Vegetation Management Practices to Increase and Enhance Roadside Pollinator and Wildlife Habitat: Literature Search
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Resources searched: Transport Database, MnDOT Library Catalog, TRB Research in Progress, Google

Summary: Results are compiled from the databases named above. Links are provided for full-text, if applicable, or to the full record citation. The results at the top specifically address monarch, butterfly, and pollinator species. The other results address seeding and roadside vegetation management and its effects on other wildlife as well as maintenance.

Most Relevant Results
Title: Roadside as Habitat for Pollinators: Management to Support Bees and Butterflies.
Author: Hopwood Jennifer L
Abstract: Pollination of flowering plants is an essential ecosystem service. It is estimated that 85% of flowering plants worldwide and 35% of global crop production rely on animals for pollination. Pollinators such as bees, flies, wasps, beetles, moths, and butterflies play multiple roles in food webs in addition to facilitating the reproduction of flowering plants. Fruits and seeds, the product of pollination, are an important part of the diet of many birds and mammals, and pollinators are a direct food source for other wildlife such as songbirds and even grizzly bears as well. However, research indicates that some managed and wild pollinators are in decline. Threats to pollinators affect not only pollinators themselves but also the stability of natural ecosystems and agricultural productivity. Roadsides are known to have value as habitat for plants, as well as birds, small mammals, amphibians, reptiles, ants and beetles. Roadsides can also be a refuge for pollinators, especially in landscapes substantially altered by urbanization or agriculture. Often the only semi-natural areas remaining in heavily altered landscapes, marginal habitats like roadsides can provide pollinators with places to forage for food and to nest. Pollinator habitat must include blooming flowers, which supply pollinators with protein-rich pollen and energy-providing nectar. Pollinators also require a place to nest or to lay their eggs. Butterflies and moths generally lay their eggs on or next to the host plant upon which their vegetation-eating caterpillars will feed. In contrast, bees create nests in which they leave food for their young. Many bee species dig subterranean nests in their preferred soil type, while other species nest above ground in plant stems or cavities in dead wood. Bumble bees nest within insulated cavities, under clumps of grass or in old rodent burrows. Studies demonstrate that roadsides planted with native plants support more butterflies and bees than do roadsides dominated by non-native grasses and flowers. With millions of acres of land in roadsides, managing roadsides with pollinators in mind could have a significant impact on pollinator conservation. New roadside plantings should include a diversity of native wildflowers with overlapping bloom times, to provide for pollinators throughout the growing season, including key host plants for butterflies. For example, monarch butterflies, renowned for their impressive long-distance seasonal migration, rely on milkweed species only as host plants. Monarch populations have been declining over the last fifteen years, and reduced numbers of milkweeds across the butterfly's breeding range, particularly within agricultural fields, are likely contributing to their decline. Planting milkweeds along roadsides can restore monarch breeding habitat, including along migration routes. Roadsides can be of great benefit to pollinators. Best management practices include consideration of timing and frequency of mowing, spot spraying rather than broadcast use of herbicides, and surveys to identify existing roadside habitat that provides native plant resources for wildlife. Roadside managers can develop a management strategy that addresses safety concerns while also benefiting wildlife such as pollinators.
Title: Survey of Key Monarch Habitat Areas Along Roadways in Central and North Florida.
http://rip.trb.org/view/1377839
Abstract: The Florida Department of Transportation in collaboration with the Florida Museum of Natural History's McGuire Center for Lepidoptera and Biodiversity at the University of Florida propose to enhance roadside management of pinewoods milkweed along Florida roadways in central and north Florida - specifically Osceolla County north to the Florida-Georgia line and west to Jackson County. Specific objectives include: (1) Identification of key milkweed populations and plant densities for Asclepias humistrata (primary focus), A. tuberosa (secondary focus) along select state and county roads within the survey area, including re-evaluation of previously surveyed areas; (2) inclusion of data in a georeferenced database with identification of high density hotspots; (3) survey of select hotspot areas for successful pod (seed) production; and (4) Following identification of hotspot areas, the project will work to develop new Florida Department of Transportation (FDOT) vegetative management practice recommendations to maximize the quality and availability of pinewoods milkweeds to support early season monarch breeding. The resulting pinewoods milkweed population "hotspots" could additionally be managed to help generate local ecotype seed production for other key habitat restoration or augmentation projects in the future.

Title: Evaluating Integrated Roadside Vegetation Management (IRVM) Techniques to Improve Pollinator Habitat.
http://rip.trb.org/view/1440192
Abstract: The State Highway Agency (SHA) is working to develop performance measures that comply with the June 2014 Presidential Memorandum – Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators. This is a proposed 2-year pilot study to establish and manage roadside meadows, and compare such meadows with intensively mowed and current/proposed Integrated Roadside Vegetation Management (IRVM) strategies.

The research will measure the effects of the various vegetation management strategies on the abundance and diversity of pollinator communities, and evaluate pollinator nesting and foraging opportunities under these strategies. Pollinator Best Management Practices will be developed and pollinator-friendly, affordable seed mixes, with a focus on native plants, will be identified.

Title: Establishment of Wildflower Islands to Enhance Roadsides for Pollinators Health and Aesthetics.
http://rip.trb.org/view/1410524
Abstract: Recently, a Presidential Memorandum was released and highlights an overarching strategy goal to restore and enhance pollinator habitat acreage through federal actions and public/private partnerships. Seeded grasslands with a high density of wildflowers on roadsides have excellent potential for providing songbird and pollinator habitat.

Wildflowers are particularly critical in providing habitat for grassland songbirds and pollinators (e.g., bees and butterflies), both of which have experienced massive declines in numbers over the last decade or more. Wildflowers are particularly important to pollinators in spring and early summer, before other food sources are available.

Effective habitat restoration must be appropriate for the desired pollinator species, affordable to establish in the short term, and self-sustaining in the long-term (Black et al. 2011). Because roadsides offer continuous swaths of vegetation, testing establishment of wildflower refuges or 2 islands in this context holds great opportunity for providing pollinator habitat. This research will evaluate whether establishment of wildflower islands on roadsides will provide better stands of wildflowers, more plant diversity, improved bee health, and greater abundance and diversity of native bee pollinators compared to roadsides where wildflowers are seeded conventionally with grasses across the entire area. The problem with the latter or conventional approach to seeding is that wildflowers may become established, but don't persist in extensively managed roadsides and it is expensive for Nebraska Department of Roads (NDOR) to seed wildflowers across entire roadsides. Establishment and management of wildflowers in islands/refuges will reduce seed costs and is hypothesized to provide better establishment and persistence of wildflower populations.
Title: Evaluating the Use of Highway Corridors by Monarch Butterflies.
http://rip.trb.org/view/1407188

Abstract: In response to the decline of critical pollinators, including butterflies, a presidential memorandum entitled, “Creating a Federal Strategy to Promote the Health of Honey Bees and other Pollinators,” established the Pollinator Health Task Force. The U.S. Department of Transportation is a member of this task force and is tasked with evaluating its current guidance and identifying opportunities for establishing pollinator habitat and promoting pollinator friendly practices in transportation corridors.

The monarch butterfly is found throughout the lower 48 states, Hawaii, southern Canada, and northern South America. Because of its large bright orange and black-patterned wings and its migration path spanning much of the northwestern hemisphere, its decline has been more noticeable than most other pollinators. This butterfly has experienced a 59 percent decline, based on observations when they are concentrated in overwintering grounds. Reasons for its decline: habitat and food source loss; invasive plant species that outcompete milkweed; species both native and introduced that mimic milkweed and fool the butterfly into laying eggs where the milkweed required for the larval stage does not exist; pesticide use; and illegal logging in its very limited overwintering grounds. Milkweeds, which provide food for the larval stage, are often considered “weeds” in need of eradication in agricultural settings.

Research is needed to expand on the existing body of knowledge around roadside pollinator habitat to provide a better understanding of the relationship between long-term maintenance and roadside management activities. In particular, the information will assist in evaluating potential tradeoffs between providing monarch butterfly habitat and safety concerns relative to changes in maintenance practices to maintain the habitat.

The objectives of the research are to (1) provide objective answers as to whether planting native species, including the milkweeds preferred by the larval stage of the butterfly and nectar producing plants for the adult stage, along roadways contributes to sustainable or increased populations; (2) produce implementation guidelines on the minimal area of plantings needed to create effective habitat enhancement for the monarch butterfly, as well as location of plantings in the roadside topography, and whether planting too close to the roadway may increase butterfly mortality through strikes by vehicles or mowing plants when larvae are present in clear zones; and (3) provide information to state departments of transportation about the impacts of transportation on and benefits and drawbacks of planting milkweed and nectar providing plantings for the butterfly.

Title: Evaluating the Suitability of Roadway Corridors for Use by Monarch Butterflies.
http://rip.trb.org/view/1459512

Abstract: In response to the decline of critical pollinators, including butterflies, a presidential memorandum entitled, “Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators,” established the Pollinator Health Task Force, of which the U.S. Department of Transportation is a member. The monarch butterfly is found throughout the lower 48 states, Hawaii, southern Canada, and northern South America. Because of its large bright orange and black-patterned wings and its migration path spanning much of the northwestern hemisphere, its decline has been more noticeable than most other pollinators. This butterfly has experienced a precipitous population decline. Thus, it is under review by the U.S. Fish and Wildlife Service for listing as a threatened species (a decision is anticipated by June 30, 2019). The reasons for its decline listed in scientific and popular science literature include: habitat and food source loss, invasive plant species that outcompete milkweed, pesticide use, and illegal logging in its very limited overwintering grounds. There is a need to study the relationship between roadside habitat and the various life stages of monarch butterflies as one of the proactive conservation strategies for the species.

The objective of this research is to develop and validate a methodology for transportation practitioners to determine if roadway corridors are sources or sinks (beneficial or detrimental) to the monarch butterfly and how to maximize the beneficial aspects and minimize the detrimental impacts. The methodology should address a broad range of variables related to the project objective such as, but not limited to, the following: (1) Accounting for the differences and similarities between the eastern and western monarch butterfly populations, and migratory and non-migratory populations; (2) Analyzing mortality rates related to roadsides; (3)
Considering traffic volume, speed, right-of-way width, and roadway width; (4) Assigning functional values for different roadside vegetation types; (5) Evaluating the effects of adjacent land use and habitat; (6) Considering roadway right-of-way maintenance practices (e.g., mowing, salt, burning, timing, pesticides); and (7) Considering environmental variables (e.g., climate, precipitation, elevation and aspect).

While the methodology should be directly applicable to most situations, it should also outline decision-making processes and criteria that would assist transportation practitioners in identifying flexible solutions. Ultimately, the methodology should allow users to select and prioritize the most advantageous locations for butterfly habitat enhancement on a landscape scale (i.e., how large do habitat patches need to be and are there considerations of the amount of habitat adjacent to the roadways that would make selections of particular roadside locations more beneficial than others?).

Title: Integrating Roadside Vegetation and Erosion Control.
Author: Kuennen Tom
Citation: Better Roads. 2013/3. 83(3) pp 25-33(Figs., Photos.)
Abstract: Vegetation management is an important part of integrated roadside management programs. Vegetation control helps highway safety. If left unchecked, weeds and other plants can overrun signage and damage infrastructure. Proper care of roadside vegetation can protect and encourage wildlife and enhance the aesthetic qualities of the highway. A number of states have introduced vegetation management into their integrated roadside management programs. In Washington state, the unwanted vegetation is eliminated and desirable is cultivated. The prevention of weed overgrowth and regularly monitoring conditions are essential parts of the program. It is hoped that with proper management, the roadside vegetation will eventually become self-sustaining. Massachusetts' vegetation management plan provides a safe, unobstructed roadway. The plan has identified priorities for vegetation control and implemented them. Nebraska's plan is focused on encouraging natives plants for a sustainable roadside. The plan includes information about regional ecosystems across the state, for each type of landscape. Iowa's vegetation management program, which was established in 1988, focuses on improving vegetation with the goal of sustainability. Minnesota is developing an integrated plan that includes management of roadways for the benefit of wildlife. In addition to the control of vegetation, drainage is an important part of roadside management. Poor drainage systems can cause the deterioration of pavement and other parts of roadway infrastructure.


Title: Where the Forest Meets the Roadside: Why State Departments of Transportation Manage for Grassland Communities.
Author: Harper Lore Bonnie L
Abstract: Through a sampling of State highway maintenance practices, this paper explores how over 10 million acres of State highway rights-of-way can be converted to conservation acres. States plant and preserve native grasses and forbs, and hold back forest succession to create clear zones for the safety of highway users. This paper explains the clear zone's importance to the traveling public's safety and the evolution of policy towards the use of native plants, specifically grasslands, in clear zones. Incorporating grassland management to those rights-of-way, can result in additional conservation acres and safe travel

Title: Roadsides and Vegetation.
Author: Forman Richard T T
Abstract: A huge area, equal to 100,000 football fields in every state of the U. S., is devoted to roadsides. Most travelers see nothing there...a boring void. Yet looking closely reveals a set of plants different from those in adjacent land. Vegetation zonation across the roadside, together with patches scattered over it, is conspicuous. And like a movie film, the sequence of vegetation along the road often changes markedly.
Despite these distinctive patterns, ecologists see more problems than benefits. Indeed, roadsides represent an enormous opportunity for new thinking and approaches by the transportation community, science and society. Road construction normally is a process of moving, homogenizing, molding and smoothing earth to produce a safe, efficient and hydrologically stable road. Roadsides begin without their inherent natural heterogeneity. Soil, vegetation, and animal communities thus become relatively monotonous and impoverished. The earth forms...including road shoulder, ditch, outer road, cutbank and fillslope...are somewhat novel habitats in the landscape, especially with traffic effects superimposed on them. Soil erosion and its control mechanisms are a major issue, and establishing natural plant communities on roadsides remains a challenge. At least two dozen chemical constituents of pollutants emanate from road systems and probably have significant ecological effects (FHWA 1996). Four-fifths of the chemicals come from vehicles, with a wide variety of sources: oil, grease, hydraulic fluids, engine and parts wear, metal plating and rust, tire wear, brake lining wear, and fuel and exhaust. Non-vehicular sources include sanding and de-icing agents, roadbed and road surface wear, and herbicide and pesticide use. Pollutant levels in road runoff often correlate poorly with traffic volume, though several pollutants seem to correlate with traffic volume during storms. With a high diversity of pollutants and sources, mitigation or best-management-practice solutions for pollutants in road runoff are difficult. The total diversity of roadside plants along a road tends to be quite high, largely because of the many non-native species added (Harper-Lore 1999). In contrast, plant diversity is often low at a specific spot or site. The spread of non-natives along roads is favored by ditching, road salt, vehicle transport, vehicle-caused wind, and habitat homogenization in road construction. Native rare species are present in roadsides though little studied. Rock outcrops, bridges, culverts, other concrete structures (with calcareous conditions), and blocked drainage spots may provide microhabitats for rare species. In intensively altered landscapes such as for agriculture, roadsides may harbor some of the rare species and natural communities remaining, and thus be of considerable conservation interest. Although roadsides often contain numerous non-native species, and non-natives invade ranchland, cultivated land, parkland and natural areas, little is known about how important roadsides are in these invasions. Road-shoulder vegetation subject to vehicle disturbance, numerous pollutants and road maintenance differs sharply from ditch vegetation with much more water and sediments. Ditch vegetation differs in turn from the outer-roadside plant community with usually well-drained soil, less vehicular and maintenance disturbance, and more intense influence of adjacent land. Disturbance-induced early successional stages may be of conservation importance in areas of mature vegetation. Roadside natural strips (road reserves) in intensive agricultural landscapes of Australia are an impressive example of protecting relatively natural communities along roads. Creating roadsides as a mosaic strip, e.g., of successional communities, rare-species habitats, shrubland, savanna and forest for carbon sequestration and/or wood products, could contribute to many of society's goals. Maintenance, mowing and management occur in countless combinations, with highly diverse ecological effects (Aanen et al. 1991). For instance, vegetation can be mowed at different times and different frequencies, as well as in alternating strips of varying size, located either along the road or laterally across the roadside. Wildflower patches may be planted, tree saplings maintained or removed, wildlife encouraged or discouraged, wet spots protected or drained, and so forth. In effect, the nature of roadsides is strongly determined by road managers and workers. The ecology of visual quality is especially important in the many miles of roadsides along which the average American spends several hours a week. In the U. S. the perception of high-visual-quality roadsides has gradually changed from neatness to an increasing emphasis on beautification, followed by ecological conditions, and more recently cultural dimensions including a sense of place. The consequent ecological changes in roadsides are equally diverse. Ecological characteristics such as biodiversity, wildlife movement, vegetation type, erosion, water flows and water quality of high-visual-quality roadsides usually differs sharply from those of low-visual-quality roadsides. In conclusion, the huge area devoted to roadsides offers few ecological benefits, but with new approaches, nature's heterogeneity and richness could be reestablished, and roadsides could provide many resources and uses to society. Chemical pollutants from road systems are highly diverse, suggesting the absence of a "magic bullet" and the need for diverse solutions. The abundance of rare species in roadsides and the roles of non-native species remain little known. Finally, maintenance, mowing and management offer an enormous opportunity to enhance both roadsides and the landscapes surrounding us.
Title: The Establishment Success of Native Versus Non-Native Herbaceous Seed Mixes on a Revegetated Roadside in Central Texas.
Author: Tinsley M Jeannine; Simmons Mark T; Windhager Steve
Abstract: Revegetation is an essential component of roadside and building site construction and improvement. In the southern United States non-native grass species are frequently included in revegetation seed mixes used by highway authorities. Non-native species are frequently selected for aggressive growth characteristics, however these same traits also render them potentially invasive, and subsequently hazardous to, adjacent plant communities. Although the use of pure native seed mixes have been rejected in the past due to perceived inferior establishment characteristics, there have been few comparative quantitative field studies that justify this belief. The establishment characteristics of three seed mixes: one containing non-native species and two with native grass and forb species only, were compared in a randomized-block design along a Texas roadside following spring and summer sowing. After 60 days following the spring sowing, the two native-only seed mixes demonstrated 180% and 560% (F=10.18; P<0.0001) higher seed densities than the recommended native/non-native mix. The summer sowing results were similar with seedling densities 180% and 330% (F=9.20; P<0.01) greater than the standard non-native seeding. Although an aggressive colonizer from vegetative tissue such as stolons and rhizomes, the non-native Bermudagrass (Cynodon dactylon) has a lower than expected establishment rate thought to be due to high water demand during the first weeks following sowing. Given the invasive characteristics of this common component of many recommended revegetation seed mixes, these results call into question the widespread recommended use of Bermudagrass for such projects. These data indicate that examination of suites of early- and late-succesional native species can provide a highly effective mix for revegetation projects. Furthermore, this reduces the potential for negative ecological consequences and provides added benefits associated with wholly native plant communities.

Title: Freeways as Corridors for Plant Dispersal: A Case Study from Central Arizona.
Author: Gade Kristin J
Abstract: General ecological thought pertaining to plant biology, conservation, and urban areas has rested on two potentially contradictory underlying assumptions. The first is that non-native plants can spread easily from human developments to "pristine" areas. The second is that native plants cannot disperse through developed area. Both assume anthropogenic changes to ecosystems create conditions that favor non-native plants and hinder native species. However, it is just as likely that conditions in developed habitats will favor certain groups of plant species with similar functional traits, whether native or not. The function of corridors as conduit for plant movement has long been suggested, but the actual mechanisms at work in the process have only recently begun to be studied. Functional traits of species determine which are the most successful at each of the stages of invasion or range enlargement. The author studied the traits that allow both native and non-native plant species to disperse into freeway corridors, germinate, establish, reproduce, and then disperse along those corridors in Phoenix, Arizona. Sampling sites were selected along freeways throughout the Phoenix metro area, on both gravel-landscaped and non-landscaped road verges. Field methods included measurements of soil nitrogen content, seed bank sample collection and germination, vegetation surveys, and seed trapping. Some uncommon native species were found on the roadsides. More seeds were trapped at the gravel-landscaped sites, which also had greater average daily traffic loads than the non-landscaped sites. The seed bank study showed the opposite pattern, with higher numbers of seeds germinating in the samples from the non-landscaped sites. The majority of the seeds trapped in developed...
areas had adaptations for wind dispersal; the proportion was much smaller at the desert sites. Near the urbanized area there was little evidence of use of the freeway verges by birds or other animals. Currently, plants with weedy traits are the most likely to move along highways in the Arizona desert. The seed trapping data show that wind plays a large role in seed dispersal along the highways in developed areas. While both landscape design and maintenance choices play a large role in determining the initial roadside conditions and species assemblage, it appears that ongoing maintenance regimes and dry nitrogen deposition influence species composition and distribution along highways over the long term. This study adapted methods to gain insight into the functional traits of plants that are able to survive and potentially migrate along highways. Studying roadside plants using a functional trait approach will allow road ecologists to move toward assessing the ecological roles of design and maintenance practices. Eventually, it may be possible to manipulate design and maintenance processes to achieve goals in preventing or promoting migration of different groups of plants along roadways. This could result in benefits ranging from decreasing maintenance costs, to more effectively managing invasive species, and potentially to integrating larger ecological goals, such as promoting migration of species under changing climate conditions, into transportation system planning and maintenance.

Title: Not Just a Pretty Face: Roadside Vegetation Plays Practical, Safety and Economic Roles.
Author: Barbaccia Tina Grady
Citation: Better Roads. 2009/5. 79(5) pp 8-10, 12, 14(3 Phots.)
Abstract: This article describes a novel roadside vegetation management program that saves money, reduces maintenance, reduces carbon emissions, and returns unused areas of right-of-ways to the way they looked a few hundred years ago. The project, known as the Hoosier Roadside Heritage Program and undertaken by the Indiana Department of Transportation and a private group called Save the Dunes, involves planting wildflower seeds native to the area along U.S. 12. Not only does it restore natural habitat, but it cuts down on mowing costs. The article describes how the project was managed, what worked and what didn't. It notes that the Indiana DOT's LaPorte County grows its own seeds for the flowers it plants along the road at three seed sites. The article also describes a similar partnership between the Mississippi Department of Transportation and the Mississippi State University.

Title: INTEGRATED ROADSIDE VEGETATION: POLICIES FOR PLANTING AND MANAGEMENT (STUDY RECOMMENDATION).
Author: Summary Report prepared by the Alternative Roadside Vegetation Steering Committee, authorized by the Iowa Legislature.
Abstract: The Alternative Roadside Vegetation Steering Committee was established by the Iowa Legislature to study and make recommendations and roadside management policies and laws. The Legislature's purpose was to preserve and enhance the biology, environment, and stability of the roadsides, the safety of the motorists, and to preserve and enhance the aesthetic features of the roadsides, in a cost effective manner. Part of their definition of roadside vegetation management notes that, for the general public welfare, vegetation for Iowa's roadsides is preserved, planted and maintained to be safe, visually interesting, ecologically integrated and useful for many purposes. This report presents a summary of the study recommendations.

Title: BETTER LOOKING ROADSIDES.
Citation: Better Roads. 1973/6. 43(6) p. 16-7
Abstract: THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION LANDSCAPE MANAGEMENT TEAM HAS MOVED IN SEVEN MAJOR AREAS TO IMPROVE OPERATIONAL CONTROL OF ITS ROADSIDES. THESE AREAS ARE: (1) USE OF CROWNVETCH HAS CUT MOWING COSTS, REQUIRES LITTLE MAINTENANCE, AND IS VALUABLE IN EROSION CONTROL; (2) USE OF HERBICIDES; (3) USE OF A BASAL SPRAY PROGRAM; (4) SELECTIVE MOWING; (5) CONSIDERATION OF ALL LANDSCAPE DETAILS IN THE HIGHWAY PLANNING PROCESS; (6) USE OF UREA FORM FERTILIZER; AND (7)
DEMONSTRATION PROJECTS TO CONVINCE THE PUBLIC OF THE VALUE OF THE USE OF THE LATEST TOOLS INCLUDING HERBICIDES.

Title: WSDOT Highway Maintenance: Environmental Compliance for Protected Terrestrial Species.
Author: O’Brien Tracie; Carey Marion; Forrester Bret
Abstract: Protected plant and wildlife species that grow, forage, nest, roost, or migrate near the Washington State Department of Transportation (WSDOT) highway system may be susceptible to impacts from routine maintenance activities. In response to community-driven concerns related to the conservation of protected terrestrial species and due to the lack of existing guidance for maintenance personnel when protected-species conflicts arose, WSDOT biologists and maintenance personnel worked together to develop new guidance. The purpose of the guidance is to provide maintenance personnel with resources that identify which projects occur in sensitive plant and wildlife areas and identify best management practices (BMPs) that can be implemented to minimize or avoid impacts to protected terrestrial species in Washington State. Existing sensitive-species data and aerial photographs were used to identify locations of sensitive species and habitats and to develop guidance. To verify habitat presence, biologists conducted site visits to areas identified as possible sensitive habitats. The guidance document is in the form of a field handbook presented in a step-by-step format to facilitate use by WSDOT maintenance personnel. The guidance document provides maps and descriptions of sensitive areas, each identified by state route and milepost. Species information, such as species name, nest sites, wintering sites, or locations of sensitive habitats, are not identified in the guidance document. Alternatively, biologists placed the species into groups based on habitat needs and identified only the state-route mileposts that fall within each sensitive area. This process helped WSDOT prevent publicizing sensitive wildlife data in the guidance documents and avoided the need for evaluation of habitat by maintenance personnel. Common maintenance functions were also broken down into groups. For each sensitive location and maintenance function group, a list of BMPs is provided. BMPs may include timing restrictions, equipment use restrictions, or overall activities that should be avoided during certain seasons. The document does not address all possible conditions that may arise during maintenance operations that could affect protected terrestrial species. Maintenance staff consult with their Regional Maintenance Environmental Coordinator prior to initiating any activity that is not addressed by the guidance document or if there is any uncertainty about the applicability of the guidance. Maintenance activities that are not able to comply with the guidance typically require a field review by a biologist and the development of site-specific BMPs. Maintenance personnel do not follow this guidance for emergency actions because separate procedures were previously developed that adequately address protected species compliance for emergency maintenance actions. This project is currently being piloted with the Olympic Region Maintenance Program. Training courses conducted at individual maintenance sheds have provided opportunity for discussion and question and answer sessions. Biologists and maintenance personnel have had the opportunity to work together to learn each other’s programs, perspectives, and observations to improve the effectiveness of the environmental compliance guidance. The WSDOT Highway Maintenance Environmental Compliance Guidance for Protected Terrestrial Species Program has helped the Maintenance Program conduct their projects in a timely fashion without unnecessary delays and to remain good stewards of the environment.

Title: Best practices handbook for roadside vegetation management
Author: Johnson, Ann M. Contributing author, John D. Krenz ; edited by Fran Howard.
Call Number: Mn/DOT Library Main Collection - MNDOT TE178 .J64 2008

Title: Roadsides for wildlife [videorecording] : integrating wildlife in your roadside vegetation management
Author: Minnesota Department of Transportation.
Call Number: Mn/DOT Library DVD TE177 .R625 2008
Title: Roadside Vegetation Management of Invasive Plants to Benefit Biodiversity and MDOT Management Programs.
http://rip.trb.org/view/1396107

Abstract: Non-native invasive plants readily colonize habitat edges such as transportation corridors where sunlight, soil disturbance, and competitive advantage provide prime conditions for establishment and spread by seed or rhizome. Along roadways, invasive plants create thick infestations that can be difficult to manage, are expensive and time consuming to eradicate or control, and can cause infrastructural damage and safety hazards for motorists, management crews. For example certain invasive plants can block road signs and site lines, encroach on travel lanes, clog drainages or culverts, increase risk of fire, and even push up through pavement (Perron 2008). Furthermore invasive plants degrade wildlife habitat, clog waterways, cause economic loss, impact agriculture, and alter ecosystem services such as pollination by outcompeting and displacing native plants. It has been estimated that invasive plants cause an estimated $120 billion/year in damage and economic losses in the U.S. (Pimental et al. 2004), and invasives are considered to be the second largest cause of biodiversity loss in the U.S.

Roadside vegetation management techniques such as mowing, cutting, and herbicides are regularly employed to control invasive plants, but baseline information on the species and abundance of native (non-invasive) plants on treatment sites is lacking. Furthermore restoration and revegetation of treated sites, both to prevent re-establishment of non-native plants and to control erosion, is costly, complicated and often yields disappointing results with available seed mixes, potentially facilitating the re-invasion of non-natives. The re-establishment of desirable species of native forbs and graminoids as a component of roadside vegetation management requires a better understanding of what native species are already present on a treated site (and could promote natural regeneration). Similarly the control and prevention of infestations of invasive species requires an understanding of the species, its habit (e.g aggressiveness), and a proactive approach that emphasizes identification, early detection, and appropriate management.

In addition while roadside vegetation management is already conducted with sensitivity towards environmental resources such as rare species, wetlands, aquatic resources, and wildlife, management techniques that favor the establishment of native plants can provide habitat suitable for pollinator species such as the Monarch butterfly – part of a suite of insects that have seen population declines due in part to the spread of invasive plants (Hopwood 2010).

Objectives are as follows: (1) Conduct landscape analysis to identify priority field survey areas, focusing on sections of the Maine Interstate that intersect with rare or exemplary wetland communities, and/or public lands and Priority 1 Corridors that intersect with Focus Areas of Statewide Ecological Significance; (2) Conduct Baseline Inventory for vegetation at selected sites, to identify and map native and non-native plants (Year 1 and 2); (3) Conduct Baseline inventory for pollinator species at a subset of surveyed sites, based on an established protocol (Year 2); (4) Create Management Recommendations for the control of invasive plants and revegetation with native species for selected sites; and (5) Incorporate knowledge about species invasiveness and threat to transportation corridors in to Management Recommendations.

Least Relevant Results

Title: The effects of mowing on roadside biodiversity (Niiton vaikutus tienpentareiden nittyelioistoon monimuotoisuuteen (NIINI)).
Author: SAARINEN,K; JANTUNEN,J; VALTONEN,A
Citation: TIEHALLINNON SELVITYYSKA, FINNRA REPORTS. 2006. 3200985(9/2006) pp46p(70 Refs.)