Designing Sustainable Landscapes in the Northeast

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> North Atlantic LCC





Designing Sustainable Landscapes Project

CAD Model

The Designing Sustainable Landscapes (DSL) project has three goals:

Landscape climate change • <u>Change</u>: predict potential changes urban growth disturbance • Assessment: assess impact on ecosystem integrity and species distributions Design: use results to provide guidance for strategic habitat conservation

GIS layers including a broad but <u>parsimonious</u> suite of <u>biophysical variables</u> representing the natural and anthropogenic environment at each location at each timestep

- Ecological dissimilarity/resistance in ecological integrity metrics
- Species distribution modeling
- Resolution: 30 m
- Spatial extent: Northeast Region
- Temporal extent: 2010 2080





Abiotic (16)

- Temperature:
 - Min winter temperature
 - Growing season degree days
 - Heat index (>35° C)
- Solar energy:
 - Incident solar radiation
- Moisture & hydrology:
 - Topographic wetness
 - Flow volume
 - Flow gradient
 - Stream temperature
 - Salinity

- Chemical & physical substrate:
 - CaCO3 content
 - Soil available water supply
 - Soil depth
 - Soil pH
 - Substrate mobility
- Physical disturbance:
 - Slope
 - Wind exposure

Vegetation (2)

- Potential dominant life form
- Above-ground live biomass

Ancillary

- Land cover
- Elevation
- Roads
- High resolution streams
- Flow accumulation

Anthropogenic (6)

- Gibbs traffic rate
- Developed
- Hard development
- Imperviousness
- Terrestrial barriers
- Aquatic barriers

Pending (3)

- Tidal restrictions
- Salt marsh ditching
- Hardened structures

Designing Sustainable Landscapes Project Land cover

"Ecological systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding" (Natureserve)

- Source: NE Terrestrial Wildlife Habitat Classification (TNC)
- Hierarchical
 - 18 formations
 - 60 macrogroups
 - 138 groups
 - 197 systems



Salt marsh

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Land cover

Modifications to TNC's Northeast Terrestrial Habitat Map Roads

- Roads confounded with other types of development
- Misaligned and incomplete

Modification

 Replaced with Open Street Map roads original modified and trains (total = 8 classes)





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Modifications to TNC's Northeast Terrestrial Habitat Map

- Development/agriculture
- Single developed and agriculture classes

Modifications

- Replaced developed and agriculture classes with seven classes from NLCD 2011
- Added road-stream crossings and dams (TNC)



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Land cover

Modifications to TNC's Northeast Terrestrial Habitat Map Open water and tidal wetlands

- Single open water class
- Few tidal classes

Modifications

 Replaced with NHD and NWI lentic, NHD high resolution streams and salt marsh channels, and recently updated NWI tidal riverine, estuarine and marine (total = 39 classes)



- Elevation
 - Source: 2009 1/3 arcsecond (~ 10 m) NED
 - Reduced resolution to 30 m using methods that minimize artifacts
 - Best available for entire Northeast Region

Landscape Change Ecological Settings

- Salinity
 - Source: NWI
 - Estuarine and marine salinity modifiers converted to three classes: low, moderate, and high salinity
 - Oligohaline not comprehensive



Landscape Change Ecological Settings

- Aquatic barriers
 - Sources: TNC dams,
 OSM roads, NHD high
 resolution streams,
 gradient, NED, flow
 accumulation
 - Assigned passability scores: the degree to which culverts and dams may physically impede movement of aquatic organisms and sediment transport



Landscape Change Ecological Settings

- Gibbs traffic rate
 - Sources: TrafficMetrix, MADOT
 - Modeled average number of vehicles per day on roads and railways
 - Transformed into probability of road-crossing mortality
 (Gibbs and Shriver 2002).



For More Information

Project website:

www.umass.edu/landeco/research/dsl/dsl.html



Links to: •Overview •Metadata •Technical docs •Presentations •Products