Sustainable Ecosystems in a Changing Environment

- Biophysical System
- Natural Resources
- Ecosystem Processes
- Ecosystem Services
- Human System
## Sustainable Ecosystems

### Faculty Strengths & Synergies

<table>
<thead>
<tr>
<th>UNH (Sustainability Collaboratory, Sustainability Institute, etc.)</th>
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<tbody>
<tr>
<td>Microbial Diversity Host microbe interactions</td>
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<td>Organic Dairy Research &amp; Nutrition</td>
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<td>Wildlife Landscape Interactions Historical ecology</td>
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<td>Soil Biogeochemistry Nutrient Cycling</td>
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<td>Plant - water - nutrient cycles Ecohydrology Ecophysiology</td>
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<td>Biodiversity Agroecosystem Function Cropping Systems</td>
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<td>Plant Breeding Agricultural Plant Genetic Resources</td>
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<td>Water quality River networks Water C and N</td>
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Objectives:

- Identify major land use change trajectories
- Identify a series of watersheds to examine the effects of land use change trajectories on ecosystem services
- Develop a framework for integrating DNDC, PnET, and FrAMES
- Foster regional efforts in agroecosystem science and sustainability
Landscape scale analysis of historical LUC (biophys & socioecon) of target study areas

Assessment of local stakeholders’ future landscape visions (potential LUCTs)

Proposed Activities

Collect baseline data from study watersheds (TBD)

Develop an integrated modeling platform (PnET, DNDC, FrAMES, HYDRO)

Research planning workshops (incl. other UNH/NH collaborators): interdisciplinary team building

Regional agroecosystem conference (explore cross-institutional and multi-state collaboration & synergies)
NSF CNH-Exploratory Proposal:
Exploring the socio-environmental thresholds and resilience of agriculturally-driven land use change in New England

Social Science
- Natural Resource Economics
- Halstead

Biophysical science
- Agroecology
- Ecosystem Ecology
- Smith
- Asbjornsen
(+Sustainable Agriculture and Ecosystems Cluster)

Remote sensing/GIS
- Congalton
“Our overarching hypothesis is that rapid and dynamic changes in consumer perceptions of and demand for locally produced agricultural products are leading to fundamental reorganization of land use patterns and expansion of cultivated lands, including possible conversion of forested lands, which has implications for ecosystem services and their feedbacks to future land use decisions.”
Figure 1. Conceptual model of the coupled socio-agroecological systems (SAES) that determine the quantity and quality of ecosystem services mediated by agriculturally-driven land use change.
Objectives:

- Document the current and future land use change trajectories related to coupled socio-agroecological systems (SAES) in the GBW, along with their major socioeconomic drivers, as portrayed by stakeholder perceptions.

- Collect and synthesize data on the effects of the dominant SAES-driven land use change on carbon and nutrient cycling and hydrologic flows and develop a modeling framework for simulating these processes and transformations within the GBW.
Objectives (cont.):

- Integrate information from objectives 1-2 to develop a spatially-explicit index for potential agricultural land-use change and alteration of ecosystem services for the GBW landscape.

- Foster local to regional interdisciplinary dialogue, partnerships, and collaboration to build the conceptual architecture and base line data necessary to grow our interdisciplinary team.

- Identify specific study watersheds and develop the experimental design for the long-term research.
Synthesis in Progress
Maximizing ecosystem service benefits from increasing local agricultural production: a conceptual framework for New England

Increasing demand for local agricultural production in New England

- Food quality
- Food security
- Localvore movement

- Local economic benefits
- Landscape preservation
- Perceived environmental sustainability

Trade-offs between land use and ecosystem services

- Soil health
- GHG mediation
- Pollination

- Water quality / hydrologic regulation
- Wildlife habitat
- Disease / pest movement

Need to understand the local and global coupling of agricultural land use and ecosystem services.
Conceptual framework for evaluating the sustainability of various agricultural land use scenarios in New England

“Scale” as an organizing principle

“Sustainability” as a quest for eliminating cost transfers to higher scales (minimizing scale dependence)
Effects of local agriculture production on reactive carbon losses

A. Local level

- Exceeds C storage capacity of local/regional ecosystem due to loss of major local C-sinks

B. Global level

- C emissions decline due to reduced food transport
- C emissions increase due to loss of significant C-sinks
What kind of local agricultural production maximizes ecosystem services, locally and globally?

What does the scale of activities and impacts tell us about the roles of producers, consumers, planners, and policy-makers in the sustainable growth of local agriculture?