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# BIOFUELS AND BIOENERGY

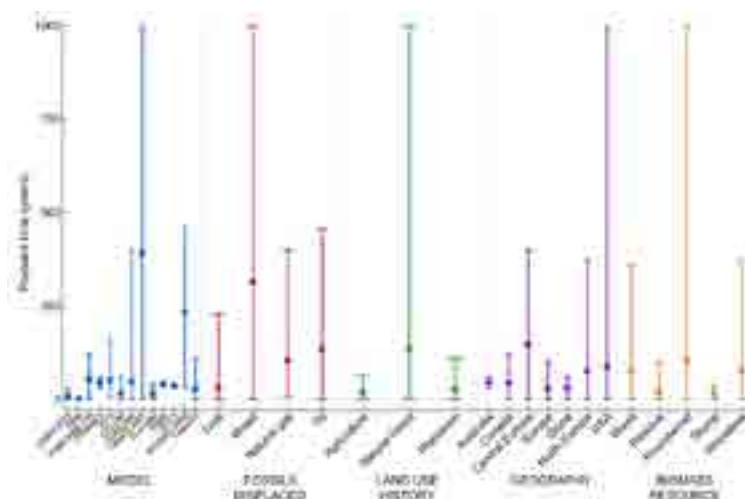
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## Carbon debt of forest bioenergy: Fact or fantasy?

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In later years the potential contribution of forest bioenergy to mitigate climate change has been increasingly questioned due to temporal displacement between CO<sub>2</sub> emissions when forest biomass is used for energy and subsequent sequestration of carbon in new biomass. Also disturbance of natural decay of dead biomass when used for energy affect the carbon dynamics of forest ecosystems. These perturbations of forest ecosystems are summarized under the concept of carbon debt and its payback time. In the vast body of literature one can find support for almost any view on the climate impact of forest bioenergy, from being instantly beneficial to analyses showing that it will not in the next 10,000 years contribute to global warming mitigation. The objectives of the paper is to identify patterns and commonalities in assumptions and outcomes across the current scientific literature on forest bioenergy, carbon dynamics and global warming mitigation potential and to identify factors influencing carbon debt and payback times of energy production based on forest biomass. Binary recursive partitioning was used for pattern search. Partitioning is a multivariate non-parametric procedure that recursively partitions data to find groupings in predictor variables that best predicts a response variable. Partitioning does not require prior knowledge of distributions, models and interactions. The meta-analysis confirms that the outcome of carbon debt studies lie in the assumptions and find that methodological rather than ecosystem and management related assumptions determine the findings. The study implies that at the current development of carbon debt methodologies and their lack of consensus the concept in itself is inadequate for informing and guiding policy development. At the management level the carbon debt concept may provide valuable information directing management principles in more benign climate directions.



## Biography

Niclas Scott Bentsen is an Associate Professor at Department of Geosciences and Natural Resource Management, University of Copenhagen, Denmark. With a background in Forest Engineering, his research focuses on quantifying agriculture and forest biomass resources, on resource allocation in energy systems and on sustainability of bioenergy with emphasis on carbon dynamics and climate impacts.

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