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Finding robust strategies to overcome biomass supply risks

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The aim of this paper is to develop and evaluate innovative strategies in order to overcome biomass supply problems and to increase the competitiveness of wood based energy production. Potential impacts of the socio-economic, political and ecological environment on future demand and the supply situation are scanned by means of portfolio and risk analyses. Based on a SWOT-strategy development process preventative and coping strategies are formulated. A holistic evaluation of the developed strategies by stakeholders of the whole biomass supply chain, including competing industries (i.e. bioenergy, pulp and panel industry) is performed by applying a standardized group decision process (Analytic Hierarchy Process) and reveals the most promising, robust strategies. The applied strategy development and evaluation process was well accepted by the stakeholders, with them cooperating in a constructive manner and engaged discussions. The proposed strategy development process and the portfolio of the top ranked strategies is a research contribution which facilitates both; the wood based bioenergy production in increasing supply security, and further research focusing on strategic issues of the forest fuel supply chain. Furthermore, the portfolio of the top ranked strategies assists relevant bioenergy stakeholders (e.g. investors, feedstock procurement managers and government agencies) in making strategic decisions with regard to investment, biomass supply and policy.

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Application of treated wastewater and digested sewage sludge to obtain bioenergy from energy crops

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B ioenergy is renewable energy made available from materials derived from biological sources and is widely used for heat and power. It currently provides more than 60% of renewable energy sources (RES) in Europe (including biomass and biofuels), and is one of the key primary energy sources for 20% RES target in 2020. A significant proportion of the current bioenergy is based on energy crops as well as of the biogenic fraction of municipal and industrial waste. The terms "biomass" and "biofuels" refers to organic matter that has stored energy through the photosynthesis process. Waste from wastewater treatment plants (WWTP) for *Cynara cardunculus L. or Helianthus annuus L.* production may be a viable solution to obtain bioenergy. The study achieved two objectives: firstly, to assess the agronomical viability of waste from the Alcázar de San Juan WWTP in central Spain (wastewater and sludge) for energy crops production; secondly, the use of biomass and biofuel from *Cynara cardunculus L. and Helianthus annuus L.* grown in this way to obtain energy. Five study plots (10 m x 10 m: 100 m²) for each crop were set up on agricultural land near the Alcázar de San Juan WWTP. Five fertilizer treatment types were considered: drinking water taken as the control, treated wastewater, 1 t ha⁻¹ of air-dried sewage sludge, at tha⁻¹ of air-dried sewage sludge and 0.7 t ha⁻¹ of commercial inorganic fertilizer. The soil, irrigation water, sewage sludge, heating values (higher heating value and lower heating value) of the biomass and fatty acid composition of achenes oil were monitored. Sewage sludge from the Alcázar de San Juan WWTP was suitable for use as an energy crops fertilizer. However precaution should be taken when irrigating with wastewater because of high salinity.

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