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Multi-purpose afforestation scenarios under climate change for carbon dioxide reduction

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This study aims at identifying the carbon dioxide reduction (CDR) potential of large-scale and multi-purpose afforestation/reforestation at the global level with special emphasis on the Mid-Latitude Region (MLR). Applying a combined remote sensing/GIS approach coupled with biophysical forest and disturbance modeling under various climate change scenarios, we identify potential afforestation locations, inter-alia on abandoned agricultural land and on areas burnt from wild land fires. With the help of IIASA's biophysical global forestry model (G4M), we calculate the associated land-based CDR potentials through carbon sequestration in afforested biomass and through climate risk-resilient and sustainable forest management dedicated to the supply of bioenergy plants coupled with carbon capture and storage (BECCS) facilities. Finally, three promising scenarios have been identified including I) afforestation; II) reforestation; and III) BECCS. In all scenarios, priority is put on sustainable forest management and nature/biodiversity conservation. Forest modeling results have been combined with recent data sets which have been overlayed in order to provide a unique basis to estimate the land-based CDR technologies' potential to mitigate climate change and contribute to reaching the goals of the Paris Agreement. In the case of afforestation, preliminary results indicate a total potential afforestation area greater than 1 billion ha. The largest area potential for afforestation have been identified in the USA. Given the higher productivity (combined with large area available), Brazil is the country with the highest total CDR potential of close to 500 MtC/yr.