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Biomass Potentials in Different Maintenance Scenarios of Satoyama Woodlands

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Woodlands near human settlements often have long histories of providing people with fuelwood and other organic materials. In Japan, these woodlands are called satoyama. While satoyama woodlands were historically coppiced to provide an essential source of fuelwood, many have been developed into residential areas as a result of the introduction of fossil fuels beginning in the 1960's. Remaining satoyamas were simply abandoned due to the loss of economic value from fuelwood. This has resulted in a loss of other satoyama-related functions such as their ecological function. In response to the abandonment of satoyamas, thousands of volunteer groups have formed since the 1990's to restore satoyama woodlands. However, in spite of the importance of grassroots volunteers, their actual activities are limited in spatial extent due to shortages of manpower, time, and maintenance skill. This suggests that more substantial incentives are necessary, if maintenance of satoyama woodlands is to be extended.
This study focused on an increased attention of biomass enegy utilization from satoyama trees as a promising incentive, and estimated biomass potentials in different maintenance scenarios of satoyama woodlands through a case study site in peri-urban Tokyo. This study set four maintenance scenarios; a) ground cover removal, b) light-thinning, c) intensive-thinning, and d) rotational coppicing. Based on the scenarios, the amount of biomass obtained, bioenergy generated, and carbon reduced were estimated respectively by the combination of conducting tree measurement and applying a long-term forest dynamics estimation model. Since there is tradeoff between CO_2 reduction through woodenergy utilization and CO_2 fixation by standing trees, these two variables were analyzed in tandem. The scenario that produces the most woody biomass was rotational coppicing, the maintenance scenario which also mimics historical management regimes. Despite the lowest potential of CO_2 fixation by standing trees, the best scenario to reduce carbon was also rotational coppicing, due to the highest potential of CO_2 reduction by woodenergy utilization.
The result suggests that rotational coppicing, which mimics historical management, can also serve contemporary ends. Rotational coppicing can be promoted from the policies related to carbon reduction, but at the same time, further studies for clarifying the optimum degree of human disturbance (e.g. frequency of tree cutting, groundcover removal) are necessary to avoid negative impacts to forest ecosystems.