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Efforts to reduce wind erosion from unpaved roads cut through environmentally sensitive Alaskan and Hawaiian rangelands

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Key words : wind erosion, off road vehicles, dust palliative

Introduction Wind erosion is a critical issue on lands disturbed by off road vehicle use in the Delta Junction area, Alaska and in the saddle between Mauna Loa and Mauna Koa, Hawaii. Low visibility for off road vehicles, impacts on restoration potential, public transportation and quality of life for area neighbors are concerns. In Alaska, cold temperatures slow plant growth and soil genesis; thus erosion losses have long-term (100+ years) effects (Grantham et al. 2001). Reduction of accelerated wind erosion is a significant first step to insuring ecological integrity, and minimizing safety and quality of life concerns.

Materials and methods The study area in central Alaska has soils derived from glacial and glaciofluvial deposits that are dry, gravelly, and well drained. The area is needleleaf forest that annually averages 381 mm precipitation and temperatures of -3 to 9°C. The study area, centered on the island of Hawaii has poorly developed and excessively drained soils, derived from nearly barren lava flows. It is cool tropical averaging 1862 mm rainfall and temperature of 12 to 28°C. Threshold friction velocity measurements (u^*) through a portable wind tunnel were successfully used to evaluate changes in soil surface characteristics (Williams et al. 1995). In Hawaii, we tested the affect of dust palliatives on the threshold friction velocity of soil particle entrainment for disturbed rangeland sites. Five treatments were applied to soil surfaces with and without Hydretein® to promote plant establishment. Five treatments over four replications with sampling were two concentrations (9.5 l/plot, E1; 4.7 l/plot, E2) of Envirokleen®, a continuous life dust control agent applied directly over disturbed sites, and the application at two concentrations (3.8 l/plot, S1; 1.9 l/plot, S2) of Soil-Sement®, a polymer emulsion dust retardant, both treatments non-hazardous, and untreated controls (C). Threshold wind velocity data were analyzed by a fixed effects General Linear Models Analysis of Variance (GLM ANOVA) with mean separation by Fischer's Least Significant Difference (LSD). Dust palliative treatments and data analysis were the same for Alaska—no Hydretein was applied.

Results In Hawaii, pre-palliative testing of plots treated with ($P > 0.05$) and without ($P > 0.05$) Hydretein showed no significant change in threshold friction velocity. Threshold wind velocity means were significantly different among soil surface treatments after dust palliative application and with ($P < 0.05$) and without ($P < 0.001$) Hydretein (Figure 1). LSD separated means between Soil-Sement when compared with Envirokleen and controls with and without Hydretein. In Alaska, pre-palliative testing of plots showed no significant background changes in threshold friction velocity ($P > 0.05$). Mean threshold wind velocities were significantly different among soil surface treatments after seeding, raking and dust palliative application (Figure 2, $P < 0.001$). LSD separated means of both Soil-Sement treatments (S1, S2) from both Envirokleen treatments and control plots.

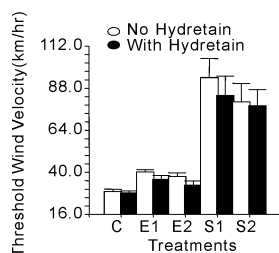


Figure 1 Post-treatment threshold wind velocity means and standard errors for the control in Hawaii (Vertical bars = s.e.).

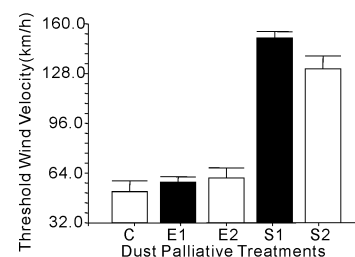


Figure 2 Post-treatment threshold wind velocity means and standard errors for the control in Alaska (Vertical bars = s.e.).

Conclusions At both locations with different soils, Soil-Sement (S1) provided superior retention of possible airborne particles to wind velocities greater than 80-160 km/h. Soil-Sement (S2) bound soil particles and resisted wind erosion less, from 72-128 km/h, still far superior to Envirokleen and controls. Both E1 and E2 produced large surface aggregates that were mobilized from 32-64 km/h. Soil-Sement is less viscous that allows for greater infiltration, a more uniform application that provides deeper cementation of surface soil particles. However, surfaces bound by Soil-Sement were observed at times to completely peel away at higher wind velocities. Plots with higher soil moisture when treated with Soil-Sement appeared to produce a stronger bond.

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