

DESIGN OF RESERVE SYSTEMS: AN EXAMPLE

The Massachusetts BioMap project

We've been talking about reserve design mostly in the abstract. Let's take a look at an example of a statewide conservation plan and ask

- How well does it exemplify the abstract principles we've been discussing?
- How successful is the plan likely to be?

The Commonwealth of Massachusetts released a report two years ago on its BioMap project (<http://www.state.ma.us/dfwele/dfw/nhesp/nhbiomap.htm>). The agencies that produced BioMap are using it "to target those lands with greater ecological value."

The goal of the BioMap is to promote strategic land protection by producing a map showing areas, that if protected, would provide suitable habitat over the long term for the maximum number of Massachusetts' terrestrial and wetland plant and animal species and natural communities.

Elements of concern

As I suggested last time, I find it useful to start by thinking about the elements of concern. The statement of purpose provides pretty clear guidance about what those elements are: (1) terrestrial and wetland plant and animal species and (2) natural communities. As Table 1 makes clear, the species of concern include not just rare species, but *all* native species in the Commonwealth.

Location of the elements

In identifying locations for each element, the scientists producing the BioMap did more than record where each species or community is currently found. In producing a land protection map identifying the the most important areas for conservation attention they also considered

- The degree of threat faced by each species and community, both globally and within the state (Table 2) and
- The viability of each known occurrence (Table 3).

Biodiversity group	Rare species	Native species
Vascular plants	246	1538
Birds	21	221
Reptiles	11	25
Amphibians	6	21
Mammals	4	85
Lepidoptera	52	2500–3000
Odanata	25	165
Orthoptera	10	2500–4000
	Verified	Total
Communities	92	>105

Table 1: Elements of concern

Rarity	Description
Critically imperiled	<5 occurrences or < 1000 individuals
Imperiled	6–20 occurrences or 1000–3000 individuals
Vulnerable	21-100 occurrences or 3000-10,000 individuals
Apparently secure	>100 occurrences or 10,000 individuals
Secure	Common, widespread, and abundant

Table 2: The categories of threat used in categorizing threats to individual species in the BioMap project.

Factor	Component
Size	Area of occupancy
	Number of individuals
	Population density
	Population fluctuation
Condition	Reproductive success and health
	Maturity of natural community
	Species composition, biological structure, and presence of exotic species
	Ecological processes and degree of disturbance
	Physical and chemical factors
Landscape context	Landscape structure, connectivity, fragmentation, and patchiness
	Condition of the surrounding landscape

Table 3: The factors used in assessing the viability of each known occurrence of an element.

Element rarity	Ranks selected	
	Rare plants	Natural communities
Globally critically imperiled	All occurrences	All occurrences
Globally imperiled	All occurrences	All occurrences
Globally vulnerable	Best occurrences	All occurrences
State critically imperiled	All occurrences	All occurrences
State imperiled	Best occurrences	Best occurrences
State vulnerable	Very best occurrences	Best occurrences
State secure	Not explicitly selected	Very best occurrences

Table 4: The number of occurrences of different elements to be included in the BioMap.

Occurrences included

At this point we need to decide how many occurrences of each element to protect. The criteria chosen by the BioMap project are in Table 4.

Identifying areas for protection

In a fashion analogous to Noss and Harris' [1] nodes, networks, and MUMs, two types of areas important for conservation were identified (Figure 1).

- **Core habitat** — An area identified as core habitat combines habitat for viable populations of rare plants and animals and supports one or more exemplary communities. Protection of core habitat has the highest priority for biodiversity conservation in Massachusetts.
- **Supporting natural landscape** — An area identified as supporting natural landscape is important to protecting core habitat, even though it may not sustain viable populations of rare plants and animals or support an exemplary community. Four types of areas provide this type of support:
 1. Core habitat buffers,
 2. Connections (corridors) between core habitats,
 3. Areas necessary to buffer impact of important ecological processes, e.g., flooding or fire, and
 4. Large, undeveloped patches of land.

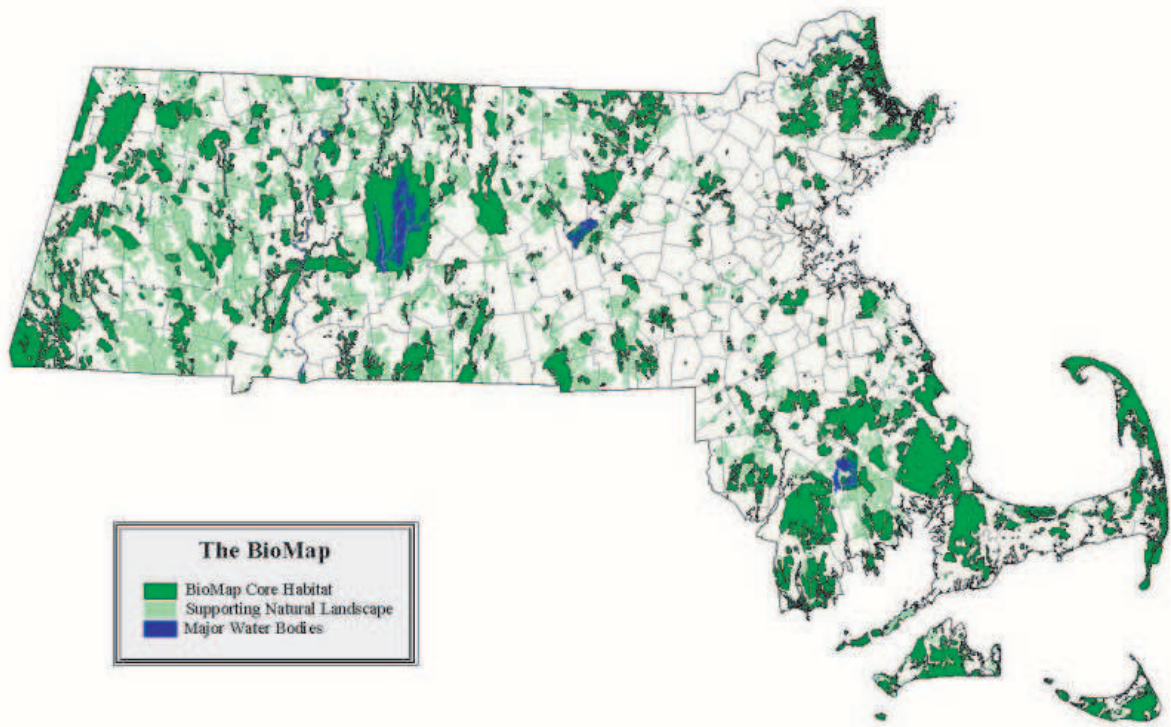


Figure 1: The final map produced by the Massachusetts BioMap project.

Aquatic biodiversity

The goal of the Living Waters Project (formerly referred to as the Aquatic Biodiversity Project) is to promote the strategic protection of freshwater biodiversity in Massachusetts. To meet this goal, Natural Heritage biologists are assessing and mapping rare aquatic species and their habitats and exemplary aquatic ecosystems. This project, begun in 2001, is funded with bond funds made available by the Executive Office of Environmental Affairs. <http://www.state.ma.us/dfwele/dfw/nhosp/nhaqua.htm>

References

- [1] R. F. Noss and L. D. Harris. Nodes, networks, and MUMs: preserving diversity at all scales. *Environmental Management*, 10:299–309, 1986.

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