Biomass Standards

Workshop on Incorporating Bioenergy into Sustainable Landscape Design

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Background: International Standards

What is a standard?

- A standard is a document that
  - Provides requirements, specifications
  - Sets forth guidelines
  - Can be used to ensure consistent and appropriate
    - Materials,
    - Products
    - Processes
    - Services

Why develop standards?

- Comparable assessment
- Help ensure products and services are "fit for purpose"
- Reduce costs by minimizing waste and errors; increasing productivity
- ***Facilitate free and fair global trade***
  - Access to new markets
  - Level the playing field for new entrants

Source: adapted from www.ios.org

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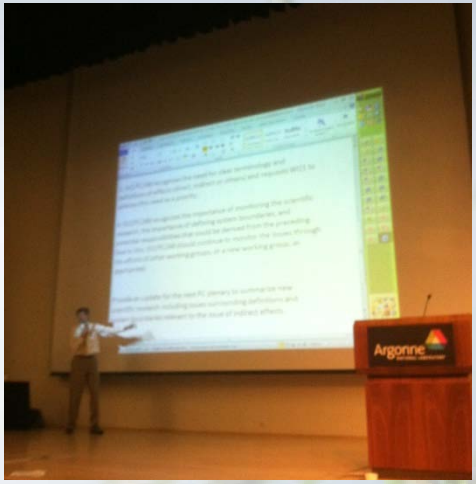
Research challenges for consistent measures of LUC



- Accurate representations based on clear **definitions** for variables and conditions of concern:
  - land attributes
  - management practices
  - baseline trends and change dynamics
- **Causal analysis** that can be validated at multiple scales
- Adequate empirical **data** to test models and hypotheses
- Multi-disciplinary, multi-institutional **learning** and problem-solving approaches

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Thoughts on standards and certification

Can certification ensure sustainability?

No, **<u>nothing can ensure</u>** sustainability and…

1. There are too many opportunities for substitution in biomass markets
2. Transaction costs for certification, monitoring and verification are too high relative to value of products
3. *Uncertainty:* is there political will and sufficient market premium to justify certification?
4. "Setting a bar" does not necessarily improve anything (e.g., wastes)
5. Even well-designed schemes can be too easily "gamed" and it only takes a few well-publicized cases to undermine credibility

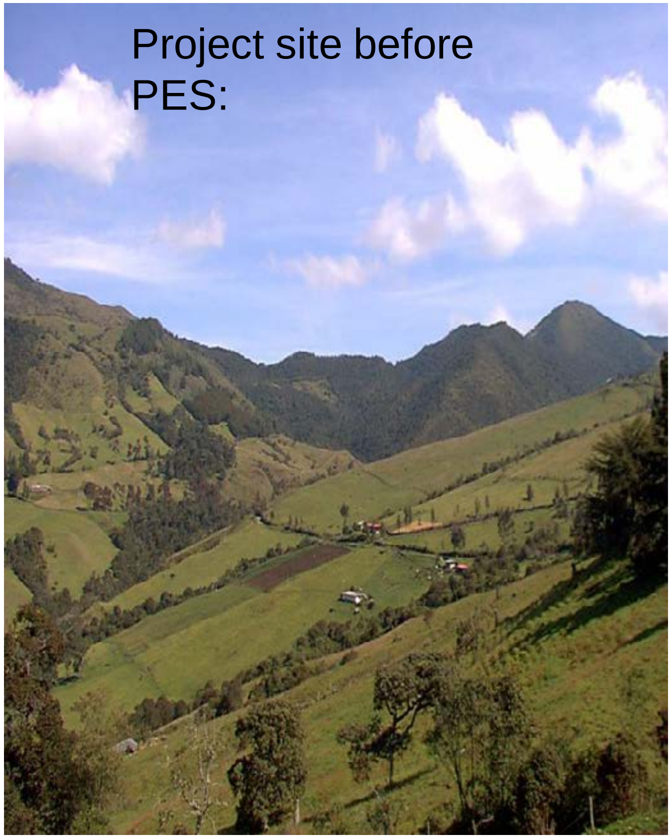

Photo: José Luis Gómez; Fondo Acción, Colombia

Slide adapted from Kline presentation for IEA Joint Task 38-40-43 presentation on LUC: http://ieabioenergy-task38.org/workshops/campinas2011

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Thoughts on standards and certification

Can a standard support more sustainable outcomes?

Yes, *if* it –

1. Is developed with users to meet their needs
2. Provides science-based tools that promote learning
3. Creates incentives that shift production toward more sustainable paths
4. Is adaptable to changing contexts and priorities
5. Encourages all to participate
6. Can be implemented on a "level playing field"
7. Is transparent and easily adopted.

Project site after PES:

Photo: José Luis Gómez; Fondo Acción, Colombia

Slide adapted from Kline presentation for IEA Joint Task 38-40-43 presentation on LUC: http://ieabioenergy-task38.org/workshops/campinas2011 also available on CBES website .

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Can landscape design principles be applied to help meet requirements for “sustainable feedstock?”

Thank you!

CBES
Center for BioEnergy Sustainability

http://www.ornl.gov/sci/ees/cbes/

How to effectively involve society?

Stakeholder engagement in process: define problem, goals and priorities, assess options, and validate proposed solutions

- How does society define the problem?
- What are priority objectives?
  - Define spatial and temporal scales
  - Consider constraints and opportunities
- Apply tools to obtain range of solutions
- Analyze trade-offs and complementarities
  - Use of indicators to measure change
  - Monitor to guide continual improvements
- Extract general rules, guidance for decision makers

Win-Win Opportunities

Improve soil & water management

- Precision management and nutrient recycling
- Reduce disturbance/tillage intensity
- Crop mix, rotations, cover crops
- Land restoration
- Technology (seed, microbe, equipment)

Increase Efficiency

- Reduce inputs/increase ***yields***
- Open, transparent markets
- Minimize transaction costs
- Prioritize, incentivize, measure

Diversify

- Uses and markets
- Substitution options
- Bases of production

Adopt Systems Perspective

- Multi-scale
- Long term and adaptive
- Integrated land-use plans

References

- Dale VH, SC Beyeler 2001. Challenges in the development and use of ecological indicators. Ecological Indicators 1: 3-10.
- Dale VH, R Lowrance, P Mulholland, P Robertson. 2010. Bioenergy sustainability at the regional-scale. Ecology and Society 15(4): 23. [online] URL: *http://www.ecologyandsociety.org/vol15/iss4/art23/*
- Dale VH, KL Kline, LL Wright, RD Perlack, M Downing, RL Graham. 2011. Interactions among bioenergy feedstock choices, landscape dynamics and land use. *Ecological Applications* 21(4):1039-1054.
- Dale, VH, RA Efroymson, KL Kline, MH Langholtz, PN Leiby, GA Oladosu, MR Davis, ME Downing, LM Eaton, MR Hilliard. In review. Indicators to support assessment of socioeconomic sustainability of bioenergy systems. Ecological Indicators.
- Efroymson, R. A., V. H. Dale, K. L. Kline, A. C. McBride, J. M. Bielicki, R. L. Smith, E. S. Parish, P. E. Schweizer, D. M. Shaw. 2012. Environmental indicators of biofuel sustainability: What about context? Environmental Management DOI 10.1007/s00267-012-9907-5
- Giglio L., J. T. Randerson, G. R. van derWerf, P. S. Kasibhatla, G. J. Collatz, D. C. Morton, and R. S. DeFries. Assessing variability and long-term trends in burned area by merging multiple satellite fire products. Biogeosciences, 7, 1171–1186, 2010.
- McBride A, VH Dale, L Baskaran, M Downing, L Eaton, RA Efroymson, C Garten, KL Kline, H Jager, P Mulholland, E Parish, P Schweizer, and J Storey. 2011. Indicators to support environmental sustainability of bioenergy systems. *Ecological Indicators* 11(5) 1277-1289.
- Parish ES, M Hilliard, LM Baskaran, VH Dale, NA Griffiths, PJ Mulholland, A Sorokine, NA Thomas, ME Downing, R Middleton. 2012. Multimetric spatial optimization of switchgrass plantings across a watershed. *Biofuels, Bioprod. Bioref*. 6(1):58-72.

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Bioenergy assessment depends on estimated “land-use change” (LUC) effects

Issues that influence estimated LUC:

1. Economic decision-making assumptions
2. Conceptual framework for drivers of ‘land conversion’
3. Land supply and management specifications
4. Assumed land use dynamics (ref. scenarios, baseline choices)
5. Modeling yield change
6. Issues of time, scale
7. Fire and other disturbances
8. Differentiate correlation versus causation
9. Attribution among different drivers of change
10. Representation of bioenergy/policy in model specifications
11. Data issues related to all above, to test hypotheses

It depends

See IEA Joint Task 38-40-43 presentation on LUC:
http://ieabioenergy-task38.org/workshops/campinas2011
on CBES website

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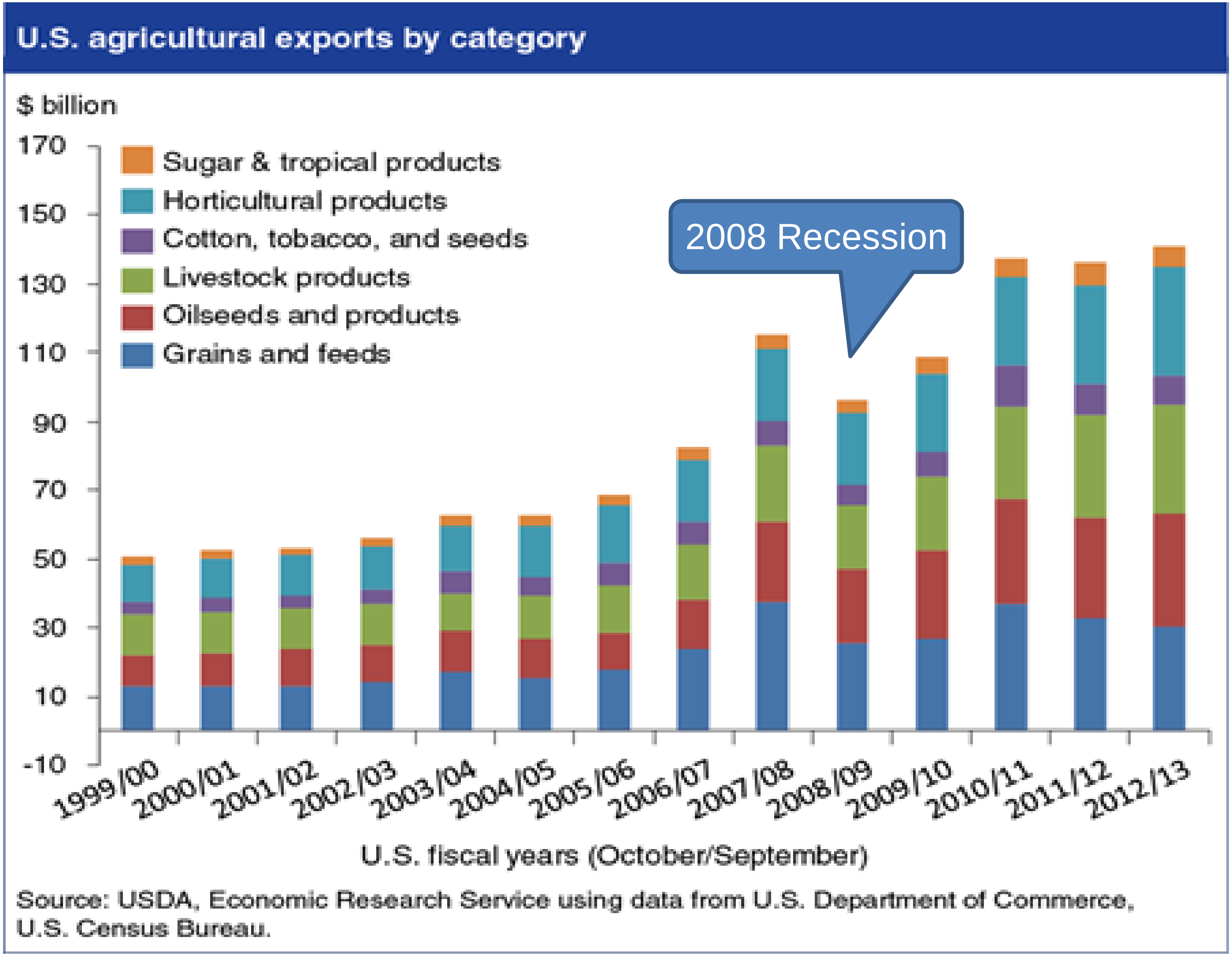
U.S. agricultural exports nearly tripled from 2000 to 2013

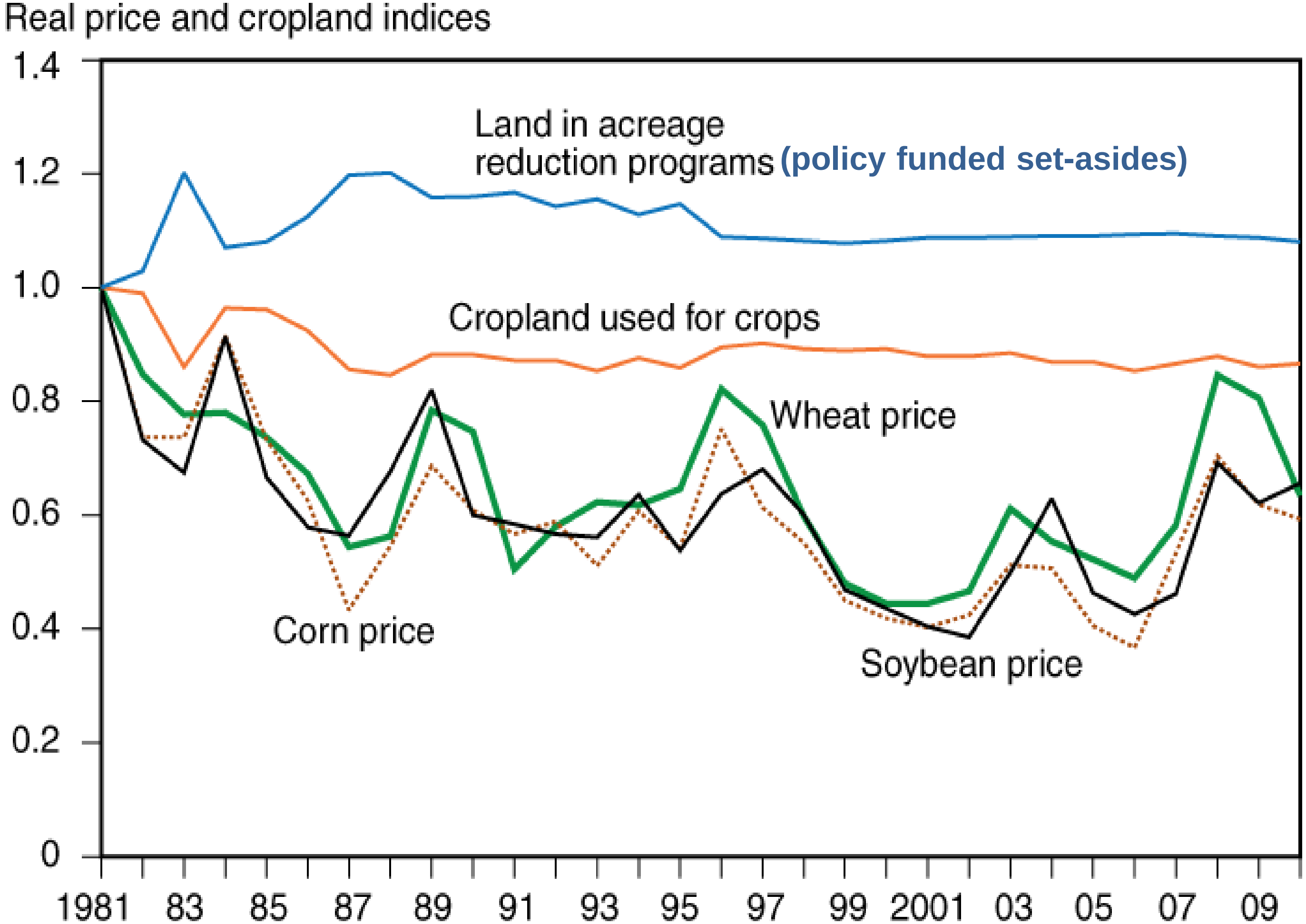


http://www.ers.usda.gov/data-products/chart-gallery/detail.aspx?chartId=43538&ref=collection

Check assumptions about price-driven LUC

Figure 6

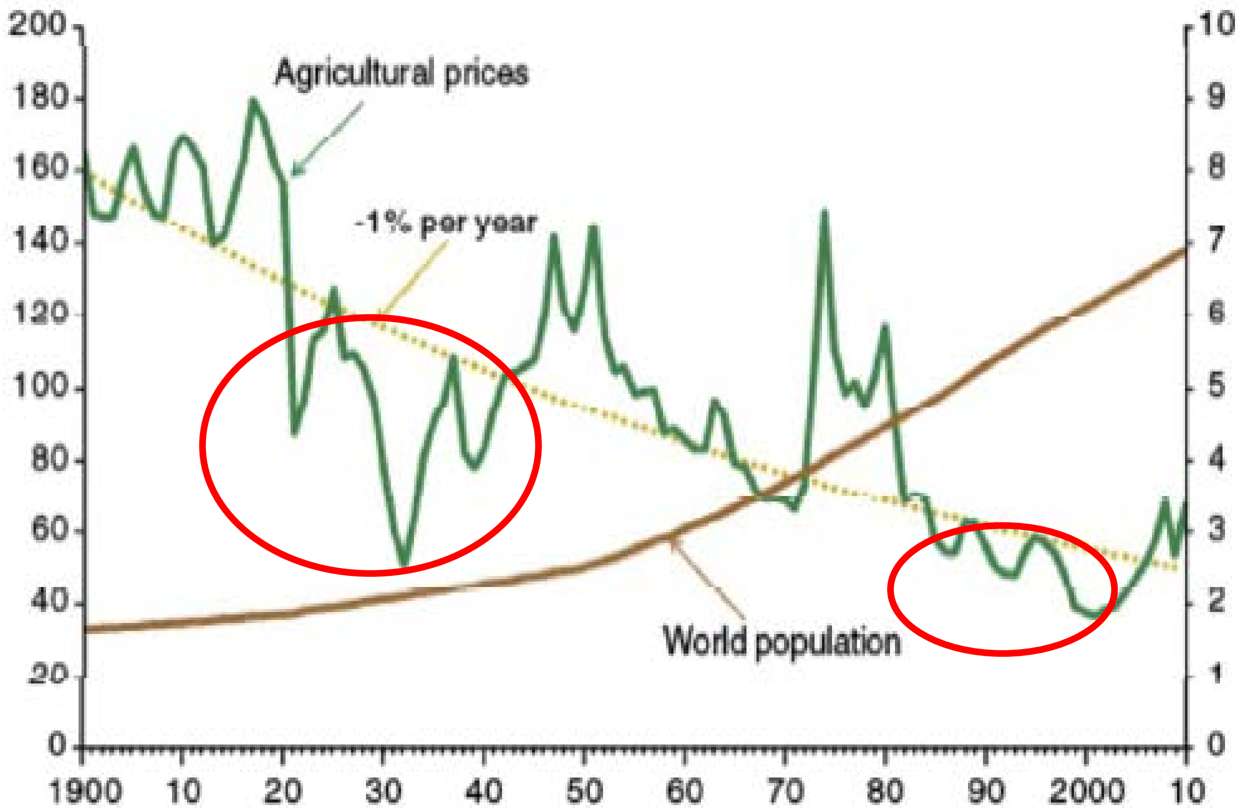
U.S. cropland used for crops and commodity prices of key crops



Source: USDA ERS 2011. http://www.ers.usda.gov/publications/eib89/

Contrary to some modeling assumptions, in the US, expectations of commodity prices and risk affect choices of *what* to grow on previously defined agricultural landscapes, not *how much* total area is dedicated to agriculture

Real agricultural prices have fallen since 1900, even as world population growth accelerated



Source: USDA, Economic Research Service using Fuglie, Wang, and Ball (2012). Depicted in the chart is the Grilli-Yang agricultural price index adjusted for inflation by the U.S. Gross Domestic Product implicit price index. The Grilli-Yang price index is a composite of 18 crop and livestock prices, each weighted by its share of global agricultural trade (Pfaffenzeller et al., 2007). World population estimates are from the United Nations.

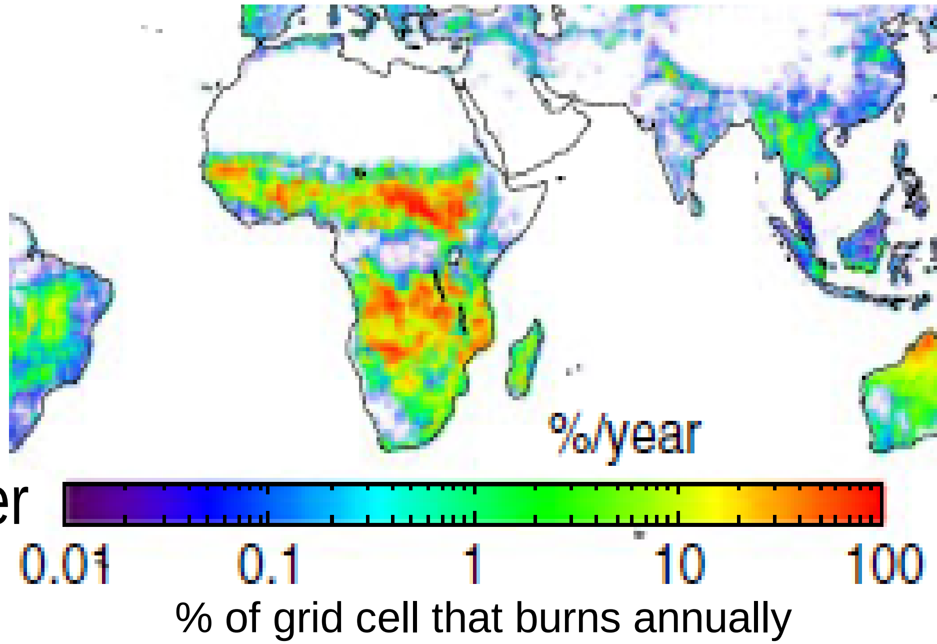
Consider historic data and trends

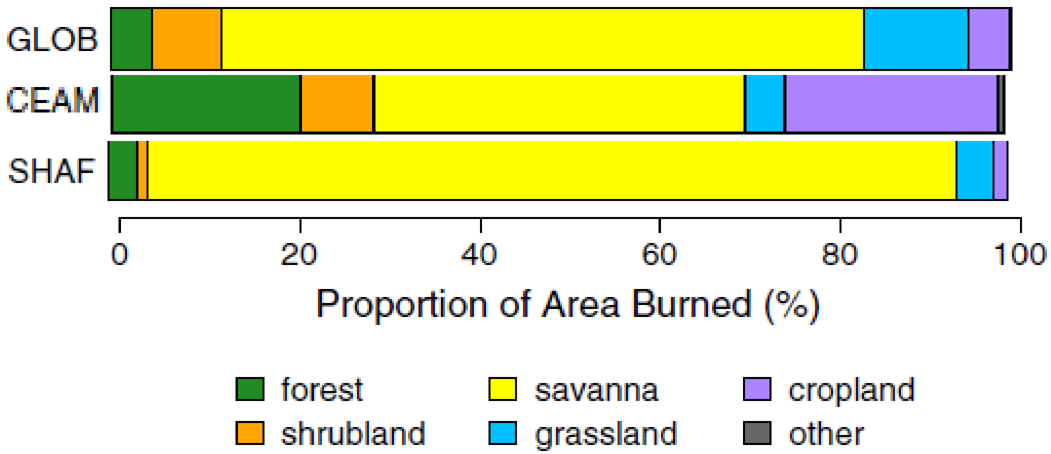
What drives destructive land transitions?

Crop prices?

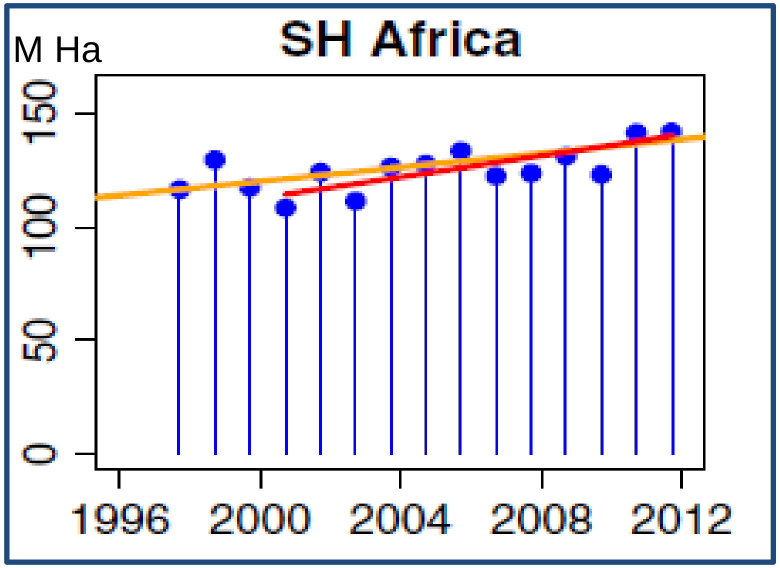
Fire and global burned areas

- Estimates of annual burned area
  - 350 Mha (Giglio et al. 2013 using GFED4; avg. for 1997-2011)
  - Including small fires could add 35%= Total est. c.450 Mha (Randerson 2013)
- Most in Africa savannah
- Some areas burn multiple times per year





GLOB = Global; CEAM = Central America;
SHAF = Southern Hemisphere Africa



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