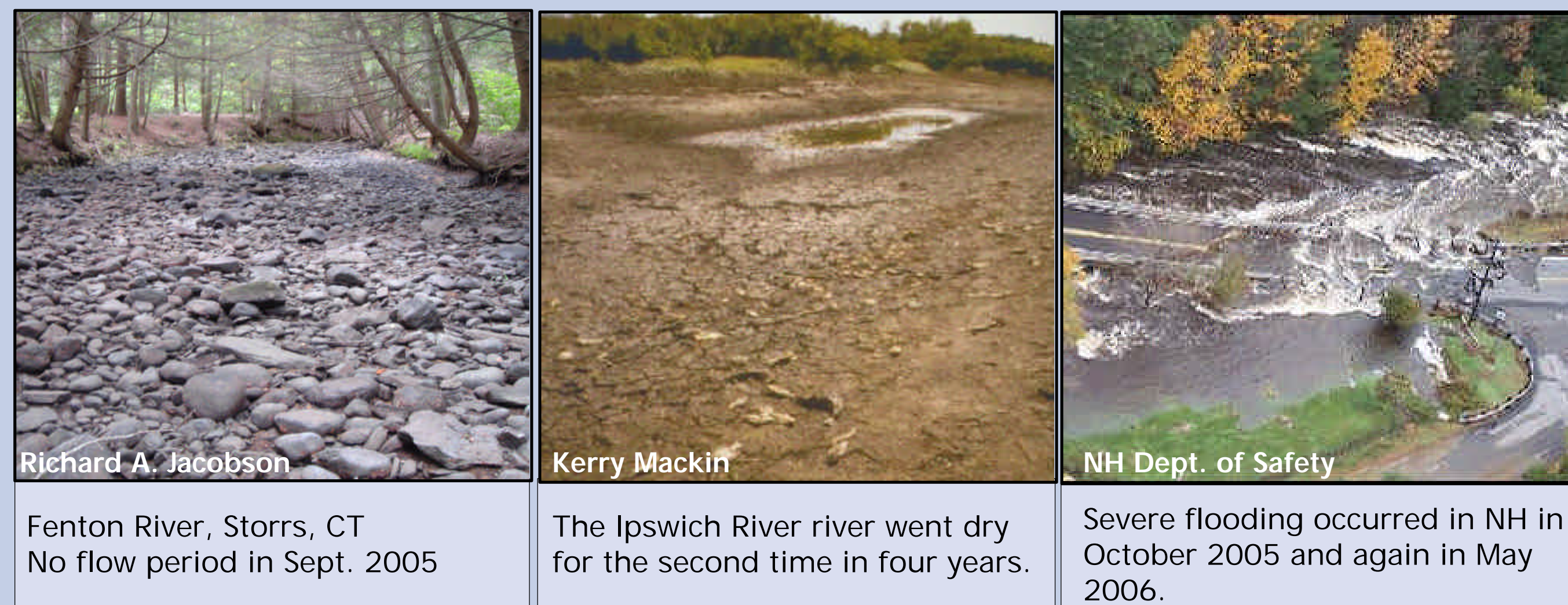


Developing reference models for water quantity regulations in New England

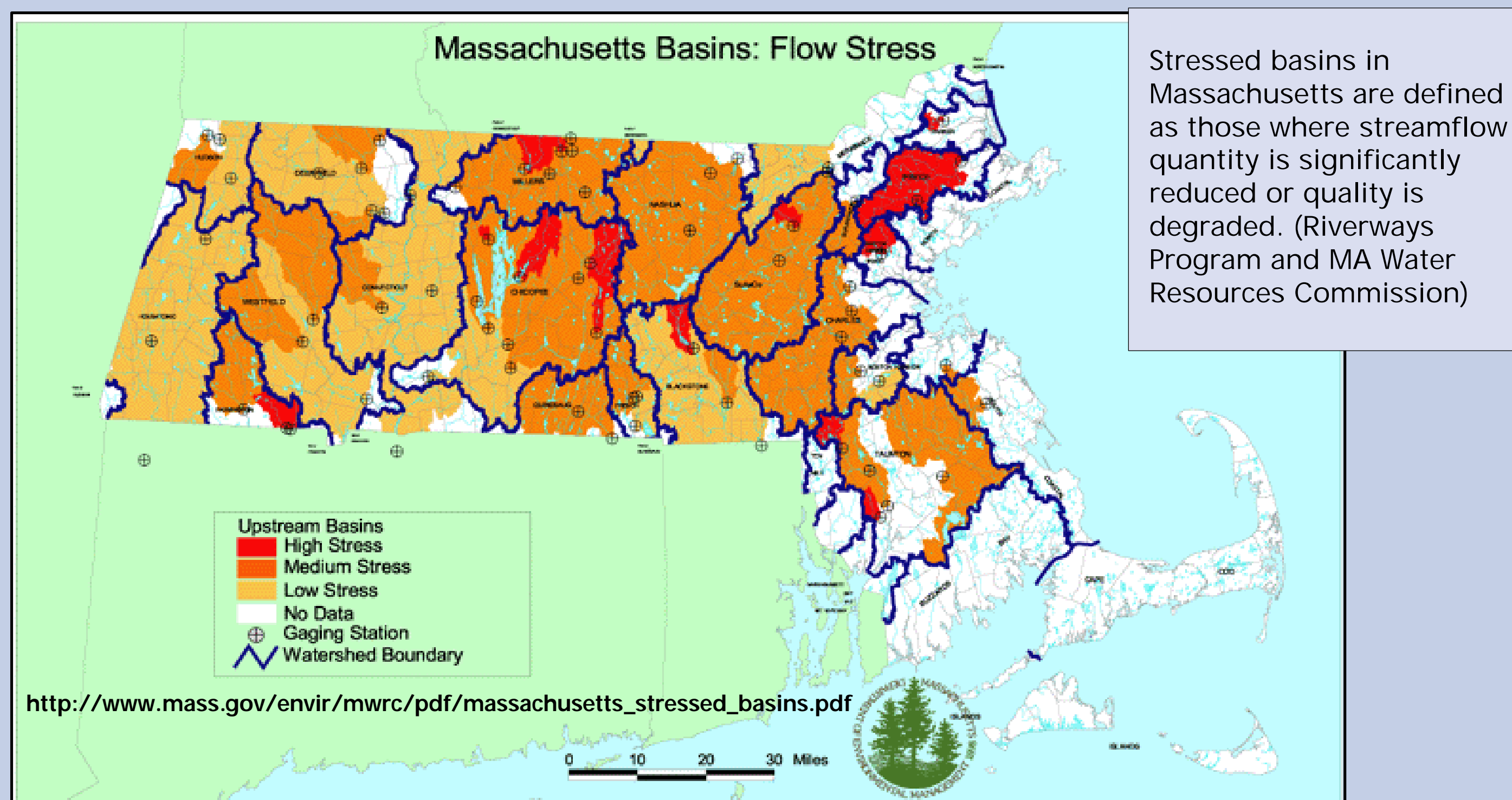
Diana Walden, Roland Deblois, Piotr Parasiewicz

WATER ISSUES IN THE NORTHEAST

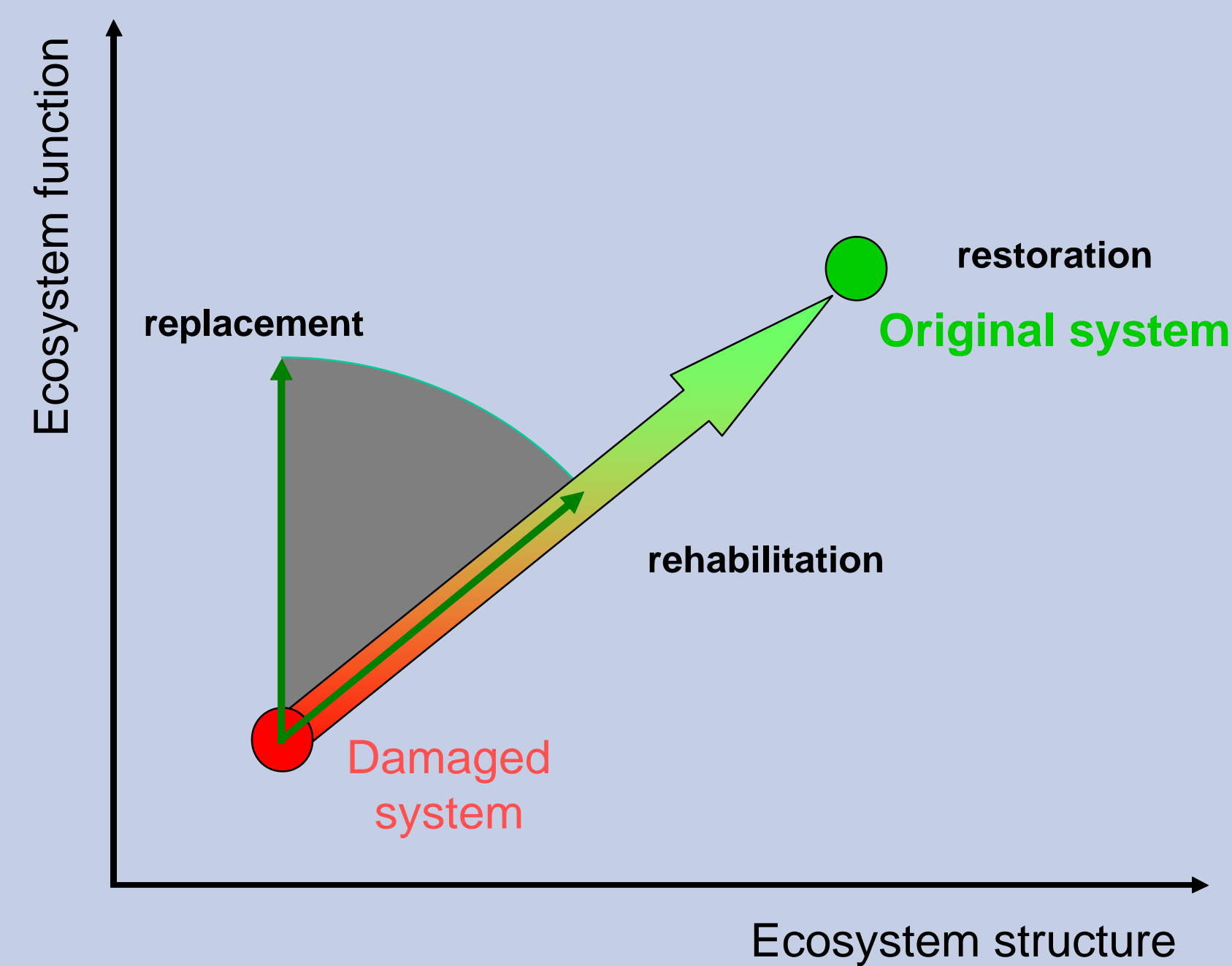
The major water management goal of many Northeastern states is to balance anthropogenic demands for drinking water, development, and industrial uses with the ecological needs of aquatic communities. However, these "water-rich", densely populated states may face a future, long-term crisis as some streams already experience extreme seasonal low-flow or no-flow conditions as a result of water withdrawals. Conversely, severe flooding is also becoming more prevalent as rivers are dammed, channelized, and cut off from their floodplain.



Multiple river basins are stressed by the effects of development such as increased impervious surfaces, decreased recharge opportunities, interbasin transfers and other withdrawals of water, introduction of non-native species, chemical and organic pollution, and physical alteration. Instream fauna are especially vulnerable to these stressors and aquatic communities have changed in response, often reflecting the level of impairment.



One of the most critical aspects in developing sustainable water use regulations is identifying reference or baseline conditions for streamflow, habitat, and ecological communities.

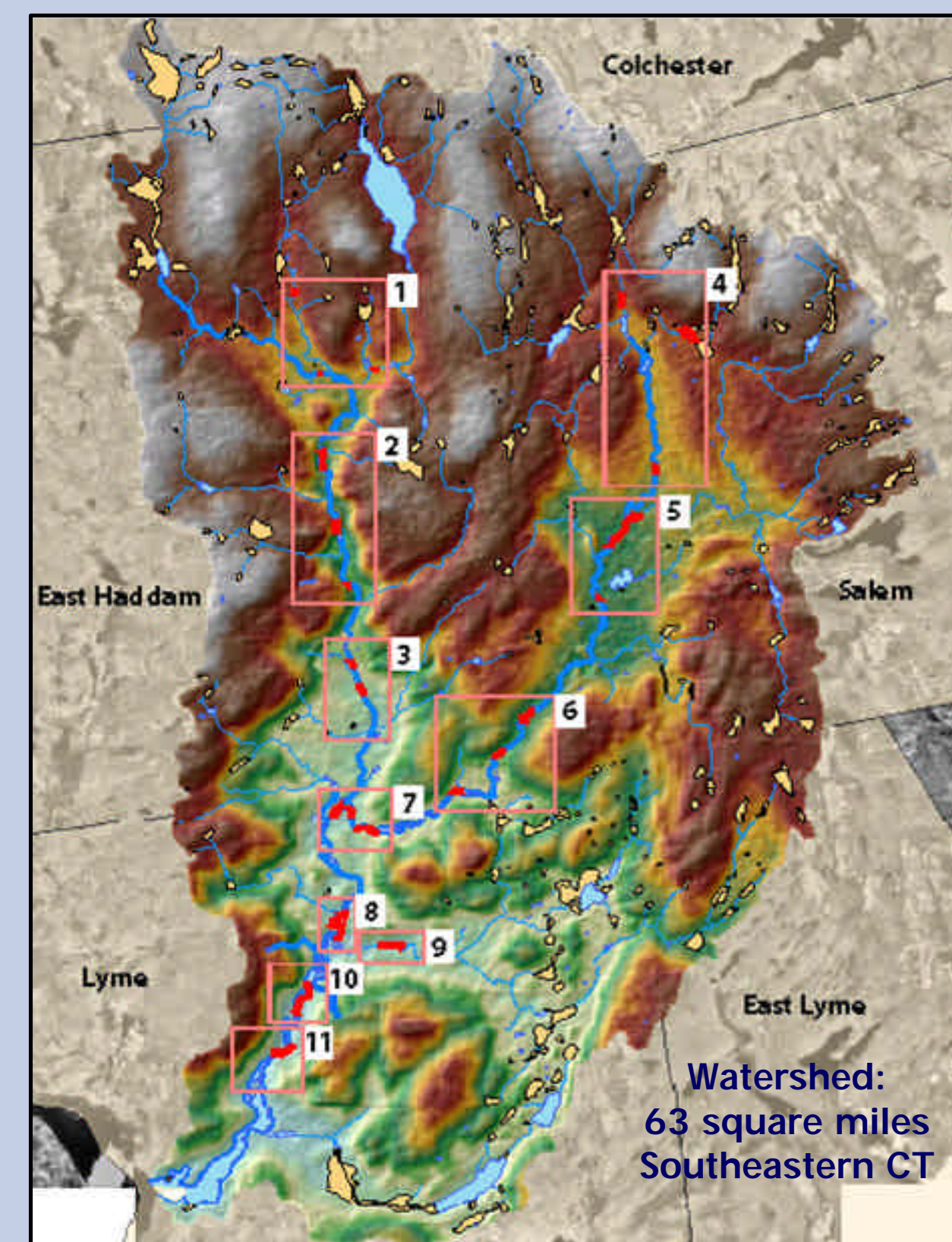


Current policy assumes that ecological structure and function can be restored relatively quickly as a degraded system returns to its natural state through mitigation.

However, a reference condition as well as the rate at which it is met, must be identified.

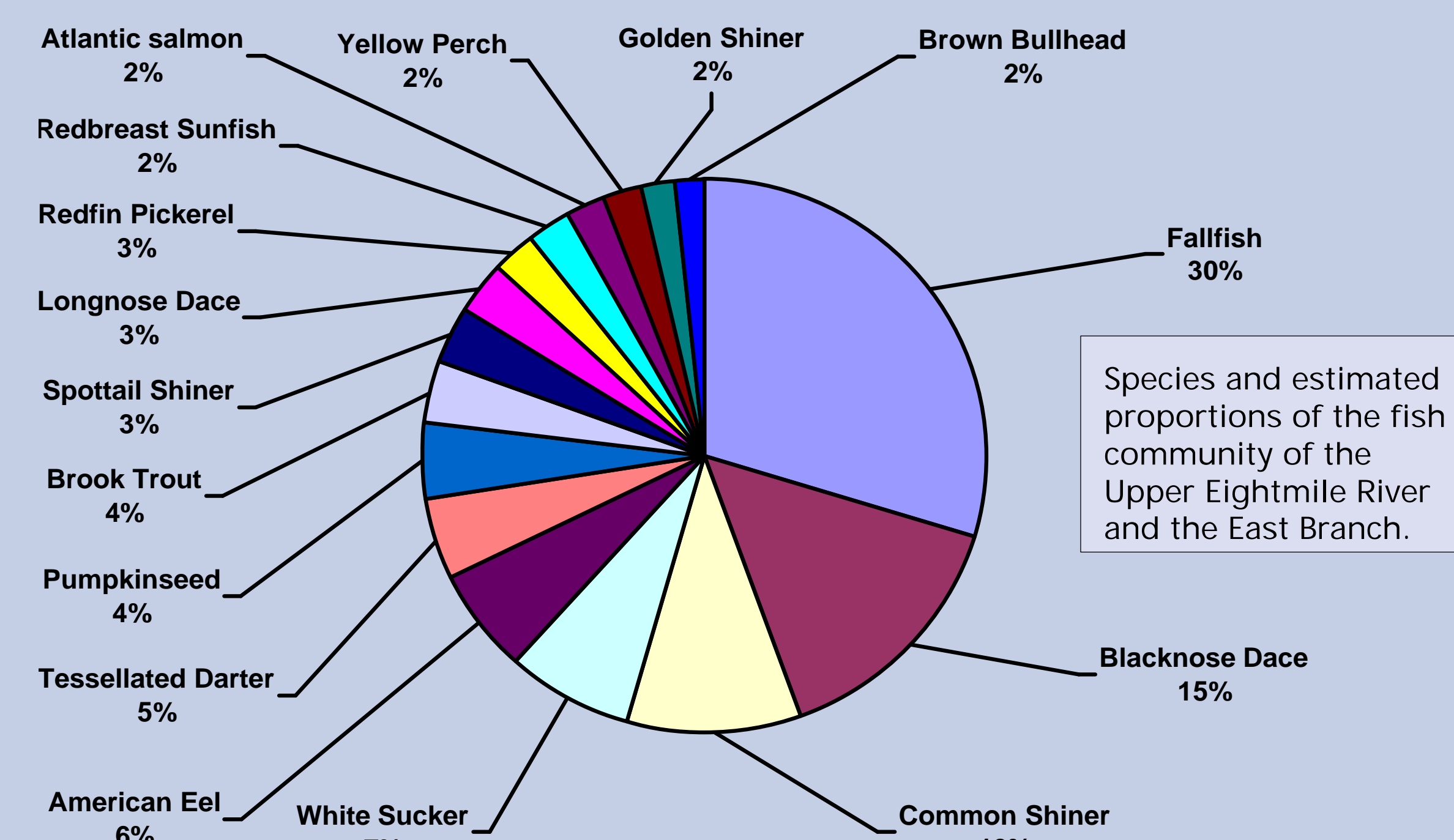
(Modified from Bradshaw (1984))

EIGHTMILE RIVER: A Potential Benchmark

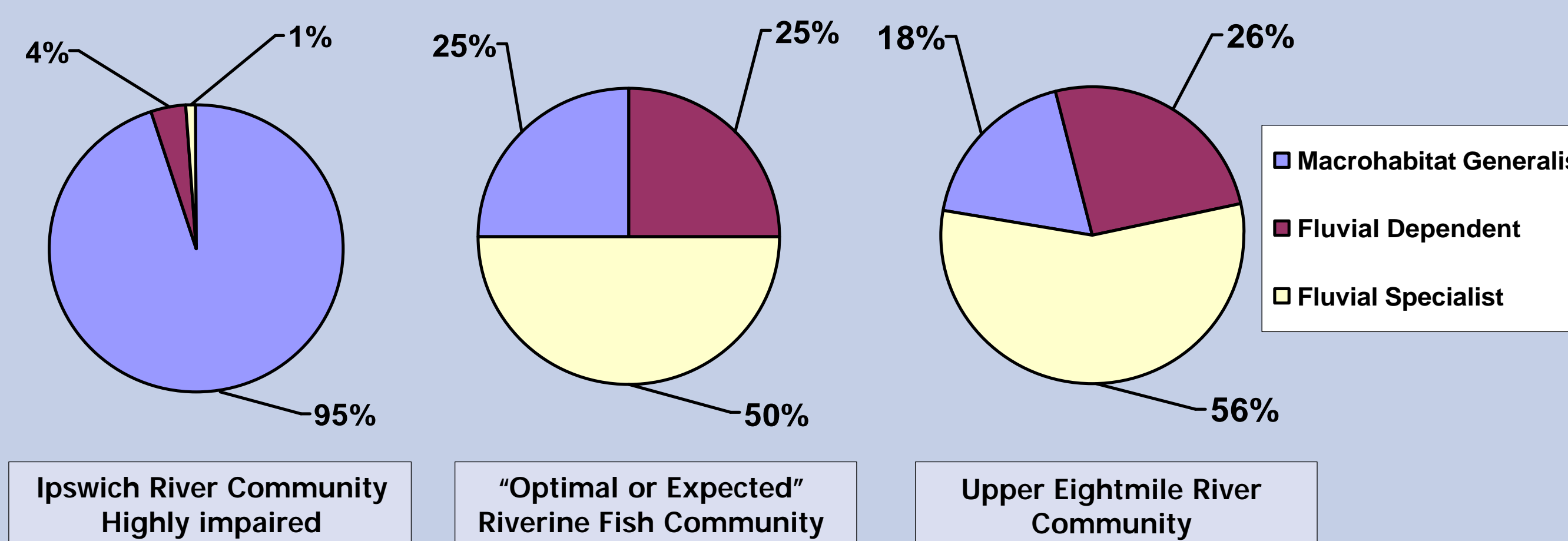


- Through help of NEMO (Nonpoint Education for Municipal Officials), TNC (The Nature Conservancy) and local citizens and groups, Eightmile is a valuable, protected resource
- Nominated for Wild and Scenic River designation.
- More than 80% of the watershed is forested (One of largest, contiguous parcels in region). Less than 10% impervious.
- High quality surface and groundwater.
- No major industrial point sources and few impediments or channel alterations.
- May provide a reference or guidance for establishing management objectives for more highly impacted rivers.

Existing Fish Community (XFC): From electroshock grid fish surveys in 2004, we summed proportions of the catch from each site, ranked the species and used the reciprocal to develop expected proportions in a power law based approach. In order to evaluate the XFC, we had previously developed a Reference Fish Community (RFC), which describes proportions of species in the community expected under natural conditions. This allows us to identify indicator/umbrella species that either dominate the RFC or need specific habitats to complete their life cycle.

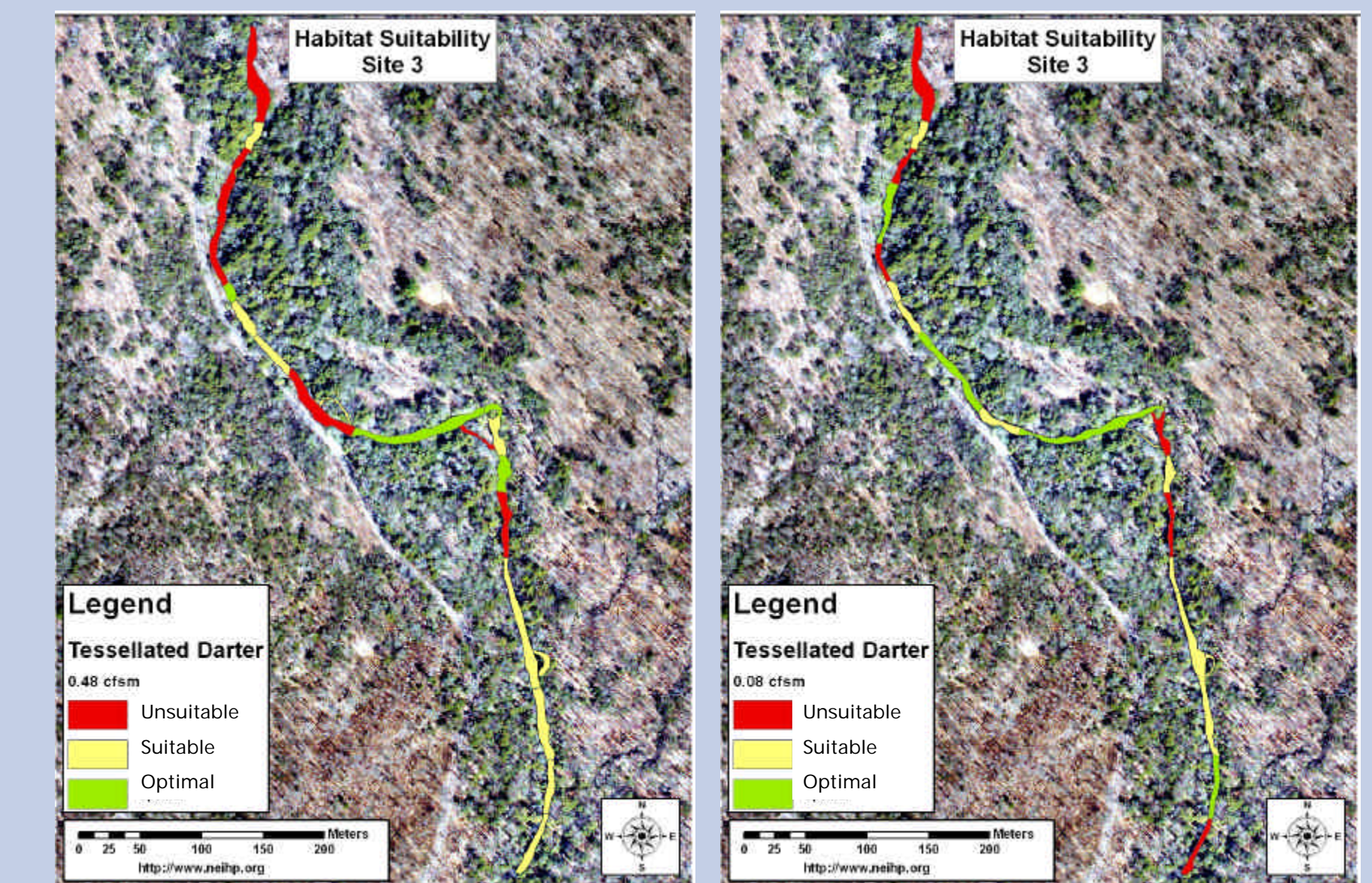


The fish community of a stream should naturally be comprised of a majority of fluvial specialist and dependent species. As streams and flow regimes are altered, the species assemblage shifts towards more tolerant macrohabitat generalists.



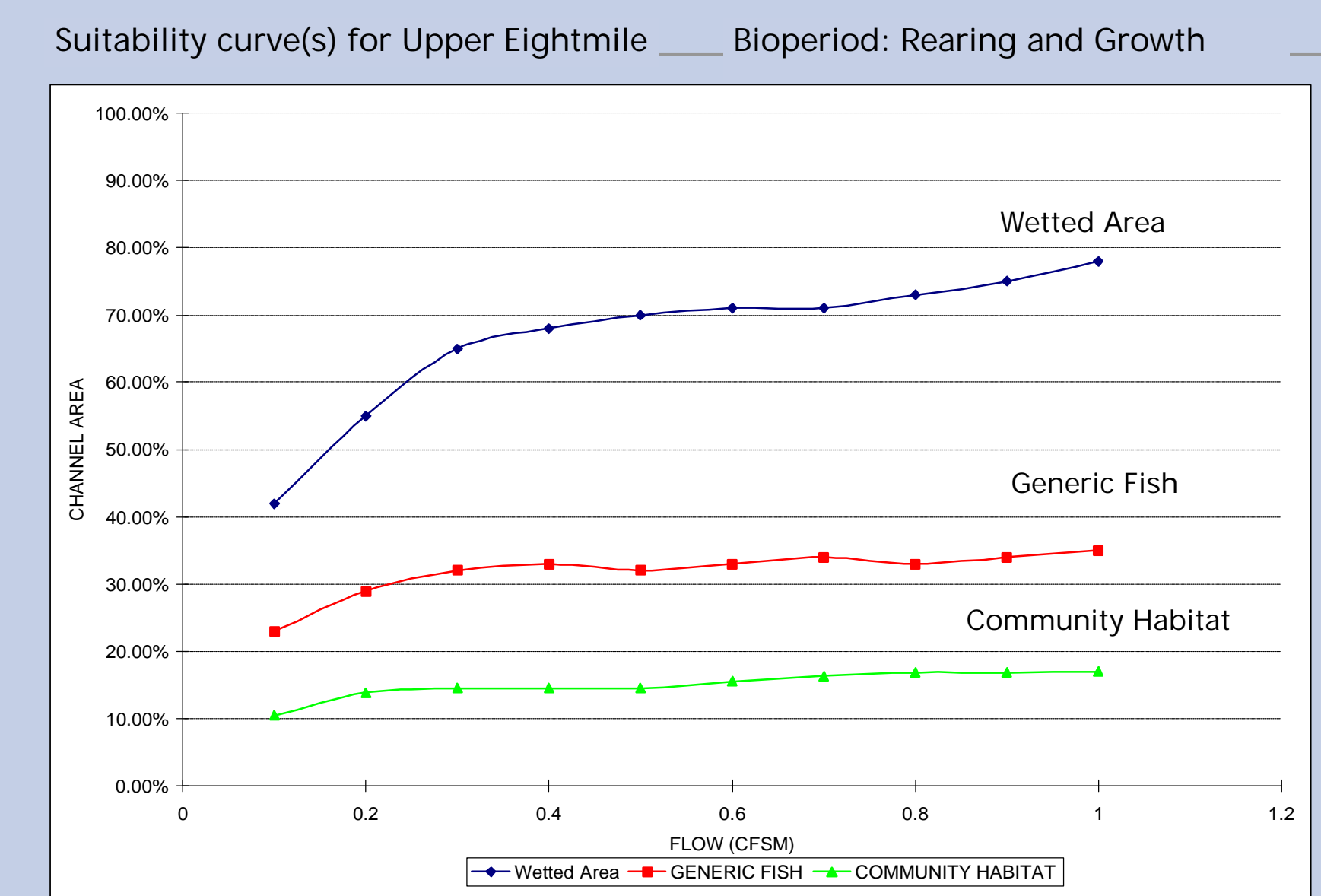
IMPLICATIONS FOR REGULATIONS

In terms of the aquatic community, the Eightmile was determined to be a high quality system in the process of recovery. We are currently in the process of modeling the river to evaluate the **habitat suitability**. Mesohabitats are mapped over various flows and the habitat quality is calculated for representative species.



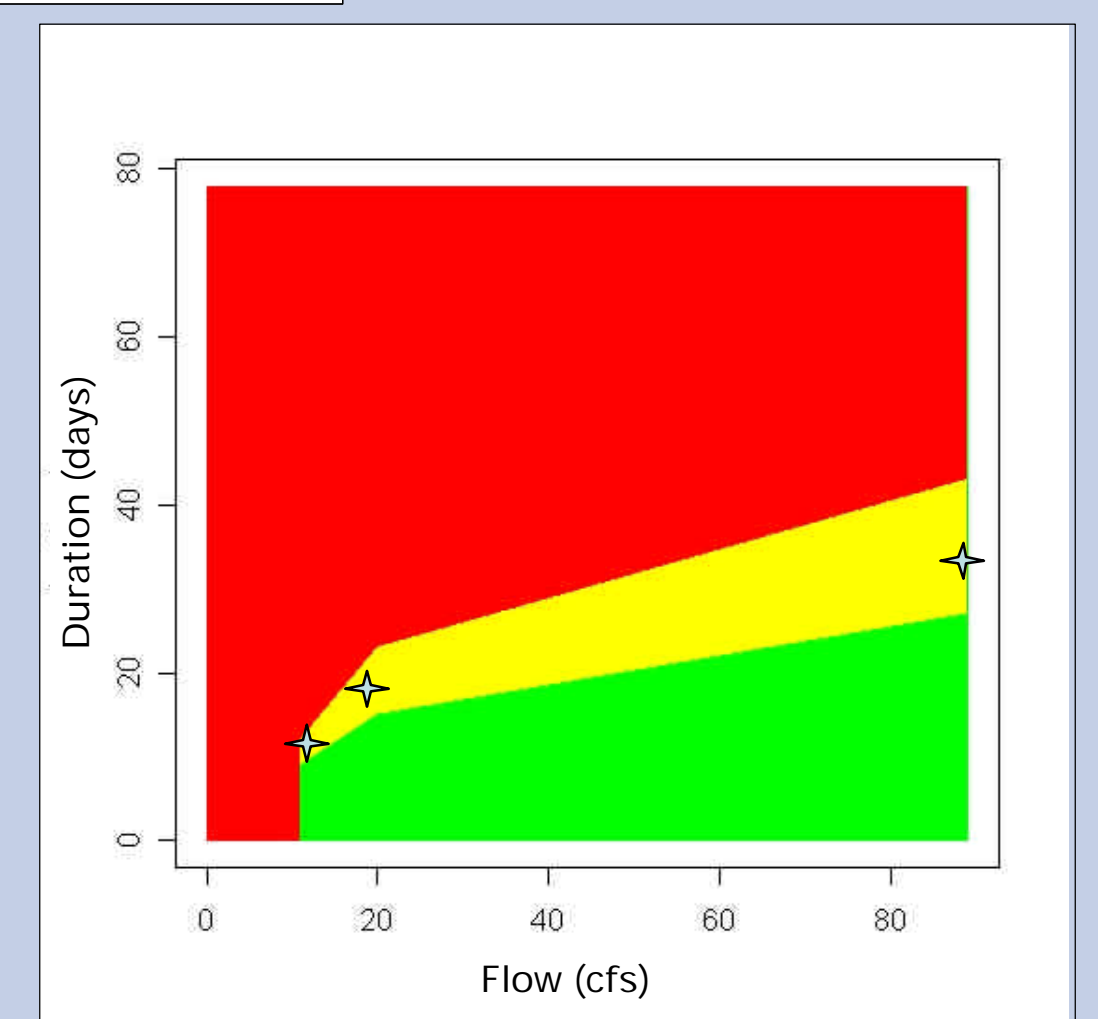
Habitat criteria was identified for the tessellated darter and each mapped unit was evaluated for its capacity to support the necessary characteristics. This is shown at 0.08 cfs flow (right) and 0.48cfs (left)

Rating curves represent changes in the relative area of suitable habitat in response to flow. The generic fish curve shows maximum available habitat (quantity) while the community curve measures quality. The higher the generic curve, the better availability.



Suitability curves can be created for different bioperiods or stages in the life cycle, i.e. spawning. This is an example of suitable habitat for rearing and growth in the Eightmile.

ACTograms will also be developed. These visually represent common (green), critical (yellow) and catastrophic (red) durations of continuous low-flow events. The stars indicate the duration of flow conditions.



These methods provide information on the critical amount of flow that must be retained to support target fish assemblages in high quality rivers in an anthropogenic landscape. Currently, MA Fish and Wildlife, RI Water Allocation Program Advisory Committee, NH DES and CT DEP have been investigating this program for potential use in instream flow regulations.

This material is based upon work by the Northeast Instream Habitat Program out of UMass Amherst. It was supported by the Eightmile River Wild and Scenic Study Committee and the National Park Service. Additional funding was provided by CSREES through the New England Regional Water Quality Program as well as BSC Group.