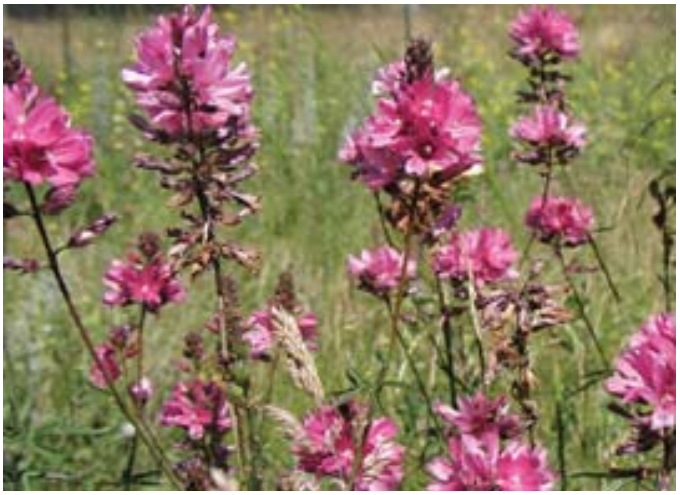
Nelson's Checker-mallow
(Sidalcea nelsoniana)

5-Year Review:
Summary and Evaluation



U.S. Fish and Wildlife Service
Oregon Fish and Wildlife
Portland, Oregon

July, 2012

5-YEAR REVIEW

Species reviewed: Nelson's Checker-mallow (*Sidalcea nelsoniana*)

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Nelson's Checker-mallow/ *Sidalcea nelsoniana*

I. GENERAL INFORMATION

I.A. Methodology used to complete this review

On July 6, 2005, the U.S. Fish and Wildlife Service (Service) published a *Federal Register* notice (70 FR 38972) that initiated a 5-year review on the status of five Willamette Valley species including Nelson's checker-mallow, *Sidalcea nelsoniana*. In addition to soliciting information on the status and biology of Nelson's checker-mallow from the general public, we also searched for new literature using databases and search engines (i.e. Web of Science, Google Scholar) and reviewed any new information the Service had compiled since listing. We compared new information (species surveys/censuses, published data, unpublished technical reports, etc.) to information known at the time of listing. We also contacted other Federal agencies, states, species experts, and land owners/managers when appropriate to obtain information we knew was available but was not in our records.

We looked at status by analyzing threats to the species based on the original 5-factor threat analysis in the 1993 listing decision (58 FR 8235), and also in terms of whether the delisting recovery criteria for Nelson's checker-mallow in the Recovery Plan for the Prairie Species of Western Oregon and Southwest Washington (USFWS 2010) had been met. These delisting criteria for the species replaced the delisting criteria detailed in the Nelson's checker-mallow Recovery Plan (USFWS 1998)

We conducted a streamlined structured decision process to reach our final recommendation. First, we reviewed the current status of the species including its biology, distribution, and threats, and compared these to time of listing. Secondly, we developed a 5-factor analysis and then assessed whether recovery criteria had been met. We then identified which areas in our analysis contained significant uncertainty and made these areas the focus of peer review. Peer reviewers were given the entire draft 5-year review document (aside from the final recommendation) and were provided questions to target areas of uncertainty and/or controversy. Peer reviewers were also given a table of sites with population information and were asked to provide updated information if available. Peer reviewers' comments and information were considered in the proposed recommendation. We requested peer review from four individuals, including the state agencies responsible for managing Nelson's checker-mallow: Oregon Department of Agriculture (ODA) and Washington Department of Natural Resources (WDNR). Three individuals (including one from ODA and one from WDNR) provided peer review comments.

After peer review results were considered and incorporated where appropriate, we developed our recommended classification. We then analyzed our confidence regarding the information used for the review using a 5-year review structured decision analysis worksheet. This worksheet ranked our confidence in the information used to describe threats and biology, ecology, distribution, and population levels. It also ranked our confidence in the quality of information used in the decision process, described whether the state agencies responsible for managing the species were given an opportunity to review the scientific analysis for the 5-year review, and

documented whether the level of controversy over this species affected the level of structured decision analysis needed. The level of management review for our recommended classification was determined by 1) our confidence in the information used to describe the species' status and to make a status recommendation, 2) whether state agencies were given an opportunity to review the scientific analysis used in the 5-year review, and 3) the level of controversy over this species.

Given our efforts to obtain information, our analysis, the opportunity for public input, and the feedback from our peer review, we have high confidence in the accuracy of our threats analysis and species information. While we have identified data gaps, we are confident that we considered the best available scientific information, and that this information is appropriate to support our recommendation. Our understanding of population levels and trends is somewhat hampered by the lack of annual monitoring data; though many sites were monitored regularly between 1984 and 1995 (or 1997 for Coast Range sites), few sites have been annually monitored since 1997. However, more than 90 percent of the sites (natural and introduced) have been censused since 2001; approximately 86 percent of the sites have been visited since 2005, and nearly 70 percent of the sites have been surveyed in the last four years. Our 5-year review and proposed classification was reviewed by the Endangered Species Division Supervisor, Assistant Project Leader, and Project Leader at the Oregon Fish and Wildlife Office (OFWO). The final recommendation was submitted to the Service's Region 1 Regional Office (RO) on July 16, 2012, for review and concurrence.

I.B. Reviewers

Lead Regional or Headquarters Office --Contact name(s) and phone numbers:

RO, R1, Portland, OR, Sarah Hall, 503-231-2071

Lead Field Office -- Contact name(s) and phone numbers:

OFWO, Portland, OR, Rollie White, 503-231-6179

Cooperating Field Office(s) -- Contact name(s) and phone numbers:

Western Washington Fish and Wildlife Office (WWFWO), Lacey, WA, 360-753-9440

Other Cooperating Office(s) -- Contact name(s) and phone numbers:

Willamette Valley National Wildlife Refuge Complex (WVNWRC), OR, 541-757-7236

Cooperating Regional Office(s) -- Contact name(s) and phone numbers: NA

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review: 70 FR 38972

I.C.2. Species status: Stable. Some sites have been extirpated, but new sites have been discovered and there have been many successful augmentation and reintroduction efforts.

I.C.3. Recovery achieved: 1 (0 to 25%). None of the delisting criteria have been fully achieved. While several actions/tasks have been initiated to make progress toward meeting delisting criteria, these actions are ongoing and are not fully completed.

I.C.4. Listing history:

Original Listing
FR notice: 58 FR 8235-8243
Date listed: February 12, 1993
Entity listed: Species
Classification: Threatened

I.C.5. Associated rulemakings: NA

I.C.6. Review History:

This is the first 5-year status review for Nelson's checker-mallow. Information that has become available since it was listed in 1993 has been used to determine the current status of the species. Below is a chronological list of the Service's actions related to the species:

December 28, 1973	Section 12 of the Endangered Species Act (Act) requires the Secretary of the Smithsonian Institution to review endangered, threatened, and extinct plants, and to provide a report to Congress within a year after enactment of the Act.
January 9, 1975	The Smithsonian Institution's report on endangered, threatened, and extinct plants (House Document No. 94-51) was presented to Congress.
July 1, 1975	The Service published a notice (40 FR 27823) of its acceptance of House Document No. 94-51 as a petition within the context of section 4(c)(2) (now section 4(b)(3)) of the Act, and its intent to review the status of the plant taxa named therein. Nelson's Checker-mallow was treated as under petition for listing as endangered.
June 16, 1976	The Service published a proposed rule to list 1,700 vascular taxa pursuant to section 4 of the Act, based on the Smithsonian Institution's report to Congress, including Nelson's Checker-mallow.
April 26, 1978	Comments regarding the proposal to list the 1,700 species are summarized in the *Federal Register*.

December 10, 1979	The Service published a notice to withdraw the portion of the June 16, 1976 proposal that had not been made final, and four other proposals that had expired.
December 15, 1980	Nelson's checker-mallow was included as a Category 1 candidate species (45 FR 82537).
October 13, 1982	The Act was amended in 1982 requiring the Secretary of the Department of Interior to make findings on certain pending petitions within 12 months of their receipt. All petitions pending on this date, including Nelson's checker-mallow, were considered as having been newly petitioned on this date.
November 28, 1983	The status changed from Category 1 to Category 2 candidate species (50 FR 39527).
1983-1990	The Service found that the petition to list Nelson's checker-mallow was warranted but precluded by higher priority listing actions.
February 21, 1990	The status changed from Category 2 to Category 1 candidate species (55 FR 6184) as a result of new information on the occurrence and status of the species.
June 7, 1991	The Service published a proposal to list Nelson's check-mallow as a threatened species (56 FR 26373).
February 12, 1993	The Service published a final rule (58 FR 8235) listing Nelson's checker-mallow as a threatened species.
September 25, 1997	A notice of availability for public review of a draft recovery plan for Nelson's checker-mallow was published in the *Federal Register* (62 FR 50397).
September 30, 1998	The Nelson's checker-mallow Recovery Plan was approved by the Service's Region 1 Regional Director.
July 6, 2005	The Service announced the initiation of a 5-year review for Nelson's checker-mallow (along with four other Willamette prairie species) (70 FR 38972).
May 20, 2010	The Recovery Plan for the Prairie Species of Western Oregon and Southwest Washington was approved by the Service's Region 1 Regional Director. This plan replaced the 1998 Nelson's checker-mallow Recovery Plan for the species.

I.C.7. Species' Recovery Priority Number at start of review*:*

The RPN changed from 5 to 2 in 2005.

I.C.8. Recovery Plan or Outline:

Name of plan: Recovery Plan for the Prairie Species of Western Oregon and Southwest Washington.
Date issued: May 20, 2010
Date of previous recovery plan: September 30, 1998

II. REVIEW ANALYSIS

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

N/A. The DPS policy applies only to vertebrate species.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X__ ***Yes***
____ ***No***

Nelson's checker-mallow has a final approved recovery plan (USFWS 2010) with delisting criteria. Nelson's checker-mallow delisting criteria are detailed in II.B.3, below. Since it is listed as threatened there are no downlisting criteria.

In addition to the specific recovery criteria, the recovery plan details actions and tasks to be implemented to achieve the recovery criteria. Actions include preserving and augmenting existing populations and habitat, developing a standardized population monitoring protocol, monitoring habitat quality and diversity at all population sites, collecting and banking seeds, reintroducing populations, conducting further research for the conservation of the species, applying adaptive management measures as needed, and developing post-delisting monitoring plans.

Specific tasks are listed beginning on page IV-51 of the recovery plan (USFWS 2010).

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

__X__ ***Yes***
___ ***No***

II.B.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.

Delisting will be considered for Nelson's checker-mallow when all of the following conditions have been met (listed in the 2010 Recovery Plan for the Prairie Species of Western Oregon and Southwest Washington (USFWS 2010)):

Criterion 1. **Distribution and abundance**
Distribution and abundance should reflect the extent of the species' historical geographic distribution to the extent practicable.

The Recovery Team concluded that each occupied recovery zone should have a goal of at least 10,000 plants subdivided into at least two populations. The target may be achieved with a combination of at least two populations that must number at least 2,000 individuals; scattered independent populations must number at least 200 individuals. Some recovery zones have larger target numbers, based on historical abundance data. In recovery zones with a target of 10,000 plants, there must be at least two separate populations; if the target is 15,000 plants, then there must be at least three separate populations. Populations may be subdivided into subpopulations in a patchy landscape, although there must be the potential for genetic interchange, via pollinator movement, among the component subpopulations. See Table 1 for the distribution and abundance goals for this criterion and the current status of Nelson's checker-mallow.

Table 1: Distribution and Abundance Goals for Nelson's checker-mallow

Recovery Zone	Delisting Goals	
	Minimum # of Populations / Zone	Target # of Plants (or Foliar Cover) / Zone
SW Washington	2	10,000 (5,000 square meters (m^2))
Portland	1	5,000 (2,500 m^2)
Coast Range	3	15,000 (7,500 m^2)
Salem East	2	10,000 (5,000 m^2)
Salem West	4	20,000 (10,000 m^2)
Corvallis East	2	10,000 (5,000 m^2)
Corvallis West	4	20,000 (10,000 m^2)
+ additional populations (may occur in any zone within species' range)	2	10,000 (5,000 m^2)
Total	**20**	**100,000 (50,000 m^2)**

Partially accomplished.
The distribution and abundance of Nelson's checker-mallow as of October 2011 is outlined in Table 2. In accordance with the guidance of the Recovery Team regarding the minimum size of a viable population, only extant naturally occurring sites that had at least 200 individuals (not counting augmentations) as of the most recent survey were counted as populations.

Table 2: Current Distribution and Abundance of Nelson's checker-mallow populations

Site Name	Date of last survey	Number of individuals	Foliar cover (in m^2)
Coast Range Recovery Zone (7 populations)			
Second Growth/Barney Reservoir	2005	500+	2,590
Walker Flat	2009	300 (BLM)	44,434
North Fork	2005	200+	
Tillamook Burn 1	2006	200+	22,662
Browns Camp East	2005	200+	6,273
Elk Creek	2004	500?	
Elliot Creek	2006	100's	
Coast Range total		population estimate: 2,000	foliar cover: 75,959
Corvallis West Recovery Zone (7 populations)			
Decker Road	2008	600	6,556
Finley Wildlife Refuge	2010	581	449,687
Coffin Butte Landfill	2008	300	
Holiday Tree Farm	2008	419	
E E Wilson	2008	377	1,093
West Hills	2005	200+	1,163
Camp Adair Rifle Range	2008	1,000	593
Corvallis West total		population estimate: 3,477	foliar cover: 459,092
Salem East Recovery Zone (4 populations)			
Hess Road	2003	381	
Salem Airport- Turner Road	2005	200+	
Santiam Interchange	2009	936	
Waldo Hills	2004	200+	
Salem East total		population estimate: 1,717	foliar cover: No Records
Salem West Recovery Zone (6 populations)			
HWY 18	2010	250	83,689
McTimmonds Valley	2009	221	271,908
CTGR Complex	2010	200	1,847
Fall City	2008	3,000	34,398
Gahr Farm	2008	3,000	5,018
Mud Slough Mitigation Bank	2010	2,000	
Salem West total		population estimate: 8,671	foliar cover:396,860
SW Washington Recovery Zone (1 population)			
Coal Creek	2006	275	136,581
SW Washington total		population estimate: 275	foliar cover: 136,581
All Recovery Zones total		**population estimate: 16,140**	**foliar cover: 1,068,492**

Although there are a combined 96 extant sites with Nelson's checker-mallow presence across all of the recovery zones, two of the zones (Portland and Corvallis East) do not contain any sites that meet the 200 individual minimum threshold for a population. Furthermore, although four zones contain the recovery-target number of populations (Coast Range, Corvallis West, Salem East, Salem West), none of these zones meet the abundance criterion for individual plants. Salem West is the closest of any zone to meeting this criterion (20,000 individual plants) with 8,671 plants. The estimate of foliar cover for three of these four zones exceed the recovery criteria, however, because the estimates are not complete and were not developed using consistent methodology, the data is less useful for our status assessment than the abundance estimate.

Criterion 2. **Population trend and evidence of reproduction.**
The number and area of foliar cover for Nelson's checker-mallow shall have been stable or increasing over a period of at least 15 years. Stable does not mean that the population size is static over time; over a period of 15 years, the number of individuals in the population may exhibit natural year-to-year variability, but the trend must not be declining. Populations must show evidence of reproduction by seed set or presence of seedlings.

Partially accomplished.
Reports of foliar cover estimates for Nelson's checker-mallow from the time of listing to the most recent surveys are infrequent. We have some cover estimates but not enough upon which to base any reasonable conclusions regarding trends over 15 years. We can, however, compare general population estimates from the time of listing to the most recent survey of naturally occurring sites (Table 3).

Table 3: Number of Nelson's checker-mallow sites in each survey count category

Survey category (in # of plants)	Number of sites	
	At Listing	Currently
1000+	6	4
100-999	18	26
10-99	16	45
1-9	8	21
0	4	12

While the number of extant naturally occurring sites that have between100-999 plants and 10-99 plants has increased since listing, there has been a drop in the number of sites that have more than 1000 plants. Furthermore, there are 12 sites that had no detectable plants at the date of last survey and may therefore be extirpated. A great deal of work has been done, however, that may facilitate the recovery of the species.

Augmentations of approximately 1,000 plants each have occurred at 10 currently occupied sites; these augmentations are not reflected in Table 3 because the consistent and regular monitoring necessary to confirm the efficacy of the augmentations has not occurred. Furthermore, in addition to the earliest introduction of the species at Meadow Lake in 1991, introductions of between100 to over 1,000 plants have occurred at 21 different sites since 2001. Two smaller introductions also occurred in 2011. Monitoring of the augmentations and introductions over time will help provide clarity on the overall stability of the species.

Criterion 3. **Genetic material is stored in a facility approved by the Center for Plant Conservation.**

The stored genetic material in the form of seeds must represent the species' geographic distribution and genetic diversity through collections across the full range of the species. Collections from large populations are particularly important as reservoirs of genetic variability within the species.

Partially accomplished.

Seeds have been collected for seedbanking from at least 18 sites, including Lewis County, Washington. This site is on the periphery of the range and due to its isolation could be genetically important. Other periphery sites have not yet had seed collection, including the newer sites in the Nehalem and Clackamas Subbasins. Seeds are stored at Portland State University's Rae Selling Berry Seed Bank in Portland, Oregon, and at the University of Washington's Botanic Garden in Seattle, Washington where they are dried, counted, weighed, placed in envelopes and frozen for long-term storage.

Criterion 4. **Post-delisting monitoring plans and agreements to continue post-delisting monitoring are in place and ready for implementation at the time of delisting.**

Monitoring of populations following delisting will verify the ongoing recovery of the species, provide a basis for determining whether the species should be again placed under the protection of the Endangered Species Act, and provide a means of assessing the continuing effectiveness of management actions.

Not accomplished at this time.

Major Recovery Actions to date

Of the listed prairie plants in the Willamette Valley, the Nelson's checker-mallow appears to be the most readily recoverable species. Several recovery actions have been implemented and are ongoing (see I.C.8), but no tasks are fully completed. Ongoing actions include the following: evaluating the status of all extant populations, protecting reserves, conducting censuses and demographic monitoring, procuring seeds and establishing plants, reducing the threats of

succession, inter-specific competition, and impacts of off highway vehicles, and evaluating the efficacy of habitat management techniques and ways to reduce the competition threat from non-native plants. Nelson's checker-mallow plants respond well to various management activities (out-planting, transplanting, mowing, burning, etc.). However, current efforts toward recovery have been initiated at only a few select locations over the range of the species.

There are several protected sites that are essentially functioning as reserves. One such site, the Willamette Valley National Wildlife Refuge Complex (WVNWRC), has undertaken numerous recovery efforts for this species. Currently, there are 16 sites on Finley National Wildlife Refuge (Finley) (6 established since 2003) and 9 on Baskett Slough National Wildlife Refuge (Baskett) (with at least 3 established since 2003). With the assistance of partners, WVNWRC staff has collected, grown-out, and planted seeds from existing plants on Finley, Ankeny, and Baskett National Wildlife Refuges (NWRs). Outplantings of 9,600 plants at Finley and 6,035 at Baskett NWR have occurred, including augmentation and new sites. At Ankeny NWR, one new site was established in 2008 with 2560 plants (and seeding in 2007). Two sites were augmented with seeding at Finley. The WVNWRC also has transplanted about 200 plants to better habitat during the past several years on both Finley and Baskett NWRs with at least 70 to 90 percent survival. Additionally, WVNWRC mows all occupied sites in the fall (after September 1) to help suppress invasive species (Jock Beall, WVNWR, pers.comm. 2011).

WVNWRC, through the Partners for Fish and Wildlife Program and/or work with the Natural Resources Conservation Service (NRCS) Wetland Reserve Program (WRP) has identified at least 10 new populations. Six of these are on WRP sites and are protected through conservation easements. All of these populations need to be maintained with appropriate site-specific management actions. The NRCS worked with WVNWRC to introduce Nelson's checker-mallow at six additional WRP sites (Appendix A). These introductions are part of NRCS's overall plan to restore over 2000 acre of native prairie habitat near the WVNWRC. NRCS covers the costs of the easements and the basic level of habitat restoration but funds are needed for the additional work to establish and monitor Nelson's checker-mallow populations on these areas (Jim Houk and Jock Beall, WVNWRC, pers. comm., 2005).

Two NWRs in Southwest Washington have conducted transplantations of Nelson's checker-mallow. In December 2007, Ridgefield NWR, in Clark County, Washington, outplanted 2,530 seedlings at sites that have been carefully managed and monitored since planting. The four year survival rate for the smallest outplanting was 28 percent. However, the biggest outplanting site on the refuge (1,846 seedlings) now has 2,142 plants, demonstrating a four year survival rate of 116 percent (Judy Lantor, USFWS, pers. comm. 2011). In 2011, Steigerwald Lake NWR outplanted 575 seedlings and monitoring and management of these plantings are ongoing (USFWS 2011).

The Confederated Tribes of Grand Ronde (CTGR) has contributed significantly to help conserve and restore the species. CTGR developed a Nelson's checker-mallow management plan to manage 1,847 m^2 of occupied plants on 82,961 m^2 (20.5 acres) at four properties in Yamhill and Polk counties in Oregon, as preservation reserves on tribal lands. Management actions include burning, mowing, and transplanting (CTGR 2004). In 2010, nearly 1,000 seedlings of Nelson's checker-mallow were planted to augment CTGR's current population of the species.

Oregon Department of Transportation (ODOT) Special Management Areas (SMAs), and other sites on state-owned and state-leased lands also receive protection and varying levels of management. Nelson's checker-mallow occurs in eleven SMAs on ODOT property which are part of a Habitat Conservation Plan (HCP) for Routine Maintenance Work. SMAs that have ecologically important populations are managed for species enhancement and regularly monitored, while those with little to no value for species recovery are closed. Impacts to Nelson's checker-mallow are offset with augmentation at higher quality sites. Additionally, natural resource surveys are conducted before projects occur on ODOT lands, and when Nelson's checker-mallow is present, ODOT mitigates the impact as appropriate. For example, when the species was recently discovered in an interchange, ODOT purchased a 30-acre parcel near the new Fort Hill interchange for combined endangered species and wetland mitigation; ODOT planted over 100,000 checker-mallow propagules developed from salvage/increase efforts (Mindy Trask, ODOT, pers. comm. 2011). In addition to ODOT's HCP, Benton County, Oregon recently completed a HCP addressing conservation of Nelson's checker-mallow and other native prairie species within the county (Benton County 2010).

Another site that has been monitored fairly consistently since listing is Walker Flat, Yamhill County. This site is owned by both the Bureau of Land Management (BLM) and the City of McMinnville. The portion of the site located on BLM land is monitored fairly regularly, but the overall population has not been monitored since 1997. Transplanting efforts were undertaken at this site (i.e. South McGuire and Neverstill) in 1986. Survival was 87 percent (CH2M Hill 1997) in 1997, though some plants were lost to inundation caused by beaver dams (Guerrant 1998). More recent monitoring of these sites shows that this reintroduction has not been very successful (Clair Hibler, BLM, pers. comm., 2006). Survival is usually high, about 70-95 percent (Gisler 2004), making this result unusual. However, one other effort, the Barney Reservoir Expansion Project, was also less successful than expected. Survival rates were high initially, and then dropped to 48 percent after several years. The population was supplemented in 2001 and overall survival rates the following year increased to 63 percent (the site has not been surveyed since 2005). Since these are longer-term transplanting attempts, they illustrate the importance of longer term monitoring to evaluate success of transplanting efforts. Also, it illustrates the importance of continuing to address threats with site-specific management. In the case of two previously occupied sites, South McGuire and Neverstill, flooding (Guerrant 1998) and succession were likely the primary reasons for lower survival rates and eventual extirpation. However, the low survival rates at Barney Reservoir could not be attributed to either of these factors (DEA 2002). Walker Flat is monitored, but not currently managed for this species, and it would greatly benefit from active management to address the imminent threat of succession.

Ongoing recovery actions (like those mentioned above) mainly address the threat of destruction, modification, and/or curtailment of Nelson's checker-mallow range by preserving and augmenting existing sites, creating new sites, and mitigating for development. Also, some of these sites are managed as appropriate to address site-specific threats (invasive species, woody species encroachment, etc.), which will help prevent further loss or modification of habitat. If large sites can be secured from habitat loss, managed to address threats, and maintain relatively stable populations, then they will have the greatest potential for long-term persistence of the

species. Smaller populations (n<100) are more vulnerable to environmental changes (Meffe et al. 1997), but will potentially serve as stepping stones between larger neighboring populations.

The species has proved to be readily grown in controlled environments, and several approaches have successfully cultivated healthy plants for augmentation of existing populations (Gisler 2003). In 2010, the Service entered into a cooperative agreement with the Institute for Applied Ecology (IAE) to provide funds for the reintroduction or augmentation of Nelson's checker-mallow into 12 priority sites, all within the Corvallis West and Salem West Recovery Units (Table 4). Planting rate varies by habitat capacity. To meet the objective of 15,000 plants per recovery zone, the IAE is planting a minimum of 2 pounds of seed/acre, 1,000 plugs, and 1,000 rhizomes. The introduction and augmentation is occurring in the highest quality sites available with appropriate distances between populations and subpopulations. Three sites/zones are being set up with an experimental framework to compare establishment rates of the three different types of plant materials utilized (seeds, plugs, and rhizomes) in a 1:1:1 ratio at each test site (Gisler and Duncan 2011).

Table 4: Reintroduction and Augmentation Sites for Nelson's checker-mallow

Site Name	Reintroduction/Augmentation	Watershed
CTGR	Augmentation	Lower South Yamhill River
Deer Creek Park	Reintroduction	Lower South Yamhill River
Dhooghe WRP	Reintroduction	Luckiamute River
E4 WRP	Augmentation	Mary's River
EE Wilson	Augmentation	Luckiamute River
Mary's River WRP	Reintroduction	Mary's River
Mud Slough WRP	Augmentation	Rickreall Creek
Raindance Ranch WRP	Reintroduction	Marys River
Sheldon Holt WRP	Reintroduction	Upper South Yamhill River
Spring Valley Creek WRP	Reintroduction	Willamette River-Chehalem Creek
Tyee WRP	Reintroduction	Mary's River
Winter Creek WRP	Reintroduction	Luckiamute River

In 2010, the Service also provided funds to the NRCS, Plant Materials Center (PMC) in order to conduct a grow-out of Nelson's checker-mallow. Plants are being grown in accordance with cultivation techniques that have been previously employed with great success by the PMC. Following successful cultivation, PMC is turning over the plants to the Service and IAE for outplanting. Seeds, plugs, and rhizomes are being used by the Service for augmentation of populations in the Willamette Valley. The grow-out allowed the Service and partners to plant a total of 2,960 seedlings at nine different locations in the Valley in 2010 and 2011; this is in addition to all of the previously discussed plantings on NWR land.

Research addressing habitat management techniques, techniques to reduce seed predation, and methods to reduce threats of competition by nonnative invasive species has been ongoing since

listing. The Service is also currently funding a study that will determine density estimates of this, and other, prairie species in relation to recovery objectives. This will be crucial to our understanding/ determination of adequate reserve sizes for recovery. Additional research and monitoring efforts will be critical to achieve recovery goals. Specifically, more information in the areas of population fragmentation and gene flow, inter-population genetic variability, population self-sustainability, and habitat management techniques would greatly inform recovery efforts.

In summary, while the above-mentioned actions have made significant progress toward recovery, they occur in only a small portion of the species' range. Also, some sites are only addressing a portion of the overall threats affecting the site. Furthermore, reserves have not been formally designated for each recovery unit, and probable sites do not yet meet the long-term monitoring, population standards, and management criteria listed in the recovery plan. Therefore, progress toward fully achieving recovery criteria is still in the early stages.

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat:

Nelson's checker-mallow is a long-lived perennial herb with pinkish-lavender to pinkish-purple flowers born in clusters at the end of 0.30 to 0.76 meters (m) (1 to 2.5 feet) tall stems. Their inflorescences are indeterminate, and often simultaneously exhibit fruits, open flowers, and unopened buds. Plants can have either perfect (male and female) flowers or pistillate (female only) flowers. Perfect-flowers are protandrous, with a complete temporal separation of male and female phases in individual flowers (Gisler and Meinke 1998). Outcrossing is encouraged because pollinators leave male-phase flowers at the top of one raceme and then fly to female phase flowers on the bottom of the next raceme. Female plants are obligately outcrossed (Gisler and Meinke 1998). In most Willamette Valley (but not Coast Range) populations, female plants vastly outnumber perfect plants. Flowering typically occurs from late May to mid-July, but may extend into September in the Willamette Valley, depending upon the moisture and climatic conditions of each site. Coast Range populations experience a shorter growing season and generally flower later and senesce earlier.

Nelson's checker-mallow is capable of vegetative expansion via rhizomes or laterally spreading root systems that form multiple crowns bearing distinct clusters of flowering stems (CH2M Hill 1986; Glad et al. 1994). Nelson's checker-mallow mostly reproduces by seed. Seeds are deposited locally at or near the base of the parent plant and may be shed immediately or persist into winter within the dry flower parts that remain attached to the dead stems. Above-ground portions of the plant die back in the fall, usually followed by some degree of regrowth at the base, with the emergence of small, new leaves that persist through the winter directly above the root crown. Some plants continue producing flowers into the fall and early winter, although this is usually limited to one or two small stems per plant, with little consequent seed production (USFWS 1998). Fruits have been observed as early as mid-June and as late as mid-October. Seed production for a Nelson's checker-mallow is typically high. An average plant may produce as many as 1,500 to 15,000 seeds per year in the absence of seed predation or other reproductive constraints (i.e. herbivory, severe drought, or disease) (Gisler 2004).

Habitat Requirements

Habeck (1961) described the plant's habitat as "moist, open ground and thickets." Others have described the plant as occurring in moist to dry sites with poorly drained to well drained clay, clay loam, and gravelly loam soils, in meadow, and rarely, wooded habitats (CH2M Hill 1986; Glad et al. 1987). Nelson's checker-mallow is often found in areas where prairie or grassland remnants persist, such as along fence rows, drainage swales, and at the edges of plowed fields adjacent to wooded areas. The woody, rhizomatous (underground) stem of Nelson's checker-mallow enables the plant to persist in some disturbed situations such as roadside ditches and mowed hayfields. Nelson's checker-mallow primarily occurs in open areas with little or no shade and generally will not tolerate closed-canopy forested habitat. Shrub and tree intrusion has been documented on most of the relic prairie sites occupied by Nelson's checker-mallow.

In the Willamette Valley, Nelson's checker-mallow occurs primarily in wet prairies and stream sides and Oregon ash (*Fraxinus latifolia*) swales below 200 m or 650 feet. Nelson's checker-mallow populations usually occupy open habitats supporting early seral plant species, but they also occasionally occur in the understory of woodlands or among woody shrubs. Some populations occur along roadsides at stream crossings where non-native plants, such as reed canarygrass (*Phalaris arundinacea*), blackberry (*Rubus spp*.), and Queen Anne's lace (*Daucus carota*), are also present. Soil textures of the occupied sites vary from gravelly, well drained loams to poorly drained, hydric clay soils (CH2M Hill 1986; Glad et al. 1994).

Glad et al. (1994) reported 111 species associated with Nelson's checker-mallow, with about half of them being non-native. Some of the native plants commonly associated with Nelson's checker-mallow in the Willamette Valley include: yarrow (*Achillea millefolium*), common rush (*Juncus effusus*), sedge (*Carex* spp.), western spiraea (*Spiraea douglasii*), bird's-foot trefoil (*Lotus corniculatus*), black hawthorn (*Crataegus douglasii*), large-leaved avens (*Geum macrophyllum*), and Oregon ash (Gisler 2004). Most sites have been densely colonized by invasive weeds, especially introduced forage grasses. Common non-native species found with Nelson's checker-mallow include: tall fescue (*Festuca arundinacea*), rose (*Rosa* spp.), Canada thistle (*Cirsium arvense*), St. John's wort (*Hypericum perforatum*), blackberry, timothy grass (*Phleum pratense*), common velvet grass (*Holcus lanatus*), vetch (*Vicia* spp.), oxeye-daisy (*Chrysanthemum leucanthemum*), colonial bent-grass (*Agrostis tenuis*), meadow foxtail (*Alopecurus pratensis*), reed canarygrass, and Queen Anne's lace (Gisler 2004; USFWS 1998).

Coast Range Nelson's checker-mallow populations typically occur in open, wet to dry meadows, intermittent stream channels, and along margins of coniferous forests, with clay to loam soil textures (Glad et al. 1987). These areas generally support more native vegetation than Willamette Valley sites. Plants commonly associated with Nelson's checker-mallow in the Coast Range include: tansy ragwort (*Senecio jacobaea*), spear-head senecio (*Senecio triangularis*), wild strawberry (*Fragraria virginiana*), common velvet grass, timothy grass, rushes (*Juncus* spp.), sedges, and yarrow (USFWS 1998). Coast range Nelson's checker-mallow populations occupy mountain meadows ranging from 488 m to 597 m (1,600 to 1,960 feet) in elevation.

Several mammals and insects are associated with Nelson's checker-mallow. Stems and inflorescences are commonly eaten by deer and elk. Nelson's checker-mallow is pollinated by a

variety of insects, including 17 species of bees, 3 species of wasps, 9 species of flies, 6 species of beetles, and 5 species of lepidopterans (Gisler 2003). The most common pollinators include three species of bumblebees (*Bombus californicus, B. sitkensis* and *B. vosnesenskii*) (Gisler 2003). One solitary bee pollinator, *Diadasia nigrifrons*, is a checker-mallow specialist, and may also pollinate Nelson's checker-mallow in the Willamette Valley (Gisler and Meinke 1998). The species is also a host for various insects such as aphids (Aphididae), stinkbugs (Pentatomidae), scentless plant bugs (Rhopalidae), spotted cucumber beetles (Chrysomelidae), plant bugs (Miridae), milkweed bugs (Lygaeidae), spittlebugs (Cercopidae), butterfly larvae (Lycaenidae: *Strymon melinus*; Nymphalidae: *Vanessa anabella*), and, in the Willamette Valley, weevils (Curculionidae: *Macrorhoptus sidalcea*). Other insects found in association with Nelson's checker-mallow include ants and earwigs (Forficulidae) (BLM 1985; CH2M Hill 1986; USFWS 1998).

Pre-dispersal seed predation by weevils (*Macrorhoptus sidalceae*) is extremely high in many populations, and may severely curtail, if not virtually eliminate, seed survival (Gisler and Meinke 1998). The weevils appear to be restricted to Willamette Valley, southwestern Washington and lower Coast Range populations (around Grand Ronde), but do not infest the Coast Range populations in Yamhill, Tillamook, and Washington Counties. The weevils are native, host-specific, and are themselves parasitized by tiny undescribed wasps (Gisler and Meinke 1998).

II.C.1.a. 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, etc.), or demographic trends:

Abundance and population trends for this species are difficult to summarize for a few reasons. First, populations (or sites) are not monitored regularly throughout the entire range. Secondly, the terms "site" and "population" are loosely used, where one site may be equal to one population, or multiple "sites" may in fact be more accurately described as one population. A third factor that confounds population trend analysis is that monitoring and census techniques for the species have been highly varied, which has been problematic when attempting to look at status differences range-wide and over time. Census techniques have included presence/absence, plant counts, range of plants (i.e. 10-99, 100-500, etc.), occupied habitat (in m^2), and occupied/suitable habitat (in m^2). The 2010 Recovery plan calls for the development of a standardized monitoring protocol, or at least a standard set of plant features to be monitored, for Nelson's checker-mallow to allow for comparability of data among sites and years and evaluation of population trends (USFWS 2010). For the purposes of this 5-year review we summarized all available data, including measures consistent with the 5-factor analysis performed at time of listing. Finally, abundance trends are difficult due to changes in site nomenclature over time. For example, Finley was referred to as one "site" in 1993, and again in 1998, but in 2006 we tracked 16 individual populations/sites at Finley separately.

At the time of listing, there were six population centers (historically interbreeding populations) of Nelson's checker-mallow: four in Oregon's Willamette Valley, one in the Oregon Coast, and one in Washington. An additional population center in the Willamette Valley was already reported to be extirpated at listing. The five population centers in Oregon were monitored between 1984 to 1995 (or 1997 for Coast sites) by the City of McMinnville (CH2M Hill 1995;

1997). The five centers in Oregon had 48 extant and four extirpated sites at time of listing, and the Washington center contained one extant site. Population estimates for these sites (even though most were directly counted) were categorized into rough population estimates for the listing package (0-9 [though all sites counted had at least 1], 10-99, 100-999, or 1,000+ plants per site). Specifically, at listing 8 sites had 1-9, 16 had 10-99, 19 had 100-999, and 5 had over 1,000 plants per site.

Since listing we are now aware of at least 12 additional potentially extirpated sites. Furthermore, one site that was formerly monitored by CH2M Hill (1997) in Philomath is extirpated, but two sites remain and it is not clear whether this was a separate site or essentially the same location. We have also confirmed many new sites since listing, including at least 12 new populations identified by WVNWRC. Additional small sites have been discovered through the Section 7 Consultation process for regulatory wetlands with fill permits. For these projects, we are able to modify actions to include some conservation of the species, especially through introduction (i.e. WRPs) and/or augmentation of populations (i.e. Coffin Butte Landfill, Philomath Couplet, and Mill Creek Development) in the Coast Range and the Willamette Valley.

There are currently up to 96 extant natural occurrences throughout the species' range, with 13 in the Coast Range (Yamhill, Washington, Clatsop, Columbia, and Tillamook counties), 81 in the Willamette Valley and western Cascades (Benton, Clackamas, Linn, Marion, Polk, Washington, and Yamhill counties) and two extant Puget Trough occurrences (Lewis and Cowlitz counties in Washington). Since some of these sites have not been surveyed in the last decade, new counts would be necessary to confirm presence absolutely, but for this review we are considering a site occupied unless we have confirmation showing otherwise. Appendix A provides Nelson's checker-mallow plant counts at every natural and introduced site from 1990 through 2011. Of the 96 extant sites, 21 have 1-9, 45 have 10-99, 26 have 100-999, and four have over 1,000 plants. Ten of these 96 sites have been further augmented with approximately 1,000 plants or more each. Nelson's checker-mallow has been introduced at 23 additional sites; approximately half of these sites with 1,000 or more seedlings, and between 100 and 1,000 seedlings at most of the other sites.

Of the 96 extant occurrences of the species, roughly 40 percent are on private property (including WRP and CREP sites), 34 percent are on public or tribal, and 26 percent are on mixed or unknown ownership land. Of the 23 introduction sites, 11 are on private property, 11 are on public land, and one site has mixed ownership. A distribution map of currently occupied sites (both naturally occurring and introduced) can be found in Appendix B.

Population monitoring has occurred at some sites throughout the range, but there is no comprehensive, systematic monitoring plan of all sites (or all potential reserve locations). To help determine the current status and distribution of the species, the Service visited many known sites in 2005 and pooled information received from land managers and/or property owners to assess the status of the species. Additionally, IAE conducted a recent survey effort in the Corvallis West and Salem West recovery zones, counting plants at most sites in those zones within the last four years. In 2012, IAE plans to survey the remaining sites in the Corvallis East, Salem East, Coast Range and Portland recovery zones (Melanie Gisler, IAE, pers comm. 2011).

Some sites have been monitored more regularly (i.e. Walker Flat, ODOT SMAs, Baskett, and Finley, etc.) since listing. The most intensive, long-term, and consistent population monitoring has occurred at Walker Flat. Population monitoring at Walker Flat began in the middle 1980s by the BLM and the City of McMinnville. Due to the large population size, relative changes in frequency (of the BLM portion) within random sampling plots were measured (Guerrant 2003). An estimate of overall population size (both BLM and city-owned) through 1997 was then estimated based on random stratified sampling within fixed grids (CH2MHill 1997). Currently only the BLM portion is monitored regularly. This information can help explain trends that may affect the overall Walker Flat population, but it is important to note that threats, population sizes, and land practices could differ by site so this is not conclusive.

While there are many newly confirmed naturally occurring sites since listing, it is important to note that many of these sites are small and isolated, and are highly vulnerable to extirpation over time if threats are not adequately addressed. In some cases a site only consists of a single plant, but is a potential area for management and augmentation. Also, many sites do not have a management plan to address threats to the species at the sites. For these reasons the Service continues to emphasize that the recovery of the species should entail addressing the threats to the species, not just managing the number of populations or occurrences.

Another method of describing the amount of Nelson's checker-mallow throughout its range is to analyze the area it covers (occupied area or combination of occupied and suitable area). Since this species can spread via rhizomes or laterally spreading root systems it can be difficult to differentiate between individuals. Consequently, one or more plants within a one-by-one m plot are considered one occupied m^2 of habitat (USFWS 1998). This method was used by CH2M Hill (1995; 1997), where one occupied m^2 of habitat was considered one plant. This is apparent when comparing the results of CH2M Hill studies with the 1998 recovery plan. For example, the Bald Hill Park site had 316 plants in the (CH2M Hill) 1997, and was considered as 316 occupied m^2 in the 1998 recovery plan.

One caveat with area estimates is the importance of considering density within the occupied patches. For example, the Oregon Natural Heritage Program (ONHP) Database (ONHP 2004) mapped a total of 2,061,919 m^2 or 510 acres of occupied habitat in 77 habitat patches. The occupied habitat ranges in size from 1 m^2 (0.0002 acre) to 624,302 m^2 (154 acres) for Oregon. The density of Nelson's checker-mallow within each patch is unknown, and this area estimate does not, in most cases, equate to population size. The Prairie Species Recovery Plan (2010) provides a more current summary of the estimated plant cover in acres of Nelson's checker-mallow at most of the known sites in five of the seven recovery zones (Table 5). Again, the data does not provide any indication of density within the patches at each site.

Table 5: Estimated foliar cover of Nelson's checker-mallow across its current range

	Acres (m^2) of foliar cover	Number of sites
Coast Range	137.58 (556,767)	10
Corvallis West	220.19 (891,077)	39
Salem East	289.25 (1,170,553)	12
Salem West	449.59 (1,819,426)	27
SW Washington	179.88 (727,949)	2
Total	1276.50 (5,165,812)	90

Additional mapping and monitoring will be necessary to verify, clarify, and track foliar cover information.

II.C.1.b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

There is no additional information on Nelson's checker-mallow intra- and inter-population genetics. The Nelson's checker-mallow recovery plan recommends exploration in the area of genetics including the study of inter-population and intra-population genetic variability, genetic isolation on levels of inbreeding depression (if any), and rates of genetic drift. Genetics research will be useful information for reserve selection and management.

There is, however, additional information on the hybridization potential of Nelson's checker-mallow. Four other native *Sidalcea* species are found within the geographic range of Nelson's checker-mallow (Hitchcock and Cronquist 1973; Gisler 2004), including *S. virgata* (rose checker-mallow), *S. campestris* (meadow checker-mallow), *S. cusickii* (Cusick's checker-mallow), and *S. hirtipes* (Bristly-stem checker-mallow). There is a strong potential for interspecific hybridization among Nelson's checker-mallow and its congeners in the region, although there are some ecological and genetic reproductive barriers to prevent it from occurring (Gisler 2003; 2004). Nelson's checker-mallow is a (2n=20) diploid (Gisler 2004). Cusick's checker-mallow is also diploid, as well as rose checker-mallow (which can also be tetraploid) (Whittall et al. 2000). Specifically, allopatric populations of Nelson's and rose checker-mallow are sexually compatible and sometimes overlap flowering periods, so moving plants around could result in interspecific gene flow. Nelson's and Cusick's checker-mallows are also fully compatible and share pollinators and flowering times, but their geographic ranges are parapatric, with nearest populations narrowly separated by less than a mile at the south end of Finley National Wildlife Refuge (Gisler 2004). If these species come into contact through human-mediated dispersal, hybridization could easily occur. There are no currently known hybrids among Nelson's checker-mallow and other species, but in 2006 ODA staff visited several sites (Camp Adair, Finley) with co-occurring Nelson's checker-mallow and *S. campestris* plants and observed what appeared to be hybrids (plants with intermediate morphology). Augmentation and reintroduction efforts must consider the potential threat to prevent that from occurring.

II.C.1.c.Taxonomic classification or changes in nomenclature:

Nelson's checker-mallow was first collected by Elihu Hall in 1871 (Robinson and Parenti 1990). The plant was described by Charles Piper in 1919, based on material collected by J.C. Nelson near Salem, Oregon (Piper 1919). Nelson's checker-mallow is an herbaceous perennial plant in the mallow family (Malvaceae). The Malvaceae Family is in the Magnoliophyta Division (angiosperms), Class Magnoliopsida (dicots), Subclass Dilleniidae, and Order Malvales. Nelson's checker-mallow is in the oregana clade, along with Oregon (*S. oregana spicata*), marsh (*S. o. hydrophilia*), and Kenwood Marsh (*S. o. valida*) checker-mallows (Andreasen and Baldwin 2003). Nelson's checker-mallow is very closely related to Oregon checker-mallow (Andreasen and Baldwin 2003) However, Nelson's checker-mallow is still considered a distinct species and there have been no changes to its taxonomic classification and/or nomenclature since listing.

Taxonomic relationships between Nelson's, rose, meadow, and Cusick's checker-mallows, as well as various populations of Nelson's checker-mallows were investigated before listing. This involved a comparison of pollen using a scanning electron microscope and performing principal component analysis (PCA) on gross morphological features of the plants. All four were found to be distinct species (based on PCA analysis), and Nelson's checker-mallow was found to be morphologically consistent throughout its range (based on identical chromosome numbers for six populations and PCA analysis found no distinct sub-taxa), supporting the hypothesis that Walker Flat (Coastal population) is not genetically distinct from Willamette Valley populations (Halse et al. 1989). However, morphometric analyses indicate that several characters (stem decumbency, flowering stem length, inflorescence branching, and raceme congestion) distinguish Willamette Valley from Coast range populations. Also, there are some ecological, phenological, and sex ratio differences between the two eco-regions. This indicates there still may be some question as to whether the Coast and Willamette sections are distinct.

II.C.1.d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

Nelson's checker-mallow primarily occurs in Oregon's Willamette Valley, but is also found at several sites in Oregon's Coast Range and at two sites in the Puget Trough of southwestern Washington. The plant's range extends from southern Benton County, Oregon, north to Cowlitz County, Washington, and from central Linn County, Oregon, west to the crest of the Coast Range. The historical distribution of the species is thought to be similar to what is found today, although its abundance is thought to be significantly lower than it once was (58 FR 8243, Alverson 1990). Currently, the species is known to occur at roughly 119 sites in Oregon and Washington. This includes both natural and introduced populations, as well as occurrences with one individual and thousands of individuals.

In the Willamette Valley, populations of Nelson's checker-mallow occur at low elevations (below 200 m or 650 feet)) within a mosaic of urban and agricultural areas, with concentrations around the cities of Corvallis and Salem. In the Coast Range, Nelson's checker-mallow

populations range in elevation from 488 m to 597 m (1,600 to 1,960 feet), and are found in open, grassy meadows within a larger matrix of coniferous forest.

There has not been a significant change in range since listing. There are, however, three more recently confirmed sites at the periphery of its range, one in the Clackamas Subbasin, one in the Nehalem Subbasin, and another Washington site in the Upper Chehalis Creek Subbasin. There were four confirmed extirpated sites at listing and 12 additional sites that may now be extirpated, but these have been roughly balanced by newer confirmed sites and augmentation efforts.

II.C.1.e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Grasslands and oak savannahs dominated the Willamette Valley landscape prior to European settlement in the 1840s (Habeck 1961; Johannessen et al. 1971; Towle 1982; Boag 1992). The historic landscape included roughly 1,010,000 acres of native prairie, two-thirds of which were upland and one-third of which were wet prairies (Habeck 1961). Prairies are typically maintained by natural or human-induced disturbance. Historic prairies in the Willamette Valley were maintained by native Kalapuya people through frequent, intentional burning (Boyd 1986).

Most native Willamette Valley prairies have either been removed or severely degraded by conversion to agricultural use, urbanization (Boag 1992), fire suppression, and subsequent woodland succession. Currently only about one percent of historic prairie habitat remains (Hammond and Wilson 1993; Kaye et al. 2003). Remaining native prairies vary in size and quality, and are highly fragmented. A separate survey of upland prairie remnants, using information from experts and the literature (Wilson 1996), identified only five sites that contain relatively large areas of high or very high quality prairie. Only one of these sites, Baskett NWR is known to have Nelson's checker-mallow. Bottomland (wet) prairies are also greatly reduced (99 percent) from historic levels, with only 4,942 acres remaining as of 1995 (TNC 2000).

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

A 5-factor analysis to describe and analyze threats to the species was completed for Nelson's checker-mallow at time of listing (USFWS 1993). Reasons for listings and threats were also described in the current recovery plan (USFWS 2010). Table 6 compares the threats identified in the final listing rule for this species to current threats. The key threats, including any discussion of new (or further clarified) threats, are described in III.C.2.a through III.C.2.e.

Table 6: Threats to Nelson's checker-mallow identified at listing and currently

	Identified at Listing	Current Threats
A. The present or threatened destruction, modification, or curtailment of habitat or range.		
- On-site agriculture conversion and management practices	X	X
- Adjacent land use practices		X
- Historic management and disturbance	X	X
- Housing and urban development		X
- Hydrologic alterations	X	X
- Improper prairie management	X	X
- Invasive species	X*	X
- Isolation and fragmentation	X	X
- Road development and maintenance	X	X
- Utilities installation and maintenance		X
- Timber harvest, silviculture, and logging	X	X
- Wildfire and burning	X*	X
B. Overutilization for commercial, recreational, scientific, or educational purposes.		
- Field research activities	X*	
- Recreation	X	X
- Over-collecting and poaching	X	X
C. Disease or predation		
- Herbivores/predators	X*	X
- Livestock grazing	X*	X
- Parasites (weevil predation)	X	X
D. Inadequacy of existing regulatory mechanisms.		
- Habitat Vandalism	X	X
E. Other natural or man-made factors affecting the continued existence of a species.		
- Succession to native woody plants	X	X
- Impaired ecological functions	X*	X
- Small population size/low genetic variability	X	X
- On-site pesticide use	X	X
- Potential for hybridization		X
* This threat was alluded to but was not clearly articulated and/or was mentioned outside of the 5-factor analysis in the final listing rule.		

II.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

The effects of past and present widespread habitat destruction and modification continue to threaten Nelson's checker-mallow populations. Multiple land uses, including agriculture, hydrologic alterations, tree farms, grazing, logging, road development/maintenance, utility

installation, mowing, herbicide application, improper fire management (suppression and/or inappropriate application), urban development, and adjacent land-use practices (unrestrained livestock, spread of invasive species, and herbicide drift) threaten the long-term viability of the species.

The primary reasons for the decline of their historic prairie habitat include the alteration of natural and human-mediated disturbance processes (i.e. fire and flooding) that maintained the early seral stage of the plant communities, urban development that permanently removed prairie habitat (Altman et al. 2001), and the above-referenced land uses that have modified wet prairie habitat quality and/or quantity to one percent of historic levels (TNC 2000).

Agricultural and urban development have modified and destroyed habitats, fragmenting populations into small, widely scattered patches. In the Willamette Valley, extirpation is an ongoing threat to many Nelson's checker-mallow occurrences on private lands, roadsides, and undeveloped lots zoned for industrial and residential development. Many extant sites are not regularly monitored and managed to address threats, making these at continued risk of extirpation. Development pressures continue in the species' range, particularly in the Willamette Valley (i.e. Coffin Butte Landfill, urban development in Philomath, Corvallis, and Salem, road improvements, etc.). This has resulted in the extirpation of populations, and the need to transplant plants from proposed project areas to secure habitat.

At the time of listing, the potential construction of a reservoir threatened the largest known population, Walker Flat. This population is partly owned by the BLM, but is mostly located on private property. This area is still protected under the state Scenic Waterway System. There had been previous attempts to remove this site from this protective designation. We are not aware of any current effort to remove this designation, but it is still a possible threat (non-imminent) for the future. There are additional large populations throughout its range, but this site is still the largest in the Coast Range (based on monitoring of the site until 1997 and regular monitoring of the BLM portion currently).

A serious long-term threat to Nelson's checker-mallows (along with other Willamette Valley prairie species) is the change in community structure due to plant succession. Habitats occupied by Nelson's checker-mallow contain native grassland species and numerous introduced taxa. In some areas, habitats occupied by Nelson's checker-mallow are undergoing an active transition towards a later seral stage of vegetative development, often due to the encroachment of non-native, invasive species (i.e., brush competition). Invasive woody species of concern include non-native plants such as Himalayan blackberry, multiflora rose (*Rosa multiflora*) and Scotch broom (*Cytisus scoparius*). Invasive native species include Oregon ash, black hawthorn, Nootka rose (*Rosa nutkana*) and western spiraea. Due to this rapid invasion by woody vegetation (especially Scotch broom) in some areas and the suppression of natural fire regimes secondarily, successional pressures on these plant populations are expected to increase over time. The natural transition of prairie to forest in the absence of disturbance such as fire will lead to the eventual loss of Nelson's checker-mallow (as well as other prairie) sites unless they are actively managed (Johannessen et al. 1971; Hammond and Wilson 1993; Kuykendall and Kaye 1993). Succession is a threat at many sites throughout the range, including Walker Flat. Monitoring efforts on BLM show that while the frequency of Nelson's checker-mallow is roughly the same now as it

was 10 years ago, the amount of woody species is increasing each time it is monitored (Ed Guerrant, Berry Botanic Garden, pers. comm., 2006). Walker Flat is not actively managed for succession, but this will be necessary for the long-term viability of this population (in the absence of natural disturbance regimes).

Prairies attract human recreation, which can have negative effects. Off-road vehicles, hikers, cyclists and horses may crush or uproot plants, and seeds of invasive species may be spread by vehicle tires, horse manure, and by other anthropogenic means. Recreational motorcycling still is a threat at Browns Camp (Devils Lake Fork) in the Coast Range. Recreation is also a threat in areas with elevated public use, such as city parks.

Habitat loss and fragmentation has isolated populations of Nelson's checker-mallow. Population isolation reduces gene flow among populations, alters metapopulation structures, and increases susceptibility to local population extirpation caused by environmental catastrophes (Meffe et al. 1997). Some remnant patches of prairie are too small to contain self-sustaining plant populations. Habitat loss and fragmentation has likely resulted in the loss of genetic diversity, but inter-population and intra-population genetics studies have not been completed yet to determine to what extent this has occurred. While there is a continued threat of habitat loss and modification to the species, this is partially abated by augmentation and reintroduction efforts in parts of its range. Specifics on these conservation efforts are detailed in section II.B.3.

Active management is required to maintain the prairie habitat occupied by this plant, although the species can occur in fairly disturbed and non-native sites. Fire, mowing, shrub removal, and transplanting efforts can be effective management techniques, but must be used with care. Few populations occur on federal or other protected lands and are being managed for the species. Thus, a majority of populations remain vulnerable to extirpation. Detailed monitoring (to the standards specified in the recovery plan) has not been established across most sites (including NWR sites) to track an increase or decrease in the species. Population numbers for most sites have been updated recently, but continued monitoring of sites and threats needs to be conducted to track the status of this species, and to help direct recovery efforts.

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:

Scientific collection was cited as a threat at listing, but is not considered a significant threat currently. Since it is a state and federally listed species, the collection is regulated by both ODA and the Service. Care is taken to minimize potential negative effects to populations, and collection is used primarily for the purpose of restoring or augmenting other sites. Research on management techniques also can impact individual plants, but is focused on the long-term benefit of restoring populations.

Over-collection can be a threat for this species, especially for small populations. Four previously extirpated sites (i.e. Bellevue, Independence, and two Salem sites) were previously collected for herbariums. Collection may have contributed to their extirpation. Generally, over-collection is small in scope and not considered a significant threat that contributes to risk of extinction.

II.C.2.c. Disease or predation:

Herbivory by deer, elk, and weevil predation continue to threaten this species. When populations are small, even the loss of a few individuals can affect overall population viability. Gisler and Meinke (1998; 2001) have studied the effects of weevil predation on Nelson's checker-mallow plants. Seed predation can substantially deplete soil seed banks and can reduce the reproductive output of plants. If seed predation is maintained at high levels over consecutive years, it can decrease recruitment and affect population dynamics (Gisler and Meinke 2001). Pre-dispersal seed predation by weevils is extremely high in many populations, and may severely curtail or eliminate seed survival (Gisler and Meinke 1998). Early in seed production, weevils often consume developing embryos and may account for up to 100 percent loss of pre-dispersal seed (Gisler and Meinke 1998; Gisler 2004).

Weevils appear to be restricted to populations in the Willamette Valley and lower Coast Range (around Grand Ronde) in Oregon and the Lewis County population in Washington. They apparently do not infest the Oregon Coast Range populations in Yamhill, Tillamook, and Washington Counties. The weevils are native, host-specific, and are themselves parasitized by tiny wasps (Gisler and Meinke 1998). Weevils may be controlled by insecticides, but it may be necessary to treat populations periodically (Gisler and Meinke 2001). However, as weevils are a native species, specific to *Sidalcea*, weevil control may have unintended and undesirable consequences to their status as they may be as or more rare than Nelson's (Gisler 2004).

Predation via livestock grazing can affect populations similar to elk and deer grazing. Grazing removes vegetative and reproductive plant structures, which can be destructive if it occurs during the growing season. Depending on the intensity of the grazing, and the type of livestock, the effect can also include substantial disturbance of the substrate. Grazing can also increase the spread non-native plant seeds into native habitats.

II.C.2.d. Inadequacy of existing regulatory mechanisms:

As a federally-threatened species, regulatory measures are undertaken to conserve this species. All Federal agencies are required to actively pursue efforts to conserve listed species (section 7(a)(1)) and ensure that activities they fund, authorize, or carry out are not likely to jeopardize the continued existence of the species (section 7(a)(2)). The Service has addressed certain projects that have resulted in impacts to Nelson's checker-mallow through section 7 consultations with other Federal agencies. In 2007, 2008 and 2009 non-jeopardy opinions were issued addressing the effects of Army Corps of Engineers, the Animal Plant and Health Inspection Service, Federal Highway Administration, and the Farm Service Agency projects that were occurring in Nelson's checker-mallow habitat. The primary activities in these projects included landfill expansion, water pipeline development, wetland development, the deregulation of a genetically modified grass (non-jeopardy for Nelson's checker-mallow), habitat restoration projects, and highway improvements. The Service has also addressed impacts to Nelson's checker-mallow from its own recovery actions through Intra-Service section 7 consultations. Non-jeopardy opinions were issued from 2007 through 2011 addressing the effects of various restoration actions including chemical treatment of invasive vegetation and insects, collection of seed and plant material, use of prescribed fire to restore habitat, and effects of conservation

programs (Partner's for Fish and Wildlife, Coastal and Recovery Programs, Safe Harbor Agreements and Habitat Conservation Plans).

The Act also regulates interstate and foreign trade of Nelson's checker-mallow, prohibits willful destruction in violation of State trespass laws on all lands, and prohibits reduction to possession on federal lands. Additionally, because this species is associated with wetland habitats that are protected by U.S. Army Corps of Engineers and Oregon Division of State Lands regulations (wetland fill permits), they are afforded some protection through regulation of wetland fill permits. As a state of Oregon-endangered species, all non-federal public agencies must ensure the activities they authorize, fund, or carry out on non-federal publicly owned or leased land are not likely to adversely affect any state-listed species. ODA also regulates trade of Nelson's checker-mallow within Oregon.

The passage of the Natural Area Preserves Act (NAPA) in 1972 authorized WDNR to establish and manage a statewide system of natural areas in cooperation with private individuals and organizations, and local, state, and federal agencies. Currently WDNR and its partners manage more than 5 million acres of land in Washington. The NAPA was amended in 1981 to establish a Natural Heritage Program (WNHP) within WDNR to develop a scientific approach to the process of identifying candidate sites for the natural areas system. WNHP maintains a list of rare, threatened, and endangered plants for Washington. Washington State does not have a state endangered species act, making the WNHP plant list advisory only. However several county, state, and federal agencies have adopted policies, regulations, and ordinances that recognize WNHP's list and provide protection for species contained in it (WNHP 2006).

Although current regulatory mechanisms are mostly adequate, vandalism still is a potential threat for this species and could be better addressed through the regulatory process. Vandalism is small in scope but occasionally occurs when rare species cause unpopular restrictions on use of public or private lands. Even though it is not a common occurrence, vandalism reduces habitat function and destroys individual plants, increasing the risk of extinction for listed plants.

II.C.2.e. Other natural or manmade factors affecting its continued existence:

The potential of hybridization with other Sidalcea species was recognized by the Service as a new threat since listing. Gisler (2003) identified several risk factors that promote interspecific hybridization including sexual compatibility between members of the genus, sympatry of potential interspecific mating partners, human-mediated dispersal of Willamette Valley checker-mallow species (via horticultural, agricultural, and restoration practices), ubiquity of disturbances that promote habitat homogenization and creation of novel microsites for hybrid colonization, outcrossing mating systems, and the ability to spread vegetatively (which can promote hybrid establishment even if they are sexually sterile). Current pre- and post-mating attributes discourage hybridization, but human-mediated dispersal could be problematic if it disperses taxa beyond their current range. Care must be taken to prevent dispersal, and especially to make sure Cusick's and Nelson's checker-mallow ranges are not mixed, as they are fully inter-fertile (Gisler 2004).

Succession to woody plants, alteration of disturbance regimes, and competition from invasive species for habitat threatens this species. Because they are related to habitat loss and modification they were detailed above in section II.C.2.a. Impaired ecological functions, small population size, fragmentation of habitat have also resulted from habitat modification and loss and are detailed in section II.C.2.a.

Within the *Sidalcea* genus, population sex-ratios may contribute to its genetic vigor or vulnerability such that the ratio of pistillate to perfect flowers may ultimately control the amount and quality of seeds produced regardless of habitat quality. Strongly female biased population structures are primarily restricted to Willamette Valley populations (USFWS 1998). In general, population structures based on imperfect flowers (such as Nelson's checker-mallow in the Willamette Valley) show greater genetic diversity and vigor among offspring than population structures based on perfect flowers (Delph and Mutikainen 2003) and there is no evidence that female-biased population structures lead to lower productivity than populations with more balanced female to male ratios (Gisler and Meinke 1998).

Factors associated with the changing climate will have an effect on populations of Nelson's checker-mallow. The Intergovernmental Panel on Climate Change (IPCC) has concluded that recent warming is already strongly affecting terrestrial biological systems (IPCC 2007); this is evident in earlier timing of spring events such as migration and egg-laying, and in poleward and upward shifts in plant and animal distribution (IPCC 2007). The IPCC has further concluded that the resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change, associated disturbances (*e.g.*, flooding, drought, wildfire, insects, ocean acidification) and other global change drivers (IPCC 2007). Projections for the Willamette Valley include a rate of climate change that exceeds the ability of native species to adapt and an increase in invasive species that compete with native species (CLI & NCCSP 2009).

Although climate change is almost certain to affect prairie habitats, there is great uncertainty about the direction and specific effects of climate change on Nelson's checker-mallow and other listed prairie species. In order to promote conditions that allow populations of target species to be resilient to changing environmental conditions and to persist as viable populations into the future, the Recovery Plan for the Prairie Species Western Oregon and Southwest Washington (2010) stressed maintaining large populations distributed across their entire historical range, with management plans focusing on protecting sites with high habitat heterogeneity and a range of elevations. Additional recovery actions to address climate change focused on monitoring species status and response to changing conditions, and seeking expert input and consensus on recommendations to prepare for future environmental change.

II.D. Synthesis

Summary of Threats

Nelson's checker-mallow is threatened by historic and continued habitat loss and modification. Only about one percent of historic bottomland/wet prairie habitat remains in the Willamette Valley (TNC 2000), and the remaining patches are located in isolated fragments. Nelson's checker-mallow is especially threatened by the encroaching succession of species throughout most of its range (including Walker Flat), primarily resulting from suppression or elimination of natural disturbance regimes including periodic flooding and fires. These disturbance regimes

previously maintained the early seral stage of the plant communities, and the lack of disturbance is resulting in the continued loss of available habitat.

Land uses have modified and limited habitats, fragmenting populations into widely scattered patches many of which are very small in extent and numbers of plants. Land uses that have resulted in habitat loss include agriculture, urban development, and hydrologic alterations. Additional land uses that have been incompatible with maintaining native prairies are detailed in II.C.2.a.

Small population sizes, genetic isolation, and lack of variation within local populations may further threaten the species' ability to survive over the long term. Roughly two thirds of all presently occupied extant sites have fewer than 100 individuals. Smaller populations (0-99 individuals) are generally more vulnerable to extirpation from stochastic events (Meffe et al. 1997). Within the last five years, ten of these sites have been augmented with over 1,000 additional Nelson's checker-mallow plants in an effort to enhance the site's potential for persistence.

Other key threats to the species include competition from non-natives and weevil predation on seeds. Evidence of reproduction and recruitment is very important in determining likelihood of long-term persistence for Nelson's checker-mallow. Because the plant is very long-lived and a single plant may occupy a site for long time, mere presence is not an adequate measure of long-term persistence. Climate change is expected to have some effect on populations of Nelson's checker-mallow, but the extent of that effect is uncertain and difficult to predict.

Application to ESA Definitions and Service Regulations/Policy

To translate the available biological information (II.C.1) and threats (II.C.2) into a regulatory/policy recommendation under ESA, we considered terminology embedded in the regulatory definitions, including endangered and threatened, listable entity, foreseeable future, and significant portion of its range.

The Act defines an "endangered" species is one that is in danger of extinction throughout all or a significant portion of its range. A "threatened" species is one that is likely to become endangered in the foreseeable future.

A listable entity, or "species," includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species or vertebrate fish or wildlife which interbreeds when mature. Nelson's checker-mallow is still considered a distinct plant species (II.C.1.c), listable under the ESA.

The "foreseeable future" definition is applicable to the threatened species definition. This term is not defined in the Act and the Service has not promulgated rules to define foreseeable future. What we can reasonably predict in the future varies by species, and depends on the scientific information available, species status and historic trends, threats (type, distribution, rate, and permanence), current mitigation and conservation measures, etc. There is no single, straightforward methodology to describe foreseeable future, which complicated our efforts to define this term. Additionally, there have been no population viability analyses for this species

to help inform our definition. We defined the foreseeable futures as 20-60 years. We based our definition on the following: 1) we assumed that threats, as well as conservation and mitigation efforts, will continue at the same level; 2) while individual plants can live at least 100 years, threats are impacting sites within a much shorter timeframe; and 3) monitoring at Walker Flat, one of the largest extant sites, has shown a steady increase of woody succession in frequency monitoring plots. While this information is preliminary, we reason that if succession occurs at the same rate that 100 percent of the monitoring plots will contain woody species. Succession to non-natives and invasive woody species could also significantly affect, if not eliminate, many other sites within this timeframe in the absence of natural or appropriately managed disturbance.

For listing determinations, the Service considers threats throughout all or a significant portion of a species' range. Threats to Nelson's checker-mallow differ by site, but are generally similar range-wide. Since threats are similar throughout its range we do no need to define what may constitute a significant portion of its range.

This species has not recovered and still faces threats. While recovery efforts have been initiated and appear promising, the species still has a low recovery progress number (less than 25 percent of goals achieved). Propagating and transplanting efforts appear promising to help ultimately recover this species. There have been studies since listing to determine how to properly manage site for the species, and many efforts to augment, reestablish, or create new populations. However, the Service and a recovery team have not identified reserve sites. Furthermore, sites that appear promising to be reserves have not had long-term management to address threats to species coupled with monitoring to ensure it meets recovery criteria.

Conclusion

We recommend that Nelson's checker-mallow remains classified as threatened, because the current status and threats are similar to that at listing. While 12 sites may have become extirpated since listing, several new sites have been confirmed, and there have been many successful transplanting efforts to augment existing and establish new populations. The species continues to be susceptible to numerous threats (described above), of varying magnitude and imminence. At least one, but often multiple, significant threats affect populations throughout its range, including historic and current habitat loss and modification, incompatible land management practices (i.e. spraying, inappropriate mowing or fire management, etc.), succession, weevil predation, and consequences of small population sizes.

This species is not endangered because of mitigation, augmentation, and introduction efforts, and because many threats, while ongoing will take place over time (i.e. succession, isolation effects) and could still be addressed in the foreseeable future.

III. RESULTS

III.A. Recommended Classification*:*

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist*:*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X__ **No change is needed**

III.B. New Recovery Priority Number

No change, recovery priority number remains 2. The species continues to have high threats with a high recovery potential. Many successful transplanting efforts indicate that transplanting this species to protected, managed sites could greatly aid and accelerate recovery efforts.

III.C. If a reclassification is recommended, indicate the Listing and Reclassification Priority Number

Reclassification (from Threatened to Endangered) Priority Number: ____

Reclassification (from Endangered to Threatened) Priority Number: ____

Delisting (Removal from list regardless of current classification) Priority Number: ____

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

The 5-year review identified areas where more information or greater consistency is needed to more accurately evaluate and quantify the status of Nelson's checker-mallow. We also identified actions that are needed to further recovery efforts for the species.

- Develop a monitoring protocol to track species status and fulfill the monitoring requirements specified in the recovery plan. Past monitoring efforts have included plant counts, frequency plots, and estimates of occupied area and available habitat. It is not possible to compare estimates of occupied area if there is no consideration of density within the occupied area.

- Survey all sites more consistently to keep apprised of the status of the species throughout the range. Ideally surveys will include population information (number of individuals, occupied and available habitat), and site-specific threats for the species).

- Create a species database that can be queried to help inform recovery efforts and track the species' status. We recommend, at a minimum, the following fields be included: site

name, ownership, first surveyed/detected, last surveyed, threats, management actions, available habitat, occupied habitat, density (if known), and number of plants.

- Develop consistency in the nomenclature and mapping of sites. Map sites with a highly accurate GPS so sites are easier to track.

- Identify/designate protected sites for each recovery unit and develop a strategic plan to augment populations to the level needed for recovery. Identify site-specific threats and develop a management plan and monitoring protocol that is consistent with requirements of the recovery plan.

- Continue outreach to land owners and managers to identify target areas and willing participants to establish reserves.

- Continue developing a seed bank for the species, including sites throughout its range.

- Pursue Safe Harbor Agreements with interested landowners for Fender's blue butterfly that include protection and enhancement of nectar species, including Nelson's checker-mallow; this will help to manage threats to Nelson's checker-mallow.

- Select reserves primarily based on the following criteria: habitat quality, edge effects, the size needed to maintain genetic diversity, and ability to accommodate natural or anthropogenic disturbance.

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Signature Page

U.S. FISH AND WILDLIFE SERVICE 5-YEAR REVIEW of
Nelson's checker-mallow *(Sidalcea nelsoniana)*

Current Classification: Threatened

Pre-1996 DPS listing still considered a listable entity? NA

Recommendation resulting from the 5-Year Review;

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X__ No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable: NA

Review Conducted By: Rebecca Toland, OFWO, Portland, Oregon

_____ Date 5/29/12
Lead Field Supervisor, Fish and Wildlife Service

_____ Date 7/11/12
Cooperating Field Supervisor, Fish and Wildlife Service

APPENDIX A- Population abundance estimates for Nelson's checker-mallow from 1990 to 2011.

Survey counts refelct the best estimate of individual plants at each site.
p= presence confirmed but no count conducted.
Number of plants introduced is listed in parentheses for each introduction/augmentation.
Site names in italics are sites that have been augmented with propagated or translocated plants.
Ownership abbreviations: Ci= City, Co= County, F= Federal, P= Private, S= State, T= Tribal, U= Unknown
Sites beginning with X indicate a probable extirpation.
Sites beginning with I indicate an introduction site.

Recovery Zone	Site Name	Owner	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011
Coast Range	Browns Camp East	S														200+						
Coast Range	Browns Camp West	S														0 to 9						
Coast Range	Devils Lake Fork Wilson River	U	285	p	p	p	p	p								200+	111					
Coast Range	Elk Creek	U													500?							
Coast Range	Elliot Creek	U															100's					
Coast Range	Elsie	S														1						
Coast Range	Forest Grove	S								1												
Coast Range	North Fork	P		167												200+						
Coast Range	Second Growth/Barney Reservoir	Ci./P	116	112	125	145	149	(?#)								500+						
Coast Range	Tillamook Burn 1	P	4460	p	p	p	p	p									200+					
Coast Range	Tillamook Burn 2 & N. Fork	P					140	p								200	7					
Coast Range	Walker Flat	F/P		7378	p	p	p	7008								200+ (BLM)				300 (BLM)		
Coast Range	Weyerhauser Trask	P																		100		
Corvallis East	Almen Drive	P							2+													
Corvallis East	I-5 over Courtney creek	P													4							
Corvallis West	Alexander Road	Co.																	2			
Corvallis West	*Bald Hill Park*	Ci./P	346	346				316							0	2			3		(1223)	
Corvallis West	Bellfountain Road	Co./P		6	p	p	p	p								0			4			
Corvallis West	*Buchannen/Tyee WRP*	P																	>100		50 (2500) (30lb seed)	

Recovery Zone	Site Name	Owner	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011
Corvallis West	Bull Run Creek (Bellfountain Rd. 2)	Co./P					49															
Corvallis West	Camp Adair Rifle Range	S											300				74		1000			
Corvallis West	Chapel/Plymoth Road	Co.																	18			
Corvallis West	Coffin Butte Landfill	P												84					300			
Corvallis West	Corvallis Waterworks	Ci.	56	p	p	p	p	p								0			10			
Corvallis West	Decker Road	Co.	7	7	14	p	1	32	1							500+			600			
Corvallis West	E E Wilson	S					100s									200+			377			
Corvallis West	*E4 Ranch WRP*	P															1				1 (2000) (20lb seed)	
Corvallis West	Fern and Airport Road	U															20		59			
Corvallis West	*Finley Wildlife Refuge*	F	2366	p	p	p	p	2521						(93)	(177)	(942)	1392		1400 (2750)		581 (3150)	(2200)
Corvallis West	Harrison Blvd	Co./S														42			75			
Corvallis West	Herbert Farms	Ci.															5		5			
Corvallis West	Holiday Tree Farm	P				58													419			
Corvallis West	*Industrial Way (NE of Philomoth)/Lupine Meadows*	P		24	p	p	p	p							(200)	220 (81)		24 (1380)			(1200)	
Corvallis West	*Jackson Fraizer*	Co.				1 to 10													6			6 (1035)
Corvallis West	Katan CREP	P																	50			
Corvallis West	Lewisberg	S/P	198	p	p	p	150	p							75-100				41			
Corvallis West	Muddy Creek	Ci./P													71				71			
Corvallis West	Noyes	Ci.																	19			
Corvallis West	NRCS Plant Materials Center	F																	20			
Corvallis West	OSU Horse Center	S		656												45			45			
Corvallis West	Owens Farm	P														21-30			50			
Corvallis West	Peavy Arboreatum	S																		39		
Corvallis West	Rice	P																	37			
Corvallis West	Squaw Creek/ Dunawi Creek	P	56	p	p	p	p	p								5-10			40			
Corvallis West	Tampico and Soap Creek	P														11			43			
Corvallis West	Vincent Creek	P											100									

Recovery Zone	Site Name	Owner	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011
Corvallis West	Walnut Park, MLK Park	Ci.	4	p		p	p	p								25			33			
Corvallis West	West Hills	U														200+						
Corvallis West	Wren Prairie	U	83	p	p	p	p												2			
Portland	Beaver Creek	U							3													
Portland	Bridgeport School	Ci	15	15	p	p	p	p														
Portland	Nelson's Golden Valley	Ci./P		195	p	p	p	p														
Portland	Shellenberg	U															10-50					
Portland	Waibel Farm	P	175	155	165	p	p	p							20 to 30							
Portland	Yamhill	S																		3		
Salem East	70th Ave SE	P									50											
Salem East	Aumsville gravel pit	S/P	16	16			10						2			14						
Salem East	Burklund Lumber (at Turner)	P		158	p	p	p	158			37											
Salem East	Hess Road	P	359		p	p	p	p						381								
Salem East	Lowes	S																				89
Salem East	Ridge Drive	P	25		15		18	p			5											
Salem East	Santiam Interchange	S		112			81	81									500+			936		
Salem East	Shelburn: Miller Cemetary	Co./P	2				11 to 50	11 to 50								19						
Salem East	Waldo Hills	U		1											200+							
Salem East	Wipper Road/Battle Creek	P														4						
Salem East	Salem Airport; Turner Road	Ci.	1429		526	435	449	600								200+			U			
Salem East	Santiam Interchange KOA	S	2	2		2	2	2												150		
Salem West	*Baskett Slough NWR*	F													1437 (960)	(625)	1493(450)	(3500)	69			1500 (500)
Salem West	Besset WRP	P																	65			
Salem West	*CTGR Complex*	T						300	455						1847				1200		200 (995)	
Salem West	Dallas South	P	388	271	155	p	125	p								125			11			
Salem West	*Dhooghe WRP*	P																	30	(1000)	(794) (20lb seed)	1030
Salem West	Dyck Road	P		200	p	p	p	p								8			12			
Salem West	Fairdale Complex & Conchy	P		39	45	4533	p	p								100s	10s		25			

Recovery Zone	Site Name	Owner	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011
Salem West	Fall City	P														2400			3000			
Salem West	Fern Creek	P														25						
Salem West	Gahr Farm	P														2500+			3000			
Salem West	Goings	P																		40		
Salem West	Guthrie Park	S																	30			
Salem West	HWY 18	S		217	p	p	p	p									600				250	
Salem West	*HWY 22*	S	58	58	p	p	p	p											69 (2000)			
Salem West	Hwy 22 (MP 11.8-12)	S																	18			
Salem West	HWY 47	S				6	6	6								0			6			
Salem West	HWY 99W	S	58	p	p	p	p	p									21		30			
Salem West	Jebousek WRP	P															25					30
Salem West	Loop WRP (Spring Valley WRP)	P															U				2	(12 lb seed)
Salem West	McTimmonds Valley	S/P	1333	p	p	969	969	700								100+			200	221		
Salem West	Meyers Road	F														16			20			
Salem West	*Mud Slough WRP and Mitigation Bank*	P															2000		2000		2000 (2794) (50lb seed)	
Salem West	Rickreall 1	S																		47		
Salem West	Salt Creek (Hwy 22)	U														2			2			
Salem West	Van Well Road	S/Co./P	134	p	p	p	p	p								40-50				27		
Salem West	Wifong WRP	P															120		0	3		
Salem West	Zuger	P																	40			
SW Washington	Coal Creek	P		111												p	275					
SW Washington	Halfway Creek	P					60			13					70		88		p	p		
X- Coast Range	Nestucca River	Ci./P		2	2	3	5	5								0						
X- Corvallis West	Ashbrook School	P														16			0			
X- Corvallis West	OSU Turkey Farm	S		1784												0			0			
X- Portland	Folsom Road	P														0						
X- Salem East	Fletcher Road	P	33											32		0						
X- Salem East	Walker Road	U	54	p	p	p	p	27	0													
X- Salem West	Fir Villa Road/ Kulus	P													51				0			
X- Salem West	Mill Creek Industrial Park	Ci./P														0						
X- Salem West	Panther Creek	Co./P		22	p	p	p	p								0			0			
X- Salem West	Reservoir Road	P	1	1		1	1	1								0						

Recovery Zone	Site Name	Owner	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011
X- Salem West	Salt Creek (Church Road)	P	266	p	p	p	p	p											0			
X-Unknown	Lakeside	S	248	232		222	1994-5: all plants moved to Second Growth/Barney Reservoir															
I- Corvallis West	**Marys River Natural Park WRP**	Ci.																			(2500) (30 lb seed)	(2000)
I- Corvallis West	**Winter Creek WRP**	P																			(2000) (20lb seed)	
I- Corvallis West	**Corvallis Home Depot**	P																			(250)	
I- Portland	**Atkinsen Middle School**	Ci.																				(8)
I- Portland	**City of Portland**	Ci.																				(75)
I- Portland	**OMSI**	P																				(10)
I- Portland	**Oregon Zoo**	Co.																				(120)
I- Portland	**Portland Metro**	Co.																				(1200)
I- Portland	**Stub Stewart State Park**	S																				(185)
I- Portland	**Tualatin Hills Parks and Rec.**	Co.																			(360)	
I- Portland	**Tualatin NWR**	F																			(200)	
I- Portland	**Wetlands Conservancy**	P																			(500)	(300)
I- Salem West	**Ankeny NWR**	F																	(2650)			
I- Salem West	**Deer Creek County Park**	Co.																				(1397)
I- Salem West	**Fort Hill**	S																				(2000) (25 lb seed)
I- Salem West	**Joe Day Creek**	P													(2000)							
I- Salem West	**Johansen WRP**	P														(100)			80			
I- Salem West	**Meadow Lake**	Ci.		(631)												361						
I- Salem West	**Morris WRP**	P															(100)		70			
I- Salem West	**Rassmussen CREP**	P											(100)									
I- Salem West	**Sheldon Holt WRP**	P																			(2000) (30lb seed)	
I- SW Washington	**Ridgefield NWR**	F																(2506)		2062	1896	2415
I- SW Washington	**Stiegerwald Lake NWR**	F																				(575)

APPENDIX B- Map of current Nelson's checker-mallow locations (including introductions).