Massachusetts CAPS Landscape Metrics – February 2021

This document describes the landscape metrics available in CAPS. These metrics are weighted and combined separately for each community, using the community model listed in Appendix F. Detailed descriptions of the DSL versions of most of these metrics are available at umassdsl.org. Source: https://umasscaps.org

Metric name	Grid name	Description
Stressor Metrics		
Development & roads		
Habitat loss	habloss	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. *Data source*: land cover
Watershed habitat loss	whabloss	Measures the intensity of habitat loss caused by all forms of development in the neighborhood upstream from the focal cell, based on the aquatic distance from the focal cell using on a time-of-flow model. *Data source*: land cover, streams, flow direction, watershed resistance
Road traffic	traffic	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. *Data source*: land cover, traffic rates
Mowing & plowing	mowplow	Measures the intensity of agriculture in the neighborhood surrounding the focal cell, based on a logistic function of distance. This metric is a surrogate for mowing/plowing rates (which are a direct source of animal mortality). *Data source*: land cover

Metric name	Grid name	Description
Microclimate alterations	edges	Measures the adverse effects of induced (human-created) edges on the integrity of patch interiors; that is, factors that negatively intrude on the patch from its surroundings. 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. *Data source*: land cover
Pollution		
Road salt	salt	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. *Data source*: land cover, streams, flow direction, watershed resistance
Road sediment	sediment	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. *Data source*: land cover, streams, flow direction, watershed resistance

Metric name	Grid name	Description
Nitrogen enrichment	nitrogen	Measures the percent increase in nitrogen in streams due to anthropogenic sources in the watershed of the focal cell. Excess nitrogen can be an important pollutant in freshwater and estuarine streams.
		This metric is based on an empirical model developed by Elizabeth Homa (Homa et al. 2013). This metric is not available for the Cape and Islands, due to a paucity of empirical data for these hydrologically distinct areas. This metric only applies to streams, not wetlands or lentic waterbodies.
		Data source: land cover, streams, flow direction, watershed resistance, minimum annual temperature, imperviousness, water discharges, percent of households in each town with septic systems.
Phosphorus enrichment	phosphorus	Measures the percent increase in phosphorus in streams due to anthropogenic sources in the watershed of the focal cell. Excess phosphorus can be an important pollutant in estuarine streams.
		This metric is based on an empirical model developed by Elizabeth Homa (Homa et al. 2013). This metric is not available for the Cape and Islands, due to a paucity of empirical data for these hydrologically distinct areas. This metric only applies to streams, not wetlands or lentic waterbodies.
		Data source: land cover, streams, flow direction, watershed resistance, minimum annual temperature, annual precipitation, water discharges.
Biotic alterations		
Domestic predators	cats	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.
		Data source: land cover

Metric name	Grid name	Description
Edge predators	edgepred	Measures the intensity of development associated with sources of human commensal mesopredators (e.g., raccoons, skunks) in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for mesopredator abundance measured directly in the field. *Data source*: land cover
Invasive plants	badplants	Measures the intensity of development associated with sources of terrestrial and aquatic 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. *Data source*: land cover
Invasive earthworms	worms	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. *Data source*: land cover
Hydrological alterations		
Hydrologic alterations	hydroalt	Measures the mean percent change in streamflow due to anthropogenic alterations in hydrology across eleven exceedance probabilities representing a range of low to high annual flows for each focal stream cell. This metric is based on an empirical model developed by Elizabeth Homa (Homa et al. 2013). This metric is not available for the Cape and Islands, due to a paucity of empirical data for these hydrologically distinct areas. *Data source*: land cover, streams, flow direction, minimum annual temperature, mean humidity, mean December precipitation, percent sand, imperviousness, dam storage, water discharges.

Metric name	Grid name	Description
Imperviousness	imperv	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. *Data source*: land cover, streams, flow direction, watershed resistance, percent imperviousness
Dams	damint	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. *Data source*: land cover, streams, flow direction, watershed resistance, dams
Coastal metrics		
Salt marsh ditching	ditches	Measures the magnitude of hydrologic alteration leading to loss of water features and/or marsh subsidence around the focal cell due to ditching, based on a standard kernel density estimate of nearby drainage ditches. *Data source*: land cover, photo-interpreted salt marsh ditches
Coastal structures	jetties	Measures the proximity of the focal cell to up-gradient manmade jetty/groin, based on a logistic function of distance to nearest up-gradient jetty/groin; applied only to certain land cover types (e.g., beaches, intertidal flats). *Data source*: land cover, field-checked and photo-interpreted coastal structures
Beach pedestrians	beachpeds	Measures the intensity of beach pedestrian traffic at the focal cell, based on a standard kernel density of pedestrians. *Data source*: land cover, public beaches, photo-interpreted beach parking lots

Metric name	Grid name	Description
Beach ORVs	beachORVs	Measures the intensity of beach ORV traffic based on proximity of focal cell to ORV beaches. *Data source*: land cover, beach ORV parking areas
Boat traffic	boats	Measures the impact related to motion disturbance, noise and boat wakes (rather than more local impacts such as propeller wash or discharges of pollutants). This metric is based on a model developed by Marc Carullo (CZM) and Michael McHugh and James Sprague (MassDEP). *Data source*: land cover, Automatic Identification Systems (AIS) data, Vessel Monitoring System (VMS) data, and Recreational Boater Routes (RBR).
Tidal restrictions	tideres	Measures the magnitude of alteration to the tidal hydrology of the focal cell due to tidal restrictions. *Data source*: land cover, tides settings variable, tide range, estimated tidal restriction points (road/stream and railroad/stream crossings), flow direction.

Resiliency Metrics

Metric name	Grid name	Description
Connectedness	connect	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, as well as the similarity of surroundings. A hypothetical organism in a highly connected cell can reach a large area of ecologically similar cells with minimal crossing of "hostile" cells. This metric uses a least-cost path algorithm to determine the area that can reach each focal cell, incorporating each cell's similarity to the focal cell. *Data source*: land cover, ecological settings variables

Metric name	Grid name	Description
Aquatic connectedness	aqconnect	An aquatic version of the connectedness metric, measuring connectivity along streams and rivers. Aquatic connectedness includes the resistance from culverts, bridges and dams for organisms that are primarily aquatic. *Data source*: land cover, streams, ecological settings variables
Similarity	sim	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. *Data source*: land cover, ecological settings variables