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GIS-BASED location optimization of a biomass conversion plant on contaminated willow in the Campine region (Belgium)

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Abstract

The Campine region In the North-Eastern part of Belgium is diffusely contaminated with heavy metals like cadmium. Since traditional excavation techniques are too expensive, phytoremediation is preferred as a remediation technique. In a prior study (Schreurs et. al. 2011), the biomass potential from phytoremediation using willow in short rotation of the contaminated agricultural land in the seven most involved municipalities was assessed.

The current paper uses GIS-knowledge to investigate which of three previously identified locations is most suitable for a biomass plant, taking into account the spatial distribution of the contaminated willow supply and the total cost of willow transport. Biomass transport distance from the centroid of each contaminated agricultural parcel to each of the three potential biomass plant locations was determined following Euclidian distance calculations and distance calculations over the existing road network. A transport cost model consisting of distance fixed and distance dependent biomass transport costs were developed. Of the locations identified the Overpelt Fabriek site results in the lowest biomass transport distance and costs. When willow allocation for each parcel occurs based on the nearest potential plant location, transport costs are on average 23% lower than when all biomass is transported to the single Overpelt Fabriek site location. Therefore, when only considering transport costs, installing a smaller plant at each of the three potential plant locations would be less expensive than when installing a single biomass plant at the Overpelt Fabriek site. Current research investigates whether the presumption that economies of scale in investment and operational costs for a single biomass plant (converting willow to bioenergy based on pyrolysis) would outweigh the higher biomass transport costs is valid.