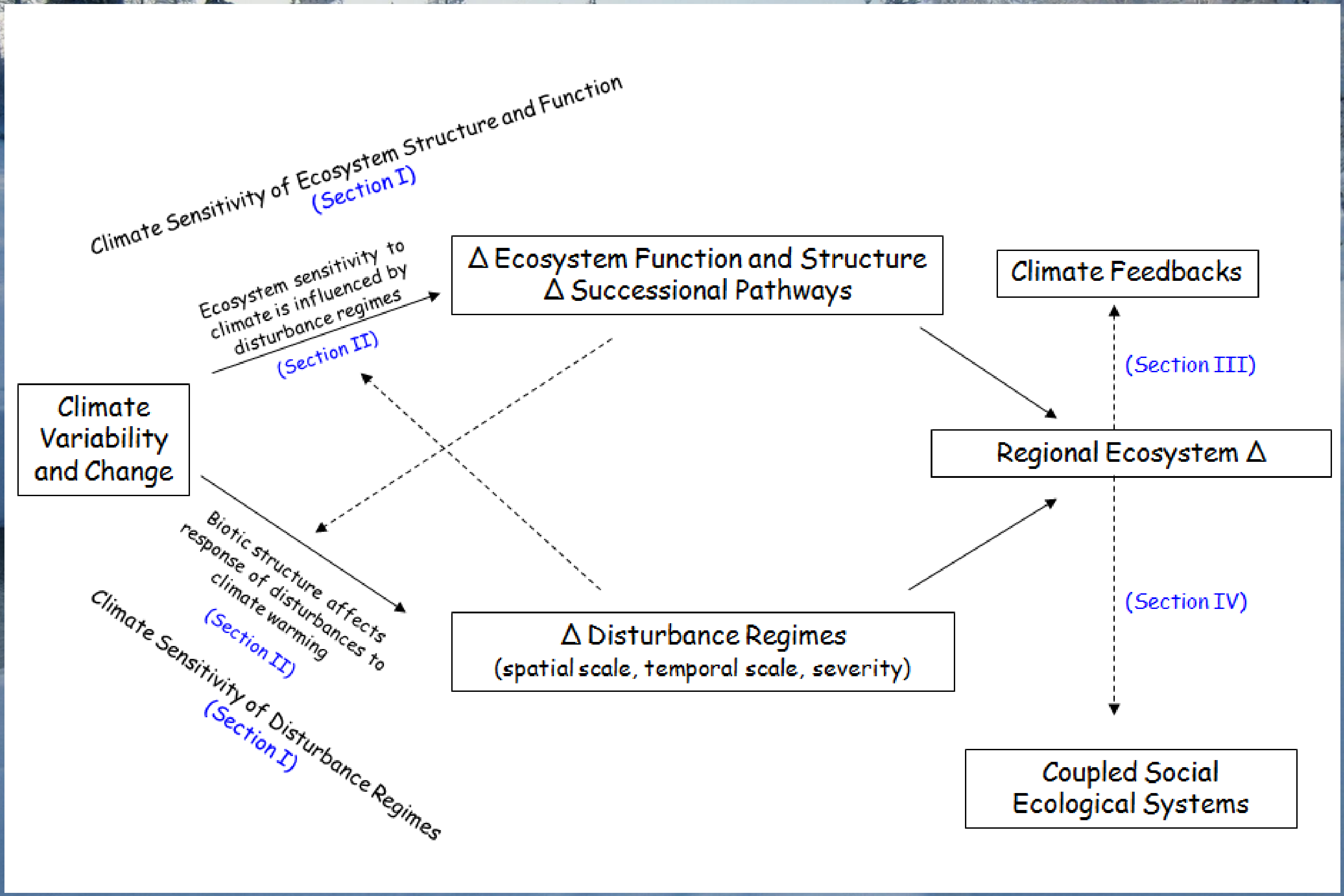
Review Team Comments:

The review team suggests that BNZ LTER devote more effort to identifying the sources of error and uncertainty in their models and explicitly quantifying uncertainty and how it propagates through to model predictions. This issue was raised during the review of their renewal proposal and has not been thoroughly addressed.

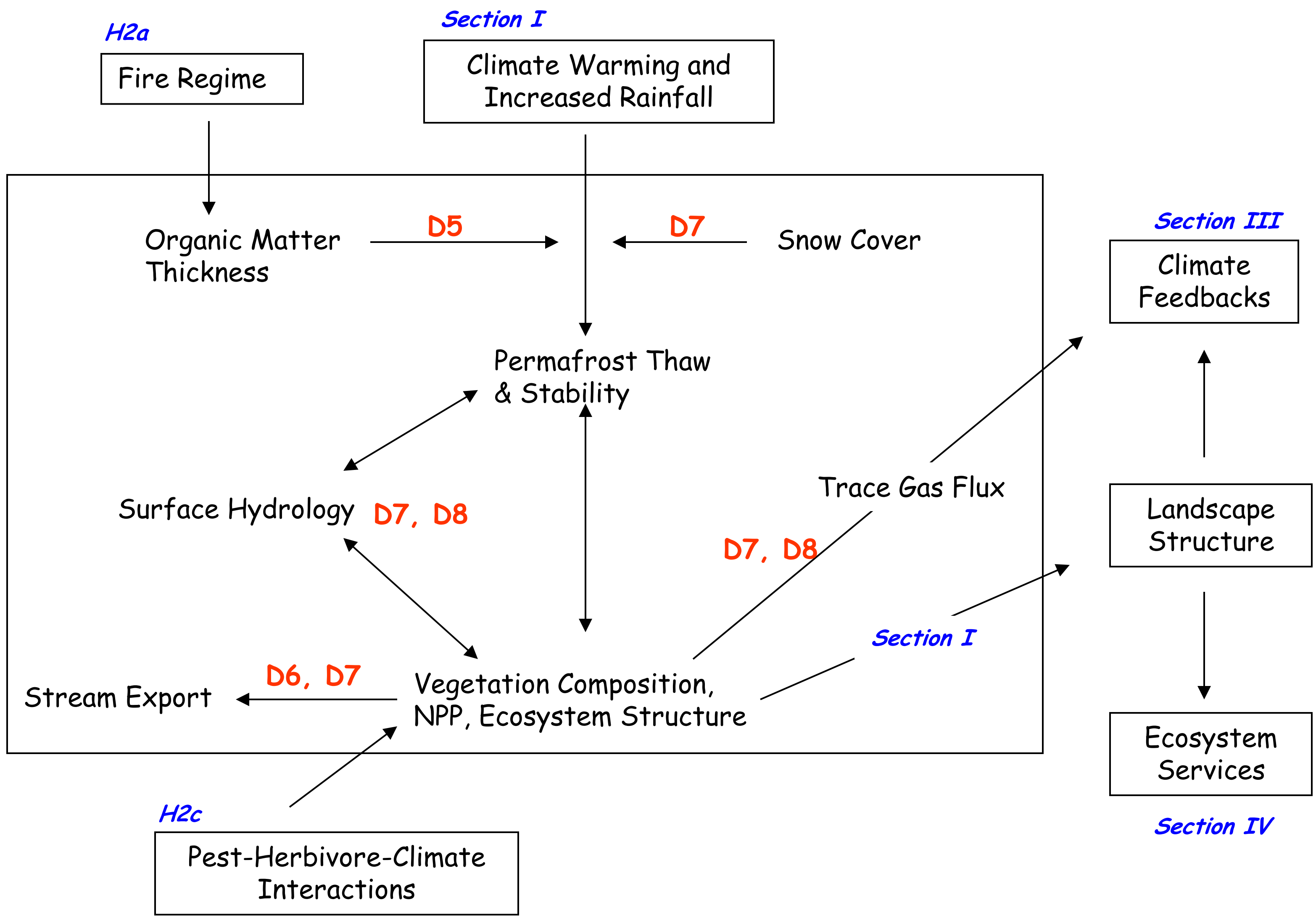
Although the BNZ LTER modeling team considers "conceptual uncertainty," they spend less effort considering the impacts of process and parameter uncertainty, parameter sensitivity, and measurement error. These are areas that could use more attention. For example, the researchers mentioned conducting a full parameter sensitivity analysis for ALFRESCO. The review team encourages them to do this and more in order to increase the confidence in model outputs.

“I continue to be concerned about incorporating uncertainty as well as process and observation errors into future modeling efforts. While the site review team considered this the ‘bleeding edge’ of ecosystem science, it has become quite common in the field of ecology. NSF has recently funded a second Research Coordination Network to incorporate uncertainty into ecosystem models. Many benefits accrue from considering uncertainty and different error terms, not the least of which is improving your ability to define thresholds and feedbacks explicitly, informing both research and policy on the effects of different treatments or approaches, and an ability to make decisions on data needed or measurements that can be dropped or reduced in frequency. I encourage your team to implement these approaches even though some of your modelers are resistant.”

Regional consequences of changing climate-disturbance interactions for the resilience of Alaska's boreal forest



H2b: Climate-Permafrost Interactions



I. Direct effects of climate change on ecosystems and disturbance regimes

Hypothesis 1: Changes in temperature and precipitation are influencing ecosystem structure and function at multiple temporal scales through effects on key species, functional types and disturbance regimes, resulting in modifications to landscape structure and heterogeneity. (Lead = Hollingsworth)

II. Climate-disturbance interactions as drivers of ecosystem and landscape change

Hypothesis 2a: Climate-driven changes in fire regime interact with environmental conditions and vegetation structure to alter ecosystem function and structure, and successional pathways. (Leader = Mack)

Hypothesis 2b: Ecosystem structure and soil drainage characteristics modulate both climate change disturbances *to* permafrost, and the ecological and hydrological *outcomes* of changing permafrost. (Lead = Jones)

Hypothesis 2c: Climate-driven changes in outbreaks of defoliating insects and plant pathogens affect successional pathways and ecosystem function by altering the abundance of key plant species. (Lead = Ruess)

III. Regional ecosystem dynamics and climate feedbacks.

Hypothesis 3a: Responses of boreal ecosystems in interior Alaska to projected changes in climate and disturbance regimes will directionally shift vegetation distribution towards more deciduous forest cover primarily through increased disturbance frequency and severity, leading to successional pathways that allow regeneration by deciduous tree species at the expense of conifer tree species. (Lead = McGuire)

Hypothesis 3b: The responses of water and energy exchange associated with changes in climate and disturbance frequency and severity throughout the 21st Century will result in 1) positive feedbacks to climate warming during the shoulder seasons, and 2) negative climate feedbacks during summer, with net positive feedbacks over the annual cycle. (Lead = McGuire)

Hypothesis 3c: Boreal ecosystems of interior Alaska will lose C as CO_2 to the atmosphere as a result of increased disturbance frequency and severity and increased decomposition because of permafrost thaw, with the response to disturbance dominating the overall flux. CH_4 emissions of boreal wetlands will change because of warming-induced increases in methanogenesis and drainage-induced decreases in methanogensis, with the former response dominating the overall flux. (Lead = McGuire)

IV. Coupled Social-Ecological Dynamics for Interior Alaska (Lead = Kofinas)

Trophic-climate-disturbance interactions

Insects:

Climate and disturbance impacts on insect population dynamics and distributions/range extensions into AK, including controls over and consequences of regional-scale insect outbreaks

Interest in continued monitoring of insect predators and recent invasive outbreaking species (amber marked birch leaf miner)

Better linkages with State monitoring programs!

Vertebrates:

Fire-vegetation-moose-human interactions: linking population dynamics of vegetation and moose across spatial and temporal scales.

Hares – next big questions addressed by long-term monitoring?

Synchrony and amplitude of population increase, peak and decrease across a latitudinal gradient (Tetlin NWR, BNZ, and Gates of the Arctic NP)

Population dynamics and movements of lynx across a latitudinal gradient (Tetlin, BNZ, GAAR)

Role of coyotes as hare predators (isotope chemistry and fecal DNA)

Epigenetics of snowshoe hare population dynamics (telomeres and adult body mass)

Pathogens:

Results from 10 year monitoring of A. tenuifolia canker summer of 2015
Patterns and consequences of Alnus viridis canker spread
Tree conks in long-term monitoring program?

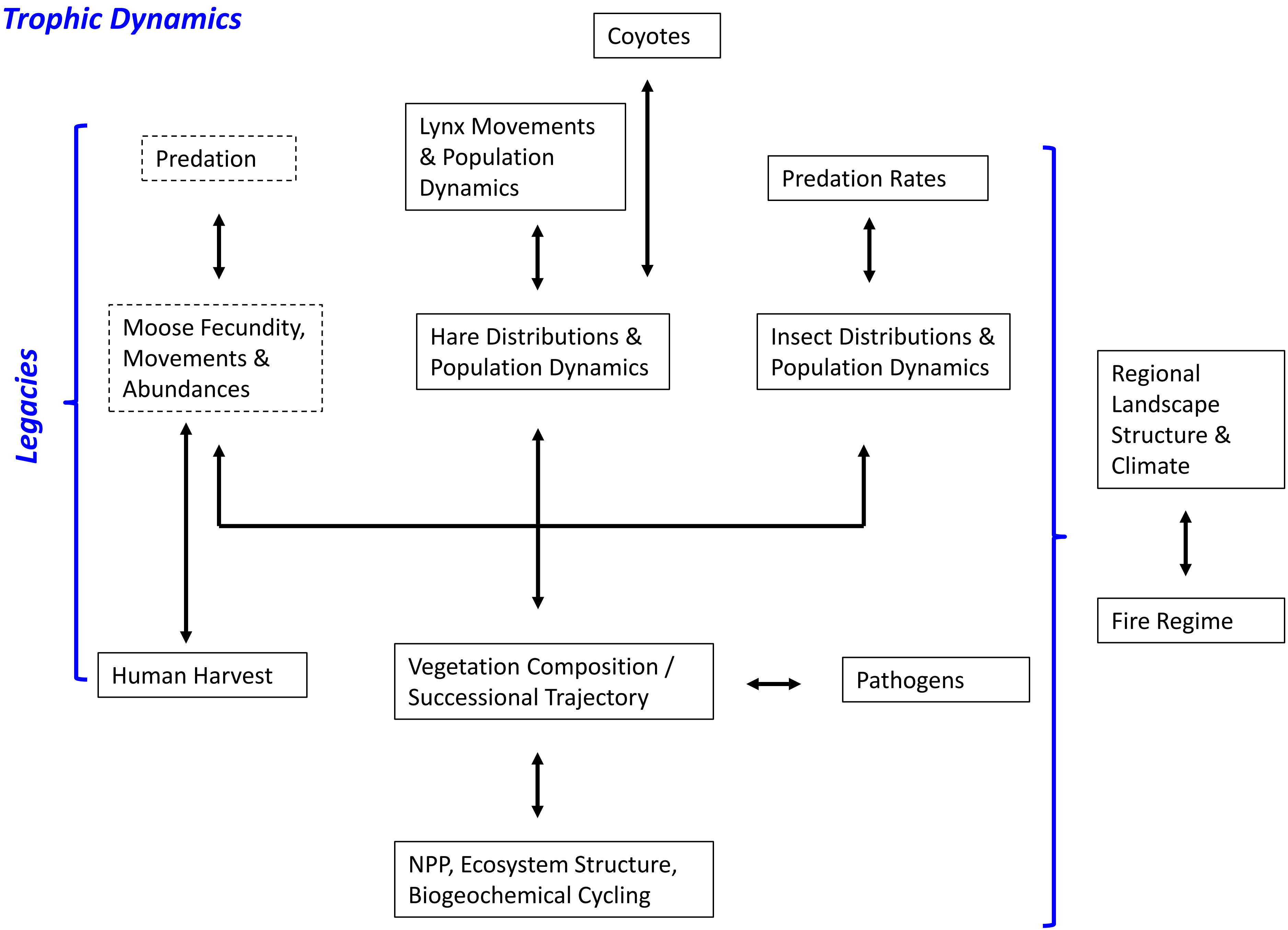
Other trophic issues:

Importance of trophic legacies on vegetation communities, ecosystem function, and future disturbance regimes

Interactions between vertebrate and invertebrate herbivory (At present this pertains to blotch miners on willows and moose browsing in winter – so we have a complicated interaction of temporally separated, qualitatively different modes of herbivory).

Herbivore effects on biogeochemical cycling; a) new floodplain experiment, b) role of alder in linking N and P biogeochemical cycling

Long-term monitoring of forage quality


Trophic Dynamics
Coyotes
Lynx Movements & Population Dynamics
Predation
Predation Rates
Legacies
Moose Fecundity, Movements & Abundances
Hare Distributions & Population Dynamics
Insect Distributions & Population Dynamics
Regional Landscape Structure & Climate
Fire Regime
Human Harvest
Vegetation Composition / Successional Trajectory
Pathogens
NPP, Ecosystem Structure, Biogeochemical Cycling