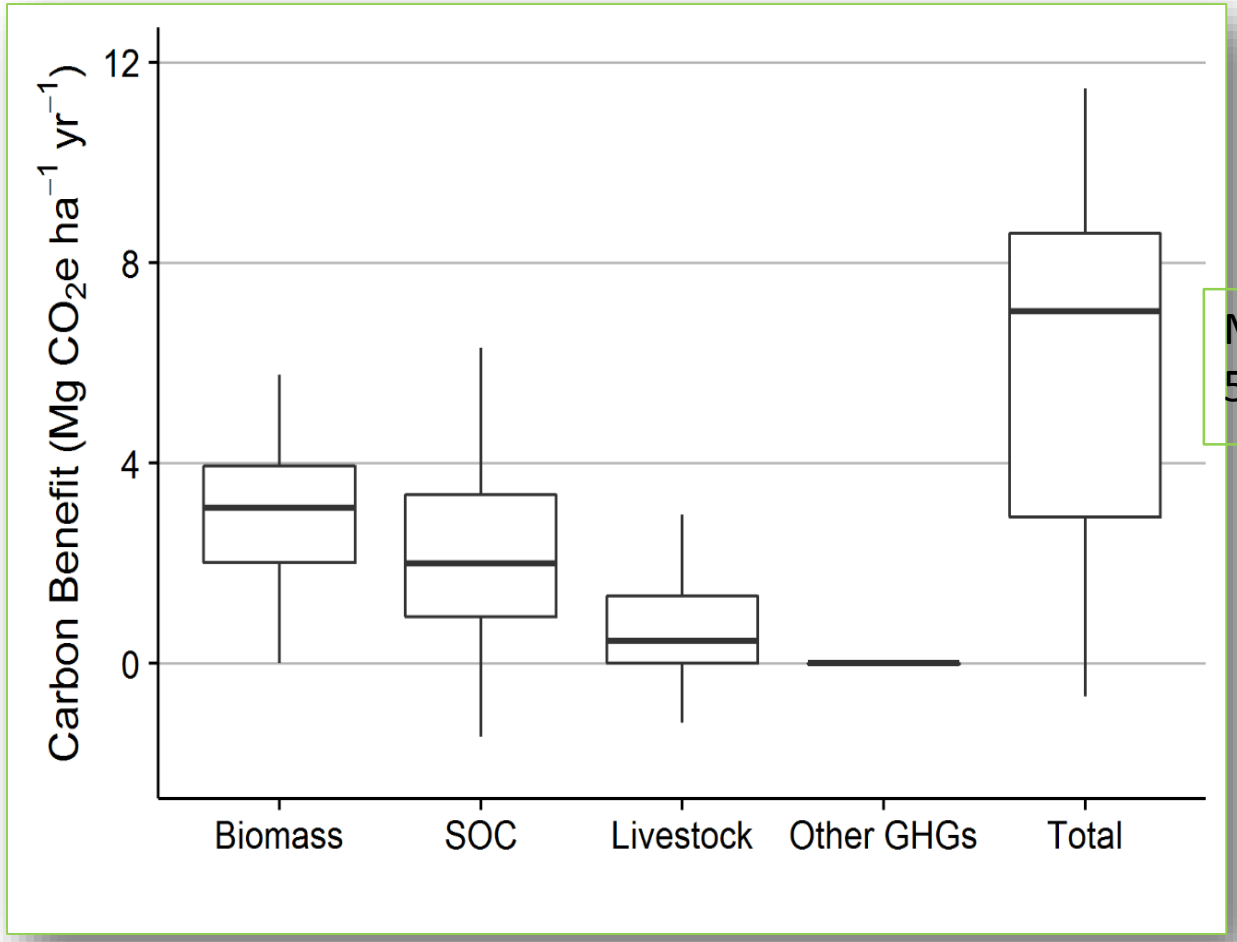


Figure 4: Net greenhouse gas fluxes from PSNP sites, aggregated by land use.

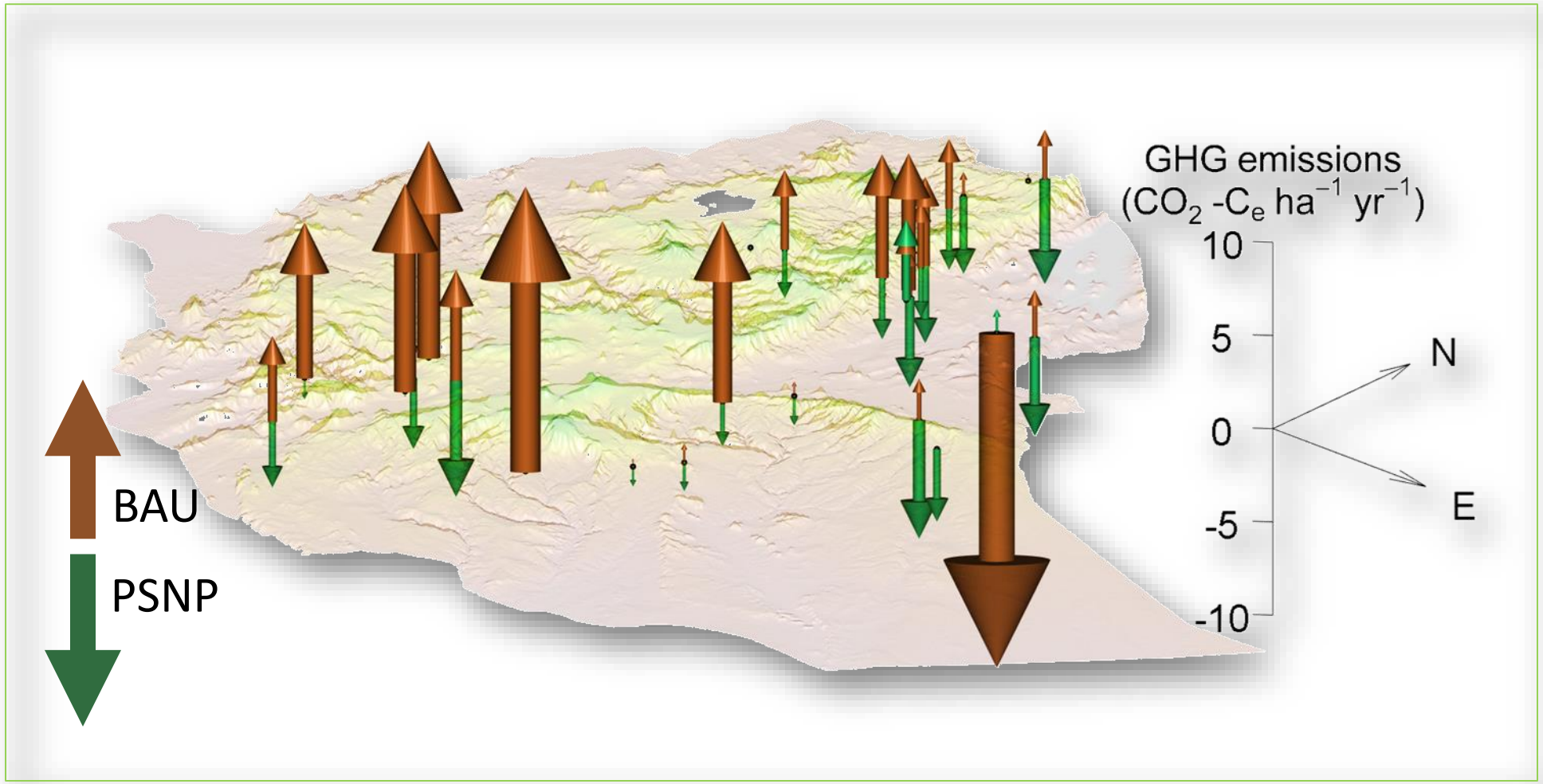
Carbon benefits aggregated over all project sites across Ethiopia



Mean carbon benefit:
5.7 tonnes CO_2e ha^{-1} yr^{-1}

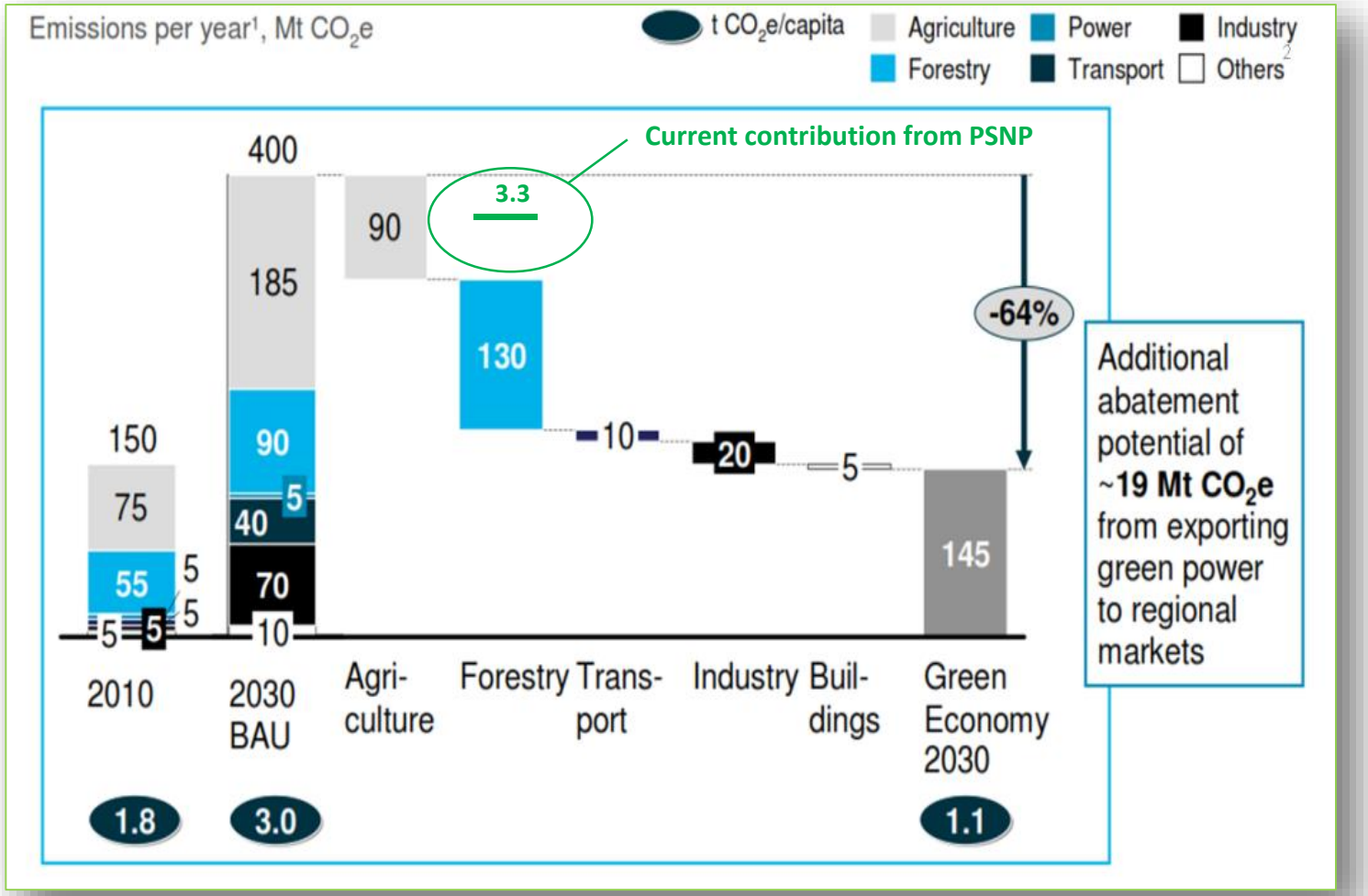
- Substantial variability between sites indicates potential to increase carbon benefits, by improved management and implementation

Spatial distribution of carbon fluxes over all the project sites



- **GHG emissions from BAU by far exceed from project scenarios thus mitigation co-benefits are being realized**
- Variability depends partly on biophysical, climatic, and ecological factors
- But, crucially, also on local management decisions, objectives and socioeconomic constraints
- Optimal management for balancing food security and climate change mitigation and adaptation must be responsive to local conditions

Contribution to Ethiopia's Nationally Determined Contribution (NDC)



- Ethiopia aims to reach middle income status by 2025 without increasing GHG emissions from 2010 baseline.
- Ethiopia's NDC p**lans to limit net GHG emission to 145 Mt CO2e in 2030**
- **Agriculture and forestry account for 86% of the abatement potential**
- PSNP provides 3.4 Mt CO2e yr-1 from just about 600,000 ha
- 1.5% of NDC
- **How far can this be scaled up?**
  - **Enhanced spatial extent?**
  - **Improved management?**
  - **Incentivizing it with other ways?**

Policy insights and take home message

- **Land-based food security interventions could restore extremely degraded and almost uninhabitable ecosystems in SSA**
- **Provide substantial climate-change mitigation co-benefit by creating a vehicle for investment in land and ecosystem restoration**
  - PSNP is on a scale comparable to the largest AFOLU projects in other parts of the world solely intended for climate mitigation
  - PSNP also offers other resilience related co-benefits including enhancing soil fertility and agricultural productivity at the national scale
- **Development partners and countries should develop and facilities strategies with ancillary climate benefits in food security sector**

- **Land-based food security interventions are crosscutting and transferable and could provide lessons to other programs beyond social safety net in SSA**
- **Enhancing food security and mitigating/adapting to climate change can be mutually supportive**
  - Scaling up and sustainability, however, is limited by available finance for food security interventions
  - Climate change mitigation co-benefits could potentially support sustainability and scalability via access to future climate finance

Policy insights and take home message

- **Land-based food security interventions could restore extremely degraded and almost uninhabitable ecosystems in SSA**
- **Provide substantial climate-change mitigation co-benefit by creating a vehicle for investment in land and ecosystem restoration**
- PSNP is on a scale comparable to the largest AFOLU projects in other parts of the world solely intended for climate mitigation
- PSNP also offers other co-benefits in terms of improved soil fertility and enhanced agricultural productivity at the national scale
- **Development partners and countries should develop and facilities strategies with ancillary climate benefits in food security sector**

- Design of such programs to maximize mitigation co-benefits, while enhancing but not compromising adaptation, resilience and food security objectives requires the following issues to be effectively addressed:
  - Climate variabilities and change, as well as adaptation and mitigation responses should be mainstreamed into planning and implementation at all levels
  - Cross cutting oversight that integrates disaster risk management, land restoration and climate change policy and implementation
  - Scaling up of projects from watershed level to entire jurisdictions in a manner that avoid leakage

- **Land-based food security interventions and approaches implemented as part of Ethiopia's PSNP are crosscutting and transferable, and could provide lessons and experience to other programs beyond social safety net**
- **Results show that enhancing food security and mitigating/adapting to climate change can be mutually supportive**
- Scaling up and sustainability, however, is limited by available finance for food security interventions
- Climate change mitigation co-benefits could potentially support sustainability and scalability via access to future climate finance opportunities