

Grassy ecosystem conservation will protect biodiversity, human livelihoods and underground carbon

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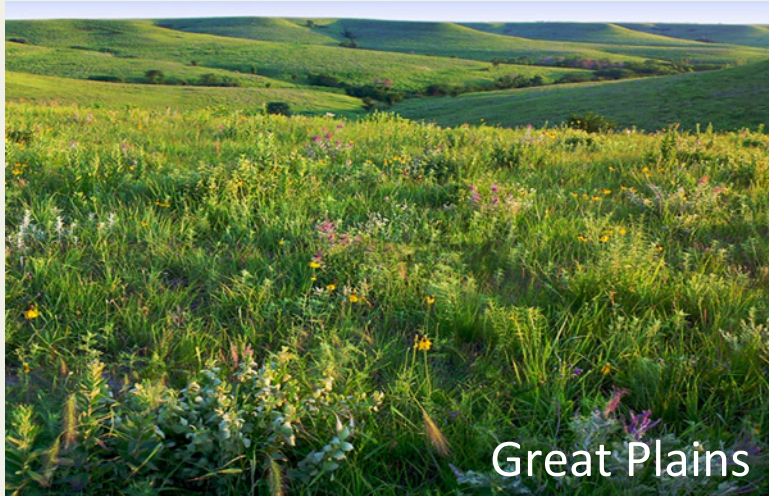
Many native ecosystems are grassy



Grasses fuel fire and feed herbivores, limiting tree dominance



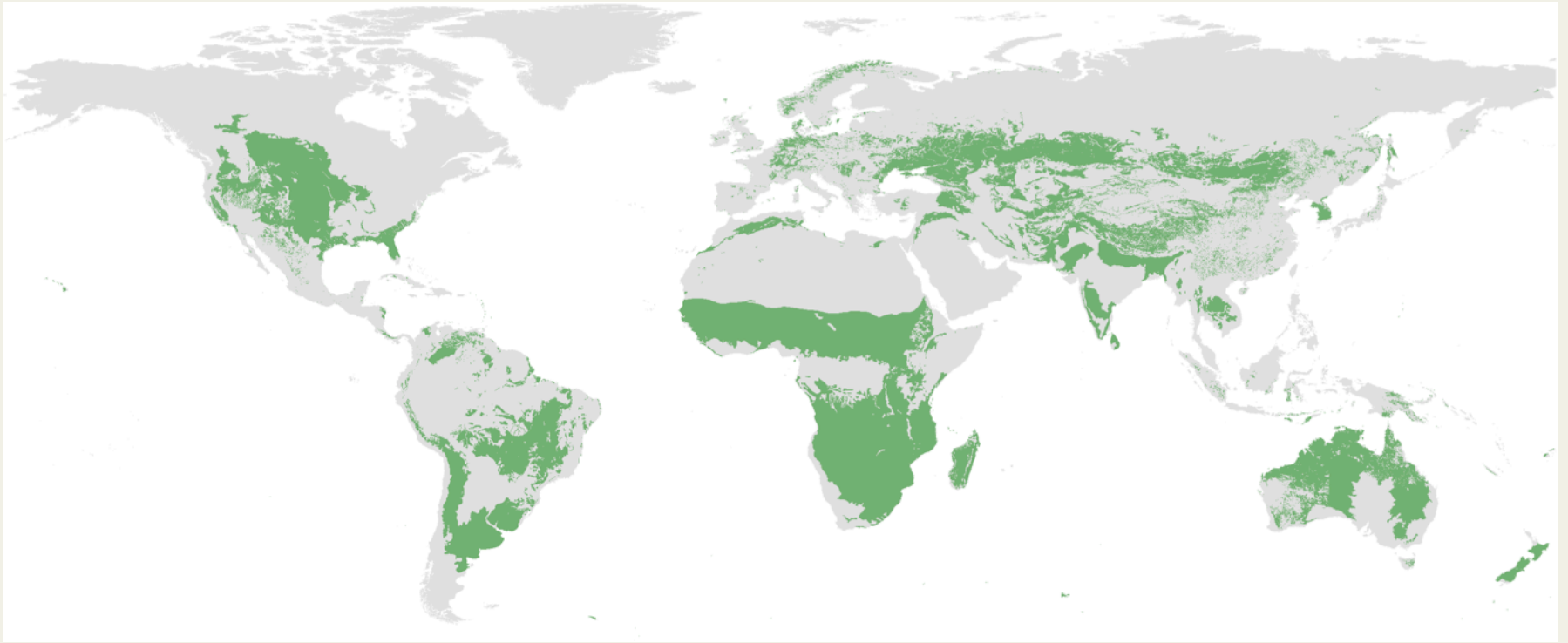
Savannas, woodlands and grasslands



Mosaics of grassy and woody vegetation



Native grassy ecosystems extend globally



NESCent Grasslands Working Group, unpublished

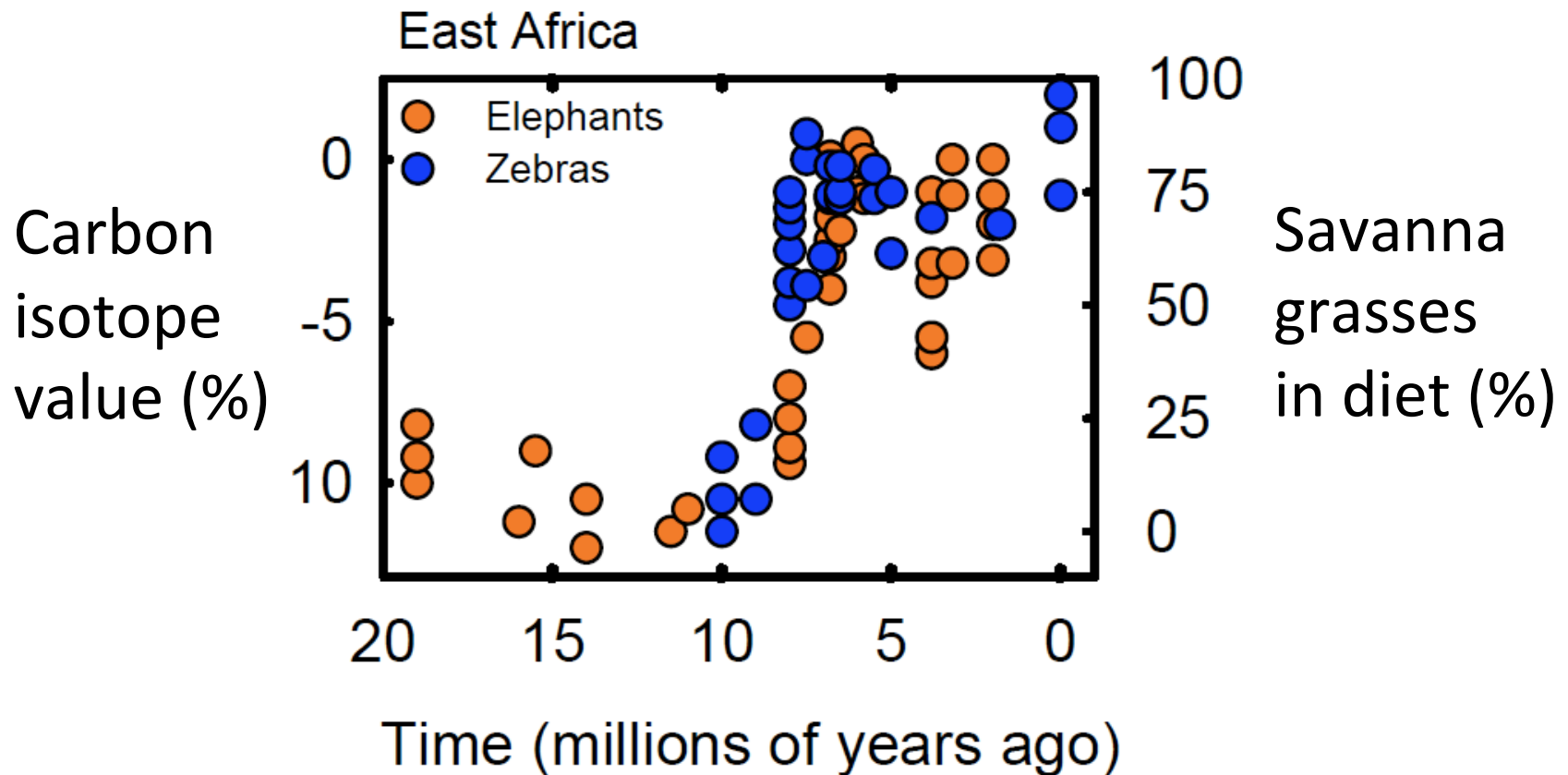
How old are these ecosystems?



Evidence from fossil teeth



Fossil teeth show grassy ecosystems are ancient



Humans evolved in savannas



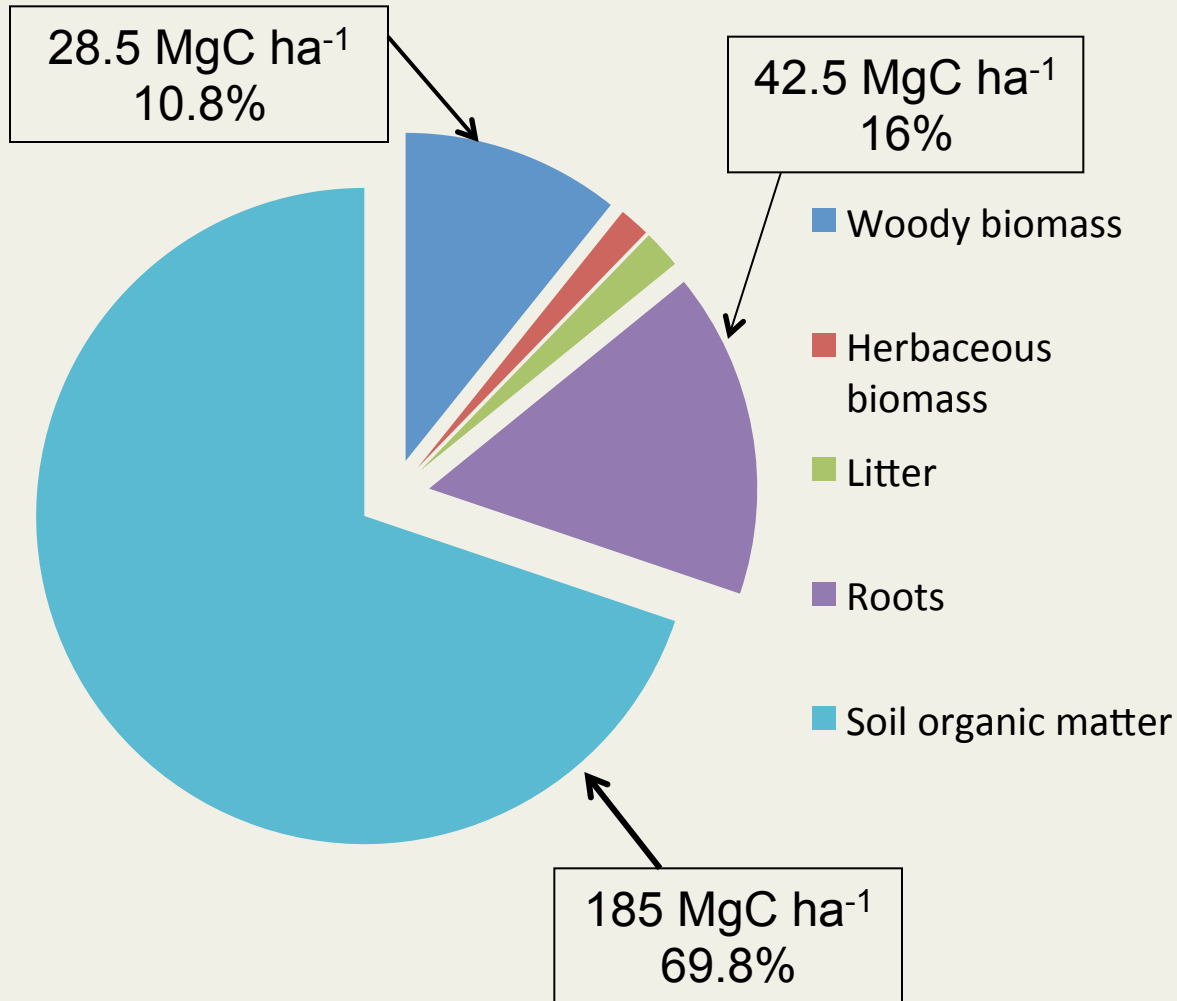
Carbon isotope ratios of fossil soils from African hominin sites (< 6myr) indicate majority are savannas (Cerling *et al.*, 2011. *Nature*)

What's the value of native grassy ecosystems compared with forests?



Carbon stocks in a typical Cerrado

Vegetation + **soil** (up to 1 m depth)= 265.0 Mg C ha⁻¹



Water resources

Headwaters of important hydrological basins
= water supply for millions of people:

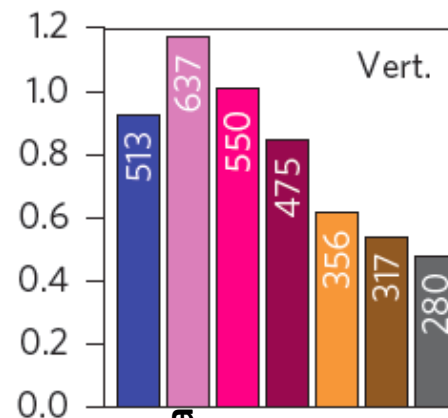
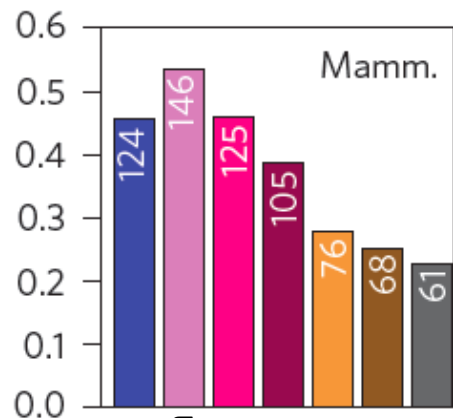
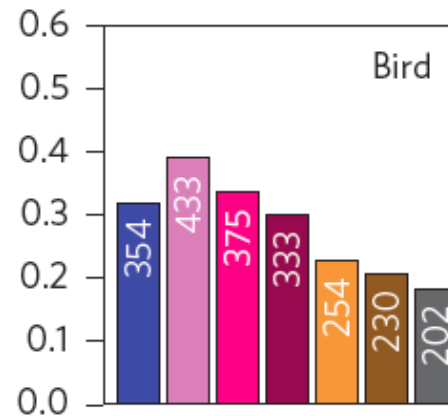
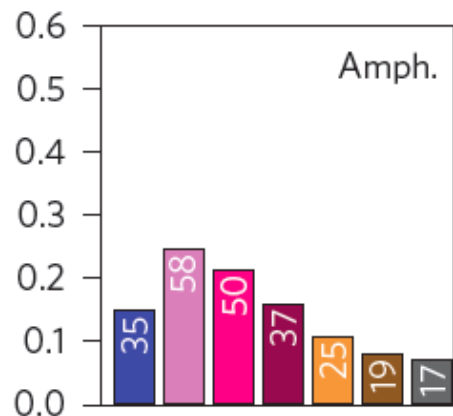
River basin (% in Cerrado)

- 1. Araguaia- Tocantins (78%)
- 2. São Francisco (50%)
- 3. Paraná (48%)



Similar biodiversity to tropical wet forest

**Standardized
diversity**



Guinea Savanna
Cerrado Savanna
Tropical Forest
Similar climate
Similar rainfall
Global Savanna
Global average

Guinea Savanna
Cerrado Savanna
Tropical Forest
Similar climate
Similar rainfall
Global Savanna
Global average

Social and economic benefits



- Pasture for grazing domestic animals
- Firewood harvesting + charcoal production
- Charismatic animals bring tourism revenue

Deforestation can lead to degraded grassy vegetation



Degraded grassy vegetation can arise in other ways



Abandoned agriculture, old field,
arrested succession
Photo: J. Veldmann

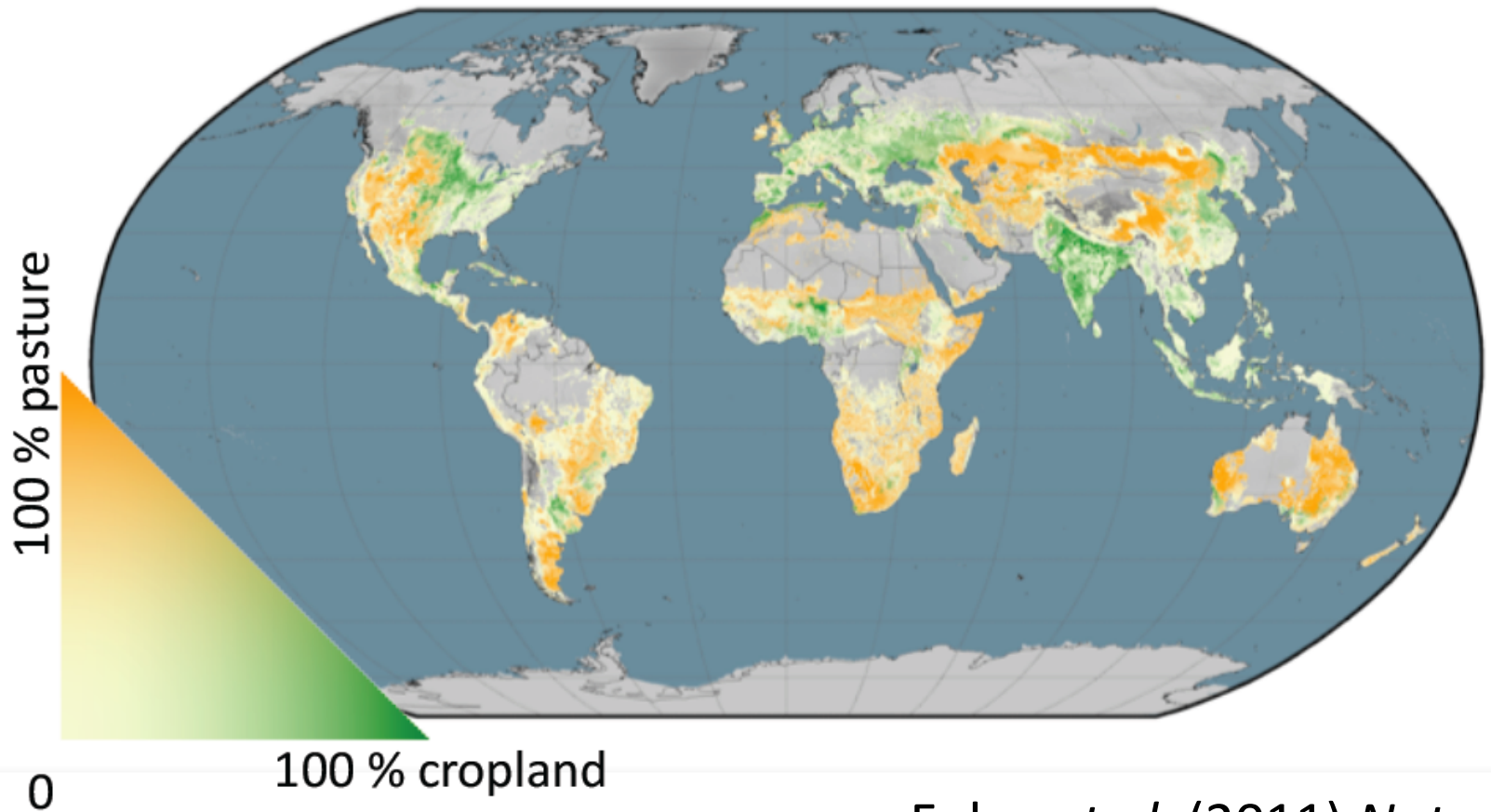


Secondary grasslands after
removal of pine plantation
Photo: E. Buisson

Threats to native grassy ecosystems



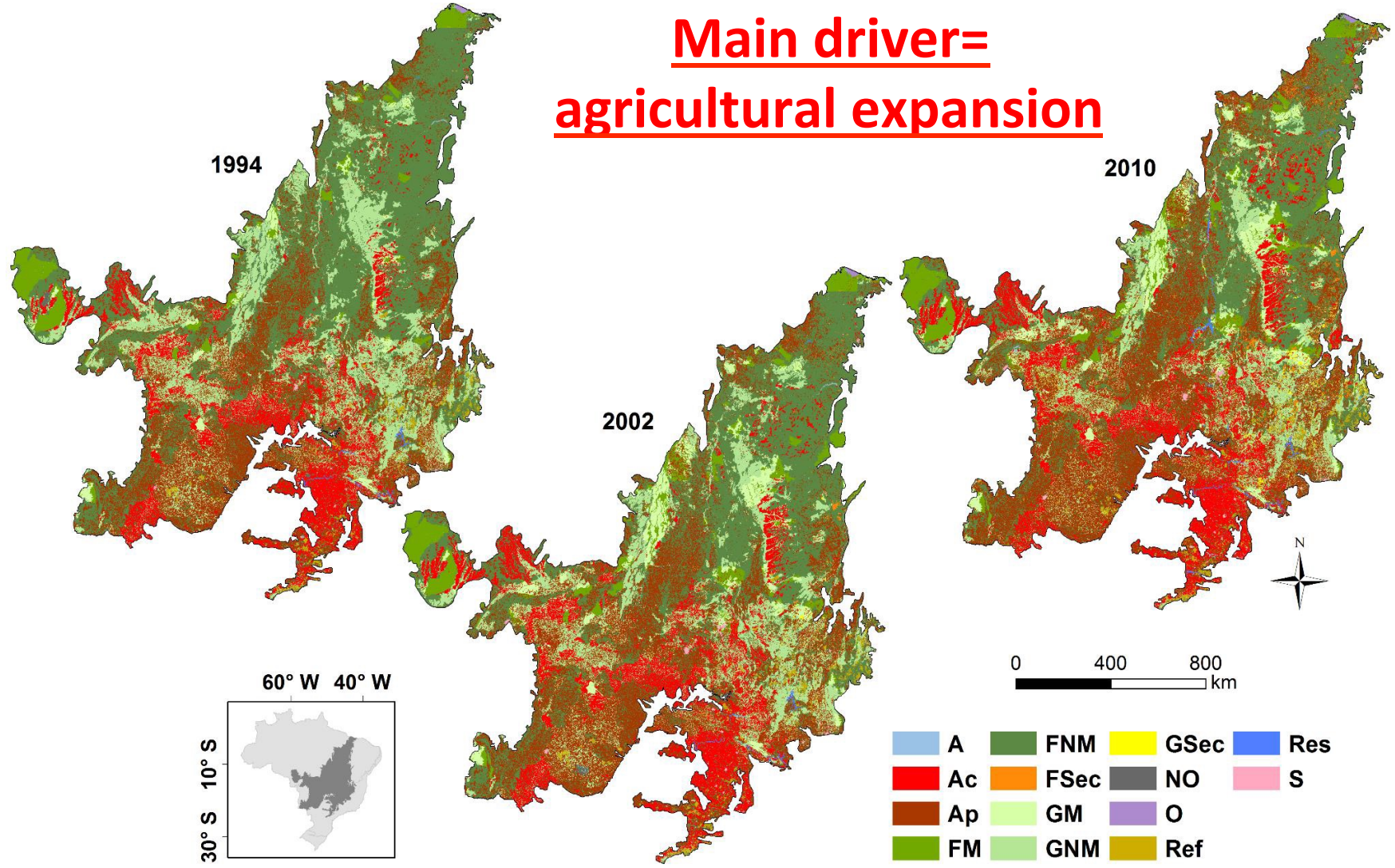
History of agricultural conversion



Foley *et al.* (2011) *Nature*

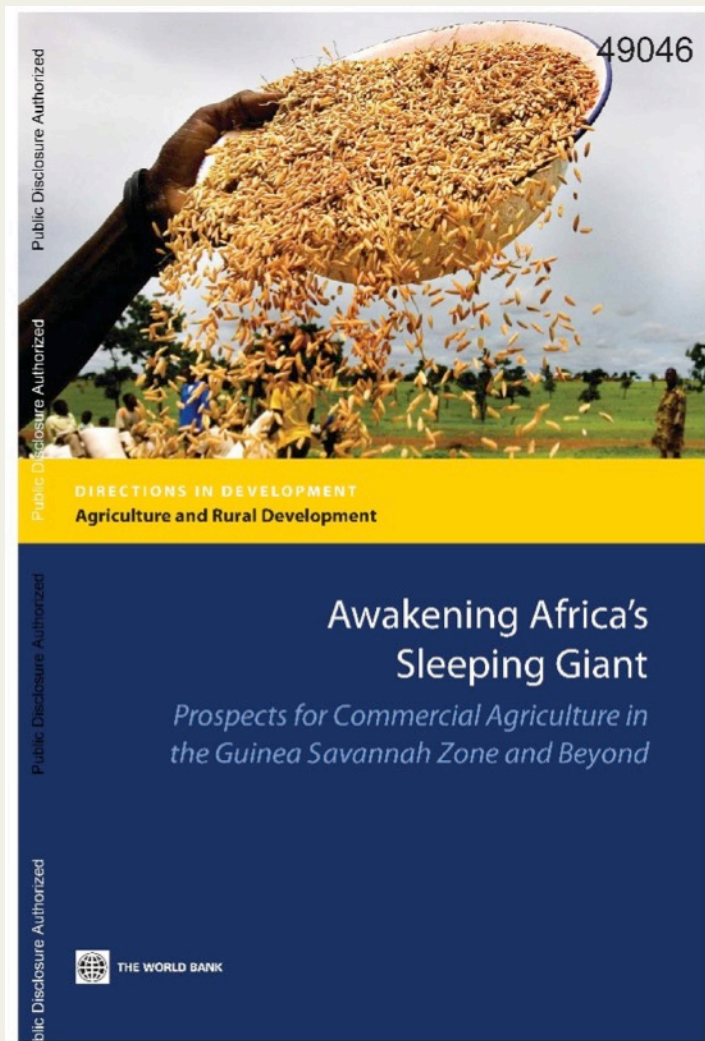
Recent agricultural conversion

Main driver=
agricultural expansion



Data: 3rd National Inventory of GHG, MCTI

Future agricultural conversion?



WORLD AGRICULTURE TOWARDS 2030/2050

The 2012 Revision

Nikos Alexandratos and Jelle Bruinsma
Global Perspective Studies Team

ESA Working Paper No. 12-03

June 2012

Agricultural Development Economics Division

Food and Agriculture Organization of the United Nations

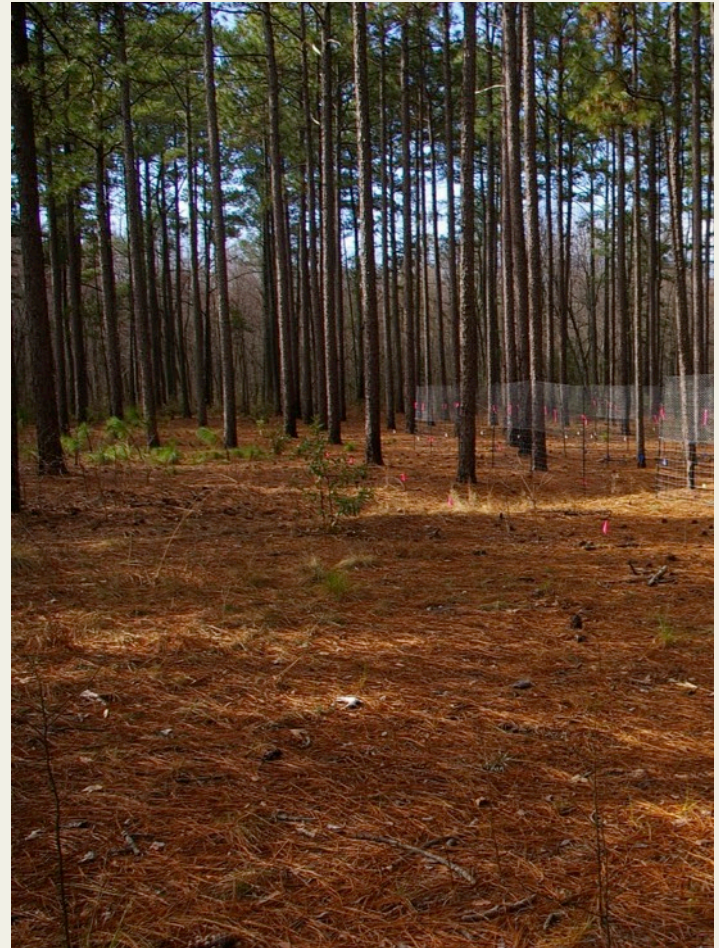
www.fao.org/economic/esa



Native grassy ecosystems take centuries to recover from clearance



Old-growth pine savanna USA

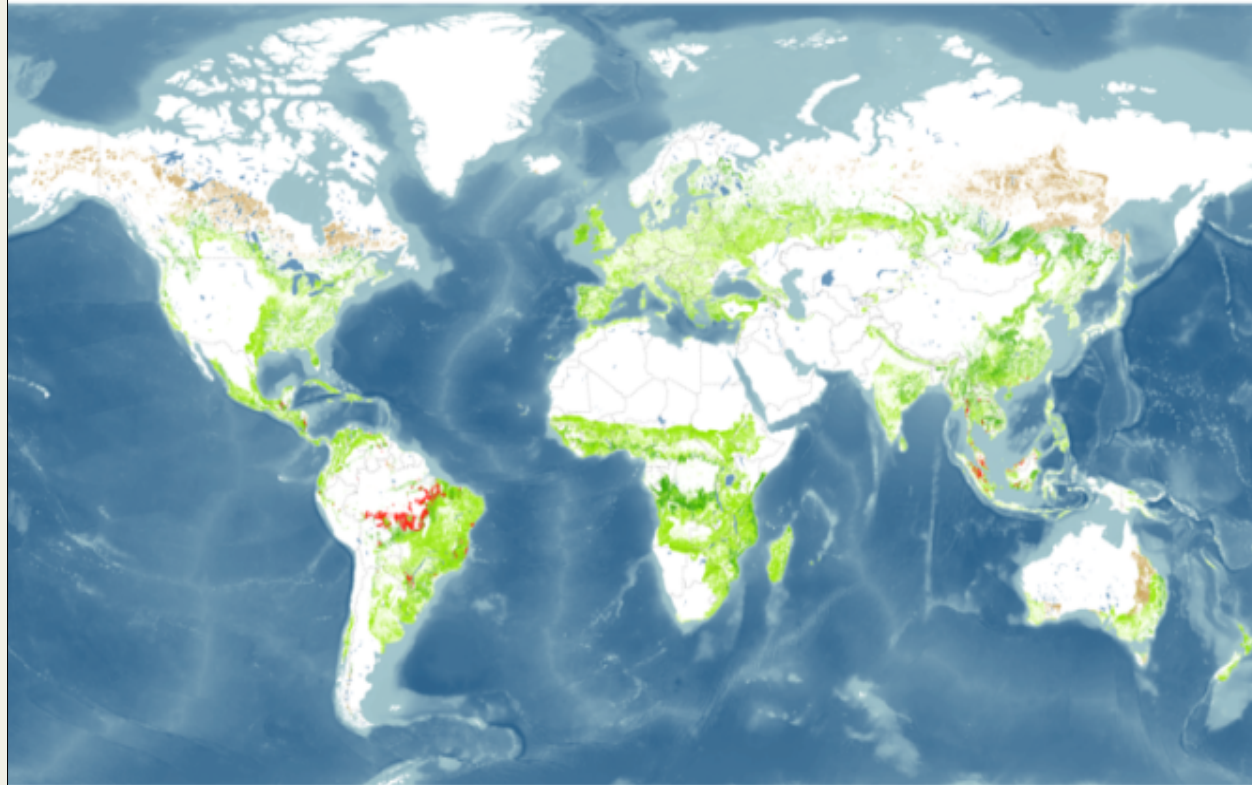


Degraded savanna - 90 yr after agriculture




Afforestation: opportunity or threat?



A World of Opportunity for Forest and Landscape Restoration



FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES

-  Wide-scale restoration
-  Mosaic restoration
-  Remote restoration

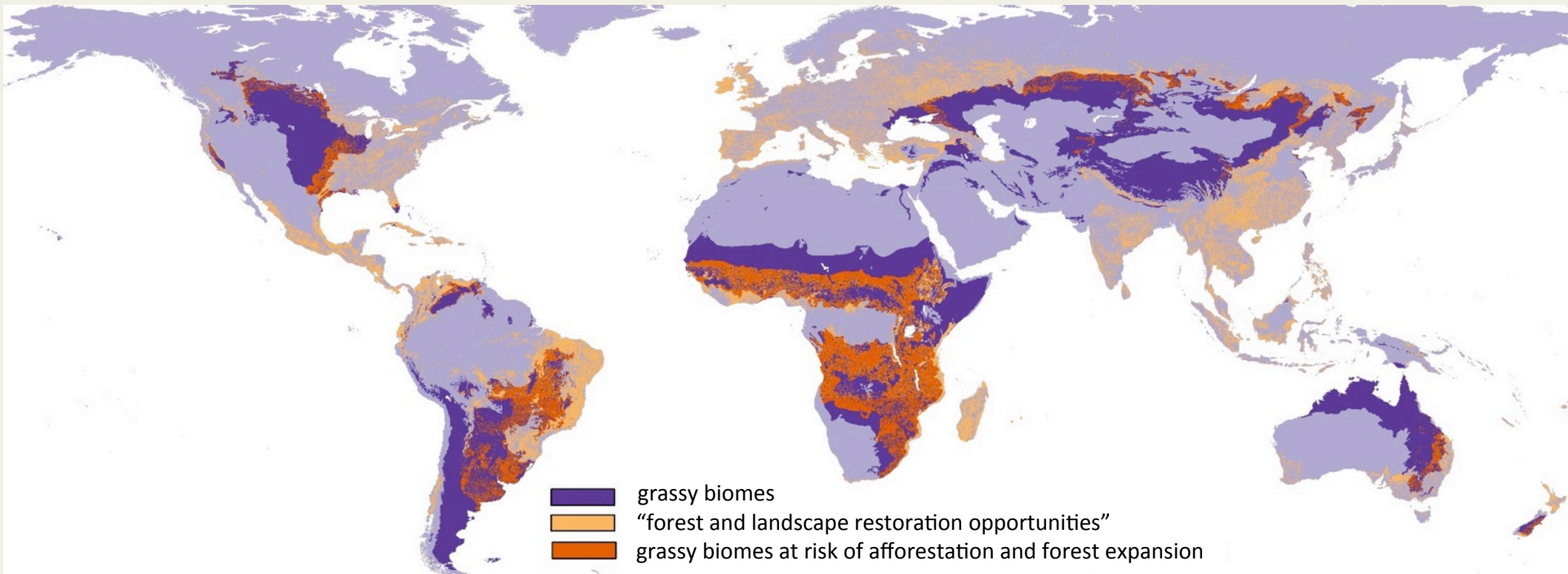
OTHER AREAS

-  Recent tropical deforestation



- restore 150 million hectares of deforested and degraded lands worldwide by 2020
- “20+20” initiative to restore 20 million hectares of degraded land in Latin America by 2020

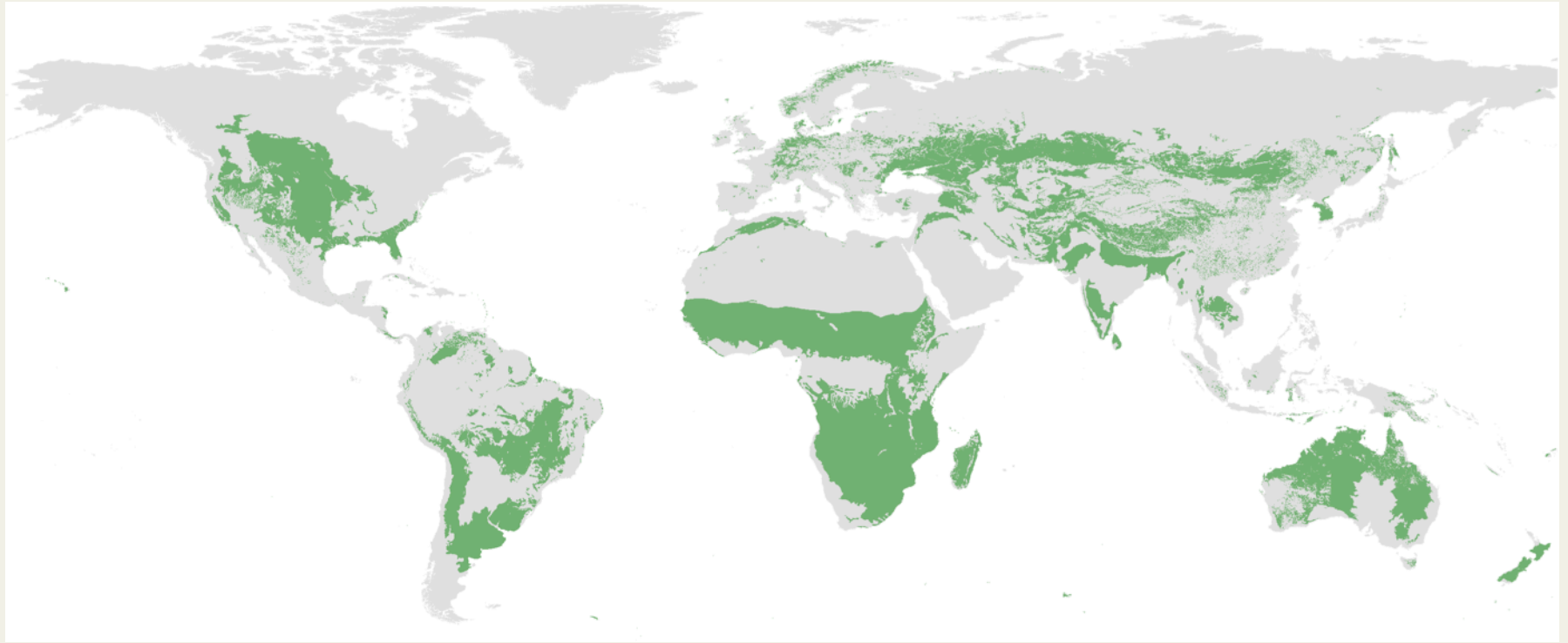
Assessment of the *Atlas of Forest and Landscape Restoration Opportunities*



9 million km² (40%) of "opportunities"
correspond to grassy biomes

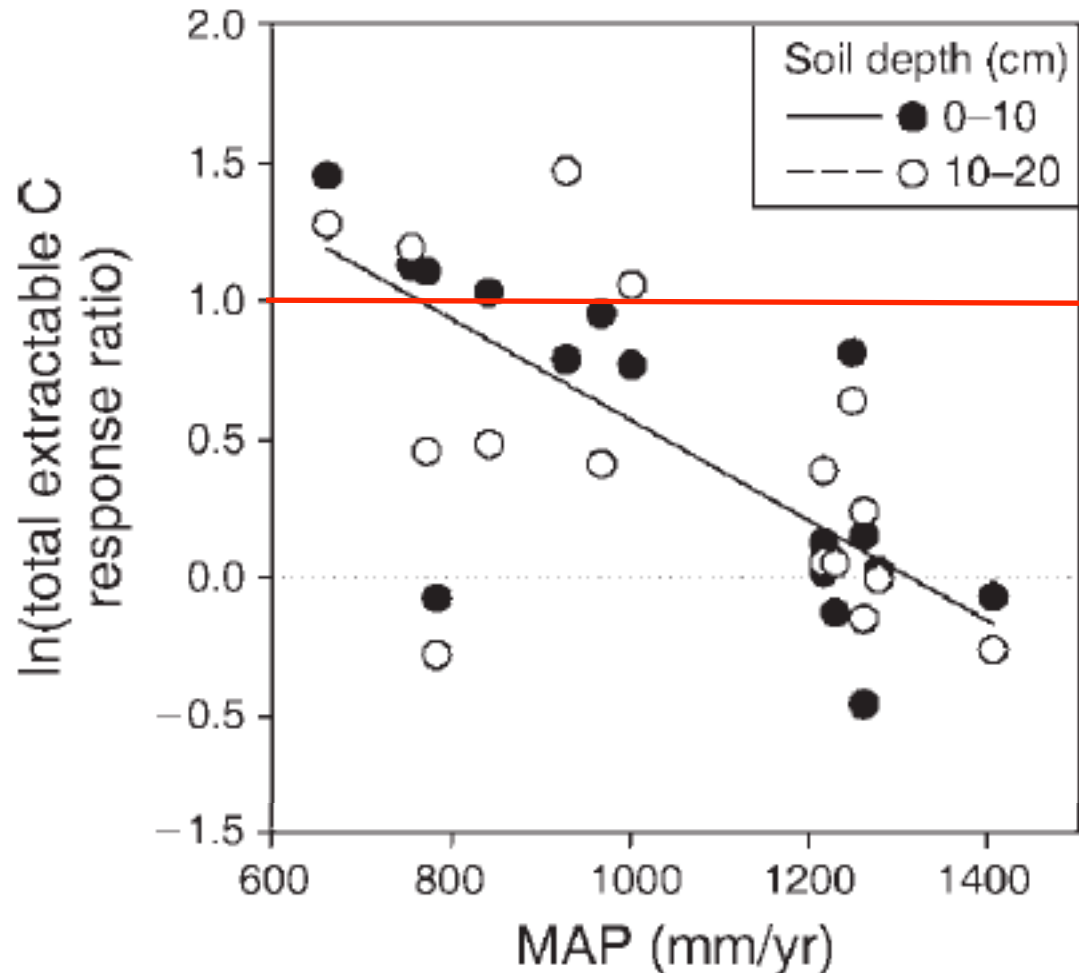
Veldman *et al.* (2015) *Bioscience*

New map suggests native grassy biomes extend further than in previous maps



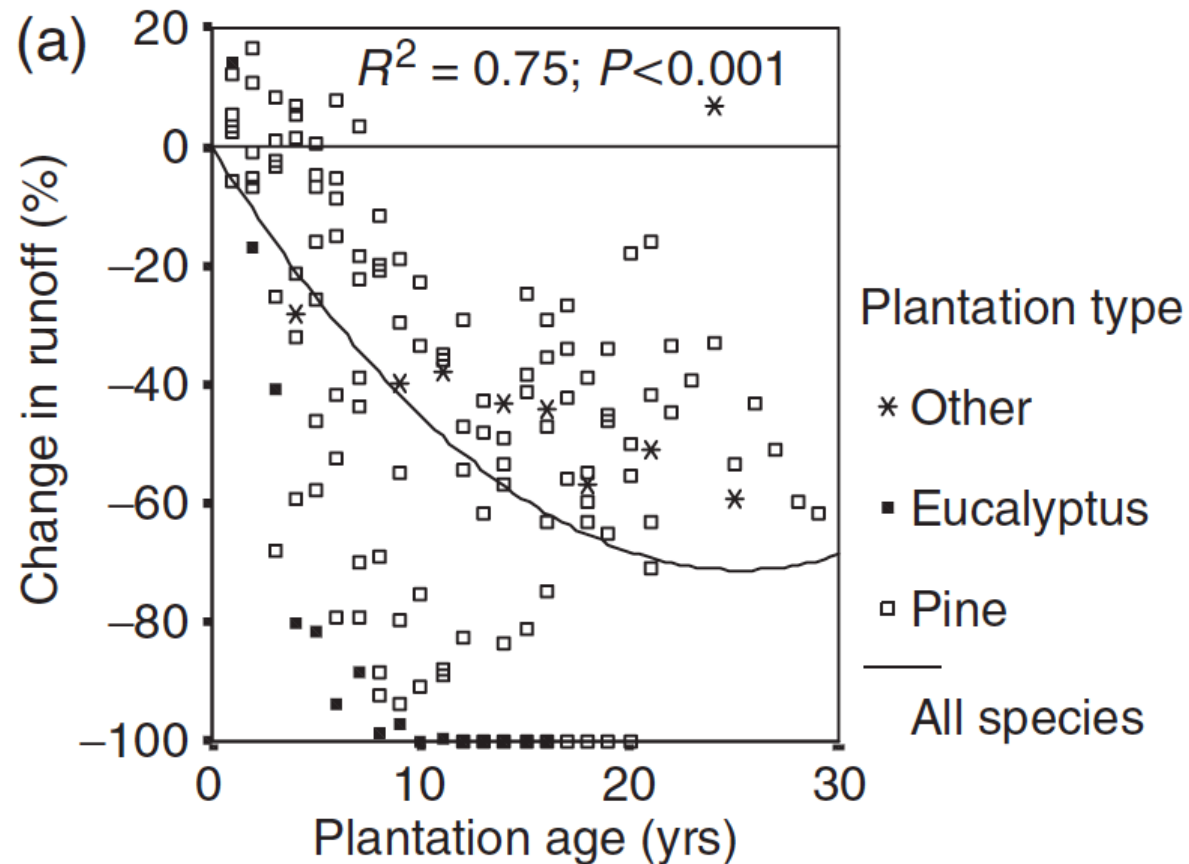
NESCent Grasslands Working Group, unpublished

Afforestation of grassy biomes can degrade underground carbon stocks



Rio de la Plata grasslands, Uruguay (Berthrong *et al.* 2012 *Ecol. Appl.*)

Afforestation of grassy biomes compromises water resources



Farley *et al.* (2005) *Global Change Biol.*

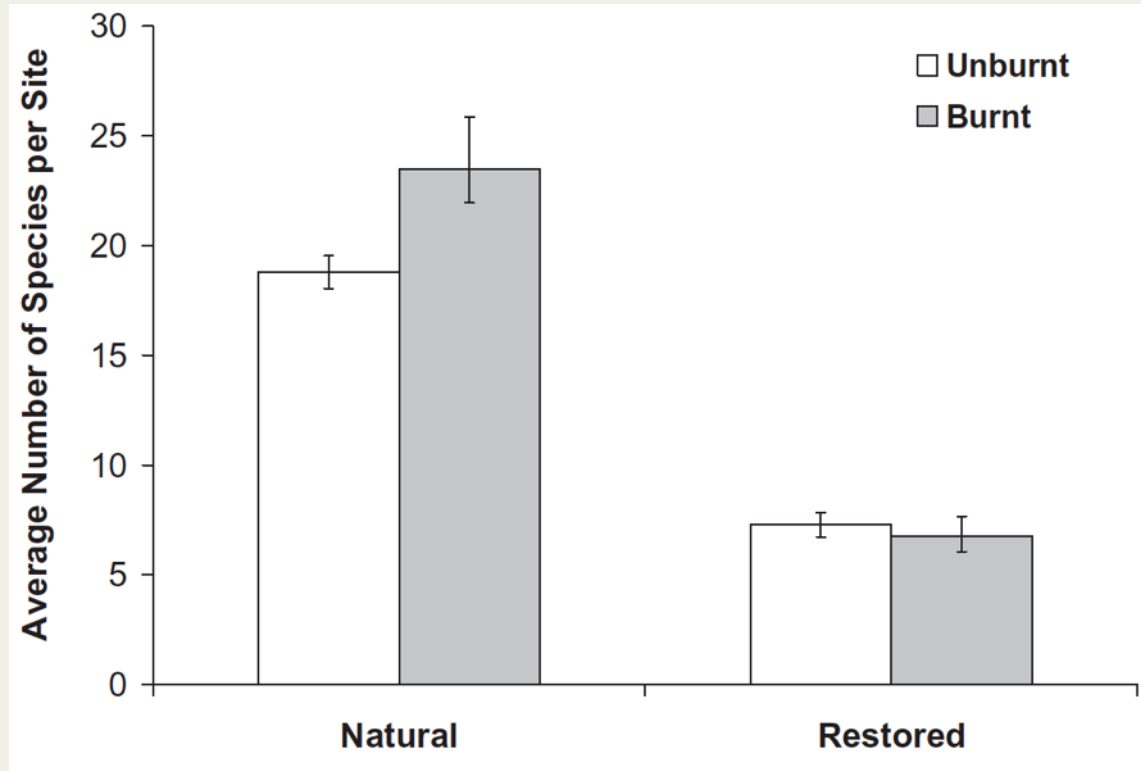
Clearing trees for water security



e.g. Working for Water programme in South Africa
Removal of alien tree species restores streamflow and groundwater recharge

Photos: Kowie Catchment Campaign

Grassland “restoration” after afforestation – no way back?

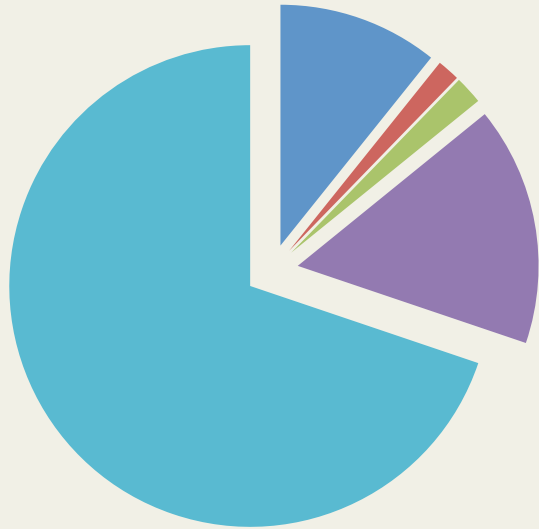


Forbs with underground storage organs have not come back 17 yrs after clearance of pine plantation (Zaloumis & Bond, 2011)

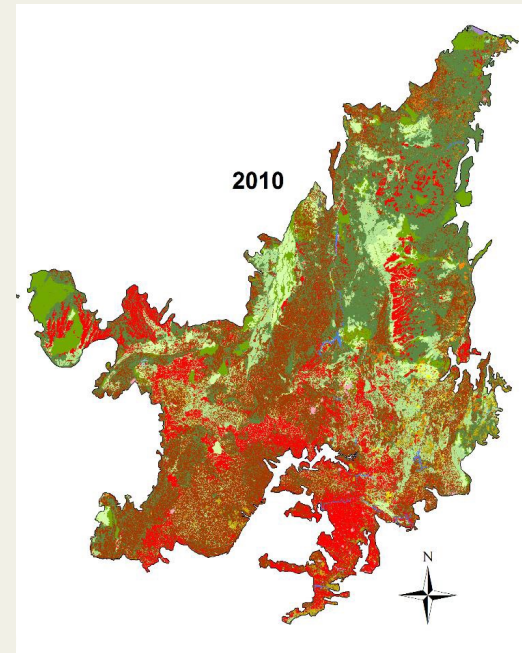
Our recommendations



Avoid afforestation or clearance of native grassy ecosystems



Value for carbon,
water, biodiversity



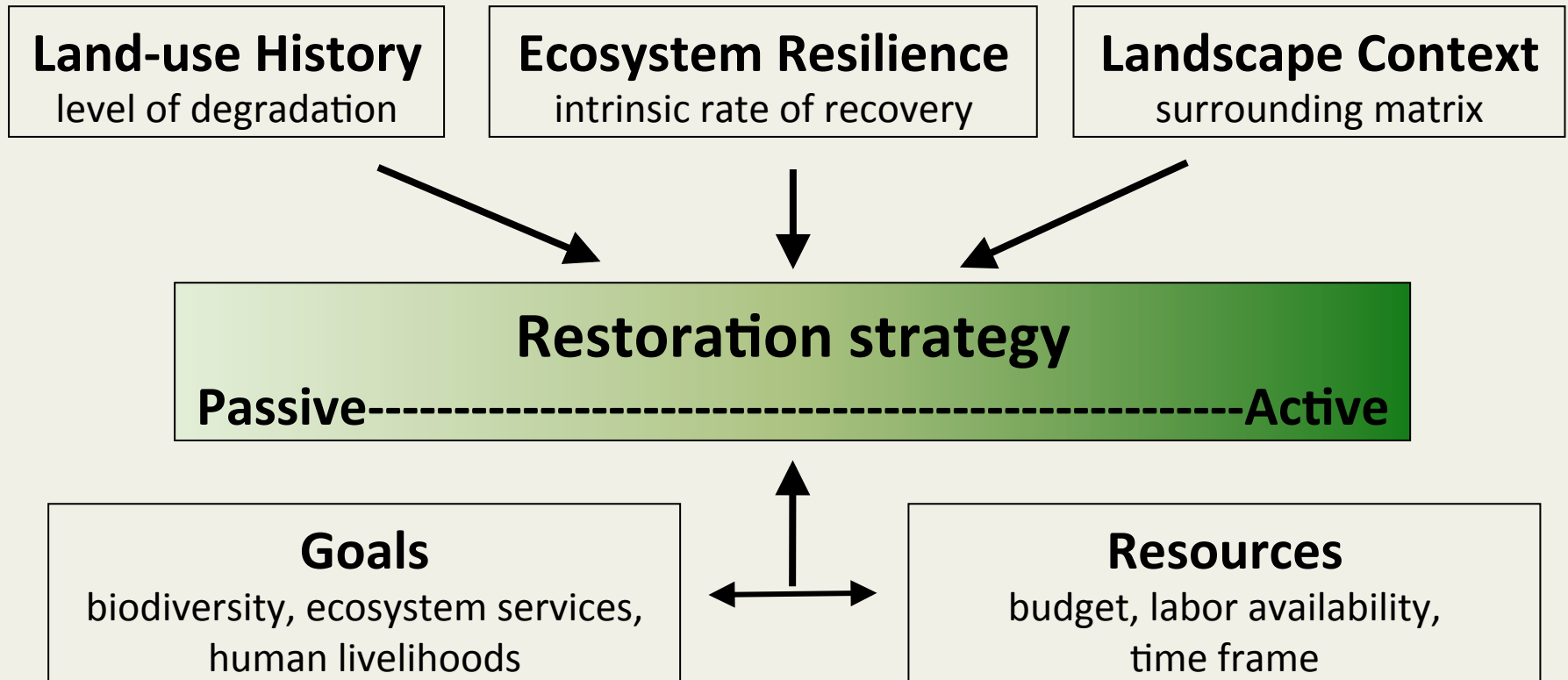
Under greater threat
than many forests

Target restoration or agriculture to degraded grassy ecosystems



Biodiversity low, underground carbon depleted

Need to assess natural regeneration and tailor restoration strategies to the system



Holl and Aide 2011 *Forest Ecology and Management*

Recognizing native grassy ecosystems

1. Intact disturbance regimes



Recognizing native grassy ecosystems

2. High species diversity



Recognizing native grassy ecosystems

3. Underground storage, resprouting capacity



Recognizing native grassy ecosystems

4. Fire adaptations



- Resprouting from underground buds
- Fire-stimulated flowering
- Fire-insulated bark



Urgent need to identify and map native grassy ecosystems

- Native grassy ecosystems distinguished from degraded ones via well established criteria.
- Ground-based, local validation essential.
- Requires a global initiative with local experts in each region facilitating decision making.
- Global and fine-scale maps of areas suitable for reforestation.

Conserve native grassy ecosystems to protect livelihoods, water and carbon



Taita Hills project, Kenya

- Accounts for avoided conversion of grasslands.
- Generates REDD+ carbon offsets from protection of forest and savanna mosaic.
- Focus on soil carbon, conserving biodiversity, and sustainable charcoal production.
- Conservation within existing mechanisms.

