Session 1.1. Biomass potential and mobilisation

Renewables Landbank: Assessing the potential of Scottish non-agricultural land for sustainable bioenergy production

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In the context of the food fuel water security nexus and recent concerns surrounding the land use change, both direct and indirect as a result of bioenergy production on agricultural land, it is increasingly necessary to gain a better understanding of the non-agricultural land resources that exist. The aim of the renewables landbank project is to investigate the area and spatial distribution of non-agricultural land available for bioenergy provision in Scotland. A GIS-based methodology was utilised to ascertain the theoretical, technical and realistic non-agricultural landbank. A spatial database containing brownfield land, licensed and historic landfill sites has been compiled, enabling a better understanding of the national distribution of non-agricultural areas. A multi-criteria evaluation was undertaken, applying a number of ecological, agrotechnical and topographic constraints, in order to identify the technical potential of this landbank. Ultimately it is hoped this research will identify a more realistically implementable landbank for bioenergy production, and future work will aim to compare the landbank with other spatial indicators such as heat demand.

The Scottish Government has set ambitious targets of generating 11% of heat demand from renewables by 2020, four times the current levels being met[1]. With such targets in mind, this project aims to determine the collective area of non-agricultural land that might be available for bioenergy production. Encouragingly the 2013 Vacant and Derelict Land Survey indicates that there are 11,114 ha of vacant and derelict land or 'brownfield' land. Furthermore Scotland's Zero Waste Plan has set a goal of no more than 5% of waste to landfill by 2025, which would lead to the closing of four out of five landfills. It is hoped that further suitable land area could be derived from other forms of derelict, underutilised and neglected (DUN) land[2].

An extended understanding of locality and distribution is especially important when assessing potential sites for bioenergy provision. The sustainability of bioenergy is heavily impacted by factors such as distance from point of use, and potentially overlooked small sites could be deemed usable if located within a close proximity to clusters of other identified areas. The investigation's GIS methodology is based on an adaption of Voivontas et al's[3] categorisations of potential. Initially the theoretical landbank, the hypothetical maximum amount of land available, took the form of a spatial database of non-agricultural land in Scotland. This involved the compilation of data sets for vacant and derelict land, licensed landfills and historic landfills from various local authorities and the Scottish Environmental Protection Agency (SEPA). In many cases site boundaries had to be manually drawn using satellite imagery. Having built up a spatial database representing the theoretical landbank, it was then possible to identify clustering of sites which may be 'sweet-spots' for bioenergy production. A multi-criteria evaluation was then carried out, applying a number of ecological, agrotechnical and topographic constraints, in order to identify the technical potential of this landbank. The realistic potential of these sites will be assessed according to how likely they are to be mobilised for bioenergy use when factors such as environmental protection and competing land use are included.

With the sustainability of biomass production on agricultural land increasingly questioned due the impact this has on the food fuel water security nexus, the identification of DUN land for renewable energy provision could unlock a number of benefits. The use of non-agricultural land would avoid conflict with global food production and the related direct and indirect land use change, therefore also avoiding the carbon debt that displacing agricultural land entails. Further advantages of utilising DUN land for bioenergy include remediation of brownfield sites and the subsequent social, environmental and economic benefits this may have for the surrounding community. Bioenergy potential studies in the literature predominantly focus on a top-down raster based GIS approach which identify a large quantity of land but often problematically still include agricultural areas. Recent attempts to locate 'marginal' land for bioenergy use, often with ambiguous definitions and changing terminology, continue to include agricultural areas. This project aims to provide the first national study of non-agricultural land availability for bioenergy provision, and in doing so hopes to identify a more realistically implementable landbank.

The initial investigation enabled the compilation of a complete set of boundaries of sites covering 11,114 ha as reported in the Scottish Vacant and Derelict Land Survey. The total amount within the spatial database of non-agricultural land was then increased >50% with the identification, digitisation and inclusion of SEPA licensed and historic landfill sites. These sites are predominately clustered around the post-industrial central belt and East Coast of Scotland, well located to potentially provide low carbon, affordable energy to centres of use. The distribution of DUN land can now be evaluated in relation to other spatial indicators such as heat demand, with the aim of finding clusters of sites close to centres of need.

[1] Scottish Executive (2011). 2020 Routemap for renewable energy in Scotland. Edinburgh: Scottish Government.
[2] Northwest Development Agency, The Forestry Commission (2002). The Derelict, Underutilised and Neglected Land Survey in the Northwest.
[3] Voivontas, D., Assimacopoulos, D., & Koukios, E. G. (2001). Aessessment of biomass potential for power production: a GIS based method. *Biomass and Bioenergy*, *20*, 101–112.