

Internship Executive Summary

First Landing State Park first opened in 1936 at Cape Henry in northern Virginia Beach. First Landing is an extremely important ecological and socioeconomic resource. It is one of the most visited state parks in Virginia, provides approximately \$17.9 million in total economic value, offers many recreational activities, and contains a variety of state and globally rare species and natural communities (Park Ranger EDU, 2018; Magnini, 2018). Therefore, the protection of this park in the face of climate change is an issue that should be addressed as soon as possible. The purpose of this report was to identify threats of climate change to First Landing, the vulnerabilities of First Landing to these threats, possible future scenarios, relevant stakeholders, possible options, and to make recommendations to best protect the park.

Climate Change Hazards

- Changes in Surface Temperature and Precipitation Patterns
 - Increase in extreme hydrological droughts (low water supplies) (Strzpek et al., 2010).
 - More intense precipitation events and hurricanes in terms of rainfall amount and wind speed (IPCC, 2015).
 - Areas where hurricanes reach their peak intensity are also migrating north, meaning more intense hurricanes could reach Virginia more often (Rahmstorf et al. 2018)
 - Increase in heat wave frequency and magnitude
- Invasive Species and Migration of Non-native Species
 - Japanese Stilt Grass, Red-eared Sliders (Leicht et al., 2015; Pearson et al., 2015)
 - Non-native species may migrate into First Landing as temperatures increase
- Land Use Changes
 - Increasing interest in outdoor recreation (Monz et al., 2010).
 - Increasing Virginia Beach Population (Weldon Cooper Center for Public Service, 2017)

Vulnerabilities to Climate Change

- Changes in Surface Temperature and Precipitation Patterns
 - Much of First Landing soil is considered sandy soil, which is highly vulnerable to wind and water erosion (Agriculture and Agri-Food Canada, 2014).
 - Virginia and particularly the coast is vulnerable to droughts (Strzpek et al., 2010).
 - Several species are living near the top of their limits for temperature.
- Invasive Species and Migration of Non-native Species
 - Japanese Stilt Grass: can survive in shade, lowers soil acidity (Leicht et al., 2015)
 - Red-eared Sliders: reproduce at earlier age than most turtles, outcompete native turtle species when resources are limited (Pearson et al., 2015)

Possible Future Scenarios

- Global Mean Surface Temperature Scenarios (IPCC, 2015)
 - RCP2.6 (low scenario): 0.3-1.7 °C increase by 2100
 - RCP4.5 and 6.0 (intermediate scenario): 1.1-3.1 °C increase by 2100
 - RCP8.5 (high scenario): 2.6-4.8 °C increase by 2100
- Virginia Beach Population Based on Projections by Weldon Cooper Center for Public Service (2017); 491,054 by 2040
 - Low scenario: population increases slower than projected, possible decrease
 - Intermediate scenario: population projections are relatively accurate
 - High scenario: population projections are much lower than projected

Decision Making: Stakeholders, Agencies, and Legislation

- Virginia Department of Conservation & Recreation, Virginia Department of Game & Inland Fisheries
- First Landing management and staff, Virginia State Governments, Virginia Beach local community
- Virginia Code of Law, Title 10.1. Conservation, Chapter 2.Parks and Recreation, § 10.1-200.1. State park master planning.

Possible Options

- Create new methods of monitoring usage of trails (questionnaires/surveys of visitors, GPS tracking, etc.)
- Establish new management techniques to minimize impacts of recreation activities (mulched rip lines, decrease slopes of hiking trails)
- Further research on possible ecological impacts of invasive and/or non-native species such as red-eared sliders and coyotes
- Develop citizen science program to monitor early warnings of climate change impacts

Recommendations

- Use GPS tracking to more accurately count the number of visitors using trails, which trails they use, and their activity on the trails.
- Commit resources to research on the potential negative ecological effects of coyotes and red-eared slides, as well as research on potential of other migrating non-native species which may soon be established in First Landing.
- Develop a citizen science program to educate the public about climate change impacts, how to monitor these impacts, and report them to First Landing personnel.