Bilevel Programming Representation and Analysis of Timberland Supply Chains for Biorefineries

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Recently, the timber processing industry has shown interest in pursuing biofuels as a new avenue of production. The economic analysis of the current timberlands system will verify the economic feasibility of biorefinery investments. Harvest restrictions create limitations on materials for manufacturers; new infrastructure introduces additional competition for supply. Collaboration with timber company Weyerhaeuser led to using Stackelberg games and bilevel programming in the initial modeling of interactions between harvesters and pre-existing manufacturers. Bilevel problems are commonly solved by combining the top level with optimal conditions of the bottom level. The introduction of biorefineries adds another level to the system, creating a trilevel program, a problem much more difficult to solve. To reduce the complexity, the initial bilevel results are compared to the results of a single level model, which retains the constraints of the bilevel model but assumes that decision makers aim to maximize a common objective. Assessment of results will determine the feasibility of combining the existing structure into one decision making unit.