Appendix G. CAPS Integrity Metrics.

The following appendix is from the report "Conservation Assessment and Prioritization System (CAPS) Preliminary Statewide Massachusetts Assessment", June 2, 2009. Kevin McGarigal, Bradley W. Compton, Scott D. Jackson, and Kasey Rolih. Landscape Ecology Program, Department of Natural Resources Conservation, University of Massachusetts, Amherst.

These ecological integrity metrics are included in the Conservation Assessment and Prioritization System (CAPS). Integrity metrics include both anthropogenic *stressor* metrics that measure the level of anthropogenic activities exclusively and *resiliency* metrics that measure the combined effect of anthropogenic stressor and landscape context.

Stressor Metrics	
Development & roads	
Habitat loss	Measures the intensity of habitat loss caused by all forms of development in the neighborhood surrounding the focal cell, based on a logistic function of Euclidean distance.
Wetland buffer insults	Measures the adverse effect of impervious surfaces within the 100-foot regulatory buffer around a wetland.
Road traffic intensity	Measures the intensity of road traffic (based on measured road traffic rates) in the neighborhood surrounding the focal cell, based on a logistic function of distance.
Microclimate alterations	Measures the adverse effects of induced (human-created) edges on the microclimate of patch interiors, such as moisture, temperature, and wind. The edge effects metric is based on the "worst" edge effect among all adverse edges in the neighborhood surrounding the focal cell, where each adverse edge is evaluated using a "depth-of-edge" function in which the "effect" is scaled using a logistic function of distance.
Pollution	
Road salt intensity	Measures the intensity of road salt application in the watershed above an aquatic focal cell weighted by road class and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model. This metric is a surrogate for road salt application rates.

Road sediment intensity	Measures the intensity of road sediment production in the watershed above an aquatic focal cell weighted by road class (i.e., size, substrate, gradient) and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model. This metric is a surrogate for road sediment production rates.
Fertilizer intensity	Measures the intensity of fertilizer application in the neighborhood surrounding the focal cell, based on the aquatic distance from the focal cell based on a time-of-flow model to development classes (primarily agriculture and residential land uses). This metric is a surrogate for fertilizer application rate.
Point-source pollution	Measures the intensity of actual or potential point-sources of pollution (such as permitted discharges into streams, municipal and industrial sewage plants, and underground storage tanks) in the watershed above an aquatic focal cell, weighted by type and size of point source and by the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Biotic alterations	
Domestic predators	Measures the intensity of development associated with sources of domestic predators (e.g., cats) in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for domestic predator abundance measured directly in the field.
Edge predators	Measures the intensity of development associated with sources of human commensal mesopredators (e.g., raccoons and skunks) and nest parasites (cowbirds) in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for mesopredator/nest parasite abundance measured directly in the field.
Non-native invasive plants	Measures the intensity of development associated with sources of non-native invasive plants in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for non-native invasive plant abundance measured directly in the field.

Non-native invasive earthworms	Measures the intensity of development associated with sources of non-native invasive earthworms in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for non-native invasive earthworm abundance measured directly in the field.
Hydrological alterations	
Imperviousness	Measures the intensity of impervious surface in the watershed above the focal cell, based on imperviousness and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Percent impounded	Measures the proportion of the watershed above an aquatic focal cell that is impounded by dams, weighted by the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Upstream road crossings	Measures the number of upstream road crossings per kilometer of stream above an aquatic focal cell weighted by the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Dam intensity	Measures the number of dams in the watershed above an aquatic focal cell weighted by dam size and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Resiliency Metrics	
Connectedness	Measures the disruption of habitat connectivity caused by all forms of development between each focal cell and surrounding cells as well as the "resistance" of the surrounding undeveloped landscape. A hypothetical organism in a highly connected cell can reach a large area with minimal crossing of "hostile" cells. This metric uses a least-cost path algorithm to determine the area that can be reached from each focal cell. The focal cell gets a "bank account," which represents the distance a hypothetical organism could move through the undeveloped landscape. Each cell is assigned a travel cost, based on a resistance matrix, as a function of its ecological similarity to the focal cell. The algorithm then creates a least-cost hull around the focal cell, representing the maximum distance that can be moved from the cell until the "bank account" is depleted.

Similarity	Measures the amount of similarity between the ecological setting at the focal cell and those of neighboring cells, weighted by a logistic function of distance. Similarity is based on the ecological distance between the focal cell and each neighboring cell, where ecological distance is a multivariate distance across all ecological setting variables.