NOAA CZM FY 2021, Task 71 – Conservation Targeting – Final Report

Final Report for NOAA Coastal Zone Management

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Annual Progress Report

February 2023

Table of Contents

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Introduction

In response to accelerating sea level rise and its anticipated impacts on coastal habitats and species, we proposed to develop spatial models and maps of species distributions in Coastal Virginia. This proposed project is year two of a three-year effort to develop and serve geospatial data to inform land use decision making within the context of projected habitat and current elemental occurrences to promote habitat and species persistence and resilience. The Center for Coastal Resources Management (CCRM) at the Virginia Institute of Marine Science (VIMS), in partnership with the Virginia Department of Conservation and Recreation (DCR) and the Virginia Coastal Policy Center (VCPC) has completed the second year of this effort as provided in this report.

Habitat Modeling

The habitat most likely to be negatively impacted by climate change in coastal Virginia over the next several decades is tidal marsh (Mitchell et al. 2017). Because tidal marsh extent is dictated by the intertidal range, which is rapidly changing as a result of climate change, tidal marshes must also rapidly adapt in order to persist on the landscape (Morris et al. 2002). There are two primary mechanisms for adaptation: accretion and migration. Accretion relies on the combined elevation gain from sediment and organic matter deposition on the surface of the marsh as well as subsurface biogenic contributions (Butzeck et al. 2015). Unfortunately, accretion is unlikely to be a viable option for most marshes throughout the Bay due to the combination of a microtidal environment and relatively low suspended sediment concentrations resulting in deposition rates far below what is necessary to keep apace of current rates of SLR (Kirwan et al. 2010). Without appreciable accretion, migration is the primary mechanism of persistence available to tidal marshes in the Chesapeake Bay (Feagin et al. 2010, Gardner and Johnston 2020). Migration occurs as the upland edge of the marsh moves further inland in response to rising sea level. As formerly upland areas become regularly inundated by spring tides, these areas convert to high marsh due to increasing salt content and saturation. If erosion was minimal and accretion was able to keep the low marsh high enough in the tidal envelop to prevent drowning, marshes would increase their overall areal extent through this process, as has happened repeatedly in geologic history whenever sea levels have risen. However, due to the inadequate sediment supply and rapid resulting erosion of low marsh edges, there is a net inland movement of marshes occurring throughout the Bay. In the short term, some areas are likely going to experience a net increase in areal extent due to the very low slope of immediately upland areas. Once the upper extent of the marsh reaches a steeper slope, however, the upland migration rate will slow dramatically, resulting in net loss as drowning and erosion continue at the front edge of the marsh. This process, termed coastal squeeze, will occur regardless of whether the upland slope is untenable due to natural (e.g., berms) or anthropogenic (e.g., coastal defense structures) features (Pontee 2013). The way that tidal marshes and their obligate inhabitants are likely to shift over the coming decades was the focus of the previous year’s efforts.

Data acquisition

Data were derived from the USGS CoNED Topobathymetric Elevation Model of Chesapeake Bay (https://www.usgs.gov/special-topics/coastal-national-elevation-database-%28coned%29-applications-project/science/hurricane; CBTBDEM) and the CCRM Tidal Marsh Inventory (TMI) database (https://www.vims.edu/ccrm/_forms/vasitmidownloadagreement/index.php). The TMI data were used to inform the current distribution of marshes throughout coastal Virginia, and the CBTBDEM was used to identify the areal extent of future potential marshes.

Habitat mapping

The vertical extent of tidal marshes in the Chesapeake Bay can be approximated by using mean sea level (MSL) as the lower bound, and (1.5 * Intertidal range) + mean low water elevation as the upper bound. Using the tidal datums from Sewell's Point in Norfolk, VA as the most representative for the majority of coastal Virginia. Transforming the elevations to NAVD88 vertical datum, Table 1 details the relative sea level (RSL; mean sea level accounting for SLR), mean low water, and the upper bound for tidal marshes.

Table 1 *– Elevations (m; NAVD88) of tidal marsh envelope from 2020 to 2100. RSL = relative sea level; MLW = mean low water; Upper = upper extent of tidal marsh.*

Year	RSL	MLW	Upper
2020	0.051	-0.323	0.787
2030	0.151	-0.223	0.887
2040	0.251	-0.123	0.987
2050	0.361	-0.013	1.097
2060	0.481	0.107	1.217
2070	0.621	0.247	1.357
2080	0.781	0.407	1.517
2090	0.981	0.607	1.717
2100	1.201	0.827	1.937

Using these elevations as the boundaries, we extracted the potential areal footprint of marshes for each decade from 2030 to 2100 (Figures 1 & 2) from the CBTBDEM in R version 4.1.2 (R Development Core Team 2022) using the "terra" and "foreach" packages (Hijmans 2022, Microsoft and Weston 2022). Upper and lower extents for marshes in each decade were identified using contours (Figure 3), also executed using the "terra" package in R. For a detailed script of the process, see Appendix 1. The mean low water locations are conservative estimates due to the absence of erosion and drowning as dynamic processes through time.

Results

Total potential marsh habitat decreased by ~52% from 973 km^2 in 2030 to 467 km^2 in 2100. Losses were most extreme along the Eastern Shore, where much of the marsh is contained in extensive, low-lying regions along the seaside and bayside (Figures 1 & 2). Much of the remaining area that will be within the correct tidal envelop will likely overlap with residential and agricultural lands throughout coastal Virginia, and will be a major focus of Year 3 of the planned work. Even where total areal extent is maintained or at least not entirely lost, the quality of the remaining habitat may be dramatically diminished relative to well-established regions of existing marsh. Anecdotal evidence (Bryan Watts, pers. comm.) suggests that transitional and newly migrated areas of high marsh do not provide the same habitat value for marsh obligate birds as well-established marshes.

Planned Work

By identifying where predicted future marsh habitat is likely to be, we can also identify who is likely to be impacted and what the change in land use may be. The information on who is most likely to be impacted will inform the work of the VCPC on the potential legal hurdles and policy opportunities that shifting tidal marshes will present in the coming decades.

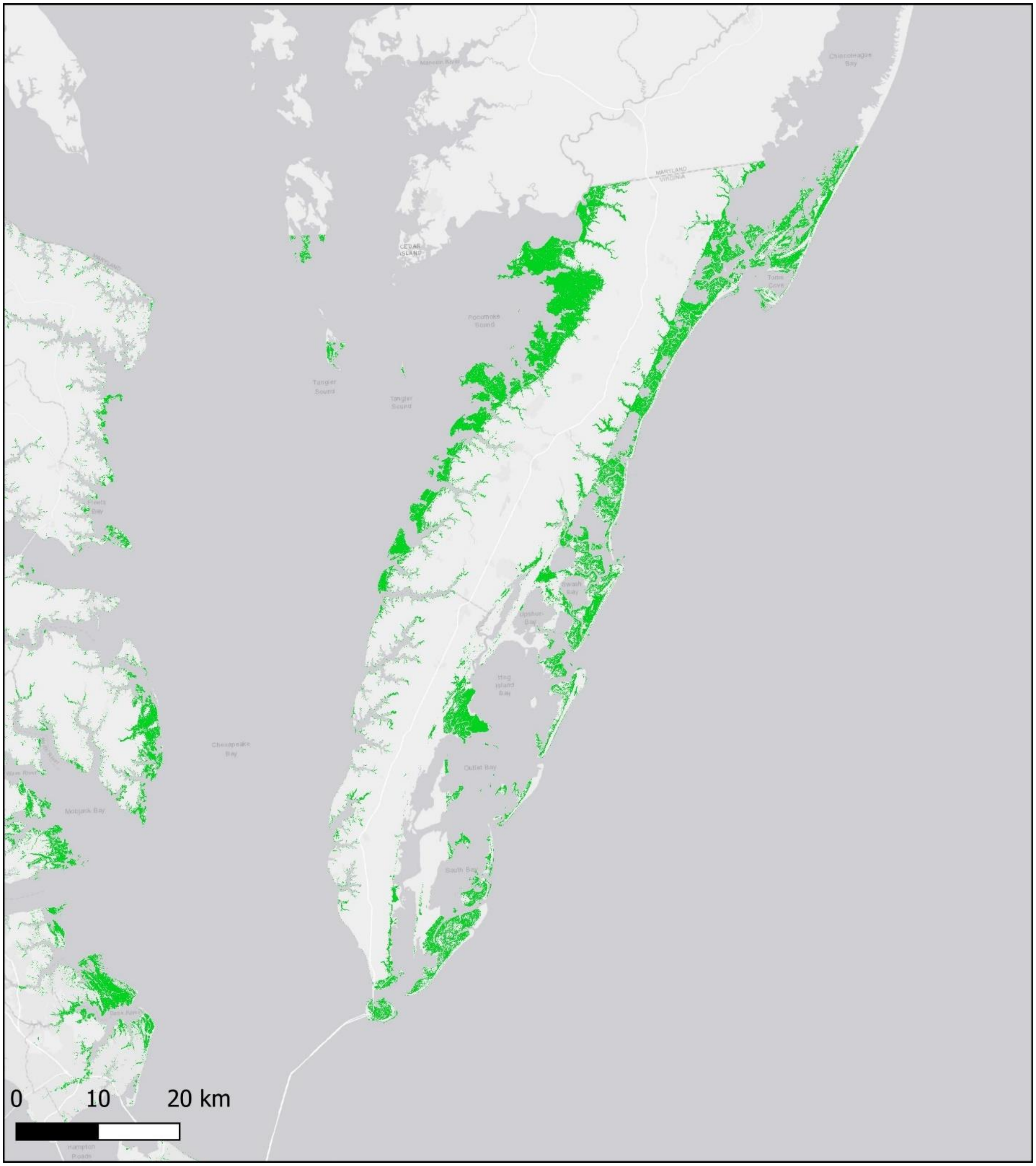

Figure 1 – Potential tidal marsh in 2030. This image shows the potential tidal marsh in 2030 shaded in green for the Eastern Shore of Virginia and select portions of the Western Shore.

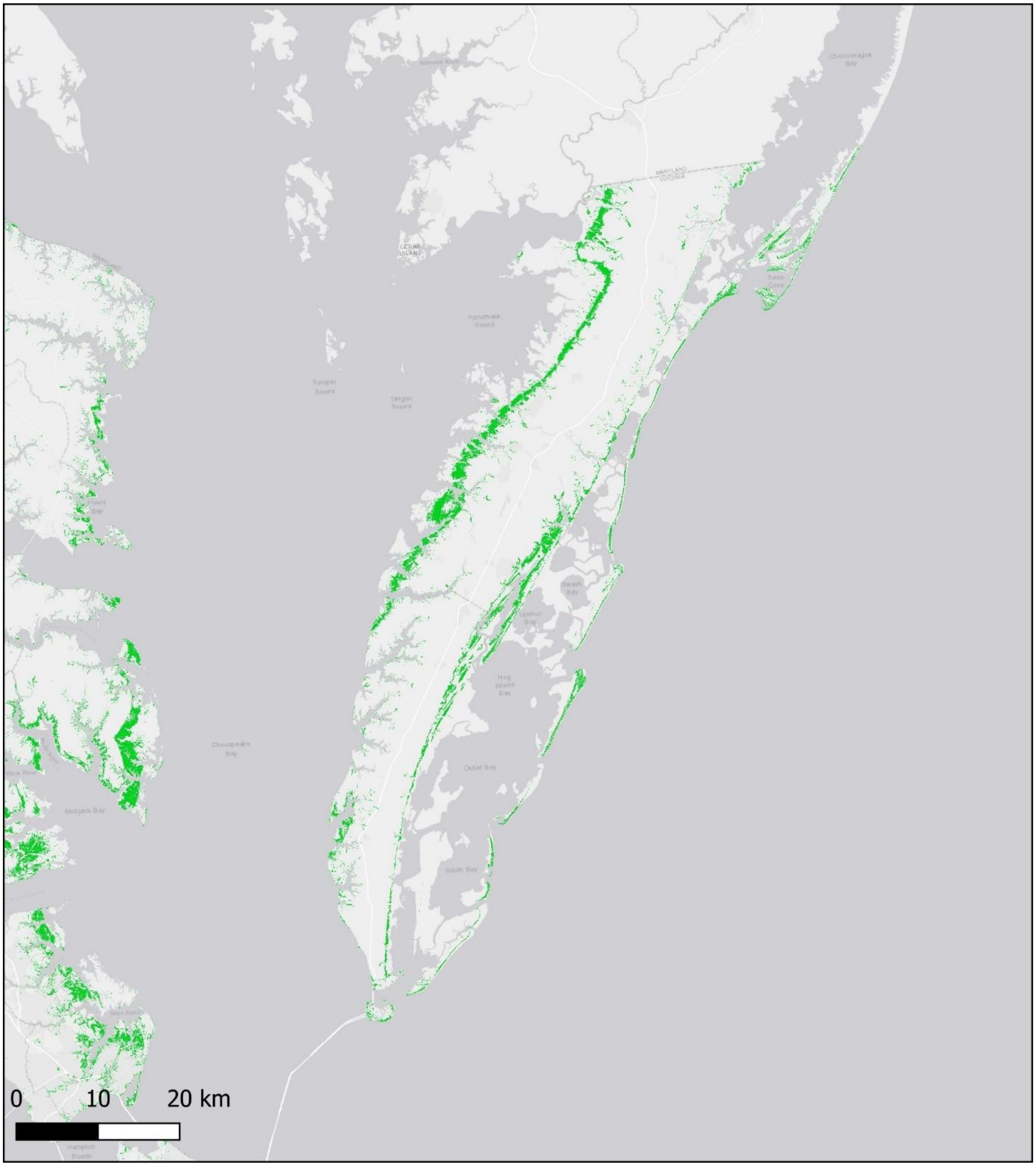

Figure 2 – Potential tidal marsh in 2100. This image shows the potential tidal marsh in 2030 shaded in green for the Eastern Shore of Virginia and select portions of the Western Shore. Potential marsh distribution is dramatically shifted from present, and substantially overlaps with residential areas throughout the region.

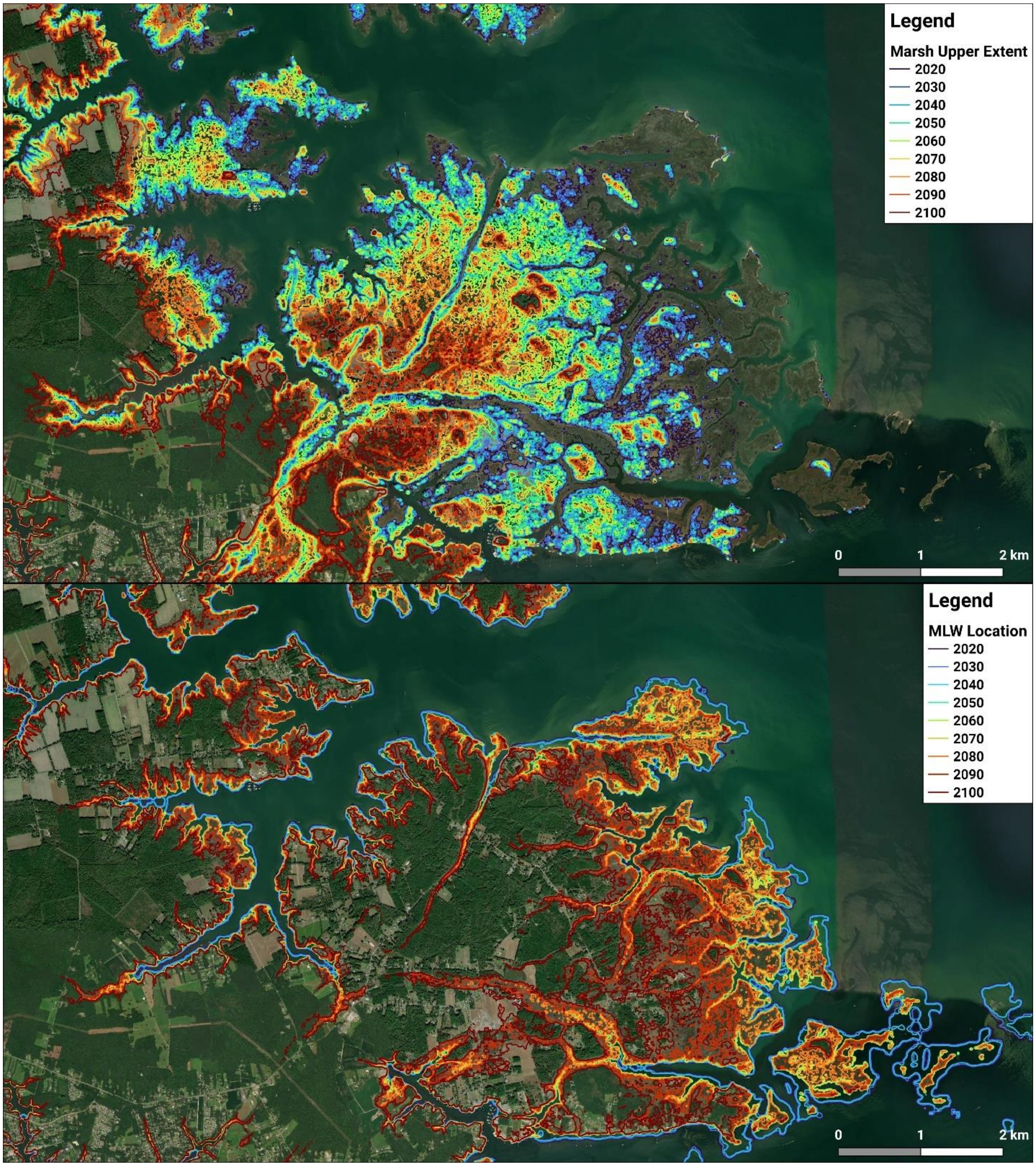

Figure 3 – Upper extent and mean low water (MLW) locations for 2020 through 2100. The upper extents show that much of the nearby upland forested areas around the Guinea Marshes will be steadily converted to marsh over time. MLW locations are conservative estimates that to not account for erosion or drowning.

Biological Survey Updates

In the Coastal Zone of Virginia, biodiversity is experiencing multiple stressors related to climate change and development. As the Virginia Natural Heritage Program (VNHP) is tasked with the identification, protection, and stewardship of Virginia's biodiversity, it is important that VNHP maintain up-to-date biodiversity information for sites resilient to climate change, especially those threatened by development. Phase 1 of a multi-year project began in 2021 with VNHP completing spatial analyses to identify significant biodiversity occurrences on climate change resilient sites. The most important of these occurrences were identified, and many had not been observed in over 25 years. Using information from spatial analyses and imagery review, a prioritization was completed to highlight occurrences on resilient sites which are most in need of biological inventory review (Bucklin et al., 2022).

In 2022, using the prioritization from Phase I, VNHP botanists, vegetation ecologists, and zoologists began conducting field surveys to update biodiversity information for prioritized sites. Over the course of 42 days, the field biologists surveyed for and/or discovered 166 element occurrences (EO) of plants, natural communities, and animals. Eighty-seven EOs were relocated and 15 new EOs were found. Of the surveyed EOs, 61 had been identified as High or Very High inventory priorities and 23 were relocated.

In the third year of the project, the updated biodiversity information will be entered into a spatial database and used to update conservation planning tools. These tools will be used to develop a parcel-based strategy to identify high-priority biodiversity occurrences that occur on unconserved resilient sites that are in urgent need of conservation. The strategy will identify parcels that may qualify for expansion of the State Natural Area Preserves system and will be shared with partners in state and federal conservation agencies, conservation NGOs, and land trusts, with the intention of pointing them to the most critical parcels for conservation action in the Coastal Zone of Virginia. Finally, the updated biodiversity information and planning tools will provide more accurate information for the next update of the Coastal Virginia Ecological Value Assessment.

Conservation Policy

The Virginia Coastal Policy Center has participated in grant-team meetings and has suggested opportunities for further engagement. No policy review or synthesis is proposed until Year 3 of the project once the major products of CCRM and DCR have been produced.

Acknowledgements

We would like to acknowledge the members of the steering committee for their extremely helpful input into the process and products of this work.

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Appendix 1

R script for elevation reclassification

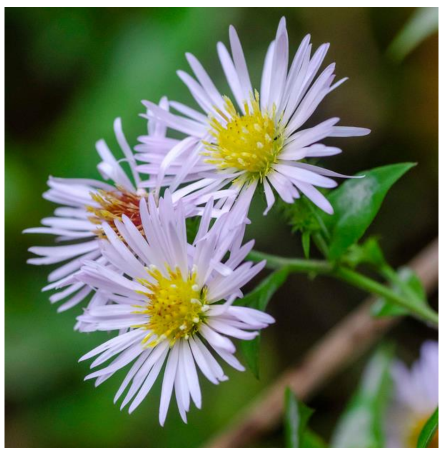
The following script documents how to calculate and extract relevant tidal elevations for potential marsh habitat.

```
library(terra)
library(foreach)
library(doParallel)
library(parallel)
library(sf)

# Data from NOAA 2022 Technical Report
# https://oceanservice.noaa.gov/hazards/sealevelrise/Sea_Level_Rise_Datasets_2022.zip
# Sewell's Point Intermediate Median values
int <- data.frame(
  year = seq(2020, 2100, by = 10),
  RSL = c(13, 23, 33, 44, 56, 70, 86, 106, 128)
)

# Tidal range
#
https://tidesandcurrents.noaa.gov/datums.html?datum=MLLW&units=1&epoch=0&id=8638610&na
me=Sewells+Point&state=VA
# Accessed 2022-04-27
MN <- 0.740
MLW <- 0.038
MHHW <- 0.840
MSL <- 0.412
ITR <- MHHW-MSL

MLW_NAVD88 <- -0.453
MSL_NAVD88 <- -0.079

# Convert RSL to m
int$MLW <- MLW_NAVD88 + int$RSL/100
int$RSL <- MSL_NAVD88 + int$RSL/100
int$upper <- int$MLW + 1.5*MN

# Read in the CBTBDEM raster
dem <- rast("//ccrmspace/vdot/RTE/GIS/VA_CBTBDEM_v2_1m.tif")

rmats <- list()
for(i in 1:nrow(int)){
  rmats[[i]] <- matrix(
    data = c(  -999, int$MLW[i], 0,
               int$MLW[i], int$upper[i], 1,
               int$upper[i], 999, 0),
    ncol = 3,
    byrow = TRUE
  )
}

cl <- parallel::makeCluster(4)
doParallel::registerDoParallel(cl)
foreach::foreach(i = seq_len(length(rmats)), .packages = c("terra")) %dopar% {
  dem <- terra::rast("V:/RTE/GIS/VA_CBTBDEM_v2_1m.tif")
  outname <- paste0("T:/watershed/PROJECTS/NOAACZMConservationTargeting/GIS/
                    DEMs/Reclass1m/WetPotential",
                    int$year[i],".tif")
```

```
  terra::classify(
    x = dem,
    rcl = rmats[[i]],
    filename = outname,
    datatype = "INT2S",
    gdal = c("COMPRESS=LZW")
  )
}
parallel::stopCluster(cl)

# Contours by year
uppers <- terra::as.contour(dem, levels = int$upper, maxcells = 1E11)
writeVector(uppers, filename =
"T:/watershed/PROJECTS/NOAACZMConservationTargeting/GIS/DEMs/UpperExtents20230203.shp"
, overwrite = TRUE)
mlws <- terra::as.contour(dem, levels = int$MLW, maxcells = 1E11)
writeVector(mlws, filename =
"T:/watershed/PROJECTS/NOAACZMConservationTargeting/GIS/DEMs/MLWExtents20230203.shp",
overwrite = TRUE)
```

COMMONWEALTH of VIRGINIA

Climate Resilience Planning for Natural Heritage Resources in the Virginia Coastal Zone: Year 2 - Element Occurrences Field Surveys



credit: John Townsend, DCR-DNH

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Virginia Department of Conservation and Recreation
Division of Natural Heritage
Natural Heritage Technical Report 23-03
January 2023

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Final Report

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January 2023

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Cover photo: Elliott's Aster (*Symphyotrichum elliottii*) - G4/S1 - two EO updated, one formerly historic, and a new source feature found - 10/25/2022

Table of Contents

EXECUTIVE SUMMARY

In the Coastal Zone of Virginia, biodiversity is experiencing multiple stressors related to climate change and development. As the Virginia Natural Heritage Program (VNHP) is tasked with the identification, protection, and stewardship of Virginia's biodiversity, it is important that VNHP maintain up-to-date biodiversity information for sites resilient to climate change, especially those threatened by development. Phase 1 of a multi-year project began in 2021 with VNHP completing spatial analyses to identify significant biodiversity occurrences on climate change resilient sites. The most important of these occurrences were identified, and many had not been observed in over 25 years. Using information from spatial analyses and imagery review, a prioritization was completed to highlight occurrences on resilient sites which are most in need of biological inventory review (Bucklin et al., 2022).

In 2022, using the prioritization from Phase I, VNHP botanists, vegetation ecologists, and zoologists began conducting field surveys to update biodiversity information for prioritized sites. Over the course of 42 days, the field biologists surveyed for and/or discovered 166 element occurrences (EO) of plants, natural communities, and animals. Eighty-seven EOs were relocated and 15 new EOs were found. Of the surveyed EOs, 61 had been identified as High or Very High inventory priorities and 23 were relocated.

In the third year of the project, the updated biodiversity information will be entered into a spatial database and used to update conservation planning tools. These tools will be used to develop a parcel-based strategy to identify high-priority biodiversity occurrences that occur on unconserved resilient sites that are in urgent need of conservation. The strategy will identify parcels that may qualify for expansion of the State Natural Area Preserves system and will be shared with partners in state and federal conservation agencies, conservation NGOs, and land trusts, with the intention of pointing them to the most critical parcels for conservation action in the Coastal Zone of Virginia. Finally, the updated biodiversity information and planning tools will provide more accurate information for the next update of the Coastal Virginia Ecological Value Assessment.

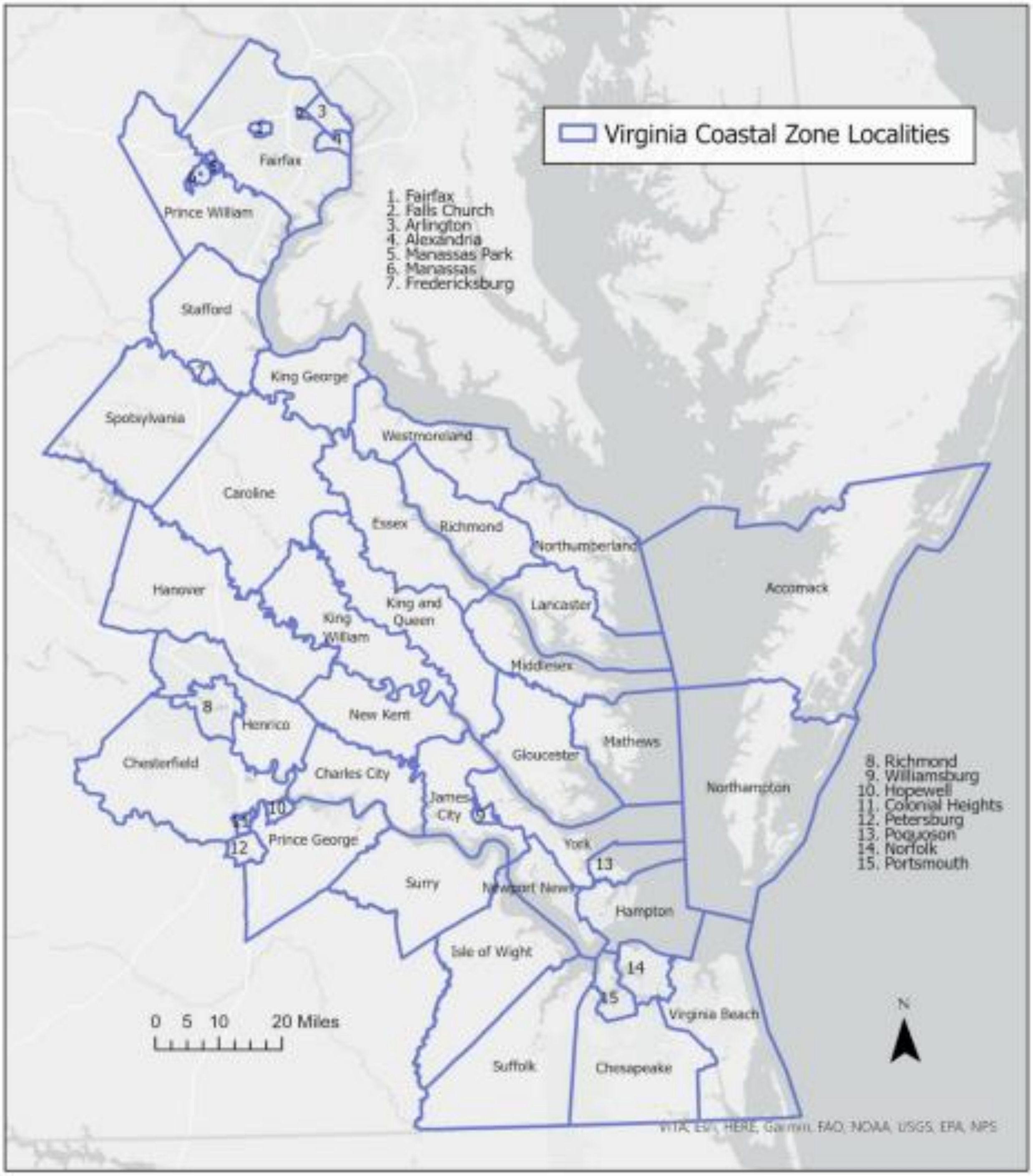
INTRODUCTION

Many rare plants and animals, and exemplary natural communities—collectively known as Elements of biodiversity, a.k.a., Natural Heritage Resources (NHRs)—are threatened by habitat loss due to climate change, development, invasive species, and other stressors. Nature is in flux due to climate change, and for plant and animal populations to survive and adapt, there must be refugia available. Nowhere in Virginia are the needs for climate resilience and habitat connectivity greater than in the coastal zone (Figure 1). Here, infrastructure, development, and converted lands consume much of the landscape and continue to expand. The coastal zone is also likely to experience some of the worst effects of climate change because of warmer temperatures, abnormal precipitation rates, sea level rise, and more violent storms. The Virginia Natural Heritage Program (VNHP) proactively and strategically works to target conservation of the rarest and most vulnerable NHRs on sites that are most resilient to these climate change stressors, so that native biodiversity can be preserved for future generations.

Central to this analysis are Element Occurrences (EOs). These areas of land and/or water where an element (species or natural community) was observed, have practical conservation value because of the NHRs they contain or were known to contain in the past. Maintaining an up to date EO database is essential, as EOs form the building blocks for many of the tools used for conservation prioritization and planning, such as VNHP's Conservation Sites. Conservation Sites are non-regulatory planning boundaries that surround one or more significant examples of NHRs, along with habitat and buffer to support their persistence.

With few exceptions, EOs that have not been observed in 30 years are automatically classified as "historic" and are no longer used to delineate Conservation Sites and are not taken into consideration during environmental review processes. A more stringent cutoff of 25 years ("near-historic") is used to exclude features from VNHP's "Essential Conservation Sites" (ECS) prioritization process. The ECS process identifies the best examples of each element and the Conservation Sites needed to preserve them. Unfortunately, the designation of an EO as historic or near-historic can lead to undesirable conservation outcomes, by excluding from consideration areas that are still worthy of protection. In many cases, an EO may be designated "historic" simply because no recent surveys have been done in the area, even though the element may still be present and thriving at that location. To ensure that conservation efforts are targeted appropriately, it is important to prioritize the survey of resilient sites with suitable habitat where historic and near-historic EOs were found in the past.

Figure 1. Localities in the Virginia Coastal Zone, used to define the study area for this project.



In 2021, VNHP Information Management staff extracted from the Biotics database, the set of Procedural Features (PF, the individual polygons that comprise an EO) in the coastal zone, added attributes that could be used for prioritization, and reviewed many of the features over imagery. No spatial edits were made at this time, but relevant attribute fields were populated during the imagery review. The purpose was to provide Inventory staff with a spatial dataset prioritized for targeting biological surveys during the 2022 field season. To be considered a survey priority for this project, PF were required to be on "resilient" sites, i.e., intersecting at least one of the following:

- The Nature Conservancy's (TNC) Coastal Resilience (Resilient Tidal Complexes and Marsh Migration space) (Anderson and Barnett, 2017)
- TNC's Resilient and Connected Landscapes (Anderson et al., 2016)
- Virginia Natural Landscape Assessment's Natural Land Network Core Interiors
- Virginia Institute of Marine Science's Marsh Migration Priorities

Higher priorities were given to historic and near-historic EOs and in areas with greater numbers of species represented in the Potential Suitable Habitat Summary[1] layer. The resulting spatial dataset of PFs contained attributes from the spatial analyses and imagery review assessments, with priority classes assigned to highlighting PFs on resilient sites that are most in need of biological inventory and assessment. This dataset formed the basis of the work performed during biological inventory phase (II) of the project.

New surveys for priority EOs are warranted for at least two reasons. First, the status of EOs change over time as populations expand and contract, and as habitats are altered through natural and anthropogenic disturbance. Threats to EOs include invasive species competition, non-native pathogens, climate change/sea level rise, and more. Second, VNHP's understanding of the biological status and condition of Virginia's NHR has expanded over time. The natural heritage resource lists of rare plants (Townsend, 2022) and animals (Roble, 2022) have changed dramatically over the past 30 years, with over 100 rare plants and animals being recognized in Virginia and with other species being dropped from the list as they are recognized as being more common than previously thought. New groups of organisms, such as lesser-known invertebrates and non-vascular plants, are added to these lists as new information about them becomes available. Perhaps the greatest advances to our understanding of Virginia's biodiversity have been made in our understanding of natural communities. As a result of this, VNHP community ecologists have revised the system of classification and naming of natural communities, while

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[1] VNHP maintains a set of Predicted Suitable Habitat (PSH) layers for federal and state-listed threatened and endangered species, and some globally rare species (*n* = 179). These PSH identify areas most likely to have suitable habitat for that species, which are mapped using known occurrences and a Species Habitat Model and reviewed by species' experts. The Predicted Suitable Habitat Summary (PSHS; VNHP, 2021) combines all PSH into a single layer, with attributes listing the number and identity of species with suitable habitat in each polygon. We intersected PFs with the PSHS, and added attributes indicating the number and identity of species with suitable habitat in the PF. Bucklin et al., 2022

keeping it aligned with the federally mandated National Vegetation Classification System (Fleming et al., 2021).

The biological inventory work described in this report is the result of Phase II of a three-year project. Data from these surveys will yield a more accurate and credible EO database for the coastal zone. During Phase III, EO updates will be finalized, and a strategy to protect the highest-priority NHRs on unconserved, resilient sites will be developed. Each of these three phases will help provide more accurate information for the next update of the Coastal Virginia Ecological Value Assessment (CVEVA) and guide ongoing field inventory and protection efforts.

METHODS

The initial dataset developed by the VNHP Information Management Section resulted in a total of 658 PF (from 495 EO) assigned to the higher biological inventory priority (BI-P) classes ("High" or "Very High"). Based on these PFs, 259 Inventory Priority Groups were delineated. By discipline, this included 146 botany groups, 21 ecology groups, and 91 zoology groups. Many priority groups (n = 82) contained higher BI-P PFs from two or more EOs, with a maximum of 22 EOs for a Botany group. The map of the Inventory Priority Groups was provided to inventory biologists and is shown in Figure 2. A second map showing the final PFs was also provided to inventory biologists, but those precise data were too sensitive for inclusion in this report.

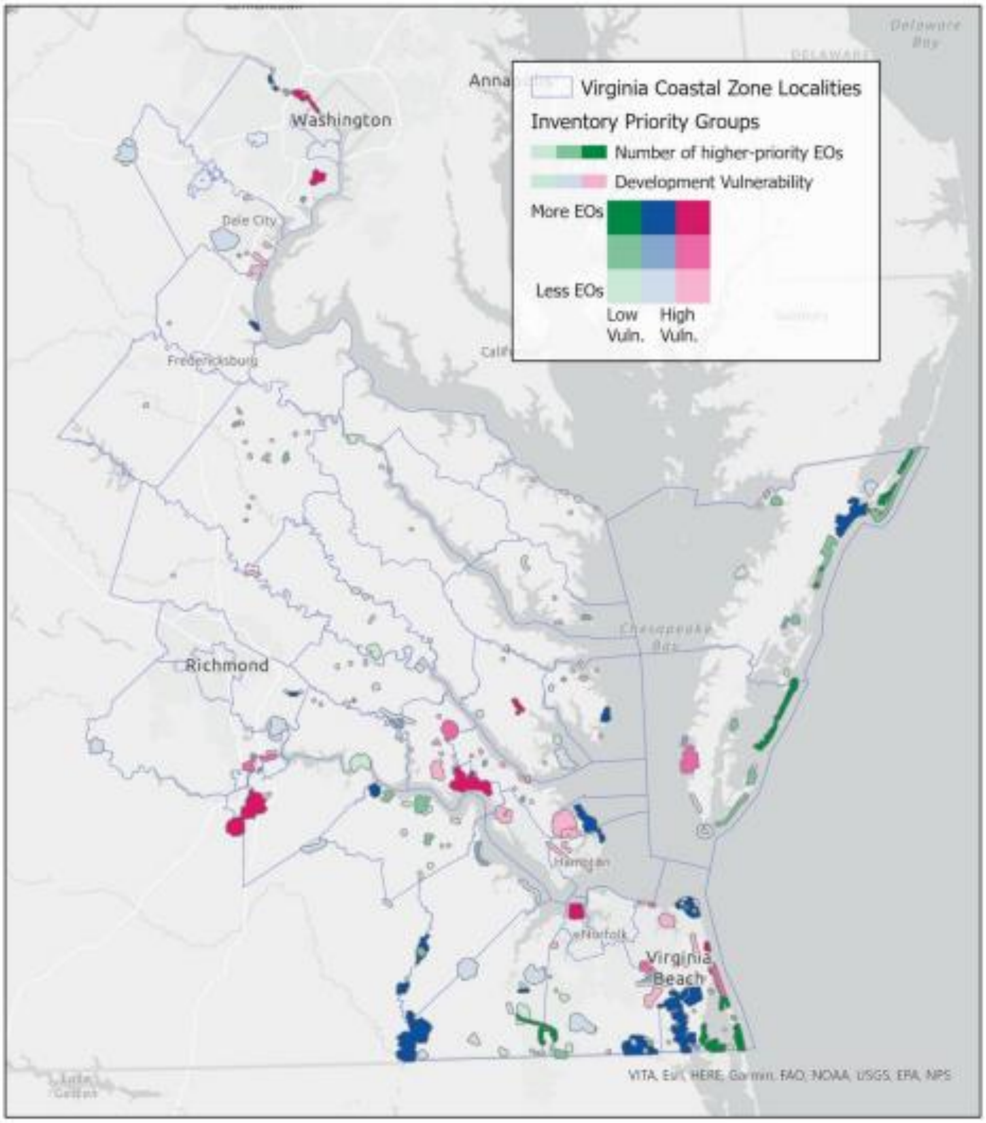
Using this information, each discipline, botany, ecology, and zoology, developed and implemented a field plan to survey for EO indicated in the BI-P. Field surveys were initiated in March 2022 and continued through October 2022. During this period VNHP inventory staff carried out surveys throughout Virginia's coastal zone, verifying selected known occurrences of natural heritage resources and documenting all additional occurrences encountered.

Overview of Natural Heritage Inventory Methodology

Staff of VNHP approach natural heritage inventories in a systematic and prioritized manner. In general, the most threatened geographic areas, habitats, and species receive inventory priority.

Natural Heritage Resource inventories are conducted through the basic steps listed below. Although a natural areas inventory can logically be broken into these steps, the work proceeds in multiple directions simultaneously and is often iterative. The 2022 coastal zone surveys focused on EOs already prioritized; however, the following steps were still used to aid in planning, permissions, and on-the-ground survey logistics.

Figure 2. *Map of Inventory Priority Groups in the Coastal Zone, developed from Procedural Features with "High" or "Very High" Biological Inventory Priority. The bivariate symbology indicates the number of higher-priority Element Occurrences included in the group, and the Development Vulnerability of the group, from the Virginia ConservationVision Development Vulnerability Model[2].*



[2] The revised EO database was compared to the ConservationVision Development Vulnerability Model (Hazler and Bucklin, 2022), which quantifies the predicted relative risk of conversion from "natural", rural, or other open space lands to urbanized or other built-up land uses. Each EO was labeled with the highest class intersected. EO that fell within classes 3-5 of development vulnerability were further prioritized for protection and/or inventory based on its occurrence in high priorities of the Marsh Migration, Coastal Resilience, and Resilient and Connected Landscapes models, as well as by rarity ranks, estimated viability, protected lands, ecological integrity, and probability of persistence. Bucklin, et al., 2022

1) Review of aerial imagery. Aerial imagery of the survey areas was reviewed in detail to identify landscape features that might support NHR. To aid in their interpretation, the imagery was compared with topographic and geologic maps.

2) Planning for field survey. Field plans were developed to maximize the productivity of the limited field time. Among the factors considered were the best time(s) of year to visit EO to ensure the visibility of rare species, which staff scientist(s) should be involved, and how much time should be budgeted for completing the survey. Property access requirements were addressed including applying for permits and receiving landowner permission.

3) Field surveys. During this stage, detailed information was collected on the rare species and exemplary natural communities present within the study area. Care was taken to map the EO as accurately as possible using GPS and aerial imagery. Standard EO data was collected for each record including number observed or area of occurrence, general condition, and landscape context. Flexibility was built into the process so that priorities could be adjusted when unexpected elements were encountered.

The methodology employed by the major disciplines in carrying out the coastal zone inventory is summarized below.

Botanical Surveys

To initiate the inventory of rare plants in the coastal zone, the list of prioritized plant EOs was consulted. Criteria used to select survey targets included:

1. Higher priority values (as assigned by Information Management)
2. Site accessibility
3. Likelihood of rediscovery (smaller polygons with extant habitat)
4. Staff availability during the suitable survey window for the species

Field visits were scheduled during the optimal survey period for each species. EO data, including population numbers, viability, and habitat condition were recorded. If an EO required mapping updates, those data were collected using Esri's Field Maps application on an iPad.

Eight different managed area/ownership area types were accessed for botanical surveys, including: seven Virginia Natural Area Preserves (two co-managed with Virginia State Parks and Virginia Department of State Forests), one state park, two national wildlife refuges, one national park, one Department of Defense facility, one University-owned Natural Area, and several private lands and public roadside rights-of-way.

Zoological Surveys

Zoological survey targets were selected based on previous analysis of Coastal Zone EO priorities, as well as phenology of species, and ownership and accessibility to the sites during the field work phase of the project. A full complement of inventory and sampling methods were employed as described below:

Sweep nets - odonates and other flying invertebrates were sampled in terrestrial and aquatic habitats using sweep nets. Specimens were either placed in glacine envelopes, or in vials using ethanol as preservative for future examination and storage.

Dip nets - rare aquatic amphibians and reptiles, as well as fish and aquatic invertebrates were targeted using dip nets.

Hand collection - reptiles and amphibians, as well as some invertebrates, were collected by hand. Transects were walked in terrestrial habitats and various cover objects were often overturned.

Visual surveys – Surveys for birds, butterflies and skippers, and dragonflies and damselflies were conducted using visual survey techniques often aided using binoculars, or in some cases a spotting scope.

UV-Light Traps - nocturnal lepidopterans and other invertebrates were captured using standard Bioquip UV traps equipped with a blacklight (= ultraviolet) powered by a 12-volt gel-cell battery. Ethyl acetate was used as a killing agent. Traps were run overnight in a variety of habitats, primarily at sites where known EO records were located.

Transects and point counts - transects and point counts were conducted to survey for rare birds and other taxa. Transects were used to survey for Canebrake rattlesnake (Crotalus horridus atricaudatus), and rare tiger beetles including *Cicindela dorsalis dorsalis, Cicindela abdominalis*, and *Cicindela trifasciata*.

Bird song tapes - recordings of bird songs were played in appropriate habitats to elicit response from rare or cryptic bird species.

Frog call surveys – surveys for rare anurans were conducted by listening for their vocalizations at appropriate wetland habitat after dark. These surveys focused primarily on Barking treefrog (*Hyla gratiosa*) and Oak toad (*Anaxyrus quercicus*) at known EO sites, but also included some random driving surveys to listen for new occurrences. Frog call surveys were conducted after dusk, and occasionally playback calls were used to elicit a response from target frog species.

Zoology surveys took places on several types of managed/owned lands: 7 Virginia Natural Area Preserves, 5 Local parks, 1 Virginia State Park, 1 US National Wildlife Refuge, 1 US National Park, 10 public roadside rights-of-way, and 8 other private and non-profit holdings.

Ecological Surveys

The need to protect indigenous biotic communities and ecosystems is a major focus of conservation efforts by federal, state, and private organizations. Natural community classification, inventory, and protection should be regarded as an essential complement to rare species inventories. Natural communities represent functioning units of the landscape that:

1. support myriad life forms too cryptic or poorly known to be catalogued and prioritized individually,
2. provide habitat for both rare and common species,
3. contribute to the maintenance of larger ecosystems, and
4. possess unique intrinsic scientific, educational, and aesthetic values.

It is therefore important to locate, classify, and evaluate these features as part of any comprehensive inventory of natural heritage resources.

In Virginia, significant occurrences of ecological communities are tracked using a natural community classification developed by the ecologists at VNHP (Fleming and Patterson 2021). This classification system is part of the U.S. National Vegetation Classification (USNVC), which in turn is a subset of the International Vegetation Classification of Ecological Communities (IVC; Grossman et al., 1998; Jennings et al., 2009, USNVC 2022, NatureServe 2023) that provides a framework for classification and conservation ranking of ecological communities occurring throughout the United States, Canada, and Latin America. The IVC was developed by ecologists at NatureServe and TNC, in conjunction with the network of state Natural Heritage programs and International Conservation Data Centers. Ecological communities classified in the USNVC receive global conservation status ranks that indicate the relative rarity or endangerment of the community throughout its range. These ranks are based on factors such as present geographic extent, threats, number of distinct occurrences, degree of decline from historical extent, and degree of alteration of natural processes affecting the dynamics, composition, or function of the type.

For the purposes of the coastal zone inventory, significant ecological communities were defined to include both outstanding examples of common ecological communities and all viable examples of rare ecological communities as indicated by their global conservation rank in the USNVC. Community taxonomy follows Fleming and Patterson (2021).

During ecological field work, significant examples of ecological communities were documented using both qualitative and quantitative methods. These methods included the collection of data on occurrence size, condition, boundaries, biotic and abiotic factors, floristics, evidence of disturbance, successional trends, and immediate or long-term threats. Community occurrences were ranked primarily by their quality, size, and condition of the surrounding landscape.

In some cases, due to rarity and/or exemplary condition, significant natural community occurrences were also documented through collection of a quantitative vegetation sample. Environmental data, other site information, and data on vegetation structure, composition, and landscape context were collected within 400 m^2 vegetation plots. Total coverage for each species (vertical projection onto the ground) was estimated visually and recorded within nine cover classes: 1 (trace), 2 (0-1%), 3 (1-2%), 4 (2-5%), 5 (5-10%), 6 (10-25%), 7 (25-50%), 8 (50-75%), 9 (75-100%). The same ten cover classes were also used to estimate each species' coverage by vegetation stratum (i.e., herb, shrub, and tree layers). Additional vegetation information collected included the height and coverage of each stratum, the leaf type and leaf phenology of the dominant stratum, and the physiognomic class represented by the stand. Each vegetation sample was georeferenced using a Global Positioning System (GPS) unit. Soil samples were collected from the top 10 cm (3.9 inches) of mineral or organic soil (below the surficial litter or humus) for later chemical analysis.

Sixteen different sites were accessed for ecological surveys, including 6 State Natural Area Preserves, 7 private parcels, 1 State Park, and 1 Local Park. Three of the private sites required locating and contacting the owners to request permission to visit. The remaining private sites included a landowner who requested a survey of known rare plants on their property, a private land conservancy assessing the conservation value of a parcel, and an “open to the public” nature trail.

RESULTS

Overall Results

Field surveys by all disciplines took place over 42 days between 1 April and 27 October 2022. Fourteen people conducted dozens of surveys for 166 EOs (Appendix A, Table 1). A total of 108 unique elements were surveyed for or newly discovered. Eighty-seven EOs were relocated and 15 new EOs were found (Table 1). A total of 61 EOs prioritized as ‘Very High’ or ‘High’ were looked for and 23 were relocated (Table 1). Forty-two EOs surveyed for had not been observed in 30 years or more (i.e., 1992 or before) and 13 of these were relocated. For EOs considered ‘near historic’, with last observations between 1993 and 1998 (n = 12), seven were relocated.

Table 1. Summary of surveys and survey results by Element Occurrence prioritization rank.

Priority Rank	EOs Found	EOs Not Found	New EO	Total
Very High	5	4	-	**9**
High	18	34	-	**52**
Medium	19	8	-	**27**
Low	2	0	-	**2**
None*	9	9	-	**18**
Not reviewed**	34	9	-	**43**
New***	-	-	15	**15**
Total	**87**	**64**	**15**	**166**

** Reviewed, deemed no priority; ** Not reviewed, no priority assigned; *** Newly discovered during 2022 surveys*

RESULTS BY DISCIPLINE

Botany surveys took place between April 1, 2022 and October 27, 2022. Of the 62 plant EOs searched for, 46 were found (76 of which were expanded with new PFs) (Table 2). Additionally, eight new EOs were discovered. Twenty-four historic and near-historic EOs were visited, and 13 were found.

Ecology surveys took place between April 12, 2022 and September 28, 2022. Of the 35 existing community EOs searched for, 34 were found (two of which were expanded with new PFs). Additionally, four new EOs were located. Two historic EOs were visited, and both were found (Table 2). Two new quantitative vegetation plots were established and sampled within two separate EOs due to the rarity and outstanding condition of the communities.

Zoology surveys took place between June 30, 2022 and October 26, 2022. Of the 64 existing EOs searched for, 18 were found (ten of which were expanded with new PFs) (Table 2). Additionally, three new EOs were located. Twenty-eight historic and near-historic EOs were visited and five were found.

Table 2. Summary of EOs surveyed for, broken out by Element Group (Discipline). Historic EOs were last observed prior to 1992, near-historic EOs were last observed between 1993 – 1998, and current EOs were last observed between 1999 – 2021.

	Animals (Zoology)				Communities (Ecology)				Plants (Botany)			
	F	NF	New	Total	F	NF	New	Total	F	NF	New	Total
Historic EOs	3	20	-	23	2	0	-	2	8	9	-	17
Near-historic EOs	2	3	-	5	0	0	-	0	5	2	-	7
Current EOs	12	24	3	39	22	1	4	27	33	5	8	46
Total	17	47	3	67	24	1	4	29	46	16	8	70

F = Found, NF = Not Found

DISCUSSION

VNHP Inventory work does not end after the field surveys. During year 3 of this project, each surveyor will incorporate their field notes into VNHP's Biotics database. This will include reviewing and updating the EO ranks (a qualitative rank designed to reflect the viability of the EO), last observation date, and reviewing/updating/adding any spatial data. Negative survey information will also be incorporated as it is important to note the landscape and habitat conditions of the previously known location for an EO. This will inform decisions about its conservation status rank and overall trends in the state.

The initial dataset developed by the VNHP Information Management Section resulted in a total of 658 PF (from 495 EO) assigned to the higher biological inventory priority (BI-P) classes ("High" or "Very High"). This number of "High" and "Very High" PF reflects the importance of the coastal zone for biodiversity conservation in Virginia. VNHP inventory staff were only able to scratch the surface regarding updating and assessing historic and near-historic EO. Updating EOs should continue to be a high priority for Virginia Coastal Zone Management program and other partners to assure the highest quality data products and information to make land conservation decisions.

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APPENDIX A

Summary table of initial findings by VNHP during surveys for Natural Heritage Resources (NHR = rare, threatened, or endangered species or exemplary natural communities) in the coastal zone. An Element Occurrence Identification number (EO ID) is applied to each unique location where an EO is found. For species, the EO ID often corresponds to a population, but may be a portion of a population (e.g., long distance dispersers) or a group of nearby populations (e.g., metapopulation). For communities, the EO may represent a stand or patch of a natural community, or a cluster of stands or patches of a natural community.

What is shown in the table is the Element Group (species type or if a community), the name of the NHR (= Element), the unique EO ID, the number of unique surveys conducted in 2022 for the EO, a general result of the survey (Y = Yes, EO found; N = No, EO not found; or New = new EO), the year the EO was last observed (prior to current survey), the inventory priority rank assigned to the EO during Phase I of this project, and the general ownership category for the property surveyed (DOD = Department of Defense, DWR = Dept. of Wildlife Resources, FWS = US Fish and Wildlife Service, LP = local/county park, NAP = natural area preserve (state-owned unless noted), NPS = National Park Service, PL = private land, RT = roadside/trail, SP = state park, TNC = The Nature Conservancy. Other area types are also indicated).

Element Group	Element Name	EO ID	No. of Unique Surveys	Found? (Y/N)	No. of New SFs	Year Last Observed	Assigned Inventory Priority from Year 1	Ownership
Animal	*Amblyscirtes alternata*	12482	3	N	0	1982	High	FWS
Animal	*Ammospiza caudacuta*	3883	1	N	0	1985	High	NAP
Animal	*Anaxyrus quercicus*	702	1	Y	2	1959	Not Reviewed	PL
Animal	*Anaxyrus quericus*	3772	1	N	0	1969	Medium	RT
Animal	*Anaxyrus quericus*	7993	1	N	0	1969	High	RT
Animal	*Bombus fraternus*	14423	2	Y	1	1931	Medium	FWS
Animal	*Bombus fraternus*	14770	1	Y	1	2020	Not Reviewed	PL (NAP)
Animal	*Calephelis virginiensis*	3989	1	N	0	1937	None	FWS
Animal	*Calephelis virginiensis*	12608	2	N	0	1970	High	LP

Element Group	Element Name	EO ID	No. of Unique Surveys	Found? (Y/N)	No. of New SFs	Year Last Observed	Assigned Inventory Priority from Year 1	Ownership
Animal	*Charadrius melodus*	4962	1	N	0	1989	High	LP
Animal	*Cicindela abdominalis*	1166	1	N	0	1936	Very High	NAP
Animal	*Cicindela dorsalis*	1475	1	Y	0	2021	Medium	NAP
Animal	*Cicindela dorsalis*	4690	1	Y	0	2021	Not Reviewed	LP
Animal	*Cicindela dorsalis*	8824	1	N	0	2020	None	NAP
Animal	*Cicindela trifasciata*	10813	1	N	0	2006	Not Reviewed	LP
Animal	*Circus hudsonius*	7280	1	N	0	1990	High	NAP
Animal	*Circus hudsonius*	11365	1	N	0	1992	High	LP
Animal	*Crotalus horridus atricaudatus*	1078	1	N	0	1995	High	LP
Animal	*Crotalus horridus atricaudatus*	1427	3	N	0	2013	None	FWS
Animal	*Crotalus horridus atricaudatus*	8148	2	N	0	2005	High	LP
Animal	*Cymatophora approximaria*	12625	2	Y	3	1989	High	SP
Animal	*Enallagma pallidum*	1412	1	N	0	2014	None	FWS
Animal	*Euphyes conspicua*	12814	2	N	0	1944	None	FWS
Animal	*Euphyes dukesi*	1106	1	Y	1	2014	Medium	PL
Animal	*Euphyes dukesi*	1257	1	N	0	2014	High	RT
Animal	*Euphyes dukesi*	2011	1	N	0	2014	High	LP
Animal	*Euphyes dukesi*	5973	2	Y	2	2014	High	RT
Animal	*Euphyes dukesi*	12700	1	N	0	2014	Medium	TNC
Animal	*Euphyes dukesi*	13536	2	Y	1	2015	Medium	LP
Animal	*Euphyes dukesii*	2011	1	N	0	2014	High	LP
Animal	*Euphyes dukesii*	11312	3	N	0	1993	None	FWS
Animal	*Euphyes pilatka*	8531	2	Y	0	2014	High	TNC
Animal	*Hyla gratiosa*	New	1	New	1	New	New	PL
Animal	*Hyla gratiosa*	3155	1	N	0	2013	Medium	RT
Animal	*Hyla gratiosa*	6583	1	Y	3	1990s	High	RT
Animal	*Hyla gratiosa*	11921	1	N	0	2003	Not Reviewed	RT

Element Group	Element Name	EO ID	No. of Unique Surveys	Found? (Y/N)	No. of New SFs	Year Last Observed	Assigned Inventory Priority from Year 1	Ownership
Animal	*Hyla gratiosa*	11952	1	N	0	1988	High	RT
Animal	*Hyla gratiosa*	11953	2	Y	1	2019	High	RT
Animal	*Hyla gratiosa*	12810	1	N	0	2013	Medium	RT
Animal	*Hyla gratiosa*	12818	1	N	0	2013	Not Reviewed	RT
Animal	*Hyla gratiosa*	12820	1	Y	1	2013	Not Reviewed	RT
Animal	*Hyla gratiosa*	14638	1	N	0	2019	Not Reviewed	NAP
Animal	*Lestes disjunctus*	1012	2	N	0	1993	High	NPS
Animal	*Lymnothlypis swainsonii*	1497	2	N	0	2010	None	FWS
Animal	*Macrodiplax balteata*	10812	1	N	0	2017	Not Reviewed	LP
Animal	*Nehalennia irene*	4534	2	Y	0	1993	High	NPS
Animal	*Nyctanassa violacea*	8842	1	N	0	1976	Very High	PL
Animal	*Papaipema* sp. 3	9134	1	Y	0	2001	Not Reviewed	NAP
Animal	*Papaipema* sp. 3	26859	1	N	0	2010	High	PL, LP
Animal	*Ploiaria carolina*	6430	1	N	0	1989	High	SP
Animal	*Pnirontis brimleyi*	1982	1	N	0	1990	High	SP
Animal	*Problema bulenta*	170	1	N	0	2008	High	Boat survey
Animal	*Pycnoderiella virginiana*	9505	1	N	0	1989	High	SP
Animal	*Rallus limicola*	14832	1	N	0	2014	Not Reviewed	LP
Animal	*Regina rigida*	1901	1	N	0	1992	Very High	Boat survey
Animal	*Rynchops niger*	551	1	N	0	1989	High	LP
Animal	*Satyrium kingii*	1239	2	N	0	1982	High	FWS
Animal	*Somatochlora filosa*	7974	1	Y	0	2001	Medium	NAP
Animal	*Sternula antillarum*	5564	1	N	0	2014	Not Reviewed	LP
Animal	*Sternula antillarum*	6921	1	N	0	2018	Medium	NAP
Animal	*Sternula antillarum*	12040	1	N	0	2010	Not Reviewed	NAP
Animal	*Sternula antillarum*	12405	1	Y	0	2011	None	PL
Animal	*Xylocopa micans*	New	1	New	1	New	New	FWS

Element Group	Element Name	EO ID	No. of Unique Surveys	Found? (Y/N)	No. of New SFs	Year Last Observed	Assigned Inventory Priority from Year 1	Ownership
Animal	*Xylocopa micans*	New	1	New	1	New	New	RT
Community	Coastal Plain / Outer Piedmont Acidic Seepage Swamp	9382	1	Y	0	1990	High	PL
Community	Coastal Plain / Outer Piedmont Acidic Seepage Swamp	14236	1	Y	0	2017	Not Reviewed	NAP
Community	Coastal Plain / Outer Piedmont Acidic Seepage Swamp	14439	1	Y	0	2018	Not Reviewed	DWR
Community	Coastal Plain / Outer Piedmont Basic Mesic Forest	9806	1	Y	0	2008	Not Reviewed	PL
Community	Coastal Plain / Piedmont Oak - Beech / Heath Forest	New	1	New	1	New	New	PL
Community	Coastal Plain / Piedmont Oxbow Marsh	New	1	New	1	New	New	DWR
Community	Coastal Plain / Piedmont Oxbow Shrub Swamp	12054	1	Y	0	2010	Not Reviewed	DWR
Community	Coastal Plain / Piedmont Small-Stream Floodplain Forest	13957	1	Y	0	2016	Not Reviewed	NAP
Community	Coastal Plain Calcareous Seepage Swamp	4585	1	Y	0	1999	Not Reviewed	PL
Community	Coastal Plain Calcareous Seepage Swamp	11231	1	Y	0	2008	Not Reviewed	PL
Community	Coastal Plain Calcareous Seepage Swamp	12721	1	Y	0	2012	Not Reviewed	LP
Community	Coastal Plain Calcareous Seepage Swamp	13955	1	Y	0	2016	Not Reviewed	NAP
Community	Coastal Plain Depression Swamp (Willow Oak - Red Maple - Sweetgum Type)	11204	1	Y	0	2019	Not Reviewed	NAP
Community	Coastal Plain Dry Calcareous Forest	1102	1	Y	0	2018	Not Reviewed	NAP
Community	Coastal Plain Dry Calcareous Forest	3172	1	N	0	1999	Not Reviewed	PL
Community	Coastal Plain Dry Calcareous Forest	9805	1	Y	0	2008	Not Reviewed	PL
Community	Coastal Plain Mixed Oak / Heath Forest	6168	1	Y	0	1990	High	PL
Community	Coastal Plain River Bluff Xeric Oak Forest	New	1	New	1	New	New	PL
Community	Coastal Plain Seasonal Buttonbush Pond	11206	1	Y	0	2019	Not Reviewed	NAP
Community	Coastal Plain Seasonal Pond (Swamp Tupelo - Overcup Oak Type)	11209	1	Y	0	2019	Not Reviewed	NAP
Community	Coastal Plain Xeric Fluvial Terrace Woodland	14160	1	Y	0	2018	Not Reviewed	NAP
Community	Freshwater Tidal Hardwood Swamp	14817	1	Y	0	2019	High	PL
Community	Northern Coastal Plain Beech - Mixed Hardwood Floodplain Forest	New	1	New	1	New	New	DWR
Community	Southern Piedmont / Inner Coastal Plain Mixed Oak Floodplain Swamp	10927	1	Y	0	2010	Not Reviewed	SP

Element Group	Element Name	EO ID	No. of Unique Surveys	Found? (Y/N)	No. of New SFs	Year Last Observed	Assigned Inventory Priority from Year 1	Ownership
Community	Tidal Freshwater Marsh (Wild Rice - Mixed Forbs Type)	2625	1	Y	0	2019	High	PL
Community	Wind-Tidal Oligohaline Marsh (Big Cordgrass Type)	14257	1	Y	0	2017	Medium	NAP
Community	Wind-Tidal Oligohaline Marsh (Black Needlerush Type)	14258	1	Y	0	2017	Medium	NAP
Community	Wind-Tidal Oligohaline Marsh (Creeping Spikerush - Bull-Tongue Arrowhead Type)	6095	1	Y	0	2017	Medium	NAP
Community	Wind-Tidal Tupelo - Bald Cypress Swamp	14259	1	Y	0	2017	Medium	NAP
Plant	*Aeschynomene virginica*	2947	1	Y	0	2020	Low	NAP
Plant	*Calamovilfa brevipilis*	7991	1	Y	0	2018	None	NAP
Plant	*Carex crus-corvi*	12022	1	Y	2	2015	Not Reviewed	PL
Plant	*Carex decomposita*	7634	1	Y	0	2017	Not Reviewed	NAP
Plant	*Chrysopis gossypina*	9676	2	Y	1	2012	Medium	NAP
Plant	*Cladium jamaicense*	3084	1	Y	0	2017	Medium	NAP
Plant	*Cladium jamaicense*	4325	1	Y	0	2017	High	NAP
Plant	*Cleistesiopsis divaricata*	14534	1	Y	0	2018	None	NAP
Plant	*Coryphopteris simulata*	8628	1	Y	0	1993	High	DOD
Plant	*Coryphopteris simulata*	14238	1	Y	1	2017	Not Reviewed	NAP
Plant	*Cuscuta cephalanthi*	New	1	New	1	New	New	NAP
Plant	*Cypripedium kentuckiense*	9059	1	Y	0	2020	Not Reviewed	NAP
Plant	*Eupatorium maritimum*	11027	2	Y	2	2013	Medium	NAP
Plant	*Eupatorium maritimum*	13102	1	Y	5	2013	Medium	NAP
Plant	*Fimbristylis perpusilla*	6857	1	Y	0	2019	Not Reviewed	NAP
Plant	*Frullania caulisequa*	13985	2	Y	7	1955	High	SP
Plant	*Hydrocotyle bonariensis*	New	1	New	4	New	New	NAP
Plant	*Hydrocotyle bonariensis*	39	1	Y	5	2007	Medium	NAP
Plant	*Hydrocotyle bonariensis*	4131	1	Y	1	1986	Very High	NAP
Plant	*Hymenachne hemitomon*	1784	1	Y	1	1995	High	RT
Plant	*Hymenachne hemitomon*	4838	1	Y	1	1995	None	RT
Plant	*Hymenachne hemitomon*	7816	1	Y	1	1995	High	RT

Element Group	Element Name	EO ID	No. of Unique Surveys	Found? (Y/N)	No. of New SFs	Year Last Observed	Assigned Inventory Priority from Year 1	Ownership
Plant	*Isotria medeoloides*	4072	1	N	0	2017	High	University
Plant	*Isotria medeoloides*	13004	1	Y	0	2020	Not Reviewed	NAP
Plant	*Iva imbricata*	2561	2	Y	0	1990	Very High	NAP
Plant	*Juncus megacephalus*	2951	2	Y	0	2007	Very High	NAP
Plant	*Kalmia angustifolia*	New	1	New	1	New	New	DOD
Plant	*Kalmia carolina*	10336	1	N	0	1981	High	RT
Plant	*Lachnocaulon anceps*	New	1	New	2	New	New	DOD
Plant	*Lilaeopsis carolinensis*	3222	1	Y	1	1992	High	NAP
Plant	*Lilium catesbaei*	7894	1	Y	0	2017	Not Reviewed	PL
Plant	*Lilium pyrophilum*	New	1	New	3	New	New	DOD
Plant	*Lobelia elongata*	256	1	N	0	1995	High	NAP
Plant	*Lobelia elongata*	940	1	Y	0	1999	Medium	NAP
Plant	*Ludwigia alata*	399	1	N	0	2018	High	NAP
Plant	*Ludwigia alata*	6623	1	N	0	1995	High	NAP
Plant	*Ludwigia alata*	10929	1	Y	2	2006	Not Reviewed	NAP
Plant	*Ludwigia brevipes*	6250	3	N	0	2007	Medium	NAP
Plant	*Micranthemum umbrosum*	2611	2	Y	8	2005	Not Reviewed	NAP
Plant	*Mimosa macrophylla*	New	1	New	2	New	New	RT
Plant	*Mimosa macrophylla*	6699	1	Y	1	1993	None	RT
Plant	*Morella pumila*	9845	1	Y	0	2002	None	NAP
Plant	*Oenothera riparia*	14354	1	Y	8	2017	Medium	NAP
Plant	*Ophioglossum petiolatum*	9582	1	N	0	1979	High	RT
Plant	*Paspalum distichum*	10923	1	Y	1	2006	Not Reviewed	NAP
Plant	*Pityopsis microcephala*	14164	1	Y	0	2018	Not Reviewed	NAP
Plant	*Pyxidanthera barbulata*	2750	1	Y	3	2016	None	NAP
Plant	*Pyxidanthera barbulata*	9426	1	N	0	1981	High	NAP
Plant	*Quercus hemisphaerica*	2778	1	Y	2	2013	Medium	NAP

Element Group	Element Name	EO ID	No. of Unique Surveys	Found? (Y/N)	No. of New SFs	Year Last Observed	Assigned Inventory Priority from Year 1	Ownership
Plant	*Quercus incana*	5257	1	N	0	1936	Medium	RT
Plant	*Rhynchospora fascicularis*	2074	2	Y	0	2013	Medium	NAP
Plant	*Schlotheimia rugifolia*	14038	1	N	0	1892	Very High	FWS
Plant	*Scutellaria incana*	2890	1	N	0	1989	High	University
Plant	*Sphagnum macrophyllum*	897	1	Y*	0	1988	Very High	NAP
Plant	*Sphagnum macrophyllum*	14042	1	N	0	1937	None	LP
Plant	*Sphagnum macrophyllum*	15123	1	Y	0	2006	Not Reviewed	FWS
Plant	*Stachys aspera*	654	1	Y	0	2018	High	NAP
Plant	*Stewartia ovata*	6831	1	Y	1	1991	None	PL
Plant	*Stipulicida setacea*	New	1	New	1	New	New	RT
Plant	*Symphyotrichum elliottii*	557	1	Y	0	2008	Not Reviewed	NAP
Plant	*Symphyotrichum elliottii*	3031	1	Y	0	1971	Very High	NAP
Plant	*Tetragonotheca helianthoides*	6544	1	N	0	1972	High	RT
Plant	*Tillandsia usneoides*	7261	1	Y	3	2017	Not Reviewed	NAP
Plant	*Triadenum tubulosum*	New	1	New	1	New	New	PL
Plant	*Trillium pusillum* var. *virginianum*	4088	1	Y	0	1992	Low	PL
Plant	*Trillium pusillum* var. *virginianum*	7792	1	Y	0	2008	Medium	PL
Plant	*Utricularia purpurea*	2536	1	N	0	1991	High	NAP
Plant	*Xyris caroliniana*	1966	1	Y	0	2002	High	NAP

**I.D. pending confirmation*.