LANDIS-II Workshop January 10-13 UW-Madison
Discussion Group on seed dispersal/establishment
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We identified five research issues in LANDIS-I I concerning seed dispersal/establishment:

1) Currently LANDIS cannot simulate the intrinsic directionality in the seed dispersal process. These can be conveniently grouped within three types of seed dispersal: (1) wind distributed, (2) animal distributed, and (3) gravity distributed, all involving some kind of directionality (e.g., prevailing wind, bird migration pattern, upslope to down-slope). However, currently with LANDIS, a cell with mature trees in the model can disperse seeds with equal probability in all eight directions within the range of a fixed distance. It would be useful if the user could provide parameters so that seeds would have a higher likelihood of dispersal in certain directions may have higher likelihood than other directions to obtain seeds of a certain plant species.
   Wildlife ecologists and landscape ecologists are increasingly interested in applying connectivity indices/metrics in studying animal routes, which could be potentially incorporated into seed dispersal simulation in LANDIS as well. This could be done either by means of the integration of habitat suitability models of relevant animal species involved in the dispersion of seeds, or by the use of a cost distance algorithm for seed dispersion. An alternative solution would be applying the outputs of such (already existing) models and algorithms, separately run, parameterized, calibrated and the like as the input in LANDIS.
2) LANDIS models can use yearly-updated EC (establishment coefficient) to simulate annual variation of seedlings biomass at the land type or eco-region level. However, this annual variation cannot be simulated at cell level in LANDIS models. To better simulate forest landscape response to climate change, seed quantities or seedling quantities at a cell level should respond to weather conditions too.
3) Low probability random long distance seed dispersal may play a role in forest (and indeed species migration patterns) response to climate change. Seed dispersal distance is currently limited to the maximum seed dispersal distance. Increasing this distance to great lengths will vastly increase processing time; thus the development of an alternative method to distribute seeds long distances may improve forest climate change response simulation.
4) We recognize that establishment plays a much more important role than seed dispersal in simulating plant species migration patterns. Common LANDIS practices for simulating plant species migration is to update EC at various temporal stages. It remains unknown to users how much influence various seed dispersal algorithms in LANDIS might exert on plant migration patterns.
5) The effect of browsing and grazing on species establishment is important in many ecosystems. Yet it remains under-developed in LANDIS models. There have been many good ideas on developing a grazing component in LANDIS. One approach is to develop a grazing stress GIS layer based (e.g.) on the distance to rivers, streams and other land features; and let LANDIS simulate spatial patterns of grazing based on this GIS layer. Here we'd like to point out a unique

characteristic in grazing that differs from other disturbance such as fire or insect: The ungulates are prey and therefore elusive; so they often disturb the edges of a patch and gradually encroach into the core. Because LANDIS is a raster model, such patch based processes are difficult to simulate. It’s possible to use a neighborhood approach to simulate such effects even though this would significantly increase computational time.