

ENVIRONMENTAL IMPACTS OF REGIONAL BIOMASS CHAINS

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ABSTRACT: During the last few years, sustainability issues related to bioenergy production has increasingly become a point of discussion in scientific, societal and political arenas. The objective of this work is to develop an integrated multidisciplinary approach to assess the environmental impacts of biomass supply chains at a regional level taking the spatial heterogeneity of the physical context into account. This study focuses on the green house gas balance of regional bioenergy chains and the impacts on soil, water and biodiversity as a consequence of land use changes in favour of bioenergy production. Ethanol production from first and second generation energy crops in the North of the Netherlands is used as a case study to demonstrate the methodology. The region specific assessment of the spatial distribution of environmental impacts will be mapped using Geographical Information System (GIS). This results in a quantitative and integral view of the threats and opportunities of increased implementation of biomass supply chains.

Keywords: Environmental impacts, Regional, Bioethanol, Land use, Geographical information system (GIS)

1 INTRODUCTION

During the last few years, sustainability issues related to biomass production and use for energy has increasingly become a point of discussion in scientific, societal and political arenas. However, initiatives regarding formulation of codes of conduct are mainly developed in a general and top down approach and are not differentiated for region specific circumstances. The objective of this work is to develop an integrated multidisciplinary approach to assess the environmental and socioeconomic impacts of biomass supply chains at a regional to local level taking the spatial distribution of production and use into account. This results in a quantitative and integral view of the threats and opportunities of increased implementation of biomass supply chains.

2 METHODS

Several potential bioethanol production routes from crops cultivated in the North of the Netherlands will be used as a case study to assess spatial environmental impacts of regional bioenergy chains. In earlier research, the economic viability of bioenergy cropping systems based on soil suitability had been used to map potential land use changes in GIS for the North of the Netherlands. These maps combined with existing infrastructure and logistic routes are used to determine possible locations of ethanol production plants and transport routes. The potential spatial implementation of the bio ethanol production chains is the starting point for the environmental impact assessment. Region and location specific characteristics will be incorporated in the assessment of consequences of land use change and the life cycle assessment in order to determine the local and regional environmental impacts like emissions to water, soil and air; energy use; water use; soil erosion and biodiversity. A multi criteria analysis will be applied to integrate the various quantitative impacts to an overview and evaluation of the sustainability several bioenergy supply chains. Weight factors can be allocated in order to indicate priorities of mitigating impacts.

3 RESULTS

The location specific assessment of environmental performance will result in a spatial distribution of environmental impacts that will be mapped in GIS maps. The spatial distribution of environmental impacts and economic viability are key parameters to evaluate the sustainability of biomass supply chains. The multi criteria analysis and priority settings related to the mitigation of impacts facilitate in selecting suitable chains for implementation in the region. Therefore, spatial information on environmental impacts and economic viability is essential for (regional) policy makers for bioenergy and spatial planning.