The Role of the Forest in Climate Policy

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Akademisk avhandling

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Abstract
In **Paper [I]**, I develop the FOR-DICE model to analyze optimal global forest carbon management. The FOR-DICE is a simple framework for assessing the role of the boreal, tropical, and temperate forests as both a source of renewable energy and a resource to sequester and store carbon. I find that forests play an important role in reducing global emissions, especially under ambitious climate targets. At the global level, efforts should focus on increasing the stock of forest biomass rather than increasing the use of the forest for bioenergy production. The results also highlight the important role of reducing tropical deforestation to reduce climate change.

In **Paper [II]**, I develop the FRICE to investigate the role of two key efforts to increase the stock of forest biomass, namely, afforestation and avoided deforestation. FRICE is a multi-regional integrated assessment model that captures the dynamics of forest carbon sequestration in a transparent way and allows me to investigate the allocation of these actions across space and time. I find that global climate policy can benefit considerably from afforestation and avoided deforestation in tropical regions, and in particular in Africa. Avoided deforestation is particularly effective in the short run while afforestation provides the largest emissions reductions in the medium run. This paper also highlights the importance of not solely relying on avoided deforestation as its capacity to reduce emissions is more limited than afforestation, especially under more stringent temperature targets.

In **Paper [III]**, we investigate how uncertainties linked to the forest affect the optimal climate policy. We incorporate parameter uncertainty on the intrinsic growth rate and climate effects on the forest by using the state-contingent approach. Our results show that forest uncertainty matters. We find that the importance of including forest in climate policy increases when the forest is subject to uncertainty. This occurs because optimal forest response allows us to reduce the costs associated with uncertainty.

In **Paper [IV]**, we explore the implications of asymmetries in climate policy arising from not recognizing forest carbon emissions and sequestration in the decision-making process. We show that not fully including carbon values associated with the forest will have large effects on different forest controls and lead to an increase in emissions, higher carbon prices, and lower welfare. We further find, by investigating the relative importance of forest emissions compared to sequestration, that recognizing forest emissions from bioenergy and deforestation is especially important for climate policy.

Keywords
climate change; integrated assessment; forest carbon sequestration; forest bioenergy; avoided deforestation; afforestation; uncertainty; dynamic modeling; DICE; RICE

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