



## Meadows Habitat, ChesLen Preserve

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

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

### Habitat Description

ChesLen Preserve, located in Chester County, PA contains terrestrial grassland-mixed meadow habitat in dry upland fields, with the largest meadow spanning about 40 acres (1). Meadow vegetation is comprised of native grasses (e.g., big bluestem [*Andropogon gerardii*], sweet vernal grass [*Anthoxanthum odoratum*], little bluestem [*Schizachyrium scoparium*], broom sedge [*Andropogon virginicu*], Indian grass [*Sorghastrum nutans*]) and wildflowers (e.g., blue lupine [*Lupinus angustifolius*], butterfly weed [*Asclepias tuberosa*], common milkweed [*Asclepias syriaca*], and St.-John's-wort [*Hypericum spp.*]). Exotic herbaceous plants such as Canada thistle [*Cirsium arvense*], bedstraw (*Galium spp.*), and daisy fleabane (*Erigeron philadelphicus*) are also present (2). Segments of grassland are also scattered throughout the edges of the preserve's agricultural areas. The preserve's meadows and grasslands provide habitat for a variety of pollinators and birds (3).

### 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).

### 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:

- Soil water deficit in the preserve's meadow habitats, particularly during periods of drought, due to warmer temperatures that facilitate increased plant transpiration (1). Drier soils could prove challenging for wildflower species with shallow root systems that cannot access water stored deep in the soil. Over time, some plant species may experience distributional shifts as a

response to drying conditions; however, these shifts may be difficult for species that depend on specific hydrologic patterns and soil types (4).

- Earlier flowering and seeding of some meadow plants due to warmer temperatures earlier in the year. This could lead to discrepancies between plant species flowering time, pollen and nectar availability, and the needs of insect and bird species that rely on these plants (5, 6).
- Increased topsoil erosion, spread of unwanted pollutants or runoff from nearby roads and agricultural fields, the introduction of invasive species as heavy rain events and flooding become more frequent (1, 4).
- Increased variability in annual precipitation amounts may favor generalist species, making it difficult for specialized plants to survive, potentially impacting the habitat's biodiversity (6). However, increased precipitation and flooding also have the potential to replenish groundwater and transfer nutrients into meadow habitats.
- Increased instances of wildfire could benefit meadow environments by mitigating forest encroachment, potentially reducing the need for habitat maintenance through mowing and prescribed burns (1).

Meadow habitats within the preserve are vulnerable to non-climate stressors that spread pollutants or degrade water quality (e.g., through runoff from roads and overspray of herbicides from agricultural fields) or degrade the integrity of the meadow areas via activities such as recreation (1). Land-use conversion (e.g., converting meadows into agricultural lands or converting lands surrounding the preserve into residential or commercial lands) may also limit species movement and dispersal in response to changing climate conditions (1).

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## 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 meadow habitats to cope with climate impacts include:

### *Intrinsic Factors*

- ▲ Provide critical habitat for birds and pollinators (1, 3), and could serve as climate refugia and/or corridors for wildlife
- ▲ Protect soil by filtering runoff, contributing to enhanced water quality in the preserve (1, 3)
- ▲ Fairly continuous habitat within the preserve
- ▼ Surrounding agricultural lands, trails, and nearby roadways could be barriers to species dispersal/movement (1)
- ▼ Somewhat limited refugia outside of the meadow habitat of the ChesLen Preserve for bird and pollinator species
- ▼ Tree encroachment could impact habitat ecological integrity, species composition, and function as a critical habitat for bird and pollinator species

### Extrinsic Factors

- ▲ Generally high public support due to aesthetics and the value of these habitats are carbon sinks (1)
  - ▲ High regulatory and societal support for management via government grants and programs that support grassland conservation and planting (1)
  - ▲ Management strategies already underway include control of invasive species, planting wildflower seeds in select areas, removing obsolete hedgerows, and mowing after birds have fledged (1)
  - ▼ Potential conflicts of interest for this habitat include the desire to convert meadow/grassland habitats into agricultural lands (1)
  - ▼ Possible challenge in having the necessary staff capacity and funding to continue implementing the management strategies needed to maintain/conservate the habitat under changing conditions
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## 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>).

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## Literature Cited

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