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Vehicles as a vector of plant seed dispersal: quantifying seed loss over distance

The invasion of natural ecosystems by non-indigenous plant species (NIS) is a problem for land owners and managers, and billions of dollars worth of resources are allocated to control the spread of noxious weeds every year in the United States. Secondary movement of plant propagules by vehicles is an important but relatively unmeasured component of the invasion story, and few data exist quantifying how far propagules are dispersed once present on a vehicle and under different driving conditions.

We conducted a controlled experiment measuring seed loss over distance on a passenger vehicle. Known amounts of a soil and seed slurry were applied to specially fabricated 0.1 m² plates, dried, and the plates then attached to the chassis of a four wheel drive pickup truck. The vehicle was driven seven set distances (from 0 - 256 km) on either unpaved or paved roads and under both wet and dry conditions. A dispersal curve (Kot et al. 1996, Model 4: $N = e^{(a-b\sqrt{x})}$) was fitted to the data. Preliminary analysis showed that loss of seed from the plates on paved roads was minimal under dry conditions, with more than 95% of seeds still retained after 256 km. However, under wet conditions on paved roads, some plates lost as much as 100% of propagules, depending on position under the vehicle. Seed losses from plates when the vehicle was driven on unpaved roads under dry conditions were similar to those on paved roads, with minimal seed loss over all distances. But, on wet paved roads the rate of seed loss was much higher, with 25 % of seed lost by 30 km and 50 % by 130 km compared to dry conditions where only 4% of seed were lost within 30 km and 10 % by 130 km, demonstrating a fat dispersal tail and long dispersal distance. These data suggest that seeds adhered to a vehicle in a dry soil substrate may travel indefinitely until acted upon by wet driving conditions, where propagule dispersal increases quickly and significantly. One way to slow the dispersal process would be increased emphasis on washing vehicles before and after recreational activities or travel on unpaved roads, as is already advertised and promoted for watercraft, to reduce the potential for seed spread by vehicles and subsequent invasion by NIS.