

Summary of break-out session: Insect disturbance/Ungulate Herbivory

Insect Disturbance

Development of insect disturbance within LANDIS-II is already underway, and therefore discussion on this topic was brief. There was recognition that different insect disturbance extensions were likely preferable to one single extension that “does it all”. The book chapter by Cooke et al. (2007) provides a useful way to categorize outbreak species by life history traits. A defoliator extension based that interacts with biomass succession and allows for partial disturbance is already underway. There is a clear need for a bark beetle extension. Some desirable attributes of a bark beetle disturbance extension include: threshold dynamics, aggregated feeding/spread behavior, and temporal behavior that is driven by climate (as opposed to one that is empirically defined). A second issue raised was accommodating uncertainty in effects: Short-term damage patterns might be empirically defined, but can change with context – hence long-term damage patterns may be better addressed probabilistically.

Ungulate Herbivory

Ungulate herbivory is an essential process within many forested ecosystems. A generic ungulate herbivory model would likely receive wide use across a variety of systems worldwide. A critical question was whether process of herbivory disturbance from wild populations of ungulates was fundamentally different from that of domesticated ungulates. Group consensus was that there were more similarities than differences – suggesting a single extension could be designed to investigate both functional groups of herbivores. The following outline provides a roadmap for a new ungulate herbivory disturbance extension for LANDIS-II.

Key processes to simulate:

1. Food preference: Ungulates have species preferences affecting their choice and (and resulting impacts) on juvenile trees.
 - a. This process could be implemented similarly to the method now implemented in the Biological Disturbance Agent extension (i.e., site resource dominance).
 - b. “salad bowl” effect and relative concentration of herbivory
 - c. Issue – “juvenile” stage is not necessarily restricted to an age (particularly if herbivory restricts growth).
2. Population Dynamics
 - a. Temporal Changes in Abundance
 - i. For wild ungulates, this could include explicit population dynamics, including predator relationships, hunting pressure, winter kill, etc.
 - ii. For domesticated ungulates, this can include seasonal and/or interannual herding practices, economics and its consequences (e.g., abandonment, etc.), land tenure and grazing allotments, etc.
 - b. Spatial Distribution and/or Change in Abundance

- i. Alternative food sources (if browsers) or primary food sources (if grazers)
 - ii. Shelter (e.g., cedar “deer-yards”)
 - iii. Water
 - iv. Climate/Environment
 - 1. Temperature
 - 2. Snow depth
 - v. Movement, migration, & dispersal behaviors
 - vi. Farm locations, grazing tenure, etc.
 - c. Note that factors affecting spatial distribution are simpler to model if they do not affect temporal changes in abundance.
 - i. A sophisticated population dynamics extension may be required for highly detailed and/or specific changes in abundance (may be difficult to generalize). This will be particularly important if landscape dependencies affect population dynamics of the ungulates (i.e., ungulates are dynamically related to landscape condition)
 - ii. Analogously an economics-based abandonment extension was proposed
 - iii. Chronic herbivory disturbance could eliminate the above complexity
- 3. Herbivory Effects
 - a. Mortality
 - b. Establishment
 - c. Biomass Accumulation
 - d. “Suppression” (i.e., delay in growth stage related to herbivore pressure)