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CARBON SEQUESTRATION POTENTIAL OF BIOMASS-BASED PRODUCTS: A SYSTEM DYNAMICS MODELING APPROACH FOR GRASSLAND MANAGEMENT

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Abstract – It is known that forests are significant carbon storage, as well as harvested wood products. Both sectors are included in the national greenhouse gas inventories. When wood or other types of biomass grow, it absorbs carbon dioxide through photosynthesis. If biomass is used in the production of new products, the carbon stored in them is effectively removed from the atmosphere and held in the product. Carbon stored in products is considered temporary because the products eventually will burn or decompose and release carbon dioxide back into the atmosphere. However, when products are used for long-lasting applications, the carbon stored in them can remain sequestered for many decades, which can significantly contribute to climate change mitigation. If it is possible to store carbon in wood products, the question arises as to whether it is also possible to promote carbon sequestration in products with other types of biomass. In this work perennial biomass was analyzed. It is a product of semi-natural grasslands, where grass cutting is necessary, which produces grass biomass that is often not fully used. A literature analysis was performed to select suitable products with different carbon storage periods and minimal production emissions, such as those made from biorefining, boards for packaging or building materials, and biochar for soil carbon sequestration. A system dynamics model was developed to estimate carbon stocks and flows between atmosphere, living biomass and products. The base scenario is modeled according to carbon flows in grasslands according to IPCC guidelines – grasslands are net carbon sources and the carbon concentration in the atmosphere only increases. The addition of a product-manufacturing scenario decreases the carbon concentration in the atmosphere.

Keywords –Carbon cycle; carbon dioxide; hay biomass; greenhouse gases; value-added products