A pan-European quantitative assessment of soil loss by wind

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Wind erosion creates many problems on Europe. In **northern Europe** the problem is severe on light sandy soils(...). Wind erosion also occurs on more silt- or clay-rich soils in the drier parts of **southern Europe**, but the problem is less well researched, and probably less extensive or intense.

Source: *Wind erosion on agricultural land in Europe.* Andrew Warren, 2002
Towards first qualitative estimation of wind erosion

In 2013, the European Commission requested to the JRC a new wind erosion assessment.

LUCAS topsoil sampling

Wind-erodible fraction of soil

Index of Land Susceptibility to Wind Erosion

Borrelli et al., 2014. *Geoderma*, 232

Borrelli et al., 2016. *Land Degradation & Development*, 27

Borrelli et al., 2015. *Sustainability*, 7
Methodological approach

- Wind-erodible fraction of soil (EF) is one of the key parameters for estimating the susceptibility of soil to wind erosion
- EF computed on around 19,000 points of LUCAS survey and then interpolated (Cubist-rule based model)
- The resulting erodible fraction values ranged from 3.6% to 69.0%, with a mean value of 30% (±10.6%).
- Results were compared with local studies in Lower Saxony and Hungary

Methodological approach

• Combining spatiotemporal variations of the most influential wind erosion factors (i.e. climatic erosivity, soil erodibility, vegetation cover and landscape roughness)

GIS-RWEQ model

The first quantitative assessment at European level.

Main Factors influencing wind erosion (included in the model):

**Climate**: wind velocity & direction, Rainfall and evaporation

**Soil characteristics**: sand, silt, clay, Calcium Carbonate(CaCO3), organic matter, water-retention capacity and soil moisture

**Land use (vegetation cover)**: land use type, percent of vegetation cover and landscape roughness

**Model used**: RWEQ

The model scheme is designed to describe the daily soil loss potential at regional or larger scale

Soil loss by wind modelled for the European arable land

- The average annual soil loss predicted by GIS-RWEQ in the EU arable land totalled 0.53 Mg ha\(^{-1}\) yr\(^{-1}\)
- 2\(^{nd}\) quantile equal to 0.3 Mg ha\(^{-1}\) yr\(^{-1}\)
- 4\(^{th}\) quantile equal to 1.9 Mg ha\(^{-1}\) yr\(^{-1}\)
- Highest wind erosion rates in arable lands: Denmark, Netherlands and Bulgaria
- Noticeable rates in Eastern UK, North France, Belgium, Czech Republic, Slovakia and Hungary
- In Mediterranean, higher soil loss rates were located in the Spanish regions of Aragón, Castilla y Leon, the Italian regions of Apulia, Tuscany and Sardinia, in the Provence in France and the Greek regions of Central and Eastern Macedonia and Thrace and Aegean islands.


Borreli et al., 2017. Land Degradation & Development, 28: 335-344
INTRODUCTION

Soil erosion by wind is a prime land degradation problem (Borrelli et al., 2012b, 2015a). Wind erosion, also known as soil crusting (Borrelli et al., 2015a), synthesis that commonly occurs on agricultural lands (Borrelli and Scopelliti, 2015) and beyond in arid and semi-arid areas (Borrelli et al., 2015b). Soil erosion by wind is a major global environmental and socioeconomic concern that affects all continents, with different degrees of importance in various regions, particularly in arid and semi-arid areas (Borrelli et al., 2015b, 2015c). Wind erosion is a natural process that can be exacerbated by human activities, such as deforestation, overgrazing, and tillage practices (Borrelli et al., 2015a). The extent and severity of wind erosion depend on various factors, including climate, soil properties, vegetation, and human activities (Borrelli et al., 2015a). Wind erosion has significant impacts on soil fertility, crop production, and human health, as well as economic and social implications (Borrelli et al., 2015a). Therefore, understanding and mitigating wind erosion is crucial for sustainable land management and ecosystem health (Borrelli et al., 2015a).

TOWARDS A PAN-EUROPEAN ASSESSMENT OF LAND SUSCEPTIBILITY TO WIND EROSION

Borrelli et al. (2017) - Journal of Land Degradation
Borrelli et al. (2016) - Journal of Land Degradation
Borrelli et al. (2015) - Geoderma
Borrelli et al. (2014) - Geoderma

ABSTRACT

Wind erosion is a widespread phenomenon causing serious soil degradation in arid and semi-arid regions (Borrelli et al., 2015b, 2015c). In arid zones, the process can contribute to the desertification of the Mediterranean coast (Borrelli et al., 2015b, 2015c) and beyond in arid and semi-arid areas (Borrelli et al., 2015b, 2015c). The severe impact of wind erosion on soil and vegetation is evident across Europe, particularly in the Mediterranean region (Borrelli et al., 2015b, 2015c). Wind erosion is a major concern for land managers and policymakers, as it affects soil fertility, crop yields, and human health (Borrelli et al., 2015b, 2015c). The recognition of wind erosion as a serious problem is essential for the implementation of effective land management strategies (Borrelli et al., 2015b, 2015c). The aim of this study is to assess the susceptibility of European soils to wind erosion, providing a comprehensive assessment that can inform land management decisions and support sustainable land use practices (Borrelli et al., 2015b, 2015c). The assessment can be used to identify areas at risk, prioritize intervention strategies, and guide the implementation of effective management practices (Borrelli et al., 2015b, 2015c). The results of this study can contribute to the development of sound policies and practices for the management of wind erosion in Europe (Borrelli et al., 2015b, 2015c).