Simulating Human Agropastoral Activities
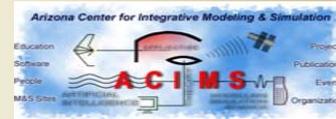# Using Hybrid Agent-Landscape Modeling: A Multidisciplinary Approach

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Mediterranean Landscape Dynamics Project (MEDLAND)

- Studies the effects of **agropastoral activities on landscapes and societies** from the Neolithic through the Bronze Age in the Mediterranean Basin.
- **International**, **interdisciplinary** team: researchers from the United States, Spain, and Jordan in the disciplines of Anthropology, Geology, Geography, and Computer Science and Engineering are collaboratively studying the long-term dynamics of human land use in the Mediterranean Basin.

Objectives:

Investigate three primary themes of human landuse:

1. The effects of growth in agropastoral economies on biodiversity,
2. Subsequent land use intensification and diversification and its impacts on landscape vulnerability and resilience, and
3. Studying the sustainability of human-maintained ecosystems.

Human Model

- A human household is represented as an agent
- Households are grouped into villages
- Households have goals, requirements based upon population, and the ability to manage some resources
- Household actions impact the surrounding landscape (e.g., deforesting to plant crop increases soil erosion)

Approach: Model and simulate agent and landscape dynamics separately and synthesize them to understand their complex interactions.

Interaction Model

- Relations between agents and landscape dynamics are represented in a rigorous and flexible fashion
- Connects agent and landscape models from both the formalism and software viewpoints
- Unified user interface for simulation control and data display

Challenges

- **Correctness**
- **Resolution vs Scale**
- **Computing Resources**
- **Synchronization**
- **Visualization**

agent

Agent DEVS Models

interactions

Data Transformation + Control Models
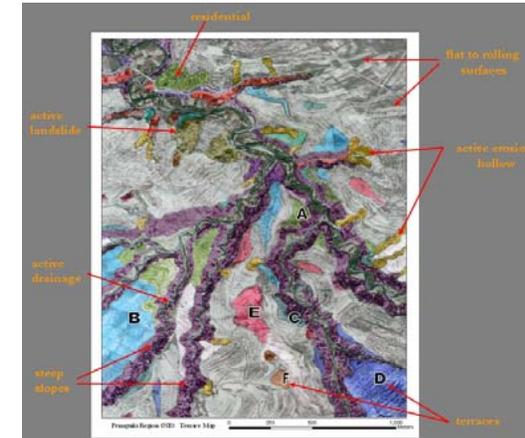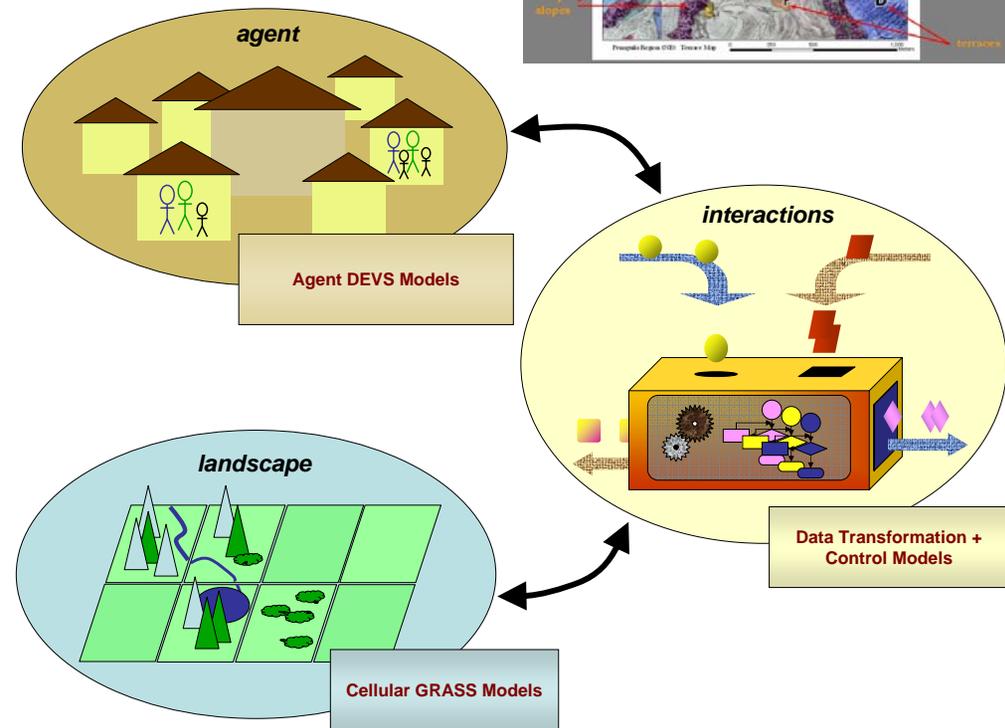
Environment Model

- Landscape and climate elements (e.g., soil, slope, and precipitation data)
- Landscape / climate dynamics
- Changing environment impacts the agents (e.g., decreased soil quality produces a reduced crop yield)

landscape

Cellular GRASS Models

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