Mapping Historic Open Canopy Habitat using USGS Surface Soil Data

Emma Flatland, Professor Corbin
Union College

Introduction

Though forested habitats dominate much of New York State and the northeastern region, open habitat including barrens, shrublands, grasslands, and dune ecosystems are important habitats for rare and endangered species. While once prevalent across New York State, today this habitat is rare (Boyle and Kurczewski, 2000). Open canopy habitat should receive high conservation priority due to the extensive range of species it supports (Swanson et al. 2010). To understand the progression of habitat loss, and to better direct restoration efforts, estimates of the historic extent of open canopy habitat are useful. However, few reliable estimates exist.

Soils supporting open canopy habitat have distinctive futures that can be identified using maps. Open canopy habitat can be located on sandy and gravel sediments deposited by water in the form of outwash plains and terraces, kames and eskers (Howard et al. 2011). **This study will therefore map an approximation of historic open canopy habitat in New York State based on present day surficial geology and methodology of the Massachusetts Division of Fisheries and Wildlife.**

Methods

We used ArcMap, a geographic information system (GIS) application, to create a habitat model that estimates the historic extent of open canopy habitat.

A map of specific soil types that form the deep soil profiles where open canopy habitat can be found was created with surficial geology data from the United States Geologic Survey. These soil types include kame deposits, dunes, fluvial sand, fluvial gravel, and outwash sand and gravel. We also mapped land cover throughout New York State, including needleleaf forest, broadleaf deciduous forest, grassland, shrubland, and barren land. Grassland, shrubland and barren lands are open canopy, broadleaf deciduous forest is primarily closed canopy, and needleleaf forest can be a mixture of open and closed canopy.

The soil map only included federally and state protected land from the Protected Areas Database. We focused our model on protected areas because they prioritize preservation of biological diversity and are open to the public. This should make it easier to conduct site visits of identified land and propose implementation of open canopy habitat restoration to land owners, further down the road.

The land cover map and the soil map were projected to the North American Datum 1983 Universal Transverse Mercator Zone 18N coordinate system. We used a tool in ArcMap called 'Extract by Mask' to produce a map containing only areas of overlap between the land cover map and the soil map. A tool called 'Zonal Geometry by Table' calculated the areas of each land cover type of the resulting map. The 'Region Group' tool grouped pixels of the map into regions based on connectivity; Pixels directly left, right, above and below one another were grouped together.

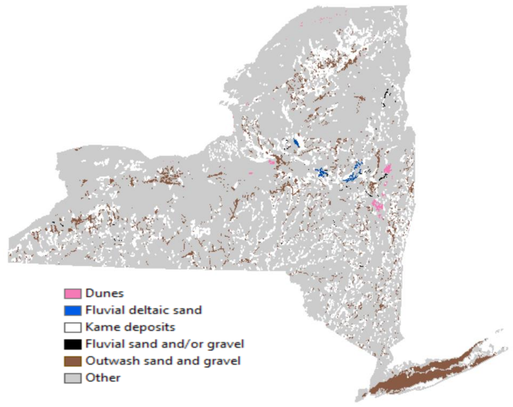


Figure 1. All sandy soils throughout New York State, by soil type.

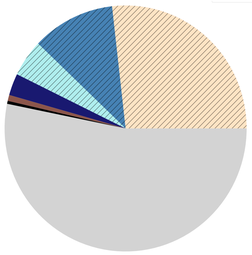
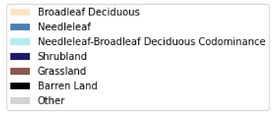


Figure 2. Sandy soil distribution by type of land cover. Hash marks indicate land cover types that may be closed canopy.



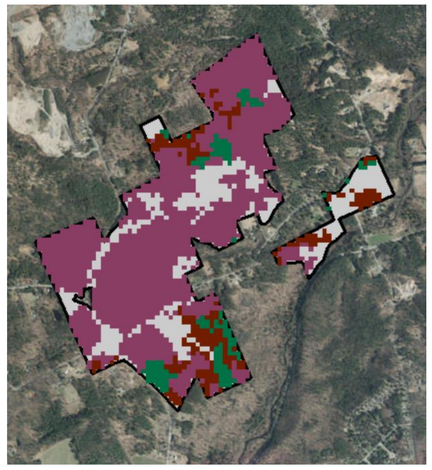
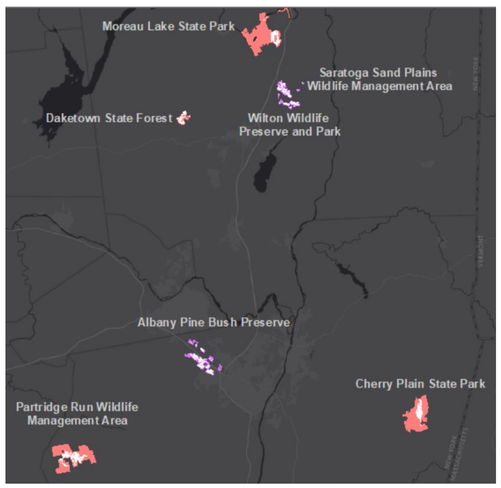


Figure 3. The result of Extract by Mask for Daketown State Forest.

Temperate needleleaf forest on sandy soil
Temperate broadleaf deciduous forest on sandy soil
Broadleaf-needleleaf codominance on sandy soil
Other land cover and soil type

Table 1. Area of major land cover types in New York State including the area protected in state or local parkland. The percentages indicate the portion of total area on sandy soils that is protected for each land cover type.

Land Cover Type	Total Area on sandy soils (ha)	Protected Area on sandy soils (ha)
Broadleaf Deciduous	395,208	68,771 (17.4%)
Needleleaf	163,506	45,058 (27.6%)
Needleleaf-Broadleaf Deciduous Codominance	71,824	12,458 (17.4%)
Shrubland	42,348	3,996 (9.4%)
Grassland	11,482	654 (5.7%)
Barren Land	5,852	920 (15.7%)
Other	785,037	51,279 (6.5%)
Total	1,475,259	183,136 (12.4%)



No known pine barrens
Known pine barrens
Areas with specified soil and land cover

Figure 4. Extent of protected areas are shown in red and pink. Extent of protected areas supporting pine barrens, a type of open canopy habitat, are pink. Extent of protected areas that do not support pine barrens are red. The result of the extract by mask is shown in white. This is land with sandy soil and at least one of the six specified land covers located within each protected area.

Results

Sandy soils are widespread throughout New York State, accounting for 1.5 million hectares, or 12% of the state's area (Figure 1). Only about 12% of these 1.5 million hectares are protected (Table 1). Furthermore, only about 4% of these 1.5 million hectares is either shrubland, grassland or barren land while approximately a quarter is broadleaf deciduous (Figure 2). Daketown State Forest is located on protected, sandy soil (Figure 3). The state park is primarily needleleaf forest, in addition to some scattered clusters of broadleaf deciduous and needleleaf-broadleaf deciduous codominance (Figure 3). Cherry Plain State Park, the Partridge Run Wildlife Management Area and Moreau State Park also have areas of sandy soil and landcover that could potentially be restored to open canopy habitat. These protected locations are in the vicinity of existing open canopy ecosystems, including Saratoga Sand Plains Wildlife Management Area, the Wilton Wildlife Preserve and Park, and the Albany Pine Bush Preserve (Figure 4).

Discussion

Our study confirms that sandy soils are widespread across New York. It is likely that most, if not all, xeric, sandy soils located in this study supported open canopy habitat at some point in history. The wide spread nature of these soils, and the small area of open canopy habitat currently located on these soils, suggests that there are large areas of land where future restoration efforts could focus to increase the area of present-day open canopy habitat and protect the vast number of species this habitat hosts.

Sites close to existing open habitat such as the Pine Bush, Saratoga Sand Plains Wildlife Management Area, and the Wilton Wildlife Preserve, are likely the most feasible to target for restoration. The prevalence of broadleaf deciduous and needleleaf forest at Daketown State Forest indicates the forest may contains areas of closed canopy, and is thus a potential candidate for restoration to open canopy habitat. The same is also possible for Cherry Plain State Park, Moreau State Park, and the Partridge Run Wildlife Management Area.

These land areas exist not only in the vicinity of but across New York State. Restoring open canopy habitat at these locations would increase habitat available to support and preserve high levels of biodiversity.

Acknowledgements

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