Outline of NWR

Elise Boos

Katie Warnell

**Introduction**

To further show how Natural Capital Accounting (NCA) data can be re-aggregated to different areas of interest to support management efforts, we built on the methods from Warnell et al. 2020 to illustrate how NCA data can be applied to National Wildlife Refuges (NWR), specifically a case study on those within North Carolina.

North Carolina has 11 NWR and 1 NWR located on the along the border of North Carolina and Virginia. Almost all NWR within North Carolina and the overlapping NWR with Virginia were considered in the analysis and total an area of 786,815 acres. Mountain Bogs National Wildlife Refuge was not included in the analysis as it was missing from the boundary layer used to summarize the data.

Map

Description automatically generated

**Key Insights**

*Changes over time*

* Ecosystem Services
  + From 2001-2016 the area of water purifying land remained consistent and then from 2016-2019 there was a 2000 acre increase in the amount of water purifying land in the refuges.
  + The area of pollinator dependent crops within the refuges has been steadily declining over time while in contrast there has been a 15% increase in pollinator habitat from 2011 to 2019. This indicates that more crops are being grown surrounding the refuges that are in need of pollinator services.
  + There has been an increase in birding days being done within the refuges over time with majority of observations being done within wetland area.

Chart

Description automatically generated

*Figure 1.* Pollinator habitat within North Carolina National Wildlife Refuges over time.

* Land Cover
  + When comparing from 2001 to 2019 there has been an 146% increase in developed medium Intensity area and a 128% increase in developed high intensity.
  + There has been an 19% decrease in emergent herbaceous wetlands over the time period of analysis.
  + Area of forest types (deciduous, evergreen and mixed) have remained constant from 2001-2019.

*Comparison to all of NC state*

* + North Carolina National Wildlife Refuges make up 2.5% of land in North Carolina.
    - Large percentage of recreational birding for North Carolina is happening in the NWR.
      * Between 8-10% of birding is occurring within the refuges throughout 2001-2019.
    - Of all purifying land in NC, around 0.48% of water purifying land is in the refuges.
    - Of all pollinator habitat, around 0.75% is found in the refuges.

*Land Cover Breakdown*

* For both pollinator habitat and water purifying land, majority of the services are being performed by mainly emergent herbaceous wetlands and then woody wetland. Below is a breakdown of percent of the purifying land for each land cover for the most recent year. A similar trend is also seen in pollinator habitat.

Chart

Description automatically generated

*Figure 2.* Water purifying land broken down by NLCD classification for 2019 in the North Carolina National Wildlife Refuges.

* Most recreational birding days were done in wetland area or in open water areas from 2001-2016.

**Methods**

Boundaries of the NWR were obtained from the ArcGIS online Living Atlas. The feature layer used titled *National Wildlife Refuges* was published by Federal\_User\_Community in 2020 and updated in May 2022. The total of area the refuges in North Carolina from these boundaries totaled 786,815 acres.

**Recreational birding days:**

Recreational birding days were obtained from an eBird point shapefile developed for the southeastern U.S. by Warnell et al. (2020). We rasterized the point shapefiles for 2001, 2006 and 2011 and 2016 at 30-meter resolution and ran the Zonal Statistics tool in ArcGIS to sum the total number of birding days that fell within each NWR. Since 2001, eBird point records have grown in number with each point containing fewer observations (i.e., the data have become more fine-grained over time). To account for this, we scaled recreational birding data as a percentage of the state total for each land cover type for each year of analysis. We expect more recent eBird data to further improve in the size and quality of its dataset with the 2012 release of an eBird mobile application.

**Water filtration (purifying land cover in flowpath):**

We used the ‘purifying land cover in flowpath’ 30-meter raster data to summarize the total acreage of land cover that provides water filtration within each NWR. The dataset was binary, indicating the presence/absence (1 for presence) of “natural” land cover types (e.g., forest, grassland, shrubland, wetland) located downstream from a nonpoint pollution source (developed land or cropland) and upstream of a water body (Warnell et al. 2020). We selected all pixels that had a value of 1 and converted the 30-meter pixel to acres.

**Wild pollinator habitat (habitat near pollination-dependent crops):**

We used the ‘wild pollinator habitat near pollinator dependent crops’ 30-meter raster dataset (Warnell et al. 2020) to summarize the total acreage of land cover providing potential pollinator habitat within a 1.1 km distance of pollinator dependent drops for each NWR. The dataset was a binary, presence/absence (1 for presence) raster; we selected all pixels that had a value of 1 and converted the 30-meter pixels to acres.

Chart, table

Description automatically generated

*Figure 3.* Accounting table of area of land cover classifications within the NC NWR and the percent change for each from 2001 to 2019.

Table

Description automatically generated

*Figure 4.* Accounting table of area of land cover classifications within the NC NWR for each ecosystem service analyzed from 2001-2019.

A picture containing chart

Description automatically generated

*Figure 5.* Accounting table for birding days based on land cover classification from 2001-2016 in the NC NWR.