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

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Introduction Wind erosion is a critical issue on lands disturbed by off road vehicle us 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 . 9℃ . 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 .8℃ . 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 Hydretain® 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 Hydretain was applied .

Results In Hawaii , pre-palliative testing of plots treated with ($P>0$ .05) and without ($P>0$ .05) Hydretain 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) Hydretain (Figure 1) . LSD separated means between Soil-Sement when compared with Envirokleen and controls with and without Hydretain . 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 .

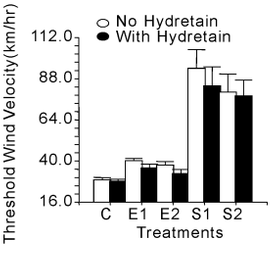

Figure 1 *Post-treatment threshold wind velocity means and standard errors for the control in Hawaii (Vertical bars= s .e .) .*

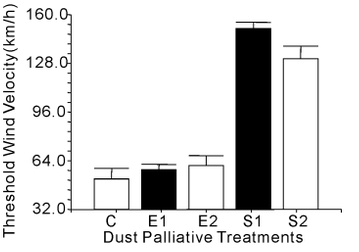

Figure 2 *Post-treatment threshold wind velocity means and standard errors for the control in Alaska (Vertical bars= s .e .) .*

Conclusions At both locations with different soils , Soil-Sement (S1) provided superior retention of possible airborne particles to wind velocities greater from 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 .

References

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