

# Indirect LUC definitions and science-based measurement

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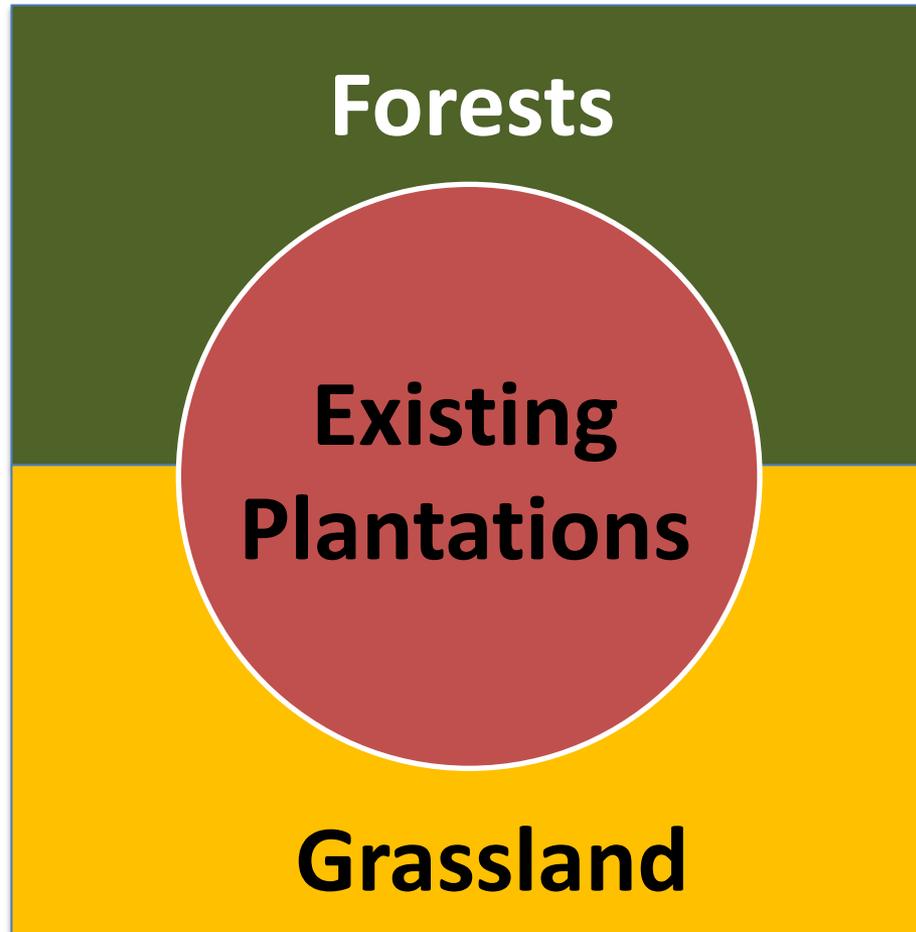


<http://www.ornl.gov/sci/ees/cbes/>

# Challenges

- **ILUC estimates depend on the model, assumptions and system boundaries**
- **Most models lack: calibration/validation... key drivers of change ... and LAND!**
- **ILUC lacks a clear, consistent *definition*:**
  - ✓ Sectors and mechanisms considered
    - Agriculture markets
    - Energy markets
    - Land markets
    - Regulations and standards
  - ✓ “Change”(s) in what?
    - Land “use” or uses, by whom?
    - Consumption
    - Land cover
    - Harvest utilization
    - Land management
    - How do we define “management” versus “unmanaged” or “mismanaged” or “abandoned”  
(time frames are important)
- ✓ ILUC Compared to what?
  - Modeled counterfactual
  - Natural experiment
  - Baseline condition
  - Reference scenario
  - Normative reference system

**Models for land-use change often begin with simplified representations of land cover (use). Such approaches assume ILUC by design rather than scientific analysis**



Adapted from Fritsche et al. 2011 (ILUC Study for European Parliament), Ecofys 2010 (Dehue), Ecofys 2011, and OEKO 2010.

# Primary drivers of land cover change are LOCAL

Tenure policies, cultural, technical, biophysical, social, economic, demographic, corruption, speculation



Initial disturbance triggers are distinct; degradation process continues over time



**Shaded area:**  
**realm of ILUC**  
**modeling based**  
**on market**  
**linkages**

Subsequent and ongoing changes in land cover and land management (market driven)

Global land cover time A

Prices, Quantities, Distribution of Goods Time A (no biofuels)

Biofuel Demand

Global Economic Model

Prices, Quantities, Distribution of Goods Time B (with biofuels)

Global land cover time B

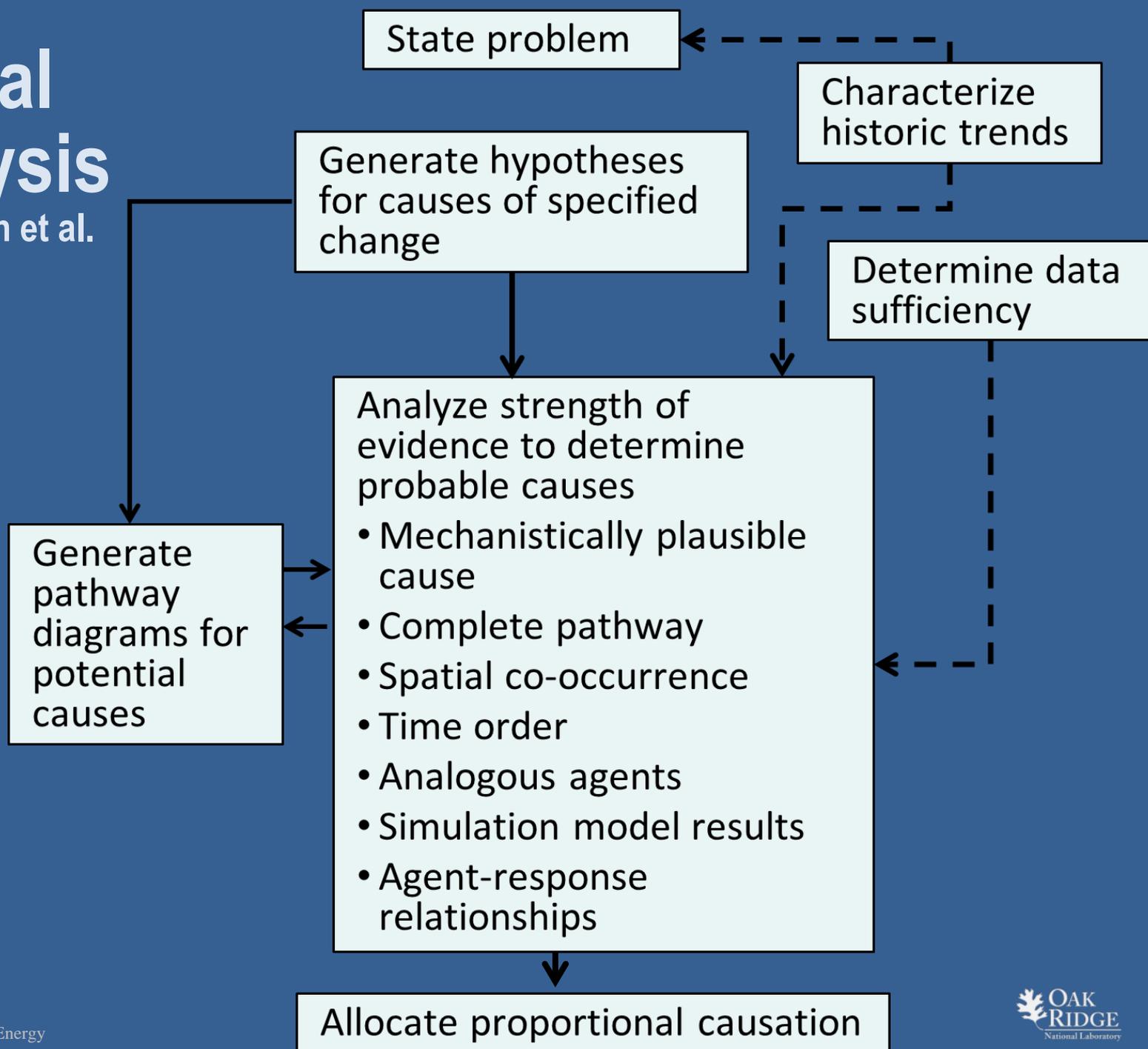
$\Delta A-B =$   
"Land-Use  
Change"

# Science-based analysis is needed

- **Science: systematic methodology based on evidence and observation**
  - ✓ Start with clear definition of problem
  - ✓ Test hypotheses
  - ✓ Conduct critical analysis
  - ✓ Determine cause and effect
  - ✓ Document verifiable, replicable results
  - ✓ Learn from other sectors (epidemiology)
- **Confounding data and terminology**
  - ✓ Land cover versus land uses (multiple)
  - ✓ Crop price and trade versus total production and management
  - ✓ Correlation versus causation
- **Science evolves as new data and understanding become available**
- **Targeted data collection...**

# Causal Analysis

(Efroymson et al. in prep.)



# **Bioenergy policy – effects include encouraging beneficial LUCs**

- **Motivation to adopt improved land management practices and invest in improved technologies**
- **Value chain incentives for increased system efficiencies (total factor productivity)**
- **Create employment that reduces pressure on isolated forest frontiers (reduced deforestation)**
- **Biomass valued: reduces loss from fires, disturbances**
- **Accelerate ongoing shifts to higher performing land and systems**
- **Increased global scrutiny of illicit land-mgmt activities**
- **Pressure to apply sustainability criteria and other effects that extend to broader sectors**