Cranberry Bog Habitat, Bear Creek Preserve

Brief Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

This document represents a brief evaluation of climate change vulnerability for cranberry bog habitat in the Natural Lands' Bear Creek Preserve in Luzerne County, Pennsylvania. The following information was based on expert input provided in fall 2022 as well as sources from the scientific literature.

Habitat Description

Bear Creek Preserve, located in Luzerne County, Pennsylvania, includes a cranberry bog complex comprised of two open-canopy wetland areas that cover approximately 15–20 acres in the northeast section of the Dry Land Hill tract (*1*). The cranberry bog is dominated by cranberry (*Vaccinium macrocarpon*) and few-seeded sedge (*Carex oligosperma*), a threatened (S2) species, and is underlain by sphagnum (*Sphagnum* spp.). Other species that may be found within these wetlands include three-way sedge (*Dulichium arundinaceum*), northern blue flag (*Iris versicolor*), and marsh St. John's-wort (*Hypericum virginicum*). The two bog areas are separated by a dense hedgerow of highbush blueberry (*Vaccinium corymbosum*) and winterberry (*Ilex verticillata*), and the bog complex is surrounded by red maple palustrine woodlands comprised of red maple (*Acer rubrum*), white oak (*Quercus alba*), sheep laurel (*Kalmia angustifolia*), and highbush blueberry) (*1*).

Key Climate Vulnerabilities

Moderate Vulnerability

High Confidence

Vulnerability is evaluated by considering the habitat's sensitivity and exposure to various climate and non-climate stressors as well as the habitat's adaptive capacity or ability to cope with these stressors with minimal disruption. The overall vulnerability of the habitat is ranked on a scale from low vulnerability (dark green) to high vulnerability (yellow). The confidence in the vulnerability ranking's accuracy is similarly ranked on a scale from low (light blue) to high (dark blue).

Cranberry and few-seeded sedge are considered highly and extremely vulnerable to climate change, respectively, according to an assessment of priority species in Pennsylvania using the Climate Change Vulnerability Index developed by NatureServe (*2*). This suggests that the cranberry bog in Bear Creek Preserve may be at significant risk of degradation or loss over the coming decades.

Sensitivity & Exposure

Sensitivity *is a measure of whether and how a habitat is likely to be affected by a given change in climate and climate-driven factors, changes in disturbance regimes, and non-climate stressors. By contrast,* ***exposure*** *is a measure of how much change in these factors a resource is likely to experience. Sensitivity and exposure are combined here for a score representing climate change impact, with high (yellow) impact scores corresponding to increased vulnerability and low (dark green) scores suggesting a habitat is less vulnerable to climate change.*

Potential impacts of projected climate changes on this habitat may include:

- Modeling indicates that climate conditions suitable for *V. macrocarpon* will shift northwards, with the majority of the state of Pennsylvania becoming significantly less suitable under both lower- and higher-emissions scenarios (*3*).
- Shifts in bog species composition and habitat structure if drier conditions reduce the level of the water table, which could result in declines in shallow-rooted cranberry plants and accelerate peat decomposition, allowing the encroachment of upland species that ultimately reduce wetland extent (*2*–*4*).
- Possible declines as air temperatures increase, suggested by the observation that both cranberry and few-seeded sedge primarily occur in cooler microsites within their geographic range (*2*). Phenological mismatches may also occur between cranberry and associated insect pollinators, as cranberry flowering times shift 2 days earlier along with each 1°C increase in May temperatures (*5*).
- Dependence of cranberry on ericoid mycorrhizae, which enable the uptake of nitrate from nutrient-limited bog habitats, may increase the vulnerability of this species to climate change (*2*); however, the lack of comprehensive research on these complex dynamics make it challenging to predict specific impacts (*6*).
- Prolonged severe flooding have the potential to cause mortality in sensitive plants (*4*), although wetland-adapted species are typically able to tolerate inundation (*7*).

The cranberry bog may also be vulnerable to non-climate stressors that degrade the bog directly (e.g., heavy recreational use) or alter hydrological regimes to reduce the level of the water table and intensify drying. However, the location of this habitat within the larger protected area of Bear Creek Preserve reduces the likelihood of these impacts and their potential interaction with climate change.

Adaptive Capacity

Adaptive capacity *is the ability of a habitat to accommodate or cope with climate change impacts with minimal disruption. High adaptive capacity (dark green) corresponds to lower overall climate change vulnerability, while low adaptive capacity (yellow) means that the habitat will be less likely to cope with the adverse effects of climate change, thus increasing the vulnerability of the habitat.*

Intrinsic (i.e., inherent characteristics) and extrinsic (i.e., management potential) factors that enhance or undermine the ability of cranberry bog habitats to cope with climate impacts include:

Intrinsic Factors

▲ Within Pennsylvania, cranberry is within the center of its global range (*2*)

▲ Hosts multiple rare species dependent on these wetlands for survival (e.g., bog copper butterfly [*Lycaena epixanthe]*) and holds a high proportion of the state's population of few-seeded sedge (*4*)

▼ Limited extent and isolation increase vulnerability to disturbances and extreme events (*4*)

▼ Restricted to scattered glacial depressions and surrounded by extensive forests, which form natural barriers to plant dispersal (*2*)

▼ High dependence on adequate soil moisture and high water table reduces potential for

▲ Prior evidence of recovery from periodic drought (*4*)

Extrinsic Factors

▲ Presence on protected lands within the preserve reduce the threat of habitat fragmentation and land-use conversion (*4*)

▲ High regulatory support for wetland protection, with multiple agencies and organizations committed to the effort (*4*)

▲ High conservation value due to the presence of rare species within this sensitive habitat (*4*)

resistance and recovery under drier climate futures (*3*, *4*)

▼ Management under very dry conditions would pose a significant challenge, as pumping water to the site would be cost prohibitive (*4*)

Recommended Citation

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Further information on the Natural Lands Climate Adaptation Project is available on the project page (https://ecoadapt.org/goto/Natural-Lands).

Literature Cited

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