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Evaluating the amount of plant propagules transported by different types of vehicles

Non-indigenous plant species (NIS) are a global-scale problem that threatens the ecological integrity of native plant communities and ecosystems. NIS are introduced to areas by a variety of natural and anthropogenic means, and the number of anthropogenic introductions has increased in recent decades. Vehicles are often considered key agents in the dispersal of NIS propagules, both along roads and where military exercises or combat takes place. Plant propagules (seeds and other reproductive parts) have been observed on vehicles, but the number of studies is limited. Transporting equipment, materiel, and personnel between sites, conducting off-road maneuvers, and simply driving on unpaved roads pose a measurable risk of transferring NIS within and between sites. More propagules are likely to be collected by vehicles driven off-road than on paved roads, and by tracked or all-terrain vehicles than civilian pattern vehicles, but there are no quantitative data to support this hypothesis. In the execution of SI-1545, a main objective was to evaluate the amount of plant propagules transported by different types of vehicles. Five different types of vehicles (M1 tanks, Bradleys, PLS (palletized loading system), Humvees, and Hemmet fuelers) were tracked over a 12 day period (June 1-12th, 2008) as part of annual training at Orchard Training Area, Boise, ID. Vehicles were washed before and after training using a portable commercial wash unit. The resulting soil and propagule waste (greater than 75 μ) was contained for each vehicle type and is being germinated and recorded over a year long period under greenhouse conditions. These data, and those from past and future experiments will be used to develop protocols which will aim to reduce the movement of non-indigenous plant propagules, within and between Department of Defense installations.

Evaluating Plant Propagule Richness & Abundance When Transported on Different Vehicle Types

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Summary:

Vehicles are known to transport plant parts, but few quantitative studies exist explaining the quantity of propagules (seeds and vegetative parts) transported on different types of vehicles and the distance travelled before released. This study aims to provide such data. Two field exercises and one experiment have been completed.

Introduction:

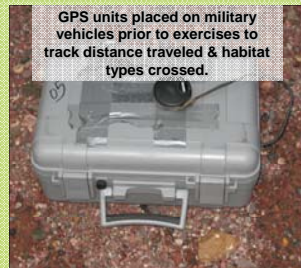
Invasion by non-indigenous plant species (NIS) is a global-scale problem that threatens the ecological integrity of native plant communities and ecosystems. NIS are introduced to areas by a variety of natural and anthropogenic means. Roads and vehicles are often regarded as dispersal vectors and dispersal agents for NIS respectively. However, the quantity of plant propagules transported by vehicles, and how this varies with vehicle type is poorly understood. More propagules are likely to be collected by vehicles driven off-road than on paved roads, and by tracked or all-terrain vehicles than civilian pattern vehicles, but there are no quantitative data to support these hypotheses. Washing vehicles is viewed as one of the easiest ways to combat the dispersal of NIS by vehicles.

To address these issues, field trials were conducted at two military training areas during the summers of 2007 (site 1) and 2008 (site 2). An experiment to determine distance of propagule transport was also conducted during summer 2008.

Objectives:

- Assess the potential of different types of military vehicles to transport NIS propagules under field conditions.
 - Site 1: Limestone Hills, Helena, MT.
 - Site 2: Orchard Training Area, Boise, ID.
- Quantify the proportion of seeds lost from a vehicle after driving set distances.

Field Exercises



Germination and identification of seedlings from the vehicle wash waste will be recorded over 1.5 years for each exercise. Samples are kept at ambient temperature for 1 year then subject to an 8 week cold stratification period to stimulate remaining seed and then returned to ambient conditions to record further seedling germination. Seeds can be damaged by the washing process, trials have been conducted to estimate the percent loss and this will be used as a correction factor for abundance estimates.



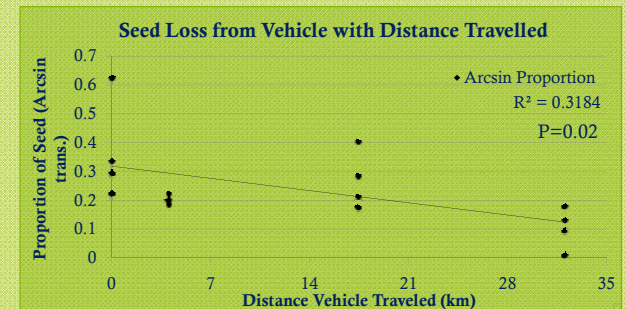
Seven different vehicle types have been studied: humvees, 2.5 and 5 ton personnel trucks, Hemmet fuelers, palletized loading systems, M1 tanks and Bradleys. All vehicles used in the study had GPS units placed on them to record their location at all times during the exercise. Vehicles were driven on asphalt and gravel roads, and in areas away from roads. Vehicles were washed before, during and at the end of the exercise with a commercially available wash unit. The waste was retained and placed in a greenhouse for germination trials. Numerous different species have been recorded: 41 from the 2007 study and 43 from the 2008, both studies are still producing more specimens so the data are currently incomplete.

Data from the GPS tracking of vehicles on gravel roads suggest that each vehicle picked up and transported 1-10 viable seeds per kilometer driven. If the number of viable seeds destroyed by filtration in the wash unit is taken into account, this increases the estimate to between 7 & 67 viable seeds per vehicle for each kilometer driven. More data are forthcoming.

Distance Seeds Travel on Vehicles



The seed mix that was applied to the truck was composed of a mix of crop species. Therefore, dormancy of seeds was not an issue. Due to overspray and dripping, not all of the mud that was put into the applicator was retained on the undercarriage of the truck. A large tarp was placed underneath the application area and cleaned after each application to determine the actual amount of soil/seed mix that remained on the truck. The data indicate that the proportion of seed material retained on a vehicle declines significantly with distance travelled.



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