Landuse and Landscape Socioecology in the Mediterranean Basin

A Natural Laboratory for the Study of the Long-Term Interaction of Human and Natural Systems

<http://www.asu.edu/clas/anthropology/research/LLSMB>

Interdisciplinary Partners

- NSF Biocomplexity in the Environment Program
- ASU: Anthropology, Geological Sciences, Computer Science and Engineering, Geography, Center for Environmental Studies
- Partners: Universitat de València, Universidad de Murcia, University of Jordan, North Carolina State University, University of Wisconsin, Center for Desert Archaeology, Geoarchaeological Research Associates.

Questions

- How does landuse shape landscapes over the long-term?
- What processes drive the long-term socioecological consequences of agropastoral landuse?

Significance of Agriculture

- As socioecological phase change
- As strong attractor in human adaptive landscape
- Because all human society depends on agropastoral systems
- As source of most extensive and significant long-term impacts on terrestrial landscapes

Issues

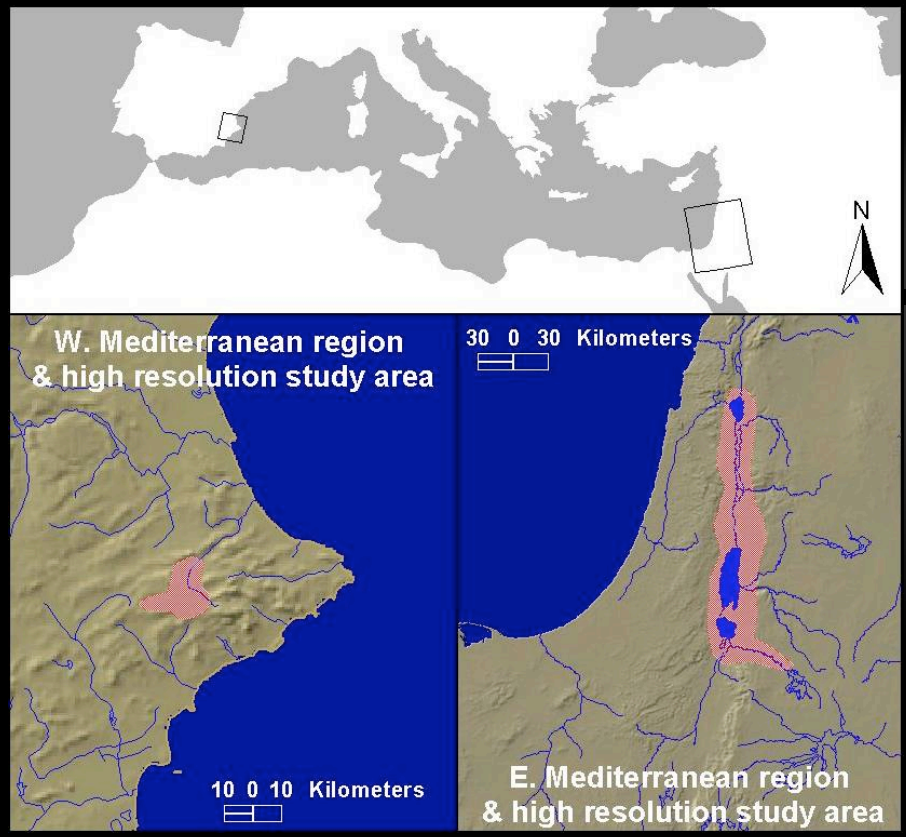
- Recursive, non-linear interactions between society and landscape in in agripastoral socioecosystems
- Most significant landscape consequences of agropastoral landuse are long-term
- Consequences for society affect quality of life, and even life or death
- Many of the past issues relevant today, on a larger scale

Goals

- Model landscapes and geomorphic processes using dynamics geospatial models
- Model human landuse using agent-based simulation
- Link geospatial and agent models to study interactions and outcomes at varying spatial and temporal scales
- Use knowledge of the past to verify and tune models

Project Location: Space & Time

- Mediterranean Basin
  - Longest history of agropastoral systems
  - Variable sustainability across space and over time
- Opposite ends of Mediterranean Basin
  - Encompasses wide range of ecological & social variation
  - Tracks initial spread of agriculture & replacement of foraging systems
  - Different trajectories to the appearance of complex societies

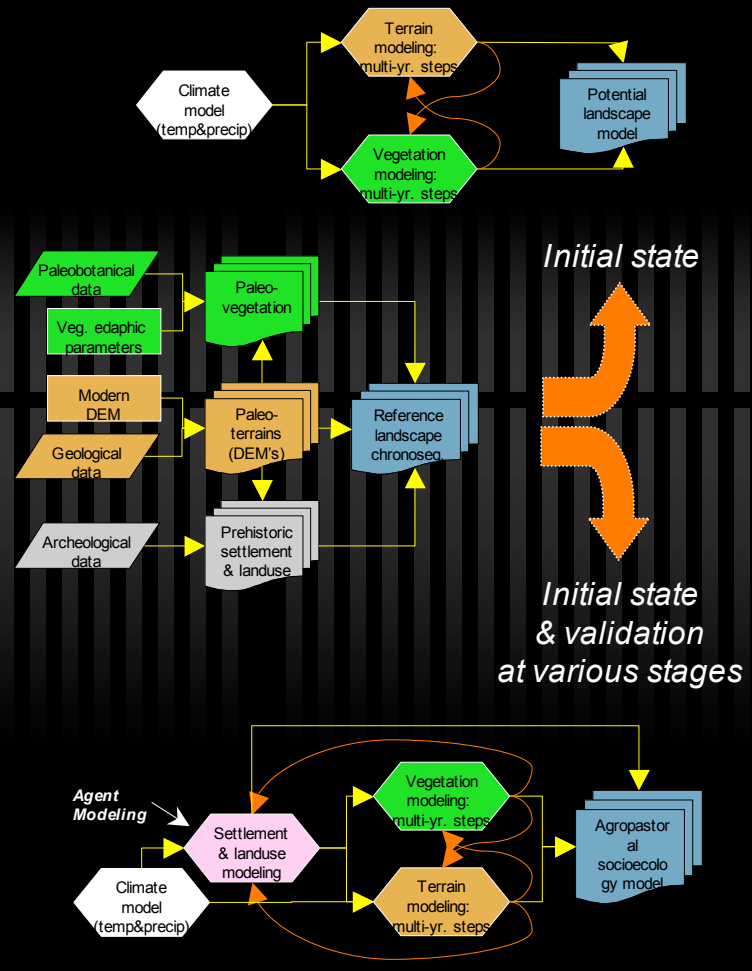


Project Location: Space & Time

- Ca. 8000-2000 BCE
- Beginning of Neolithic farming to beginning of Bronze Age complex society
  - Encompasses social and ecological consequences of shift from foraging to farming
  - Encompasses first reorganizations of agricultural systems in response to ecological impacts of these systems.
    - Intensification
    - Pastoralism
  - Encompasses circumstances leading up to next major socioecological phase change of Holocene: rise of urban civilization

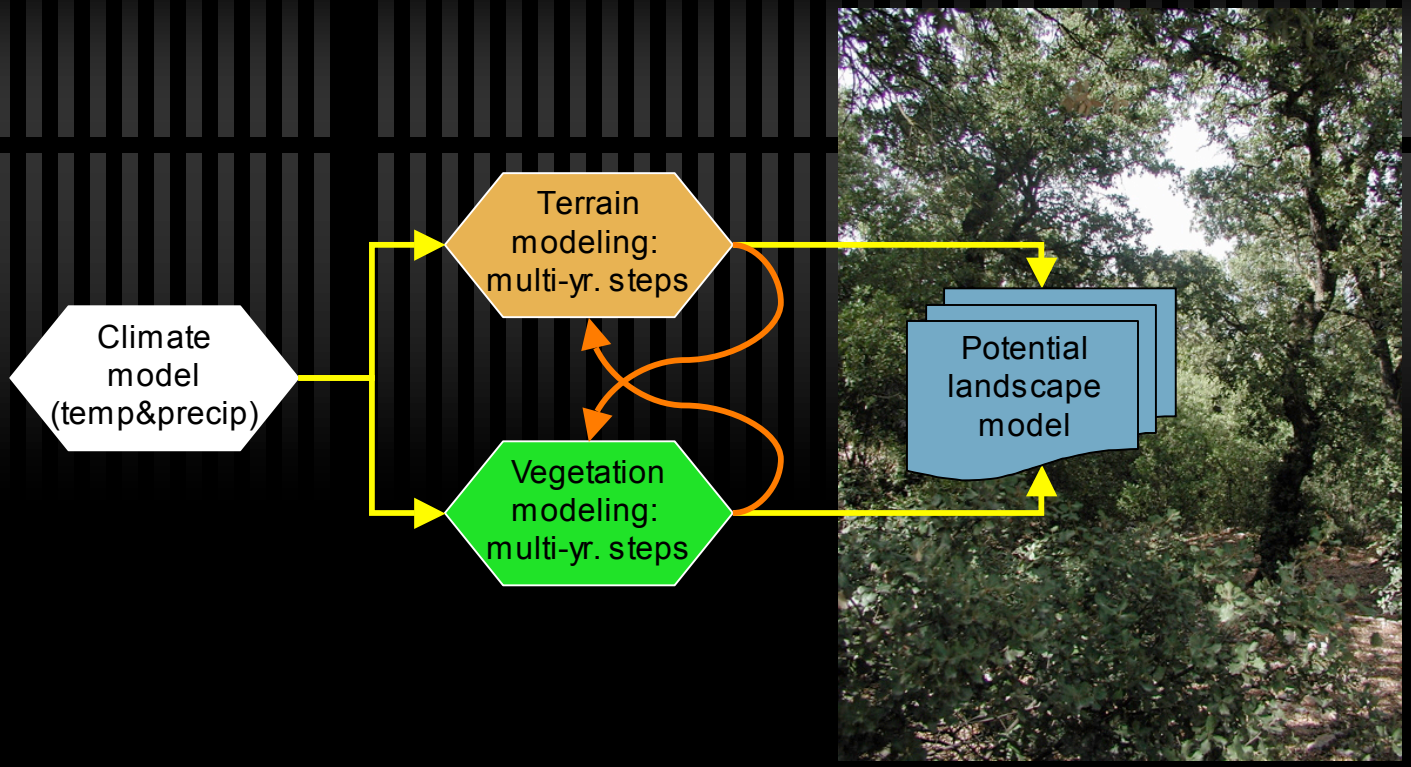
Model Building

- GIS platform
  - Data management
  - Critical spatial dimension of socioecosystems
  - Linkage between models
- 3 Interlinked modeling environments
  - Potential landscape model
  - Reference landscape chronosequence
  - Agropastoral socioecology model



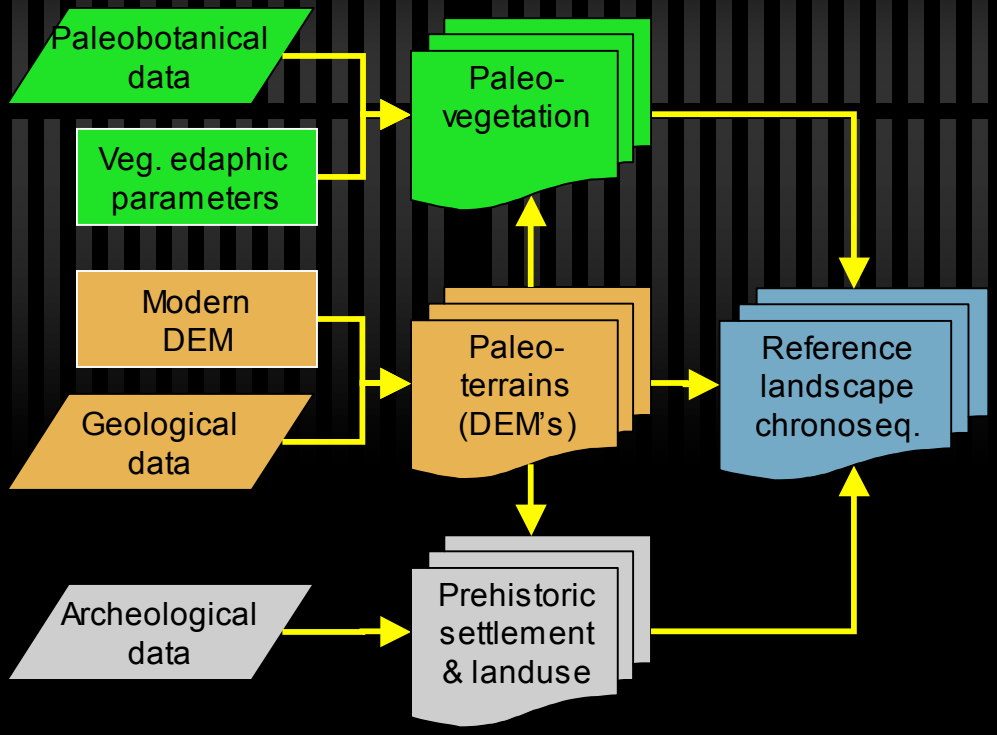
Model Building: Geospatial

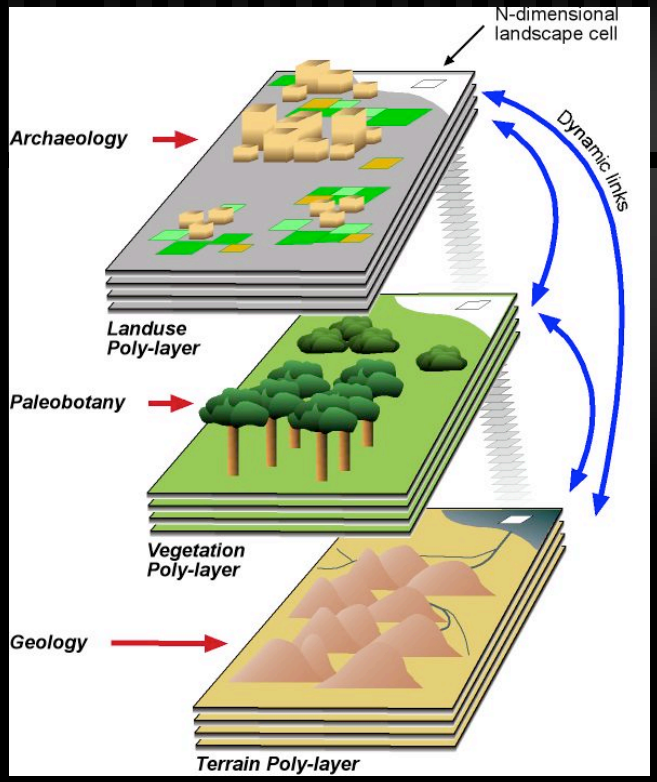
- Potential landscape model



Model Building: Geospatial

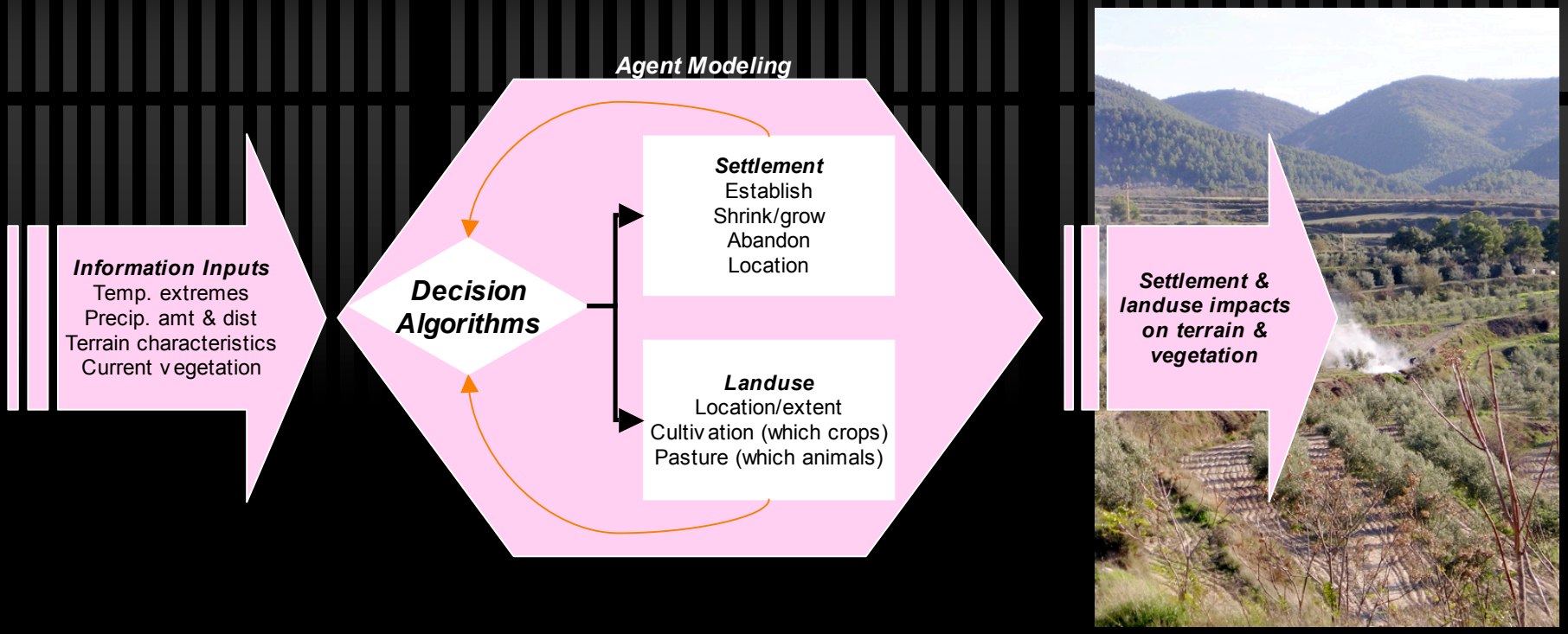
- Reference landscape chronosequence





Model Building: Agent Simulation

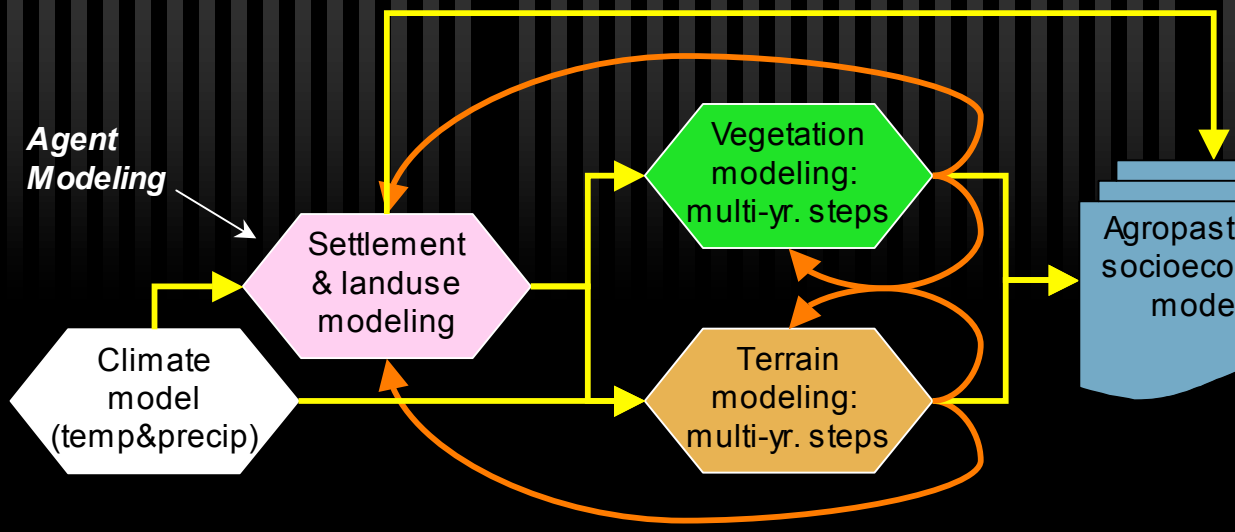
- Human landuse

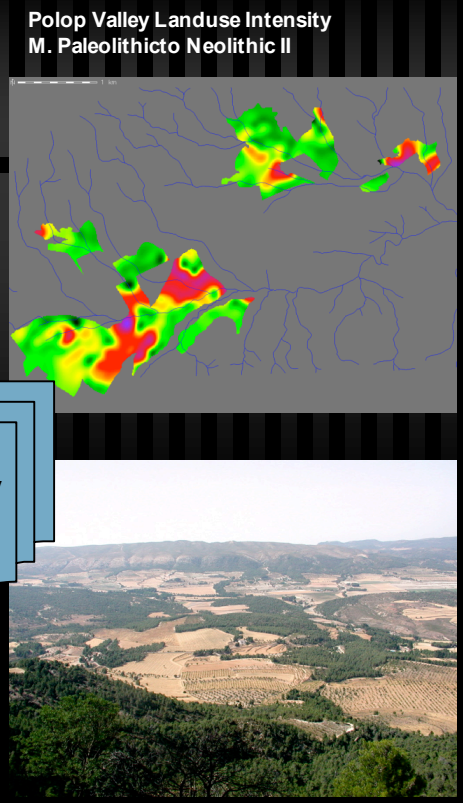


Model Building: Hybrid

- Geospatial + agent modeling

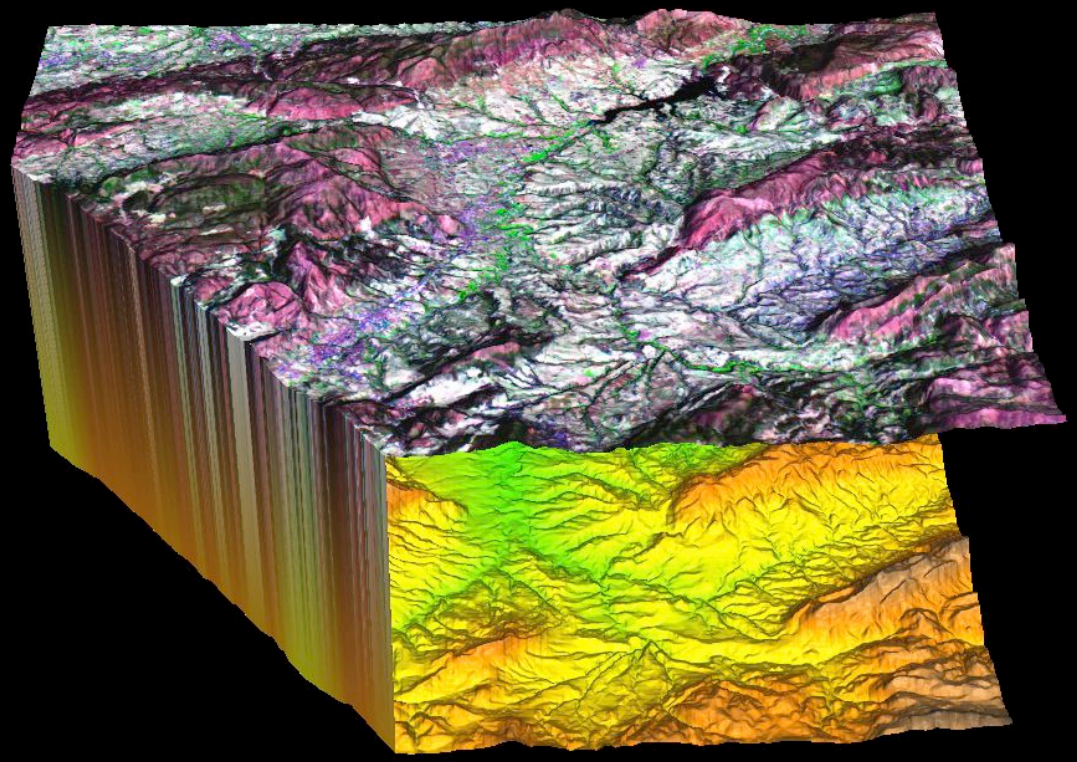
➡ landscape socioecology





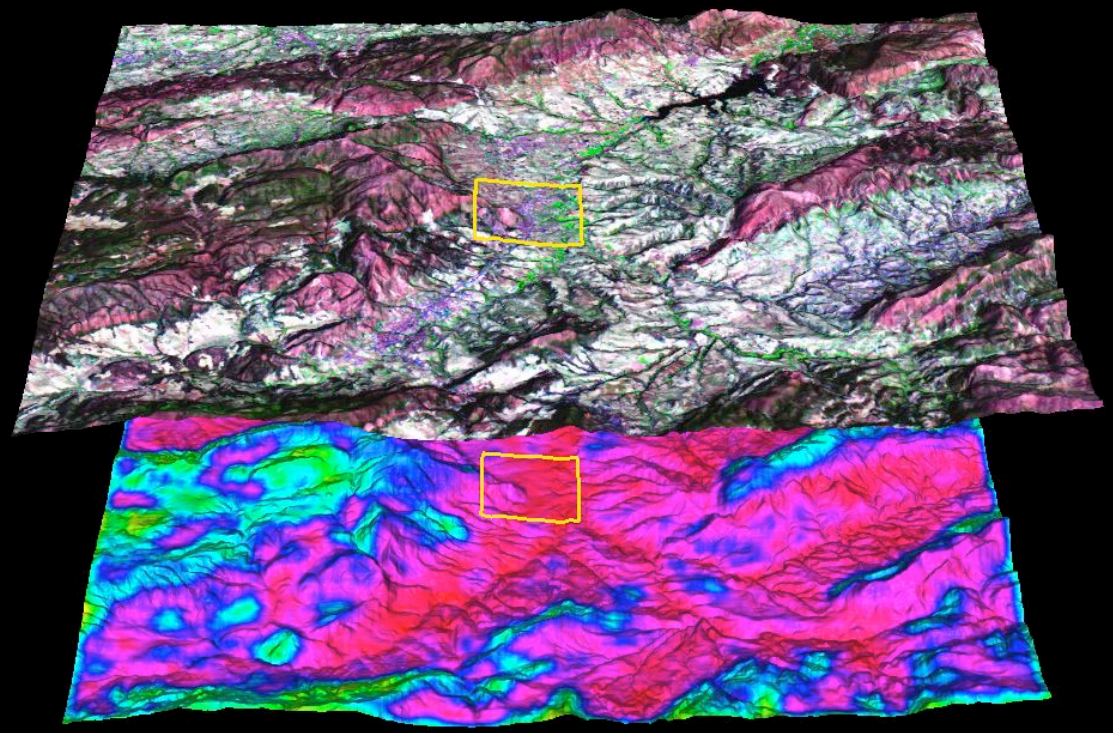
Validation and Tuning

- Comparisons with reference chronosequence



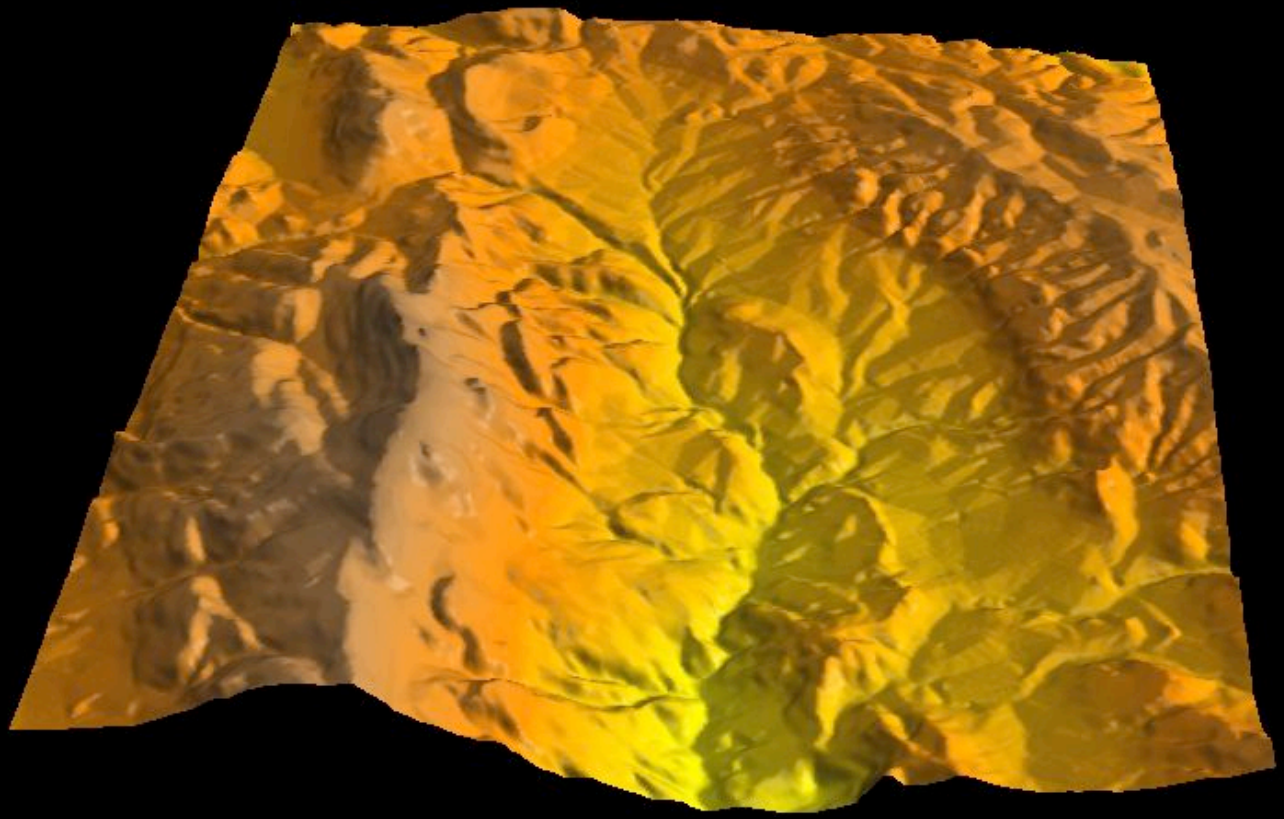
Addressing Research Questions

- Effects of growth of agropastoral systems on biodiversity at varying spatial and temporal scales



Addressing Research Questions

- Effects of intensification and diversification on landscape resilience and vulnerability to degradation



Addressing Research Questions

- Long-term sustainability of human maintained socioecosystems in different contexts

Past as Key to the Future

- As prehistorians, we learn about outcomes and seek to understand processes

Past as Key to the Future

- Modeling societies as complex systems can help link the past and present to offer a glimpse of the future