Connecticut River Watershed Pilot Landscape Conservation Design
Process and Key Decisions
August 2014

Background: In the Connecticut River watershed and across the nation, large connected natural areas provide habitat for fish, wildlife and plants and provide jobs, food, clean water, storm protection, recreation and many other natural benefits that support people and communities. To ensure a sustainable future for these resources in the face of climate change, urban growth and other land-use changes and pressures, scientists and conservationists must work together to strategically conserve these large landscapes. Facilitated by the U.S. Fish and Wildlife Service (FWS) and supported by the North Atlantic Landscape Conservation Cooperative (LCC), the Connecticut River Watershed Landscape Conservation Design Pilot is a collaborative effort to plan and design such a landscape. The pilot is led by a Core Team of conservation partners composed of federal and state agencies and private organizations working at various scales in the Connecticut River watershed, including the Friends of the Silvio O. Conte National Fish and Wildlife Refuge and other partnerships. The University of Massachusetts *Designing Sustainable Landscapes* team is leading the technical development of the conservation design that reflects the decisions of partners during the design process.

Purpose of this document: To assist partners in their collaborative efforts and as a record of progress, this document summarizes the status of decisions that are necessary to develop the landscape conservation design. The following key is used:

Decision The core team (or relevant subteam) has reached full or substantial consensus on a decision.

Provisional Decision The team has been briefed on and discussed the topic, and consensus is inferred, but either the team has not been formally asked to indicate approval or the team is awaiting additional information to make a final decision

Under Discussion The team has discussed the topic but has not reached a decision

1) Conservation Goals

Decision Conservation Goals for the watershed (ecosystem + species) have been established: *[Last modified 3/24/2014]*

1. The Connecticut River watershed sustains a diverse suite of intact, connected, and resilient ecosystems that provide important ecological functions and services that benefit society, such as clean water, flood protection, and lands for farming, forestry, and recreation.
2. The Connecticut River watershed sustains healthy and diverse populations of fish, wildlife, and plant species for the continuing benefit and enjoyment of the public.

2) End Products of the Conservation Design

Provisional Decision Based on discussions among the core team at multiple meetings, the conservation design is to include both of the following:

1) Partners' collective prioritization, based on both species and ecosystems, of high priority (core) areas, connections between them, and tiering or other methods that show entire landscape necessary to achieve goals and objectives
2) Individual inputs to the design (e.g., ecological integrity, individual species results) that can be used independently

3) Scope of the Conservation Design

- ***Decision*** Land protection, restoration (e.g., for aquatic passage and terrestrial road crossing), and management (e.g., forest and shrubland management) are all to be part of the design.
- ***Decision*** Current conditions and projected scenarios of change to 2030 are focus; secondarily, simulations to 2080 to be considered.
- ***Under Discussion*** Threats to be addressed by the design include loss or degradation of habitat, barriers to passage, and loss of water quality and quantity.

4) Selecting Species of Fish, Wildlife, and Plants

Terrestrial

- Representative Species considerations
  - As part of the larger Designing Sustainable Landscapes project, the UMass team is scheduled to complete species models for 25 representative species[1]. 13 of those species, most relevant to the Connecticut River watershed, were prioritized for use in this project. These species were chosen (prior to the initiation of the collaborative Pilot process) to represent the major ecosystem (habitat) types of the watershed, and associated wildlife, that occur in the watershed.
  - ***Decision*** Use the 13 representative species already in the process of being modeled. Caveat that species with limited dispersal are not well-represented and should be reconsidered when appropriate during the pilot process. *[April 22, 2014, Reaffirmed June 23, 2014]*.
  - ***Under Discussion*** Several other representative species have been suggested for inclusion, but habitat models are not yet complete: Cerulean Warbler, Piping Plover, Saltmarsh Sparrow, Semipalmated Sandpiper. *[April 22, 2014 and May 30, 2014]* Limited beach and saltmarsh habitat is present in the watershed and it may be able to address species that use those habitats through the ecosystem component of the project.

[1] UMass Designing Sustainable Landscapes Presentation (see slide 50)

- Rare & otherwise not-well-represented species considerations
  - ***Decision*** Certain federally threatened or endangered species (or candidates for listing) use rare habitat types not mapped in the terrestrial habitat classification system and are not likely to be well-represented by the represented species. Known habitat locations for the following species will be incorporated into the design: bats (specifically, hibernacula [caves]); cobblestone and Puritan tiger beetles (use cliff and cobblestone river shoreline); New England cottontail; Jessup's milk-vetch *[April 22, 2014; May 30, 2014;reaffirmed June 23, 2014]*. Incorporation is conditional on obtaining high quality locational data.
  - ***Under Discussion*** It has been proposed that occurrences of all rare species (e.g., natural heritage rankings of S1, S2; or regional high priority SGCNs) be incorporated into the design. An alternative proposal is to overlay these occurrences with the design after it is complete to assess whether such an approach was necessary. Obtaining these data from all of the states is likely to be an issue, and concerns have been raised about the quality of some species data.

Aquatic

- ***Under Discussion*** Considered anadromous fish, aquatic invertebrates, freshwater mussels, odonates *[May 8, 2014]*, wood turtle and Louisiana waterthrush *[May 8, 2014]*, USFWS/NALCC Representative Species list[2] *[April 22, 2014]*, anadromous, diadromous, catadromous (American eel) fish, Common loon, brook trout *[June 27, 2014]*.

5) Selecting Ecosystems

Full Core Team

- ***Provisional Decision*** Accepted recommendation to assess ecosystems using three products: UMass Index of Ecological Integrity (IEI); TNC terrestrial resilience; and USGS stream sensitivity. Added state rare natural communities, which are not mapped by the terrestrial classification that underpins IEI. Provisionally accepted ranking scheme that weights IEI "3," terrestrial resilience "2," and stream sensitivity "1" (and rare natural communities having highest weight).
- ***Decision*** The aquatics subteam is responsible for areas of natural lotic and lentic water, e.g. streams, rivers. The adjacent wetlands (e.g., NWI palustrine areas) will be addressed by the terrestrial/wetlands sub-team.

[2] Aquatic Representative Species List

Terrestrial

- ***Decision*** Use the Northeast Terrestrial Habitat Classification System as a focus for identifying and prioritizing ecosystems in the conservation design *[April 22, 2014]*. However, team has requested that UMass ensure that the scaling process (based on macrogroups, which aggregate ecological systems) does not "leave behind" rare ecological systems.

Aquatic Considered the TNC aquatic classification, stream order classification.

- ***Decision*** Use the TNC classification of river/stream macrogroups based on stream size and temperature *[May 8, 2014].* All qualitative temperature categories developed by TNC (warm, cool, cold) will be retained, even though some types are small or rare fragments in the project area.
- ***Decision*** Update after 9/4/2014 meeting: The core selection index is now comprised of only only two elements for the aquatic ecological systems; Index of Ecological Integrity (UMass) and headwater stream temperature resilience (USGS). The TNC terrestrial connectivity element will now be eliminated from the aquatic assessment. We decided there was no reason to weight one element of the selection index over the other, so we would like to use the un-weighted selection index. *[September 4, 2014]*
- ***Decision*** The majority of attending group members would like to see a hybrid of geography areas used to scale the selection index (HUC8 and CTR). *[September 4, 2014]*
- ***Under Discussion*** Beyond these options, the team speculated that use of the HUC 6 unit boundaries might serve the goals of long-term stable ecological integrity and bio-diversity by spreading the core areas along the long north-south axis of the CTR project area. At the same time the team speculates this would avoid some of the bias problems they perceive will occur using the more numerous HUC 8 sub-divisions.

6) Setting Species Objectives

Terrestrial[3]

- ***Provisional Decision*** General agreement that the proposal for population objectives of increasing Woodcock, Meadowlark and Wood Thrush while maintaining current populations of the other 10 representative species was acceptable. [April 22, 2014]
- ***Under Discussion*** discussed the possibility that objectives could vary spatially (e.g., focus objectives for grassland species in agricultural regions of the watershed).

Aquatic

[3] Suggestions for Setting Population Objectives (5-30-14)

- ***Under Discussion*** Considered proposed fish passage goals as described by Ken Sprankle. Want to develop these for American shad, river herring, brook trout *[June 27, 2014]*

7) Setting Ecosystem Objectives

Terrestrial

- ***Provisional Decision*** General (qualitative) objectives have been accepted *[July 22 and 25, 2014].*
- ***Under Discussion*** More quantitative objectives, such as extent of landscape to be encompassed by core areas, have been discussed but not agreed upon.

Aquatic

- Discussion planned for Aug. 28.

8) Prioritizing (Weighting) Species

Weighting Species

Terrestrial

- ***Provisional Decision*** General agreement that the suggested criteria (degree of current threat, regional responsibility, regional rarity) are appropriate for using in assigning weights to species[4] *[May 30, 2014, reaffirmed August 19, 2014]*. No final decision until team can see model results with equal weights, as well as with weights, in order to understand the impact of the weighting *[June 27, 2014]*
- ***Under Discussion*** Methods and information for deriving the weights have been presented and refinement has been ongoing in August and September.

Aquatic

- Discussion planned for Aug. 28.

9) Prioritizing (Weighting) Ecosystems

Weighting Ecosystems

Terrestrial:

[4] Detailed description of criteria available in meeting notes

- ***Decision*** A set of criteria for prioritizing ecosystems has been developed and applied in increasing priority for several ecosystem types of concern, including floodplain wetlands and boreal forest. *[April 25, 2014]* This decision was revisited and reaffirmed to keep weighting of certain macrogroups. *[September 22, 2014]*
- ***Decision*** Do not take into account existing levels of protection when creating the design (i.e. do not up- or down-weight existing protected lands) *[May 13, 2014]*

Aquatic

- ***Decision*** Proposed weighting all aquatic systems/macrogroups equally at this time, due to a lack of clear reasons to increase the general importance of one macrogroup in the watershed above another *[June 12, 2014]*
- ***Decision*** Modify some of the weights for the 18 metrics that are inputs into the IEI calculation for the 25 aquatic macrogroups
- ***Under Discussion*** Considered prioritizing unimpounded/free-flowing stream reaches *[April 22, 2014]*; Riparian buffers more important on small streams than the main stem *[April 22, 2014]*
- ***Provisional Decision*** Preserve a "manual override" option to select priority areas *[June 27, 2014]*

10) Considering Future Scenarios of Climate and Development

Development

Terrestrial

- ***Provisional Decision*** an index of projected change due to anthropogenic development should be incorporated into the final species models with higher weights placed on areas with high current habitat suitability but also a high risk of being lost to human development, as long as such areas will not become isolated patches with little connectivity to other high quality habitat. *[June 23, 2014]*. Additionally, species at relatively greater risk of habitat loss due to scenarios of future development will receive increased weight when species results are combined *[August 19, 2014]*.

Aquatic

Climate

Terrestrial

- ***Provisional Decision*** Want to include areas with climate resilience: index of projected change in climate niche that places higher weight on areas with high climate resilience be incorporated into the species habitat models, but these should be reviewed on a species-by-species basis as to whether using this index of change in climate suitability is something that makes sense and what the weight should be (should not be uniformly applied across all species without assessment) *[June 23, 2014].* Additionally, species with

projected greater vulnerability to climate change will receive increased weight when species results are combined *[August 19, 2014]*.

Aquatic

11) Defining Ecosystem Core Areas

CORE AREAS

Terrestrial

- ***Under Discussion*** How much area should be in cores, or alternatives for defining number/extent of cores?
    - The options include 20%, 25%, or 30% in core areas, although suggestions are welcome. At the subteam meeting on 9/22, consensus was growing toward choosing either 25 or 30%, with an acknowledgement that the precise number chosen is not as important as having a clear explanation of what it means to be a core area.
- ***Provisional Decision*** Fewer, larger core areas (avoiding numerous small "slivers" are preferred *[July 22 and 25, 2014].* The approach will "build out" core areas from "seeds" of locations of highest integrity and resilience. Two alternatives for review are in development my UMass. Consensus was reached that fewer, larger core areas is acceptable, although several team members expressed a desire for the rare/natural communities datasets to be incorporated into the design before connectivity modeling. In addition, using HUC8 scaling generates a set of cores skewed towards more/smaller, and may be an acceptable means of attaining this goal. Therefore this remains a provisional decision. We anticipate most of the core area decisions being finalized about the same time due to how interconnected they are. *[September 22, 2014]*
- ***Provisional Decision*** Core areas are to be distributed across the watershed to assure a well-distributed network *[July 22 and 25, 2014]*. Methods to implement this while also ensuring areas of highest integrity are represented are in development by UMass, likely using a combination of HUC8 and full watershed scaling.
- ***Decision*** *[July 25, 2014]*
    - Major development – dense urban areas, expressways, etc. should be a barrier to core area spread
    - Minor development – rural areas and lightly trafficked roads – don't need to be a barrier to spread
- Additional Considerations
    - ***Decision*** "No white space" – areas not in core, buffer, or connector should still have some value associated with them. We don't want to label any area as unworthy.

Aquatic

- ***Decision*** The team reached consensus that core areas will be grown out from the 30m pixels rather than generalize these data to a HUC and subsequently identify core areas as ranked HUCs. *[September 4, 2014]*

- ***Decision*** The team decided to enhance the linear extent of lotic aquatic core areas by extending the initially selected high score seed sites up and down stream as a function of the quality of data in adjacent stream cells. The goal is to create core areas that are more ecologically sound by making them longer, like natural stream/river sections. *[September 4, 2014]*
- ***Decision*** Extension of core areas does not proceed past barriers like dams, nor into areas with a major change in macro-group type (e.g. initial seeds in headwater streams would not be extended into small rivers, etc.). *[September 4, 2014]*
- ***Decision*** Related, high scoring cells that start a core area in lentic water bodies are extended to include all the cells within that lentic body (i.e. to the extent of the pond or lake shore line). *[September 4, 2014]*
- ***Provisional Decision*** How much area in cores: 30% (general impression) *[Andrew, August 7, 2014]*
- ***Under Discussion*** Extent to which core areas are consolidated (more smaller vs. fewer larger)
- ***Under Discussion*** "seeds" of the highest value ecosystems: Team wants to review 5% *[July 22, 2014],* 10% and 20% *[July 31, 2014]*
- ***Under Discussion*** How to distribute cores across the watershed (see "multi-scale framework")
- Slice or algorithmic approach? [*July 22, 2014]*
    - ***Provisional Decision*** Algorithmic: approach is to extend the core sites downstream for up to 2 km based on the presence of adjacent aquatic cells with high scores.
    - ***Under Discussion*** Downstream extension will be limited to the same stream size (width? Macro group?)
- Should there be a minimum core area size?
    - ***Under Discussion*** Minimum linear size of a lotic area to be used in a core area/macrogroup *[July 31, 2014]*
    - ***Under Discussion*** Downstream distance to expand a core site (distance or resistance algorithm?)? *[July 31, 2014]*
- ***Under Discussion*** Development as a barrier to spread? Dams are definitely a barrier to spread.

BUFFER

Terrestrial

- Discussion: Whether and how to create a buffer around core areas has been raised but not discussed in detail. Options include a tier, fixed width buffer, and others. Given the preference for "building out" core areas, the core areas themselves may already be considered to incorporate buffers.
- ***Decision*** In early descriptions of the design, the plan was to identify high priority core areas and then to surround them with buffers to further ensure their integrity. However, the methodology of the development of core areas has evolved to "grow out" core areas from high value "seeds" (referred to as the algorithmic approach). The expanded areas can serve the role of buffers around the seeds, which in one sense could be considered the true cores. But the current plan is to label the unified seed and expanded areas simply as "cores" and there will not be further steps to add additional buffers.

Aquatic

- ***Decision*** The aquatic team also decided not to create buffers as originally envisioned. Instead, terrestrial areas of influence on core stream/river segments will be generated *[August 26, 2014]*. The process is similar to that discussed for buffers previously: use the

upslope watershed of the extended core area sites. Buffers will be constrained so as to extend into the upland based on the size of the originating aquatic system (furthest from headwater stream core areas and least from the large river sites). Point being that the large river system buffer areas will more closely resemble riparian corridors. *[July 22, 2014]*

- ***Under Discussion*** Constraints to use when generating the "watershed" buffer? *[July 31, 2014]*
- ***Under Discussion*** Minimum/maximum geographic spread of the core/buffer areas *[July 31, 2014]*

CONNECTIVITY ***Under Discussion*** pending presentations by UMass

- Identifying core area will allow construction of corridors to connect them. It may not be necessary for the group to make decisions about the corridors.

The following decisions and topics are pending:

12) Defining Species Core Areas
13) Developing the Initial Design
14) Revising the Design
15) Finalizing the Design
16) Documenting and Communicating Results
17) Delivering and Implementing the Design (Long-term)