U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: ***Boltonia montana***

COMMON NAME: **Mountain Doll's Daisy**

LEAD REGION: **Department Region 1, North Atlantic-Appalachian**

DATE INFORMATION CURRENT AS OF: **2/2020**

STATUS/ACTION

X Species assessment - determined either we do not have sufficient information on threats or the information on the threats does not support a proposal to list the species and, therefore, it was not elevated to Candidate status

___ Listed species petitioned for uplisting for which we have made a warranted-but-precluded finding for uplisting (this is part of the annual resubmitted petition finding)

___ Candidate that received funding for a proposed listing determination; assessment not updated

___ New candidate

___ Continuing candidate

___ Listing priority number change
Former LPN: ___
New LPN: ___

___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on taxonomy, or biological vulnerability and threats, to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

Date when the species first became a Candidate (as currently defined): **n/a**

Petition Information:
___ Non-petitioned
_X_ Petitioned; Date petition received: **4/20/10; 404 aquatic species**
90-day substantial finding FR publication date: **9/27/11**
12-month warranted but precluded finding FR publication date: **n/a**

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? **No**
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? **N/A**
c. Why is listing precluded? **N/A**

PREVIOUS FEDERAL ACTIONS:
On April 20, 2010, we received a petition from the Center for Biological Diversity, Alabama Rivers Alliance, Clinch Coalition, Dogwood Alliance, Gulf Restoration Network, Tennessee Forests Council, and West Virginia Highlands to list 404 aquatic, riparian, and wetland species, including *Boltonia montana* (referred to by the common names "Doll's-daisy" and "doll's daisy" in the petition), as endangered or threatened species under the Act. On September 27, 2011, we published in the *Federal Register* (76 FR 59836) a 90-day finding in which we announced that the petition contained substantial information indicating listing may be warranted for the species. This document constitutes our 12-month finding on the April 20, 2010, petition to list *B. montana* under the Act.

ANIMAL/PLANT GROUP AND FAMILY:
Plants; Family Asteraceae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE:
New Jersey, Pennsylvania, Virginia

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:
New Jersey, Virginia

LAND OWNERSHIP
In New Jersey, there are 21 historical population sites. Five populations are on land owned or managed by the New Jersey Department of Environmental Protection (Swartswood State Park and White Lake Wildlife Management Area), 6 populations are on private property owned or managed by a conservation non-governmental organization (NGO; Muckshaw Ponds Preserve and Pleistocene Cave Sinkholes), and the remaining 10 populations are privately owned.
In Virginia, there are 22 historical population sites. Seven populations are on U.S. Forest Service land (George Washington and Jefferson National Forest), and the remaining 15 populations are on private property. In Pennsylvania, historical records indicate two specimens collected from the banks of the Susquehanna River near Dauphin, Pennsylvania. More precise information is not available and therefore location of the historical sites cannot be determined; there is no evidence of extant populations in Pennsylvania.

LEAD REGION CONTACT
Martin Miller, Chief, Division of Endangered Species, 413–253–8615

LEAD FIELD OFFICE CONTACT
Ron Popowski, Supervisory Fish and Wildlife Biologist, Ecological Services, 609–385–4515

BIOLOGICAL INFORMATION

The Species Status Assessment report (SSA report) for the *Boltonia montana* is a summary of the information assembled and reviewed by us and incorporates the best scientific and commercial information available for this species. The following sections represent a summary of the biological information provided in the SSA report. For more detailed information on the species' description, taxonomy, life history, range, species needs, factors influencing the species, current and future conditions, and uncertainties inherent in the calculations, please refer to the SSA report (Service 2020, entire).

Species Description

Boltonia montana is described as a perennial (i.e., living for 2 or more years) herb standing 1.2 to 15 decimeters (dm) (4.7 to 59 inches (in)) tall (Townsend and Karaman-Castro 2006, p. 874). Its habit is generally erect, although often the lower stems remain prostrate (lying flat on the ground). Plant stems are glabrous (smooth), light to yellow-green in color, and ribbed with yellow or golden striations. The upper stem has a branching structure with compound racemes (clusters of flowers), often arranged to appear as a convex or flat-topped cluster.

The disk flowers (the tiny florets that make up the “eye” of Asteraceae flower heads) are pale yellowish green to pale yellow white, and the ray flowers (the petals or modified leaves that surround the disk) are pale lavender to pinkish (Townsend and Karaman-Castro 2006, p. 874). The leaves are smooth, generally broad and rounded at the end, and taper to the base. They are dark green or blue green with whitish or reddish color at their base and have prominent, lighter colored midribs. Basal (lower) leaves are 1.0 to 17.5 centimeters (cm) (0.4 to 6.9 in) long and 0.1 to 2.0 cm (0.04 to 0.8 in) wide and can be arranged alternately or in a rosette. The cauline (upper) leaves are 2.7 to 11.0 cm (1.1 to 4.3 in) long and 0.5 to 1.9 cm (0.2 to 0.7 in) wide, though sometimes smaller leaves cluster at stem nodes.

Taxonomy

The species’ currently accepted taxonomic classification is as follows:

- Phylum: Plantae
- Division Magnoliophyta (flowering plants)
- Class: Magnoliopsida (dicotyledons)
- Subclass: Asteridae
- Order: Asterales
- Family: Asteraceae

- Genus: *Boltonia*
- Species: *montana*

Habitat

Boltonia montana is known primarily from isolated depressional ponds subject to fluctuating water levels. In New Jersey, the species occurs in calcareous sinkhole ponds ("dolines") in the Kittatinny Valley of the Appalachian Valley and Ridge physiographic province (Walz et al. 2001, pp. 1-1–1-5). In Virginia, the species is known primarily from similar "Shenandoah Valley sinkhole ponds," located along the western base of the Blue Ridge Mountains, also in the Valley and Ridge physiographic province (Fleming and Van Alstine 1999, pp. 67–69). The only information available regarding the species' habitat in Pennsylvania indicates specimens were collected from riverine areas along the Susquehanna River (Townsend and Karaman-Castro 2006, pp. 877, 881).

The bedrock geology underlying *Boltonia montana* sites in New Jersey and Virginia is primarily dolomite and limestone. In New Jersey, surface soils at *B. montana* sites are described as calcareous silt loams to silty clays, and occasionally silt marl or peat, with pH ranging from 6.2 to 7.8 (lightly acidic to mildly alkaline) (Townsend and Karaman-Castro 2006, p. 880). In Virginia, site soils are described as infertile clays or clay loams with pH ranging from 3.9 to 4.0 (acidic), though early (1936) collections from the South River mention "sandy, wet soil" (Townsend and Karaman-Castro 2006, pp. 878, 881). In both the New Jersey and Virginia metapopulations, some sites had soils with elevated levels of aluminum, calcium, or magnesium (Townsend and Karaman-Castro 2006, pp. 878–881).

The size of population sites in New Jersey range from about 0.1 to 8.0 hectares (ha) (0.3 to 19.8 acres (ac)), with the average size being about 2.6 ha (6.5 ac). In Virginia, population sites ranged from about 0.1 to 5.8 ha (0.3 to 14.3 ac), with the average size being about 1.1 ha (2.7 ac).

Life History

Boltonia montana can reproduce both sexually from achenes (i.e. a dry, one seeded fruit) and vegetatively by the production of "basal offsets," the formation of advantageous root systems at stem nodes that become independent of the parent plant (Townsend and Karaman-Castro 2006, p. 876; Townsend 2013, p. 5). Individual *B. montana* plants behave as perennials and can persist over multiple growing seasons by producing basal offsets that establish as independent rosettes before the parent plant flowers and dies in the fall. The new rosettes, which overwinter then bolt and flower the following season, are genetically identical to the parent. Therefore, under favorable conditions (e.g., freedom from competition, seasonal water level drawdowns) vegetative propagation can result in genetic individuals persisting at a site for years (Schwegman and Nyboer 1985, p. 114; Baskin and Baskin 2002, p. 17).

Flowering and achene production occur in the late summer and early fall, typically August to mid-October (although during dry years or in dry micro habitats, some plants may flower in July). The flower morphology of *B. montana* suggests that, like other members of the genus, it is

reliant on generalist insect pollinators for fertilization, including bees, flies, gnats, and wasps. The species is a prolific seed producer, with mature plants producing up to 50,000 achenes. *Boltonia montana* appears to form a seedbank, with seeds likely remaining viable in the environment for 1 to 7 years, depending on soil conditions. The seeds exhibit an annual dormancy/non-dormancy cycle that allow them to germinate at any time from late March to late October.

The presence or dominance of reproductive lifeform (i.e., vegetative rosettes or seedlings) may vary in response to local environmental conditions (Mettler-McClure 1997, p. 6; Smith and Keevin 1998, pp. 70, 76–77; Smith and Mettler 2002, p. 114; Townsend and Karaman-Castro 2006, pp. 876–877). Following extended periods of inundation, a local population may be composed solely of new plants originating from the seedbank or perhaps a combination of new plants from the seedbank and vegetative rosettes that survive from the previous season's adult plants. Conversely, following extended periods of drawdown, seedling establishment may be low and local populations may be dominated by vegetative rosettes or adult plants that originated from vegetative rosettes. The best available information suggests periodic site inundation serves to limit competing vegetation and is a disturbance mechanism required for *Boltonia montana* to persist at a site.

Historical and Current Range/Distribution

The best available data indicate that *Boltonia montana's* historical range is limited to 3 disjunct areas in New Jersey, Pennsylvania, and Virginia (Figure 1). For purposes of our analyses, we consider each pond where the species has been confirmed to be a "population." Some of these populations are in close proximity to each other, potentially allowing for genetic connectivity; we refer to these groups as "population areas." We are uncertain of any relationship between population areas themselves or between other individual isolated populations, but herein we refer to the collective groups of populations in each state as a "metapopulation" even though a strict definition of the term may not apply. In New Jersey, the 21 historical population sites are located within an area of about 144 square kilometers (km^2) (56 square miles (mi^2)) near the town of Newton. At 2 of the New Jersey sites, the historical data indicate *B. montana* populations with greater than 10,000 individuals; 1 of these sites was estimated to have more than 710,000 plants during a survey in July of 1988. Four sites had populations estimated to be in the thousands of plants, 2 sites had populations estimated to be in the hundreds, and 6 sites had populations estimated to be less than 100 plants (with three of these in the single digits). There are no historical population estimates for the remaining New Jersey sites.

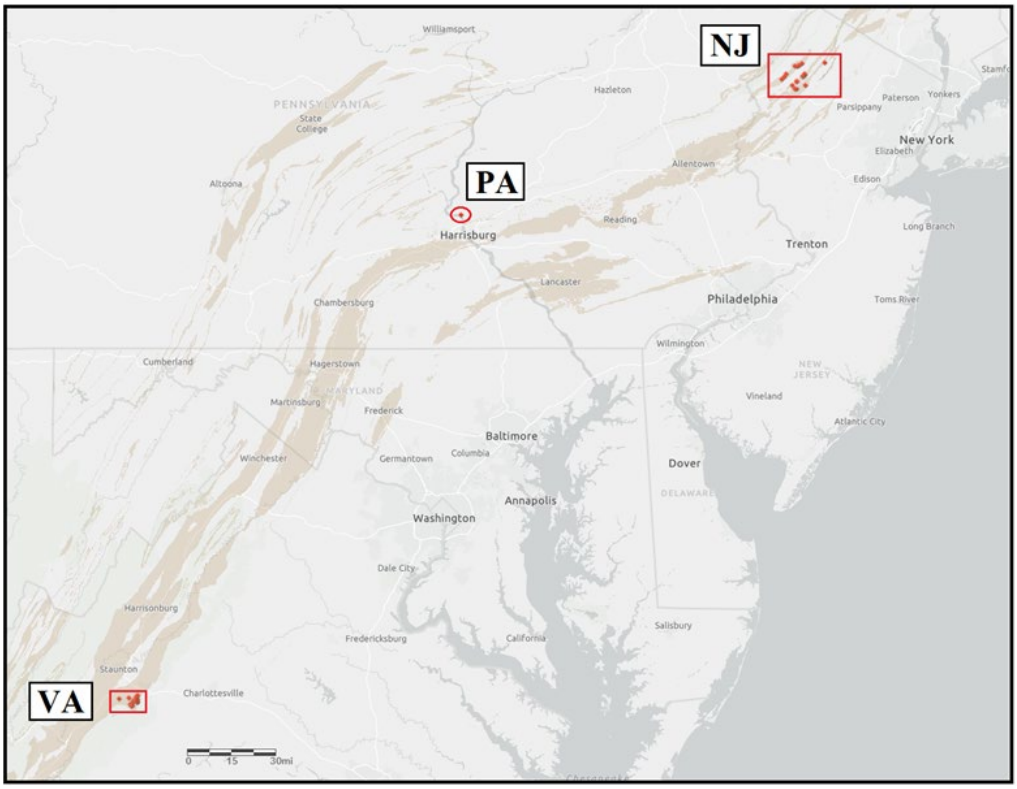

Figure 1. Distribution of *Boltonia montana* metapopulations (indicated in red). The Pennsylvania metapopulation is historically extirpated.

Based on the best available information, *Boltonia montana's* current (2010 to 2019) distribution in New Jersey is similar to its historical condition, though current survey data are sparse. The species was confirmed at 5 sites, with thousands of plants estimated at 1 site, about 250 plants at a second site, and 8, 1, and 17 plants reported at 3 other sites. However, there is uncertainty regarding its status at most population sites. To help resolve this uncertainty in a consistent and systematic manner, we developed criteria that relies on the available survey data and habitat conditions to categorize *B. montana* populations as presumed extant or presumed extirpated. Based on these criteria, we presume the species is extant at 14 sites and extirpated at 2 sites.

In Virginia, the 22 population sites are within an area of about 34 km^2 (13 mi^2) in western Virginia, southwest of the Town of Waynesboro. Nineteen of the sites are historical while 3 population sites in this area were determined after 2009. The 3 sites identified during the current period are within the area defined by the historical occurrences and, therefore, do not represent an increase in the species range. The historical data indicate 7 sites with populations in the hundreds and 6 with less than 100 plants (2 of these numbered in the single digits). Six historical sites in Virginia had no estimated population numbers available.

Current surveys (2010 to 2019) confirmed the species at 11 of 22 sites, with 5 reportedly supporting "healthy" or "robust" populations with plant numbers in the 100s to 1,000s. Two populations were described as having expanded slightly in area from earlier observations and three had fewer plants than indicated by previous surveys. The species was not confirmed at 11

sites due to no access provided or excessive water levels; it is presumed extant at 6 of these sites and presumed extirpated at 5 sites based on the criteria discussed above.

Except for two sites, all of the Virginia population sites are in relatively close proximity to each other (generally within about 1 km (0.6 mi)). While some population sites in New Jersey are clustered together, in general, the species appears to be more widely dispersed in this metapopulation.

In Pennsylvania, the presumption of a historical *Boltonia montana* metapopulation is based on two specimens collected in 1864 and 1865 from the banks of the Susquehanna River near Dauphin, Pennsylvania (Townsend and Karaman-Castro 2006, pp. 877, 881). Because there is no other information available for these occurrences, including the specific location of the collections, numbers of plants present, or other habitat characteristics, we are unable to ascertain the historical distribution or abundance of the species in this presumed metapopulation. These are the only records of the species in the state; subsequent surveys by the Pennsylvania Natural Heritage Program have failed to re-confirm the species (Goad 2020, p. 2).

State Listing Status

The State of New Jersey lists *Boltonia montana* as an endangered plant species (NJAC 2013, p. 5); however, the governing statute does not afford any protections to such listed species. The Commonwealth of Virginia also lists it as an endangered species. Under the governing law (Virginia Administrative Code 2013, p. 1), it is unlawful to "dig, take, cut, process, or otherwise collect, remove, transport, possess, sell, offer for sale, or give away" *B. montana* occurring in the wild, "other than from such person's own property."

Population Structure

The population structure of *Boltonia montana* has not been studied. The species is known primarily from isolated depressional ponds, which we consider a "population." The distribution of the species in Virginia (including some historical observations in riparian areas) and local stream morphology suggests surface water flows occasionally disperse seeds; therefore, the population structure in Virginia may exhibit metapopulation characteristics. The species' distribution and the regional geomorphology in New Jersey does not suggest a clear connection between most of those populations, therefore the overall population structure in New Jersey is less clear. For our analysis, we also used site proximities and in some cases watershed boundaries to group *B. montana* populations into "population areas."

SPECIES NEEDS

We assessed the best available information to identify the physical and biological needs to support individual fitness at all life stages for *Boltonia montana*. The following sections summarize the individual, population, and species needs for the daisy. Full descriptions of all needs are available in chapter 2 of the SSA report (Service 2020, pp. 24–27).

Species (Resource) Needs

At the scale of the individual *Boltonia montana* plant or population site, we identified soil, water, sunlight, pollinator services, and a suitable annual temperature regime, as interrelated resource needs. At the metapopulation scale, it is likely the species requires some degree of habitat connectivity to maintain viability; however, there is significant uncertainty regarding the degree of connectivity that may be necessary between population sites. We assume there is no natural connectivity between the two extant metapopulations in New Jersey and Virginia.

THREATS

We define "threat" as any action or condition that is known to or is reasonably likely to negatively affect individuals of a species. This includes those actions or conditions that have a direct impact on individuals, as well as those that affect individuals through alteration of their habitat or required resources. The mere identification of "threats" is not sufficient to compel a finding that listing is warranted. Describing the negative effects of the action or condition (i.e., "threats") in light of the exposure, timing, and scale at the individual, population, and species levels provides a clear basis upon which to make our determination. In determining whether a species meets the definition of an "endangered species" or a "threatened species," we consider the factors under section 4(a)(1) of the Act and assess the cumulative effect that the threats identified within the factors—as ameliorated or exacerbated by any existing regulatory mechanisms or conservation efforts—will have on the species now and in the foreseeable future.

Based on the life history and resource/habitat needs of *Boltonia montana*, we identified the primary threats/stressors as falling into two broad categories: habitat modification and changing climate conditions (Figure 2). The following sections summarize these two threats, including the associated sources for habitat modification (from development, agriculture, off-road vehicle use, altered surface hydrology, and groundwater withdrawals), that are resulting in rangewide effects on *B. montana* or its habitat. We have analyzed not only individual effects of each threat on the species, but also their potential cumulative effects. After identifying and evaluating the impacts of present threats on the species, we then considered how such threats are likely to impact the species in the foreseeable future. Our assessment in the SSA of the current and future conditions of the species encompasses and incorporates the threats individually and cumulatively. Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but also to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Full descriptions of each of the threats and their sources, including examples across the species range where specific threats are impacting the species or its habitat, potential catastrophic events, and the existing regulatory mechanisms or conservation efforts are available in chapter 4 of the SSA report (Service 2020, pp. 39–50).

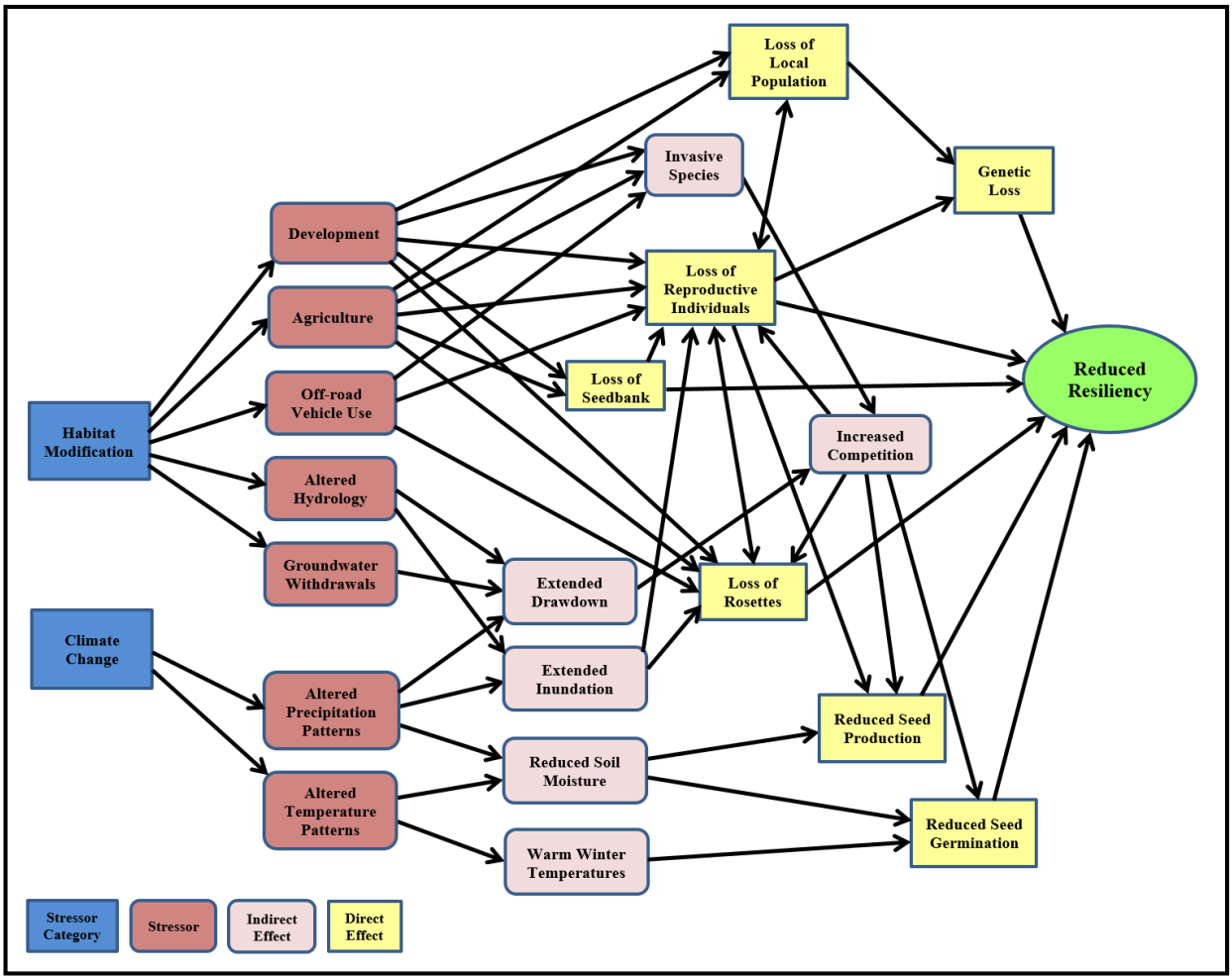

Figure 2. Factors affecting the resiliency of individual *Boltonia montana* populations. Connecting lines indicate stressor-effect relationships, but not the potential magnitude of the relationships.

Habitat Modification—Development

This threat or stressor includes those activities associated with the direct physical disturbance, modification, or destruction of the habitats required by *Boltonia montana*. These include land-disturbing activities such as the filling of wetland areas for road or construction purposes; trash dumping; conversion of depressional areas for agriculture, silviculture, pasture, or turf; or the dredging or excavation of depressional areas to create deeper pond habitats for farm or recreational uses. The effects of such physical disturbances include the loss of suitable habitat, the destruction of individual *B. montana* plants, and the elimination of any viable seed bank (Van Alstine 2019, entire; Walz 2019a, pp. 5–6). Other activities associated with development that do not necessarily involve disturbance of the soil or substrate are included in this category. One example is the mowing of depressional areas during the growing season, which may damage or kill adult plants and reduce or eliminate sexual reproduction in the population. Additionally,

human development increases the likelihood that invasive plant species are introduced into *B. montana* sites.

The best available information indicates that most *Boltonia montana* ponds were historically subject to disturbance caused by land conversion to agriculture, road construction, and other activities. At many populations, development pressure continues to occur; for example, surveys and aerial imagery indicate six Virginia population sites have been recently modified or disturbed, two sites have been mowed, and nonnative species have been planted near two sites. In New Jersey, trash and debris is washing into one site from an adjacent road, an invasive plant has invaded four ponds, and one site was mowed when water levels were low in 2016.

Habitat Modification—Agriculture

We identified several activities associated with agricultural land use (other than the direct conversion of habitat, discussed above) that may be detrimental to *Boltonia montana*. These stressors include livestock pasturing, exposure to agricultural chemicals, and excessive groundwater withdrawals (which we discuss separately below). Livestock (e.g., cattle, sheep) have the potential to affect *B. montana* or its habitat in a number of ways (Morris and Reich 2013, pp. 17–18). Hooved animals treading in depressional ponds can physically damage or kill adult plants or rosettes. Additionally, treading in wetlands causes soil disturbance that may reduce seed bank viability and increase water turbidity, thereby reducing the growth or survival of submerged *B. montana* rosettes. The cultivation of herbicide-treated crops in areas adjacent to *B. montana* sites increases the likelihood that plants or rosettes are exposed to and affected by herbicide spray drift, with potential population-level effects (Schmolke et al. 2018, pp. 1,552–1,554).

Recent surveys and aerial imagery indicate recent livestock grazing at two Virginia sites and crop production or haying at or adjacent to six other sites. In New Jersey, aerial imagery indicates agricultural cultivation near two populations. Because many privately owned *B. montana* population sites are located in a mixed low density rural residential/agricultural setting, it is likely agriculture will remain a stressor to some populations.

Habitat Modification—Off-road Vehicle Use

The operation of off-road vehicles at *Boltonia montana* sites can damage or kill adult plants and rosettes, disturb soils and increase water turbidity thus reducing the growth and survival of submerged rosettes, disturb the seedbank, and damage or kill overwintering rosettes (Ouren et al. 2007, pp. 25–26; Switalski and Jones 2012, pp. 16–17). Additionally, off-road vehicles are a potential vector of invasive plant species into *B. montana* ponds (Ouren et al. 2007, pp. 11–12).

Recreational off-road vehicle operators often seek out wet, muddy areas to ride in, and aerial imagery and survey reports indicate recent off-road vehicle use at six Virginia *B. montana* sites (U.S. Forest Service 2019, p. 16; Van Alstine 2019, pp. 10–16). While we presume off-road vehicle disturbance damages or kills growing *B. montana* plants or disturbs the seed bank, there have been no studies confirming the degree to which off-road vehicle use affects *B. montana* populations.

Habitat Modification—Altered Surface Hydrology

Surface modifications such as the construction of berms, levees, ditches, swales, or land grading can change patterns of overland water flow, possibly affecting water levels and soil moisture at some *Boltonia montana* sites (Jackson et al. 2014, pp. 58–60; McCauley et al. 2015, pp. 8–12). Because the species relies on seasonally fluctuating water levels to maintain suitable habitat conditions and limit competition, such changes to surface water inflows or discharges could be detrimental to individual populations. Survey reports from Virginia indicate several *B. montana* sites have had their hydrology modified to varying degrees (Van Alstine 2019, pp. 10–16). Aerial imagery indicates five New Jersey population sites are adjacent to roads or railroads that likely altered the local hydrology; however, there is no information available documenting effects to *B. montana* at those sites.

Habitat Modification—Groundwater Withdrawals

Boltonia montana relies on fluctuating water levels to reduce competing vegetation at occurrence sites. The best available information suggests water levels in most *B. montana* ponds is closely tied to local groundwater fluctuations; however, this linkage has only been studied at several sites in New Jersey (Walz et al. 2001, pp. 5-3–5-8). Therefore, excessive groundwater withdrawals that lower the water table near occupied *B. montana* sites could affect the conditions required by the species. Ongoing changes in the climate (discussed below) may also alter groundwater conditions. For example, extended drought conditions could simultaneously decrease aquifer recharge rates and increase the demand for groundwater pumping for agricultural and municipal purposes. In both Augusta County, Virginia, and Sussex County, New Jersey, groundwater makes up more than 90 percent of the water used (Maynard 2012, p. 26; Sussex County New Jersey 2019, p. 15). In Augusta County, Virginia, total water demand is predicted to increase from about 5.9 million gallons per day in 2017 to about 9.5 million gallons per day in 2037 (Central Shenandoah Planning District Commission 2011, pp. 5-1–5-3); similar data are unavailable for New Jersey. There are no studies directly linking excessive groundwater withdrawals to *B. montana* population sites; however, it is reasonable to conclude that the species could be negatively affected by this stressor.

Climate Change

The best available information indicates temperature and precipitation patterns within the range of *Boltonia montana* have changed since the late 1800s and are predicted to continue to change in the future (National Oceanic and Atmospheric Administration 2019, entire). In general, temperatures are warming, and precipitation is increasing (Romero-Lankao et al. 2014, p. 1,452). These changes can affect wetland hydrology and community structure; however, models suggest significant response variability by wetland type and landscape position (Burkett and Kusler 2000, entire; Wardrop et al. 2019, entire).

There have been no studies of the response of *Boltonia montana* or its habitat to the observed or predicted changes in climate and there is significant uncertainty regarding the species' response to these changes, regardless of the particular climate model considered (e.g. RCP 6.0, RCP 8.5).

Therefore, we do not directly assess the potential effects of climate change to the population sites, but instead consider their modeled relative condition (compared to each other currently and under future scenarios) as an indicator of their capacity to persist in light of changing climate conditions.

CURRENT CONDITIONS

We used the conservation principle of 3Rs—resiliency, redundancy, and representation—to summarize the current condition of *Boltonia montana*. Data sufficient to directly assess the resiliency of the various populations are sparse; therefore, we developed an assessment model using six surrogate metrics to compare the resiliency of population sites with each other, both currently and under plausible future scenarios (Table 1). We also estimated the resiliency of each population area based on the survey data and condition of the individual population sites. Specifically, we considered the site characteristic scores for the extant populations within each population area, the total number and size of extant populations in each area (i.e., redundancy within the population area), and other factors such as observed population size, specific local stressors, and the certainty of the available survey data. We assessed the species' redundancy and representation based on the distribution of the species across its range. Using this methodology, 15 *B. montana* populations (10 in New Jersey, 5 in Virginia) are estimated to have high resiliency, 15 populations (8 in New Jersey, 7 in Virginia) have moderate resiliency, and 6 have low resiliency (1 in New Jersey, 5 in Virginia). As discussed above, at least seven historical populations (two in New Jersey, five in Virginia) are presumed extirpated.

Boltonia montana is extant in two geographically isolated metapopulations, one in New Jersey and one in Virginia; a Pennsylvania metapopulation is presumed historically extirpated. Within the New Jersey metapopulation, the species is extant (or presumed extant) at 19 of 21 individual population sites. In Virginia, the species is extant (or presumed extant) at 17 of 22 population sites. Therefore, we consider *B. montana* to currently maintain moderate to high redundancy in the New Jersey metapopulation and moderate redundancy in the Virginia metapopulation.

There are no available studies on the genetics or other characteristics with which to determine variation between *Boltonia montana* populations or metapopulations. The two extant metapopulations are geographically isolated from each other by approximately 500 km (310 mi) and have certain differing habitat characteristics (e.g., community associates, soil chemistry, temperature fluctuations). Therefore, we assess the species' representation based on its status in each metapopulation. Because the species currently maintains representation in two of three known metapopulations (at the northern and southern extremes of its range), we conclude that representation is currently considered adequate.

Table 1. Criteria for scoring individual *Boltonia montana* site metrics.

Pond Size	
Large (greater than 5 Ha (12.4 ac)).	1
Medium (0.5 to 5 Ha (1.2 to 12.4 ac)).	0
Small (less than 0.5 Ha (1.2 ac)).	-1

Disturbance	
No reported or visable evidence of physical disturbance or invasive plant species.	1
Reported or visable evidence of historical disturbance or invasive plant species.	0
Reported or visable evidence of current disturbance or invasive plant species present.	-1

Hydrology	
Water levels appear to fluctuate naturally.	1
Water levels appear to fluctuate with altered periodicity and/or magnitude.	0
Water levels do not appear to fluctuate.	-1

Landscape Setting	
Watershed forested with little or no development.	1
Watershed includes residential, commercial, or agricultural development, but the pond site is buffered.	0
Watershed mostly residential, commercial, or agricultural development and the pond site is not buffered.	-1

Proximity	
Population located within about 0.5 km of more than one other population.	1
Population located within about 0.5 km of one other population.	0
No other populations within about 0.5 km.	-1

Conservation Measures	
Area managed for land or habitat conservation.	1
Unmanaged natural area or area managed for outdoor recreational use.	0
Unmanaged residential, commercial, or agricultural area.	-1

Trends and Population Estimates

The best available information is not sufficient to determine potential trends in *Boltonia montana* abundance. For many population sites, the available survey data are limited to "presence/absence," and where population estimates are provided, the data are infrequent and generally incomparable because survey methodologies were not documented. Therefore, it is unknown if *B. montana* population numbers are changing over time at the various population sites. The species is presumed extirpated from 8 (18 percent) of 44 known sites[1].

[1] We note here that the two Pennsylvania collections are treated as a single extirpated population site.

Unknowns and Assumptions

- *Boltonia montana* plant numbers can fluctuate widely year-to-year, and survey data are generally sparse; therefore, there is uncertainty regarding the species' population size, or trends at the various population sites.

- While the best available information suggests a link between the species' needs and the identified stressors, there are no scientific studies documenting the magnitude or significance of the stressor effects to the species. This uncertainty is especially concerning in regards to the effects of climate change, which has the potential to affect the species across its range.

- In the absence of current survey data for some populations, we assume that, if a historically known population site maintains habitat conditions conducive to the species, the population is presumed extant. If this assumption is incorrect, we may be overestimating the current condition of the species; conversely, if *B. montana* populations exist at unknown/new sites that have not been surveyed, we may be underestimating the species' current condition.

- There is uncertainty surrounding the potential effects some stressors may have already had on the species. This may result in our not knowing or in underestimating the importance of some species needs. For example, while the species is generally known from isolated sinkhole ponds, it is possible that the various populations were originally more connected on the landscape than the historical distribution information suggests. Therefore, we may be underestimating the significance of habitat fragmentation as an ongoing threat to the species.

FUTURE CONDITIONS

In the SSA, we forecasted *Boltonia montana's* response to plausible future scenarios of environmental conditions and conservation efforts by modeling three future scenarios that are representative examples from the potential range of plausible scenarios. The future scenarios project the threats into the future and consider the impacts those threats could have on the daisy's viability in conjunction with the predicted environmental conditions and conservation efforts. Similar to the current condition analysis, the future condition analysis is described in terms of resiliency, redundancy, and representation. It is important to note that the scenarios described in the SSA report represent only three possible future conditions for the species, and that uncertainty is inherent in this and any risk assessment. When assessing the future, viability is not a specific state, but rather a continuous measure of the likelihood that the species will sustain populations/colonies over time.

We modeled the potential future condition of *Boltonia montana* under three plausible scenarios. We use the results to describe the species' condition using the 3Rs in about the year 2050. We selected this 30-year timeframe because, given the historical pace of change, it is likely that our modeled changes in land use, development, or conservation measures will manifest their effects

on *B. montana* populations within that timeframe. Additionally, uncertainties surrounding our assumptions will increase past that point in time.

Under scenario 1, we project no significant changes are made to the activities currently affecting the extant *Boltonia montana* population sites. We consider extant population sites currently with high and moderate resiliencies to be at low risk of extirpation within the next 30 years. The exception to this assumption is at population sites where invasive plant species currently occur. Under this scenario, we assume the growth and spread of invasive plants will increase competitive pressure on these populations and lower their resiliency over the next 30 years.

Under scenario 2, we project that public and private land managers will implement various measures that result in the protection or enhancement of *Boltonia montana* habitat, where feasible. The results modeled under this scenario represent perhaps the best possible outcome for the species. Under this scenario, we assume agencies and organizations have the resources necessary to implement these efforts, landowners are willing to make land use decisions supportive of *B. montana* conservation, and the proposed conservation measure actually increase the species' resiliency.

Under scenario 3, we assume no new conservation measures are implemented and habitat disturbances increase at most privately owned population sites. These disturbances result from plausible increases in residential development, agricultural intensity (e.g., livestock grazing, crop production), forest clearing, and other disturbances associated with human development. Additionally, under this scenario, we project that by 2050, invasive plant species spread from ponds where they have already been identified into adjacent sites, increasing competitive pressure on these populations.

FUTURE 3Rs

Resiliency

Under scenario 1, it is likely that by 2050, invasive species competition will continue to affect several *Boltonia montana* populations in the Swartswood and Muckshaw population areas in New Jersey; however, our model does not project a significant loss of resiliency in these areas. Physical disturbances are projected to continue affecting Virginia populations in the Campbells and Lyndhurst population areas, but again, under this scenario their resiliencies are not predicted to change significantly from the current condition (Table 2).

Under scenario 2, in New Jersey, invasive species control projects in the Swartswood and Muckshaw population areas are projected to increase the resiliencies of five populations, and the implementation of conservation land management in the Greendell population area is projected to increase the resiliencies of three populations. In Virginia, hydrological improvements, removal of disturbances, and conservation land management are projected to increase the resiliencies of 14 populations in the Maple Flats, Campbells, and Lyndhurst population areas.

Under scenario 3, in New Jersey, the spread of invasive species and increased habitat disturbances are projected to lower the resiliencies of two populations in the Swartswood and

Muckshaw population areas, and increased habitat disturbance is projected to lower the resiliencies of three populations in the Greendell population area. In Virginia, increasing land-use intensity and habitat disturbances are projected to lower the resiliencies of five populations. We project this will significantly lower the resiliencies of the Greendell, Campbells, and Lyndhurst population areas.

Table 2. Summary of current and projected *Boltonia montana* population area resiliency.

Population Area		Curr. Cond.	Future Scenario		
			1	2	3
NJ	Swartswood	High	High	High	High
	Muckshaw	High	High	High	High
	White Lake	Mod	Mod	Mod	Mod
	Greendell	Mod	Mod	High	Low
	Huntsville	Low	Low	Low	Low
	Lake Grinnell	Extirp.	Extirp.	Extirp.	Extirp.
VA	Maple Flats	High	High	High	High
	Campbells	Low	Low	Mod	Low
	Lyndhurst	Mod	Mod	High	Low
	South River	Extirp.	Extirp.	Extirp.	Extirp.
	Hattons	Extirp.	Extirp.	Extirp.	Extirp.

Redundancy

Under scenarios 1 and 2, we do not project a change in *Boltonia montana* redundancy from the current condition; the species will maintain moderate to high redundancy in the New Jersey metapopulation and moderate redundancy in the Virginia metapopulation.

While our model does not explicitly predict population extirpations, under scenario 3 it is possible that the modeled increases in land-use intensity and habitat disturbance could cause populations with low resiliencies to disappear. In New Jersey, *Boltonia montana* resiliency and within-population area redundancy suggests that while several populations have low resiliencies and may be at risk of extirpation, their potential loss would not cause the extirpation of the population area. However, in Virginia, four populations in the Lyndhurst and Campbells population areas are projected to have lower resiliencies under scenario 3. Because this includes all three of the populations in the Campbells population area, the entire analytical unit may be at risk of extirpation. Therefore, under scenario 3 we project *B. montana* will maintain moderate to high redundancy in the New Jersey metapopulation but perhaps decrease from moderate to low redundancy in the Virginia metapopulation.

Representation

There are no available studies on the genetics or other characteristics with which to determine variation between *Boltonia montana* populations or metapopulations. The three metapopulations (two extant, one extirpated) are geographically isolated from each other by between about 180 and 310 km (112 and 193 mi) (approximately 500 km (310 mi) between the extant New Jersey and Virginia metapopulations) and they have certain differing habitat characteristics (e.g.,

community associates, soil chemistry, temperature fluctuations). Therefore, we assess the species' representation based on its status in each metapopulation.

Under all scenarios, the species would remain extant in the New Jersey and Virginia metapopulations; therefore, its representation is not predicted to change from the current condition (though we note that the historical extirpation of the Pennsylvania metapopulation may have reduced the species representation).

FINDING

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of an endangered species or a threatened species. The Act defines "endangered species" as a species "in danger of extinction throughout all or a significant portion of its range," and "threatened species" as a species "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence.

Given the best available scientific and commercial information, we considered threats to *Boltonia montana* and its responses to threats for approximately 25 to 30 years into the future. This timeframe is based on the availability of trend information, planning documents, and climate modeling that helps inform potential future conditions.

Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determined that the threats affecting *Boltonia montana* and its habitat are habitat degradation (resulting from development, agriculture, off-road vehicle use, altered surface hydrology, and groundwater withdrawals), and changes in precipitation and temperature associated with climate change (Factor A), including the combined impacts of those threats. Habitat degradation from development, agriculture, and off-road vehicle use are also known to exacerbate or introduce invasive, nonnative species that compete for resources that *B. montana* relies on (see Species Needs, above). No threats were found to impact individuals or populations across the species' range related to overutilization (Factor B), disease or predation (Factor C), or other natural or manmade factors (Factor E). Further, we considered the impact of existing regulatory mechanisms (Factor D) and conservation measures on the magnitude of existing threats.

We determined that the species' abundance does not appear to have significantly changed across its range as demonstrated by the occupied population areas and population sites still considered extant where it has historically occurred (noting that only two specimens from Pennsylvania in the 1860s is all that is known from that historical location). Assuming that the historical

occurrence in Pennsylvania was one population in one area, *Boltonia montana* is historically known to have occurred within 44 populations and 11 population areas in 3 states. Currently, the species occurs in 36 populations and 8 population areas in 2 states, which represents the species' continued presence in 81 percent of its historically occupied populations and 72 percent of its historically occupied population areas. The 36 currently extant populations (and 8 population areas) are considered to be either high, moderate, or low resiliency (see Table 1, above):

Currently, 15 populations (42 percent; 10 in New Jersey and 5 in Virginia) are highly resilient, 15 (42 percent; 8 in New Jersey and 7 in Virginia) are moderately resilient, and 6 (16 percent; 1 in New Jersey and 5 in Virginia) have low resiliency. This is also demonstrated by three of eight population areas being highly resilient, three population areas being moderately resilient, and two population areas being low resiliency. The presence of 30 highly or moderately resilient populations distributed in two geographically distinct metapopulations suggests *Boltonia montana* currently has moderate redundancy and representation.

Under scenario 1, all eight of the currently known population areas are projected to maintain their current resiliency level, and under scenario 2, three of the eight population areas (one in New Jersey and two in Virginia) are projected to increase in resiliency. Under scenario 3, *Boltonia montana's* resiliency and redundancy are projected to decline; one of eight population areas in New Jersey and one in Virginia are projected to decline from moderate to low resiliency. Under none of the representative scenarios are any populations projected to become extirpated. However, we consider the probability distribution for the species to be weighted toward scenario 3. And we consider scenario 3 to represent a group of scenarios including some that lead to extirpation of some populations and some scenarios that lead to extinction of the species. However, while we believe there is a high probability that a small number of populations will become extirpated over the modeled timeframe, we believe the probability of extinction of the species is very low over this timeframe.. Also, our analysis indicates that the rate of increase in the risk of extinction will not increase markedly over the modeled 30 years. So, a status assessment conducted at some point in the next 30 years would be unlikely to result in a determination that the species is in danger of extinction. Thus, after assessing the best available information, we determine that *B. montana* is not in danger of extinction now or likely to become so in the foreseeable future throughout all of its range.

Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. Having determined that *Boltonia montana* is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the species' range for which it is true that both (1) the portion is significant; and, (2) the species is in danger of extinction now or likely to become so in the foreseeable future in that portion. Depending on the case, it might be more efficient for us to address the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we

do not need to evaluate the other question for that portion of the species' range.

In undertaking this analysis for *Boltonia montana*, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the species is endangered or threatened.

For *Boltonia montana*, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: habitat modification (resulting from development, agriculture, off-road vehicle use, altered surface hydrology, and groundwater withdrawals) and effects associated with climate change, including cumulative effects. The best available information, including survey reports, aerial imagery, and information from species experts, indicates that the threats associated with habitat modification affect *Boltonia montana* populations throughout the species' range. Likewise, climate projections indicate the effects of climate change will affect the species throughout its range.
We found no concentration of threats in any portion of the *B. montana's* range at a biologically meaningful scale. Therefore, no portion of the species' range can provide a basis for determining that the species is in danger of extinction now or likely to become so in the foreseeable future in a significant portion of its range, and we find the species is not in danger of extinction now or likely to become so in the foreseeable future in any significant portion of its range. This is consistent with the courts' holdings in *Desert Survivors* v. *Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018), and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d , 946, 959 (D. Ariz. 2017).

Determination of Status

Our review of the best available scientific and commercial information indicates that *Boltonia montana* does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. Therefore, we find that listing *B. montana* is not warranted at this time.

BATCHED NOTICE LANGUAGE

Boltonia montana is a perennial plant in the Asteraceae family that is known from Augusta County, Virginia; Sussex and Warren Counties, New Jersey; and Dauphin County, Pennsylvania, the latter regarded as a historical occurrence. The species occurs in certain isolated sinkhole ponds that have widely fluctuating water levels and its life history is adapted to these variable habitat conditions.

Individual plants range from 1.2 to 15 decimeters (dm) (4.7 to 59.0 inches (in)) in height (Townsend and Karaman-Castro 2006, p. 874). Its habit is generally erect, although often the lower stems remain prostrate (lying flat on the ground). Plant stems are smooth, light to yellow-green in color, and ribbed with yellow or golden striations. The upper stem has a branching structure with compound racemes (clusters of flowers), often arranged to appear as a convex or flat-topped cluster. The disk flowers (the tiny florets that make up the "eye" of Asteraceae flower

heads) are pale yellowish green to pale yellow white, and the ray flowers (the petals or modified leaves that surround the disk) are pale lavender to pinkish. The leaves are smooth, generally broad and rounded at the end, and taper to the base. They are dark green or blue green with whitish or reddish color at their base and have prominent, lighter colored midribs. Basal (lower) leaves are 1.0 to 17.5 centimeters (cm) (0.4 to 6.9 in) long and 0.1 to 2.0 cm (0.04 to 0.8 in) wide and can be arranged alternately or in a rosette (Townsend and Karaman-Castro 2006, p. 874). The cauline (upper) leaves are 2.7 to 11.0 cm (1.1 to 4.3 in) long and 0.5 to 1.9 cm (0.2 to 0.7 in) wide, though sometimes smaller leaves cluster at stem nodes (Townsend and Karaman-Castro 2006, p. 874).

Boltonia montana can reproduce both sexually from achenes (i.e. a dry, one seeded fruit) and vegetatively by the production of "basal offsets," the formation of advantageous root systems at stem nodes that become independent of the parent plant (Townsend and Karaman-Castro 2006, p. 876; Townsend 2013, p. 5). Individual *B. montana* plants behave as perennials and can persist over multiple growing seasons by producing basal offsets that establish as independent rosettes before the parent plant flowers and dies in the fall (Schwegman and Nyboer 1985, p. 114). The new rosettes are genetically identical to the parent; therefore, under favorable conditions (e.g., freedom from competition, seasonal water level drawdowns) vegetative propagation can result in genetic individuals persisting at a site for years (Schwegman and Nyboer 1985, p. 114; Baskin and Baskin 2002, p. 17).

The species is a prolific seed producer, with mature plants producing up to 50,000 achenes (Schwegman and Nyboer 1985, p. 114; Smith and Keevin 1998, pp. 73, 76). Flowering and seed production occur in the late summer and early fall, typically August to mid-October (Townsend and Karaman-Castro 2006, p. 876). *Boltonia montana* appears to form a seedbank, with seeds likely remaining viable in the environment for 1 to 7 years, depending on soil conditions (Baskin and Baskin 2002, pp. 19–20). The seeds exhibit an annual dormancy/non-dormancy cycle that allow them to germinate at any time from late March to late October (Baskin and Baskin 2002, p. 22).

The presence or dominance of reproductive lifeform (i.e. vegetative rosettes or seedlings) may vary in response to local environmental conditions (Mettler-McClure 1997, p. 6; Smith and Keevin 1998, pp. 70, 76–77; Smith and Mettler 2002, p. 114; Townsend and Karaman-Castro 2006, pp. 876–877). Following extended periods of inundation, a local population may be composed solely of new plants originating from the seedbank or perhaps a combination of new plants from the seedbank and vegetative rosettes that survive from the previous season's adult plants. Conversely, following extended periods of drawdown, seedling establishment may be low and local populations may be dominated by vegetative rosettes or adult plants that originated from vegetative rosettes.

In New Jersey, the species is historically known from 21 population sites within an area of about 144 km^2 (56 mi^2). The size of population sites in New Jersey range from about 0.1 to 8.0 hectares (ha) (0.3 to 19.8 acres (ac)), with the average size being about 2.6 ha (6.5 ac). Five New Jersey *Boltonia montana* populations are on land owned or managed by the State, 6 populations are on private property owned or managed by a conservation organization and the remaining 11 populations are privately owned. Two populations are reported to be greater than 10,000

individual plants, four sites have populations estimated in the thousands of plants, two sites have populations estimated in the hundreds, and six sites have populations estimated at less than 100 plants (with three of these in the single digits). There are no estimated population numbers for eight New Jersey sites.

In Virginia, the species is known from 22 individual sites, encompassing a total range of about 34 km^2 (13 mi^2). The Virginia sites range from about 0.1 to 5.8 ha (0.3 to 14.3 ac), with the average size being about 1.1 ha (2.7 ac). Seven of these populations are on U.S. Forest Service land and the remaining 15 populations are on private property. Seven Virginia populations are estimated to number in the hundreds of plants, six have populations numbering less than 100 plants (two of these numbered in the single digits), and six sites in Virginia have no estimated population numbers available. Except for two sites, all of the Virginia population sites are in relatively close proximity to each other (generally within about 1 km (0.6 miles)). While some population sites in New Jersey are clustered together, in general the species appears to be more widely dispersed in this metapopulation.

In Pennsylvania, the presumption of a historical *Boltonia montana* metapopulation is based on two museum specimens collected in July 1864 and August 1865 from the banks of the Susquehanna River near Dauphin, Pennsylvania Townsend and Karaman-Castro 2006, pp. 877, 881). Subsequent surveys have failed to find the species since then, therefore the species is presumed extirpated in Pennsylvania.

At the scale of the individual *Boltonia montana* plant or population site, we identified soil, water, sunlight, pollinator services, and a suitable annual temperature regime, as interrelated resource needs. At the metapopulation scale, it is likely the species requires some degree of habitat connectivity to maintain viability; however, there is significant uncertainty regarding the degree of connectivity that may be necessary between population sites. We assume there is no natural connectivity between the two extant metapopulations in New Jersey and Virginia.

We identified several stressors likely affecting the viability of *Boltonia montana*. Activities associated with habitat disturbance include those that physically disturb or kill *B. montana* plants or degrade or destroy the habitat required by the species. Examples include development, agricultural cultivation or livestock pasturing, and off-road vehicle use. The effects of climate change, including altered temperature and precipitation patterns, may also affect the species. However, there is uncertainty how and to what degree *B. montana* will respond to predicted climate changes. These stressors occur individually or in combination at many population sites across the species' range.

There are also conservation measures affecting the species. *Boltonia montana* is listed as state endangered by both New Jersey (New Jersey Administrative Code 2013, entire) and Virginia (Virginia Administrative Code 2013, entire). This status affords the species some protections on public lands in Virginia and helps guide conservation decisions in New Jersey. In New Jersey, 50 percent (11 of 22) population sites are on land managed by the state or a conservation organization, which affords them protection from development. In Virginia, about 32 percent (7 of 22) of the populations are on U.S. Forest Service land managed specifically for the conservation of rare species and their supporting habitats. Additionally, Virginia is actively

pursuing additional protections for at least two privately-owned population sites (Townsend 2020, p. 3).

Because *Boltonia montana* survey data are sparse, we developed an assessment model using habitat metrics to estimate the condition of each population and compare them with each other, both currently and under plausible future scenarios. There is significant uncertainty regarding the species' potential response to changing temperature and precipitation patterns. Therefore, we do not directly assess the potential effects of climate change to the population sites but instead consider their relative condition as an indicator of their capacity to persist in light of changing climate conditions. The best available information, including the results of our assessment model, suggests 15 *B. montana* populations currently have high resiliency (10 in New Jersey and 5 in Virginia); 15 populations currently have moderate resiliency (8 in New Jersey and 7 in Virginia); and 6 populations have low resiliency (1 in New Jersey and 5 in Virginia). Eight populations are presumed extirpated (2 in New Jersey, 5 in Virginia, and 1 in Pennsylvania).

We modeled the potential future condition of *Boltonia montana* under three plausible scenarios. We use the results to describe the species' condition using the 3Rs in about the year 2050. We selected this 30-year timeframe because we assume that our modeled changes in land use, development, or conservation measures will manifest their effects on *B. montana* populations within that timeframe. Under scenario 1, we project no significant changes are made to the activities currently affecting the extant population sites. Under scenario 2, we project that public and private land managers will implement various measures that result in the protection or enhancement of *B. montana* habitat, where feasible. And under scenario 3, we assume no new conservation measures are implemented and habitat disturbances increase at most privately-owned *B. montana* populations.

Under scenarios 1 and 3, by 2050, between 3 and 11 populations are predicted to have lower resiliencies than the current condition, and under scenario 3, the changes may result in the extirpation of several low resiliency populations, perhaps causing a loss of redundancy. Under scenario 2, we predict feasible conservation efforts would improve the condition of 22 populations. Under all scenarios, the species would maintain multiple moderate or high resiliency populations in the New Jersey and Virginia metapopulations; therefore, its representation is not predicted to change from the current condition (though we note that the historical extirpation of the Pennsylvania metapopulation may have reduced the species representation).

Despite impacts from the primary stressors, *Boltonia montana* has maintained resilient populations throughout its range. Although we predict some continued impacts from these stressors in the future, we anticipate the species will continue to maintain resilient populations throughout the foreseeable future. Therefore, we find that listing *B. montana* as an endangered species or threatened species under the Act is not warranted. A detailed discussion of the basis for this finding can be found in the species assessment form, and other supporting documents, such as the accompanying SSA report (Service 2020, entire) (see **ADDRESSES**, above).

COORDINATION WITH STATES

All States within the range of the species provided information or comments on the species or latest species assessment, including Pennsylvania, New Jersey, and Virginia.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: WENDI WEBER Digitally signed by WENDI WEBER Date: 2020.06.03 09:29:31 -04'00'

Regional Director, Fish and Wildlife Service Date

Concur: AURELIA SKIPWITH Digitally signed by AURELIA SKIPWITH Date: 2020.11.19 17:24:11 -05'00'

Director, Fish and Wildlife Service Date

Do not concur:

Director, Fish and Wildlife Service Date

Director's Remarks: