NEVADA DEPARTMENT OF TRANSPORTATION

RESEARCH DIVISION

FEASIBILITY STUDY OF UNMANNED AERIAL VEHICLE IMAGERY FOR MAPPING ROADSIDE MILKWEEDS AND NECTARING PLANTS FOR THE MONARCH BUTTERFLY

Key · Points

Project Number:
564-22-803

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33 months

Project Cost:
$290,449.00

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PROBLEM

The monarch butterfly has been gaining national attention as population declines from 75-85% have been documented across its range. It is a "candidate" species for federal protection under the Endangered Species Act (ESA) and is scheduled for listing in December of 2023 under the US Fish and Wildlife (USFWS) 5-year workplan. Once protected under the ESA, all state or federal activities that intersect with monarch habitat must be reviewed for impacts and either Section 10 (state) or Section 7 (federal) consultations will be required. These consultations are time consuming and costly and could be required for all actions including small maintenance projects to large road projects.

Because of the pending listing, a nationwide Candidate Conservation Agreement with Assurances (CCAA) was developed in collaboration with USFWS. To participate in the monarch CCAA, the landowners and land managers must document suitable habitat and decide what areas will be covered under the agreement (i.e., adopted acres) and protect a portion of that habitat for the monarch butterfly (i.e., mitigation sites). The applicant must develop a plan for each mitigation site and perform yearly surveys that requires counting both milkweeds and flowering plants during the growing season. Traditional survey methods require a biologist to walk the site and document the plants, but this is labor intensive and must be completed during the appropriate growing seasons. Since the growing seasons in Nevada are very short, we need to investigate new technologies that will help staff complete the required surveys in a relatively short timeframe.

One method that has shown promising results in the realm of biological surveys is the use of drones. Drones use high resolution cameras to capture images of large sections of the landscape in a very short time. This provides an opportunity to cover significantly more ground than foot surveys during the short growing season. Additionally, drone imagery allows for postponed analysis. This would allow multiple drone surveys to occur at the appropriate flowering times without regard for the availability of a biologist. Postponed analysis would allow biology staff to conduct more surveys at the appropriate times of year and review drone images at later times. This is important due to the low number of biologists that work for NDOT and their heavy workload during the growing season.

Although drones have been used in various survey techniques, we are not aware of their use for identification and counting of milkweeds or other flower plants, especially as they relate to monarch butterflies or other pollinator species. Therefore, we would like to investigate if imagery taken by NDOT drones can provide high enough resolution needed to identify milkweeds and other flowering plants.

With the increased number of pollinators declining, and federal ESA listings increasing, the burden to improve habitat and maintain and monitor such sites will continue to increase across the nation. This will only increase workload, so having an effective method like this to cover more ground and allow for delayed analysis is important. If successful, this method could save Nevada, as well as the nation, an enormous amount of time and money and maintain efficient delivery of Department projects.

OBJECTIVES

This research focuses on four major objectives: (1) Complete a literature review on using drones to map both milkweeds and nectaring plants. (2) Potential study areas will be determined from a combination of sources including the milkweed habitat models by Dilts et al. (2019), records from iNaturalist, the Western Monarch and Milkweed Mapper, and other associated natural history databases and local field knowledge. (3) Conduct a full factorial experiment to cross 3 levels of flight altitude with 3 levels of side overlap and 3 dates (early, middle, and late growing season, ~June, July, and August) in order to determine optimal settings for efficient data collection. This step will be coordinated with the NDOT Location Drone Team. (4) Using the drone imagery, develop a set of vegetation maps for each study site to quantify milkweed cover, floral density, and other vegetation and cover types including shrubs, perennial grasses, annual grasses, annual forbs, rock, litter, and bare ground.

METHODOLOGY

Staff within NDOT Environmental Services and Location Division have discussed the general research approach. The research team will work closely with NDOT Environmental Services and NDOT Location Drone Team. Together they will select a site(s) close to the Reno/Tahoe area that can be flown by the NDOT Location Drone Team and surveyed by the research team multiple times during the active growing season. This would allow for the research team to review images from various growth stages and field check those images during the same timeframe.

IMPLEMENTATION POTENTIAL

The full factorial design is intended to lead to a potential monitoring protocol that will maximize the benefits (accuracy of drone-based mapping) while minimizing the costs (time required to fly the imagery by the NDOT Location Drone Team, process the imagery in the office, and collecting field data to train and validate models). The cost: benefit analysis will be critical in scaling up the drone-based mapping to cover larger study areas without sacrificing needed detail. This will be important when working towards meeting the goals of the monarch CCAA as well as protect NDOT's operations once the monarch is listed.

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