COMBINING PHYSICAL INDICATORS OF POTENTIAL LAND DEGRADATION RISK

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INTRODUCTION

This paper shows indicators of physical land degradation associated with soil erosion and salinity. We are exploring how to combine these and other data to produce synoptic predictions of the associated risks under different environmental change scenarios.

Land degradation and desertification are processes characterised by deterioration in the quality of land in terms of its capability to support land use, forms and functions. Desertification is extreme land degradation where land loses much of its natural productivity, usually associated with sparse vegetation of low biodiversity. As the soil becomes prone to erosion vegetation becomes less likely to grow back in a positive feedback loop. Usually the extremes are associated with regional and climatic changes which may threaten large areas in the Mediterranean climate region of the European Union. The DESERT risk processes have been of concern for well over a decade. In this region, it is thought that climate change compounded by changing land use is resulting in natural resources (especially water) being used unsustainably increasing both the incidence and risk of land degradation.

Some areas are more likely to degrade than others and in different ways. In some areas land degradation has been observed for some time and no mitigation action has been taken, in other areas something has been done to try and mitigate certain problems and reduce the risks. This paper does not look at the prescription what should be done where mitigation is a priority, it merely illustrates an attempt to map out the risks.

Since the early 1990s there have been numerous European Commission (EC) funded research projects that have investigated land degradation. The process is now known to be complex, socio-economics is intricately interlinked and all the various factors interact at different spatial and temporal scales. This poster is a product of some work which is trying to draw it all together and focus on the EU. It is a licenced extract from three EC funded projects; DESERTLINKS, MEDACTON, and PESERAI.

SALINISATION RISK

Soil salinisation is a process through which soil becomes more saline. This can happen in at least three ways:

1. Soil near the surface can become more saline as salt is drawn up in solution from water within the root zone.
2. Coastal flooding can cause salinisation by an influx of salt water.
3. Irrigation with slightly saline water in a way that results in significant leaching to an accumulation of saline deposits.

In general, the more saline soil is, the more limited the vegetation that it supports. Some vegetation grows better on slightly saline soils, though there are limits beyond which vegetation dies back. It is gradually being replaced by more saline tolerant vegetation. The minimum level of salinity at which most of the present ecosystem will persist, then, is the threshold above which there is land degradation risk. On the other hand, if there is a likelihood of salinisation continuing unchecked or if it is unlikely that the present ecosystem will cope, then again there is a high land degradation risk.

Satisfied soils can be treated by leaching flushing with water and by adding neutralisers to the soil. This is a remedy for cultivated land that has become salinised, but is also a way of preparing uncultivated land for production. Saline land varies in how easily and irrespectively it can be treated. Thus, in some areas, it is more likely to be the case that others it is likely to be abandoned or left unused.

Figures 3 and 4 are maps of predicted salinisation surfaces at a 5km resolution. The map is generated using available data and is based on some simplifying assumptions: Equation 1 is the formula applied to combine three variables PM, FLUX, and STDEVEL into salinity estimates. PM, FLUX, and STDEVEL into salinity estimates. Equation 1: Salinity estimation formula

\[ \text{SALINITY} = \frac{(\text{PM}) \times \text{FLUX}}{1000} \]

PM is a parent material variable. This is a simple bi-valued parent material classification based on the GLC dataset. Each 1km region was coded 1 if the main parent material could potentially be driven down into soils and 0 otherwise.

FLUX is a proxy for soil water level fluctuation driven from MARS data. For Figure 3 FLUX was calculated as follows. The water balance for each month was calculated as rainfall minus potential evapo-transpiration (PET) and then the FLUX was taken as the minimum of the maximum water balance, and the negative of the minimum water balance for the 12 month values. For Figure 4 PET was simply substituted for FLUX. The variable FLUX is responsible for the difference in the surfaces mapped in Figures 3 and 4 and STDEVEL is the standard deviation of evaporation calculated from the original OTTCPO data. The source data was projected and transformed into a 3 km resolution grid to align with the other data. From this the standard deviation of evaporation for each cell and its immediate neighbours was calculated. This makes areas at lower and therefore by Equation 1 a higher estimate of salinity. Figure 3 shows where soils are more likely to be saline naturally and especially in south Europe. These estimates are less likely to be too high in areas with a substantial rainfall in winter months because this will tend to leach out salinity accumulated in the growing season. Figure 4 shows up some other areas which may become salinised if irrigated with high salinity irrigation water. The areas which are indicated are the other areas which may become salinised if irrigated with high salinity irrigation water. The areas which are indicated are the other areas which may become salinised if irrigated with high salinity irrigation water. The areas which are indicated are the other areas which may become salinised if irrigated with high salinity irrigation water. The areas which are indicated are the other areas which may become salinised if irrigated with high salinity irrigation water.