

Biofuel plantations and isoprene emissions in Svea and Götaland

Introduction: Short Rotation Coppice (SRC) such as willow and poplar as bioenergy crops are mainly used for heat and energy production in heat and power plants (CHP). They proved to have climatic, biodiversity and environmental benefits. Their life cycle starts at any time in July. They are cultivated mostly on agricultural land. Harvest starts in winter after 3-4 years (4 growing seasons). Renewable energy in Sweden forms 50.6% of the total energy use. Bioenergy forms 33.6% of that figure. Willow chips produced 0.55 TWh in 2013.

Problem: Land Cover Change (LCC) from agriculture land into SRC. SRC are isoprene emitters. Isoprene leads to changes in air chemistry and formation of Ozone, once it interacts with Nitrogen dioxide (NO₂) pollutant that >1.88 ug/m₃ level.

Objective: is to map the temporal and spatial development of willow, poplar 2001-2014 in Svealand and Götaland regions. To Analyze their distribution and fields size, to quantify LCC from forest/agriculture land into SRC. And to quantify isoprene emissions from SRC yearly. This study was premised on three hypotheses testing.

Methodology: Different GIS analysis tools was carried out to meet the objectives using ESRI ArcGIS software.

Results

- The areas used for willow and rapeseed plantations increased between 2002-2008 and declined between 2008 -2014
- An increase in the number of small fields (<= 6 ha) and removing large fields
- LCC occurred on non-irrigated arable land, 24,000 ha used in 2002, 9000ha in 2014, forest land usage for SRC increased in 2014
- SRC produces 0.85TWh for 9000 ha, rapeseeds produces 4.9TWh for 90,000 ha
- 130 tons of isoprene released from a 9000 ha of SRC in 2014, 15 tons from agriculture
- Isoprene from SRC forms 0.05% of the total isoprene in Sweden, mostly located in sites where NO₂ levels are >1.88 ug/m₃, sufficient for Ozone.
- Size of potential suitable sites for willow expansion on agriculture land are 300,000 ha where NO₂ levels are <1.88 ug/m₃, would produce 29TWh. That increases isoprene from willow to 0.7% of the total emissions

Keywords

Geographical Information Systems (GIS), Short Rotation Coppice (SRC), Isoprene, Nitrogen dioxide (NO₂), Biofuels

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