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Title	Sustainable forest management and bioenergy expansion : A multi-scale approach from global to local [an abstract of dissertation and a summary of dissertation review]
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Degree Grantor	北海道大学
Degree Name	博士(環境科学)
Dissertation Number	乙第6986号
Issue Date	2016-03-24
Doc URL	https://hdl.handle.net/2115/62091
Rights(URL)	https://creativecommons.org/licenses/by-nc-sa/2.1/jp/
Type	doctoral thesis
File Information	Florian_Kraxner_abstract.pdf, 論文内容の要旨



学 位 論 文 内 容 の 要 旨

博士 (環境科学)

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学 位 論 文 題 名

Sustainable forest management and bioenergy expansion

-A multi-scale approach from global to local-

(持続可能な森林管理とバイオマスエネルギーの拡大

—全球から地域までの多規模アプローチ—)

Integrated assessment modeling scenarios in which dangerous climate warming is limited to 2°C by the end of this century, expect bioenergy to contribute between 100-300 Exajoules to the global energy portfolio - per year, by 2050. Such scenarios include large-scale deployment of bioenergy and their combination with carbon capture and storage (BECCS) as a possible negative emissions technology. Substantial impact on direct and indirect land use change is to be expected. This thesis shows biomass feedstock and bioenergy assessments at global, regional and local scales. The study argues that only the integration of multi-level assessments using top-down and bottom up approaches will help identify realistic bioenergy potentials at high geographic resolutions. While demand figures from Integrated Assessment Models serve as targets, the combination of biophysical and economic land use models can help breaking down the target figures from the IAMs into realizable and sustainable potentials on the ground. This thesis goes all the way from global bioenergy feedstock assessment under different protection and conservation scenarios to a conservative and environmentally sound assessment of bioenergy potentials on regional levels. The study concentrates on Korea and Japan. Finally, the regional assessment is completed with a field study – type analysis in rural Japan where the public opinion is investigated with respect to sustainable forest management, forest certification and forest-based bioenergy. The local results are then put into perspective vis-à-vis lessons learned from Austria which is a good example to compare Japan to because of a similar forest and geographical situation. The study finds that sustainable forest management is key for a bioenergy-driven rural revitalization strategy. Especially, investment in forest infrastructure is among the main elements to ensure competitive harvesting costs in

mountainous areas. Sustainable forest management (SFM) based on forest certification ensures that economic and environmental goals can be achieved in unison. It is concluded that while many factors are similar between Japan and Austria, public support differs between the Japanese regions which indicates that different bottom-up measures including capacity building and awareness raising need to be developed corresponding to the different contexts. Local sustainably realizable bioenergy potentials that can contribute to mitigate climate change depend to a substantial extent on the public opinion and support.