Lakeside Daisy
(Tetraneuris herbacea)

5-Year Review:
Summary and Evaluation

Photo Credit: USFWS

U.S. Fish and Wildlife Service
Ohio Field Office
Columbus, Ohio

2021

5-YEAR REVIEW
Lakeside daisy/*Tetraneuris herbacea*

1.0 GENERAL INFORMATION

1.1 Reviewers:

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Canadian Wildlife Service, Environment and Climate Change Canada
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1.2 Methodology used to complete the review:

This 5-year review was prepared by Jennifer Finfera, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service (Service), Ohio Ecological Services Field Office, in coordination with other Field Office biologists in the Midwest Region and other species experts in the United States and Canada. The Service requested new scientific or commercial data and information that may have bearing on the species' current classification as threatened via a Federal Register notice (85 FR 53842) initiating the 5-year review. We reviewed past and recent literature, public comments, the final listing rule (53 FR 23742), the Lakeside daisy Recovery Plan (USFWS 1990), and current information on continuing quarry operations on the Marblehead Peninsula. In the past 10 years, quarry activities in Ohio have accelerated therefore, current efforts to recover the species have focused on seed and plant collection for establishment of new populations on public lands. We relied heavily on recent data on the status of these newly introduced populations and our efforts to establish new populations on new sites within the historic range.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:
85 FR 53842 (August 31, 2020) for 14 listed animal and plant species

1.3.2 Listing history

Original Listing
FR notice: 53 FR 23742: Lakeside daisy, *Hymenoxys acaulis* var. *glabra*
Date listed: June 23, 1988
Entity listed: species
Classification: threatened

1.3.3 Associated rulemakings: none

1.3.4 Review History:

September 19, 1990: Recovery Plan for the Lakeside daisy (*Hymenoxys acaulis v*ar. *glabra*). Recovery Plan summarized the species status, distribution, and recovery objectives.

The Lakeside daisy was included in a November 6, 1991 cursory 5-year review conducted for all species listed before 1991 (56 FR 56882).

A 5-year review for this species was conducted in 2010 following initiation on April 22, 2008 (73 FR 21643).

A 5-year review for this species was conducted in 2016 following initiation on July 8, 2014 (79 FR 15867).

No other 5-year reviews have been completed for this species.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 5, indicating a high degree of threat and low recovery potential, due to the pervasive threat of habitat loss and the reproductive implications of a self-incompatible species.

1.3.6 Recovery Plan

Name of plan: Lakeside daisy (*Hymenoxys acaulis* var. *glabra*) Recovery Plan
Date issued: September 19, 1990

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate? No, the species is a plant; therefore, the DPS policy is not applicable.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

No. The recovery criteria are not current. It has been 30 years since the recovery criteria were developed and published. Habitat modifications have occurred through time that has decreased the available and suitable land available for Lakeside daisy. Quarry operations have increased in recent years at the site of the largest population in the U.S. and limited additional habitat has been protected. The recovery criteria do not include the multiple populations that have been discovered and established in Michigan. Multiple efforts have been made to successfully establish new populations in Ohio. The recovery criteria do not reflect all these changes.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

Yes. However, listing factor C (disease or predation) is not considered relevant for this species.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

<u>1990 Recovery Plan Criteria</u>

Lakeside daisy (*Hymenoxys acaulis* var. *glabra*) [now *H. herbacea*] can be considered for delisting when the following four criteria have been met.

1) 475 acres of essential habitat containing the population center at the Marblehead Quarry, Ottawa County, Ohio are acquired and managed.

   Criterion 1 has NOT been met.
   The area that contained the highest densities of mature plants no longer exists. In addition, removal and/or movement of quarry piles results in plants being dislodged and crushed by the heavy equipment. Essential habitat is defined as occupied and unoccupied suitable Lakeside daisy habitat between Hartshorn and Bay Shore Roads. The Lakeside Daisy State Nature Preserve was established in 1988 protecting approximately 19 acres and just under 118 additional acres were acquired when land adjacent to the Lakeside Daisy State Nature Preserve was purchased by the state of Ohio in 2019 through grant funding from the Service. These purchases total 137acres of land on the Marblehead Peninsula that have been acquired and is being managed for this species. This is slightly more than a quarter of the 475 acres of essential habitat needed as stipulated in this criterion. The potential for additional habitat to be protected is very limited due to the modification of many alvar sites (flat limestone or dolostone bedrock with thin to no soil, few to no trees, and is subject to seasonal drought (TNC 1999)) by quarry activities. Because quarry operations have increased over the last few years, much of the habitat on the Marblehead peninsula has been fragmented by quarry excavation. Remaining habitat for this species is quickly becoming limited to the periphery of the mined quarry excavation area.

Quarry operations have eliminated significant areas of available habitat in the past 15 years and operations have accelerated in the last 10 years. Activity at the center of the quarry has resulted in deep excavation and removal of the gravel piles that the Lakeside daisy previously occupied. The amount of suitable habitat available within the LafargeHolcim property has decreased significantly due to westward and southward expansion of the quarry. This criterion needs to be updated to reflect the reduced amount of habitat remaining in this area for this species.

2) 465 acres of additional essential habitat at the Marblehead Quarry is protected through easements, restrictive covenances, or leases.

Criterion 2 has NOT been met.
Similarly, to criterion 1, LafargeHolcim plans to continue active mining throughout the property. Easements and other restrictions on the property are not feasible as LafargeHolcim intends, and has permits, to quarry the entire area available. In 2019, the Service and the Ohio Department of Natural Resources (ODNR) provided funding for the fee simple purchase of just under 118 acres of land to the east of Alexander Pike and south of the Lakeside Daisy State Nature Preserve. This area does provide some suitable habitat and management will occur to enhance the quality of the suitable habitat. This criterion needs to be updated to reflect the limited amount of habitat remaining in this area for this species.

3) The variety [now a species] is restored to a minimum of one large (>5,000), stable population in each of two geographically distinct, protected sites of suitable size within the variety's historic range in Illinois.

Criterion 3 has NOT been met.
The Manito Prairie Nature Preserve, Tazewell County, Illinois population was reestablished with 300 transplants in fall 1988, with a 78% survivorship in spring of 1989 (USFWS 1990). Only two plants flowered in 2013 and both of these were browsed. No plants were found in 2014, 2015, or 2018 (USFWS 2020).

Also in 1988, two sites (Lockport Prairie Nature Preserve and Romeoville Prairie Nature Preserve) were established with Lakeside daisy transplants in Will County, Illinois. These sites were monitored in 2017, 2018, 2020, and 2021 (USFWS 2020, Forest Preserve District of Will County 2021, unpublished data). Over this time the Lockport Prairie Nature Preserve population averaged fewer than 200 plants annually and the Romeoville Prairie Nature Preserve populations averaged fewer than 75 plants annually.

The Waterfall Glen site in DuPage County, Illinois originally supported one planted population in two separate areas on the same hill (Signal Hill). This population was monitored during 2009 to 2011, 2017, 2018, and 2021. No plants were observed at this site in 2017, 2018, or 2021 (USFWS 2020, Forest Preserve District of Will County 2021). However, in 2021 blooming plants were found in a different area of the site quite a distance from the original population. This new area had been seeded with Lakeside daisy in the past but not monitored (Kobal, Forest Preserve District of DuPage County, personal communication, 2021).

In Cook County, Illinois, the site at the Chicago Botanic Garden contained less than a dozen plants when it was monitored in 2010, 2016, and 2018. In 2018, the population had three sterile clumps (USFWS 2020). These individuals are maintained as a collection and are not considered an ecological functioning unit and therefore are not contributing to recovery of the species. The second site in Cook County, Illinois was started from seed that resulted from crosses of Illinois and Ohio plants. Only six plants were documented in 2006. In 2016, approximately 39 clumps (77% flowered) were observed. In 2017, 44 clumps (97% flowered) were observed and in 2020, 68 individuals (USFWS 2020) were observed. Monitoring at this site has been inconsistent over the years so trends are difficult to determine. Clumps may refer to clusters of rosettes of a single plant and therefore a clump may be synonymous with a single individual of multiple rosettes.

The Recovery Plan defines a large, restored population as having greater than or equal to 5,000 adult plants within a minimum of 3 hectares (USFWS 1990). The restored populations in Illinois have continued to decline with limited evidence of recruitment. In reviewing the information from the other sites in DuPage and Cook County, none of the Illinois sites represent large or stable populations.

4) The maintenance of restored populations for 15 consecutive years, with monitoring to continue for an additional 10 years.

Criterion 4 has NOT been met.
Long term maintenance of the restored Illinois populations has not occurred and monitoring has been conducted inconsistently. For more information see section 2.3.1.2. The introduced populations at Kelleys Island have persisted and increased. However, these populations are not within counties where the species was previously documented, so they are not considered restored populations and instead are considered introduced.

2.3 Updated Information and Current Species Status

In the last five years, significant areas that previously had high densities of daisies are now part of the Marblehead Quarry pit and no longer suitable habitat. Continued coordination with LafargeHolcim is necessary to ensure a continued source of seed and plants from within the quarry for recovery efforts to introduced populations in future years.

The restored and introduced populations in Illinois, and the original and introduced populations in Michigan and Ohio have different levels of protection along with varying degrees of population growth success. The protected natural population at the 137-acre Lakeside Daisy State Nature Preserve is a dedicated state nature preserve owned by the ODNR Division of Natural Areas and Preserves and this population is increasing.

2.3.1 Biology and Habitat

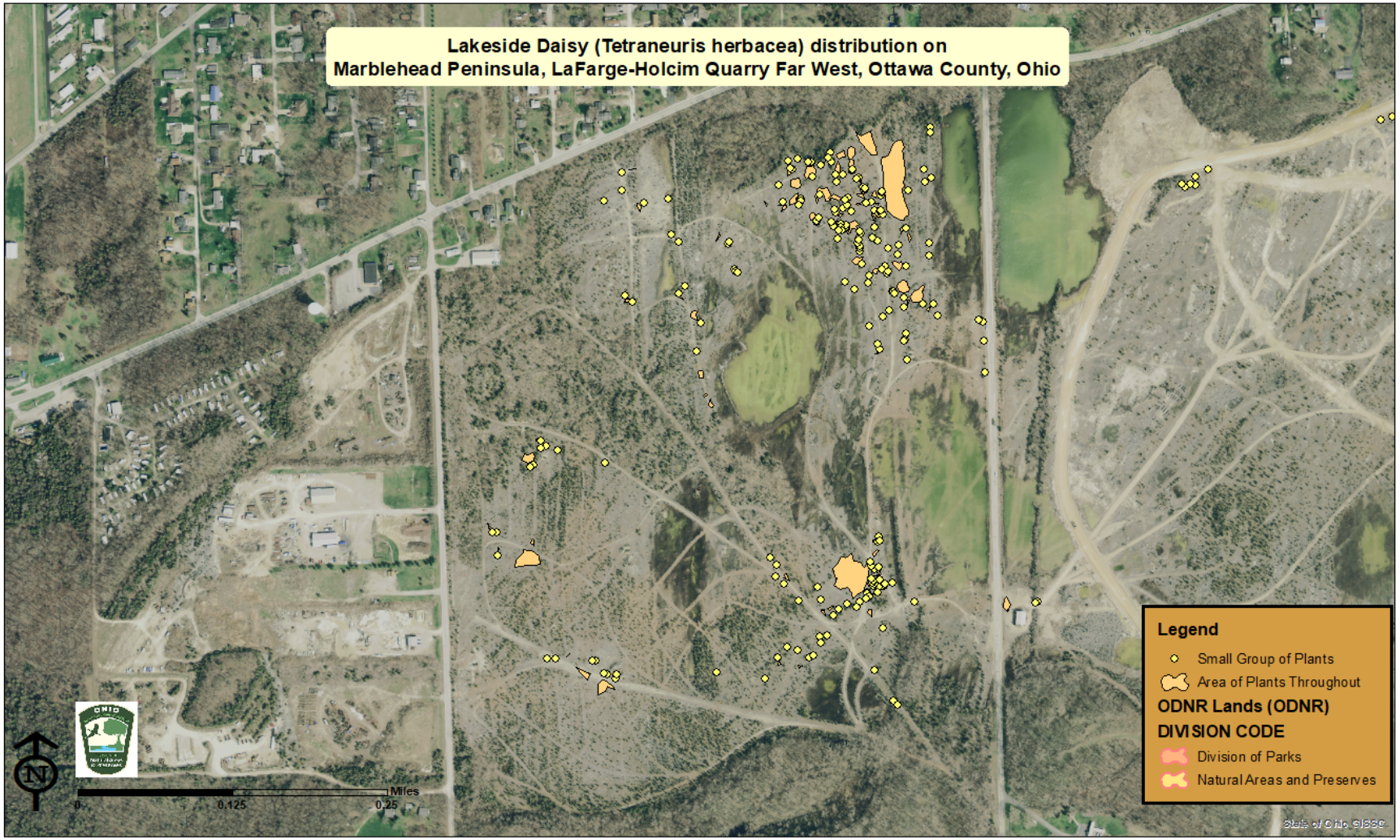
According to the Alvar Working Group, alvar habitat consists of flat limestone or dolostone bedrock with thin to no soil, few to no trees, and is subject to seasonal drought (TNC 1999). This species also occurs on modified alvar habitat in which the original alvar habitat has been altered or removed by quarry activities. The Lakeside daisy populations on the Marblehead Peninsula, as

well as the introduction sites on Kelleys Island, the introduced population in Castalia Quarry Metropark, and the introduced quarry population in Michigan all occur on modified alvar habitat. Plants at these sites continue to grow and large amounts of blooming plants were observed during the 2021 field season.

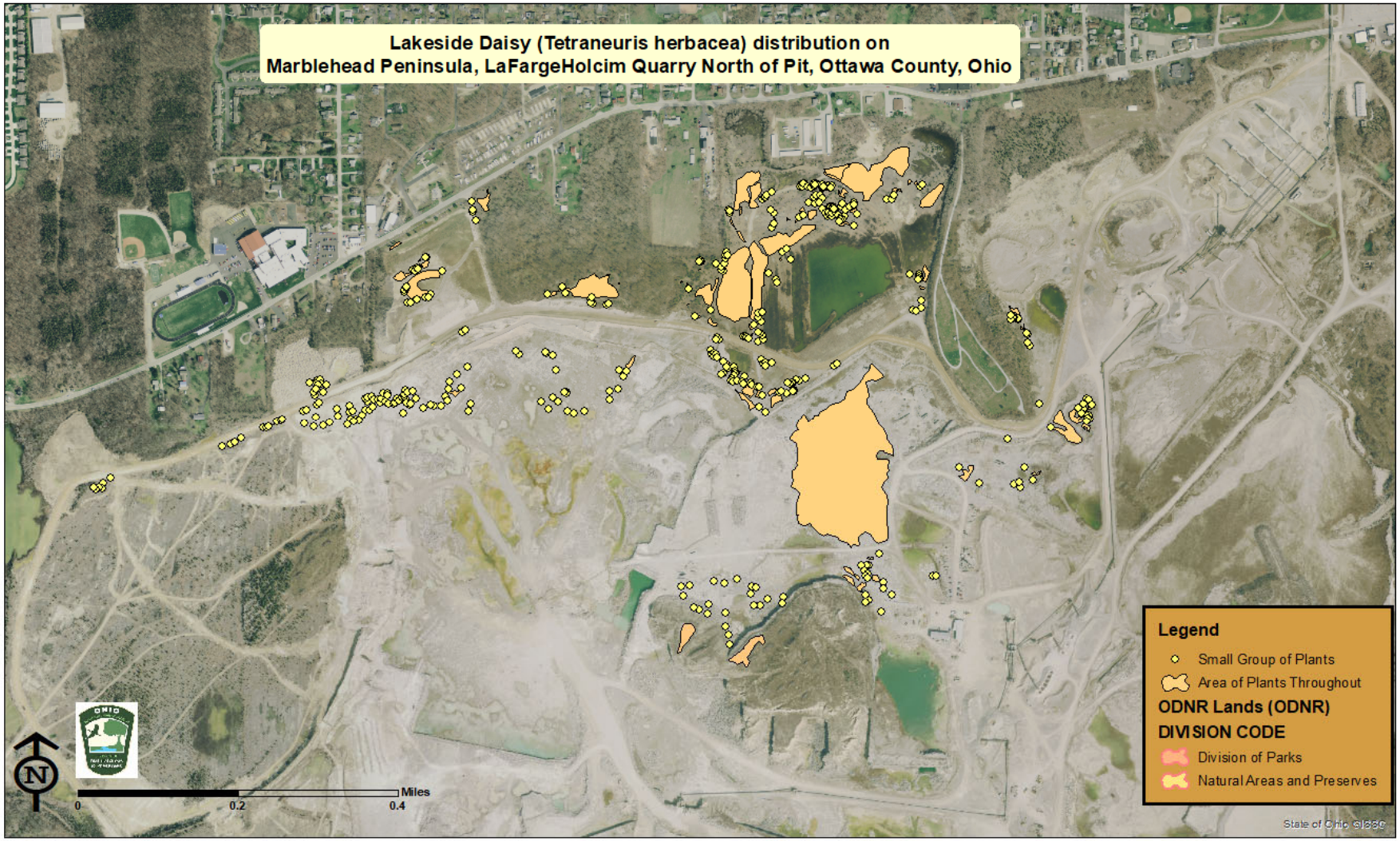
When Lakeside daisy was listed as endangered, only one fragmented population was known in the U.S., on the Marblehead Peninsula in Ottawa County, Ohio. The Lakeside daisy had also been recorded in Will and Tazewell Counties in Illinois but was presumed extirpated prior to listing. Lakeside daisy is known from two regions in Ontario, Canada, consisting of sites on the Bruce Peninsula and the Manitoulin Island region (Ministry of the Environment, Conservation and Parks 2019). Currently there are 34 subpopulations in Canada (COSEWIC, In Press, 2019).

Since the time of listing, populations have been discovered in Michigan and introductions have occurred in Illinois, Michigan, and Ohio. Many of these introductions contain only a few plants in small areas. Rangewide, suitable habitat has continued to decline due to ongoing quarry activities as well as succession and competition from other vegetation at specific sites. The most recent survey of occupied habitat in Ohio was conducted in 2021 and this 5-year review is using that preliminary data.

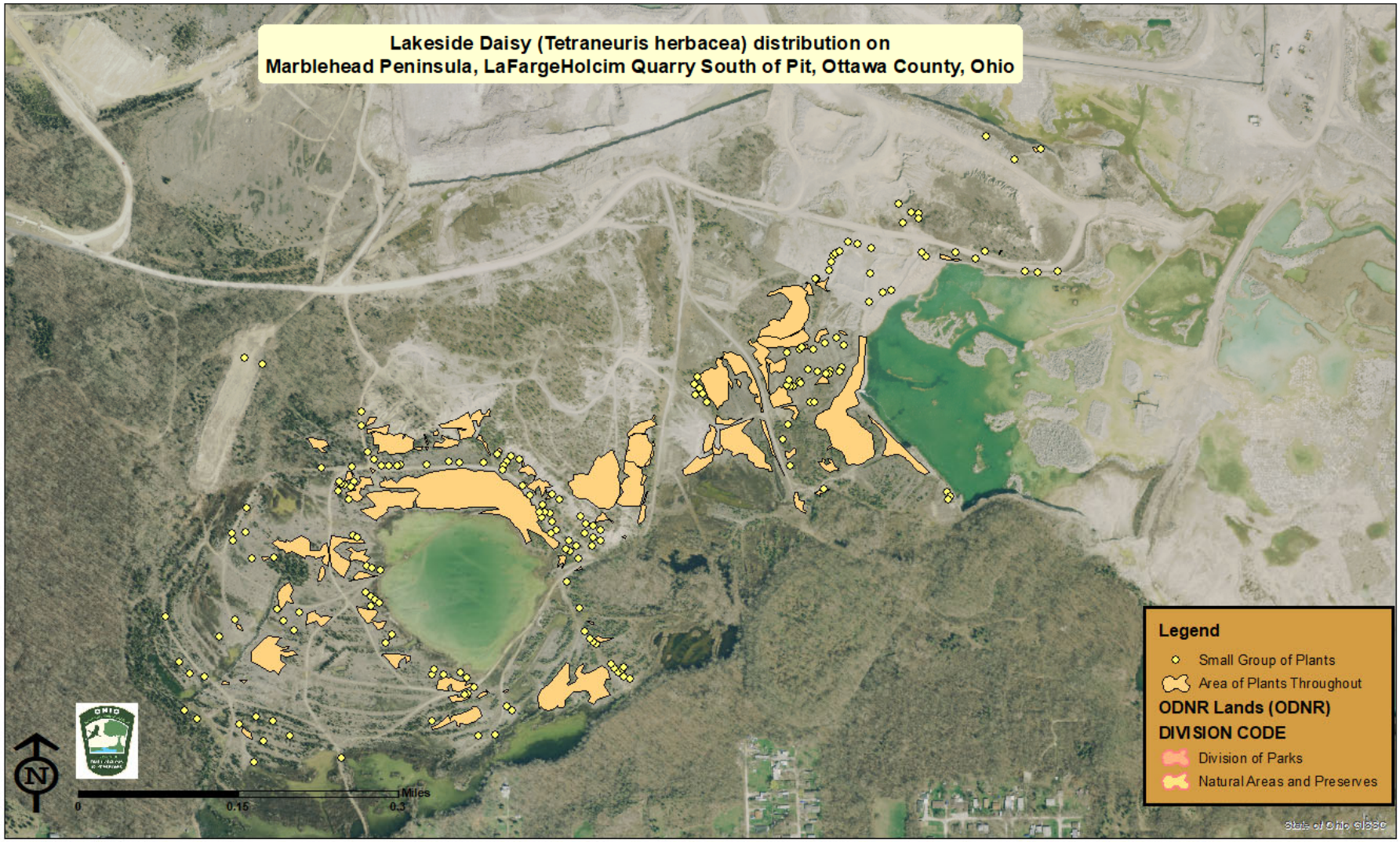
Map 1. Marblehead Peninsula West of Quarry Road



Map 2. Marblehead Peninsula North



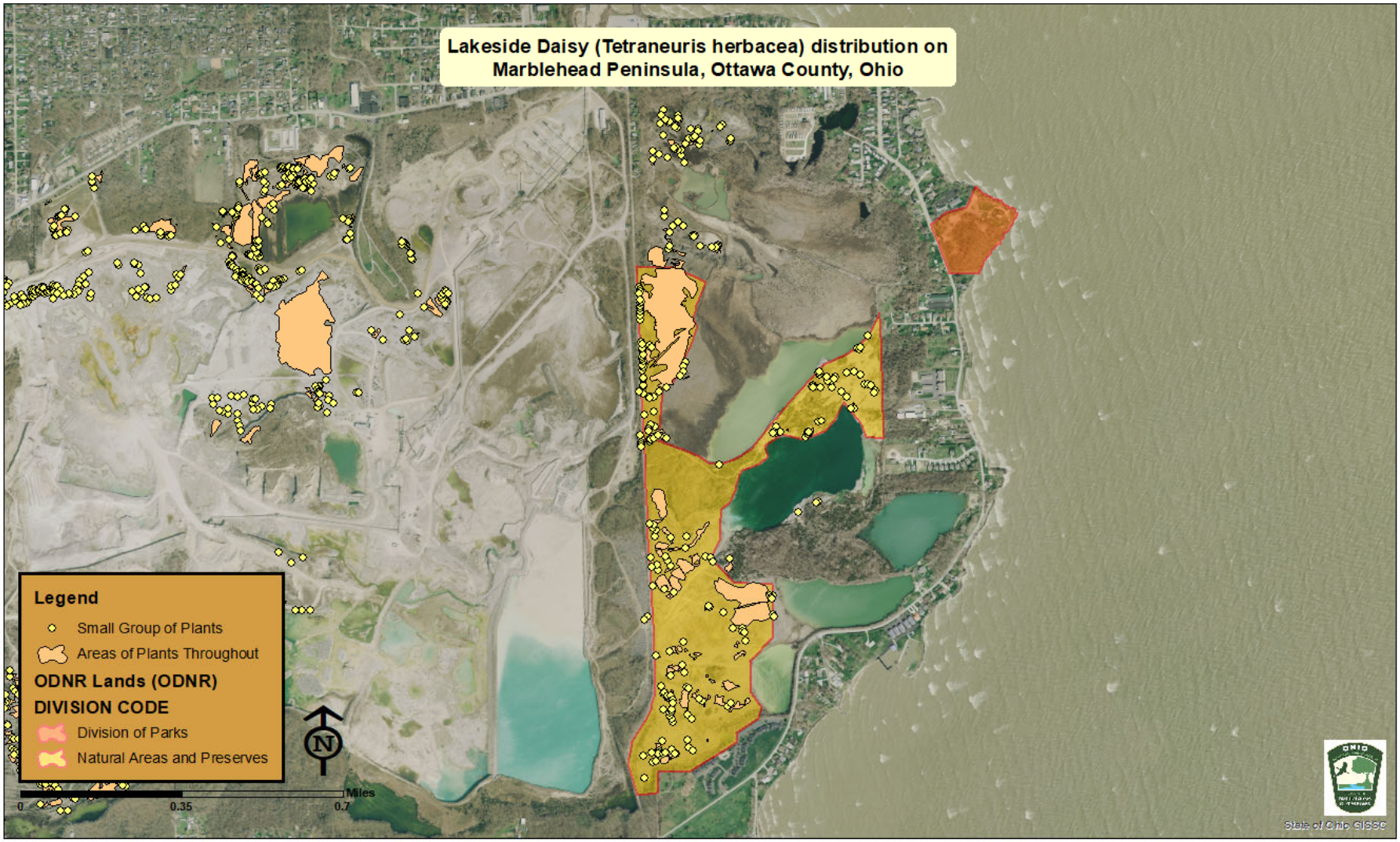
Map 3. Marblehead Peninsula South



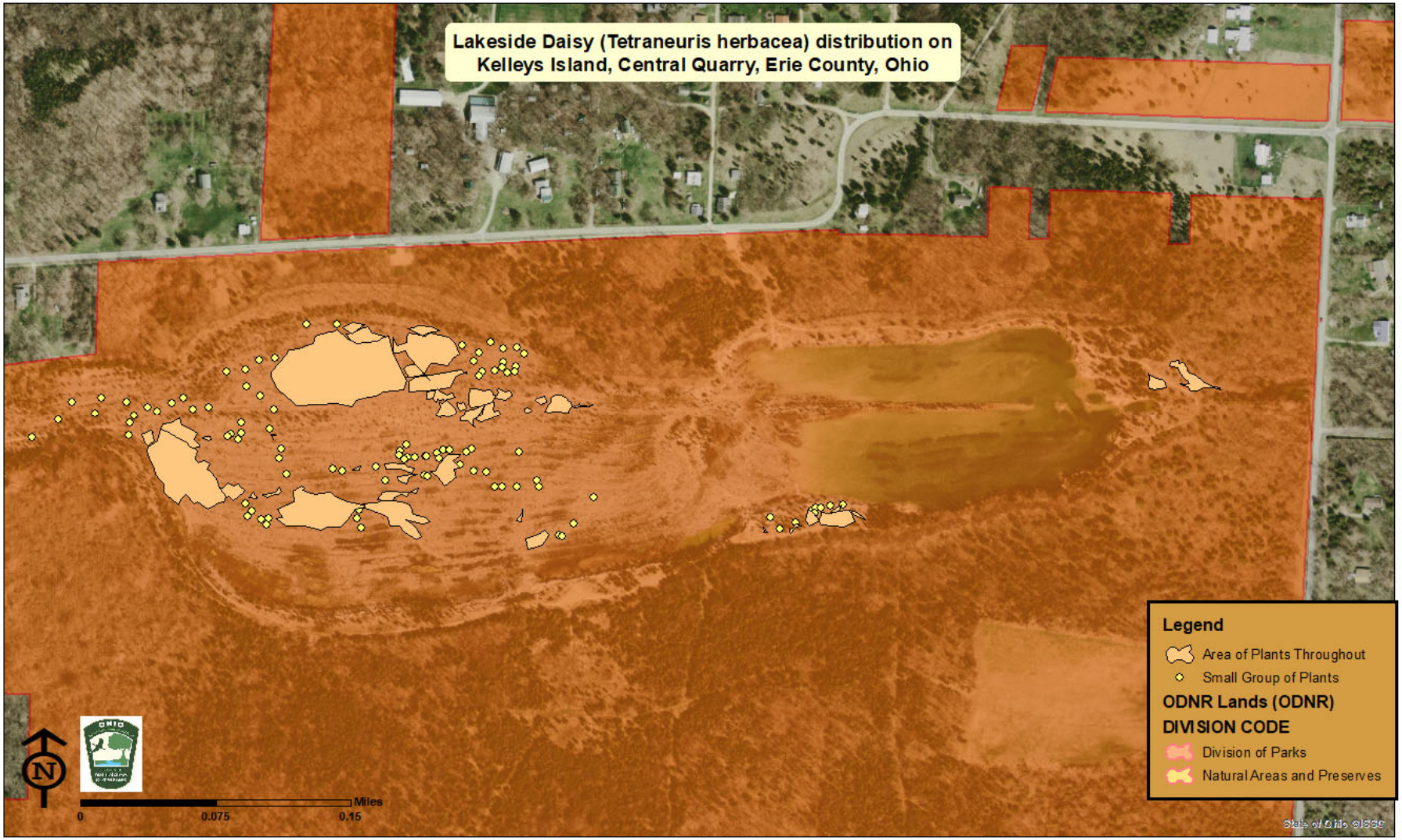
Since Lakeside daisy had never been recorded on Kelleys Island prior to introduction efforts in 1989, the sites on Kelleys Island are identified as introduction sites. There are three populations on Kelleys Island: north quarry, central quarry, and Huntley Beatty Preserve. The introduced populations on Kelleys Island in Erie County, Ohio have increased dramatically. However, limited data has been collected from these populations. The area was mapped in 2009 as a limited, large polygons that defined the extent of the plants. The mapping conducted in 2021 focused on delineating the dense areas of plants and provides more concise polygons of where plants are located. The area of these polygons was then multiplied by the density estimates used in the last review and provides more accurate population estimates. At this time these data are still preliminary.

Additional populations were established at the Huntley-Beatty Preserve on Kelleys Island and at Castalia Quarry Metropark in Margaretta Township, Erie County in the fall of 2012 with seed from Marblehead Quarry. Lakeside daisy had not been recorded in Erie County prior to introduction in 2012, so the Castalia Quarry Metropark site is also identified as an introduced site. Based on preliminary data Huntley-Beatty contains over 130,000 plants and over 60,000 are present at Castalia Quarry.

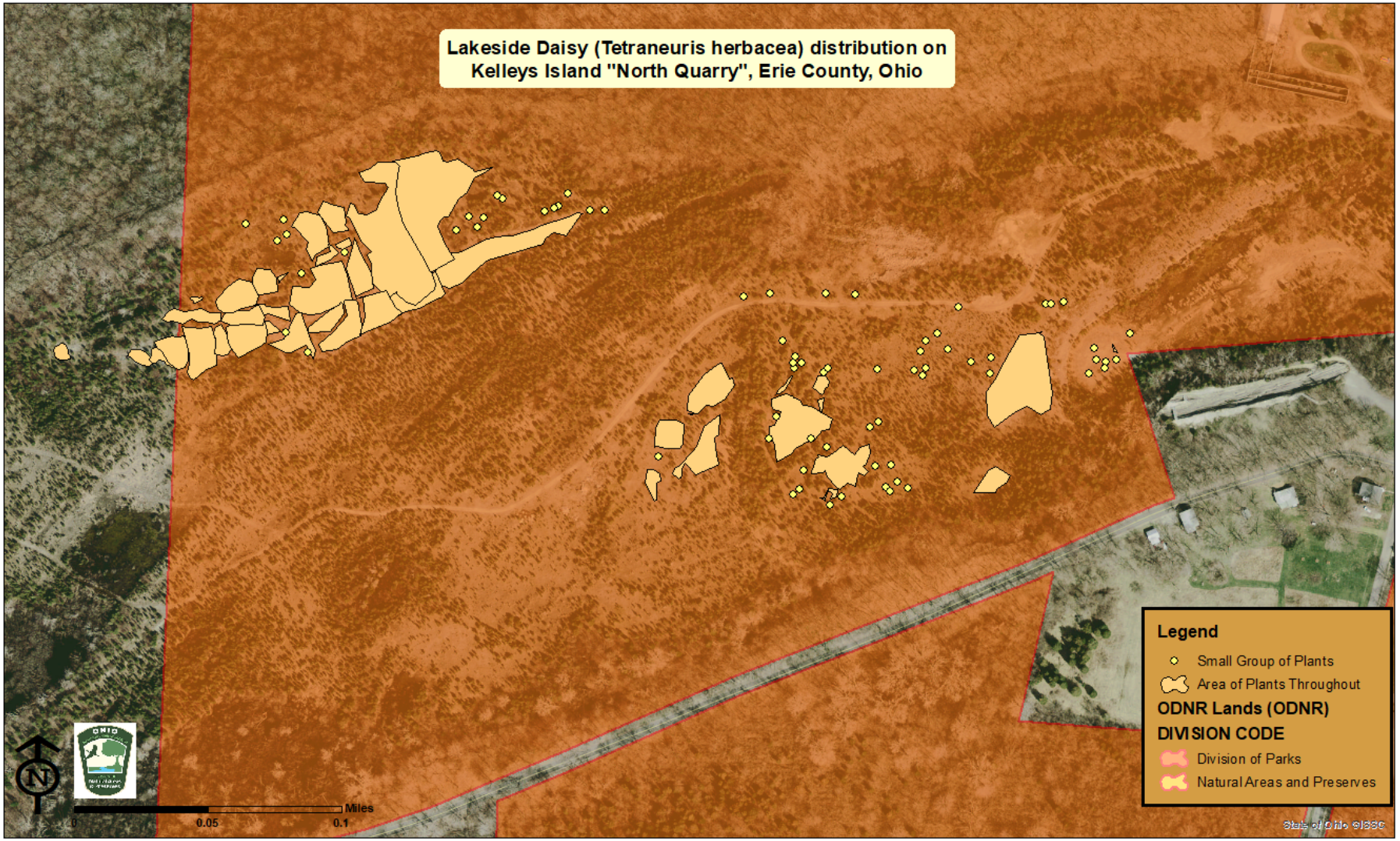
Map 4. Lakeside Daisy State Nature Preserve



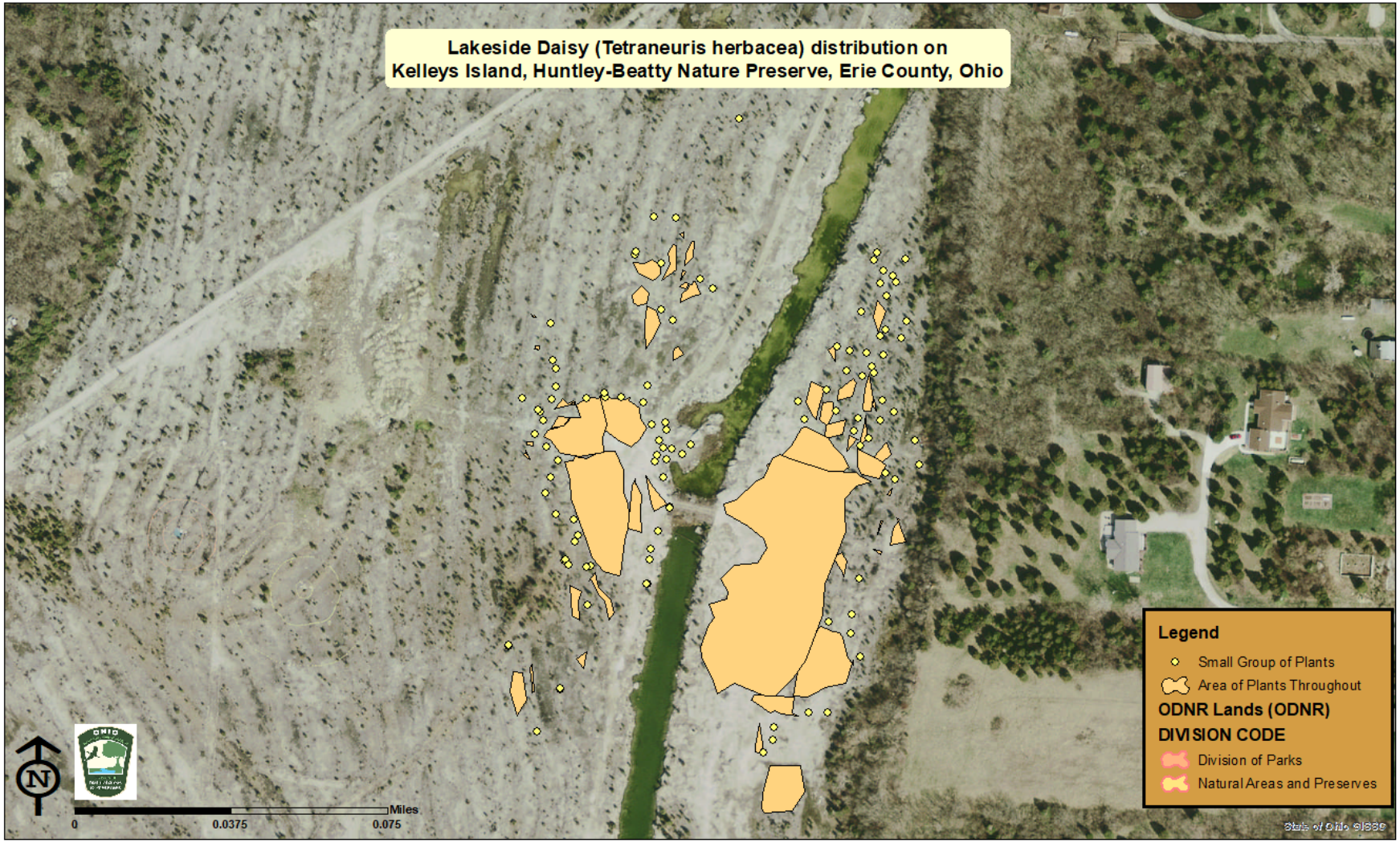
Map 5. Kelleys Island, Central Quarry



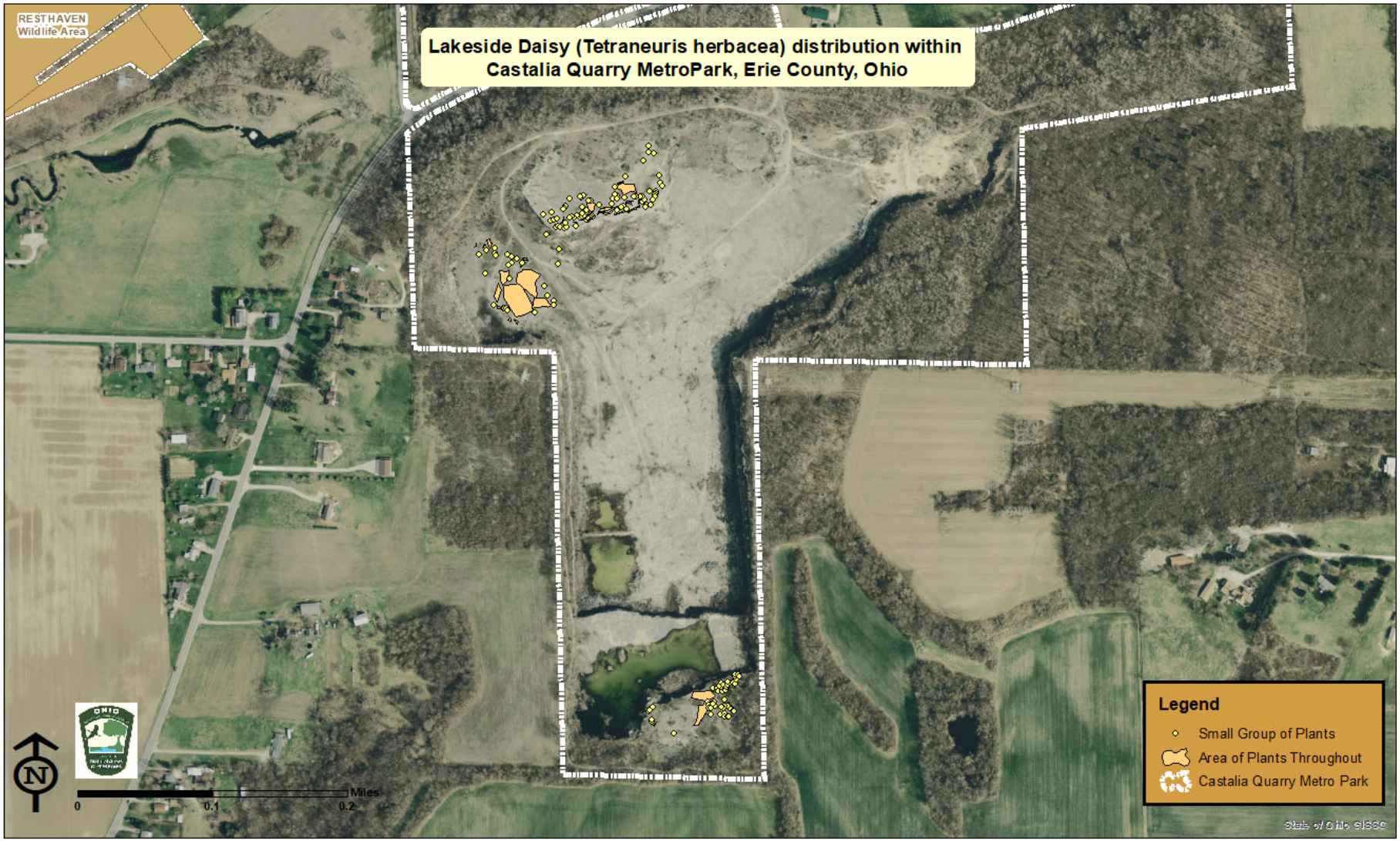
Map 6. Kelleys Island, North Quarry



Map 7. Kelleys Island, Huntley-Beatty



Map 8. Castalia Quarry



2.3.1.1 New information on the species' biology and life history:
According to the Recovery Plan, the following types of insects have been observed to pollinate Lakeside daisy: bumble bees (Apidae), small carpenter bees (Xylocopidae), and halictid bees (Halictidae). Recent observations in Ohio, have documented multiple insects visiting and potentially pollinating Lakeside daisy flowers. These include the pearl crescent (*Phycoides tharos*) (Parshall, Ohio Lepidopterists, personal communication, 2015), a small butterfly, and multiple syrphid flies (Syrphidae) including the transverse-banded flower fly (*Eristalis transversa*), tufted globetail (*Sphaerophoria contingua*), and margined calligrapher (*Toxomerus marginatus*) (USFWS 2021).

In addition, other insects appear to feed on the disk flowers. A larva of the wavy-lined emerald (*Synchlora aerata*) (Wagner, University of Connecticut, personal communication, 2021) was observed on a flower disk in 2021. Multiple shining flower beetles were also observed on the disk flowers (USFWS 2021) and may be responsible for the holes observed in multiple disk flower heads.

Occasionally atypical flowers are observed, such as those with additional whorls of ray flowers (USFWS 2021). Some flowers have been observed with twisted stems and the flowers appear to prematurely senesce thus failing to produce seed. If the cause of this stem deformation spreads, it could have detrimental effects to small populations.

2.3.1.2 Abundance, population trends, demographic features, or demographic trends:
Naturally-occurring populations are known from two sites on the Marblehead Peninsula in Ottawa County, Ohio (Marblehead Quarry and Lakeside Daisy State Nature Preserve), and along the coast of Manitoulin Island and the tip of Bruce Peninsula in Ontario, Canada. Two populations are located in Michigan, with an additional reserve population established and an introduced population established at an abandoned quarry with seed from the Brevort Lake Road site. Restored and introduced populations are located in Illinois. Restored populations in Illinois include three sites where Lakeside daisy was re-established in counties where the species had been previously recorded. These include two sites in Will County (Lockport Prairie Nature Preserve and Romeoville Prairie Nature Preserve) and one site in Tazewell County (Manito Nature Preserve). Introduced populations, in which populations are brought into counties where the species had not been documented as naturally-occurring, are located in Cook and DuPage Counties in Illinois. A few plants were rescued from the original Tazewell County, Illinois population and moved to the Morton Arboretum in Illinois, where clones of individuals were established for scientific purposes (USFWS 1990).

Canada
Monitoring has occurred at some, but not all, of the 34 subpopulations in Canada. Of the populations monitored; half were stable, a third had decreased, and the remaining monitored populations were stable or increasing (COSEWIC, In Press, 2021). This monitoring did not include the large populations and at some sites, did not include the entire population. Therefore, the populations monitored may not be representative of the overall trend of the Canadian populations.

Illinois

There are two sites in Will County (Lockport Prairie Nature Preserve and Romeoville Prairie Nature Preserve) and one site in Tazewell County (Manito Nature Preserve) where populations have been in decline for many years. Less than 200 plants have been observed since 2012 at Lockport Prairie Nature Preserve and Romeoville Prairie Nature Preserve has had less than 75 plants documented since 2012 (USFWS 2020). While population trends at the two Will County sites currently appear relatively stable, there is little sign of recruitment. This may indicate that the plants are persisting only vegetatively and that cross-pollination and/or successful germination is not occurring.

At the DuPage County introduction site, no plants were observed during monitoring in 2017, 2018, and 2021 at the two original subpopulations (USFWS 2020; Kobal, Forest Preserve District of DuPage County, personal communication, 2021). These two subpopulations previously contained over 400 plants combined (USFWS 2020). However, seed from this population was used to establish another subpopulation at Waterfall Glen with adult plants currently developing and successfully blooming (Kobal, Forest Preserve District of DuPage County, personal communication, 2021).

Both populations in Cook County continue to produce flowers (USFWS 2020). Most of the Illinois populations are located on public land and therefore have some level of protection, which ranges from legally protected state nature preserves to limited protection at County preserves. Due to infrequent and inconsistent monitoring, long-term trends of these populations cannot be determined. However, the populations in all these counties are relatively small and could be very susceptible to catastrophic events, as the dramatic decline in plants at the two DuPage County (Waterfall Glen) subpopulations indicate.

Table 1. Illinois Population Estimates

State	Location	First Recorded or Established	Most Recent Monitoring	2015 Number of Plants (Adults and Juveniles)	Current Number of Plants (Adults and Juveniles)
IL	Chicago Botanic Garden	Prior to 2010	2018	<12	3
IL	Cook County Site	Prior to 2006	2020	Present	68
IL	Waterfall Glen	1994	2021	Present	Present
IL	Lockport Prairie	1988	2021	<200	175
IL	Romeoville Prairie	1988	2021	<200	12
IL	Manito Prairie	1998	2018	0	0
Total				**<412**	**258**

Michigan

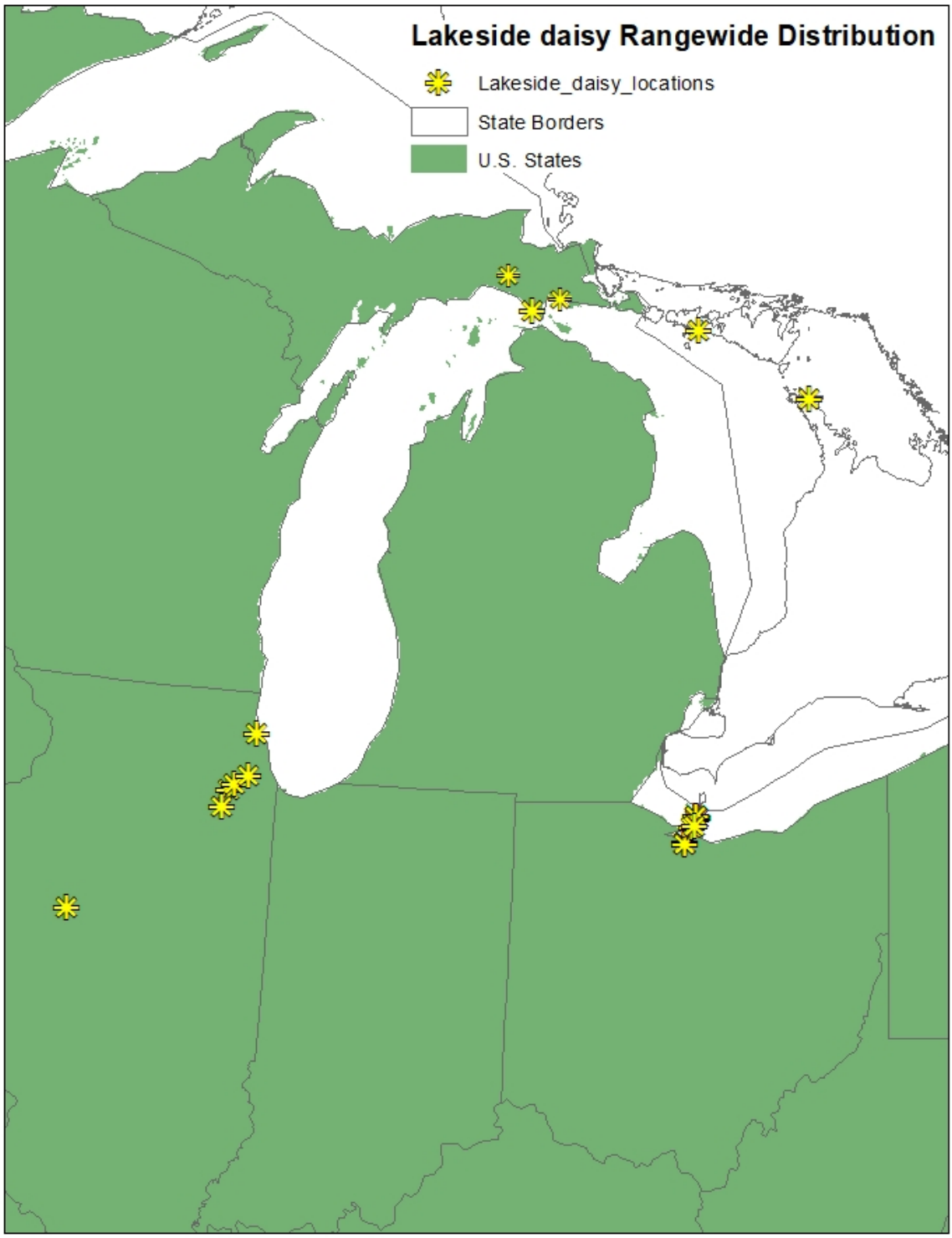
In Michigan, there are three plants on property owned by Hiawatha National Forest (Liebermann 2021). Additional plants are located adjacent to this site on land owned by Michigan Nature Association (MNA). Due to the fragile nature of the habitat at this location, MNA has established a reserve population on gravel habitat. Currently there are over 1,900 plants in the reserve population (Bacon 2020). In 2016, MNA established an introduced population at an abandoned quarry with nearly 400 plants (Bacon 2020). This population has been augmented with additional individuals in 2020 and the population is increasing. Seedlings were added, bringing the quarry population up to 550 individuals (Bacon 2020). Habitat at this site appears to be less than ideal in several plots with periodic flooding and a small low-lying wet area impacting survival.

The St. Martin Peninsula (Marquette Township) population has an unknown origin, and due to its recent discovery, no genetic work has been conducted on this population. No specific population numbers were provided but estimates of the population range from hundreds to thousands of plants (Lieberman 2021). Due to its relatively small population size, it most likely contains little genetic diversity.

Table 2. Michigan Population Estimates

State	Location	First Recorded or Established	Most Recent Monitoring	2015 Number of Plants (Adults and Juveniles)	Current Number of Plants (Adults and Juveniles)
MI	Brevort Township	1996	2015	<200	<200
MI	Reserve Population	2010	2020	>400	>1,900
MI	Marquette Township	2014	2020	<30	200-2,000
MI	Quarry	2015	2020	N/A	550
Total				**≈630**	**≈3,750**

Map 9. Lakeside Daisy Rangewide Distribution



Ohio
Naturally-occurring populations are known from two sites on the Marblehead Peninsula in Ottawa County, Ohio (Marblehead Quarry and Lakeside Daisy State Nature Preserve). The Marblehead Peninsula contains the largest population in the U.S., however, in the numbers are declining due to quarrying activities and disposal of overburden material.

This most recent survey (2021) resulted in more individual points versus polygons compared to previous years. Individual GPS points were taken if the area was too small to be designated as a polygon or if the daisies in the area were isolated from a larger area of dense daisies. For each point the number of individual plants was recorded. To calculate the number of individuals at the site, the area of the polygons was multiplied by the corresponding density estimates (scattered, moderate, or high) and added to the number of individuals recorded for all of the points.

Consistent monitoring of large Lakeside daisy populations is challenging due to changes in GIS technology and standards. The Index of Area of Occurrence in Canada was previously based on 1 x 1 km squares. The most recent analysis uses the current 2 x 2 km standard (COSEWIC, In Press, 2021). Thus, long term trends in both area occupied and population numbers can be hard to determine.

In, Ohio nearly all the areas surveyed in 2015 were visited in 2021. This survey effort indicated that one of the two high density areas of Lakeside daisy has now been lost to quarry activities as well as a significant amount of other habitat (Gardener, ODNR, personal communication, 2021). Most of the quarry area was considered to contain a low density of plants with some areas described as having a medium density of plants (Gardener, ODNR, personal communication, 2021). In addition, 118 acres of the quarry were added to the Lakeside Daisy State Nature Preserve in 2019. The 2021 census of this area based on the 2015 density estimates of daisies yielded a preliminary population estimate of 2,711,159 individuals (Gardener, ODNR, personal communication, 2021).

The 2021 Ohio census numbers for the Marblehead quarry were over 40% lower than 2015. Some of the loss in individuals at the quarry corresponds to the loss of acreage at the quarry to the State Nature Preserve. However, the loss of the highest density areas at the quarry most likely also resulted in the reduced number of individuals at this site. Approximately three million (79%) of the adult plants that in the quarry during the 2015 survey were in an area planned for imminent mining in the next three to five years (Gardner 2015, unpublished data).

Table 3. Preliminary Marblehead Peninsula Population Estimates

Density	Area in Square Meters	Adult Density	Adult Plants	Juvenile Density	Juvenile Plants	Total
Low	276,812.27	2.78	769,538.11	16.36	4,528,648.76	5,298,186.87
Medium	20,248.65	8.32	168,468.75	15.04	304,539.67	473,008.42
High	5.02	21.14	106.12	14.74	73.99	180.12
Total	297,065.94		938,112.99		4,833,262.42	5,771,375.41
Individual Points						27,607
Total						**5,798,982**

The Lakeside daisy State Nature Preserve has a relatively high density of mature plants throughout the preserve. In 2019, 118 acres were added to the preserve and this new area of the preserve contains a much lower density of plants with less occupied habitat than the original Preserve. The preliminary number of individuals documented at the State Nature Preserve in 2021 was 2,711,159. This increase was most likely due to the expansion of the State Nature Preserve by nearly 118 acres, an increase in area of nearly 600%.

Table 4. Lakeside Daisy State Nature Preserve Population Estimates

2015 Data	2021 Preliminary Data		
2015 Population Estimate	**Population Density Estimate**	**Individuals Counted**	**2021 Total**
1,373,588	2,707,782	3,377	**2,711,159**

Populations were established on state-owned land at the Central Quarry and North Quarry sites at Kelleys Island State Park in Erie County. Limited quantitative data has been taken at these sites. Previous mapping of the sites included the areal extent of the Lakeside daisy. In 2021 surveyors recorded polygons around dense areas of habitat and point data was recorded for isolated and small areas. Point data included counts of individual plants. In 2012, additional populations were introduced at the Huntley-Beatty Preserve on Kelleys Island and Castalia Quarry Metropark in Margaretta Township of Erie County, Ohio. Very little data has been collected from these sites. The 2021 survey of these sites was conducted as described above using polygons to identify areas of various density and points with a specific number of individuals.

Table 5. Preliminary Kelleys Island (North Quarry, Central Quarry, and Huntley-Beatty Preserve) Population Estimate

Density	Area in Square Meters	Adult Density	Adult Plants	Juvenile Density	Juvenile Plants	Total
Low	22,029.61	2.78	61,242.32	16.36	360,404.42	421,646.74
Medium	13,724.48	8.32	114,187.68	15.04	206,416.18	320,603.86
Total			175,429.99		566,820.60	742,250.60
Individual Points						5,023.00
Total						**747,273.60**

Table 6. Range-wide Population Estimates in the United States

State	Location	First Recorded or Established	Most Recent Monitoring	2015 Number of Plants (Adults and Juveniles)	Current Number of Plants (Adults and Juveniles)
IL	Chicago Botanic Garden	Prior to 2010	2018	<12	3
IL	Cook County Site	Prior to 2006	2020	Present	68
IL	Waterfall Glen	1994	2021	Present	Present
IL	Lockport Prairie	1988	2021	<200	175
IL	Romeoville Prairie	1988	2021	<200	12
IL	Manito Prairie	1998	2018	0	0
Total				**<412**	**258**
MI	Brevort Township	1996	2015	<200	<200
MI	Reserve Population	2010	2020	>400	>1,900
MI	Marquette Township	2014	2020	<30	200-2,000
MI	Quarry	2015	2020	N/A	550
Total				**≈630**	**≈3,750**
OH	Lafarge Quarry	Historic	2021	10,047,763*	5,798,982*
OH	Lakeside Daisy State Nature Preserve	Historic	2021	1,373,588+	2,711,159^*
OH	Kelleys Island North Quarry	1989	2021	1,418,020+	360,808*
OH	Kelleys Island Central Quarry	1989	2021		247,748*
OH	Huntley-Beatty Preserve	2012	2021	Present	138,718*
OH	Castalia Quarry	2012	2021	Present	66,711*
Total				**≈12,839,371**	**≈9,324,126**

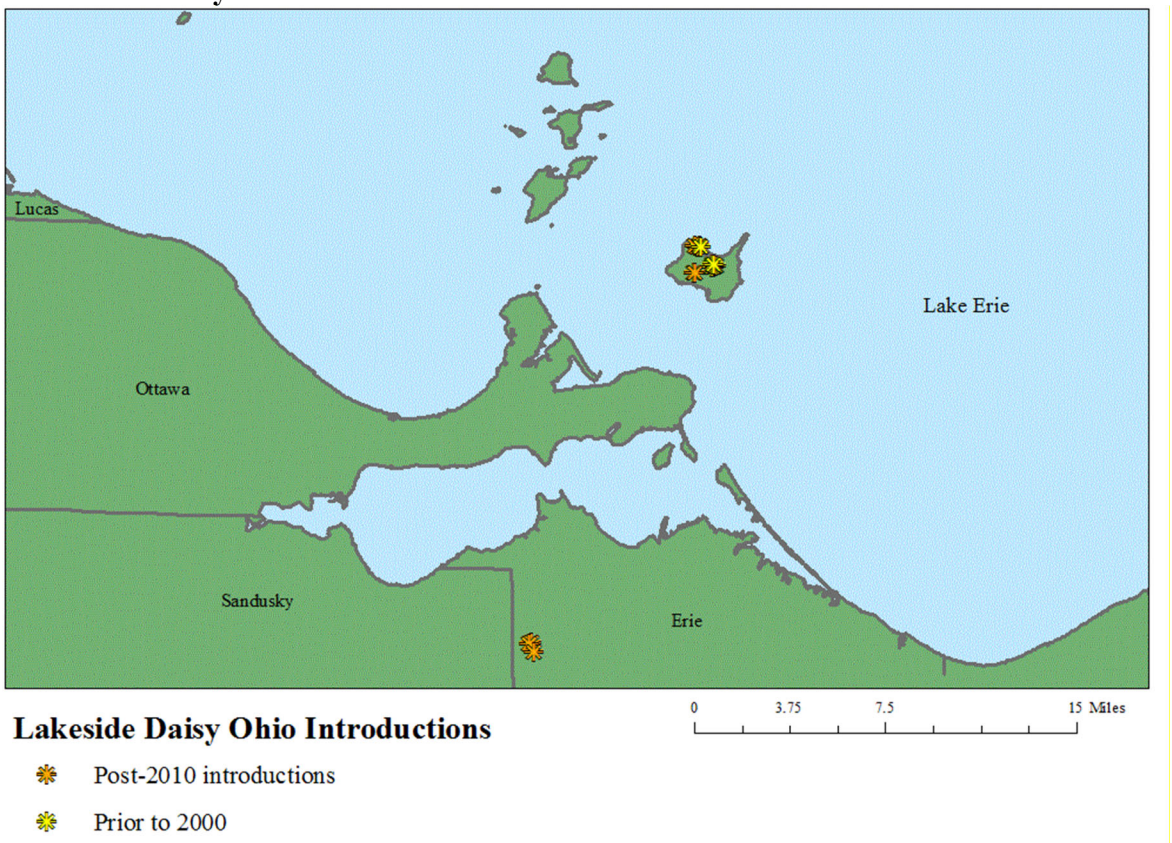
^Includes the original State Nature Preserve as well as the 2019 addition
*Population estimate based on areas of high, moderate, and scattered density
+Population estimate based on moderate density

Huntley-Beatty Preserve on Kelleys Island is protected by a conservation easement and contains approximately 138,718 plants (Gardner 2021). Populations at Kelleys Island continue to be augmented with seed and/or plants to increase the population. The population at the north quarry is estimated to be 360,808 with an additional 247,748 plants at the Central Quarry (Gardner 2021).

Due to concerns about expanding operations at the Marblehead Quarry, seeds were again collected from the Marblehead Peninsula from 2012 to 2021 to establish additional populations on protected public land. Augmenting areas with new seed collected from different areas on the Marblehead Peninsula supplements the population with additional genes to help enhance genetic diversity and increase population viability. After developing an agreement with the Erie County Metroparks, seed was placed at Castalia Quarry Metropark between 2012 and 2020. The 2021 census estimates 66,711 individuals (Gardner 2021).

Annual monitoring of Lakeside daisy populations does not occur at all sites. Some sites are visited annually, while others may only be monitored every five years. Monitoring of this species is not uniform across its range and therefore populations are not estimated in the same manner. For small sites such as those in Illinois and Michigan, all individuals can be counted. For large sites, such as Marblehead Quarry and the Lakeside Daisy State Nature Preserve, population estimates are made by extrapolating from density measurements. Therefore, consistent, accurate rangewide population and demographic information are lacking.

Map 10. Lakeside Daisy Ohio Introductions



2.3.1.3 Genetics, genetic variation, or trends in genetic variation:
The Lakeside Daisy Recovery Plan (USFWS 1990) called for increased research into the genetics of the plant to aid in the understanding of its self-incompatibility as well as the origin of the species.

The Chicago Botanic Garden has recently initiated work to observe the number of self-incompatibility (SI) alleles of the Illinois populations compared to the number of SI alleles found

in populations from outside Illinois and to conduct a common garden experiment. Results from this research are not expected for several years as the study has just been initiated.

In Ohio, plant material has been collected and will be used to compare the genetic diversity of the large, naturally occurring population on the Marblehead Peninsula with the diversity of the smaller, introduced populations on Kelleys Island. Analysis is ongoing.

2.3.1.4 Taxonomic classification or changes in nomenclature:
No changes from the last 5-year review. The taxonomic name for Lakeside daisy was *Hymenoxys herbacea* (Asteraceae). However, more recent treatment is to use Edward Greene's name of *Tetraneuris herbacea*. This is the name used by the Ohio Department of Natural Resources Division of Natural Areas and Preserves (DNAP), USDA, Center for Plant Conservation, Smithsonian National Museum of Natural History, and it is widely accepted by many other scientific organizations. However, this name has not been widely adopted by the Service.

2.3.1.5 Spatial distribution, trends in spatial distribution (for example, increasingly fragmented, increased numbers of corridors, etc.), or historic range (for example, corrections to the historical range, change in distribution of the species' within its historic range)
According to the Lakeside Daisy Recovery Plan (USFWS 1990), the center of the population within the Marblehead Peninsula has moved over time in a westerly direction. As quarry activities have eliminated the eastern side of the population, the western edge continued to persist for several years. In recent years, the western edge of the population center has been severely impacted. As of 2021 this high-density area has now been destroyed by quarry activities. It is unknown whether the diversity within the population center was matched elsewhere within Marblehead Peninsula and whether further stochastic events may decrease genetic diversity. Plants were collected from both the western and eastern sides of the population in an effort to maintain some of this genetic diversity. Some genetic diversity may have been eliminated with the loss of this habitat and the associated individuals.

Continued accelerated operations are expected to fragment this population even further as the area of quarry operations is expanded to the south. Opportunities to establish new populations on the mainland have been limited. However, approximately 118 acres of additional modified alvar habitat were purchased and added to the Lakeside Daisy State Nature Preserve in 2019 after LafargeHolcim agreed to sell this parcel.

In Canada, populations are located in close proximity to each other and severe fragmentation is not occurring (COSEWIC, In Press, 2021).

2.3.1.6 Habitat or ecosystem conditions (for example, amount, distribution, and suitability of the habitat or ecosystem):
Climate change may present a serious threat to this species, as the habitat for Lakeside daisy is restricted to rare dry, limestone prairies and alvar communities, and no refugia are present (Campbell et al. 2002). Populations of Lakeside daisy cannot expand to unsuitable habitat, and some, particularly those associated with the Great Lakes, including the three sites at Kelleys Island, cannot migrate northwards due to the presence of the Great Lakes and/or development.

Some subpopulations in Canada may be at risk from increased wave-wash and ice build up associated with increased storm intensity (COSEWIC, In Press, 2021). LafargeHolcim continues its quarry operations which reduces the amount of modified alvar habitat available. It is anticipated that once quarry operations are complete, the quarry will then naturally fill with water and become a large lake. The only remaining upland habitat would be limited to the periphery. Thus, without permanent protection of alvar and modified alvar habitat, the amount of suitable habitat for this species will continue to decline.

Management requirements to maintain suitable habitat for the Lakeside daisy varies at different sites. The populations in Illinois experience greater vegetative competition, so greater levels of management are needed to maintain open habitat. The Michigan populations are also experiencing some shading by trees, which may require some management to maintain the light levels needed by Lakeside daisy. In Ohio, some removal of cedar, and other woody species, is required to maintain sunny, open alvar habitat. This management is required infrequently. In general, Lakeside daisy is well adapted to occupying alvar habitat that other plants cannot tolerate and therefore competition is limited.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms):

The final rule (53 FR 23742) listing Lakeside daisy as threatened identified the threats to the survival of Lakeside daisy as habitat destruction, succession of competitive overgrowth by woody species, over-collecting for gardens, inadequacy of existing regulatory mechanisms, and the species' self-incompatibility.

With the exception of over-collection, all of the threats described in 1988 are still affecting the species. Additionally, climate change is now a threat not discussed when the Recovery Plan was written. In addition to climate change, the most significant threats range-wide are habitat destruction and succession of woody species.

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

The Endangered Species Act prevents the removal and possession of both federally listed endangered and threatened plants from federal property. Federally listed endangered plants are also protected from removal or destruction on private property if it violates any law or regulation of that state. The Marquette Township population located on the property of the Hiawatha National Forest is protected because it is located entirely on federal property. However, the Brevort Township population is only protected on the side of the road that is owned by the Hiawatha National Forest. The opposite side of the road is privately owned by MNA.

Human encroachment activities (powerline maintenance, ATV use, snow plowing, etc,) and associated non-native invasive species introduction continue to threaten the Brevort Lake Road and St. Martin Peninsula populations. A large portion of habitat at the Brevort Lake Road site was damaged by improper equipment use by contractors for the utility resulting in perforation and tearing of the organic mat and soil compaction and displacement. The Brevort Lake Road population is also at risk due to the instability of the tufa and marl substrate, which is eroding and causing some plants to fall into the roadside ditch (Bartoo et al. 2000).

All of the populations in Illinois, except one (Chicago Botanic Garden) are on public land and receive some level of protection and management. Populations at designated as Illinois State Nature Preserves (Lockport Prairie Nature Preserve, Romeoville Prairie Nature Preserve, and Manitou Prairie Nature Preserve) receive the highest level of protection. The Theodore Stone population in Cook County and the Waterfall Glen population in DuPage County occur within County Forest Preserves and have limited protection as management for Lakeside daisy is not consistent. Both populations in Cook County are managed in an attempt to reduce invasive species and promote prairie habitat. The level of management at the Waterfall Glen site in DuPage County is currently unknown. The Waterfall Glen site currently consists of one subpopulation as the original two subpopulations are believed to be extirpated. The most recent monitoring of the remaining subpopulation counted rosettes instead of full plants (Kobal, Forest Preserve District of DuPage County, personal communication, 2021), therefore the number of adults plants is currently unknown as is the level of management.

The largest natural population in the United States is on private land within an active quarry (Marblehead Quarry, Ottawa County, Ohio) and therefore does not receive any federal protection. The Lakeside Daisy Nature Preserve in Ottawa County, and the introduced populations at Kelleys Island at the North Quarry and Central Quarry in Erie County, are all located on land owned by the state of Ohio and are protected under Ohio law as this species is listed as state endangered. Permission from the property owner as well as permit from ODNR DNAP would be required to take plants from these locations. In addition, the Lakeside Daisy State Nature Preserve is a dedicated preserve which provides a very high level of protection through deed restrictions to prevent development and other activities. Huntley-Beatty Preserve is protected by a conservation easement which prohibits development and other activities. The Service has signed a Memorandum of Understanding (MOU) with ODNR for the North Quarry and Central Quarry at Kelleys Island State Park, the Kelleys Island Park District for the Huntley-Beatty Preserve, and with the Erie County Metroparks for the Castalia Quarry Metropark property. The MOUs were developed to ensure that these sites are managed appropriately for Lakeside daisy. These sites require regular monitoring by the Service to ensure that they are being appropriately managed to conserve and protect Lakeside daisy populations (for example, from other development or habitat degradation).

One serious threat to the species is that, of the approximately 2,500-acre area of former and active quarry at Marblehead Peninsula in Ottawa County, Ohio, only 118 acres are permanently protected on the Marblehead Peninsula in a dedicated state nature preserve. The majority of the population is found on private property owned by LafargeHolcim. Well over 300 acres of occupied habitat have been lost since 1990 when the Recovery Plan was written. Continued loss of habitat is expected to occur as quarry activities continue.

In undisturbed areas of the quarry, Lakeside daisy will recolonize modified alvar habitat if competition is low. However, LafargeHolcim was required by the ODNR Division of Mineral Resources Management (MRM) to stabilize areas by planting them with various grasses and other species, as a part of their mining permit. While these species may stabilize soil, they also create significant competition to the establishment of Lakeside daisy. The Service worked with ODNR-MRM to modify the LafargeHolcim mining permit to reduce the required planting of grasses and other species to minimize competition for Lakeside daisy. The permit revision was approved in early 2019. This will allow Lakeside daisy to colonize undisturbed gravel piles with less competition from other plants.

While the number of sites throughout the range of this species with some degree of protection is high, the combined population of all these sites throughout the range of this species is a fraction of the number of individuals that do not receive any protection because they are located on land privately owned by LafargeHolcim on the Marblehead Peninsula. In addition, outside of Ohio, most populations are small and relatively isolated.

In addition to the threats listed above, threats in Canada include trampling by pedestrians, logging in adjacent forests, and recreational climbing which can remove the organic matter Lakeside daisy utilizes for establishment on rock surfaces (COSEWIC, In Press, 2021). A significant amount of Lakeside daisy habitat is protected in Canada as park land. However, trampling and recreational climbing can still be a threat in parks. In Canada this species was previously considered Threatened, however in 2021 its status was updated to Special Concern (COSEWIC, In Press, 2021).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:
Overutilization of the Lakeside daisy for commercial use appears to be a minimal threat.

There likely are Lakeside daisy plants in privately owned gardens on the Marblehead Peninsula. These were probably established with small collections of plants or seeds. Small collections likely do not have enough genetic diversity to successfully be pollinated and therefore do not contribute to recovery. A small population has been established at the Heritage Garden at the Ohio Governor's Residence in Columbus, Ohio to showcase the alvar habitat and its associated rare plants in Ohio. An additional population is also located at Holden Arboretum. In the village of Lakeside, Ohio, for which the Lakeside daisy is named, there is a small garden area composed of approximately 100 plants in a 10-ft by 20-ft area. These populations do not contribute to recovery but are an educational resource as the public can easily view these plants.

Recovery of the species occurs when the plant is established in a genetically diverse population that is being successfully pollinated and is germinating within suitable natural habitat. The maintenance of plants in cultivated gardens or greenhouses does not constitute recovery, even if the number of plants is significant. Therefore, the Service does not support removal of plants or seeds from the wild for private or commercial use.

2.3.2.3 Disease or predation:
Disease and predation were not listed as threats to the Lakeside daisy at the time of listing (53 FR 23742), though herbivory was included as an ecological threat to both natural and restored populations in the Recovery Plan (USFWS 1990). Predation, namely deer and rabbit herbivory, of this plant continues to pose a threat to Lakeside daisy, particularly small populations.

2.3.2.4 Inadequacy of existing regulatory mechanisms:
The inadequacy of state and Federal laws for plant and plant habitat protection remain the same as discussed in the 2016 5-year Review for Lakeside daisy. One recent change is that despite coordination between the Erie County Metroparks and the Service, including an MOU, impacts to this species are still occurring. During 2021 monitoring, Lakeside daisy plants were found pulled from the ground in an area where it appeared that illegal camping had also occurred. In addition, recent actions due to right-of-way work resulted in significant disturbance at the Brevort Township site in Michigan.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Populations continue to be threatened by human use of the habitat, including ATV activities, which can destroy plants and habitat. Maintenance along the right-of-way near the Michigan Brevort Township population resulted in significant impacts to this population in 2019 (Mensing, U.S. Fish and Wildlife Service, personal communication, 2019). The ground was significantly disturbed, and the Forest Service attempted to regrade the most heavily rutted areas but substantial damage to the soil remains (Liebermann 2021). In addition, invasive species encroachment continues to pose a threat to Lakeside populations.

In Ohio, invasive species such as columnar buckthorn (*Rhamnus fragula* 'Columnaris'), autumn olive (*Elaeagnus umbellata*), callery pear (*Pyrus calleryana*), and others are present in Lakeside daisy habitat. In addition, visitor disturbance such as off-trail mountain bike use also impacts habitat in both Ohio and Michigan. In 2021, piles of daisies that had been pulled from the ground were found during a monitoring event at one of the Ohio sites (Castalia Quarry) that is on public property.

Climate change may be a serious threat for a rare, endemic plant species like the Lakeside daisy. The habitat for the Lakeside daisy currently spans a narrow range of habitat types, including dry, limestone prairies; alvar communities, which are globally rare; and modified alvar habitat such as active and abandoned quarry locations in the Great Lakes Region. According to the Intergovernmental Panel on Climate Change (IPCC), annual precipitation and runoff has been increasing in the Midwest and projections are that temperatures over North America are very likely to increase. Higher temperatures and increased rainfall may alter the habitat for the Lakeside daisy. More frequent heavy precipitation events could create standing water in alvar areas and impact habitat conditions for Lakeside daisy. Based on transplanting efforts in both Ohio and Michigan, Lakeside daisy has not survived when it was transplanted into areas that flood or low-lying areas that may experience temporary ponding. It is not known how the Lakeside daisy will be impacted by temperature changes or the potential for an increased growing season. However, additional rainfall will likely not buffer drought and lowered lake levels caused by increased temperature. Furthermore, the largest population of Lakeside daisy in the United States is situated in Ottawa County, Ohio, on the coastline of Lake Erie, and no refugia are available nearby for this plant. Therefore, climate change poses a serious threat to the Lakeside daisy due to the severely restricted habitat requirements and the limited range of the species.

2.4 Synthesis

Since the Lakeside daisy was listed as threatened in 1988 (53 FR 23742), the number of populations in the United States has increased from the single large, fragmented population at Marblehead Peninsula in Ottawa County, Ohio. In Michigan two populations were found and three populations were introduced. Additionally, three populations have been restored (two in Will County, Illinois, one in Tazewell County, Illinois). In Illinois three populations have been introduced (two in Cook County and one in DuPage County), two populations were introduced in Michigan (Brevort Lake Road reserve and quarry), and four populations have been introduced in Ohio (three on Kelleys Island and one in Margaretta Township, Erie County). Most populations in Illinois and Michigan appear to be stable, however some, such as the DuPage and Tazewell County, Illinois populations have been declining. It is likely that some of the populations categorized as stable may also show declining trends if long-term data were available.

The population within Marblehead Quarry is at risk of significant reduction by active quarrying (Windus, ODNR, personal communication, 2015). Thus, although the number of populations has increased since 1988, the number of plants has most definitely declined and will continue to do so, primarily due to the quarry operations in Ohio. The increased number of populations provide greater redundancy in the species. However, these small populations are often sourced from a single, small population and most likely do not contain all the genetic diversity found in a large, robust population. Efforts should be made to increase the representation in these small populations through additional seed or plant augmentation.

Additionally, research into the genetics and pollination biology of the Lakeside daisy has provided limited information regarding the sporophytic self-incompatibility of the species. Work has also been performed to understand the geological patterns associated with the species and to determine the origin of the population in Brevort Township, Michigan, with limited results (Esselman et al. 2000; Esselman et al. 2002). Neither isozyme nor inter-simple sequence repeat genetic markers provided enough genetic differentiation between populations to determine the cladistics of the populations known at that time. However, results of a genetic diversity and seed set study within the introduced Illinois populations found that these populations suffer from reduced genetic diversity, increased asexual reproduction, and reduced seed production, suggesting the Lakeside daisy will not be preserved by a single effort to establish an introduced population (Esselman and Williams 2003). These results indicate that Recovery Criteria 3 and 4 have not been met, and will not be accomplished with existing recovery actions. Populations that lack sufficient diversity to be self-sustaining are not able to contribute to the recovery of the species. Genetic diversity should be increased at these sites through the addition of significant numbers of plants and/or seed from different mating groups in a repeated and sustained manner over multiple years, to increase the likelihood of success in establishing new populations. To ensure long-term persistence of the population and viability of the habitat, appropriate habitat management also needs to be incorporated.

According to the recovery criteria outlined in the Recovery Plan (USFWS 1990), the species can be considered recovered when essential habitat at the Marblehead Quarry is restored, the species is restored to one large population in each of two geographic areas in Illinois, and a minimum of 5,000 individuals in one restored population per Illinois county is restored for 15 consecutive years with an additional 10 years of monitoring. These criteria have not been met. Limited progress is being made on this species' recovery through continued efforts to establish introduced populations. The restored populations of Lakeside daisy in Will County, Illinois have survived for the past 21 years, although both populations are exceedingly small and do not appear to indicate any signs of significant sexual reproduction as substantial numbers of seedlings have not been observed. This suggests that these populations may lack sufficient genetic diversity and may be functionally extirpated. Information from 2013 indicated that the Manito Prairie Nature Preserve site contained very few individuals and no plants have been observed in the years since (USFWS 2020). The Michigan populations have an unknown origin and therefore their contribution to the diversity of this species is unknown. The two Kelleys Island populations (North Quarry and Central Quarry) established between 1989 and 1994 through repeated seeding and transplanting with individuals from many diverse sites within the Marblehead Quarry have steadily increased in size and provide a model of reintroduction techniques. While LafargeHolcim will continue active quarrying throughout the site indefinitely, they do permit the efforts of the state and Federal agencies to monitor populations of Lakeside daisy. They also allow seed collection and gathering plants for transplant from the inactive sections of the quarry.

Some populations of Lakeside daisy occurring on preserves have been monitored and maintained infrequently for the continued survival and recovery of the species. The two introduced populations in Will County have been monitored every one to five years since their introduction. Regular monitoring occurred since its introduction in 1988 until 2002 at Manito Prairie Nature Preserve in Tazewell County, Illinois. However, there are limited data since then.

Twenty-three plots were established during 1989-1997 from the original sites at Kelleys Island in Erie County, Ohio. Monitoring conducted in 2014 and 2015 confirms that these populations are successfully continuing to reproduce. During this monitoring, 16 of 17 transplant plots were censused; all have significantly increased except one, due to poor plot selection that included a low-lying area that was more wet than other locations.

The Lakeside daisy population on the Marblehead Peninsula has been monitored periodically in 1986, 1989, 2009, 2015, and 2021 to develop population estimates. The Marblehead Quarry includes a large area of suitable habitat with low to medium density of plants. However, the amount of suitable habitat continues to significantly decrease due to quarry activities. The Lakeside Daisy State Nature Preserve has a high density of plants in the original portion of the Preserve. In the 118 acres of habitat recently added to the Preserve in 2019, there is a lower density of plants, but a significant amount of potentially suitable habitat available for natural plant expansion or augmentation.

Threats include: encroachment of woody species, non-native invasive species, ORV use, right-of-way maintenance, and herbivory; continue to impact the Brevort Township, Michigan, population. Additional populations in Michigan are also threatened from woody species encroachment, shading, and non-native invasive species.

The greatest threat remains the ongoing quarry activities which occur at the largest population in the U.S. (Table 6). Quarry activities since 1989 have reduced the amount of potential habitat for this species. In addition, activities have expanded to the west and south where some of the highest densities of Lakeside daisy previously occurred. Additionally, the threat of climate change may be serious for the Lakeside daisy, because its habitat range is restricted to rare alvar and limestone areas and dispersal to the north for most sites is constrained by the Great Lakes.

Canadian populations are not specified in the recovery criteria. While the Canadian subpopulations contribute to the redundancy of Lakeside daisy, it is not clear if the Canadian subpopulations are resilient due to questionable protections, continuing threats, or unstable population trends. Recent monitoring has not documented an increase in the overall Canadian populations. Canada has recently proposed designating Lakeside daisy as Special Concern instead of Threatened, however, this is due to change in the interpretation of severe fragmentation (COSEWIC, In Press, 2019), not because of growth in the number of populations or individuals. There has been no change in protection of populations of this species in Canada. Multiple threats continue to occur, even in protected areas, such as trampling and bouldering activities by park visitors.

The recovery criteria and recovery actions rely heavily on protecting, managing, and acquiring the habitat on which Lakeside daisy needs to maintain viability (USFWS 1990). In addition, recovery of the Lakeside daisy relies on a greater understanding of the biotic and abiotic needs of the species to apply adequate management. Therefore, because the criteria for delisting have not been met, the Lakeside daisy continues to meet the definition of a threatened species.

At this time, the acquisition of a significant amount of suitable habitat, as required by the recovery criteria, is no longer attainable due to the increased level of quarry activity at the Marblehead Quarry in Ohio. However, the Service continues to work toward protection of any occupied, suitable habitat. The Illinois populations are most likely declining and there is a lack of continuous, long-term data for the Michigan populations. The criteria and recovery actions may need to be revised to reflect the current condition and updated information. More suitable habitat for the species should be acquired and permanently protected. Quarry activities permanently modify and can eliminate alvar habitat. Over 98 acres of suitable habitat were lost between 2009 and 2015.

Due to the continued threats to this species and the lack of significant recruitment on public land outside of Ohio, it is recommended that the priority number for this species be maintained at 5 to illustrate the threats and limited ability of this species to recover.

3.0 RESULTS

3.1 Recommended Classification: No change is needed.

3.2 New Recovery Priority Number: Retain as 5, which indicates that the species has a high degree of threat and a low recovery potential.

3.3.1 Listing and Reclassification Priority Number: Not applicable.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

Future actions required to proceed with the recovery of this species focus on revision of current recovery criteria, population habitat management and protection, as well as research into the genetics of Lakeside daisy. These actions are listed below with highest priority actions listed first:

- Provide adequate habitat protection for the only large, naturally occurring population in the United States, Marblehead Peninsula, through the purchase or establishment of conservation easements of suitable modified alvar habitat from LafargeHolcim.
- Cooperatively work with LafargeHolcim to collect seed and transplant individuals from the areas of the quarry that have the greatest threat of being quarried and have the highest genetic and habitat diversity.
- Conduct research into the genetics and diversity of the different populations to determine if seed from Ohio could increase the viability of the Michigan and Illinois populations.
- Increase genetic diversity by continuing to augment introduced Lakeside daisy populations on suitable sites within the species' historical range with seeds and plants as feasible.
- Provide necessary management at all sites, including removing non-native invasive species and woody encroachment, deterring herbivory, limiting ORV access, and reducing competition.
- Coordinate monitoring among all three states and Ontario where this species currently occurs so that information is consistent and meaningful for comparisons.
- Continue to monitor populations of Lakeside daisy, both natural and introduced, for reproductive output, recruitment, individual plant growth, and survival.
- Improve awareness to the public about the harm of collecting federally listed plant species and the importance of protecting and maintaining unique ecosystems, such as alvars, for recovery of plant species.
- Botanical and geological surveys should be performed throughout Ohio, Indiana, Illinois, Michigan, and Wisconsin to assess the potential for suitable habitat to establish Lakeside daisy populations.
- Consider revising recovery criteria to include new data prior to the next 5-year review.

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U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Lakeside daisy *(Tetraneuris herbacea)*

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: Maintain at 5.

Review Conducted By: Jennifer Finfera, Ohio Ecological Services FO, USFWS

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve [signature] ACTING FOR PATRICE ASHFIELD Date 9/30/2021

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.