Habitat Modeling for Representative Species – Staging the Work

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 The terrestrial component of the representative species project, which included three expert workshops, identified a total of 88 species representing clusters of ecological systems across the North Atlantic LCC region. One use of the set of representative species is to develop habitat models as part of the Designing Sustainable Landscapes project. Because the initial phase of modeling involves only two people (Bill DeLuca of UMass and myself), setting priorities among the list is important to meet the objectives of the project and to maximize the number of species that can be effectively modeled. Based on discussions among participants in the LCC project, I have prepared the following criteria to help us stage our modeling work. The criteria are intended to be flexible and require judgment because they cannot all be achieved simultaneously.

 **Note: these criteria and their application are for the habitat modeling component of the Designing Sustainable Landscapes project. They are not intended to limit or delay use of representative species for other purposes.**

Ecological Criteria – Factors Indicating Higher Priority

* Clusters of habitats representing large proportions of the LCC (i.e., matrix habitats) or one of the three LCC subregions (Northern New England, Southern New England/New York, Mid-Atlantic)
* Habitat clusters and species that are wide-ranging (e.g., span all three LCC subregions).
* Habitat clusters and species that are sensitive to landscape and climate change
* Species whose primary population limiting factors are directly related to habitat availability and quality within the LCC

Feasibility of Modeling Criteria – Factors Indicating Higher Priority

* Species with substantial habitat-relationship data and evaluations, including monitoring data (the effectiveness of modeling will be improved for species with well-documented, scientifically sound, regional monitoring programs)
* Species whose habitat needs and critical stressors are amenable to landscape-scale modeling across the entire LCC

Sequencing Criteria

* It is preferable to sequentially choose species that represent different habitat clusters rather than choose multiple species from the same habitat cluster.
* It is preferable to choose species from multiple taxonomic groupings and/or life history characteristics

 In applying the ecological and feasibility criteria collectively, our approach was to identify the clusters of habitat types that are most important (primarily based on land area) both across the LCC and within each subregion and then to select at least one species to be the initial representative for each cluster. We chose the initial representative based on expert discussion at the workshops, how closely the species is associated with the cluster across the LCC, and how feasible we thought that it would be to develop habitat models for the species. However, as we develop models we may determine that the habitat suitability is more difficult to model than we expected and therefore we may need to select an alternative representative species. Our preliminary application of the criteria resulted in three tiers for organizing our work (shown in the following tables): a first tier with eight clusters of high priority ecological systems, a second tier of ecological systems that are also important but more difficult to model across the LCC during the first phase of the landscape modeling project (such as coastal systems), and a third tier of minor ecological systems (such as cliff and talus systems). For several Tier 1 clusters, we selected two species where we thought a single species was inadequate to represent the entire LCC.

Preliminary Application of the Criteria

**Tier 1 (begin within next 0 to 6 months)**

| **Tier 1 habitat cluster** | **Comments on cluster** | **First representative species (and comments)** | **Alternative representative species** |
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| Hardwood forests | Dominant systems of NA LCC | **Wood Thrush** (along with Ovenbird, the only species selected for all 3 subregions; abundance declines in north; well-studied) | Eastern Red Bat (selected 2 subregions incl. floodplains; difficult to model?)Eastern Box Turtle (1 subregion; requires sandy soils)Red-shouldered Hawk (1 subregion)Eastern Whip-poor-will (1 subregion; requires open canopy areas)Eastern Wood-Pewee (1 subregion)Ovenbird (3 subregions)Black-and-White Warbler (1 subregion)Worm-eating Warbler (1 subregion)Eastern Towhee (1 subregion) |
| Spruce-fir forests | Matrix systems of northern subregion but uncommon or rare to south | **Blackpoll Warbler** (data available; probably low occurrence in low elevation spruce/fir forests of northern region) | American Marten (limited distribution?)White-throated Sparrow (see also early successional habitats)Spruce Grouse (more limited distribution) |
| Mixed deciduous-coniferous forests | Important in northern subregion but may not be explicitly tied to particular ecological systems | **Blackburnian Warbler** (1 subregion; not a Mid-Atlantic subregion breeder) |  |
| Pine forests and barrens | Important in southern areas of LCC, pine-dominated forests rare in northern areas | **Northern Pine Snake** (1 subregion) &/or **Brown-headed Nuthatch** (1 subregion; modeled in Southeast but confined to southern area of LCC) | E. Hognose Snake (1 subregion; does not appear confined to pine forests)Prairie Warbler (2 subregions; also occurs in other early successional habitats) |
| Hardwood swamps | Important systems across NA LCC | **Northern Waterthrush** (2 subregions; does not breed in southern areas; we also have concerns about its absence from many northern swamps) |  |
| Floodplain forests, riparian areas | Important systems across NA LCC | **Wood Turtle** (1 subregion; Mass. Habit@ model exists; disjunct populations, absent from s. Virginia)**Louisiana Waterthrush** (1 subregion; used as an indicator of riparian quality; uncommon or absent in northern areas) | Marbled Salamander (1 subregion)Wood Duck (1 subregion)Willow Flycatcher (1 subregion)Warbling Vireo (1 subregion; also tolerant of developed areas such as parks; not in southern coastal region)Prothonotary Warbler (1 subregion)Kentucky Warbler (1 subregion) |
| Freshwater marshes | Important wetlands systems across LCC | **Marsh Wren** (only species selected all 3 subregions) | Bog Turtle (1 subregion, wet meadow/shrub-swamps)Northern Pintail (1 subregion; non-breeding)American Black Duck (1 subregion for this cluster, but also selected for other clusters; migration)King Rail (1 subregion)Virginia Rail (1 subregion)American Bittern (1 subregion)Least Bittern (1 subregion) |
| Grasslands/hayfields | Important systems, almost exclusively anthropogenic, within the LCC | **Eastern Meadowlark** (2 subregions; not common in north, but Upland Sandpiper and Bobolink are essentially absent from S. Mid-Atlantic and Grasshopper Sparrow is very uncommon in north) | Upland Sandpiper (1 subregion)Grasshopper Sparrow (1 subregion)Bobolink (2 subregions) |

**Tier 2 (later in Phase 1 as time and data permit; species not yet prioritized)**

| **Tier 2 habitat cluster** | **Comments on cluster** | **Representative species (and comments)** |
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| Saltmarshes | Important stressors difficult to monitor at present, especially effects of sea level rise; other ongoing efforts in the LCC will inform this project | Diamond-backed Terrapin (also islands)American Black Duck (also mudflats)Snowy Egret (also islands)Clapper RailWilletNelson’s SparrowSaltmarsh Sparrow |
| Beaches | Piping PloverSanderlingLeast Tern |
| Mudflats | Horseshoe CrabRed KnotSemipalmated Sandpiper |
| Rocky shores | Purple SandpiperAmerican Oystercatcher |
| Islands (a mix of systems) | Common EiderCommon TernBlack Skimmer |
| Coastal open water | Habitat loss less direct or amenable to modeling compared to other systems; species use may be particularly transitory or difficult to model compared to terrestrial systems | Loggerhead Sea TurtleCanvasbackBlack ScoterSurf ScoterWhite-winged ScoterLong-tailed DuckBuffleheadRed-breasted MerganserCommon Loon (also lakes) |
| Lakes and ponds | Habitat loss less direct or amenable to modeling compared to other systems | Spotted TurtlePainted Turtle Ring-necked DuckCommon Merganser |
| Old fields | Almost exclusively anthropogenic within the LCC | Field Sparrow |
| Early successional forests (various habitat systems) | Currently difficult to model, especially projected into the future; disturbance components of phase 2 of overall landscape modeling effort will be informative | Ruffed GrouseAmerican Woodcock (see also glades / woodlands)Chestnut-sided WarblerBlue-winged WarblerPrairie Warbler (see also glades and pine forests)Brown ThrasherWhite-throated Sparrow |
| Vernal pools | Important amphibian habitat but difficult to model across LCC | Wood FrogSpotted Salamander |

**Tier 3 (phase 2 as time and data permit)**

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| **Tier 3 habitat cluster** | **Comments on cluster** | **Representative species (and comments)** |
| Glades and woodlands | Minor components of LCC | American Woodcock (not primary habitat)Eastern Whip-poor-will (see also hardwood forests)Prairie Warbler (see also pine forests)Eastern Towhee (see also hardwood forest)Bur Oak (serpentine areas) |
| Cliffs, talus, outcrops, balds | Minor components of LCC; not highly vulnerable to habitat loss | None selected |
| Erosional bluffs | Minor components of LCC | Bank SwallowPuritan Tiger Beetle |
| Tundra and krummholz | Minor components of LCC | Bicknell’s ThrushMountain Avens |
| Bogs and fens | Minor components of LCC | Palm WarblerMink Frog |
| Maritime grasslands | Minor components of LCC | Common Nighthawk |
| Caves and mines | Minor components of LCC; not highly vulnerable to habitat loss | Little Brown BatTricolored Bat |