Application of GIS-BIOLOCO for design and assessment of biomass delivery chains

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Introduction

The spatial fragmentation of different biomass sources makes design and assessment of sustainable biomass delivery chains rather complicated. This poster presents a GIS-BIOLOCO tool that enables the design and facilitates a sustainability assessment of biomass delivery chains at a regional level, in terms of the regional availability of biomass resources, costs, logistics and spatial and environmental implications.

The BIOLOCO model optimizes chain designs to a set of pre-defined economic and GHG efficiency targets. The combination of BIOLOCO with GIS makes it possible to:

1) **compute more accurately the expected supply of biomass in a certain region**
2) **compute more accurately the transportation distances and related costs**
3) **to assess the spatial impacts of the feedstock subtraction of different chain designs on land use, environment, landscape and biodiversity.**

Methodology

5 steps:

1) Map of maximum biomass potential

2) Chain specification:

- The conversion unit which is specified technically, economically, per biomass type and quantity
- The supply network which is characterized according to biomass sources, collection points and conversion units

3) Optimization of the chain

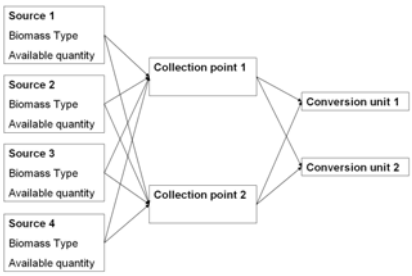
Optimization is possible on, i.e. economics, logistics or emissions from transport. Result is an optimum chain and a corresponding feedstock subtraction pattern, feedstock mix and amount and transport distance.

4) Spatial implementation

When type and substracted amount of biomass per grid cell are given by BIOLOCO the biomass allocation pattern within a grid cell is determined. This can be done by taking several factors into account; e.g. soil, climate, environmental and ecological constraints.

5) Regional environmental assessment

Once the exact biomass allocation pattern is known environmental assessments can be done: GHG-balance, effects on water, soil, landscape and biodiversity can be done.



Network design with GIS input:

On biomass supply map a grid structure is applied. Per grid (15*15 km) the different Sources are assessed in relation to:

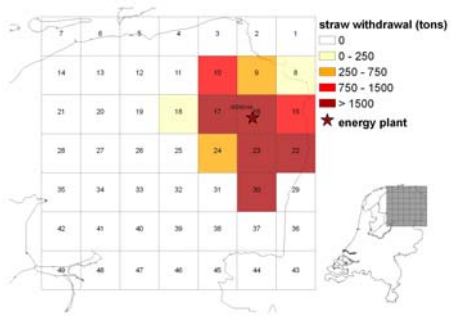
1) the amount of biomass per type
2) the purchase price
3) the distance to Collection Points and Conversion Units
4) Pretreatment needs

Evaluation biomass chain:

Feedstock to electricity	Straw	Willow
Transport costs (€)	30	46
Storage costs (€)	204	89
Pre-treatment costs (€)	308	2432

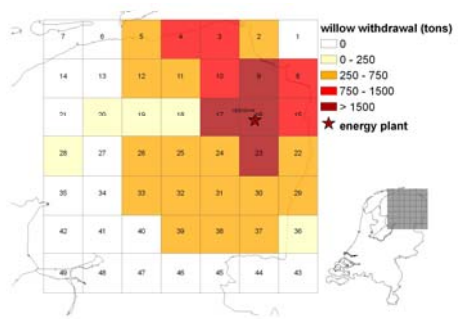
Case study 1: Straw to electricity

Based on a maximum straw supply map GIS-BIOLOCO optimizes the chain for the profit margin and generates a straw subtraction pattern. The subtraction pattern of the straw is fairly condensed and located in the direct vicinity of one conversion unit. In competition with this unit a second conversion unit was not economically viable.



Case study 2: Willow to electricity

When using willow as feedstock, again only one conversion unit is economically viable. The feedstock subtraction pattern, however, is more spread out resulting in higher transport costs and related GHG emissions.



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