



Research Postgraduate Student Oral Presentation

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Date : 20 October 2020, Tuesday
Time : 10:00 a.m.
Venue : The presentation will be conducted via Zoom.
<https://hkbu.zoom.us/j/91651011742>



Can Carbon-Subsidized Afforestation Compete with Crop Production? A Case Study of China

Abstract

Afforestation projects in China have substantially contributed to national CO₂ sequestration and play an important role in international climate change mitigation. However, these nation-wide afforestation projects are usually funded by the national government, with very large and unsustainable investments. It is important to find alternative sources of funding to finance afforestation, and convince poor farmers to become involved in afforestation projects. Carbon-subsidized afforestation could be the choice.

The current study aims to find out i) whether farmers need additional subsidies to reforest their marginal farmland; if so, ii) whether the value of carbon sequestration of afforestation can offset farmers' net costs. To do this, first I determine the amount of carbon sequestration through afforestation. Second, I assess the value of carbon sequestration and the costs and benefits of afforestation projects. Third, I investigate the optimal rotation period of the plantations considering a joint production of timber and carbon, for different species.

Results show that total carbon sequestration by tree biomass and soil carbon following afforestation differs among tree species and stand age as well as across regions. Economic trees sequester less carbon than ecological trees and bamboo. Among economic trees, nut trees with an inedible hard shell sequester more carbon than fruit trees. The regional context significantly influences the carbon sequestration potential, with more carbon sequestered in southern and eastern regions than in northern regions. Bamboo also shows a remarkable carbon sequestration potential, which is even greater than Chinese fir and Poplar in northern regions.

Although afforestation programs have huge potential to store carbon, the voluntary acceptance by landowners crucially depends on their economic outcome. Usually carbon credits can compensate for the opportunity costs of alternative land uses, except i) for afforestation on highly profitable cropland for which carbon credits are insufficient, and ii) for afforestation on cropland that generates low incomes, for which carbon credits are not needed. Fruit trees are the most cost-effective option for afforestation. Bamboo afforestation is economically attractive if carbon revenues are included. The minimum price of carbon credit decreases with increasing project duration because more carbon is stored when time increases. This does not hold for fast-growing trees like Eucalyptus, for which the minimum price increases with extended project duration.

Given the temporal variations of joint production of timber and carbon sequestration, the carbon accounting regimes (tCER, temporary Certified Emission Reductions and ICER, long-term Certified Emission Reductions) have a significant impact on the optimal rotation as well as on the revenue calculations. Forest managers have an incentive to apply tCER accounting to finance slow-growing plantations, and ICER for fast-growing ones. A sensitivity analysis detects the changes of rotation period with different carbon prices and discount rates. While the optimal decision for slow-growing species (e.g. Chinese fir) is highly sensitive to changes in both variables under tCER accounting, the results concerning fast-growing species (e.g. Eucalyptus) are most sensitive under the ICER accounting regime. In contrast, carbon revenues have a minimal impact on the optimal rotation of Poplar plantations, no matter which regime is applied.

To conclude, carbon-subsidized afforestation is a feasible way to offset the opportunity costs of retired farmland and support the livelihood of farmers. The findings can contribute to the efficient and sustainable management of carbon sequestration forestry projects, while the methodology can also be applied to other regions in the developing world.