Agent Based Approaches to Land-Use and Land-Cover Change in the Southern Yucatan Peninsular Region of Mexico

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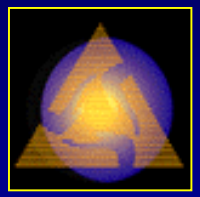
Acknowledgements



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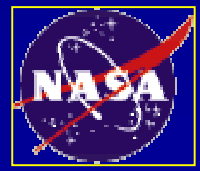

NSF Decision, Risk, and Management Science and NSF Geography and Regional Science Programs

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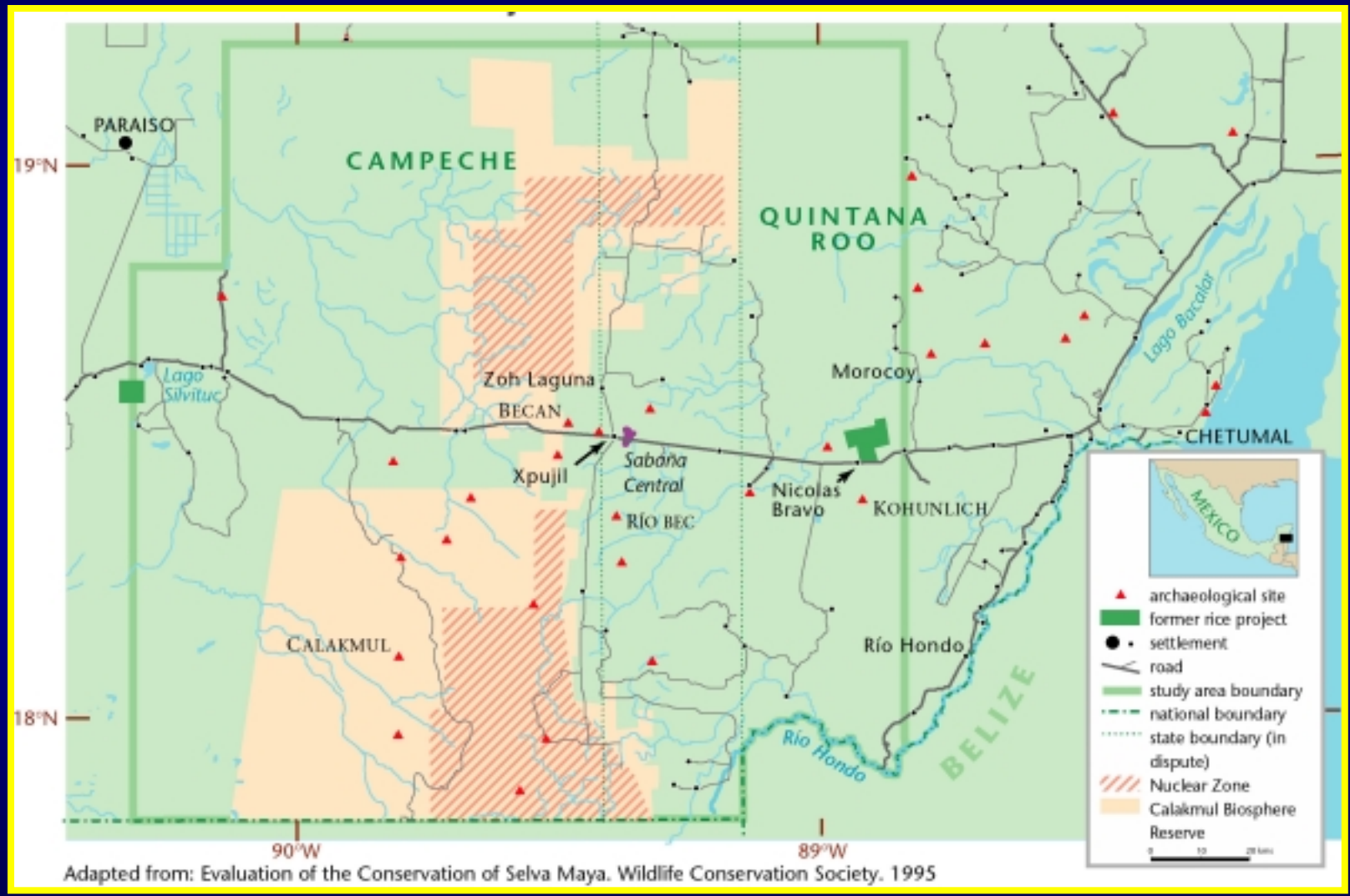
SYPR Study Site



Adapted from: Evaluation of the Conservation of Selva Maya. Wildlife Conservation Society. 1995

Study Site Characteristics

- Migration
- Development
- El Mundo Maya

- World Bank “Critical Corridor”
- Calakmul Biosphere Reserve
- Deforestation “Hot Spot”

LUCC Drivers:
Global change science perspective

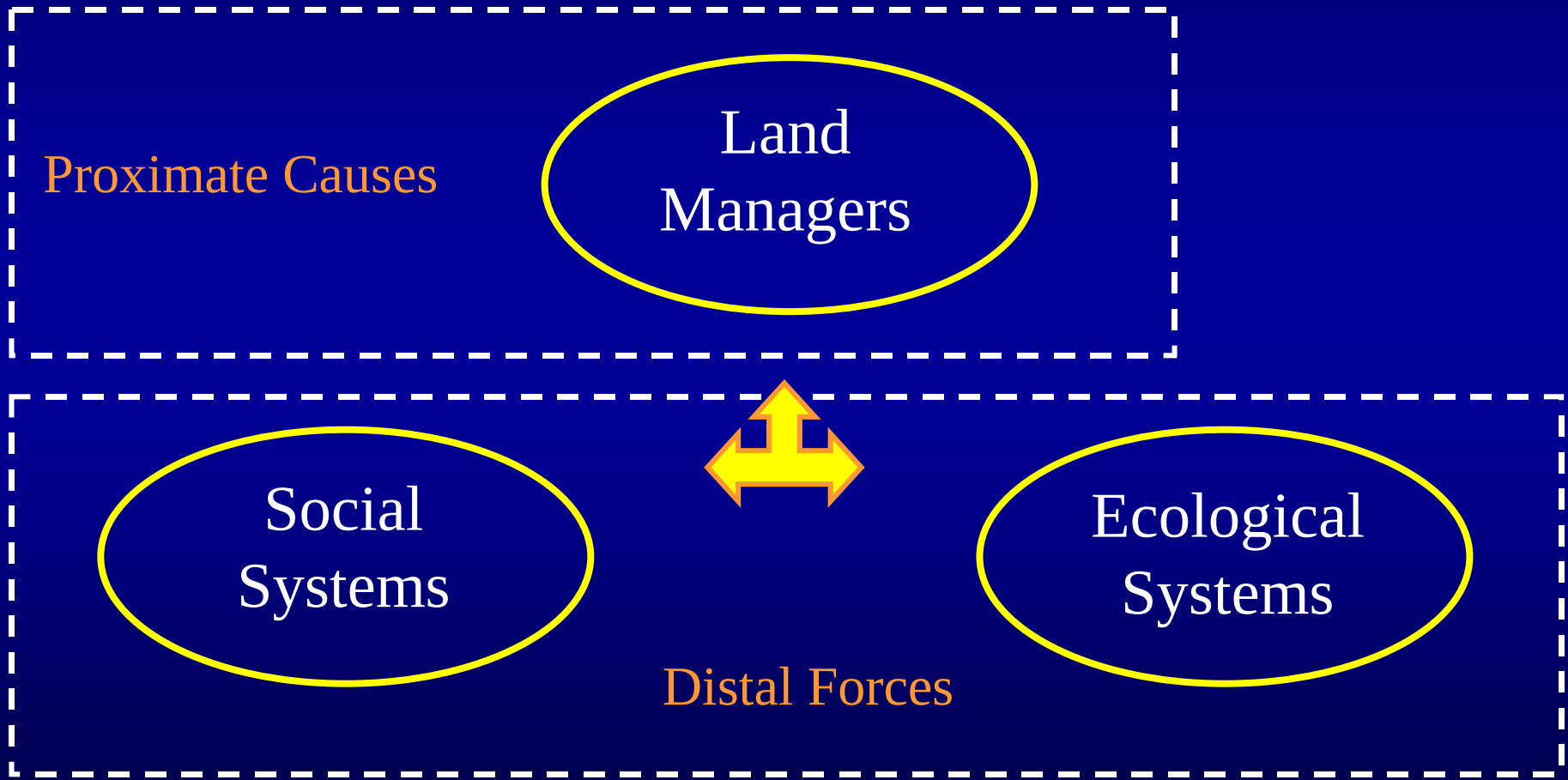
Distal Forces

- Population
- Markets
- Infrastructure
- Technology
- Policy

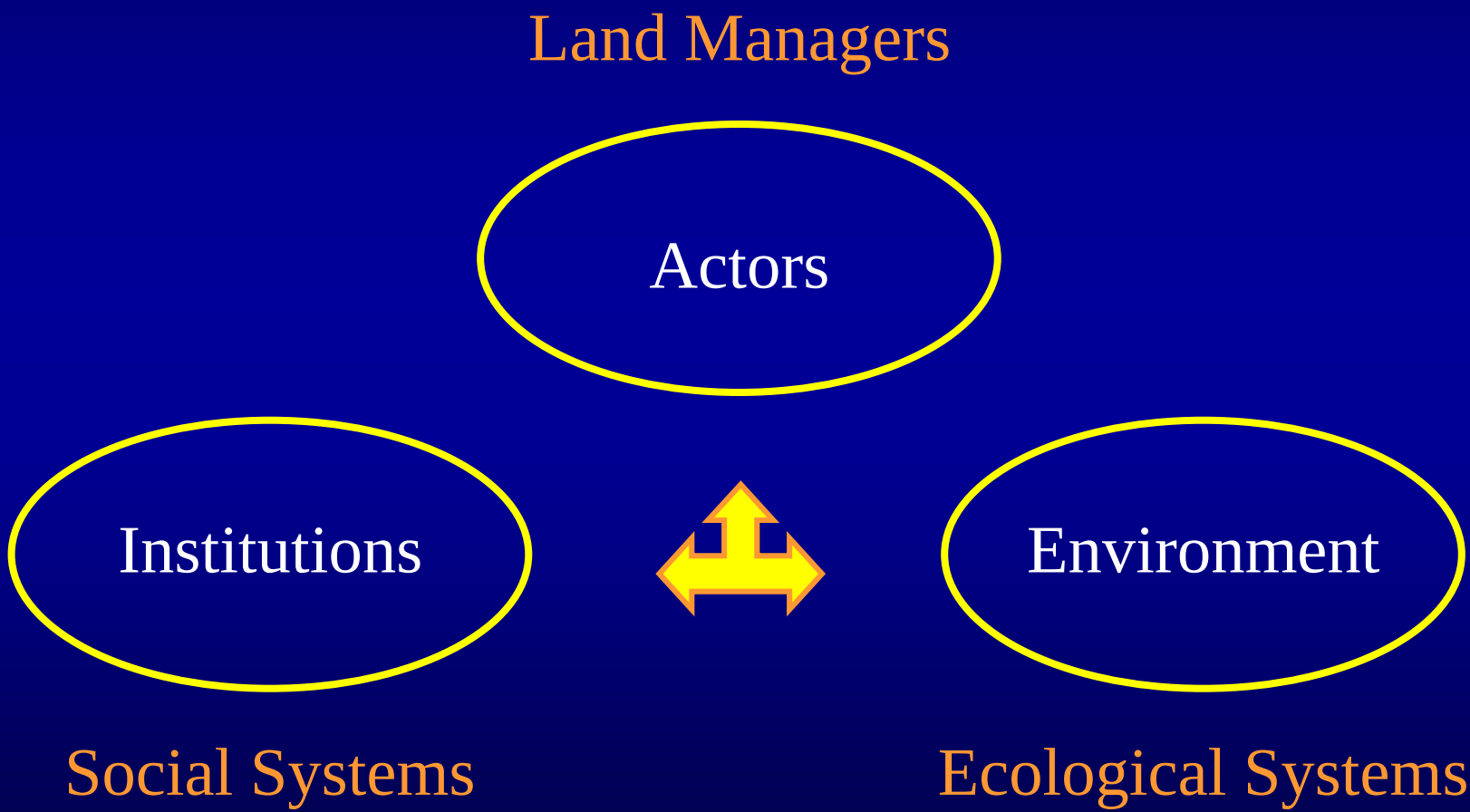
Proximate Causes

- Logging
- Farming
- Cattle rearing

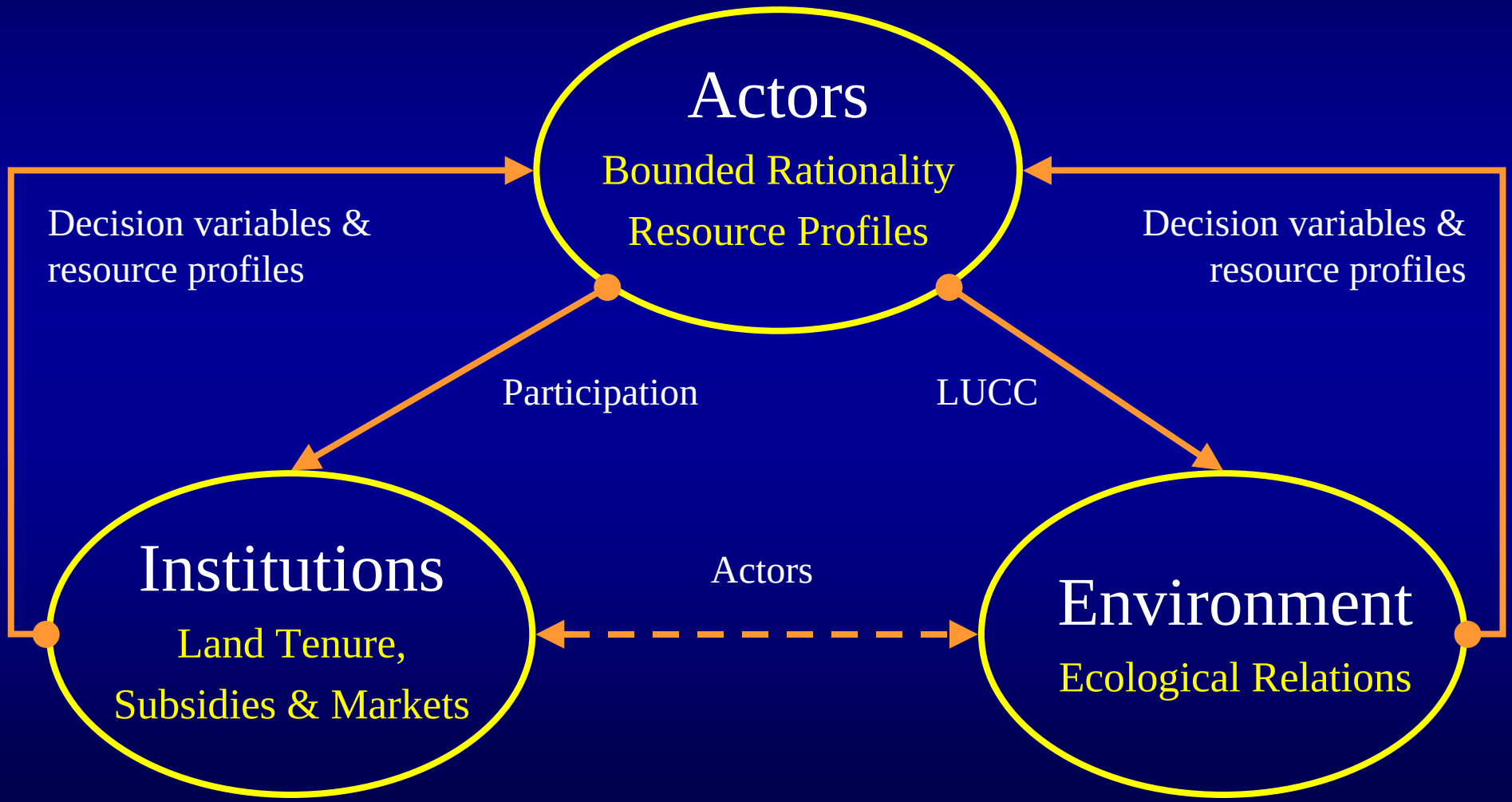
LUCC Drivers:
LUCC Research Plan Perspective



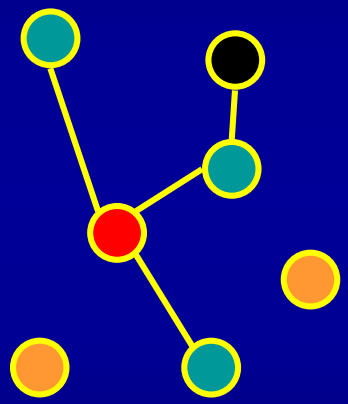
LUCC Drivers: SYPR IA Perspective

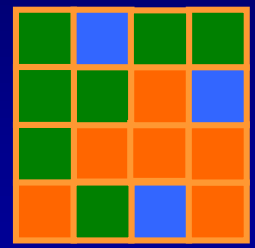


Conceptual Model: Relationships



From Concept to Practice





Cellular Model

+

Agent-Based Model

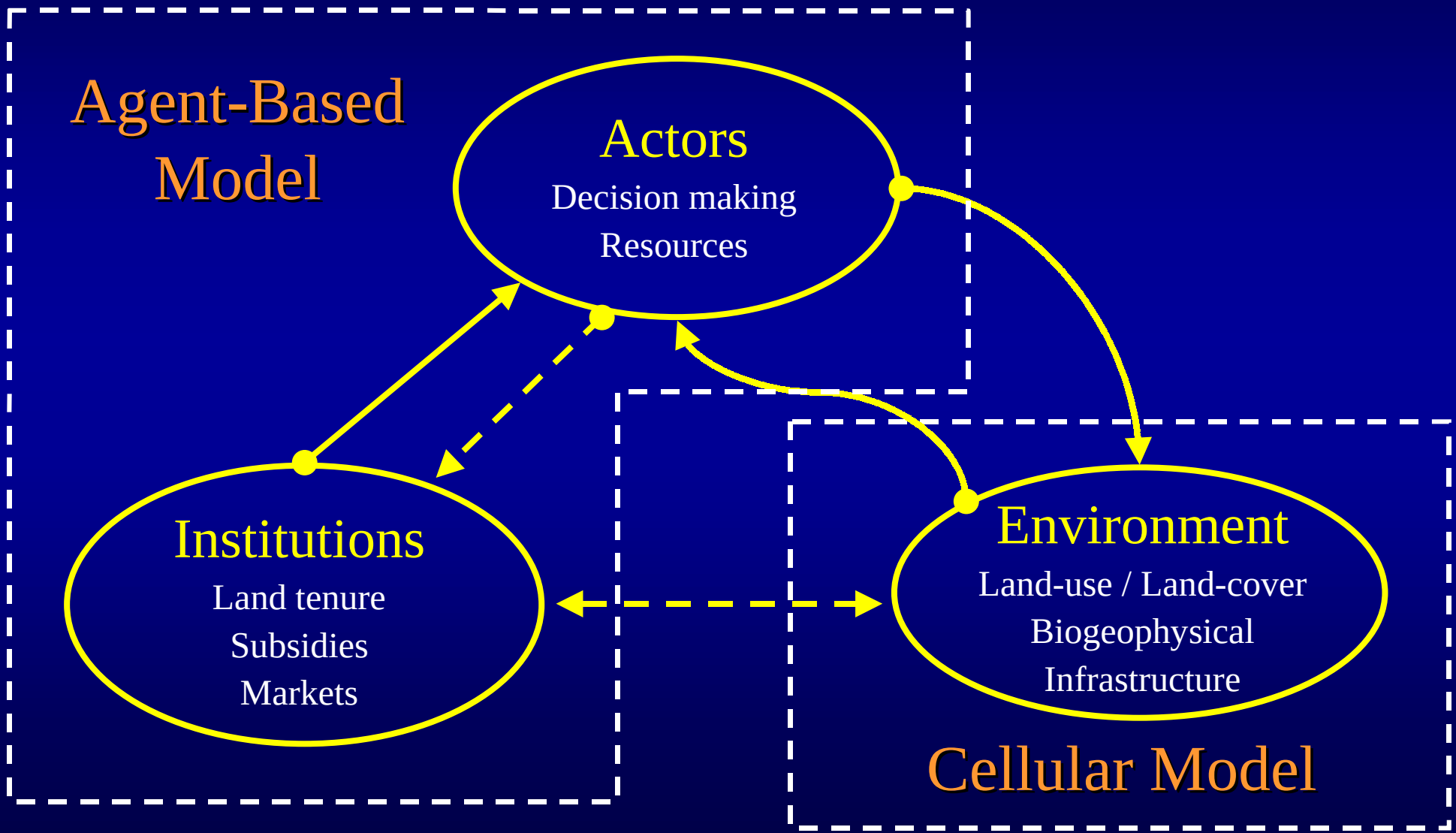
=

Multi-Agent System/LUCC Model

(MAS/LUCC)

SYPRIA

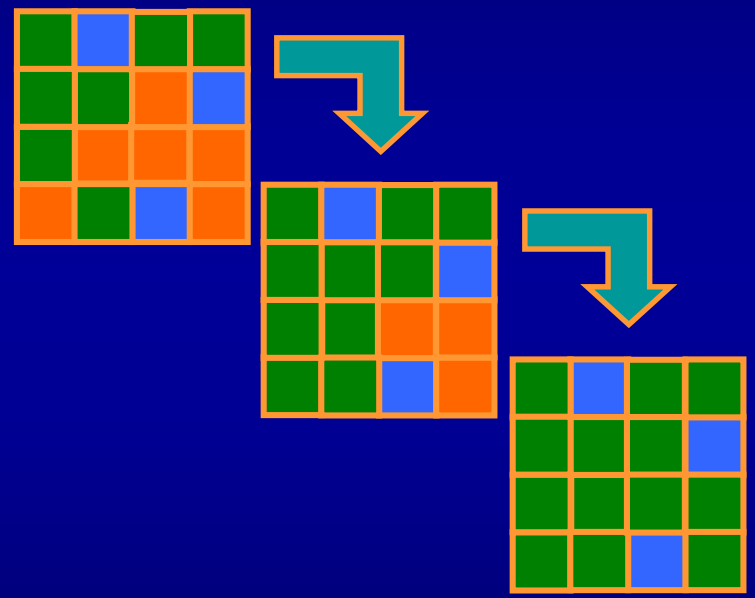
SYPRIA: Model Structure



SYPRIA: Cellular Model

Characteristics

- Simple, portable, yet complex!
- Proven ecological applications

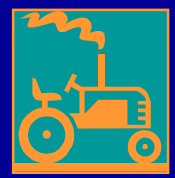


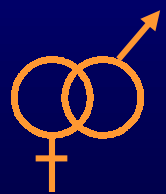
Represents

- Ecological functions
- Agent intervention (LUCC)

SYPRIA: Agent-Based Model

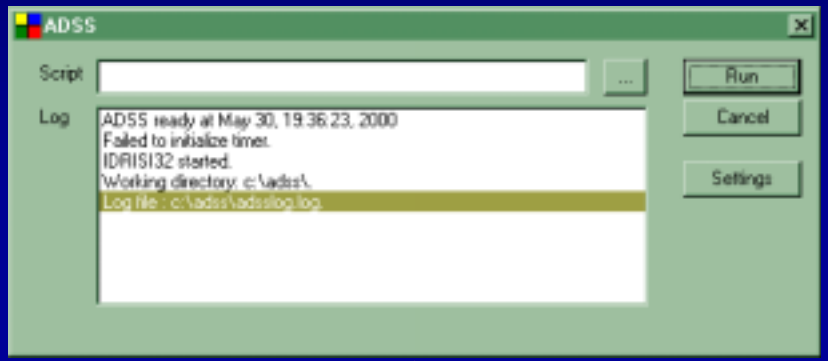
	Actors	Institutions
Processes	Decision making Communication Capabilities	Effects on actors Mechanisms
States	Household characteristics Resource profiles	Characteristics $$$

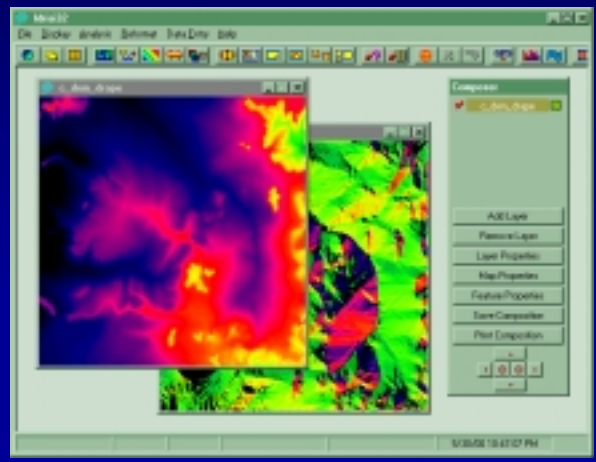




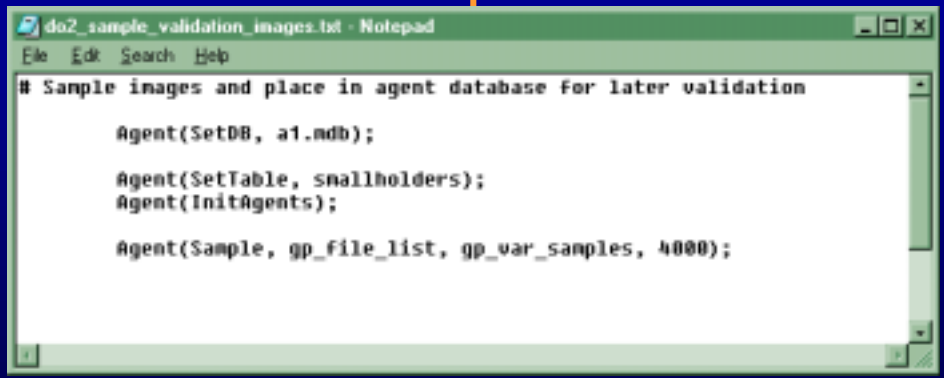
SYPRIA: Implementation

Core

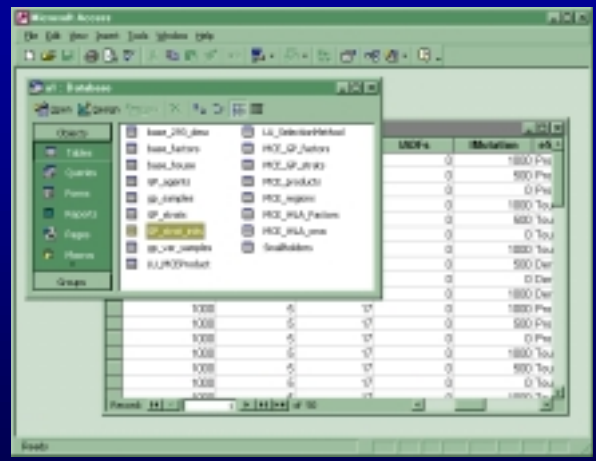




Idrisi32 GIS



Scripts



Access Database

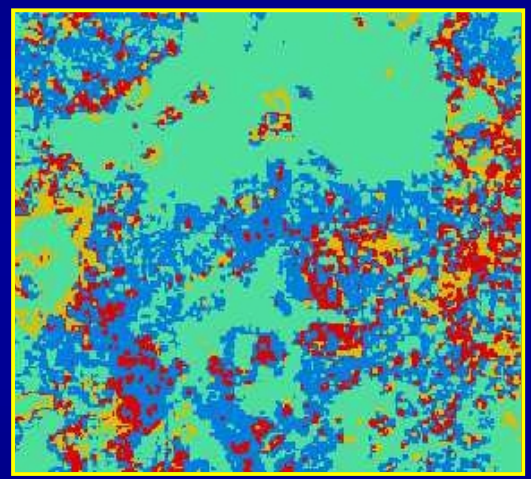
SYPRIA: Simulation Procedure

1. Update exogenous parameters
2. Institutions change actor profiles
3. Actors choose production activities
4. Actor behavior changes resource profiles and impacts environment through land-use
5. Environment updates

SYPRIA: Validation

Metric assessments performed on spatial LUCC outcomes

- Kappa Index of Agreement
- Pattern measures
- Multi-Resolution Goodness of Fit
- Monte Carlo uncertainty tests



Structural assessment

- Disaggregated expert tests of domain knowledge
- Integrated Assessment - Structural changes lead to meta change?

Conclusion

Challenges

- Spatiotemporal dynamics
- Nature/society integration
- Uncertainty/surprise

Goals

- Policy
- Methodological
- Theoretical

Future Research Directions

Broaden extent: expand temporal and spatial scales

System integration: anthropology, economics, & ecology

Policy: better linkage to livelihoods, biodiversity and climate models

GIScience: further methodological and conceptual innovations

Scaling issues: scale, global environmental change, and GIS

Complexity: complexity theory and complex systems

Uncertainty handling: consultation with CMU/Idrisi/Maastricht

Comparative modeling: CMU, Maastricht, Indiana, & Waterloo

Vulnerability & resilience: SYPR Phase 2 & Resilience Network