Evaluation of the Potential of Biomass to Energy in Portugal—Conclusions from the CONVERTE Project

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Abstract: The main objective of the Portuguese project "CONVERTE-Biomass Potential for Energy" is to support the transition to a low-carbon economy, identifying biomass typologies in mainland Portugal, namely agri-forest waste, energy crops and microalgae. Therefore, the aim was to design and construct a georeferenced (mapping) database for mainland Portugal, to identify land availability for the implementation of energy crops and microalgae cultures, and to locate agricultural and forestry production areas (including their residues) with potential for sustainable exploitation for energy. The ArcGIS software was used as a Geographic Information System (GIS) tool, introducing the data corresponding to the type of soil, water needs and edaphoclimatic conditions in shapefile and raster data type, to assess the areas for the implantation of the biomass of interest. After analysing the data of interest in each map in ArcGIS, the intersection of all maps is presented, suggesting adequate areas and predicting biomass productions for the implementation of each culture in mainland Portugal. Under the conditions of the study, cardoon (72 kha, 1085 kt), paulownia (81 kha, 26 kt) and microalgae (29 kha, 1616 kt) presented the greater viability to be exploited as biomass to energy in degraded and marginal soils.

Keywords: biomass; energy crops; miscanthus; cardoon; *Paulownia tomentosa*; microalgae; marginal land; contaminated soils; geographic information systems (GIS); ArcGIS

1. Introduction

In the past few years, a significant increase in the demand for agricultural species for biofuels production that compete with the food and feed sectors have been reported, such as, starch-rich crops (corn, wheat, barley, oats as well as tubers and roots such as sweet potatoes, yams, cassava and potatoes), sugar-rich crops (sorghum, sugar beet and sugar cane) and oil-rich crops (sunflower, soybean, coconut, palm, sesame and olive), increasing the pressure on suitable soils for agriculture [1]. To avoid the risk of conflicts on land use due to competition for food and feed, it is necessary to limit and even prohibit the use of land presenting high carbon stock for the implementation of non-food crops or directed to the production of energy. The greater relevance is to utilize uncultivated land (or wasteland) and degraded soils that are not implemented in conventional agriculture [2].

Portuguese Decree-Law n. 152-C/2017 (created from European Directive 2015/1513), highlights the need to reduce the use of conventional biofuels obtained from food raw materials and from species grown on agricultural land or land with a high organic load. Another principle is to encourage