

Lignin-first biorefining of Nordic poplar produces cellulose fibers which could displace cotton production on agricultural lands

Background

- Today's cotton fiber production requires substantial amounts of fertilizer and irrigation on arable lands around the world
- Climate-adapted woody feedstocks capable of growth on marginal lands could change land-usage for textile manufacturing to enable land reclamation and water savings from cotton back to food production

Approach

- This work examined the impacts of regenerated cellulose fibers from poplar grown on marginal boreal lands as a replacement for cotton fibers
- Life cycle assessment (LCA) was used to estimate the benefits of using a “lignin-first” approach using reductive catalytic fractionation (RCF) to make cellulosic textile fibers along with lignin-derived biofuels from poplar hybrids adapted for growth on marginal lands

Results

- LCA estimates that the textile fiber production from poplar grown in northern Europe marginal lands can substitute 42% of global cotton production and add 5.2 million cubic meters of biofuel annually
- Replacing a portion of cotton fiber with cellulose fiber from north European poplar plantation has the potential to free up 14.5 million hectares of fertile agriculture land for food production

Significance

- This work demonstrates potential for holistic biomass conversion and poplar farming on marginal lands for multiple sustainability benefits including both biomaterials and biofuels product streams

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