Creating the Business Case for Habitat

Potential Habitat Benefits and Business Case Opportunities

1. **Cost savings from changes in management practices**
    a. Reduced mowing reduces operational costs.
    Introduction: Mowing can be expensive because results do not last long, it must be repeated multiple times, it uses a lot of fuel, and uses a lot of labor. [26] Some roadsides and utility companies have reduced mowing frequencies in recent years to save money and/or promote wildlife habitat.

        - In an experiment, a cost savings of over 40% was achieved with one application of herbicide instead of one cycle of mowing along Indiana DOT roadsides. According to visual observations, one herbicide application reduced broadleaf weed presence in the year applied and the following two growing seasons. [13]
        - Mississippi DOT mows approximately 139,253 acres of roadsides four times per year at a cost of more than $250/acre, for a total of $35 million annually. Eliminating one mowing per year would save around $8.7 million and eliminating two mowings would save over $17 million. [10]
        - Along Delaware DOT roadsides, it costs $3,480 to maintain one acre of turf grass mowed eight times per year while one acre of meadow costs $435 per year to maintain if mowed annually and $870 per year if mowed biannually. [4]
        - Mowing cost the Florida DOT $13 million for FY 2011-2012. A conservative cost per acre for mowing was about $414, based on seven mowing cycles per year (Harrison 2014). From 2009-2011, FDOT tested the effects of reducing the frequency of clear zone mowing. [25] While the 10-foot safety strips adjacent to inside and outside lanes of pavement were mowed regularly, the rest of the clear zones were mowed only once in the fall. The reduced mowing schedule saves over $1,000 per mile per year without negatively impacting turf quality. The reduced mowing regime had no adverse impacts on erosion, safety, aesthetics or turf quality. The reduced mowing regime also enhanced overall roadside aesthetics because of an increase in blooming native wildflowers.

    b. Selective chemical use reduces operational costs.
    Introduction: Through selective chemical use such as herbicide application, there is potential for management cost savings.

        - Case study: In 2010, Oregon DOT issued internal directive to reduce herbicide use, with goal of reducing amount of active ingredient used by 25%. Roadside staff replaced outdated equipment with newer, more efficient equipment and spot sprayed problem weed areas. By 2015, Oregon DOT reported they have reduced the number of pounds of herbicide used by nearly 50% In most locations. [14]
        - The application of IRVM principles by Iowa counties led to 70-90% reductions in herbicide use compared to the $70,000-$80,000 spent per county for broadcast herbicide spray contracts in the 1980s. [30]

- Jones County, Iowa reduced cost spent on roadside herbicides from hiring a roadside manager in 2005. From 1999-2004, all broadleaves in the roadside were sprayed by contractors at a cost of $80,000-$100,000 a year. In 2005, the county switched to only spraying noxious weeds and in 2008-009 only spraying thistles, and a roadside manager oversaw the contractors. In 2015, all the spraying was done in-house at a cost of $2,182 in material (personal communication, Wes Gibbs, Jones County roadside manager).

c. Tall roadside vegetation keeps pavement warmer, increasing the life of the pavement and reducing snow drift.

Introduction: **-Additional Information Needed**

- Areas protected by snow fences such as trees, shrubs, and terrain features were 6°C (10°F) warmer than adjacent unprotected road in Wyoming. [33]

d. Better drought tolerance and erosion control due to deeper roots, avoiding the need to re-seed. **-Additional Information Needed**

2. Regulatory impacts

a. Build and improve working relationships with regulators. **-Additional Information Needed**

b. Pro-actively address future regulatory responsibilities. **-Additional Information Needed**

c. Voluntary actions can help avoid future regulation (e.g., endangered species listings). **-Additional Information Needed**

d. Habitat work can ease/improve public relations that can then help public acceptance and buy-in for regulatory approvals and streamline the public input/comment process. Public approval of new ROWs can help facilitate regulatory approvals.**-Additional Information Needed**

3. Sustainability and environmental stewardship

a. Increase overall ecosystem value of managed lands.

Introduction: **-Additional Information Needed**

- The benefits transfer method was used to estimate several ecosystem services: the economic value of runoff prevention, carbon sequestration, pollination and other insect services, air quality, invasive species resistance, and aesthetics for Florida's roadside ROW in the state highway system. The total value of these benefits was conservatively estimated to be nearly a half billion dollars, more than the $33.5 million that was spent on the cost of vegetation management in 2011-2012. [12]
- "In the 1990s, Costa Rican hydropower company Energia Global (now Enel Latin America) was literally losing its source of power. Landowners were clearing the forested slopes upstream of the company's dams for livestock and agriculture. With the trees gone, heavy rains were causing increased soil erosion and river sedimentation, lowering dam reservoir capacity and power output. Energia Global now pays farmers to keep trees on their farms." 12
- Ecosystem services can be separated into 4 categories including provisioning services, regulating services, cultural services and supporting services. [1]

b. Provide valuable habitat resources and increase biodiversity of birds, pollinators, predatory insects, etc.

Introduction: **-Additional Information Needed**

- Roadside milkweeds in the upper Midwest have lower per plant use than milkweeds in other habitats. However, roadside milkweeds are used by monarchs for breeding and given the large area of roadside ROW, roadsides have a large conservation potential for monarchs, especially in areas with little other habitat and when wildlife-friendly roadside management practices are used. [18]
- In west-central Illinois ROWs between agricultural crops and roads, the number of bird species increased rapidly with increased ROW width on roads with low traffic. On roads with high traffic, the number of bird species increased only slightly with increasing ROW widths. Wider roadside ROWs with thicker and taller vegetation had the greatest conservation value for birds and small mammals. [23]
- Reducing mowing during peak seasonal butterfly activity in Florida increased butterfly abundance along highway ROWs. [11]
- Case study: A unique property appraisal allowed Allegheny Energy to turn ecosystem services like wildlife habitat, water purification and climate regulation into environmental assets. The project yielded millions in tax savings from a bargain sale to the U.S. Fish and Wildlife Service. The challenge, then, was in realizing the value of ecosystem services of this 12,000-acre tract, beyond traditional real estate valuation. The solution was a complex property transaction involving a sale of the property to the Fish and Wildlife Service. [1]
- Despite negative ecological effects of power lines including increased habitat fragmentation, edge effects, and bird collisions with power lines, the repeated removal of vegetation from ROWs is a disturbance agent that keeps plant communities in an early successional stage and provides habitats for a variety of species. [20]
- According to management guidelines, vegetation on power line ROWs in Finland is managed by mechanical clearing with an interval of every 6 years. This study shows that regularly cleared and drained mires on power line ROWs can be viewed as habitat patches for mire-dependent butterflies. The results also suggest that the optimal vegetation clearing interval on mires on ROWs is 2–4 years, but shortening the current 6-year interval by a year or two would already enhance habitat quality for all butterflies. [20]
- Railway tracks located on sun-warmed embankments containing a reach pool of nectar plants could enable multi-species communities to persist in an environment of good suitability. Bootstrap t-tests revealed that the group of sites containing meadows and railway tracks had greater species richness of

both butterflies (t = 5.538, P = 0.003) and nectar plants (t = 3.927, P = 0.009) than the group containing forest clearings and degraded meadow. [17]

- Our results indicated that railway tracks contain a reach-wide pool of butterfly species as well as nectar plant species at a nested subset pattern of β-diversity, and consequently they have potential value for both grassland and forest butterflies. These sites seem to enable multi-species communities to persist in an environment of good suitability and quality, as revealed by the nectar plant richness and specific microclimatic conditions. The suitability of railway tracks for butterflies may be expressed in three ways: (1) as a habitat for species that end a complete lifecycle; (2) as a habitat for adult individuals; and (3) as a dispersal corridor. [17]
- We proved that railway tracks, if they are located in forests, might successfully replace forest clearings. It could be predicted that longer tracks located on sun-warmed embankments are more heterogeneous, e.g. in terms of vegetation height or bare ground cover, which promote other pollinators such as solitary bees. Therefore, the conservation of these sites is necessary for the long-term persistence of species populations on a large landscape scale. On the other hand, exposure of the tracks may be an important limiting factor. Railway tracks that are not located on embankments may be characterized by extremely different conditions such as lower temperature, high vegetation and a lower source of nectar plants; therefore, their lower value should be expected. [17]
- Our results revealed that the abundance of various flowering plants is a good indicator of habitat quality for insects at railway tracks. High nectar abundance turns out to be the most important factor in increasing the numbers of meadow butterflies along track verges. Consequently, we proved that artificial habitats have potential value if they have rich plant species communities. The greatest threat to butterflies inhabiting railway tracks is a lack of management that results in the overgrowing of track verges by shrubs, and consequently in the alteration of plant species communities. However, improper management, e.g. too-frequent mowing, is also a threat. Furthermore, all restoration work along railway tracks should be carried out with conservation aims in view, including the preservation or reconstruction of suitable plant species composition. [17]

c. Provide corridors linking habitats and favorable landscapes for pollinators, birds, and other species.

Introduction: Properly managed electrical power transmission lines, natural gas and oil pipeline rights-of-way can create corridors that link habitats. These corridors are essential in that encourage native low-growth and flowering plants which can benefit both native wildlife and beneficial pollinators. Rights-of-Way are especially attractive to species with large home ranges. Not only do buffer strips create habitat, they also assist with soil erosion and water runoff.

- In central Iowa, restoring roadsides to prairie vegetation benefited butterflies, with lower mortality risk compared to roadsides dominated by non-native grasses or weeds. Butterflies were also less likely to exit prairie roadsides compared to the other habitat types, indicating they may use the prairie roadsides as corridors. [32]
- Total annual market value of threatened and endangered species (U.S.): $200 million. [1]
- Because early successional habitat is becoming less common in the eastern United States and because species dependent on these habitats are showing populations declines, the maintenance of a ROW via the wire–border zone method is extremely valuable to the long-term conservation of early successional bird species. Transmission ROW are linear corridors that often traverse contiguous forests, thereby making these ROW extremely valuable for bird species requiring early successional habitats. [31]
- Border zones established on ROW provide abundant and diverse nest sites for the nesting bird community (Bramble et al. 1994; Yahner et al. 2002b). Cover type in mowing plus herbicide units consists of a grass–forb–shrub combination, which has restricted tree invasion to 185 trees/ha (75 trees/ac) compared to 495 trees/ha (200 trees/ ac) in other units on the SGL 33 ROW. [31]
- Powerline rights-of-way (ROWs) often provide habitat for early successional bird species that have suffered long-term population declines in eastern North America. Some shrubland bird species were more abundant on narrower ROWs or at sites with lower vegetation or particular types of vegetation, indicating that vegetation management could be refined to favor species of high conservation priority. Powerlines can also play a more direct positive role, however, by providing extensive, continuous habitat for species that require low vegetation. [3]
- Powerline rights-of-way (ROWs) provide a stable source of appropriate habitat for shrubland birds because large areas of early successional habitat must be continually maintained to ensure that overhead lines are kept free of tall-growing vegetation [17]. Habitat is especially favorable for early successional species where herbicides are applied selectively to target tall-growing trees and invasive shrub species in the powerline corridor, (Figure 1). Creation of new powerline corridors through heavily forested regions is not generally recommended, however, because it results in forest fragmentation that may have a negative effect on birds nesting in the surrounding forest. [3]
- Vegetation management on power line ROWs is essential to ensure secure and uninterrupted transfer of electricity. Some studies indicate that ROWs can serve as an alternative habitat for threatened plant, grassland butterfly and bee species. [21]

- In Finland, two thirds of natural mires have been drained for silviculture, which transforms open wetlands into dense forests. However, vegetation management of power line rights-of-way (ROW) maintain the drained mires as open areas. The species richness or abundance of mire butterflies did not differ between the power line ROWs and natural mires. In contrast, both species richness and abundance of butterflies was low on the unmanaged control sites. The results indicate that the active vegetation removal in the power line ROWs maintain alternative habitats for mire butterflies; yet, the power line ROWs cannot substitute the natural mires. [21]

d. Vegetation can be managed for carbon sequestration and support climate goals *(this may be a tough issue to support for electric utilities. Trees sequester more CO2 than grasses.)*

   Introduction: Due to rising levels of carbon emissions and atmospheric conditions, the management of carbon sequestration is a primary concern. Vegetation may assist in carbon sequestration by naturally storing carbon within leaves, stems and roots. Once the vegetation, carbon is released back into the atmosphere. This natural process could assist in the reduction of greenhouse gas emissions.

   - There are approximately 5.05 million acres of roadside right-of-way in the National Highway System that is currently storing approximately 91 million metric tons of carbon, or 1.06 metric tons of carbon per acre per yer. This translates into a total potential value of $8.5-$14 billion per year, using a hypothetical carbon price of $20 per metric ton. [8]
   - The FHWA has developed a Highway Carbon Sequestration Estimator to help DOTs assess the return on investment for different carbon sequestration scenarios, available from emailing Carson Poe at carson.poe@dot.gov [8]
   - The New Mexico DOT has been testing different plantings and techniques and increased carbon storage on roadsides from 35 to 350 percent over areas that weren't actively managed. Native grasses in the state's prairie regions produced the largest increases (quoted in a Scientific American article, "Roadside Shrubs Could Sink Carbon Pollution", trying to find report to cite from New Mexico DOT)
   - The eight federal land management agencies (FLMA; U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Reclamation, Bureau of Indian Affairs, U.S. Army Corps of Engineers, and military installations) are collectively associated with over 17 million acres of roadside rights-of-way that could be used for carbon sequestration. Extrapolating from the vegetation types present in four case studies, the eight FLMAs have the potential to store over 8 million metric tons of carbon along their roads. This is the same as the annual carbon emissions of 1.6% of the annual greenhouse gas emissions from the transportation sector. [2]
   - The carbon density of highway vegetated filter strips and vegetated swales along 4-lane highways in North Carolina was similar to that of grasslands. Because the percent total carbon was higher in wetland swales compared to dry

swales, wetland swales would be preferable to dry swales to promote carbon sequestration. [5]

- Through an EPRI project, Allegheny Power realized over $5 million in tax savings when it considered the value of ecosystem services. The traditional real estate appraisal valued the land at $16 million. After EPRI conducted an eco-assessment of the marketable environmental benefits (carbon sequestration credits, wetland mitigation credits), the value rose to $33 million. Allegheny Power sold the land for $16 million under "bargain sale" tax provisions to the United States Fish and Wildlife Service [5] and claimed a donation of $17 million, ultimately resulting in over $5 million in savings after all other expenses were accounted for. [1]
- Total annual market value of carbon(global) : $142 billion [1]
- Since 1750, the atmospheric concentration of carbon dioxide has increased by about 32%, primarily due to the combustion of fossil fuels and land use changes. Approximately 60% of that increase has taken place since 1959. [1]
- In 2008, the USDA created the Office of Environmental Markets (OEM), which supports the development of emerging markets for carbon sequestration, water quality, wetlands, biodiversity, and other ecosystem services. USDA's involvement is based on an interest in providing financial incentives for ecosystem services as an alternative to selling and developing rural lands. [1]

e. Less frequent mowing reduces air pollution.
Introduction: Emission from lawn mowers significantly contribute to pollutants that help form the ozone due to the release of carbon monoxide, hydrocarbons and nitrogen oxides. Not only do the harmful emissions of mowing contribute to pollution but it also reduces the potential benefits of a landscape. In order to help reduce air pollution, mowing should be less frequent.
    - **Additional Information Needed**

f. Incorporate habitat into Corporate Social Responsibility strategies. **-Additional Information Needed**

g. Develop a positive environmental metric **-Additional Information Needed**

h. Bioenergy
Introduction: **-Additional Information Needed**
    - A 3-year study by a multidisciplinary team that included the Illinois Sustainable Technology Center at the Prairie Research Institute at the University of Illinois found that nearly $2 million in energy could be recouped by harvesting ROW biofuel for energy. This would be net revenue that would offset the cost of mowing. A 10-acre pilot project will be implemented in Madison County, Illinois and will include nectar plants. [15]
    - In Denmark, the annual yield of biomass obtainable from roadside verges varied greatly depending on local site conditions. However, the energy return on invested energy was above 2 for all researched scenarios, meaning the use of roadside grass in biogas production is feasible in Denmark from an energy point of view. [24]

i. Environmental KPI for sustainability reporting **-Additional Information Needed**
j. Resiliency/climate change adaptation **-Additional Information Needed**

4. **Site maintenance/management solutions**
    a. Native vegetation provides soil erosion control.
    Introduction: Native vegetation can conserve top soils and prevent open areas from wearing away.
        - In exchange for payments, farmers agree to plant long-term, resource-conserving land cover to improve water quality, control soil erosion and enhance habitats for waterfowl and wildlife. [1]
    b. Native vegetation can improve stormwater management. **-Additional Information Needed**
    c. Native vegetation can support invasive species management. **-Additional Information Needed**
    d. Native vegetation can reduce snow drift. **-Additional Information Needed**
5. **Cross-functional collaboration**
    a. Leverage other maintenance/construction activities to provide habitat conservation. **-Additional Information Needed**
    b. Advanced imaging technologies can improve vegetation management (including habitat assessments) and support operational and infrastructure maintenance needs. **-Additional Information Needed**
    c. Sharing the values of the workforce of the future **-Additional Information Needed**
    d. Providing common conservation currency across business units and borders **-Additional Information Needed**
    e. Vertical/horizontal integration **-Additional Information Needed**
6. **External partnership opportunities**
    a. Build and improve working relationships with new and existing partners.
    Introduction: **-Additional Information Needed**
        - There are opportunities for power companies to monetize restoration and conservation approaches for ecosystem services, either through establishing company owned banks, or by buying credits from other banks to meet compliance obligations that also protection ecosystem services. [1]
        - We proposed that the most compelling business case for sustainability from the research can be summarized into three opportunities: saving money, making money, and managing risk. The background information, quotes, and case studies can all be put to practical use for internal communication within an electric power company. [22]
    b. Gain expertise from organizations that specialize in managing for habitat. **-Additional Information Needed**
    c. Share resources to reduce cost and increase effectiveness of habitat efforts. **-Additional Information Needed**
7. **Positive public relations**

a. Increase engagement with local community and neighboring landowners. **-Additional Information Needed**
b. Be a part of the solution while public concern for pollinators is high. **-Additional Information Needed**
    - A lesser known direct value is that of pollination services. In the agricultural world, many producers rent bee hives. The total U.S. value of pollination services is estimated at four to six billion dollars per year. [1]
c. The public prefers the look of a more natural and/or diverse vegetated landscape. *(Not sure about this one. Native vegetation plots don't look all that nice during the winter. All the signage in the world won't make them look better.)*
   Introduction: **-Additional Information Needed**
    - One positive outcome can be a new relationship between a utility company and a public entity managing a trail on these rights-of-way, creating a whole spectrum of community benefits. While this relationship means some sacrifice on the part of the utility company and transportation entity, they receive real benefits as well. But their economic, liability and maintenance concerns need to be clearly understood and strictly negotiated as part of the construction of a public trail on their right-of-way. [7]
    - Introduction of public trails along these corridors requires intensive active cooperation and planning between the trail or city agency and the utility company or transportation entity in order to minimize operation and maintenance impacts. Some of the measures that can help diminish these impacts include: Funding solutions such as seeking out a utility company who may be interested in utilizing the proposed corridor to improve and/or expand its system of delivery. Agreeing on an annual operation plan and reimbursing for additional operation costs. Establishing times for specific operation and maintenance tasks so the trail can be closed down. Establishing design standards such as separating trail from maintenance roads. Adequate signage and intensive education programs. Informal/neighborhood patrols. [7]
d. Public perception needs to be improved by focusing on the benefits for the public, making an investment and spending less time in battles with public relations overall. **-Additional Information Needed**

8. Safety benefits

a. Employees spend less time mowing steep slopes, reducing chances of accident. **-Additional Information Needed**
b. Increased plant diversity on roadside rights-of-way increases driver alertness. **-Additional Information Needed**
c. Tall shrubs or grasses can reduce snow glare on road. **-Additional Information Needed**
d. Roadways with more vegetation relative to built structures increase drivers' frustration tolerance, thereby reducing road rage.
   Introduction: **-Additional Information Needed**

- Study participants showed a higher frustration tolerance after being exposed to videotapes of highway drives with more vegetation compared to videos with more man-made material. [6]

e. Tall herbaceous vegetation and shrubs slow vehicles that leave the road and absorb some of their kinetic energy (i.e., "errant vehicle soft landing"). **-Additional Information Needed**

f. Non-woody native species are generally compatible with Federal Energy Regulatory Commission (FERC) and North American Electric Reliability Corporation (NERC) requirements. **-Additional Information Needed**

9. Cultural/educational benefits

a. Using local native vegetation in highly visible locations provides a sense of place, reflecting the area's natural heritage. **-Additional Information Needed**

b. Provide an opportunity to engage employees, partners, and others in conservation. **-Additional Information Needed**

c. Increase public awareness of the importance of pollinators and the role that working landscapes can provide in conservation. **-Additional Information Needed**

d. Using corporate lands for STEM and environmental education **-Additional Information Needed**

e. Habitat as tool for STEM education **-Additional Information Needed**

10. Tourism benefits

a. Roadside environments that provide an aesthetically pleasant travel experience increase the likelihood that tourists stop and spend money in communities along the highway (e.g. scenic byways program).

Introduction: **-Additional Information Needed**

- Florida power companies provide a wildlife haven when manatees flock to warm water discharge outflows. Tampa Electric opened a viewing platform in 1986 as a goodwill gesture. The state- and federal-designated sanctuary has hosted several million visitors. [1]
- The presence of linear utility and transportation corridors in and around these urban settings offers a tantalizing prospect for trail planners. These utilities can provide solutions to improve the economic vitality, aesthetic value, and the general quality of life for the communities they transect. Examples of these include utility corridors such as irrigation canals and electric power lines, and transportation rights-of-way. The risk of personal injury and the resulting claims/lawsuits from trail use can be reduced through conscientious trail design, construction and maintenance, but will never be eliminated from the equation. [7]

b. Some locations may be suitable for recreational opportunities.

Introduction: **-Additional Information Needed**

- Short, circular routes for walkers and cyclists should be established and promoted around both settlements and visitor attractions. Relatively minor enhancements to the public rights of way network through the provision of

missing links, infrastructure improvements or permissive access could significantly enhance opportunities for local recreation. (Northumberland Rights of Way Improvement Plan)

- South East Northumberland has a particularly high incident of people suffering from poor health. There is clear potential for the County Council to work with partners such as Sport England, Primary Care Trusts and other Health Trusts to encourage more people to participate in walking and cycling to maintain and enhance their health and well-being. (Northumberland Rights of Way Improvement Plan)
- Visitors to the countryside, many of whom use the rights of way network for all or part of their visit, make an important contribution to the rural economy through the money they spend in local shops and businesses (walking trips alone is estimated to be £240 million per annum supporting between 7,000 to 9,600 full time or equivalent jobs.)-rights of way could bring in revenue. Main purpose of countryside recreation is exercise (43%), relaxation (29%) and exercising animals (24%). (Northumberland Rights of Way Improvement Plan)

c. Improve the aesthetic on adjacent lands (parks, preserves, and other natural areas). **- Additional Information Needed**

11. Industry/leadership Innovation

a. Biodiversity/pollinator management programs will improve scores on investor disclosure **-Additional Information Needed**

With better management of biodiversity, environmental survey scores improve, leading to better investor relations and hopefully, better shareholder value.

Challenges

Many potential users of rights of way have a low level of knowledge of their local countryside and/or a lack of confidence to use it. To enable those groups who rarely visit the countryside to enjoy this resource requires a coordinated strategy of infrastructure improvement, information provision and promotion. Crucially, information needs to be effectively targeted and distributed to readily accessible locations such as doctors' surgeries, benefit and advice offices, playgroups and supermarkets. (Northumberland Rights of Way Improvement Plan)

1. **Cost of new vegetation management strategies**
    a. Creation of enhanced, diverse wildlife habitats can be difficult to sustain through regular maintenance activities at the same cost as conventional methods
        - Response: IVM is proven through research and decades of implementation data that it promotes self-sustaining communities of compatible plants which in return require increasingly lower maintenance inputs. [16]
    b. Cost of paying for roadside vegetation manager salary **-Additional Information Needed**
    c. Insufficient proof of cost savings **-Additional Information Needed**
2. **Adjacent landowner cooperation**
    a. ROW landowners or adjacent landowners may not be supportive of native vegetation or changes in vegetation management **-Additional Information Needed**
    b. Farmer perception that native plants in ROW will spread into their fields **-Additional Information Needed**
    c. Farmer perception that native plants increase crop pests **-Additional Information Needed**
    d. Farmers do not understand importance of native plants to pollinators and potential effects of pollinators on crop yields **-Additional Information Needed**
    e. Landowners planting crops in ROW **-Additional Information Needed**
    f. Some farmers mow because they don't recognize the difference between natives and invasive plants **-Additional Information Needed**
    g. Landowner mowing or spraying native plantings intentionally to get rid of the plants because of above concerns **-Additional Information Needed**
3. **Maintenance challenges**
    a. Resistance from maintenance contractors accustomed to implementing a single type of activity across the system
        - Response: In order to create familiarity, teams can work with ground crews to present IVM guidelines. [16]
    b. Concern that deep native roots will impact infrastructure (e.g., buried pipelines, drainage tile lines, etc.) **-Additional Information Needed**
    c. Length of time it takes for native plants to establish **-Additional Information Needed**
4. **Concern about invasive species in seed mixes**
    a. Concern that seed mixes will contain palmer amaranth **-Additional Information Needed**
    b. Non-native and invasive plants make it difficult to create or restore a grassland habitat that can preserve itself in the long term. [9]
        - Response: Technical advice is needed in order to make sure that there are native species within the seed mix as well as consistently monitor and control invasive

species on a regular basis. In addition, signage and communication with co-workers should be utilized in an attempt to ease potential concerns during the establishment period. [9]

5. **Scaling up practices**
    a. Difficulty moving from pilot projects to large, network-wide program **-Additional Information Needed**
6. **Quantifying / Documenting habitat**
    a. Difficulty selecting appropriate metrics **-Additional Information Needed**
    b. Difficulty tracking location and status of habitat projects **-Additional Information Needed**
    b. Identifying suitable sites **-Additional Information Needed**
7. **Safety**
    a. Liability concerns may make companies reluctant to allow employees or community members across the habitat site(s)
        - Team may have concerns that implementing conservation activities on linear features may be incompatible with regulations.
          Response: IVM has been demonstrated to be compatible within most regulatory frameworks that govern linear features. [16]
        - Response: Conservation activities do not specifically require on-site involvement, although most teams have found that systems and processes are already in place within their company to allow public access for a variety of purposes. [16]
    b. Non-native and invasive plants make it difficult to create or restore habitat that can perpetuate across the habitat site(s) **-Additional Information Needed**
8. **Training and education**
    a. Lack of information on how to proceed **-Additional Information Needed**
    b. Acceptance of natives and IRVM among contractors **-Additional Information Needed**
    c. Lack of technical expertise about how to plant and maintain natives in ROW
        - There can be a lack of education in areas such as species identification and best management techniques among team members and staff. [9]
          Response: Training and easy-to-use tools should be provided by knowledgeable staff and local experts from an existing initiative, NGO or university. As a result, project implementation and monitoring can be provided. [9]
    d. Reducing exposure of pollinators to insecticides in the ROW **-Additional Information Needed**
    e. Some programs may lack the knowledge base or resources to conduct a controlled burn safely. [9]**-Additional Information Needed**
        - Response: Prescribed fire can be a safe grassland management tool. But it should be conducted with experts in order to safely conduct a burn and provide the proper resources. [9]
9. **Risks of habitats located adjacent to ROW / Insufficient proof of conservation benefits**
    a. Conservation activities can potentially increase wildlife-related conflicts with infrastructure and equipment
        - Response: Evidence from implementation has shown that management of habitats on linear features are adaptable or compatible with maintenance needs for most

ROWs. Also, teams are able to choose suitable projects that contain flexible objectives and approaches that prevent wildlife related conflicts. [16]

b. **-Additional Information Needed**
c. Perception that ROW is an ecological sink luring pollinators to their deaths **-Additional Information Needed**
d. Understanding the effects of road salt on pollinators **-Additional Information Needed**
e. Understanding the effects of road salt on native plant establishment and health **-Additional Information Needed**
f. There is great variation within both regional and local grassland habitat concerning appropriate species composition, maintenance regimes, etc. [9]
    - Response: In order to determine the appropriate grassland types, teams should use reference information that is catered to their region as well as local expertise. That way, it can be better determined if certain grassland types need to be created or restored. [9]
    - Different regions may have different grass height ordinances which can prevent the transition from mowed corridors to any other habitat types
      Response: Most municipalities are open to wildlife habitat creation and enhancement, especially if informational signage is provided. [16]

10. **Habitat is outside primary business objectives**
    a. Other concerns within a county/state/business/organization are a higher priority over habitat creation **-Additional Information Needed**
11. **Impact of regulations**
    a. Potential listing of monarch butterfly threatened or endangered species would increase regulatory liabilities **-Additional Information Needed**
    c. State or federal funding restrictions **-Additional Information Needed**
12. **Lack of public support**
    a. Time required to establish "good-looking" habitat **-Additional Information Needed**
    b. Some people prefer manicured look
        - Due to the unruly nature of wildflower meadows and native plants, aesthetic concerns may be expressed by the public.
          Response: In order to help create an aesthetically pleasing site, the Wildlife Habitat Council can work with the site to plant a pleasing mixture of plants and flowers that can create a more structured design. [28]
    c. Concern over mosquitoes and other pests
        - There may be resistance from the public to create a habitat for bees in fear of potential stinging insects or pests. [28]
          Response: Appropriate siting, signage and education efforts can help prevent resistance from the public. [28]
    d. Herbicides are typically used within conservation integrated vegetation management which might not be accepted by the public
        - Response: Herbicides should be demonstrated through responsible use through available information from credible groups within education and outreach activities. In addition, involving stakeholders from the start of the project can also help demonstrate responsible herbicide use. [16]

Sources Cited

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