

Minnesota Dwarf Trout Lily
(Erythronium propullans)

**5-Year Review:
Summary and Evaluation**

May 2021

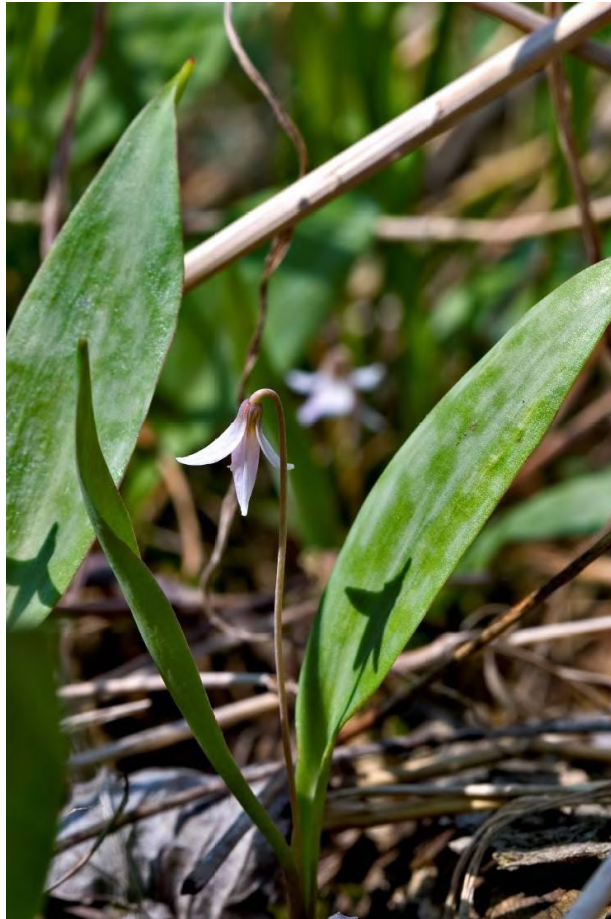


Photo by Gary Hagemester

**U.S. Fish and Wildlife Service
Minnesota-Wisconsin Field Office
Bloomington, Minnesota**

5-YEAR REVIEW
Minnesota dwarf trout lily (*Erythronium propullans*)

GENERAL INFORMATION:

Species: Minnesota dwarf trout lily (*Erythronium propullans*)

Date listed: March 26, 1986

FR citation(s): 51 FR 10521

Classification: Endangered

Lead Field Office: Darin Simpkins, Minnesota-Wisconsin Field Office, Bloomington, MN, 952-252-0092

Lead Region: Midwest Regional Office (Region 3), Bloomington, MN, 612-713-5292

BACKGROUND:

The Minnesota dwarf trout lily (hereafter DTL) is an annual plant that blooms during early spring in the woodlands of southeastern Minnesota in the Cannon River valley. As a spring ephemeral, DTL blooms, along with many other woodland wildflowers, when sunlight reaches the forest floor before deciduous trees fully leaf out. Preserving wild plants in their natural habitat appears to be the best option for ensuring survival of this rare species. The primary stressors affecting DTL are loss of woodlands that are commonly logged and converted to agriculture and housing developments, incompatible recreational uses, spread of exotic species, and large-scale precipitation events associated with a changing climate. See the 2011 5-year review for more information on existing threats to DTL (U.S. Fish and Wildlife Service [USFWS] 2011).

Most recent status review: USFWS. 2011. Minnesota dwarf trout lily (*Erythronium propullans*) 5-year Review: Summary and Evaluation. Twin Cities Field Office, Bloomington, Minnesota. 29 pp. Finalized August 2011.

FR Notice citation announcing this status review: 80 FR 78751 (17 December 2015) - Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of One Listed Animal and Five Listed Plant Species.

Recovery Plan:

The USFWS finalized the recovery plan on 16 December 1987. As identified in the plan, DTL may be considered for reclassification to threatened status if two criteria are met. These criteria are:

- 1) When a minimum of 400 naturally occurring colonies (clones) in at least 10 geographically and ecologically distinct sites are adequately protected and managed to assure their continued existence.
- 2) When a total of 500 colonies in at least 15 sites, representing the entire extant range of the species, are adequately protected and managed.

ASSESSMENT:

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened or Endangered Wildlife and Plants.

USFWS's Minnesota-Wisconsin Ecological Services Field Office conducted this 5-year review. Data for this review were solicited from interested parties through a Federal Register notice announcing this review on 17 December 2015. We also relied extensively on information and review provided by Derek Anderson of the Minnesota Department of Natural Resources (MNDNR). The Service also reviewed reports and scientific papers that had been completed since the last 5-year review that was completed in August 2011. The information below summarizes substantive new information since our previous 5-year review in 2011.

Information acquired since the last status review:

1. New information on the species' biology and life history:

No new information regarding DTL biology or life history has become available since the last 5-year review. Published research reveals that DTL rarely, if ever, produces seeds (Banks 1980; Morley 1982). It appears that this species reproduces largely, if not entirely, by asexual means through the production of offshoots. Attempts to artificially propagate DTL generally have been unsuccessful.

2. Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors), or historical range (e.g., corrections to the historical range, change in distribution of the species within its historical range):

According to the recovery plan (USFWS 1987), when boundaries of individual colonies were difficult to distinguish, "100 flowering plants" were to constitute one colony. Minnesota Department of Natural Resources abandoned counts of colonies several years ago in favor of counts of blooming plants in permanent monitoring plots (Sather 2009b). In this review, we primarily report counts of blooming plants to describe population trends, but we also provide a brief summary of progress towards meeting the recovery criteria, as described in the recovery plan (USFWS 1987).

No new populations of DTL have been discovered since the last 5-year review. DTL is restricted to portions of the Straight River, Cannon River, Little Cannon River, Zumbro River, and Prairie Creek watersheds in Minnesota (Figs. 1 & 2). In the previous 5-year review, it was noted that the MNDNR recognized 40 element occurrences of the species. More intensive survey efforts were conducted after the previous 5-year review, resulting in more plants being found between populations that were originally thought of as distinct but since have been determined to be functionally connected (Derek Anderson, MNDNR, 22 June 2020, pers. comm.). Currently, 36 element occurrences of DTL are recognized.

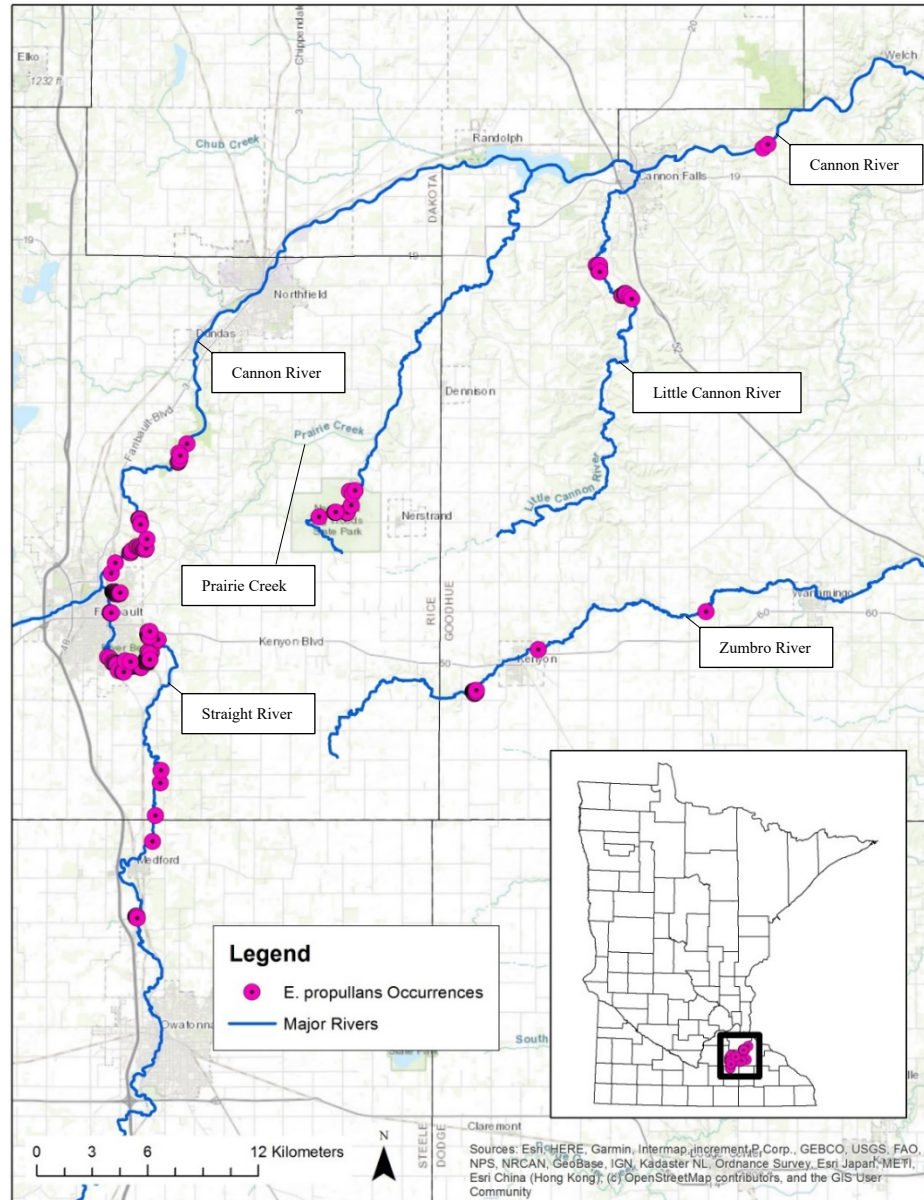


Figure 1. Spatial distribution of dwarf trout lily (*Erythronium propullans*). Dots represent centroid points of subpopulations at each site. The figure was provided by Derek Anderson, Minnesota Department of Natural Resources, for the specific purpose of this 5-review and represents data that were current as of 18 June 2020. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present.

Populations of DTL range from one to over 100 colonies, with an average of around 30 colonies per population. Actual colony size ranges from a few plants to several hundred flowering plants. The number of visible colonies and the number of plants visible within colonies is highly variable from year to year.

The species' distribution is related to the distribution of Decorah shale as the underlying bedrock layer, probably because of the finer texture soils derived from

this stratum (Sather 2009a). The species' preferred habitat appears to be maple-basswood forests on slopes and ravines or floodplain forests (USFWS 2011). Forty-two percent of known populations occur in floodplains that may be prone to flooding at least in some years. Another 37% of colonies occur on easily eroded slopes (Sather 2009a). Spatial modeling suggests that undiscovered populations of the species may exist elsewhere, such as along portions of the Straight River and its tributaries where landowner permission to conduct searches of suitable habitat has not been secured "in this highly developable corridor" (Sather 2009a). See Fig. 2.

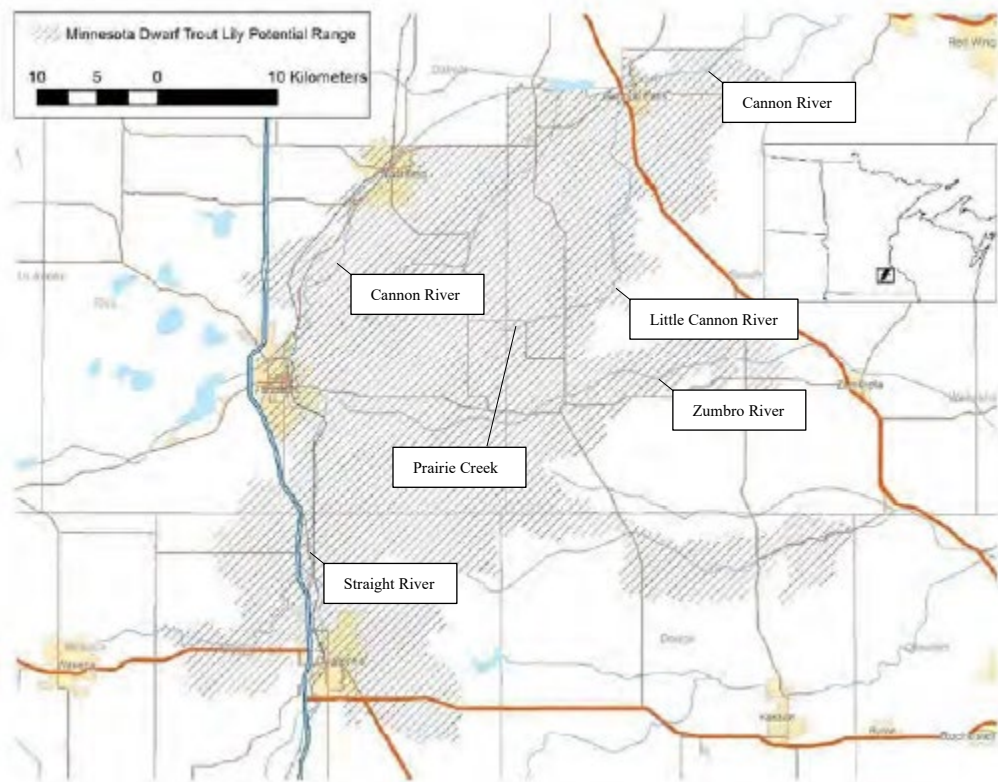


Figure 2. Predicted potential range of Minnesota dwarf trout lily based on the distribution of Decorah shale, certain plant communities of which the species is an associate, extant populations of the species, and negative surveys. Figure is from USFWS (2011).

3. Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate), or demographic trends:

The MNDNR has been intensively monitoring three sites for DTL since 1986, including Grace Nature Preserve, Nerstrand-Big Woods State Park, and River Bend Nature Center. At that time, these sites were thought to collectively contain about one-third of all DTL plants (Sather 2009b). At Nerstrand-Big Woods State Park, monitoring was discontinued in 1990 due to concerns about potential impacts of foot traffic, but it was resumed in 1999 to assess the impacts of a June

1998 flood and of “upslope land use” (Sather 2007). Since the previous 5-year review, monitoring at River Bend Nature Center has been discontinued due to a number of factors, including loss of plants to flooding impacts and loss of *in situ* monitoring infrastructure. In 2016, MNDNR started annually monitoring plots at Clinton Falls Dwarf Trout Lily Scientific and Natural Area (SNA). See Sather (2000; 2004a; 2009a) and Anderson (2019) for descriptions of the methods used to search for DTL and monitor populations.

In addition to the three primary monitoring sites, MNDNR also visits other DTL sites intermittently to assess the status of populations there (Sather 2004a; Anderson 2019). However, quantitative monitoring of populations at these DTL sites is not feasible due to the inability to distinguish non-blooming DTL from white trout lily (Sather 2004a).

Summary of Intensive Monitoring

Nerstrand-Big Woods State Park – Since monitoring began at Nerstrand-Big Woods State Park, the numbers of both plants and colonies have declined (Sather 2009a; Sather 2009b; USFWS 2011, Anderson 2019). See Fig. 3. Intensive monitoring occurs in two areas at the park – the “Boardwalk monitoring grid” and the “Oak Bridge Area” (Sather 2007; Anderson 2019). After initially monitoring plants at the Boardwalk site from 1986 to 1990, the DNR resumed intensive monitoring there in 1999 after it was affected by a 4.6 inch rainfall event that led to a major mid-summer flood in 1998. Monitoring in the Oak Bridge Area first began in 2001 (Sather 2007).

In the long-term monitoring (Boardwalk) grid, the decline in abundance has been greatest in a floodplain depression location where the June 1998 flood “buried” DTL plants with sediment (Sather 2004b; USFWS 2011). The flood also eroded away a streamside DTL habitat where 151 plants had been previously recorded (Sather 2000; USFWS 2011). Some plants displaced by the flood established new colonies where they settled (Hensley 2005). Since 2003, abundance has been highly variable around the annual mean (\pm 95% CI) of 262 ± 44.8 flowering plants (Fig. 3). Annual trends may suggest a slight, but likely statistically insignificant decline from 2003 to 2019; however, the number of flowering plants have been particularly below the mean in four out of six years between 2014 and 2019. Garlic mustard invasion and precipitation events associated with climate change may be severe threats to the viability of this population (USFWS 2011; Anderson 2019).

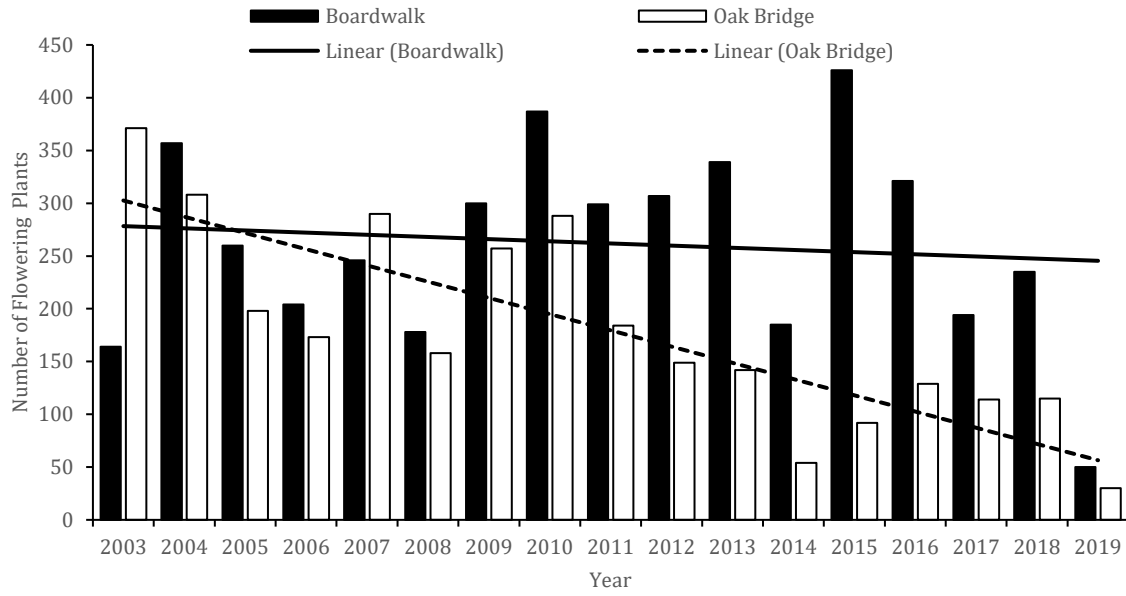


Figure 3. Number of flowering dwarf trout lily (*Erythronium propullans*) and annual trends observed at Boardwalk and Oak Bridge monitoring sites at Nerstrand-Big Woods State Park from 2003-2019. Data were provided by Derek Anderson, Minnesota Department of Natural Resources, for the purpose of this 5-year review and were current as of 26 June 2020.

Since 2002, DNR has monitored 14 colonies in the Oak Bridge area at the state park. DTL that are close to the footpath in the monitoring area have declined (Anderson 2019). Mean number of flowering plants from 2003-2019 at the Oak Bridge area was 180 ± 45.0 flowering plants, which was substantially lower than at the Boardwalk site. The number of blooming plants in this colony seems to have been in decline since 2003 (Fig. 3). From 2014 to 2019, the number of flowering plants have been consistently below the annual mean. Flooding impacts may be partially responsible for some of the declines observed at this location (Anderson 2019).

Grace Nature Preserve – The DNR began intensive monitoring of DTL at Grace Nature Preserve in 1987 (Sather 2004b) and resumed monitoring in 1999. After reaching a peak in 2004, the number of blooming plants counted within consistently monitored colonies declined (Figs. 4–8). In 2009, the number of DTL plants declined from the previous year in two colonies that had a high frequency of anomalies. In 2005, 34% of blooming plants in these colonies had exhibited anomalies in development. Declines observed at this site may also be due to impacts from flooding events (Anderson 2019)

In 2019, approximately 35 colonies were monitored at Grace Nature Preserve. Only 45 flowering plants were observed, the lowest number of flowering plants on record for this site (125 flowering plants in 2018 was the previous low, followed by 211 in 2016). This is well below the hundreds of plants observed in previous surveys. Sub-populations located closest to the river are the most significantly impacted colonies at the site. About 6.7% (3 of 45) of the observed

plants exhibited an abnormality of staminoid or stemless. Grace Nature Preserve has experienced a large-scale decline of the dwarf trout lilies throughout the site.

Spatial orientation was used to aggregate the largest colonies at Grace Nature Preserve into four major groups, often referred to as zones, to assess annual trends (Fig. 4). Monitoring did not occur in 2006, 2009, or 2020. The green zone contains three large colonies that at one time had more than 600 flowering plants (Fig. 5). Large scale flooding occurred in this area in the summer of 2012. The number of flowering plants in colonies of this zone were particularly low from 2013 ($n = 44$) to 2019 ($n = 12$). Plants within these colonies frequently exhibited abnormalities. The yellow zone includes five large colonies that at their peak contained more than 450 flowering plants (Fig. 6). The number of flowering plants in colonies of this zone were particularly low from 2014 ($n = 14$) to 2019 ($n = 26$). This area was impacted by flooding in 2012, and numbers dropped in 2014. The blue zone includes two large colonies (Fig. 7). At their peak there were more than 250 flowering plants observed in this area. The number of flowering plants in colonies of this zone were particularly low from 2012 ($n = 18$) to 2019 ($n = 1$). Abnormalities started to appear in this group in the mid-2000s. The red zone is a group of several colonies that once contained as many as 450 flowering individuals. This group has been the most stable, but it appears to be on a slight downward trend as well, with particularly low numbers in 2019 ($n = 3$; Fig. 8).

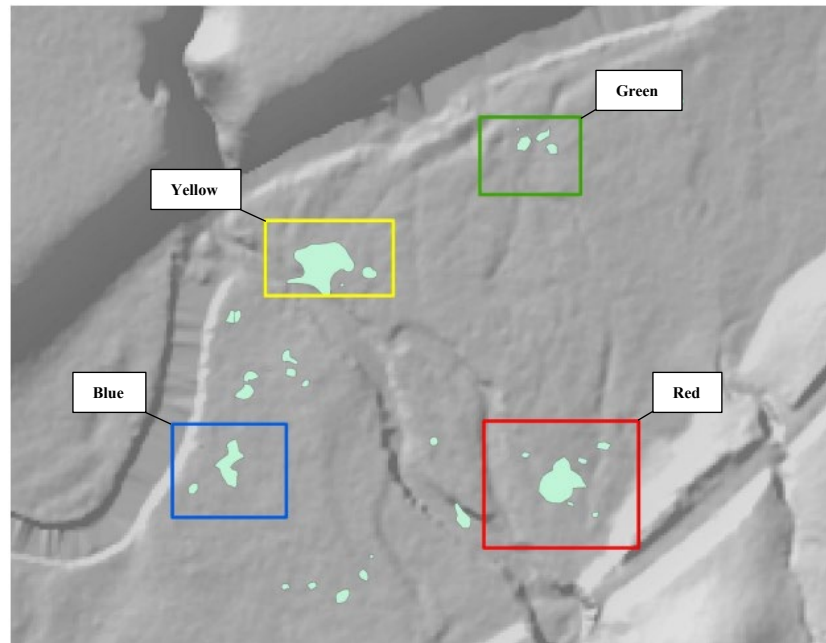


Figure 4. Colony groupings of dwarf trout lily (*Erythronium propullans*) located in Grace Nature Preserve, as depicted by different colored boxes (reproduced from Anderson 2019). Trends of each of these areas are included in subsequent Figures 5-8. This figure and data for Figures 5-8 were provided by Derek Anderson, Minnesota Department of Natural Resources, for the purpose of this 5-year review and were current as of 26 June 2020.

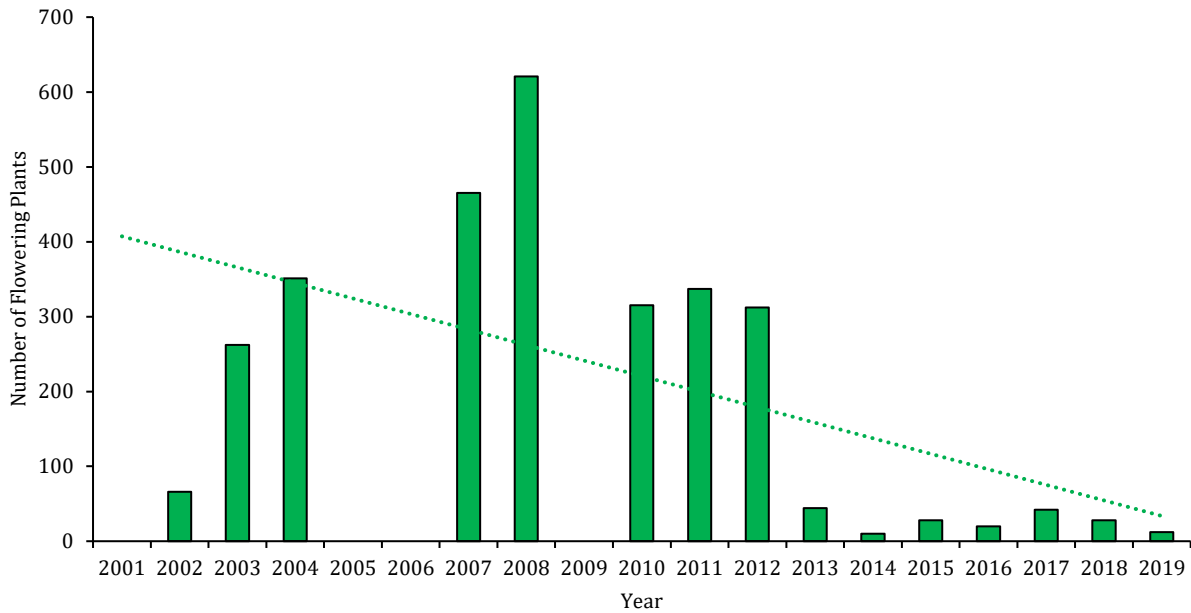


Figure 5. Annual trends in the number of flowering dwarf trout lily (*Erythronium propullans*) in colonies within the green zone of Grace Nature Preserve, as depicted in Figure 4. Data were provided by Derek Anderson, Minnesota Department of Natural Resources, for the purpose of this 5-year review and were current as of 26 June 2020.

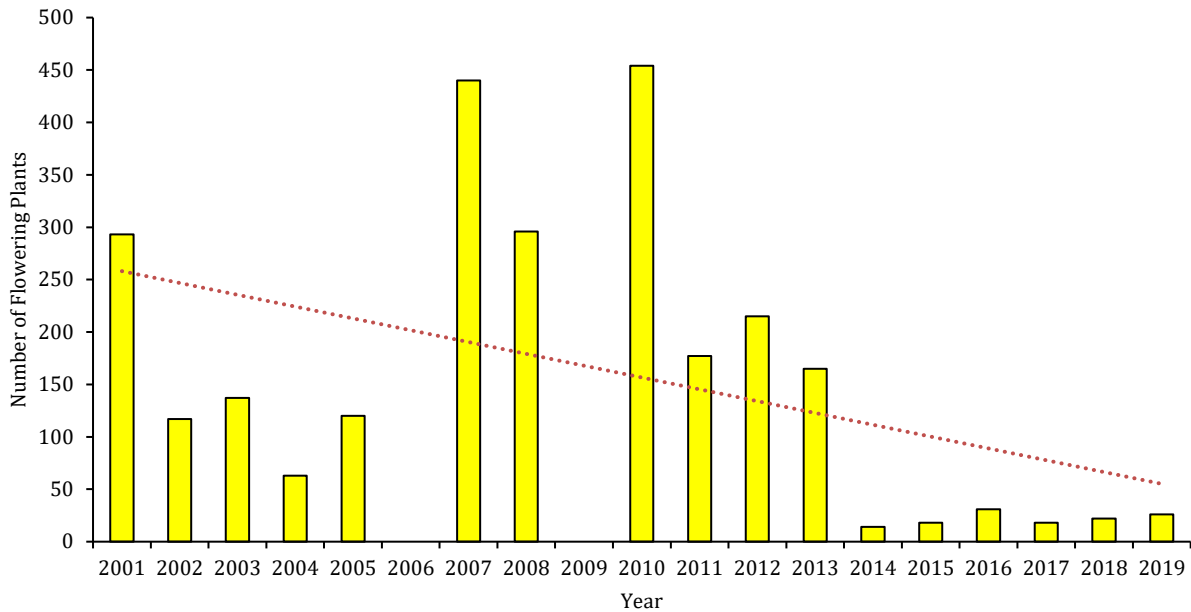


Figure 6. Annual trends in the number of flowering dwarf trout lily (*Erythronium propullans*) in colonies within the yellow zone of Grace Nature Preserve, as depicted in Figure 4. Data were provided by Derek Anderson, Minnesota Department of Natural Resources, for the purpose of this 5-year review and were current as of 26 June 2020.

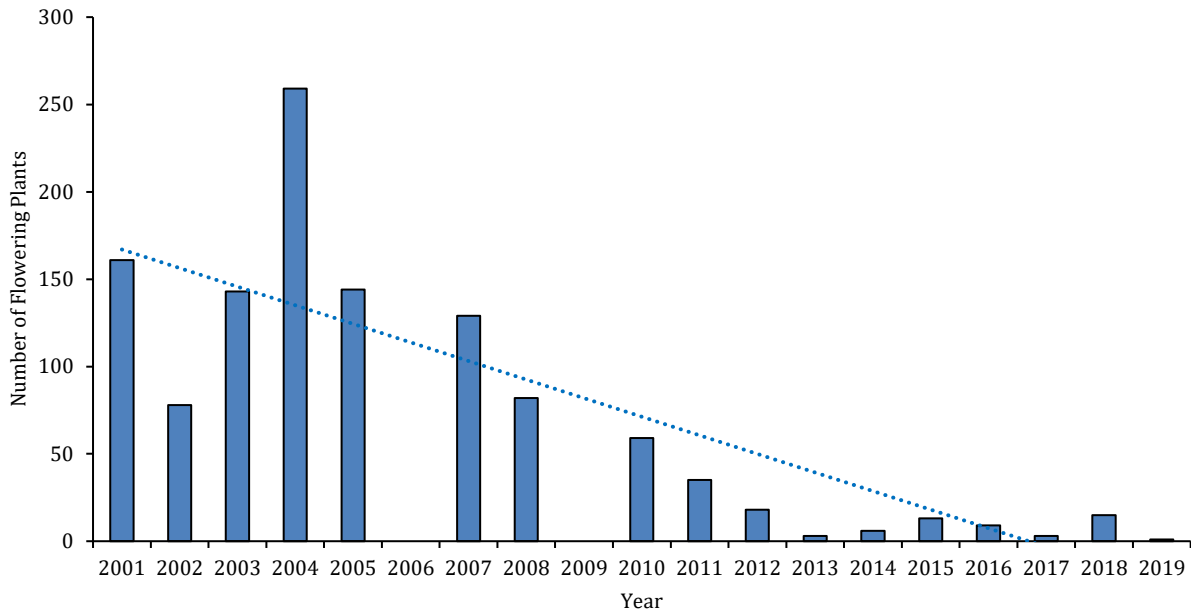


Figure 7. Annual trends in the number of flowering dwarf trout lily (*Erythronium propullans*) in colonies within the blue zone of Grace Nature Preserve, as depicted in Figure 4. Data were provided by Derek Anderson, Minnesota Department of Natural Resources, for the purpose of this 5-year review and were current as of 26 June 2020.

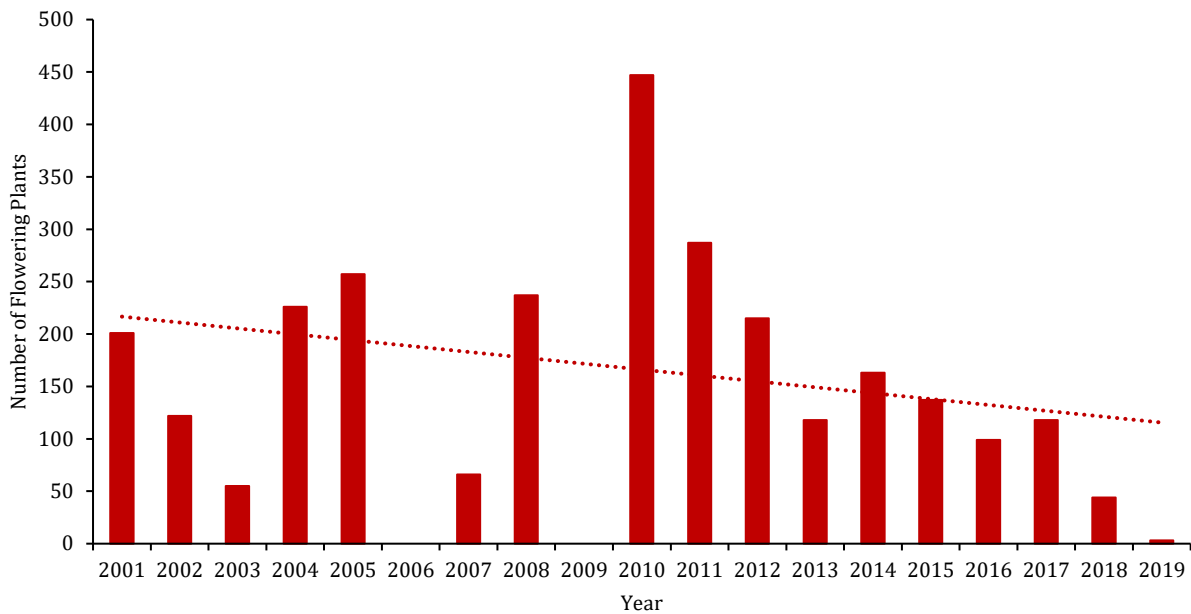


Figure 8. Annual trends in the number of flowering dwarf trout lily (*Erythronium propullans*) in colonies within the red zone of Grace Nature Preserve, as depicted in Figure 4. Data were provided by Derek Anderson, Minnesota Department of Natural Resources, for the purpose of this 5-year review and were current as of 26 June 2020.

Clinton Falls Dwarf Trout Lily Scientific and Natural Area – The Clinton Falls SNA has one of the largest, if not the largest population of DTL, containing

thousands, if not tens of thousands of plants (Anderson 2019). No anomalous plants have been observed to date within the site. Since 2016, the monitored area has averaged 401 ± 163.8 flowering DTL plants per year (Fig. 9). Numbers have remained relatively stable, but did experience a decrease in 2019. During the fall seasons of 2018 and the spring of 2019, volunteers have continued their work to improve the overall habitat of the site by removing invasive species including honeysuckle (*Lonicera* spp.), buckthorn (*Rhamnus cathartica*) and dame's rocket (*Hesperis matronalis*) that could affect the species.

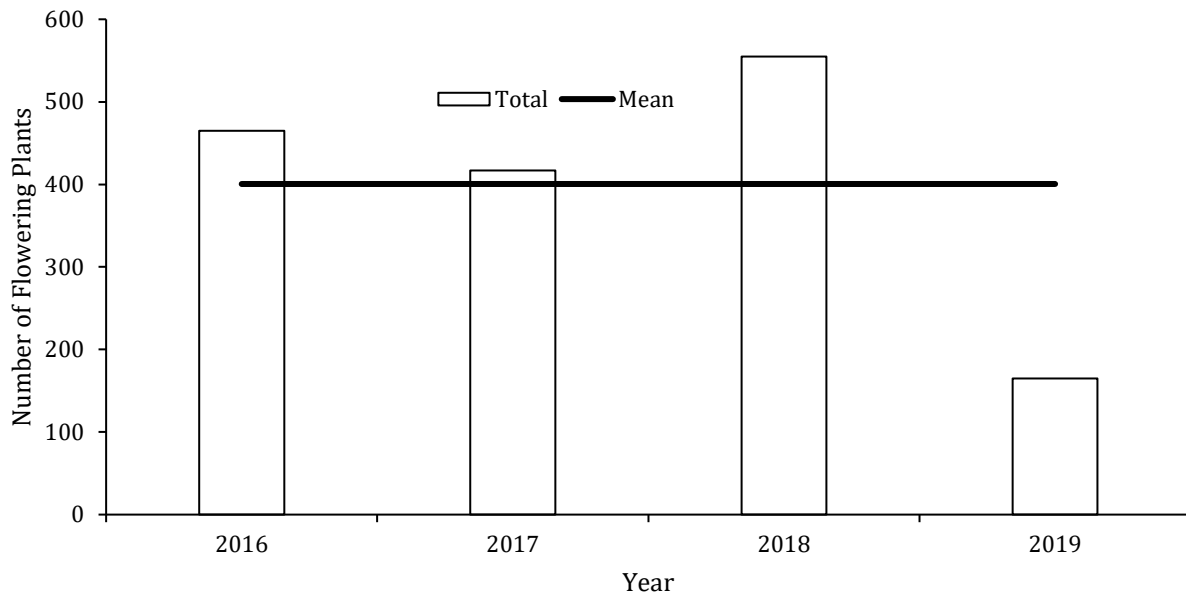


Figure 9. Annual trends in the number of flowering dwarf trout lily (*Erythronium propullans*) in colonies within the Clinton Falls Dwarf Trout Lily Scientific and Natural Area. Data were provided by Derek Anderson, Minnesota Department of Natural Resources, for the purpose of this 5-year review and were current as of 26 June 2020.

4. Genetics, genetic variation, or trends in genetic variation:

No new information on genetics, genetic variation, or trends in genetic variation since the previous 5-year review.

5. Taxonomic classification or changes in nomenclature:

No new information on taxonomic classification or changes in nomenclature since the previous 5-year review.

6. Habitat or ecosystem conditions:

Climate change and associated large-scale precipitation events throughout the season are new and emerging threats, which greatly alter floodplain habitats by

scouring away the finer textured soils where DTL grows (Anderson 2019). Such intense flood events deposit sand and other sediments (as much as 12 inches) on top of known populations, create new channels that pass through previously documented populations, and erode slopes where populations occur. (Anderson 2019).

Status Relative to Recovery Criteria

The DTL may be considered for reclassification to threatened status when a minimum of 400 naturally occurring colonies (clones) in at least 10 geographically and ecologically distinct sites are adequately protected and managed to assure their continued existence. **This criterion has not been met.**

Delisting can be considered when a total of 500 colonies in at least 15 sites, representing the entire extant range of the species, are adequately protected and managed. **This criterion has not been met.**

The recovery plan states that protection is adequate “when a public agency holds fee title, or long-term lease, to the habitat in which the colonies occur” and if “the protection and preservation of the population of the trout lily” is the primary management objective for the site. It also states that ownership by a private conservation organization is not adequate because it “can be easily condemned for public development projects” (USFWS 1987). The plan states that only SNAs administered by the MNDNR meet the plan’s standard of protection. To ensure that management is adequate, “a detailed management plan must be prepared for each site.” Voluntary, non-binding agreements are not adequate (USFWS 1987). In addition, “(A)ny lease agreement must allow legal access for management purposes, and must also provide authority to control all non-compatible land use practices.”

Progress towards Meeting Recovery Criteria

As is typical of recovery plans for plants, the recovery criteria may be split into two general parts: (1) protection of habitat and (2) appropriate management of protected habitat. Colonies are no longer appropriate for measuring population status, but the concept is retained in the discussion below to summarize progress in protecting DTL populations.

In the recovery plan, the USFWS assumed that only those colonies within MNDNR SNAs would be sufficiently protected and managed to ensure the conservation of DTL. The species occurs within three SNAs – Cannon River Trout Lily SNA, Prairie Creek Woods SNA, and Clinton Falls Dwarf Trout Lily SNA. The Clinton Falls Dwarf Trout Lily SNA was established in 2011 immediately after the previous 5-year review was completed. The number of colonies in Cannon River Trout Lily SNA is unknown, but is at least 12. One population of DTL in this SNA, which consists of approximately 28 colonies, is divided between the SNA and an adjacent property. The data available for this population do not allow us to determine how many of these 28 colonies are in the SNA. Therefore, Cannon River Trout Lily SNA contains 12-40 colonies (Minnesota DNR, unpubl. data). At Prairie Creek Woods SNA, surveys were not conducted for several years to

avoid dispersing seeds of garlic mustard (*Alliaria petiolata*), which eventually invaded the site; 14 and 11 colonies were recorded there in 1986 and 2000. However, plants occur there in one large mass that could constitute one colony (USFWS 2011). The number of colonies in the Clinton Falls Dwarf Trout Lily SNA is unknown, but it contains the largest population of DTL. The MNDNR monitors flowering plants at the site as a single geographical unit.

Recovery Criteria – Adequacy and Potential Revisions

Since the recovery plan was finalized in December 1987, MNDNR has compiled significant new information regarding this species and threats to its continued existence. This new information warrants the development of revised or new recovery criteria.

Any new or revised criteria would need to address the following threats, which were not addressed in the 1987 recovery plan: exotic species [including honeysuckle (*Lonicera* spp.), buckthorn (*Rhamnus cathartica*) and dame's rocket (*Hesperis matronalis*)], developmental anomalies, increased flooding, and perhaps also the offsite application of (lawn) herbicides.

Recovery criteria are currently based on colonies, but colonies are no longer used to monitor sites due to difficulty in distinguishing where one colony starts and the next begins. A new metric needs to be established that allows for an objective analysis regarding progress toward meeting recovery goals. Established metrics should allow for differentiation between well-defined ecologically and geographically distinct habitat types.

When developing new recovery criteria, the definition of what constitutes “protected” populations should be revised. Sather (2004b) summarized the geographic distribution, ownership, and protection status of DTL populations using a definition for “protected” less restrictive than that used in the recovery plan (USFWS 1987). In addition to populations on SNAs, Sather (2004b) also defined populations in preserves owned by The Nature Conservancy (TNC) and those in Nerstrand-Big Woods State Park as “functionally protected.” Based on this definition, the total number of colonies that are functionally protected is about 551 (DNR, unpubl. data) – about 71% of all recorded colonies. This would include some substantial populations outside of SNAs (e.g., in TNC’s Trout Lily Preserve), which overlaps partly with the Cannon River Trout Lily SNA. Since 2005, about 7000 plants have been recorded outside of the SNA in this preserve (Minnesota DNR, unpubl. data).

Summary:

Survey data and monitoring reports were received from MNDNR with updated information regarding the species’ status and current threats in the time since we conducted the last 5-year review. No new sites for DTL have been documented since the last review, but the Clinton Falls Dwarf Trout Lily SNA was established in 2011 immediately after the previous 5-year review was completed. Results of these efforts indicate that managed populations in Minnesota may be declining. However, metrics for monitoring populations and determining protected status for DTL should be revised to adequately observe trends. There does not appear to be any single event or disturbance to attribute declines (Anderson 2019). Climate change and associated large-scale precipitation events throughout the season are new and emerging threats, which alter

floodplain habitats by scouring away the finer textured soils where DTL grows and depositing sediments on established populations (Anderson 2019). Exotic species, developmental anomalies, logging associated with agriculture and urban development, incompatible recreational uses, and herbicides continue to be threats for DTL (USFWS 2011; Anderson 2019). Preserving wild plants in their natural habitat appears to be the best option for ensuring survival of this rare species.

Conclusion:

After reviewing the best available scientific information, new information does not indicate that the species' status should change. Therefore, we conclude that dwarf trout lily remains an endangered species. As described above, the recovery criteria outlined in the recovery plan have not been met. Although the majority of populations are under protective ownership, significant threats to the species remain – most notably, invasive species, developmental anomalies, development, climate change and associated severe floods. These threats, in combination with the continued declines in monitored populations, warrant maintaining the species status as endangered. The evaluation of threats affecting the species and analysis of the status of the species in USFWS (2011) remains an accurate reflection of the species current status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

The USFWS provides the following recommendations:

1. Revise the recovery criteria (USFWS 1987) to include an appropriate metric and set of methods to monitor population status. The use of “colonies” to monitor population status is not sufficiently objective and is often impractical to implement in the field because they often merge overtime (USFWS 2011). The establishment of permanent monitoring plots and periodic monitoring may be the best solution. At River Bend Nature Center, Sather (2009b) recommends “initiating a student project in conjunction with the Nature Center to count only the colonies along the path each year, with periodic MNDNR counts of colonies in the grid, perhaps on a three to five year cycle.”
2. Revise the recovery criteria (USFWS 1987) to include clear and measurable criteria to ensure the protection of DTL populations in a variety of habitat types and geographic areas. Describe the specific habitat types (*e.g.*, hill and floodplain) and watersheds or other geographic units within which a certain number of populations should be protected. Sather’s (1998) six “conceptual metapopulations” and highest priority sites” may be a good starting point for considering potential revisions to the recovery criteria.
3. Review the recovery criteria (USFWS 1987) and current protection status of all DTL habitats to determine whether it would be appropriate to consider habitats outside of SNAs to be sufficiently protected. Describe mechanisms, as appropriate, that may be necessary to ensure protection of habitats outside SNAs. Any new or revised recovery criteria should be accompanied by a clear description of the types of ownerships or

conditions (e.g., easements) that would be sufficient to consider habitat to be protected. Sather's (2004b) protection analysis and a comprehensive review of current ownership and conservation status of DTL habitats may serve as a model for considering potential revisions to the recovery criteria.

4. Revise recovery criteria to address the following additional threats: exotic species [including honeysuckle (*Lonicera* spp.), buckthorn (*Rhamnus cathartica*) and dame's rocket (*Hesperis matronalis*)], developmental anomalies, increased flooding associated with climate change, and perhaps also the offsite application of (lawn) herbicides.
5. More potential sites for DTL need to be located and all sites where occurrences are found need to be protected. Invasive species that are found in the vicinity of DTL should be removed.

RESULTS

**U.S. FISH AND WILDLIFE SERVICE
STATUS REVIEW of Minnesota dwarf trout lily (*Erythronium propullans*)**

Current Classification: Endangered

Status Recommendation resulting from Status Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist (Indicate reasons for delisting per 50 CFR 424.11):
 - The species is extinct
 - The species does not meet the definition of an endangered or threatened species.
 - The listed entity does not meet the statutory definition of a species.
 - No change needed

Lead Field Supervisor, Fish and Wildlife Service, Minnesota-Wisconsin Field Office

Approve _____ Date _____

Literature Reviewed

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