

Agricultural Productivity and Ecosystem Sustainability: *Solutions from Farm to Landscape Scale*



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Navigating the Global Food System in a New Era
IAMA, Boston, June 21, 2010**

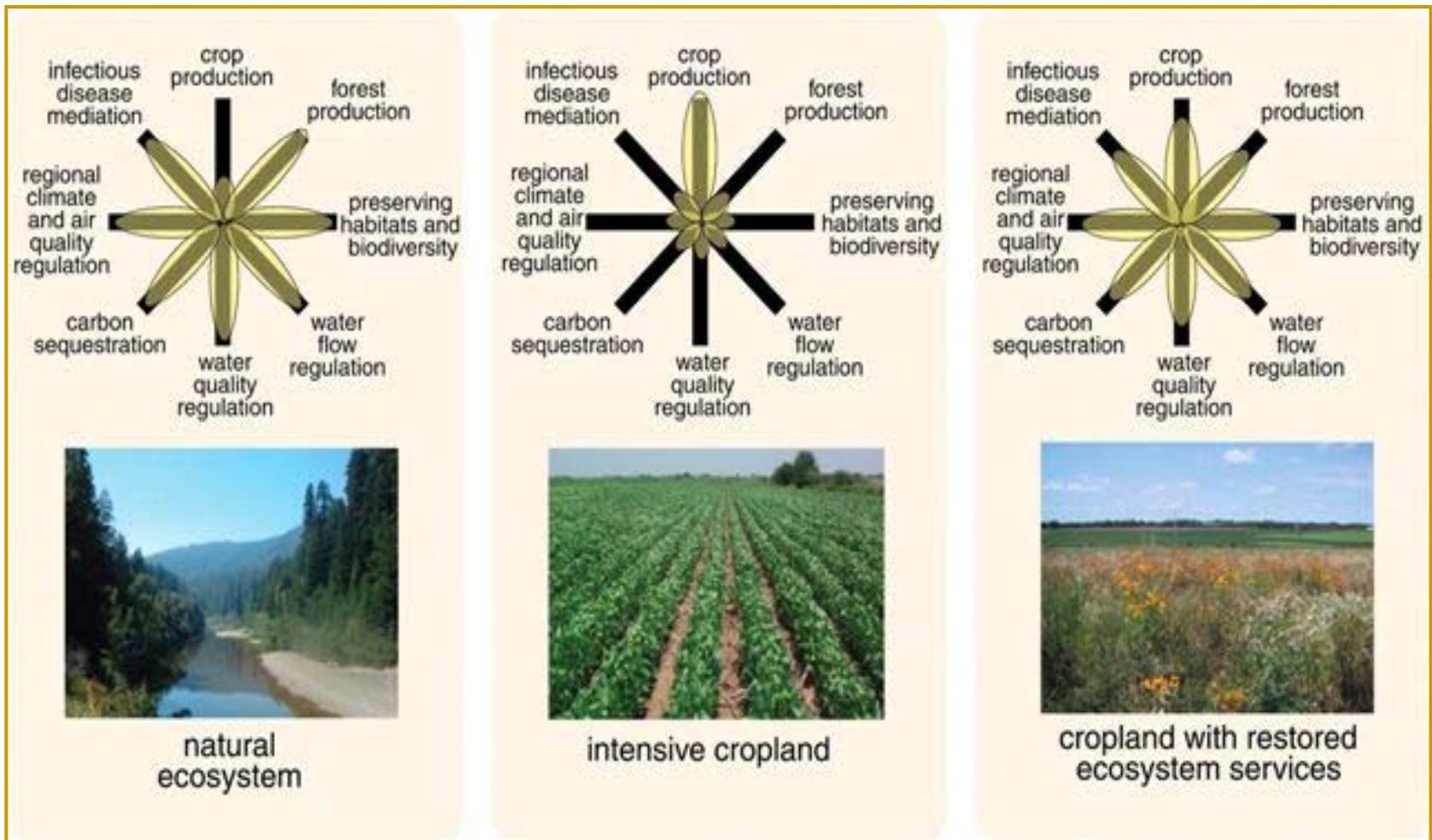


Challenges for agricultural production in the 21st century



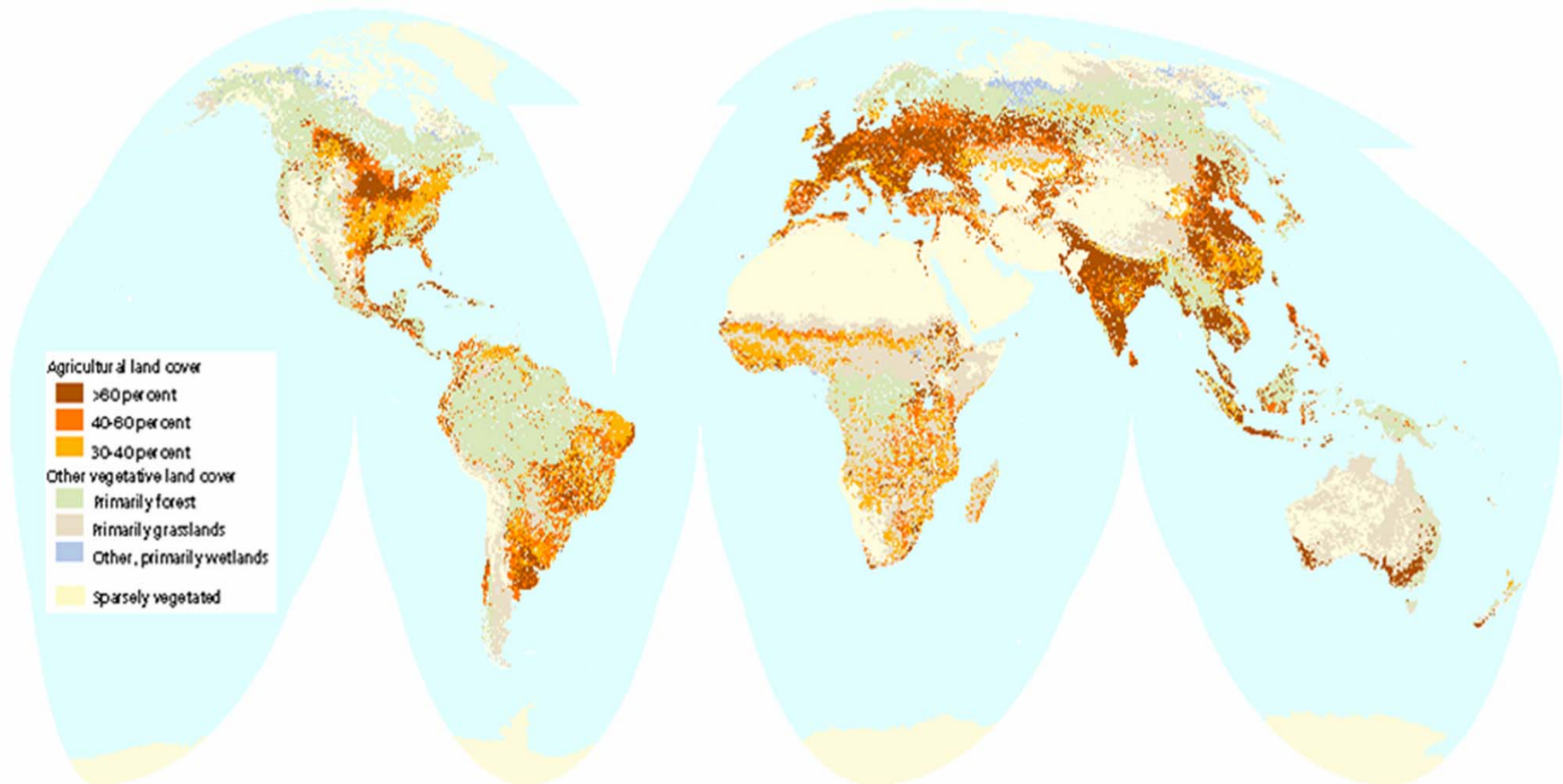
- Meet food & fiber demand for 9 billion people (↑50-100% by 2030)
- Reduce rural food insecurity and poverty; secure urban food supply
- Contribute to sustainable energy through biofuels
- Adapt to climate change
- Restore degraded resources critical for production
- Shift from a major source of greenhouse gases, to a net sink
- Contribute to and restore critical ecosystem services

Can we solve this challenge with “super-farms” + protected areas?



Importance of agric'l landscapes for ecosystems and biodiversity

PAGE Agricultural Extent



Agriculture and land use: ~ 31% of global greenhouse gas emissions

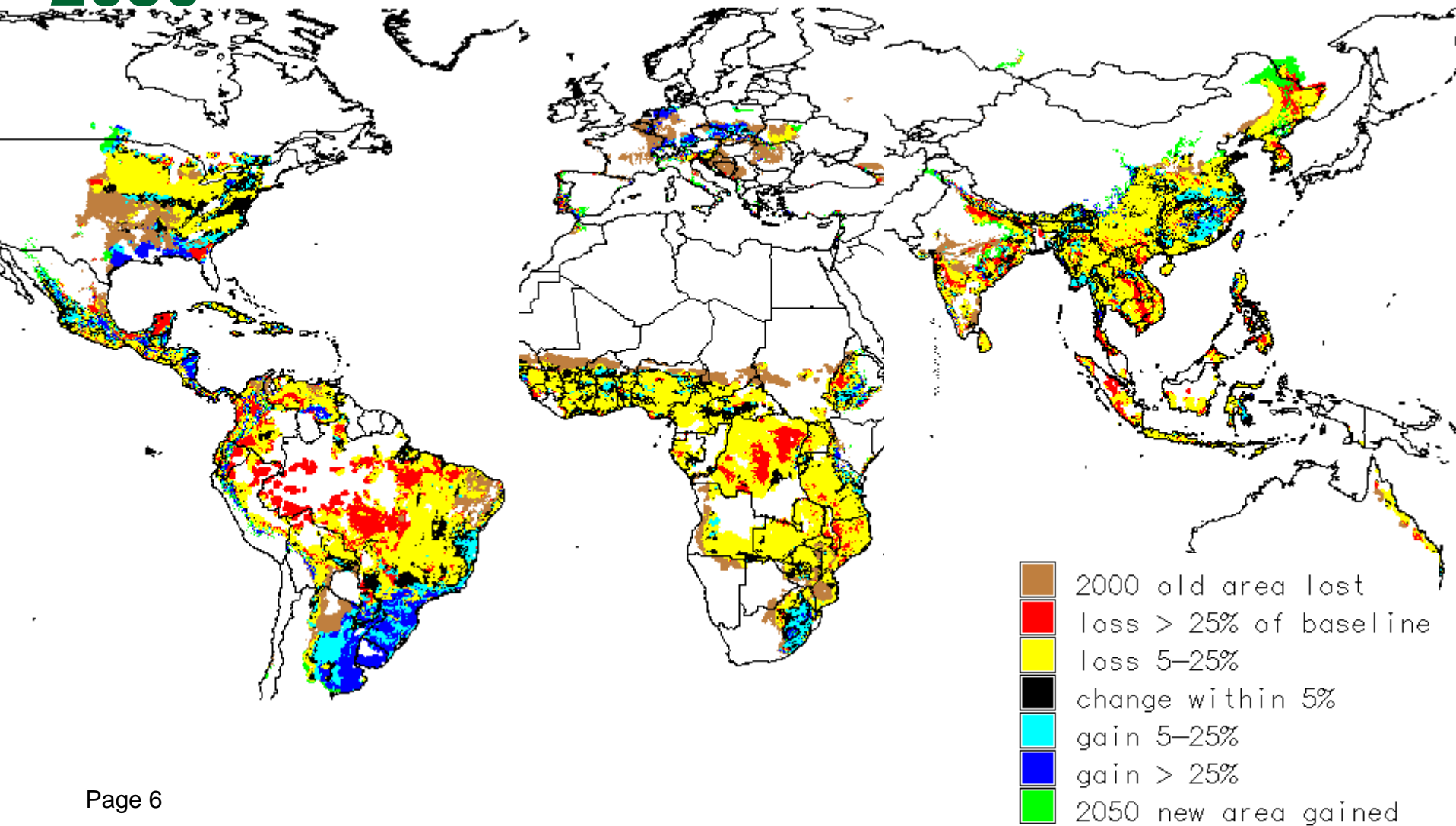


<i>Land Use</i>	<i>Annual Emissions</i>	<i>GHG</i>
Agriculture	6,558	
Soil fertilization	2,128	Nitrous oxide
Food digestion in cattle	1,792	Methane (CH ₄)
Biomass burning	672	CH ₄ , NO ₂
Paddy rice pdn	616	CH ₄
Livestock manure	413	CC ₄ , NO ₂
Chemical fertilizer pdn	410	CO ₂ , NO ₂
Delivery of irrigation water	369	CO ₂
Farm machinery	158	CO ₂
Deforestation	8,477	CO ₂
For agric or livestock	2,900	

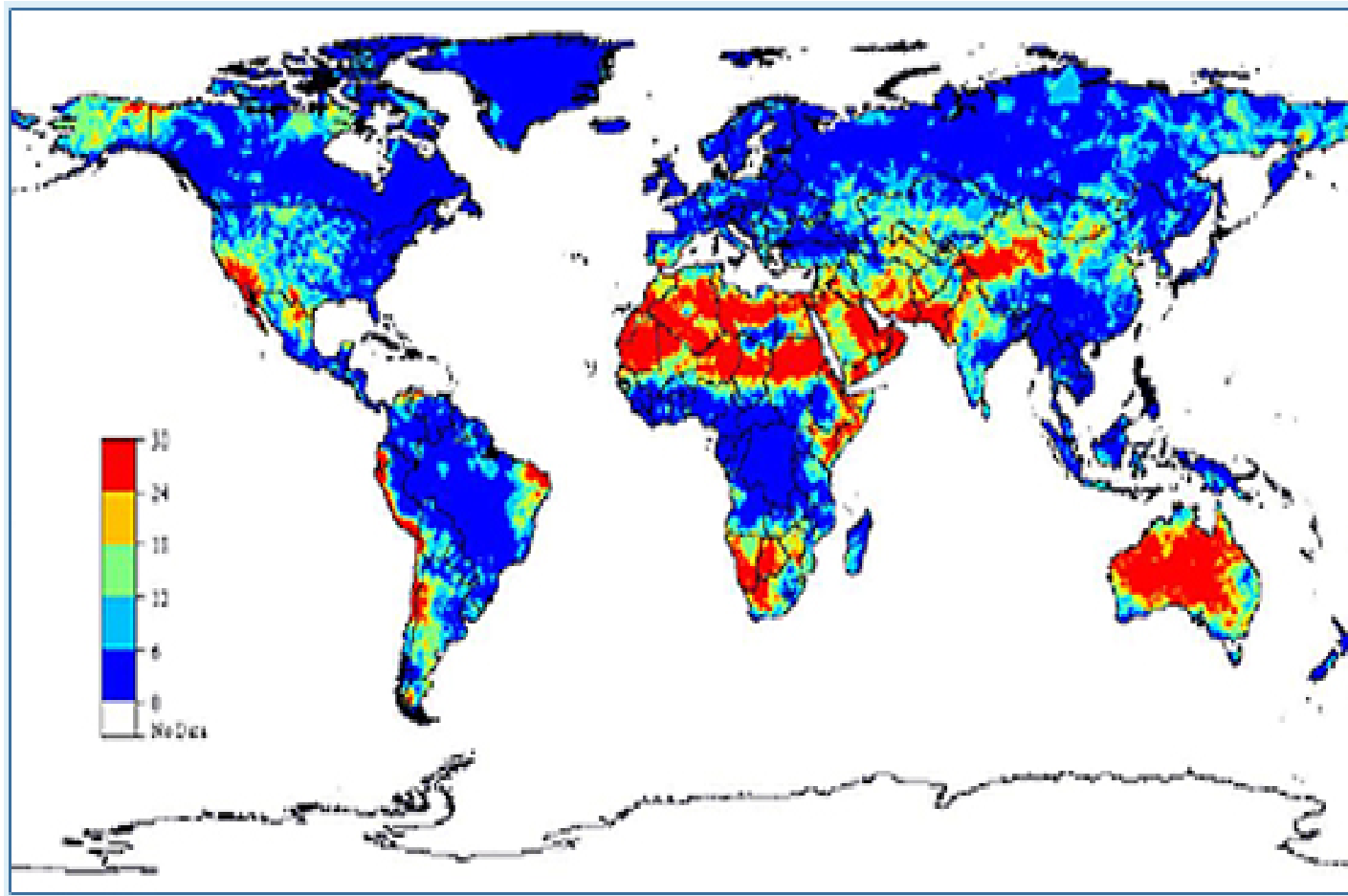
- Sources: IPCC AR4, data from 2004 and 2005.
(note: fossil fuel burning-- 27,734 million tons CO₂ eq)

Climate Change Effects on Agriculture, Hadley A2

Rainfed maize yields decline 17% by 2050



Probability of precipitation less than 75% of long-term mean annual value



Integrating the agendas to feed 9 billion & protect ecosystems



- 1) Help farmers raise production in the context of climate risks
- 2) Mitigate climate threats-shift agriculture from major source to **net sink** of greenhouse gas
- 3) Restore degraded croplands and pastures
- 4) Secure water for agriculture by protecting water quality and watershed functions
- 5) Support farmers to be major stewards of ecosystems



Ecoagriculture landscapes



Agricultural landscapes managed to enhance rural livelihoods and sustainable agricultural production (of crops, livestock, fish and forest), while conserving or restoring ecosystem services and biodiversity.



Maintaining ecosystem services in agricultural landscapes (mosaics)



In conservation areas

- Natural areas that benefit local farming communities
- Provide watershed protection, habitat connectivity thru non-farmed areas
- Reduce or reverse land conversion by increasing farm productivity
- Develop species conservation plans

In production areas

- Minimize agricultural pollution (incl. GHG)
- Manage water flow, use & infiltration-plot, farm, landscape
- Increase carbon storage in soils and vegetation
- Modify farming systems to mimic natural ecosystems
- Maintain diversity of crop species & varieties



Linking agribusiness supply chains with landscape initiatives



Kabale, Uganda



Willamette Valley, USA

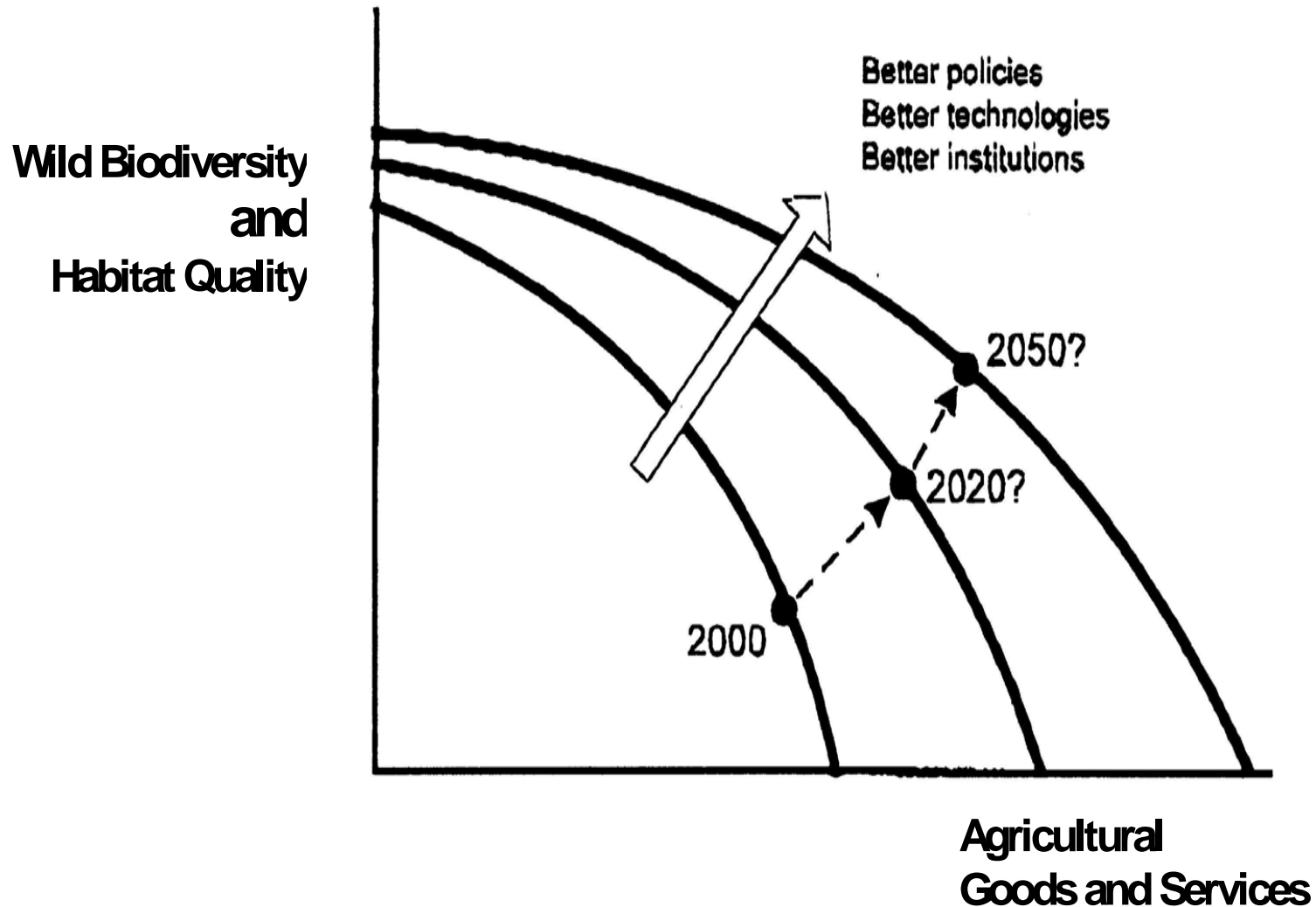


Niger



Kikuyu Escarpment, Kenya

Towards 'win-win-win' solutions: Reduce tradeoffs, realize synergies



Crop genetic selection, breeding and conservation

- *Adapt to/mitigate climate change*
- *For biodiverse systems*
- Domestication of wild species
- Minor crops/breeds
- Increasing yields, biomass
- Increasing resilience
- Perennialize annuals
- Reduce input requirements
- Productive in polycultures
- Reduce GHG emissions

**But only
part of the solution**



Cropping systems improve soils, input efficiency, carbon sequestration



- Conservation agriculture
- Minimum tillage
- Cover crops
- Vegetative erosion barriers
- Precision agriculture
- Intercrops
- Nitrogen fixation
- Bio-char

Incorporating perennials in production systems



- Fertilizer trees & shrubs
- Fruits, grasses, palms, bamboos
- Timber, fuelwood
- Live fences, windbreaks
- Natural regeneration



More climate- and ecosystem-friendly livestock production systems



- Intensive grazing systems
- Perennial feeds, fodder
- Manure management
- Bio-digesters



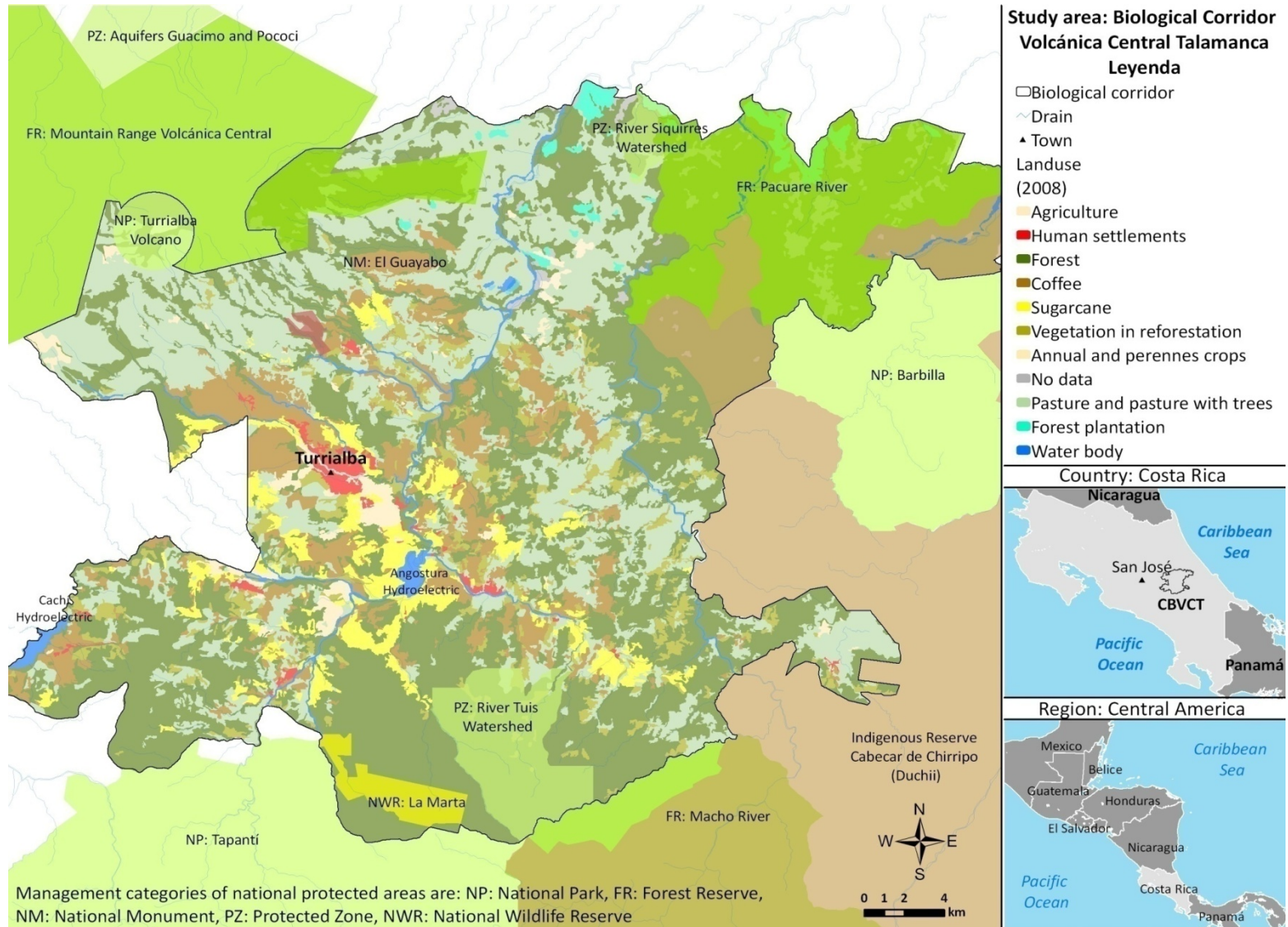
Restoring degraded watersheds & rangelands



- Riparian re-vegetation
- Reforestation
- Managed regeneration
- Rangeland rehabilitation
- Improved fallows



Conserving natural habitats and habitat networks in ag'l landscapes



Tools to plan and assess landscapes: The Landscape Measures Initiative:



Home

Mar 25th, 2008 by [leb3](#)

The Landscape Measures Resource Center (LMRC) is a collection of ideas and tools to aid in managing areas where interests in protecting biodiversity, producing food and securing rural livelihoods converge. The LMRC is rooted in the premise that measurement enhances management. Learning to measure how landscapes perform in delivering food, biodiversity and livelihood outcomes is anticipated to endow management systems with the capacity to sustain these multiple functions while reducing or reversing the degradation of natural resources.

The creators of the LMRC recognize producers of crops, livestock, fish and forest resources as stewards of ecosystems and biodiversity. The LMRC is designed to bring the knowledge of these natural resource managers and their supporters to bear on the challenges of landscape measurement and management.



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A web-based hub
for a virtual
learning network

Testing in “learning
landscapes”

www.landscapemeasures.org

Emerging markets for “green” & “climate-friendly” products & services



- Min. regulatory standards
- Eco-labeling & certification
- Public procurement rules
- Food industry standards (Sust. Food Lab, Sust Ag Init, Keystone, Roundtables)
- Processing and quality standards for minor products
- Payments for ecosystem stewardship
- Offsets for C, BD, H2O
- Shifting subsidies



Emerging business opportunities



- Crop varieties with traits benefitting ecosystems (e.g., shade tolerance, deep-rooting, high-yield polycultures)
- Technologies for diverse systems (e.g., improve minor/perennial crops; multi-species marketing; machinery for polyculture & precision farming)
- Knowledge & information services on farm & landscape mgmt
- Products & processes to facilitate land, water, habitat rehabilitation
- Spatial monitoring tools: PES, regulation, certification, footprinting

Thank you....



www.ecoagriculture.org

