

Executive Summary, Research Readiness Level Assessment, and Technology Transfer

Establishment of Wildflower Islands to Enhance Roadside Health and Aesthetics – Phase I and Phase II

Research Benefits

- Assessed seeding methods on wildflower establishment.
- Assessed attractiveness of wildflower mixtures on bee pollinators; and
- Assessed impact of wildflower islands on bee health and establishment.
- Refine seeding methods, improve maintenance practices, and change seeding mixtures to replace poor-performing species.
- Determine which mixes and seeding methods provide the most favorable insects.

Phase I Objectives

1. Determined how establishment of wildflower islands impact cover and density of wildflowers and associated floral resources, and plant species composition and diversity of roadside grasslands.
2. Evaluated the attractiveness of newly established wildflower mixtures to wild and managed bees by monitoring bee visitations, identifying plant-pollinator interactions, and assessing the diversity and abundance of wildflowers present in bee-collected pollen; and
3. Assessed potential impacts of newly established wildflowers on bee health as well as establishment of wild bee communities before and after wildflower planting.

Phase II Objectives

1. Continue to assess the plant community within wildflower islands from phase I to determine the role of island or patch size on longevity of wildflower plots;
2. On newly-seeded roadsides, we will repeat wildflower establishment in varying island sizes or strips (i.e., drill passes) but reduce the number of wildflower species in the seed mixture and introduce mowing regimes to better manage volunteer weeds and assess plant community responses to mowing;
3. Assess attractiveness of wildflower mixtures on pollinators and other beneficial insects from Phase I and Phase II sites to evaluate the ecological impact of wildflower plots.

Background

Wildflowers are crucial in the ecological function of the low-input roadside plant communities in terms of water and nutrient cycling, nutrient inputs such as nitrogen, total plant canopy cover, stand longevity, and provision of habitat for numerous small animals. Further, wildflowers provide critical foraging and nesting resources for birds, insects, and other wildlife. Unfortunately, habitat loss from agricultural and urban development has led to rapid population declines in wild bees and other pollinators across the US, thereby jeopardizing not only food production but also the sustainability of our natural landscapes (Kearns & Inouye, 1997). One way to mitigate wild bee decline is to establish more habitat corridors on public rights-of-way, such as roadsides. Planting pollinator-friendly native wildflowers on roadsides provides nutrient-rich forage and nesting resources for bees and is aesthetically pleasing. With 97,256 miles of public roadways in Nebraska (~4 million miles of roadways in the United States), roadsides play ever increasing roles in sustaining biodiversity within our state and beyond. In phase II, we will continue to monitor wildflower establishment and pollinator use at phase I sites as well as establish new plots with improved seeding mixtures and mowing treatments aimed at reducing growth of volunteer weeds. Results from phase I indicate that wildflower segregation in strips or islands may be a cost-effective method of improving wildflower establishment and persistence in diverse roadside mixtures. However, competition from volunteer weedy species was extremely high and likely due to their generally high density in the seedbank of topsoil used during planting. The continued monitoring of Phase I sites may provide further insight as to whether these absent species truly do not establish well on roadsides or were simply not observed in their initial growth stages.

Phase I Conclusion

Conventional roadside seeding methods yielded plots with lower abundance and richness of forbs and bees compared to plots seeded with wildflowers only (treatments 100, 50, 25x2) but only in the first year of establishment. Bee richness was highest in the late season, while forb abundance and richness were highest in the mid-season. No differences were observed across differently sized wildflower-only patches likely because of the recent establishment of plots. In fact, only ~50% of seeded forbs had established and roughly 14 plants out of the 40 species in the seed mixture did not establish in either survey years and may therefore be replaced in future seed mixtures. Our results indicate that wildflower segregation in strips or islands may be a cost-effective method of improving wildflower establishment and persistence in diverse roadside mixtures. As plots mature and become vulnerable to weed encroachment, the effect of patch size may become more distinguished across treatment groups, therefore, further monitoring and research may be necessary to further address issues with low establishment and highly competitive pressure from volunteer species. These data contribute to NDOT's ongoing pursuit to more effectively establish wildflowers on roadsides and to better understand that role floral enhancements have on supporting and sustaining vulnerable wildlife, such as our pollinator communities.

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Interested in finding out more?

Phase I Final Report Available:
[HERE](#)

Phase II Final Report Available:
[HERE](#)

Principal Investigator

John Guretzky (Phase II P.I.)

Walter Schacht (Phase I P.I.)

Judy Wu-Smart (Phase I / II Co P.I.)

Tom Weissing (Phase II Co P.I.)

University of Nebraska

NDOT Lead TAC Members

Ronald Poe, PE, Environmental Supervisor

Phase II Conclusion

Roadsides play an ever-increasing role in sustaining biodiversity. In 2020, we launched a project on backslopes along Highways 2 and 77 evaluating seeding and mowing treatments to enhance beneficial forbs including milkweed (*Asclepias* spp.) species. Analyses showed that seeding increased forb diversity, total forb cover, and floristic quality. However, mowing effects were less clear. Forb cover was higher on plots that were mowed in October 2020 before seeding, but effects of pre-mowing varied with site. The combination of pre-mowing and seeding was most effective at increasing floristic quality of the Highway 2 site. However, mowing after seeding in early July did not improve forb establishment. Accumulation of dead plant matter on the soil surface (i.e., litter) appeared to have a strong impact on forb density in the first year of the study. This research provides information on the limitations and opportunities in planting native wildflower seed into roadsides with previously established vegetation. Insight from this report will help guide recommendations and future research on the best management practices for Nebraska roadsides.

Phase I NDOT Recommendations Based Off Research Project – 2019

As NDOT moves into Phase II of this research topic, the study's findings will be used in shaping the next wildflower and pollinator trials. Phase II -Establishment of Wildflower Islands to Enhance Roadside Health, Ecological Value, and Aesthetics research project began in July 2020 and expected completion date of May 2022.

- *As provided by Carol Wienhold, Lead TAC Member*

Phase II NDOT Recommendations Based Off of Research Project – 2025

This research provides information on the limitations and opportunities of planting native wildflower seed into roadsides with previously established vegetation. The NDOT will use this information to re-evaluate its seed mixtures to promote greater growth and variety for Nebraska's wildflowers, which benefits pollinators. Nebraska's wildflowers are crucial in the ecological function of the roadside plant communities in terms of water and nutrient cycling, nutrient inputs such as nitrogen, total plant canopy cover, stand longevity, and provision of habitat for numerous small animals. Roadside seed mixtures are planted during highway construction projects. Mixtures that are planted away from highway shoulders are comprised of approximately 10-20% native wildflower seed, by weight. This research provides guidance to support activities to re-evaluate and enhance roadside seed mixtures. An enhanced wildflower mix would have year-round wildflower seeding types, ensuring pollinators have access to wildflowers during crucial migration seasons. Species planted are suited to the region of Nebraska in which the construction project occurs and may serve as food and habitat for pollinators. Guidance provided by this research will be part of the NDOT's toolbox to develop action plans and policies to support pollinator life cycles and develop potential habitats for their populations. Based on information included in this research, NDOT programmatic documents have been revised to recommend mowing dates and frequencies that minimize interference with pollinator life cycles and foraging needs.

- *As provided by Ronald Poe, Lead TAC Member*

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Research Readiness Level (RRL) Assessment

Level 5: Standard Practice / Fully Understood

Research adopted; no evaluation is required.

Phase I-Moved from Level 3: Development/Field-Level

RRL 5



[NDOT Roadside Vegetation Establishment and Management](#)

This brief summarizes Project SPR-P1(20) M058 and SPR-FY21(011):

“Establishment of Wildflower Islands to Enhance Roadside Health and Aesthetics – Phase I”

“Establishment of Wildflower Islands to Enhance Roadside Health, Ecological Value, and Aesthetics – Phase II”

Nebraska Department of Transportation Research Program