Predicting wind erosion and windblown dust emissions at the regional scale to guide strategic conservation targeting
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Soil wind erosion and windblown dust have long been a major concern within the Columbia Plateau of the Pacific Northwest. Wind removes the fertile surface soil and can result in a decline in soil quality, crop damage, poor visibility, and degraded air quality (see figure 1).

Dryland agriculture is practiced on about 8.2 million acres in the inland Pacific Northwest; half of this acreage is in fallow on an annual basis. Land in summer fallow is a major source of dust and PM10 (particulate matter ≤10 μm in diameter that is regulated by the US Environmental Protection Agency) in this region. However, no assessment has been made of potential soil loss and PM10 emission from fields in summer fallow within Columbia Plateau. A regional assessment of PM10 emission caused by high winds may not only illuminate areas most susceptible to wind erosion and PM10 emission but could also aid in targeting areas for implementing alternative control strategies and USDA conservation programs. Accurate estimates of soil loss and PM10 emissions on a regional basis are essential to designing, evaluating, and developing alternative cropping systems for mitigating wind erosion and improving air quality.

Figure 1
Wind erosion and dust emissions on a roadway in Washington state.

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Field monitoring to obtain regional inventories of wind-blown soil loss and PM10 emission would require a large investment of human and capital resources. As an alternative, models can be used to conduct regional assessments of soil loss and PM10 emission. Wind erosion prediction technologies have developed over the last several decades. The Wind Erosion Prediction System (WEPS) is new technology capable of simulating both soil erosion and PM10 emissions from agricultural fields in response to variations in weather, soil, and land management practices. Recently, WEPS was used to predict the wind erosion risk within Alberta, Canada. Unfortunately, no similar published work has been found for the United States.

WEPS is a field-scale model designed for field application. However, procedures are required to scale up from a field to a region. We developed a methodology that couples WEPS with geographical information systems (GIS) for scaling predictions of wind erosion and PM10 emissions from field to region. Adams County in Washington state was chosen as a case study due to the severity of wind erosion in the county. Our study identified that soil loss from fields in summer fallow was highest in west-central and south-central Adams County, suggesting that soil conservation strategies aimed at reducing wind erosion may be most effective in these parts of the county. Soil wind erosion can be mitigated by increasing soil moisture and aggregate or crust stability. The USDA Natural Resources Conservation Service’s Soil Survey Geographic (SSURGO) database classifies Adams County into six wind erodibility groups (WEGs) with soil loss increasing in severity from WEG1 to WEG6. Assessment of soil loss using WEPS indicated that soil loss was highest for soils designated as WEG1 and WEG4 and lowest for soils designated as WEG2. Likewise, PM10 emissions were highest for soils classified as WEG4 and lowest for soils classified as WEG2. Thus, control measures to reduce loss of soil and PM10 should target soils classified as WEG1 and WEG4 in the county. The procedures developed in this study are applicable to any county or region within the United States.

For more information, please see the research paper on pages 321–328.