EXAMPLES OF CONCEPTUAL MODELS
PROPOSAL WRITING

ECO 601 – RESEARCH CONCEPTS
PROF. ROY & DESTEFANO
3 OCTOBER 2012
Forest Succession

Plants Stage: First 5 years
Shrub Stage: 6-25 years
Young Forest: 26 - 50 years
Mature Forest: 51 - 150 years
Climax Forest: 150 - 300 years

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http://www.exploringnature.org/graphics/ecology/succession72.jpg
The Nitrogen Cycle

Aquatic Insect Life Cycle

JNABS 28:1022-1037

**Fig. 1.** Diagram of a generalized aquatic insect life cycle for holometabolous and hemimetabolous insects. The complete life cycle includes aquatic and terrestrial stages. The association of pupal and egg stages with the terrestrial and aquatic environments differs among species and often involves both stages. As a result, we describe these stages as being part of the aquatic/terrestrial interface. Any breakdown in the life cycle, increase in emigration, or barrier to immigration can contribute to population loss.
http://www.blm.gov/nstc/soil/foodweb/images/FOOD%20WEB.jpg
A simplified food web for the Northwest Atlantic
Conceptual Models in different sections of a Proposal/Prospectus/Paper
Urban Impacts on Streams

Notes: Most major pathways are shown with arrows. Stormwater runoff from EIA is indicated in bold to highlight its central importance in most urban areas in developed nations. Other pathways are indicated with a plus sign (e.g., “+ii” means that planning regulations also can manage the stressor source). Stressors 1-11 affect all levels of ecosystem structure and function via various mechanisms. Ecosystem response pathways are not shown for simplicity.

Abbreviations: sed. = sedimentation, regs. = regulations, mgt. = management, EIA = effective (connected) impervious area.
*To a lesser degree, stormwater runoff is also from other, altered land cover.
**Piped streams affect virtually all other stressors, although relationships are not shown here.

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Other pathways are indicated with a plus sign (e.g., +ii, vii, viii)
The Urban Stream Paradigm: Landscape-Scale Predictors and Mechanisms of Stream Degradation


Figure 2. Research approach and outcomes.

**Objective 1.** Develop common currencies of biotic response

**Objective 2.** Identify clusters of co-varying urban stressors

Generate hypotheses of dominant stressor-response relationships in different settings

**Objective 3.** Develop generalized Urban Stream Paradigm

1) Potential ecological condition for urban streams
2) Regional prediction and forecasting of stream response
3) Prescriptions for improving urban streams and managing urban build-out
In pursuit of friendly waters:
Behavioral drift of macroinvertebrates in urbanizing streams

Kutztown University Research Committee Proposal (2010)
PI: Allison Roy

Figure 3. Example placement of drift nets and Surber samplers for collection of macroinvertebrates within a stream reach.
Reach-scale effects of riparian forest cover on urban stream ecosystems

Roy et al. 2005. CJFAS 62:2312-2329

Fig. 1. Conceptual model of relationships between reach-scale riparian deforestation and responses of basal food resources and consumers in urban streams. Riparian deforestation is predicted to result in changes in habitat (e.g., temperature and habitat diversity) and food resources (e.g., organic matter inputs and algae). We predict corresponding changes in biotic assemblages, including terrestrial invertebrates, benthic invertebrates, salamanders, and fishes. For example, reductions in terrestrial-derived carbon and increases in autochthonous carbon are predicted to increase densities of algae-eating invertebrates and fishes and decrease densities of shredding insects. We hypothesize that these changes in basal food resources will also be translated into differences in the proportions of prey types consumed by salamanders and fishes between open and forested reaches. Responses in bold indicate significant effects observed in this study.

<table>
<thead>
<tr>
<th>RESPONSES TO REACH-SCALE RIPARIAN DEFORESTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Habitat and Food Resources</strong></td>
</tr>
<tr>
<td>Temperature (↑ summer temp, ↑ diel temp)</td>
</tr>
<tr>
<td>Habitat (↓ variability phi, depth, &amp; velocity; ↓ channel width)</td>
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<tr>
<td>Organic Matter (↓ large wood)</td>
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<tr>
<td>Algae (↑ chlorophyll a, ↑ biofilm biomass)</td>
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<tr>
<td><strong>Biotic Assemblage</strong></td>
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<tr>
<td>Terrestrial Invertebrates (↓ diversity, ↓ density, ↓ biomass)</td>
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<tr>
<td>Benthic Invertebrates (↓ richness, ↓ EPT, ↓ shredder density, ↑ scraper density)</td>
</tr>
<tr>
<td>Salamanders (↓ richness, ↓ density)</td>
</tr>
<tr>
<td>Fishes (↓ endemics, ↑ tolerants, ↑ herbivore density &amp; size)</td>
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<tr>
<td><strong>Trophic</strong></td>
</tr>
<tr>
<td>Salamander Gut Contents (↑ % scrapers, ↓ % shredders, ↓ diversity)</td>
</tr>
<tr>
<td>Fish Gut Contents (↓ % terrestrial, ↑ % scrapers, ↓ % shredders, ↓ diversity)</td>
</tr>
</tbody>
</table>
Examples of Conceptual Models from previous students in Research Concepts
An Evaluation of Nature-Like Fishways for Passage of Alewife (*Alosa aestivalis*)

by Abigail Franklin

**Fish Passage Designs**

- **Upstream passage**
  - Dam removal
  - Nature-like
  - Technical
    - Pool & weir
      - Vertical Slot
      - Ice Harbor
    - Baffle
    - Bypass channels
      - Rock ramp
      - Denil
      - Steepass
    - Fish lock
    - Fish lift
    - Archimedes Screw
  - Turbine modification
  - Weir

- **Downstream passage**
Climate warming effects on sugar maple (*Acer saccharum*)
distribution and implications for vertebrates of New England

Ezra Small, M.S. Candidate, Wildlife and Fisheries Conservation
A Socio-Ecological Definition of Forest: A more relevant definition for the urban-rural interface

Amy Nathanson

Ecological/physical

Canopy cover
Water bodies
Tree density
Tree type
Acreage
Elevation
(etc.)

Social

Road density
Median income
Land parcel size
Real-estate value
Population density
Public vs. Private ownership
(etc.)

Ecological Services

Carbon Sequestration
Biodiversity
Water Purification
Recreation
Timber
Evaluating the Effectiveness of Road Passage Structures for Freshwater Turtles in Massachusetts

by David Paulson

Culvert Entrance/Bypass Area

Measured Grid System
River Herring Restoration in the Ipswich River: Conceptual Model

Donor River:
Nemasket

Stressors

Fish Return

Recipient River:
Ipswich

Fish Leave

<24 Hours

Stressors

Fish Stay

Fish Don’t Spawn

Unsuitable Area

Restoration efforts unsuccessful

Fish Spawn

Suitable Area

Juveniles imprint to the Ipswich

Adults home to the Ipswich

Restoration efforts successful

Survival

Tagging experiment unsuccessful

No Survival

by Holly Frank