Problem conceptualization: A case of agricultural production in the Argentine Pampas

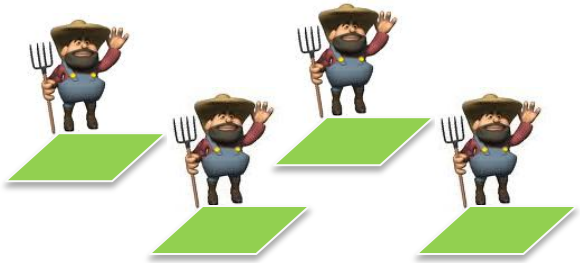
Understanding agriculture in the Pampas

- Understand historical patterns
  - Structural changes
  - Land use
  - Land tenure

Observed changes

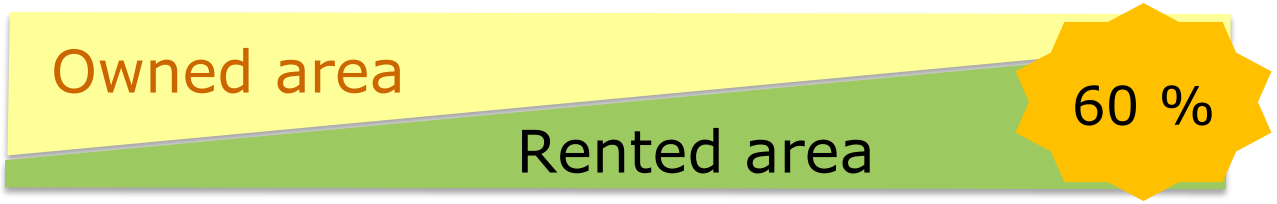
1980s → Present

Structure



Land use

Land tenure

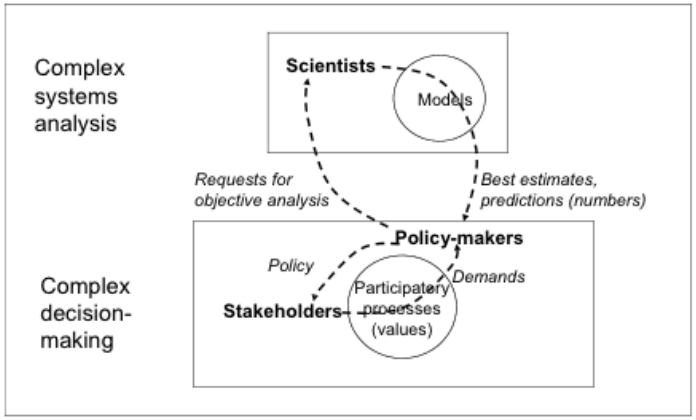


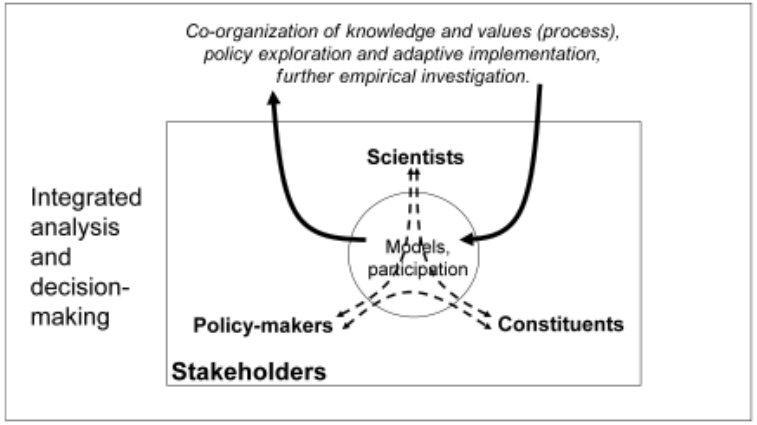
Research and policy questions

- Understand historical patterns
  - Changes in land use
  - Structural changes
- Explore future trajectories
  - Climate uncertainty (drier periods?)
  - Economic uncertainty
  - Sustainability concerns
  - Technological innovation
- Inform policy design
  - Subsidies and (dis)incentives

Why simulation/modeling?

- Forces *explicit formulation* of relevant processes
  - Identifies relevant processes
  - Clarifies what is (not) understood about processes
  - How well do we need to know value of parameter X?
- Provides "boundary object" between field, lab and stakeholders
- Provides insight/support for decisions

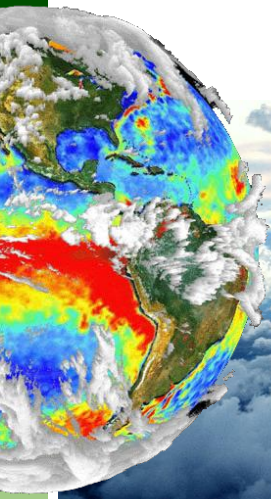




Components of the problem

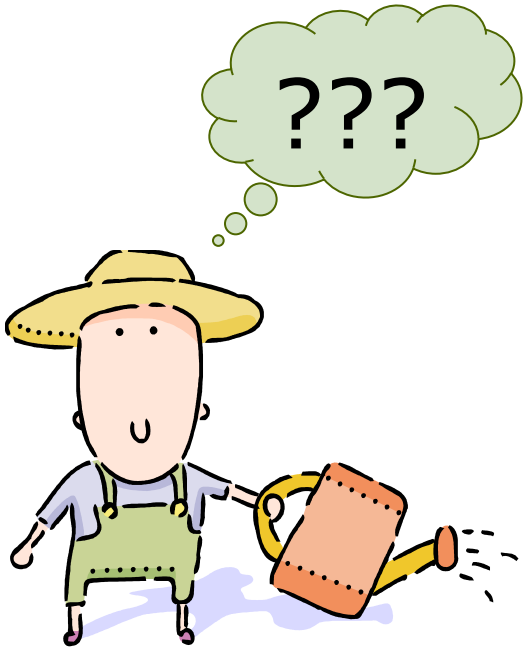
- Drivers of agriculture in the Pampas
- Relevant actors
- Actors`mental models about the problem
- Variables
- Relationships among variables
- Feedbacks (ciclos de retroalimentación)

Drivers of change



Relevant actors in agriculture

- Farmers
  - Buy or rent more land?
  - Activities
    - Crop mix? Cattle?
  - Management
    - How much fertilizer?
    - What crop varieties?
  - Financial management
    - Futures markets



Life Cycle Assessment (LCA)

Adapted from: http://sustainable-graphic-design.blogspot.com

BIOPLASTICS

Transport

Water

Fertilizer, Pesticides

Equipment

Electricity

Natural gas

Additives

Water

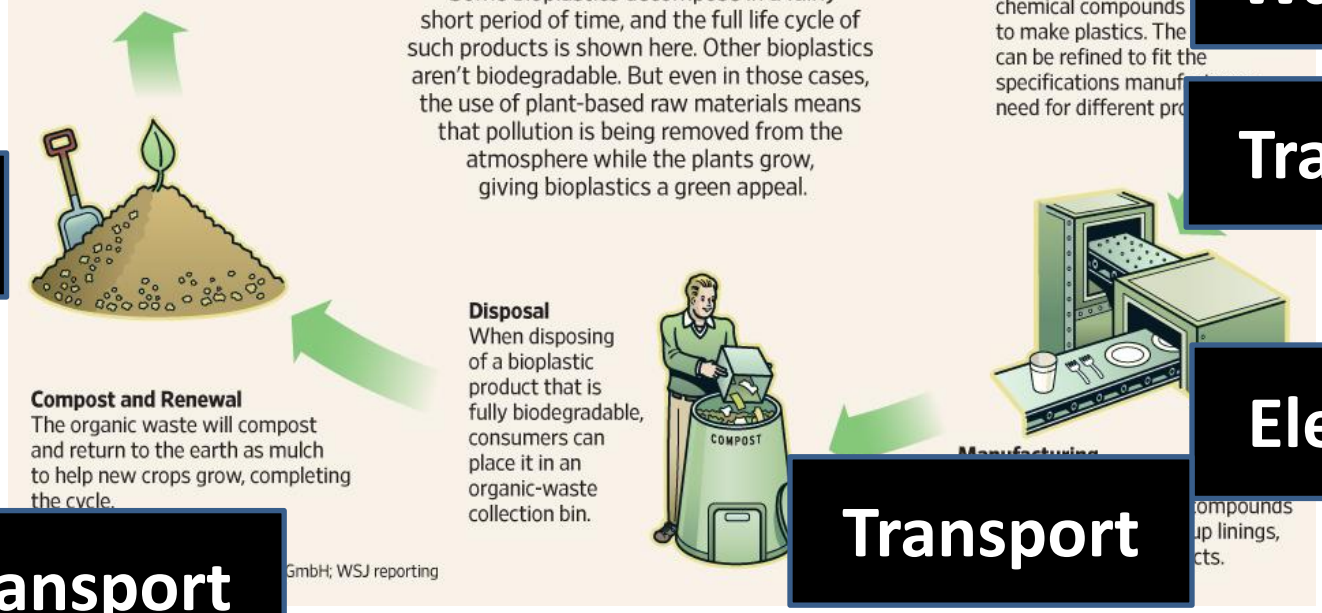
Transport

Electricity

Transport

Transport

Land



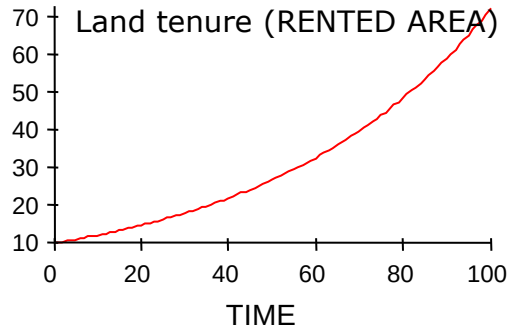
Advantages of system dynamics modeling

- The Structure of the system generates Aggregated patterns
  - Land use
  - Technology diffusion
- Decision making and policy design from the learning perspective
- Systemic perspective
- Multi cause–effect explanations
- Understanding of non linearities
- Not only computerized modeling
- Tools for mental models sharing

What is systems dynamics modeling?

Emphasis in understanding and policy design

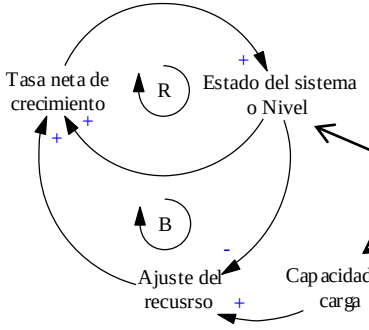
BEHAVIOR - COMPORTAMIENTO



Real systems

Virtual systems

STRUCTURE



Policy making

Mental models

Drivers

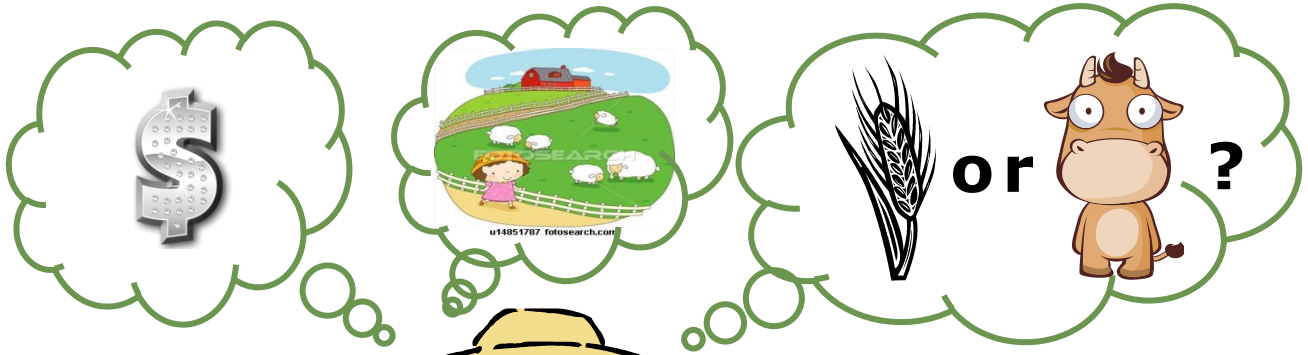
Decision making

Advantages of agent-based modeling

- Aggregated patterns *emerge* from individual decisions: microscopic ➔ macroscopic
  - Land use
  - Technology diffusion
- Heterogeneity in…
  - Decision-makers (personality, goals, experience)
  - Environmental, economic, social contexts
- Interactions between agents
  - Channeled through social networks
  - Imitation, learning
  - Social norms, social status

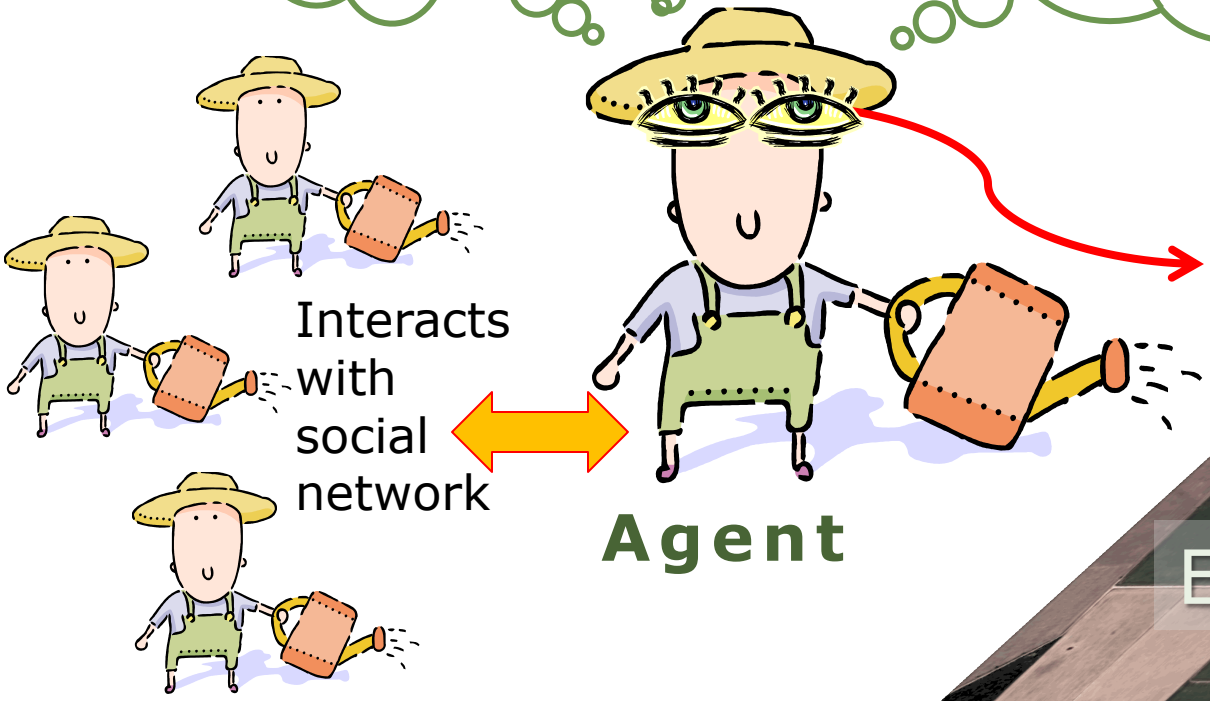
What is agent-based modeling?

Has explicit goals



Makes decisions following rules

Perceives environment & context



Interacts with social network

Agent

Environment

CRED