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Predicting and Assessing Natural Capital and Ecosystem Services through an Integrated Social- Ecological Systems Approach (PANCES)

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This project developed an integrated model of socio-ecological systems to enable comprehensive analysis of natural capital and ecosystem services from both social and ecological perspectives. This integrated model consists of co-designing future scenarios, translating scenario narratives into simulation models of population distribution and land use/cover, and assessing and projecting ecological and socio-economic values of terrestrial and marine natural capitals and ecosystem services as well as inclusive wellbeing. Key policy options were incorporated into each scenario to assess effectiveness and tradeoffs of different options through scenario comparison.

To explore plausible “futures” of Japan up-to 2050, four scenarios were identified as “natural capital-based compact society (NC),” “natural capital-based dispersed society (ND),” “produced capital-based compact society (PC)” and “produced capital-based dispersed society (PD).” In a compact society with produced capital, for example, policies will be enhanced to promote increased imports of agricultural products and timber, centralised use of energy and heat, and horticulture driven by advanced technology. On the other hand, in a dispersed society with natural capital, it is important to promote self-sufficiency in food and timber, and ecosystem-driven disaster risk reduction and management on abandoned farmland.

A population distribution model and land-use model were developed to correspond to the storylines of the four future scenarios at the national level. These models enable projection and estimation of the effectiveness of policies on terrestrial and marine natural capital and ecosystem services under the future scenarios.

Most terrestrial ecosystem services were projected to decrease by 2050 in all scenarios. Differences in trends between regions were often greater than differences between scenarios. For rice yield and cultural services (camping, hiking and field education), the difference between natural-capital-based and produced-capital-based (NC/ND vs PC/PD) was often more important. Whereas, for timber production potential (Japanese cedar and Japanese cypress), the difference between compact society and dispersed society (NC/PC vs ND/PD) was often more important.

According to the scenario analysis for marine ecosystem services, most marine ecosystem services will follow a downtrend or remain unchanged regardless of the scenario adopted, except that the impact of disasters will be alleviated. However, a few local areas show an opposite trend: in an extreme case scenario, ecosystem services might even increase in the future. The study revealed a substantial impact of climate change on kelp seaweed beds in Northern Japan, with the possible loss of many existing species under a scenario supposing a significant rise in sea temperatures.

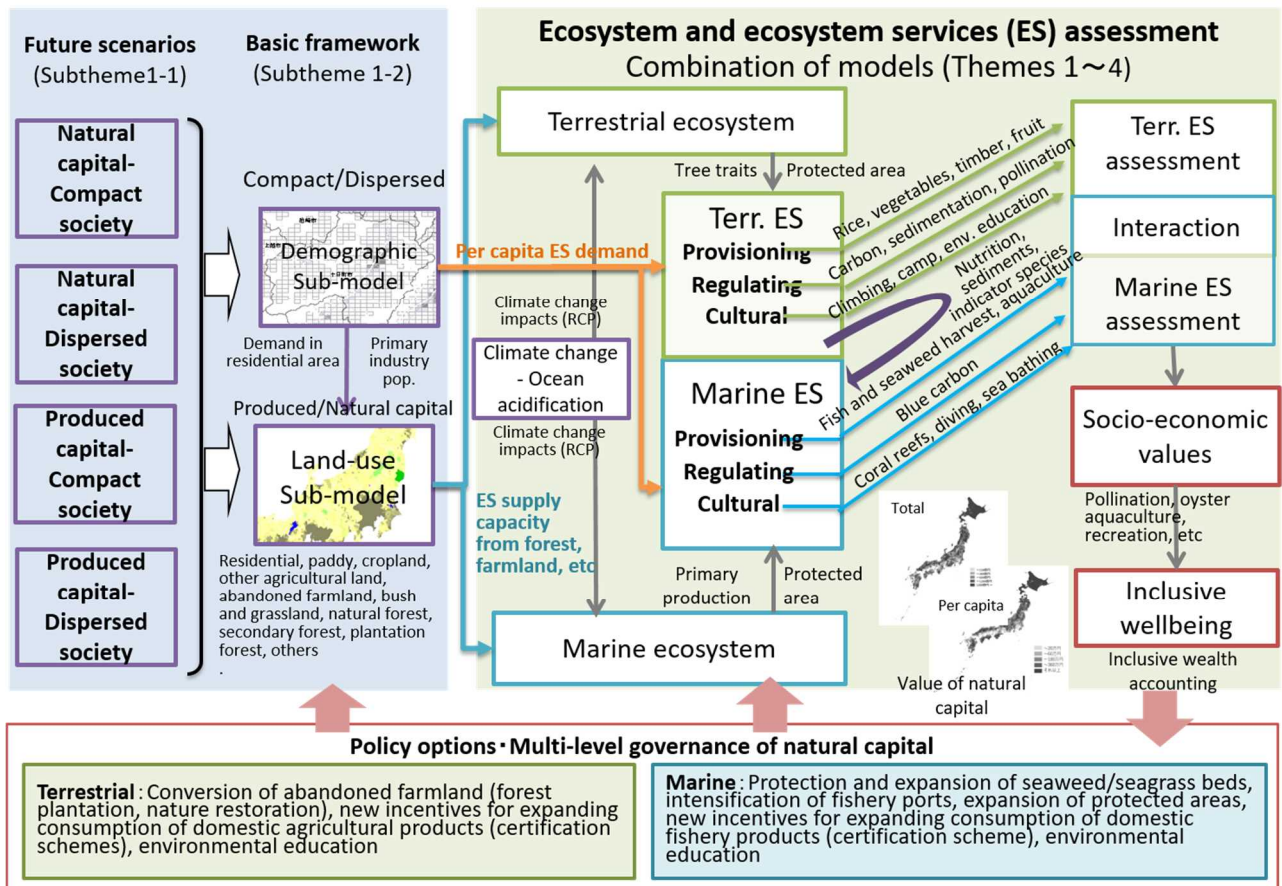


Fig. 1 Overall structure of the integrated assessment model.

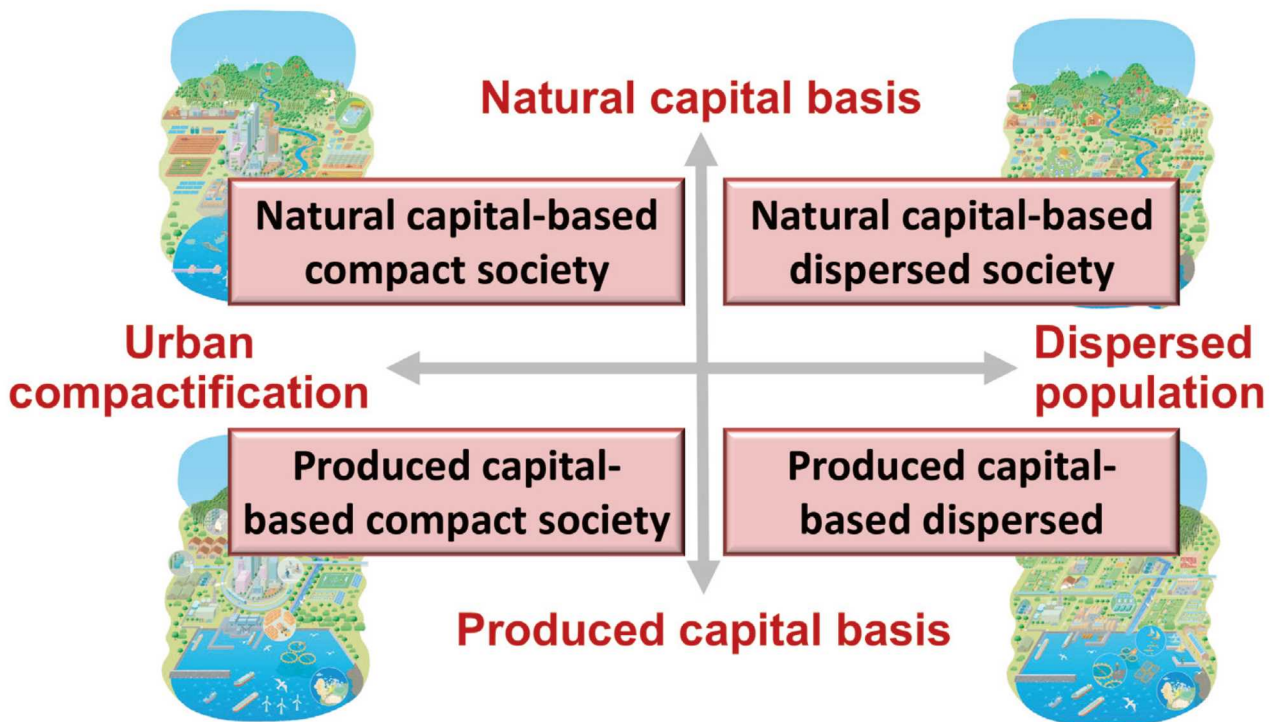


Fig. 2 Four national-scale scenarios developed by the PANCES project.

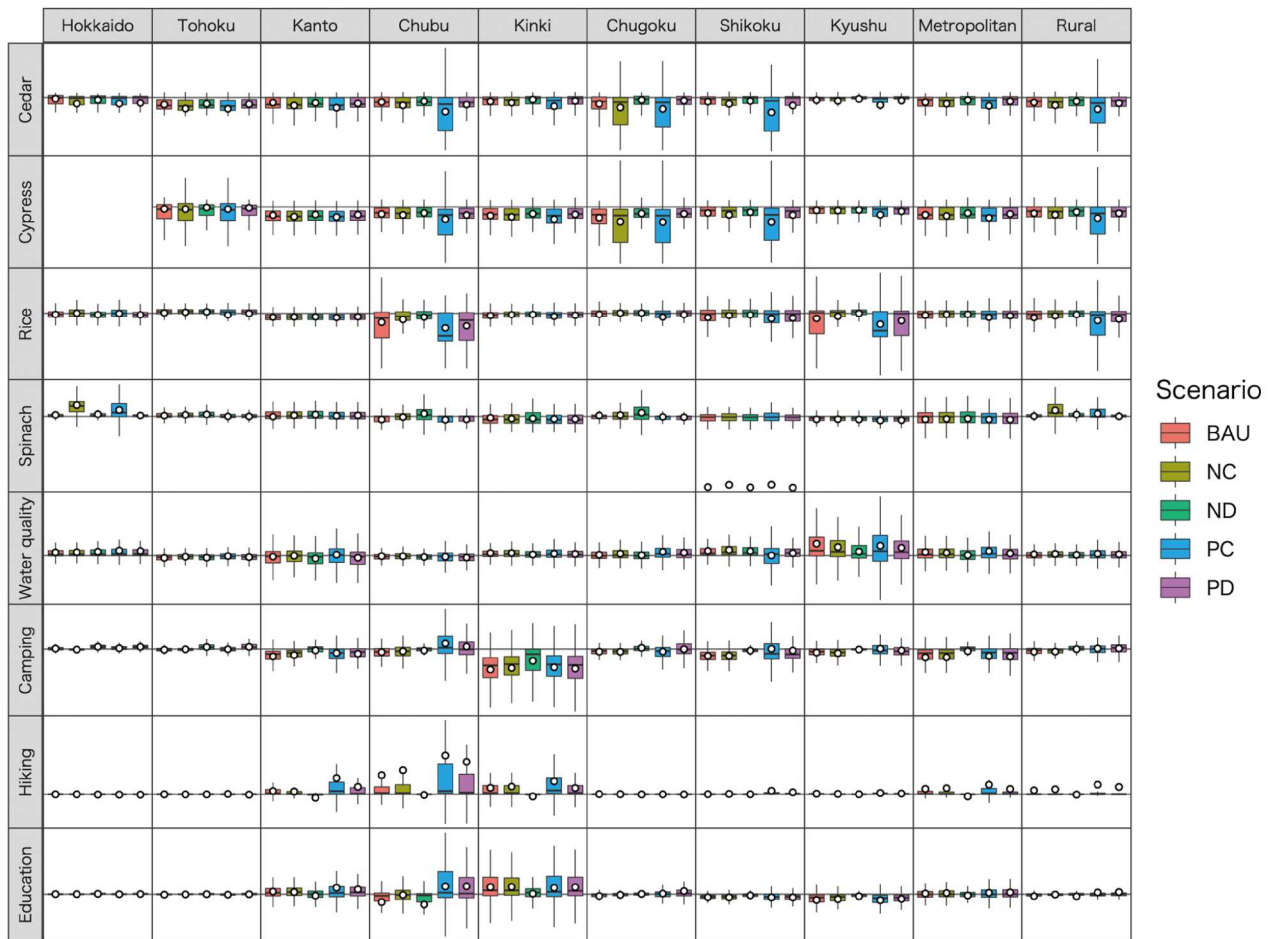


Fig.3 Summary of analysis of terrestrial ecosystem service scenarios (comparison between regions and large cities or other regions).