New York SWAP

References

Anderson, M. G., M. Clark, C. Ferree, A. Jospe, and A. Olivero Sheldon. 2013. Condition of the Northeast terrestrial and aquatic habitats: a geospatial analysis and tool set. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office, Boston, MA.

Association of Fish and Wildlife Agencies. 2012. Best practices for State Wildlife Action Plans: Voluntary guidance to States for revision and implementation. Association of Fish and Willdife Agencies, Washington D.C.

Bailey, R. 1997, July 10. Map: Ecoregions of North America. UDSA Forest Service in cooperation with The Nature Conservancy and the U. S. Geological Survey, Washington, DC.

Benítez-López, A., R. Alkemade, and P. A. Verweij. 2010. The impacts of roads and other infrastructure on mammal and bird populations: A meta-analysis. Biological Conservation 143:1307–1316.

Carpenter, S. R., N. F. Caraco, D. L. Correll, R. W. Howarth, A. N. Sharpley, and V. H. Smith. 1998. Nonpoint pollution of surface waters with phosphorus and nitrogen. Ecological Applications 8:559–568.

Comer, P. J., and J. Hak. 2012. Landscape Condition in the Conterminous United States. Spatial Model Summary. NatureServe, Boulder, CO.

Davis, B. N. K., K. H. Lakhani, T. J. Yates, A. J. Frost, and R. A. Plant. 1993. Insecticide drift from ground-based, hydraulic spraying of peas and brussels sprouts: bioassays for determining buffer zones. Agriculture, Ecosystems and Environment 43:93–108.

Dobson, J., E. Bright, R. Ferguson, D. Field, L. Wood, K. Haddad, H. Iredale III, J. Jensen, V. Klemas, and R. Orth. 1995. NOAA coastal change analysis program (C-CAP): guidance for regional implementation. NOAA Technical Report 123.

Feldmann, A. L., T. G. Howard, and E. A. Spencer. 2012. Pilot wetland condition assessment of palustrine emergent marsh in the Upper Hudson River watershed. A report prepared for the NYSDEC Division of Water by the New York Natural Heritage Program. Albany, NY.

Ferree, C. E., and M. G. Anderson. 2013. A map of terrestrial habitats of the northeastern United States: Methods and approach. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office, Boston, MA.

Forman, R. T. T. 2000. Estimate of the area affected ecologically by the road system in the United States. Conservation Biology 14:31–35.

Forman, R. T. T., and R. D. Deblinger. 2000. The ecological road-effect zone of a Massachusetts (U.S.A.) suburban highway. Conservation Biology 14:36–46.

Gawler, S. C. 2008. Northeastern Terrestrial Wildlife Habitat Classification. Page 102. Report to the Virginia Department of Game and Inland Fisheries on behalf of the Northeast Association of Fish and Wildlife Agencies and the National Fish and Wildlife Foundation, NatureServe, Boston, Massachusetts.

Grunau, L., M. Fink, K. Decker, D. G. Anderson, E. Carlson, G. Smith, C. Keske, J. Goldstein, and J. Lemly. 2012. SHRP 2 C21A: Pilot test the ecological approaches to environmental

protection developed in capacity research projects C06A and C06B. Page 271. Colorado State University, Fort Collins, CO.
Jenks, G. F. 1967. The Data Model Concept in Statistical Mapping. International Yearbook of Cartography 7:186–190.
De Jong, F. M. W., G. R. de Snoo, and J. C. van de Zande. 2008. Estimated nationwide effects of pesticide spray on terrestrial habitats in the Netherlands. Journal of Environmental Management 86:721–730.
McDonald, R. I., R. T. T. Forman, P. Kareiva, R. A. Neugarten, D. Salzer, and J. Fisher. 2009. Urban effects, distance, and protected areas in an urbanizing world. Landscape and 93:63–75.
McGarigal, K. 2014. Designing sustainable landscapes project component: Integrity. University of Massachusetts, Amherst, MA.
McLachlan, M. M., A. Daniels, and A. M. Bartuszevige. 2013. User's manual: playa lakes decision support system. Playa Lakes Joint Venture, Lafayette, CO, USA.
New York Natural Heritage Program. 2015. Element occurrence database. Albany, NY.
Olivero, A. P., and M. G. Anderson. 2008. Northeast aquatic habitat classification. The Nature Conservancy Eastern Resource Office, Boston, MA.
Olivero-Sheldon, A., A. Jospe, and M. G. Anderson. 2014. Northeast lake and pond classification system. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office, Boston, MA.
Parris, K. M., and A. Schneider. 2009. Impacts of traffic noise and traffic volume on birds of roadside habitats. Ecology and Society 14.
White, E. L., J. J. Schmid, T. G. Howard, M. D. Schlesinger, and A. L. Feldmann. 2011. New York State Freshwater Conservation Blueprint Project, Phases I and II: Freshwater Systems, Species, and Viability Metrics. Page 85. The New York Natural Heritage Program, Albany, NY.
Van der Zande, A. N., W. J. ter Keurs, and W. J. van der Weijden. 1980. The impact of roads on the densities of four bird species in an open field habitat--evidence of a long-distance effect. Biological Conservation 18:299–321.

Appendix A

New York Habitat Type Classification Hierarchy

	Formation Class		Formation		Macrogroup		New York Habitat Type
1	Headwater/Creek	1.1	Low Gradient	1.1.1	Low Buffered	1.1.1.1	Headwater/Creek; Low Gradient; Low Buffered, Acidic; Cold
1	Headwater/Creek	1.1	Low Gradient			1.1.1.2	Headwater/Creek; Low Gradient; Low Buffered, Acidic; Transitional Cool
1	Headwater/Creek	1.1	Low Gradient			1.1.1.3	Headwater/Creek; Low Gradient; Low Buffered, Acidic; Warm
1	Headwater/Creek	1.1	Low Gradient	1.1.2	Moderately Buffered	1.1.2.1	Headwater/Creek; Low Gradient; Moderately Buffered, Neutral; Cold
1	Headwater/Creek	1.1	Low Gradient			1.1.2.2	Headwater/Creek; Low Gradient; Moderately Buffered, Neutral; Transitional Cool
1	Headwater/Creek	1.1	Low Gradient			1.1.2.3	Headwater/Creek; Low Gradient; Moderately Buffered, Neutral; Warm
1	Headwater/Creek	1.1	Low Gradient	1.1.3	Highly Buffered	1.1.3.2	Headwater/Creek; Low Gradient; Highly Buffered, Calcareous; Transitional Cool
1	Headwater/Creek	1.1	Low Gradient			1.1.3.3	Headwater/Creek; Low Gradient; Highly Buffered, Calcareous; Warm
1	Headwater/Creek	1.2	Low-Moderate Gradient	1.2.1	Low Buffered	1.2.1.1	Headwater/Creek; Low-Moderate Gradient; Low Buffered, Acidic; Cold

	Formation Class		Formation		Macrogroup		New York Habitat Type
1	Headwater/Creek	1.2	Low-Moderate Gradient			1.2.1.2	Headwater/Creek; Low-Moderate Gradient; Low Buffered, Acidic; Transitional Cool
1	Headwater/Creek	1.2	Low-Moderate Gradient			1.2.1.3	Headwater/Creek; Low-Moderate Gradient; Low Buffered, Acidic; Warm
1	Headwater/Creek	1.2	Low-Moderate Gradient	1.2.2	Moderately Buffered	1.2.2.1	Headwater/Creek; Low-Moderate Gradient; Moderately Buffered, Neutral; Cold
1	Headwater/Creek	1.2	Low-Moderate Gradient			1.2.2.2	Headwater/Creek; Low-Moderate Gradient; Moderately Buffered, Neutral; Transitional Cool
1	Headwater/Creek	1.2	Low-Moderate Gradient			1.2.2.3	Headwater/Creek; Low-Moderate Gradient; Moderately Buffered, Neutral; Warm
1	Headwater/Creek	1.2	Low-Moderate Gradient	1.2.3	Highly Buffered	1.2.3.1	Headwater/Creek; Low-Moderate Gradient; Highly Buffered, Calcareous; Cold
1	Headwater/Creek	1.2	Low-Moderate Gradient			1.2.3.2	Headwater/Creek; Low-Moderate Gradient; Highly Buffered, Calcareous; Transitional Cool
1	Headwater/Creek	1.3	Moderate-High Gradient	1.3.1	Low Buffered	1.3.1.1	Headwater/Creek; Moderate-High Gradient; Low Buffered, Acidic; Cold
1	Headwater/Creek	1.3	Moderate-High Gradient			1.3.1.2	Headwater/Creek; Moderate-High Gradient; Low Buffered, Acidic; Transitional Cool
1	Headwater/Creek	1.3	Moderate-High Gradient			1.3.1.3	Headwater/Creek; Moderate-High Gradient; Low Buffered, Acidic; Warm

	Formation Class		Formation		Macrogroup		New York Habitat Type
1	Headwater/Creek	1.3	Moderate-High Gradient	1.3.2	Moderately Buffered	1.3.2.1	Headwater/Creek; Moderate-High Gradient; Moderately Buffered, Neutral; Cold
1	Headwater/Creek	1.3	Moderate-High Gradient			1.3.2.2	Headwater/Creek; Moderate-High Gradient; Moderately Buffered, Neutral; Transitional Cool
1	Headwater/Creek	1.3	Moderate-High Gradient			1.3.2.3	Headwater/Creek; Moderate-High Gradient; Moderately Buffered, Neutral; Warm
1	Headwater/Creek	1.3	Moderate-High Gradient	1.3.3	Highly Buffered	1.3.3.1	Headwater/Creek; Moderate-High Gradient; Highly Buffered, Calcareous; Cold
1	Headwater/Creek	1.3	Moderate-High Gradient			1.3.3.2	Headwater/Creek; Moderate-High Gradient; Highly Buffered, Calcareous; Transitional Cool
1	Headwater/Creek	1.4	High Gradient	1.4.1	Low Buffered	1.4.1.1	Headwater/Creek; High Gradient; Low Buffered, Acidic; Cold
1	Headwater/Creek	1.4	High Gradient			1.4.1.2	Headwater/Creek; High Gradient; Low Buffered, Acidic; Transitional Cool
1	Headwater/Creek	1.4	High Gradient	1.4.2	Moderately Buffered	1.4.2.1	Headwater/Creek; High Gradient; Moderately Buffered, Neutral; Cold
1	Headwater/Creek	1.4	High Gradient			1.4.2.2	Headwater/Creek; High Gradient; Moderately Buffered, Neutral; Transitional Cool
1	Headwater/Creek	1.4	High Gradient			1.4.2.3	Headwater/Creek; High Gradient; Moderately Buffered, Neutral; Warm

	Formation Class		Formation		Macrogroup		New York Habitat Type
1	Headwater/Creek	1.4	High Gradient	1.4.3	Highly Buffered	1.4.3.1	Headwater/Creek; High Gradient; Highly Buffered, Calcareous; Cold
1	Headwater/Creek	1.4	High Gradient			1.4.3.2	Headwater/Creek; High Gradient; Highly Buffered, Calcareous; Transitional Cool
2	Small River	2.1	Low Gradient	2.1.1	Low Buffered	2.1.1.1	Small River; Low Gradient; Low Buffered, Acidic; Cold
2	Small River	2.1	Low Gradient			2.1.1.2	Small River; Low Gradient; Low Buffered, Acidic; Transitional Cool
2	Small River	2.1	Low Gradient			2.1.1.3	Small River; Low Gradient; Low Buffered, Acidic; Warm
2	Small River	2.1	Low Gradient	2.1.2	Moderately Buffered	2.1.2.1	Small River; Low Gradient; Moderately Buffered, Neutral; Cold
2	Small River	2.1	Low Gradient			2.1.2.2	Small River; Low Gradient; Moderately Buffered, Neutral; Transitional Cool
2	Small River	2.1	Low Gradient			2.1.2.3	Small River; Low Gradient; Moderately Buffered, Neutral; Warm
2	Small River	2.1	Low Gradient	2.1.3	Highly Buffered	2.1.3.2	Small River; Low Gradient; Highly Buffered, Calcareous; Transitional Cool
2	Small River	2.2	Low-Moderate Gradient	2.2.1	Low Buffered	2.2.1.1	Small River; Low-Moderate Gradient; Low Buffered, Acidic; Cold
2	Small River	2.2	Low-Moderate Gradient			2.2.1.2	Small River; Low-Moderate Gradient; Low Buffered, Acidic; Transitional Cool

	Formation Class		Formation		Macrogroup		New York Habitat Type
2	Small River	2.2	Low-Moderate Gradient			2.2.1.3	Small River; Low-Moderate Gradient; Low Buffered, Acidic; Warm
2	Small River	2.2	Low-Moderate Gradient	2.2.2	Moderately Buffered	2.2.2.1	Small River; Low-Moderate Gradient; Moderately Buffered, Neutral; Cold
2	Small River	2.2	Low-Moderate Gradient			2.2.2.2	Small River; Low-Moderate Gradient; Moderately Buffered, Neutral; Transitional Cool
2	Small River	2.2	Low-Moderate Gradient			2.2.2.3	Small River; Low-Moderate Gradient; Moderately Buffered, Neutral; Warm
2	Small River	2.2	Low-Moderate Gradient			2.2.3.2	Small River; Low-Moderate Gradient; Highly Buffered, Calcareous; Transitional Cool
2	Small River	2.3	Moderate-High Gradient	2.3.1	Low Buffered	2.3.1.1	Small River; Moderate-High Gradient; Low Buffered, Acidic; Cold
2	Small River	2.3	Moderate-High Gradient			2.3.1.2	Small River; Moderate-High Gradient; Low Buffered, Acidic; Transitional Cool
2	Small River	2.3	Moderate-High Gradient			2.3.1.3	Small River; Moderate-High Gradient; Low Buffered, Acidic; Warm
2	Small River	2.3	Moderate-High Gradient	2.3.2	Moderately Buffered	2.3.2.1	Small River; Moderate-High Gradient; Moderately Buffered, Neutral; Cold
2	Small River	2.3	Moderate-High Gradient			2.3.2.2	Small River; Moderate-High Gradient; Moderately Buffered, Neutral; Transitional Cool

Formation Class		Formation		Macrogroup		New York Habitat Type	
2	Small River	2.3	Moderate-High Gradient			2.3.2.3	Small River; Moderate-High Gradient; Moderately Buffered, Neutral; Warm
2	Small River	2.3	Moderate-High Gradient	2.3.3	Highly Buffered	2.3.3.2	Small River; Moderate-High Gradient; Highly Buffered, Calcareous; Transitional Cool
2	Small River	2.4	High Gradient	2.4.1	Low Buffered	2.4.1.1	Small River; High Gradient; Low Buffered, Acidic; Cold
2	Small River	2.4	High Gradient			2.4.1.2	Small River; High Gradient; Low Buffered, Acidic; Transitional Cool
2	Small River	2.4	High Gradient			2.4.1.3	Small River; High Gradient; Low Buffered, Acidic; Warm
2	Small River	2.4	High Gradient	2.4.2	Moderately Buffered	2.4.2.1	Small River; High Gradient; Moderately Buffered, Neutral; Cold
2	Small River	2.4	High Gradient			2.4.2.2	Small River; High Gradient; Moderately Buffered, Neutral; Transitional Cool
2	Small River	2.4	High Gradient			2.4.2.3	Small River; High Gradient; Moderately Buffered, Neutral; Warm
2	Small River	2.4	High Gradient	2.4.3	Highly Buffered	2.4.3.2	Small River; High Gradient; Highly Buffered, Calcareous; Transitional Cool
3	Medium River	3.1	Low Gradient	3.1.0	Assume Moderately Buffered	3.1.0.1	Medium River; Low Gradient; Assume Moderately Buffered (Size 3+ rivers); Cold
3	Medium River	3.1	Low Gradient			3.1.0.2	Medium River; Low Gradient; Assume Moderately Buffered (Size 3+ rivers); Transitional Cool

	Formation Class		Formation		Macrogroup		New York Habitat Type
3	Medium River	3.1	Low Gradient			3.1.0.3	Medium River; Low Gradient; Assume Moderately Buffered (Size 3+ rivers); Warm
3	Medium River	3.2	Low-Moderate Gradient	3.2.0	Assume Moderately Buffered	3.2.0.1	Medium River; Low-Moderate Gradient; Assume Moderately Buffered (Size 3+ rivers); Cold
3	Medium River	3.2	Low-Moderate Gradient			3.2.0.2	Medium River; Low-Moderate Gradient; Assume Moderately Buffered (Size 3+ rivers); Transitio
3	Medium River	3.2	Low-Moderate Gradient			3.2.0.3	Medium River; Low-Moderate Gradient; Assume Moderately Buffered (Size 3+ rivers); Warm
3	Medium River	3.3	Moderate-High Gradient	3.3.0	Assume Moderately Buffered	3.3.0.1	Medium River; Moderate-High Gradient; Assume Moderately Buffered (Size 3+ rivers); Cold
3	Medium River	3.3	Moderate-High Gradient			3.3.0.2	Medium River; Moderate-High Gradient; Assume Moderately Buffered (Size 3+ rivers); Transiti
3	Medium River	3.3	Moderate-High Gradient			3.3.0.3	Medium River; Moderate-High Gradient; Assume Moderately Buffered (Size 3+ rivers); Warm
3	Medium River	3.4	High Gradient	3.4.0	Assume Moderately Buffered	3.4.0.1	Medium River; High Gradient; Assume Moderately Buffered (Size 3+ rivers); Cold
3	Medium River	3.4	High Gradient			3.4.0.2	Medium River; High Gradient; Assume Moderately Buffered (Size 3+ rivers); Transitional Cool

	Formation Class		Formation		Macrogroup		New York Habitat Type
3	Medium River	3.4	High Gradient			3.4.0.3	Medium River; High Gradient; Assume Moderately Buffered (Size 3+ rivers); Warm
4	Large/Great River	4.1	Low Gradient	4.1.0	Assume Moderately Buffered	4.1.0.3	Large/Great River; Low Gradient; Assume Moderately Buffered (Size 3+ rivers); Warm
4	Large/Great River	4.2	Low-Moderate Gradient	4.2.0	Assume Moderately Buffered	4.2.0.2	Large/Great River; Low-Moderate Gradient; Assume Moderately Buffered (Size 3+ rivers); Tran
4	Large/Great River	4.2	Low-Moderate Gradient			4.2.0.3	Large/Great River; Low-Moderate Gradient; Assume Moderately Buffered (Size 3+ rivers); Warm
4	Large/Great River	4.3	Moderate - High Gradient	4.3.0	Assume Moderately Buffered	4.3.0.3	Large/Great River; Moderate-High Gradient; Assume Moderately Buffered (Size 3+ rivers); War
4	Large/Great River	4.4	High Gradient	4.4.0	Assume Moderately Buffered	4.4.0.3	Large/Great River; High Gradient; Assume Moderately Buffered (Size 3+ rivers); Warm
5	Marine	5.1	Intertidal	5.1.1	Artificial Structure	5.1.1.1	Bulkheads
5	Marine	5.1	Intertidal			5.1.1.2	Groins
5	Marine	5.1	Intertidal			5.1.1.3	Jetties
5	Marine	5.1	Intertidal	5.1.2.	Aquatic Bed	5.1.2.1	Rooted Algal
5	Marine	5.1	Intertidal			5.1.2.2	Drift Algal
5	Marine	5.1	Intertidal	5.1.3	Benthic Geomorphology	5.1.3.1	Bar
5	Marine	5.1	Intertidal			5.1.3.2	Tidal Flat
5	Marine	5.1	Intertidal			5.1.3.3	Channel
5	Marine	5.1	Intertidal			5.1.3.4	Shellfish Bed
5	Marine	5.1	Intertidal			5.1.3.5	Rocky Intertidal

	Formation Class		Formation		Macrogroup		New York Habitat Type
5	Marine	5.1	Intertidal			5.1.3.6	Bank
5	Marine	5.2	Shallow Sub-tidal	5.2.1	Artificial Structure	5.2.1.1	Bulkheads
5	Marine	5.2	Shallow Sub-tidal			5.2.1.2	Groins
5	Marine	5.2	Shallow Sub-tidal			5.2.1.3	Jetties
5	Marine	5.2	Shallow Sub-tidal			5.2.1.4	Marinas
5	Marine	5.2	Shallow Sub-tidal			5.2.1.5	Reefs
5	Marine	5.2	Shallow Sub-tidal	5.2.2	Aquatic Bed	5.2.2.1	Rooted Vascular
5	Marine	5.2	Shallow Sub-tidal			5.2.2.2	Floating Vascular
5	Marine	5.2	Shallow Sub-tidal			5.2.2.3	Rooted Algal
5	Marine	5.2	Shallow Sub-tidal			5.2.2.4	Drift Algal
5	Marine	5.2	Shallow Sub-tidal	5.2.3	Benthic Geomorphology	5.2.3.1	Bar
5	Marine	5.2	Shallow Sub-tidal			5.2.3.2	Sediment Wave
5	Marine	5.2	Shallow Sub-tidal			5.2.3.3	Channel
5	Marine	5.2	Shallow Sub-tidal			5.2.3.4	Shellfish Bed
5	Marine	5.2	Shallow Sub-tidal			5.2.3.5	Benthic Flat
5	Marine	5.2	Shallow Sub-tidal			5.2.3.6	Bank
5	Marine	5.3	Deep Sub-tidal	5.3.1	Artificial Structure	5.3.1.1	Reefs
5	Marine	5.3	Deep Sub-tidal	5.3.2	Benthic Geomorphology	5.3.2.1	Bar
5	Marine	5.3	Deep Sub-tidal			5.3.2.2	Sediment Wave
5	Marine	5.3	Deep Sub-tidal			5.3.2.3	Channel
5	Marine	5.3	Deep Sub-tidal			5.3.2.4	Benthic Flat
5	Marine	5.3	Deep Sub-tidal			5.3.2.5	Shellfish Bed
5	Marine	5.3	Deep Sub-tidal			5.3.2.6	Bank
5	Marine	5.3	Deep Sub-tidal			5.3.2.7	Pinnacle
5	Marine	5.3	Deep Sub-tidal			5.3.2.8	Mound
6	Estuarine	6.1	Brackish Intertidal	6.1.1	Artificial Structure	6.1.1.1	Bulkheads
6	Estuarine	6.1	Brackish Intertidal			6.1.1.2	Groins
6	Estuarine	6.1	Brackish Intertidal			6.1.1.3	Jetties
6	Estuarine	6.1	Brackish Intertidal			6.1.1.4	Marinas
6	Estuarine	6.1	Brackish Intertidal			6.1.1.5	Docks
6	Estuarine	6.1	Brackish Intertidal	6.1.2	Aquatic Bed	6.1.2.1	Floating Vascular

	Formation Class		Formation		Macrogroup		New York Habitat Type
6	Estuarine	6.1	Brackish Intertidal			6.1.2.2	Rooted Algal
6	Estuarine	6.1	Brackish Intertidal			6.1.2.3	Drift Algal
6	Estuarine	6.1	Brackish Intertidal	6.1.3	Benthic Geomorphology	6.1.3.1	Bar
6	Estuarine	6.1	Brackish Intertidal			6.1.3.2	Tidal Flat
6	Estuarine	6.1	Brackish Intertidal			6.1.3.3	Sediment Wave
6	Estuarine	6.1	Brackish Intertidal			6.1.3.4	Shellfish Bed
6	Estuarine	6.1	Brackish Intertidal			6.1.3.5	Tidal Creek
6	Estuarine	6.1	Brackish Intertidal			6.1.3.6	Bank
6	Estuarine	6.1	Brackish Intertidal			6.1.3.7	Rocky Intertidal
6	Estuarine	6.1	Brackish Intertidal	6.1.4	Tidal Wetland	6.1.4.1	Low Marsh
6	Estuarine	6.1	Brackish Intertidal			6.1.4.2	High Marsh
6	Estuarine	6.1	Brackish Intertidal			6.1.4.3	Formerly Connected
6	Estuarine	6.2	Brackish Shallow	6.2.1	Artificial Structure	6.2.1.1	Bulkheads
6	Estuarine	6.2	Brackish Shallow			6.2.1.2	Groins
6	Estuarine	6.2	Brackish Shallow			6.2.1.3	Jetties
6	Estuarine	6.2	Brackish Shallow			6.2.1.4	Marinas
6	Estuarine	6.2	Brackish Shallow			6.2.1.5	Reefs
6	Estuarine	6.2	Brackish Shallow	6.2.2	Aquatic Bed	6.2.2.1	Rooted Vascular
6	Estuarine	6.2	Brackish Shallow			6.2.2.2	Rooted Algal
6	Estuarine	6.2	Brackish Shallow			6.2.2.3	Drift Algal
6	Estuarine	6.2	Brackish Shallow	6.2.3	Benthic Geomorphology	6.2.3.1	Bar
6	Estuarine	6.2	Brackish Shallow			6.2.3.2	Sediment Wave
6	Estuarine	6.2	Brackish Shallow			6.2.3.3	Channel
6	Estuarine	6.2	Brackish Shallow			6.2.3.4	Shellfish Bed
6	Estuarine	6.2	Brackish Shallow			6.2.3.5	Benthic Flat
6	Estuarine	6.2	Brackish Shallow			6.2.3.6	Bank
6	Estuarine	6.3	Brackish Deep	6.3.1	Artificial Structure	6.3.1.1	Reefs
6	Estuarine	6.3	Brackish Deep	6.3.2	Benthic Geomorphology	6.3.2.1	Bar
6	Estuarine	6.3	Brackish Deep			6.3.2.2	Sediment Wave
6	Estuarine	6.3	Brackish Deep			6.3.2.3	Benthic Flat

	Formation Class		Formation		Macrogroup		New York Habitat Type
6	Estuarine	6.3	Brackish Deep			6.3.2.4	Shellfish Bed
6	Estuarine	6.3	Brackish Deep			6.3.2.5	Bank
6	Estuarine	6.4	Freshwater Intertidal	6.4.1	Artificial Structure	6.4.1.1	Bulkheads
6	Estuarine	6.4	Freshwater Intertidal			6.4.1.2	Groins
6	Estuarine	6.4	Freshwater Intertidal			6.4.1.3	Jetties
6	Estuarine	6.4	Freshwater Intertidal			6.4.1.4	Marinas
6	Estuarine	6.4	Freshwater Intertidal	6.4.2	Aquatic Bed	6.4.2.1	Rooted Vascular
6	Estuarine	6.4	Freshwater Intertidal	6.4.3	Benthic Geomorphology	6.4.3.1	Bar
6	Estuarine	6.4	Freshwater Intertidal			6.4.3.2	Sediment Wave
6	Estuarine	6.4	Freshwater Intertidal			6.4.3.3	Channel
6	Estuarine	6.4	Freshwater Intertidal			6.4.3.4	Tidal Flat
6	Estuarine	6.4	Freshwater Intertidal			6.4.3.5	Tidal Creek
6	Estuarine	6.4	Freshwater Intertidal			6.4.3.6	Bank
6	Estuarine	6.4	Freshwater Intertidal	6.4.4	Tidal Wetland	6.4.4.1	Freshwater Tidal marsh
6	Estuarine	6.4	Freshwater Intertidal			6.4.4.2	Freshwater Tidal Swamp
6	Estuarine	6.5	Freshwater Shallow Sub-tidal	6.5.1	Artificial Structure	6.5.1.1	Bulkheads
6	Estuarine	6.5	Freshwater Shallow Sub-tidal			6.5.1.2	Groins
6	Estuarine	6.5	Freshwater Shallow Sub-tidal			6.5.1.3	Jetties
6	Estuarine	6.5	Freshwater Shallow Sub-tidal			6.5.1.4	Marinas
6	Estuarine	6.5	Freshwater Shallow Sub-tidal	6.5.2	Aquatic Bed	6.5.2.1	Rooted Vascular
6	Estuarine	6.5	Freshwater Shallow Sub-tidal	6.5.3	Benthic Geomorphology	6.5.3.1	Bar
6	Estuarine	6.5	Freshwater Shallow Sub-tidal			6.5.3.2	Sediment Wave
6	Estuarine	6.5	Freshwater Shallow Sub-tidal			6.5.3.3	Channel
6	Estuarine	6.5	Freshwater Shallow Sub-tidal			6.5.3.4	Benthic Flat

	Formation Class		Formation		Macrogroup		New York Habitat Type
6	Estuarine	6.5	Freshwater Shallow Sub-tidal			6.5.3.5	Bank
6	Estuarine	6.6	Freshwater Deep Sub-tidal	6.6.1	Benthic Geomorphology	6.6.1.1	Bar
6	Estuarine	6.6	Freshwater Deep Sub-tidal			6.6.1.2	Sediment Wave
6	Estuarine	6.6	Freshwater Deep Sub-tidal			6.6.1.3	Channel
6	Estuarine	6.6	Freshwater Deep Sub-tidal			6.6.1.4	Benthic Flat
6	Estuarine	6.6	Freshwater Deep Sub-tidal			6.6.1.5	Pinnacle
7	Forest and Woodland	7.1	Northeast Upland Forest	7.1.1	Central Oak-Pine	7.1.1.1	Oak-Pine Forest
7	Forest and Woodland	7.1	Northeast Upland Forest			7.1.1.2	Oak Forest
7	Forest and Woodland	7.1	Northeast Upland Forest			7.1.1.3	Pine Barrens
7	Forest and Woodland	7.1	Northeast Upland Forest			7.1.1.4	Coastal Hardwoods
7	Forest and Woodland	7.1	Northeast Upland Forest			7.1.1.5	Coastal Coniferous Barrens
7	Forest and Woodland	7.1	Northeast Upland Forest	7.1.2	Northern Hardwood and Conifer	7.1.2.1	Mixed Northern Hardwoods
7	Forest and Woodland	7.1	Northeast Upland Forest	7.1.3	Plantation/Pioneer Forest	7.1.3.1	Plantation, Disturbed Land, Pioneer Forest
7	Forest and Woodland	7.1	Northeast Upland Forest	7.1.4	Exotic Upland Forest	7.1.4.1	Non-native Upland Forest
7	Forest and Woodland	7.2	Northeast Wetland Forest	7.2.1	Coastal Plain Swamp	7.2.1.1	Atlantic White Cedar Swamp
7	Forest and Woodland	7.2	Northeast Wetland Forest			7.2.1.2	Coastal Red Maple-Black Gum Swamp
7	Forest and Woodland	7.2	Northeast Wetland Forest	7.2.2	Central Hardwood Swamp	7.2.2.1	Hardwood Swamp

	Formation Class		Formation		Macrogroup		New York Habitat Type
7	Forest and Woodland	7.2	Northeast Wetland Forest	7.2.3	Northeast Floodplain forest	7.2.3.1	Floodplain Forest
7	Forest and Woodland	7.2	Northeast Wetland Forest			7.2.3.2	Riparian
7	Forest and Woodland	7.2	Northeast Wetland Forest	7.2.4	Northern Swamp	7.2.4.1	Conifer Forest Swamp
7	Forest and Woodland	7.2	Northeast Wetland Forest			7.2.4.2	Northern White Cedar Swamp
7	Forest and Woodland	7.2	Northeast Wetland Forest			7.2.4.3	Mixed Hardwood Swamp
7	Forest and Woodland	7.3	Boreal Upland Forest	7.3.1	Boreal Upland Forest	7.3.1.1	Spruce-Fir Forests and Flats
7	Forest and Woodland	7.3	Boreal Upland Forest			7.3.1.2	Mountain Spruce-Fir Forests
7	Forest and Woodland	7.4	Boreal Wetland Forest	7.4.1	Boreal Forested peatland	7.4.1.1	Boreal Forested peatland
8	Shrubland and Grassland	8.1	Shrubland and Grassland	8.1.1	Glade and Savanna	8.1.1.1	Native Barrens and Savanna
8	Shrubland and Grassland	8.1	Shrubland and Grassland	8.1.2	Outcrop and Summit Scrub	8.1.2.1	Rocky Outcrop
8	Shrubland and Grassland	8.1	Shrubland and Grassland	8.1.3	Lake and River Shore	8.1.3.1	Lake and River Beach
8	Shrubland and Grassland	8.1	Shrubland and Grassland	8.1.4	Disturbed land/Pioneer	8.1.4.1	Non-native Shrublands
8	Shrubland and Grassland	8.1	Shrubland and Grassland			8.1.4.2	Powerline
8	Shrubland and Grassland	8.1	Shrubland and Grassland			8.1.4.3	Old Field/Managed Grasslands
8	Shrubland and Grassland	8.2	Coastal Scrub-Herb	8.2.1	Coastal Grassland/Shrubland	8.2.1.1	Great Lakes Dune and Swale
8	Shrubland and Grassland	8.2	Coastal Scrub-Herb			8.2.1.2	Maritime Dunes
8	Shrubland and Grassland	8.3	Peatland	8.3.1	Northern Peatland	8.3.1.1	Open Acidic Peatlands
8	Shrubland and Grassland	8.3	Peatland	8.3.2	Central Appalachian/Coastal Peatland	8.3.2.1	Open Alkaline Peatlands

	Formation Class		Formation		Macrogroup		New York Habitat Type
8	Shrubland and Grassland	8.4	Freshwater Marsh	8.4.1	Coastal Plain Pond	8.4.1.1	Coastal Plain Pond
8	Shrubland and Grassland	8.4	Freshwater Marsh	8.4.2	Emergent Marsh	8.4.2.1	Freshwater Marsh
8	Shrubland and Grassland	8.4	Freshwater Marsh			8.4.2.2	Great Lakes Freshwater Estuary Marsh
8	Shrubland and Grassland	8.4	Freshwater Marsh	8.4.3	Wet Meadow/Shrub Marsh	8.4.3.1	Wet Meadow/Shrub Marsh
8	Shrubland and Grassland	8.4	Freshwater Marsh	8.4.4	Modified/Managed marsh	8.4.4.1	Modified/Managed marsh
9	Alpine	9.1	Alpine	9.1.1	Alpine	9.1.1.1	Alpine
9	Alpine	9.1	Alpine			9.1.1.2	Subalpine Woodland and Shrub
10	Sparsely Vegetated Rock	10.1	Cliff and Rock	10.1.1	Cliff and Talus	10.1.1.1	Cliff and Talus
10	Sparsely Vegetated Rock	10.1	Cliff and Rock			10.1.1.2	Erosional Bluff
11	Agricultural	11.1	Agricultural	11.1.1	Agricultural	11.1.1.1	Cultivated Crops
11	Agricultural	11.1	Agricultural			11.1.1.2	Pasture/Hay
12	Developed	12.1	Developed	12.1.1	Maintained Grasses and Mixed Cover	12.1.1.1	Urban and Recreational Grasses
12	Developed	12.1	Developed	12.1.2	Urban/Suburban	12.1.2.1	Commercial/Industrial and Residential
12	Developed	12.1	Developed			12.1.2.2	Residential Rural
12	Developed	12.1	Developed	12.2.1	Subterranean	12.1.3.1	Caves and Tunnels
12	Developed	12.1	Developed	12.2.2	Extractive	12.2.2.1	Surface Mining
						13	Marine Dredge Spoil Shore
						14	Marine Intertidal Gravel/Sand Beach
						15	Vernal Pool
						16	Ditch/Artificial Intermittent Stream
						17	Great Lakes Aquatic Bed

	Formation Class		Formation		Macrogroup	New York Habitat Type
20	Lake	20.1	Pond	20.1.1	Oligotrophic	
20	Lake	20.1	Pond	20.1.2	Mesotrophic	
20	Lake	20.1	Pond	20.1.3	Eutrophic	
20	Lake	20.2	Small Lake	20.2.1	Oligotrophic	
20	Lake	20.2	Small Lake	20.2.2	Mesotrophic	
20	Lake	20.2	Small Lake	20.2.3	Eutrophic	
20	Lake	20.3	Medium Lake	20.3.1	Oligotrophic	
20	Lake	20.3	Medium Lake	20.3.2	Mesotrophic	
20	Lake	20.3	Medium Lake	20.3.3	Eutrophic	
20	Lake	20.4	Large Lake	20.4.1	Oligotrophic	
20	Lake	20.4	Large Lake	20.4.2	Mesotrophic	
20	Lake	20.4	Large Lake	20.4.3	Eutrophic	
20	Lake	20.5	Very Large Lake	20.5.1	Oligotrophic	
20	Lake	20.5	Very Large Lake	20.5.2	Mesotrophic	
20	Lake	20.5	Very Large Lake	20.5.3	Eutrophic	
20	Lake	20.6	Reservoir			

Appendix B

Northeast Index of Ecological Integrity, 2010

From http://nalcc.databasin.org/datasets/b4eb1d4210d04026b6798e559f6e72ca

This dataset depicts the ecological integrity of locations (represented by 30 m grid cells) throughout the northeastern United States based on environmental conditions existing in approximately 2010. Ecological integrity is defined as the ability of an area (e.g., local site or landscape) to sustain important ecological functions over the long term. In particular, the functions include the long-term ability to support biodiversity and the ecosystem processes necessary to sustain biodiversity.

The Index of Ecological Integrity (IEI) is expressed on a relative scale (0 to 100) for ecological systems mapped on a modified version of the Northeast Terrestrial Habitat Map developed by the Nature Conservancy and the northeastern states. Ecological systems are recurring groups of biological communities found in similar environments at scales from tens to thousands of acres and typically persisting for 50 or more years. Examples of the more than 100 mapped systems include “Acadian-Appalachian Montane Spruce-Fir Forest” and “Northern Atlantic Coastal Plain Tidal Salt Marsh.”

For purposes of calculating the index, related or similar ecological systems were grouped into about 25 macro-ecological systems such as “Northern Hardwood and Conifer” and “Emergent Marsh.” This version of ecological integrity includes two categories of landscape metrics:

• Intactness – the freedom from human impairment (anthropogenic stressors), measured as a combination of a number of stressor metrics.

• Resiliency – the capacity to recover from disturbance and stress, measured as a combination of the connectedness and similarity to neighboring natural areas.

This ecological integrity dataset is one of a larger set of results developed by the Designing Sustainable Landscapes project led by Professor Kevin McGarigal of UMass Amherst (McGarigal 2014). Projected future ecological integrity for 2030 and 2080 are also being developed based on models of development (urban growth), climate change, and forest change. More information and detailed documentation for the Designing Sustainable Landscapes project, which includes many additional datasets, is available at: http://www.umass.edu/landeco/research/dsl/dsl.html.

More details about the calculation of the Index of Ecological Integrity are as follows. The basic building blocks of the index are a series of Ecological Settings, each of which is a spatial dataset encompassing the Northeastern U.S. The ecological settings represent a broad but carefully selected suite of biophysical variables representing the natural and anthropogenic environment at each location for each time step used in the Designing Sustainable Landscapes project. Each ecological setting is available as a separate spatial dataset. One of the key components is the Northeast Ecological Systems dataset, which is a modified version of the Northeast Terrestrial Wildlife Habitat Map developed by The Nature Conservancy and the northeastern states. Other settings include variables such as temperature, soil depth, above-ground live biomass, extent of development, and traffic rate. A series of metrics, such as the intensity of urban development and the degree to which ecosystems are connected, are calculated from these ecological settings. The metrics are integrated in weighted linear combinations to calculate IEI based on the opinions of expert teams as to the importance of each metric in determining the ecological integrity of the different ecosystem types. In the final IEI, results are re-scaled by ecosystem type to make comparisons more meaningful. For example, marshes are ranked relative to other marshes rather than in comparison to forests or other ecosystem types. Hence, IEI represents a cell's percentile within its group, e.g., a cell of emergent marsh with an IEI of 80 is in the top 20% of marshes.

The specific metrics for IEI, each of which is available as a separate dataset, are the following:

Intactness Metrics

1) Habitat loss – the intensity of habitat loss due to development in the neighborhood of each cell

2) Watershed habitat loss (aquatic metric) – the intensity of habitat loss due to development upstream of the cell

3) Road traffic – the intensity of traffic in the neighborhood of the cell

4) Mowing and plowing – the intensity of agriculture in the vicinity of the cell, reflecting mortality to organisms from mowing and plowing

5) Edge effects – the effects of human-induced edges on ecosystems

6) Watershed road salt (aquatic metric) – the density of upstream roads, a surrogate for road salt application rates

7) Watershed road sediment (aquatic metric) – the density of upstream roads, a surrogate for road sediment production rates

8) Nutrient enrichment (aquatic metric) – the intensity of residential and agricultural land uses upstream of each cell a surrogate for fertilizer application rates

9) Watershed imperviousness (aquatic metric) – the intensity of impervious surface (such as roads and buildings) upstream of the cell

10) Dams (aquatic metric) – the number and proximity of dams upstream of the cell

11) Biotic alterations – the intensity of development in the neighborhood of the cell, calculated separately as a surrogate for four effects: a) edge predators (such as raccoons and skunks), b) domestic predators (such as cats), c) invasive earthworms, and d) invasive plants

Resiliency Metrics

1) Connectedness – the degree to which development and ecologically dissimilar sites interfere with connections between the cell and ecologically similar neighbors

2) Aquatic connectedness – the degree to which connections along streams and rivers are diminished by barriers such as dams and culverts

3) Similarity – the similarity (lack of contrast) between the environment of a cell and its surroundings (with higher similarity implying greater resilience)

Appendix C

New York Natural Heritage Program. October 2013. Landscape Condition Assessment (LCA2) for New York. Albany, NY.

In the context of developing protocols to assess wetland condition in New York, the New York Natural Heritage Program developed a Landscape Condition Assessment model (Comer and Hak 2012, Grunau *et al.* 2012) to cumulatively depict a suite of anthropogenic stressors across the landscape of the state. The model synthesizes these stressors at the 30 m x 30 m pixel scale – each pixel has a score representing cumulative stress – and, while it was developed to support a wetland project, it can be more broadly applied to answer questions about landscape or site-specific stress. The effectiveness of the model for estimating wetland quality is being evaluated with field work at two levels of sampling intensity.

We began with a set of GIS feature classes (input themes) with consistent statewide coverage representing elements that were expected to negatively affect wetland community composition, physical structure, and function. The first version of the model (LCA1), reported in Feldmann *et al.* (2012), included 12 inputs (Table 1, below): five transportation themes depicting roads of increasing size and impact, three development themes that increase in intensity, two types of utility corridor, and two managed open space themes (pasture and open space). Our second version (LCA2) included 13 inputs (Table 2, below); we added active rail lines to our set of transportation themes and replaced the pasture theme with a comprehensive agricultural (cropland) layer.

Following both Comer and Hak (2012) and Grunau *et al.* (2012), we incorporated the assumption that ecological effects of all input themes would decrease to zero within 2000 m of their mapped footprint. To begin our raster analysis, we prepared the input layers by creating this 2000 m 'calculation space' around them using the Euclidean distance tool in ArcGIS. Each input theme was thus converted into a raster with a 30 m x 30 m grid size extending to a distance of 2000 m from the theme's footprint. Cell values were equal to the distance value (i.e., x = 0 at the impact site).

Methodology for the LCA1 model adhered strictly to Comer and Hak's (2012) approach, using a linear decay function (Equation 1) to depict the decreasing ecological effects of the input themes. We first assigned impact scores, ranging from 0.0 to 1.0, to each input theme based on their presumed relative onsite influence, with the highest stress inputs receiving scores closer to zero. Inputs were also assigned a decay distance, the distance at which they no longer produce ecological effects. Our variable weights and decay distances were, for the most part, identical to Comer and Hak's (2012, Table 1).

Table 1. Input themes, impact scores, and decay distances for LCA1, 2012.

Input theme	**Presumed relative stress**	**Impact score**	**Impact decays to zero (m)**
Transportation			
Vehicle trails, 4-wheel drive	Low	0.7	200
Local, neighborhood, rural roads	Medium	0.5	200
Secondary, connecting, special roads	High	0.2	500
Primary highways, limited access	Very High	0.05	1000
Primary highways, w/o limited access	Very High	0.05	2000
Urban and Industrial Development			
Low intensity development	Medium	0.6	200
Medium intensity development	Medium	0.5	200
High intensity development	Very High	0.05	2000
Utility Corridors			
Electric transmission corridor	Medium	0.5	100
Natural Gas corridor	Medium	0.5	100
Land Use-Land Cover			
Pasture	Very Low	0.9	0
Open spaces	Medium	0.5	200

Stressor values for pixels in each layer were calculated as follows:

$$val = \left(\frac{x}{ddist} * (1 - imp)\right) + imp \quad [1]$$

where *x* is the Euclidian distance value, *ddist* is the decay distance, and *imp* is the impact score.

After the linear function was calculated for each input and stored as a stack of values, the final score for each cell was set as the minimum of all values, or the highest stress for that location. Statewide, pixel scores ranged from 0.05 in the most ‘stressed’ locations to 1.0 in areas with no ecological stress. Using Jenks natural breaks classification (Jenks 1967), these statewide scores were binned into categories to represent levels of stress, from low (including none) to high (Figure 1).

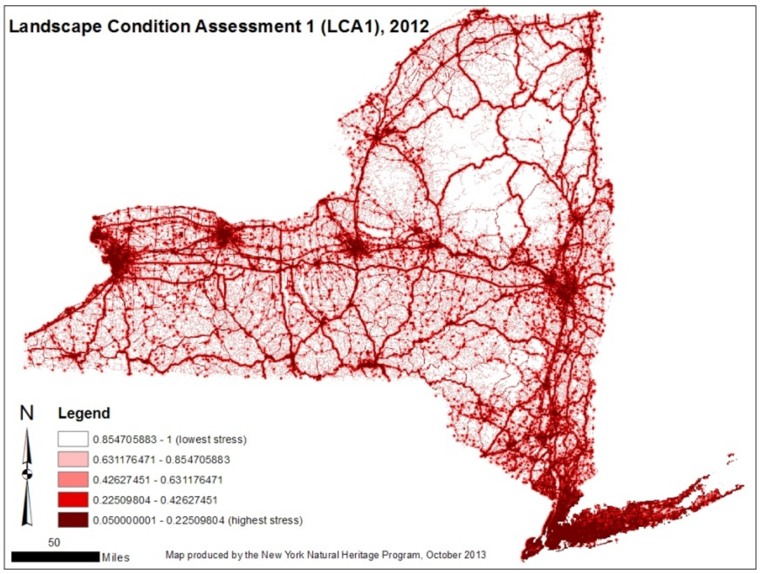

Figure 1. Statewide Landscape Condition Assessment model, version 1 (LCA1).

For our LCA2 model, we modified the decay functions from linear to sigmoidal (s-shaped), following Grunau *et al.* (2012) to better represent "effects that remain strong near the source for some distance before decreasing." We assigned each of our 13 themes (Table 2) to one of six sigmoid decay curves, each tailored to model a different degree of threat attenuation, from gradual to abrupt (Figure 2).

Table 2. Input themes, function types, variable values, and decay distances for LCA2, 2013.

Input theme	**Distance decay function type**	**a**	**b**	**c**	**w**	**Decay distance**
Transportation						
Vehicle trails, 4-wheel drive	y1 (most abrupt)	0.25	20	100	100	50*
Local, neighborhood, rural roads	y3	1	5	100	300	200
Secondary, connecting, special roads	y4	2.5	2	100	500	500
Primary highways, limited access	y5	5	1	100	500	1000
Primary highways, w/o limited access	y5	5	1	100	500	1000*
Active rail lines***	y2	0.5	10	100	500	100
Urban and Industrial Development						
High intensity development	y6 (most gradual)	10	0.5	100	500	2000
Medium intensity development	y4	2.5	2	100	400	300**
Low intensity development	y4	2.5	2	100	300	300**
Utility Corridors						
Electric transmission corridor	y2	0.5	10	100	300	100
Natural Gas corridor	y2	0.5	10	100	300	100
Land Use-Land Cover						
Cropland***	y3	1	5	100	300	200
Open spaces	y3	1	5	100	300	200

* Decay distance decreased for this input theme from LCA1 to LCA2
** Decay distance increased for this input theme from LCA1 to LCA2
*** New input theme for LCA2

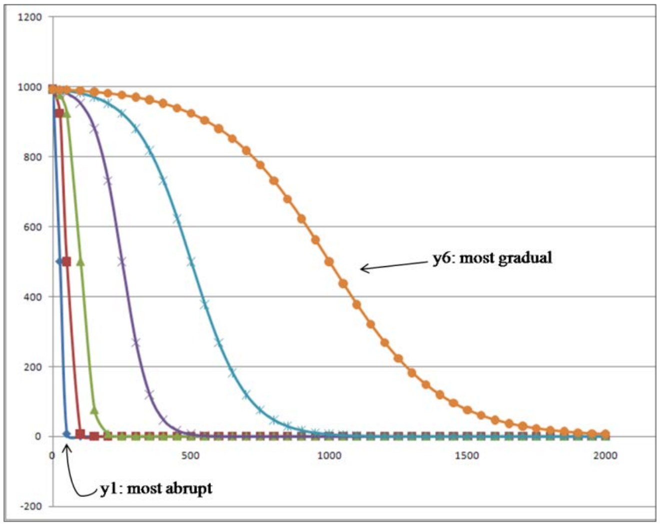

Figure 2. Sigmoid decay curves used to model the attenuation of ecological effects away from the footprint of a stressor. For stressors modeled with the y1 curve, impacts dropped off rapidly

with distance (e.g., unpaved trails); stressors associated with the y6 curve had impacts that were assumed to persist further from the footprint (e.g., high intensity urban development).

The shape of the curves was primarily defined by two variables, one (*a*) that shifts the inflection point away from center (higher *a* value implies an impact that remains high moving away from the footprint), and a second (*b*) that determines the slope of the decreasing part of the curve. A constant (*c*) was included that set the function's distance of interest to 2000 m (Equation 2), as shown below:

$$c = \frac{dist}{20} \qquad [2]$$

where *dist* is the total distance of interest, in this case equal to 2000 m.

We assigned a weight (*w*) to each stressor, from 100 to 500, which was set as its maximum value in the impact footprint. We also set a decay distance, a distance at which the stressor no longer had any effect, for the inputs, guided by Grunau *et al.* (2012), Comer and Hak (2012), and additional literature review (van der Zande et al. 1980, Forman and Deblinger 2000, Forman 2000, McDonald et al. 2009, Parris and Schneider 2009, Benítez-López et al. 2010, McLachlan et al. 2013). Some 2012 decay distances were modified in this process. In most cases, this decay distance marked a natural asymptotic approach to zero, but we did opt to set decay distances that were further up the curves in two cases (medium and low intensity development). We thought the gradual attenuation was a likely depiction of the stressors' impacts, and adopted the early cutoff from McDonald *et al.*'s (2009) data on invasive species. For this version of the model, we treated the new cropland input fairly conservatively because of limited relevant scientific data on landscape-level ecological effects of various agricultural practices (Davis et al. 1993, Carpenter et al. 1998, de Jong et al. 2008). More extensive literature review could uncover justification for splitting agriculture into levels of intensity and modeling each separately, as has been done here for development.

We prepared our new set of 13 input themes as we had for LCA1, creating a 2000 m Euclidean distance 'calculation space' around each. Decay distances for each theme were then implemented by assigning null values to cells that exceeded them, essentially shrinking the 'calculation space.' Stressor values for remaining pixels in each layer were calculated as follows:

$$val = \frac{1}{1 + \exp\left(\left(\frac{x}{c} - a\right) * b\right)} * w \qquad [3]$$

where *x* is the Euclidean distance value, *a* shifts the curve away from center, *b* determines slope of the decreasing part of the curve, *c* is a constant reflecting the total distance of interest, and *w* is the stressor's weight.

We next stacked the calculated rasters, replaced null values with zeros, and, following Grunau *et al.* (2012), we summed their scores to produce a "single…layer representing the cumulative impact to an area from the included land uses." As for the LCA1, using Jenks natural breaks classification (Jenks 1967), these statewide scores were binned into meaningful categories to represent levels of stress, from low (including none) to high (Figure 3).

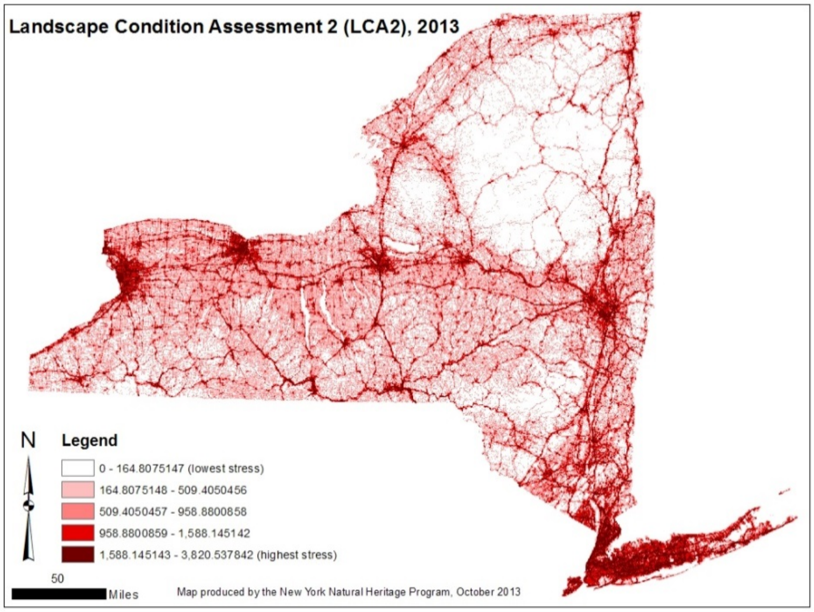

Figure 3. Statewide Landscape Condition Assessment model, version 2 (LCA2).

Notable improvements, LCA1 to LCA2:

1. Addition of agricultural lands, significantly improving stressor assessments in central and western New York.
2. Adoption of sigmoid decay curves, likely producing a more realistic depiction of stressor attenuation (Figure 4).
3. Summing the stressor impact scores to show cumulative stress.

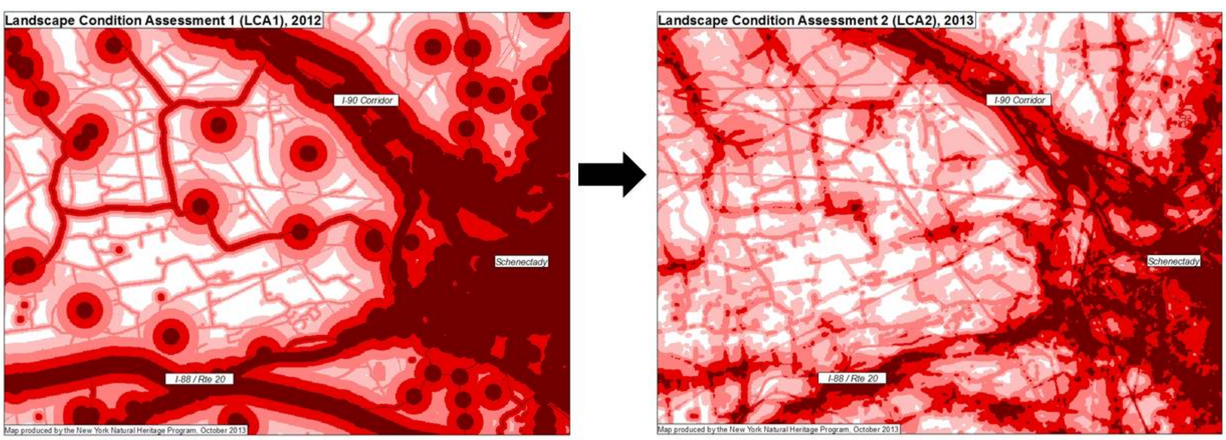

Figure 4. Depiction of landscape stress west of Schenectady, New York from the LCA1 model (left) and the LCA2 model. Sigmoid modeling of stressor reduction and cumulative (instead of maximum) stressor scoring produces a more natural, less stylized stress assessment.

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Literature Cited

Anderson, M. G., M. Clark, C. Ferree, A. Jospe, and A. Olivero Sheldon. 2013. Condition of the Northeast terrestrial and aquatic habitats: a geospatial analysis and tool set. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office, Boston, MA.

Association of Fish and Wildlife Agencies. 2012. Best practices for State Wildlife Action Plans: Voluntary guidance to States for revision and implementation. Association of Fish and Willdife Agencies, Washington D.C.

Bailey, R. 1997, July 10. Map: Ecoregions of North America. UDSA Forest Service in cooperation with The Nature Conservancy and the U. S. Geological Survey, Washington, DC.

Benítez-López, A., R. Alkemade, and P. A. Verweij. 2010. The impacts of roads and other infrastructure on mammal and bird populations: A meta-analysis. Biological Conservation 143:1307–1316.

Carpenter, S. R., N. F. Caraco, D. L. Correll, R. W. Howarth, A. N. Sharpley, and V. H. Smith. 1998. Nonpoint pollution of surface waters with phosphorus and nitrogen. Ecological Applications 8:559–568.

Comer, P. J., and J. Hak. 2012. Landscape Condition in the Conterminous United States. Spatial Model Summary. NatureServe, Boulder, CO.

Davis, B. N. K., K. H. Lakhani, T. J. Yates, A. J. Frost, and R. A. Plant. 1993. Insecticide drift from ground-based, hydraulic spraying of peas and brussels sprouts: bioassays for determining buffer zones. Agriculture, Ecosystems and Environment 43:93–108.

Dobson, J., E. Bright, R. Ferguson, D. Field, L. Wood, K. Haddad, H. Iredale III, J. Jensen, V. Klemas, and R. Orth. 1995. NOAA coastal change analysis program (C-CAP): guidance for regional implementation. NOAA Technical Report 123.

Feldmann, A. L., T. G. Howard, and E. A. Spencer. 2012. Pilot wetland condition assessment of palustrine emergent marsh in the Upper Hudson River watershed. A report prepared for the NYSDEC Division of Water by the New York Natural Heritage Program. Albany, NY.

Ferree, C. E., and M. G. Anderson. 2013. A map of terrestrial habitats of the northeastern United States: Methods and approach. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office, Boston, MA.

Forman, R. T. T. 2000. Estimate of the area affected ecologically by the road system in the United States. Conservation Biology 14:31–35.

Forman, R. T. T., and R. D. Deblinger. 2000. The ecological road-effect zone of a Massachusetts (U.S.A.) suburban highway. Conservation Biology 14:36–46.

Gawler, S. C. 2008. Northeastern Terrestrial Wildlife Habitat Classification. Page 102. Report to the Virginia Department of Game and Inland Fisheries on behalf of the Northeast Association of Fish and Wildlife Agencies and the National Fish and Wildlife Foundation, NatureServe, Boston, Massachusetts.

Grunau, L., M. Fink, K. Decker, D. G. Anderson, E. Carlson, G. Smith, C. Keske, J. Goldstein, and J. Lemly. 2012. SHRP 2 C21A: Pilot test the ecological approaches to environmental protection developed in capacity research projects C06A and C06B. Page 271. Colorado State University, Fort Collins, CO.

Jenks, G. F. 1967. The Data Model Concept in Statistical Mapping. International Yearbook of Cartography 7:186–190.

De Jong, F. M. W., G. R. de Snoo, and J. C. van de Zande. 2008. Estimated nationwide effects of pesticide spray on terrestrial habitats in the Netherlands. Journal of Environmental Management 86:721–730.

McDonald, R. I., R. T. T. Forman, P. Kareiva, R. A. Neugarten, D. Salzer, and J. Fisher. 2009. Urban effects, distance, and protected areas in an urbanizing world. Landscape and 93:63–75.

McGarigal, K. 2014. Designing sustainable landscapes project component: Integrity. University of Massachusetts, Amherst, MA.

McLachlan, M. M., A. Daniels, and A. M. Bartuszevige. 2013. User’s manual: playa lakes decision support system. Playa Lakes Joint Venture, Lafayette, CO, USA.
New York Natural Heritage Program. 2015. Element occurrence database. Albany, NY.
Olivero, A. P., and M. G. Anderson. 2008. Northeast aquatic habitat classification. The Nature Conservancy Eastern Resource Office, Boston, MA.
Olivero-Sheldon, A., A. Jospe, and M. G. Anderson. 2014. Northeast lake and pond classification system. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office, Boston, MA.
Parris, K. M., and A. Schneider. 2009. Impacts of traffic noise and traffic volume on birds of roadside habitats. Ecology and Society 14.
White, E. L., J. J. Schmid, T. G. Howard, M. D. Schlesinger, and A. L. Feldmann. 2011. New York State Freshwater Conservation Blueprint Project, Phases I and II: Freshwater Systems, Species, and Viability Metrics. Page 85. The New York Natural Heritage Program, Albany, NY.
Van der Zande, A. N., W. J. ter Keurs, and W. J. van der Weijden. 1980. The impact of roads on the densities of four bird species in an open field habitat--evidence of a long-distance effect. Biological Conservation 18:299–321.