

# Marginal soils for bioenergy production – How to identify these soils in Portugal?

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**ABSTRACT:** In the bioenergy/biorefineries sector, energy crops have achieved a relevant position as a feedstock for bio-based products, biofuels and bioenergy. To produce the energy crops, soils with low Indirect Land Use Change (ILUC) risk must be utilized, such as marginal/degraded/contaminated (MDC) soils. Locating these types of soils in any territory, region, or country is challenging. Several criteria, e.g. soil drainage, dryness, temperature, have been identified by the European Union, and allow to classify soils as marginal. Yet, the dispersed information makes the identification and selection of marginal soils a challenging process. Therefore, this study details the tools and baseline documents that can be used to identify marginal areas, presenting low ILUC risk for the cultivation of energy crops. The application of the methodology to Continental Portugal allowed to obtain a preliminary map that indicates available soils for the cultivation of energy crops.

## 1 INTRODUCTION

As energy is fundamental for the development of human life, an increasingly latent and growing need to seek alternative energy sources exists. This necessity was triggered by the current economic and social situation in Europe, with burdens related with the energetic crisis, the prevailing inflation and increase in unemployment. At the environmental level, the increase in greenhouse gases (GHG) associated with the use of fossil energy must be tackled, to meet the targets of the European Green Deal (no net emissions by 2050) (European Commission 2019). Biomass and energy crops in particular (woody, perennial and annual species, algae, Abreu et al. 2022, de Mendonça et al. 2021), can be converted into bioenergy, biofuels and bio-based products, through chemical, biological, biochemical, and thermochemical processes (Von Cossel et al. 2019b) and represent a sustainable option to reduce GHG emissions (Gomes et al. 2022a, b, Barbosa et al. 2018, Fernando et al. 2004). Yet, the increased need of biomass/energy crops, as an industrial feedstock in many applications, may cause a higher demand for land, for its cultivation, threatening the food supply, due to land use change. To reduce the fuel versus food land use competition, energy crops should be cultivated in marginal soils (Scordia et al. 2022). Indeed, energy crops are tolerant to marginality (Papazoglou & Fernando 2017, Barbosa & Fernando 2018, Fernando et al. 2018) and the burdens associated with Indirect Land Use Change (ILUC) can be avoided (Von Cossel et al. 2019a). Some types of marginal soils include those that do not compete with agriculture, such as salt-affected soils, contaminated soils (those that are polluted with toxic elements and polymetallic agents), and degraded soils (e.g. land eroded by natural factors such as climate change that cause a biological, physical and chemical change in its nature, generating soil desertification) (Abreu et al. 2020).

The identification of the marginal areas is fundamental for students, scientists, researchers, decision-makers, technicians, and beneficiaries that need to know the geolocation of suitable areas