Trophic Interactions and Population Dynamics – BNZ Working Group

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How do population dynamics and species interactions shape ecosystem responses to environmental change?

Will consumer-mediated interactions alter dynamic forest responses to changing climate and disturbance?

- Model system: Aspen and its consumers
  - Aspen leaf miner
  - Aspen running canker
- Implications for alternative successional trajectories

What is the sensitivity of forest dynamics to shifting species abundance and distributions?

- Interactions between climate and biogeography
- Vulnerability to shifting distributions of dominant tree species, consumers, and pests/pathogens

Research Directions

Aspen model system

- Detailed study of dynamics and mechanisms at a few sites
- Annual surveys of ALM & canker across regional site network to capture spatio-temporal variations in climate, productivity, and stand age

Implications for succession & forest canopy dynamics

- ➢ Monitoring of growth and mortality
- ➢ Whole tree experimental removal of consumers/pathogens
- ➢ Modelling to assess effects on stand dynamics

Interactions between climate and biogeography

- Contrast species interactions, population dynamics, and disturbance recovery across regional bioclimatic gradients

- Work with modelers to explore:
  - Ecosystem consequences of shifting species distributions (e.g. lodgepole pine, spruce bark beetle)
  - Potential for novel disturbances (pests/pathogens) to disrupt ecosystem legacies and resilience
  - Effects of phenological changes on species interactions

Role of Ecological Legacies

- Material legacies affecting plant reproduction and successional trajectories
  - Seed production
  - Asexual reproductive potential
  - Site effects on disturbance legacies
- Information (trait) legacies
  - Competitive hierarchies
- Thermal legacies
  - Impacts of past drought or climate on resistance and response to pests & pathogens
  - Permafrost & site drainage

- Biogeographic idiosyncrasies
  - Absence of lodgepole pine or Siberian larch
  - Non-native pests or pathogens
- Thermal legacies affect biogeography & potential species interactions
  - Climate constraints on pest distributions
  - Species migration processes
  - Phenological shifts

Core Data

- Existing Data Streams
  - Reproductive legacies: Annual seed trap collections
  - Aspen Leaf Miner: incorporate & maintain data from Doak/Wagner on egg counts, leaf mining, larval survival
  - Photographic monitoring of stand dynamics at BNZ from Glenn Juday – use for visualization & outreach
- Synthesis
  - Bring together observational & experimental data on plant-herbivore interactions

- New Data Streams
  - Reproductive legacies: extend measurements to include cone and catkin counts for key species
  - Aspen surveys at RSN sites of leaf damage & canker along with tree size & mortality
    - Possibly include monitoring for novel expanding pests like birch leaf miner
  - Coordinated collection of soil, leaf litter, and microbial communities at monitoring sites

Education, Engagement, EDI

- Aspen model system – collaborative opportunities
  - Maintain collaboration with USFS forest monitoring related to pests and pathogens
  - Build capacity within & outside BNZ via an annual pest/pathogen training camp
    - Aim to support local monitoring capacity within communities
  - Integrated REU program spanning multiple labs working on sites within aspen model system
- ITOC – alternative realities, games (computer & analog), art-sci
- Alaska Native Advisory Council
  - Build collaborations with communities, tribal councils for sharing observations of pests, pathogens, changing species distributions

Links within BNZ proposal

- Wildfire
  - Understanding how species interactions mediate outcomes of alternative successional trajectories
  - Biogeographic legacies affecting ecosystem responses to disturbance
- Permafrost
  - Soil microbial legacies that affect ecosystem processes with thawing permafrost
- Phenology
  - Changes in phenology that affect species interactions & knock-on effects
- Social Science
  - Impacts of changing species distributions and novel disturbances for socio-ecological interactions
- Modelling
  - Develop a better understanding of how species interactions modify ecological dynamics