

Assessing ecosystem services in Asian region by using biodiversity observation data

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- Method for quantification and mapping of ES
- How AP BON can contribute

SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS

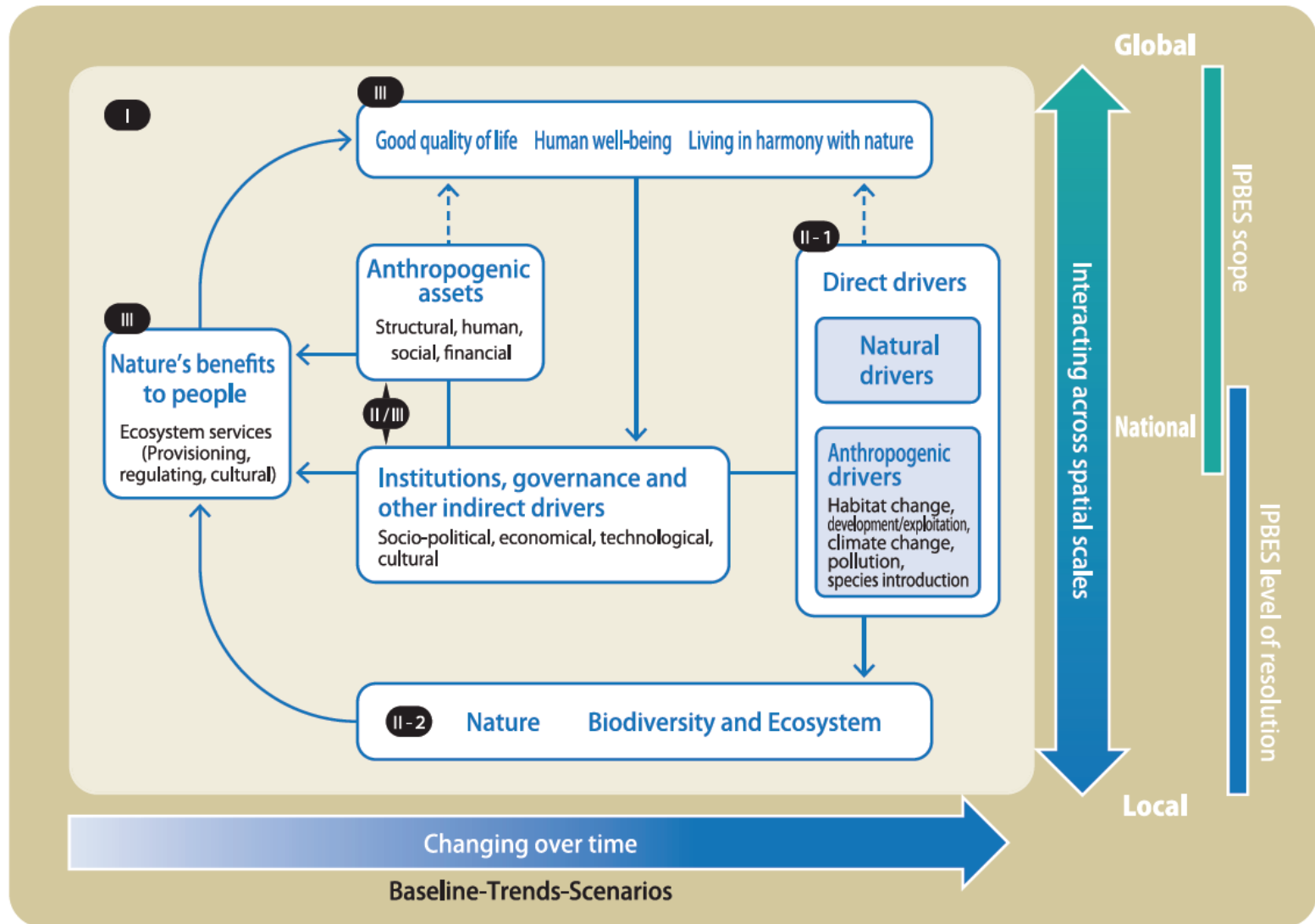


17 PARTNERSHIPS FOR THE GOALS



SUSTAINABLE DEVELOPMENT GOALS

iPBES assessment framework on ESs/NCPs



Conceptual Framework of IPBES and Structure of JBO2

JBO2

Japan Biodiversity Outlook 2

Report of Comprehensive Assessment of Biodiversity and Ecosystem Services in Japan

- How is nature related to human well-being? -



Japan Biodiversity outlook 2 (March 2016)

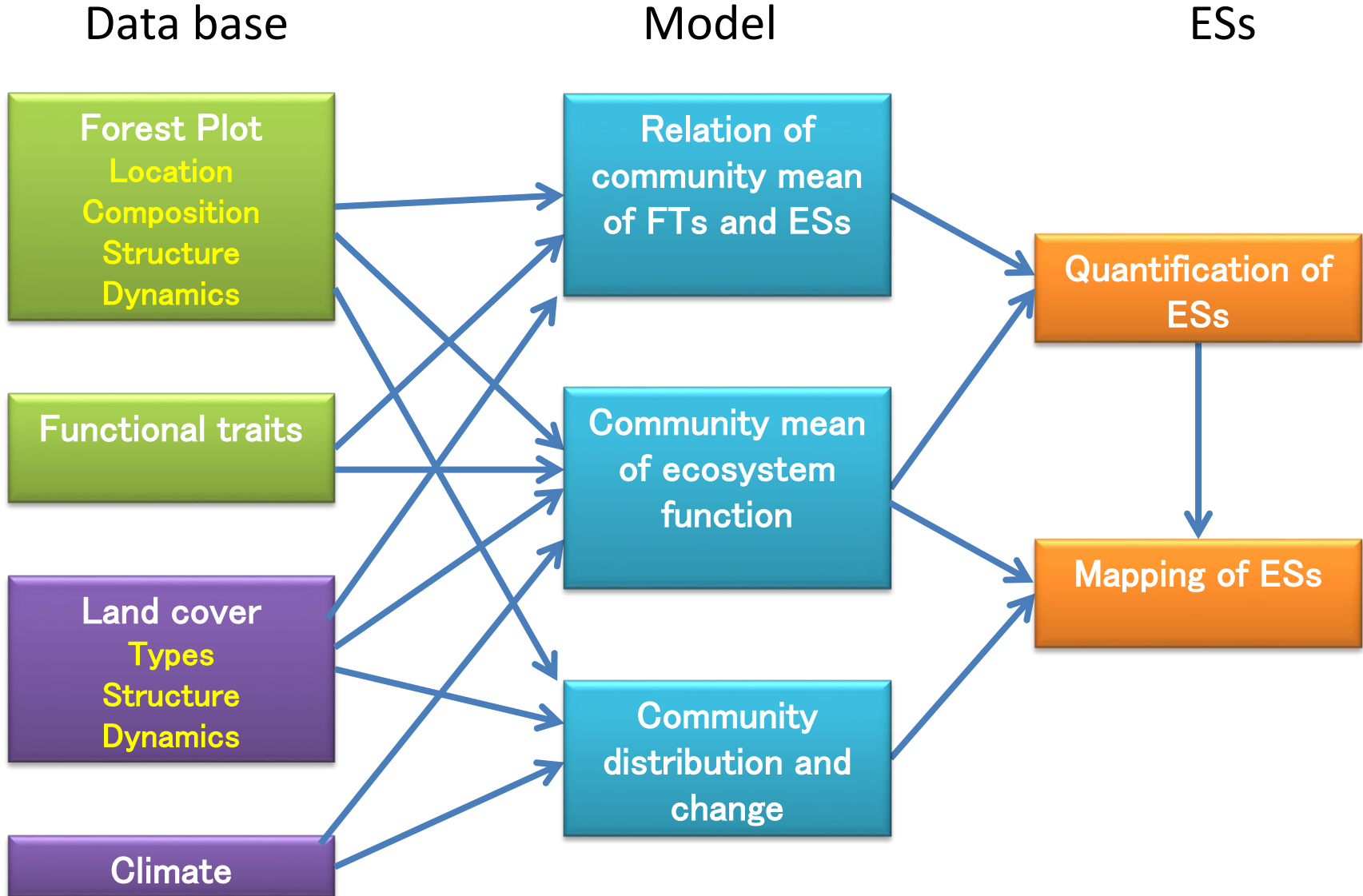
JBO1:

- May, 2010
- Assessment on biodiversity

JBO2:

- Recent trends after 2010
- Combination of GBO & IPBES
Report for Japanese ecosystems
- **Quantitative assessment** on
biodiversity & ecosystem services
- **Geographical information** (maps)
of ESs are particularly emphasized

ESs estimated from biomass and structure of forests



Functional traits measured

Target species

Japanese trees 300 spp., about 140 FTs

E and SE Asian trees 900 spp. 16 FTS

FTs measured (16 FTs)

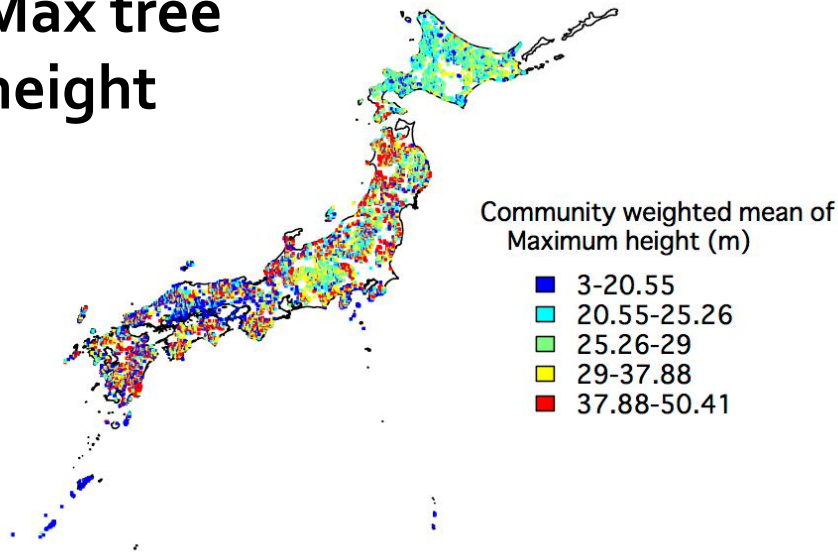
- Leaf size, LMA, toughness, thickness, water contents
- Leaf nitrogen and carbon (contents/stable isotope)
- Leaf total phenol, condensed tannin, lignin, NDF
- Leaf vein density
- Photosynthetic rate
- Wood density

Literature source (about 120 FTs)

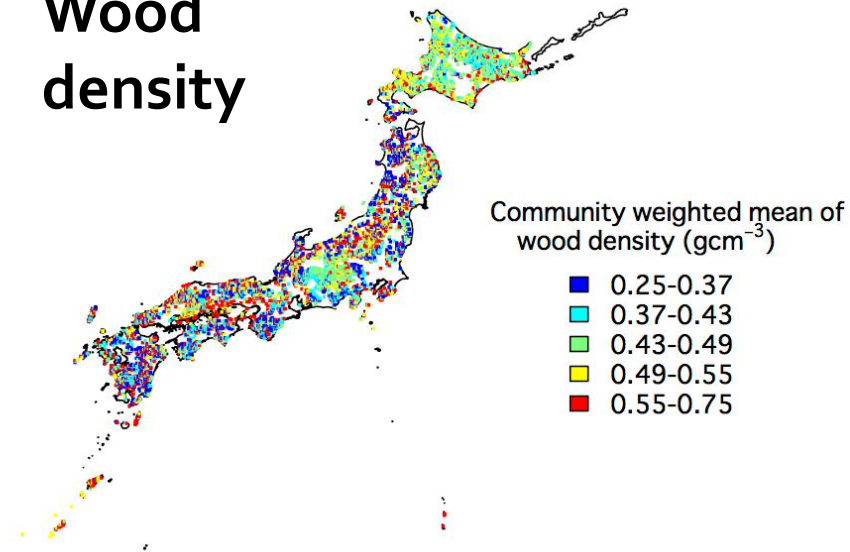
- Defensive Traits (trichomes, chemicals, etc.)
- Reproductive Traits (pollen, nectar, flower color, etc.)
- Root system (root diameter, mycorrhiza, etc.)
- Utilization (timbers, foods, medicines, etc.)

Map of FTs

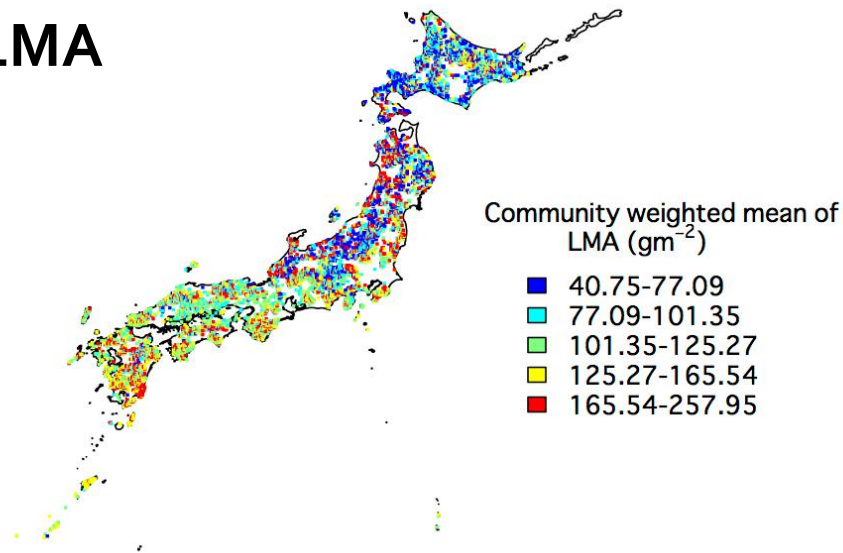
Max tree height



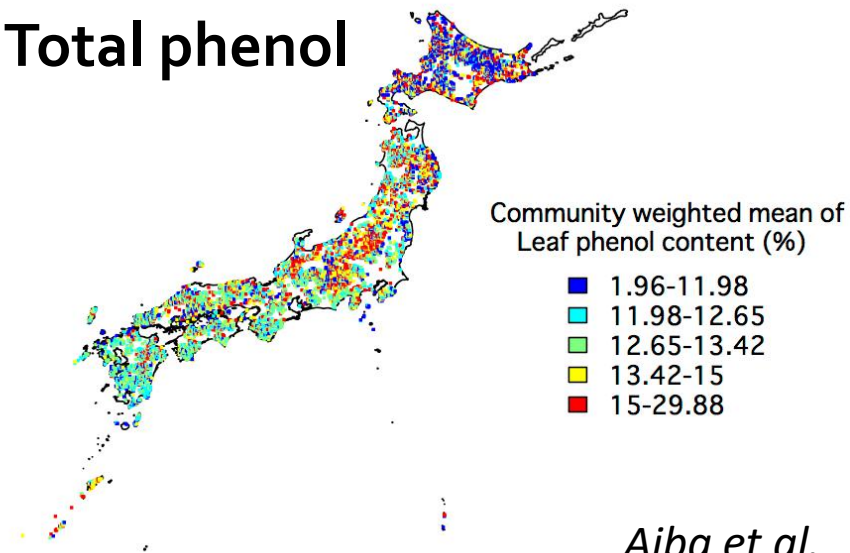
Wood density



LMA

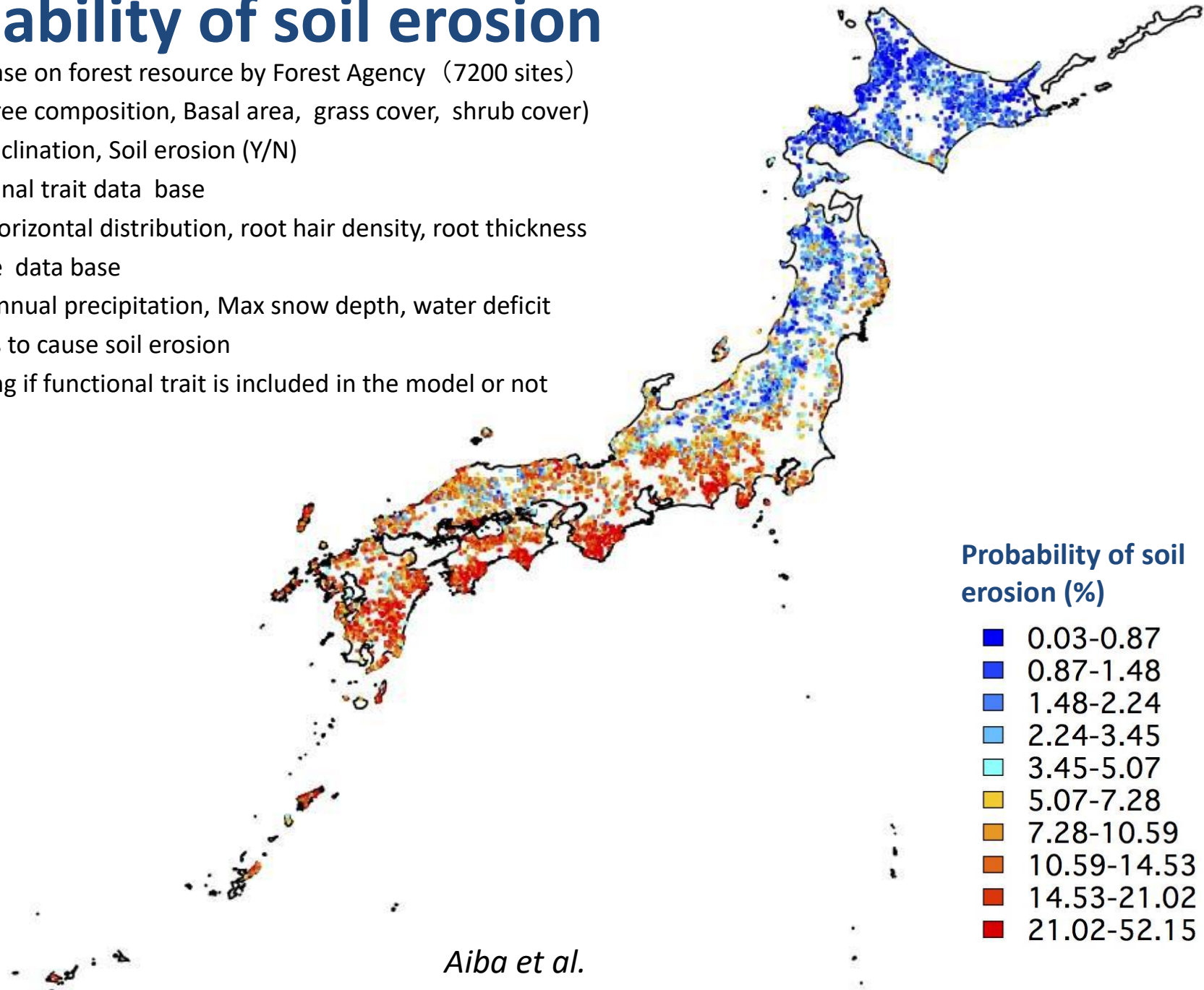


Total phenol



Probability of soil erosion

- Data base on forest resource by Forest Agency (7200 sites)
 - Tree composition, Basal area, grass cover, shrub cover)
 - Inclination, Soil erosion (Y/N)
- Functional trait data base
 - Horizontal distribution, root hair density, root thickness
- Climate data base
 - Annual precipitation, Max snow depth, water deficit
- Models to cause soil erosion
- Verifying if functional trait is included in the model or not

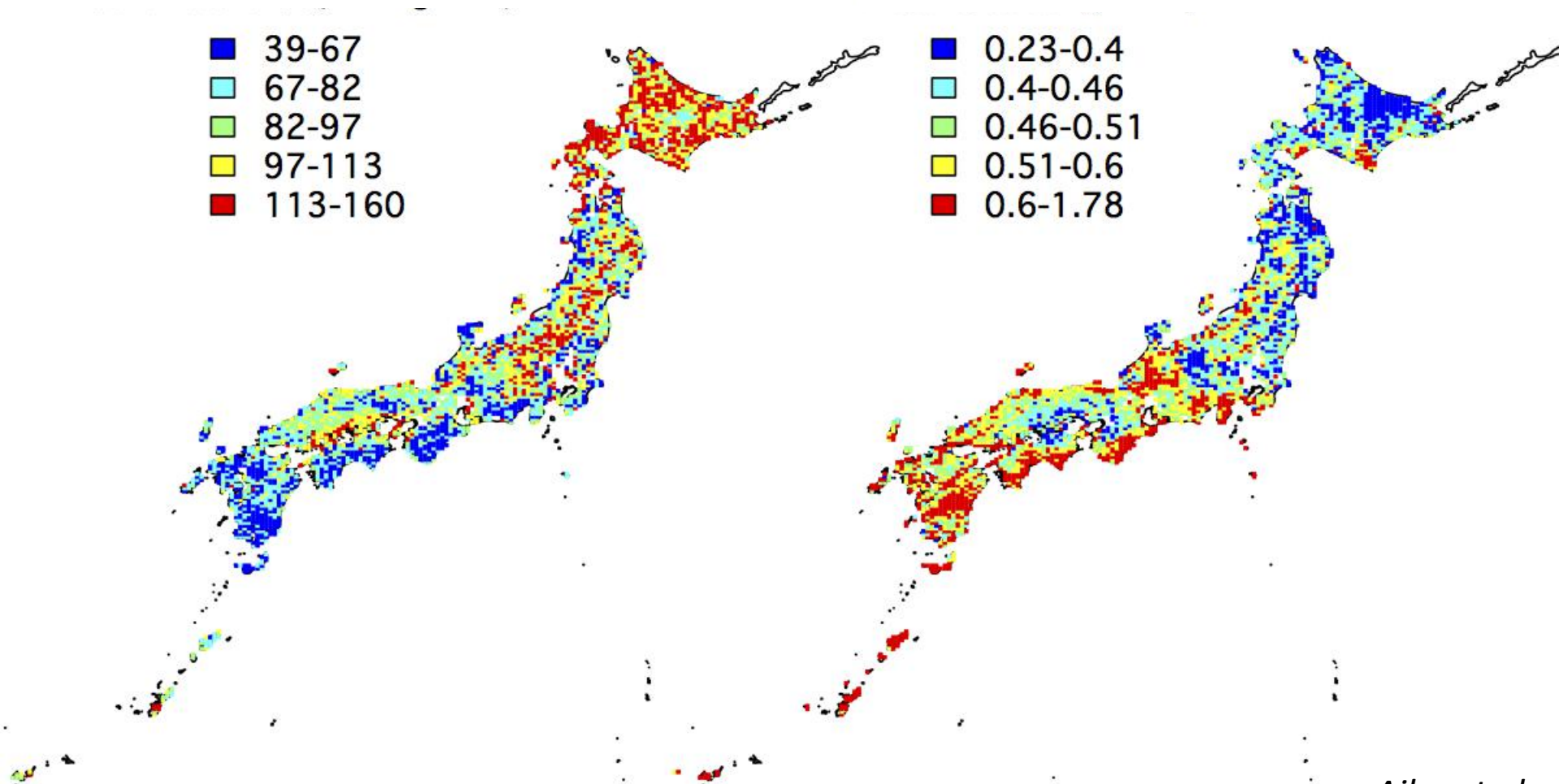
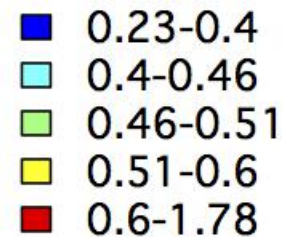
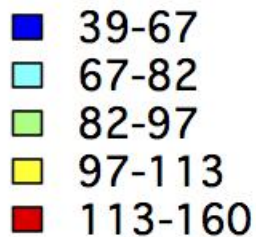


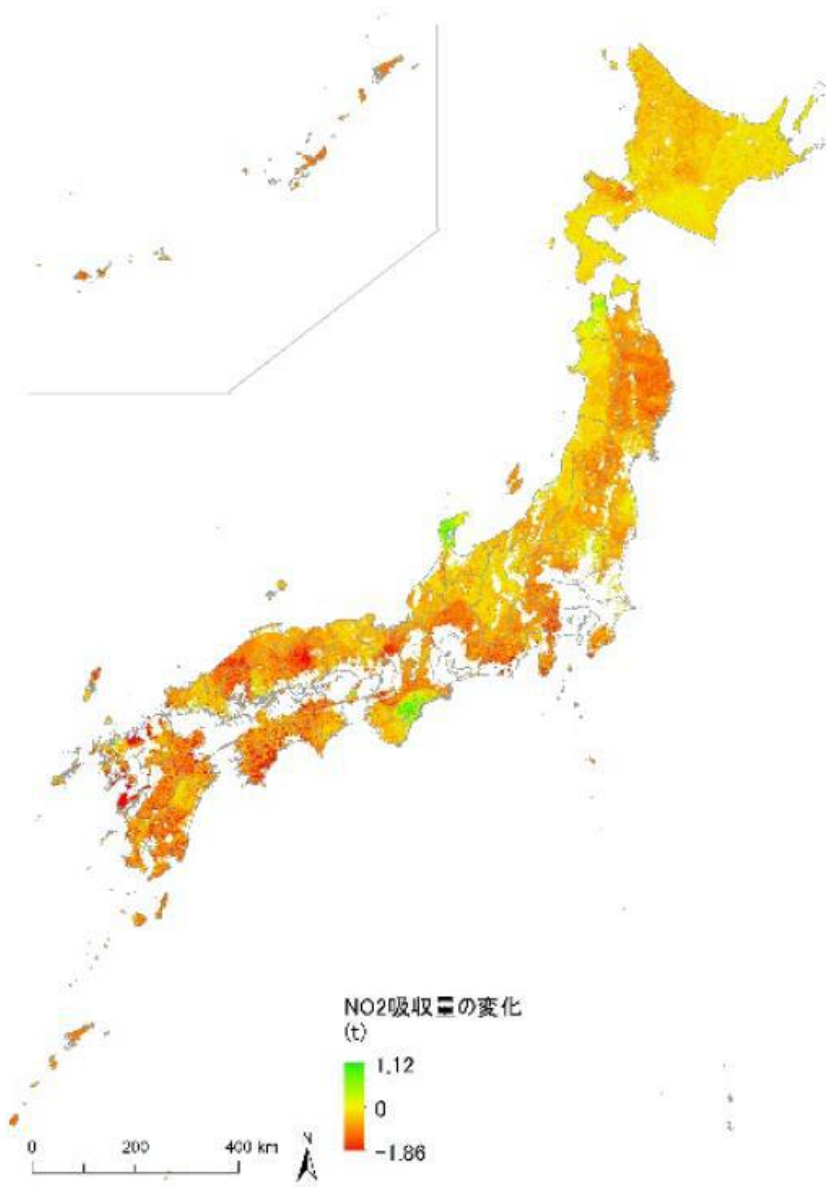
Aiba et al.

Ecosystem functions estimated by the data bases on forest plots and functional traits

Maximum photosynthesis rate
($\text{nmol g}^{-1}\text{s}^{-1}$)

Decomposition coefficient,
 K (year^{-1})





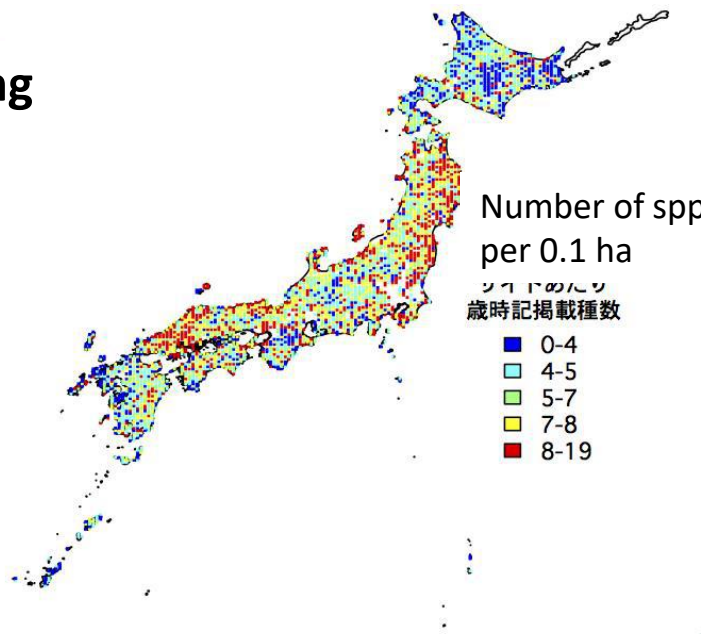
Change in NO₂ absorption between
2000 and 2010



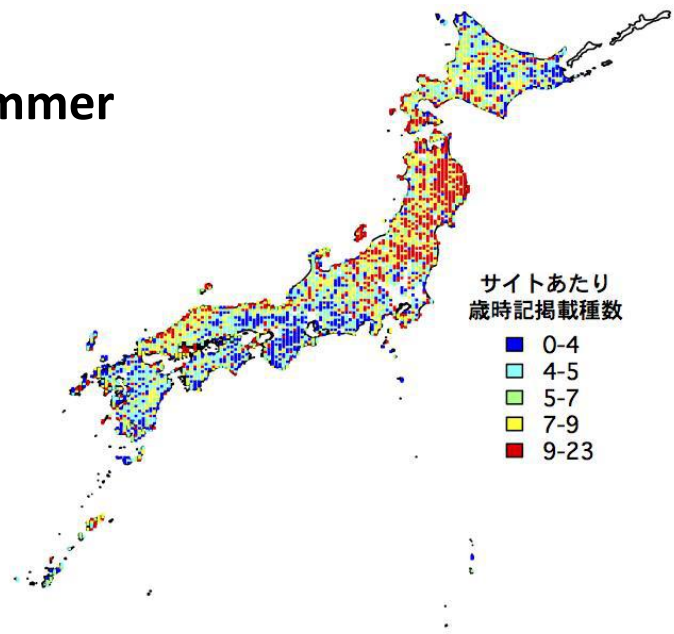
Change in underground water
charge between 1976 and 2009

Richness of tree species appeared in Haiku poetry as seasonal words (Kigo)

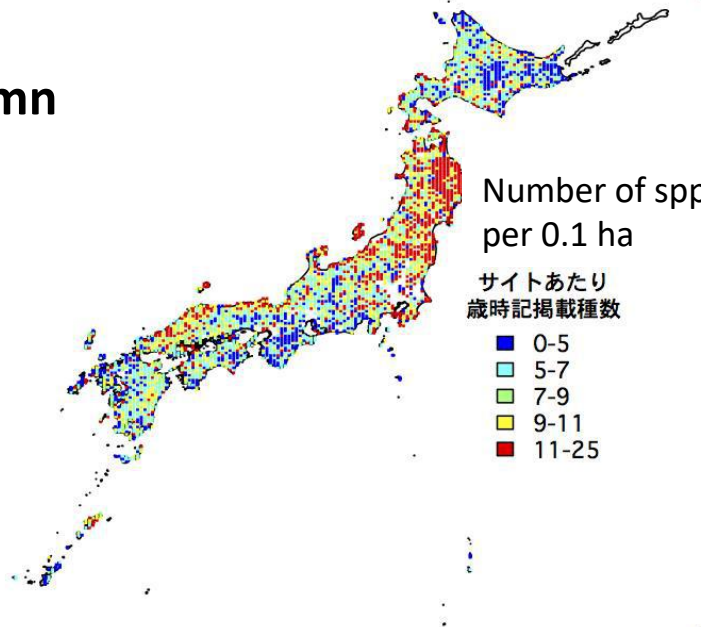
Spring



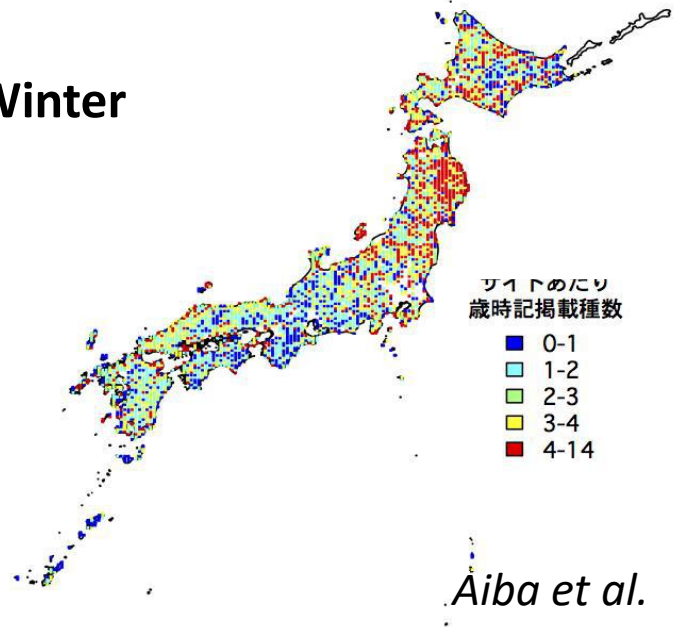
Summer



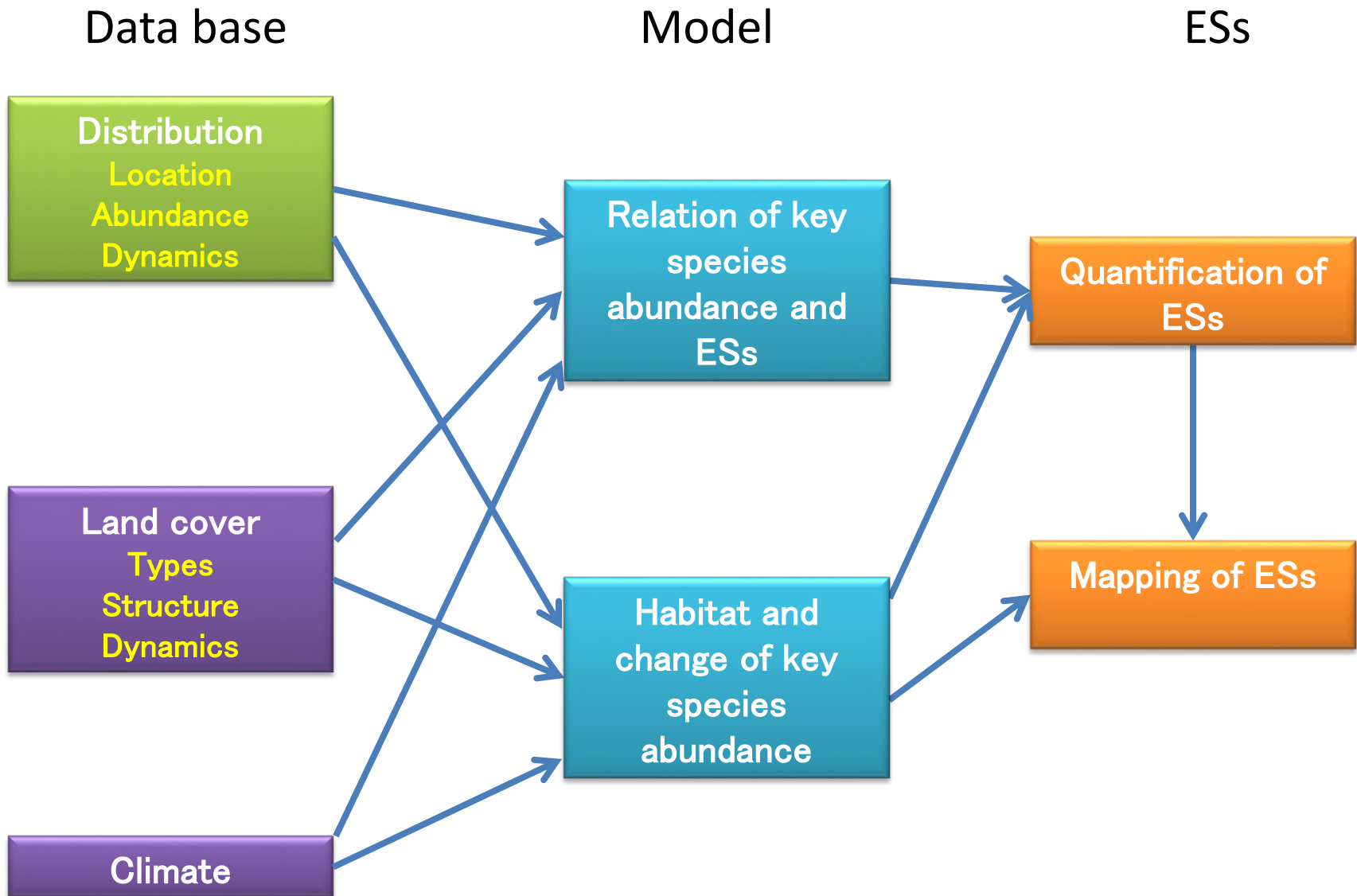
Autumn



Winter



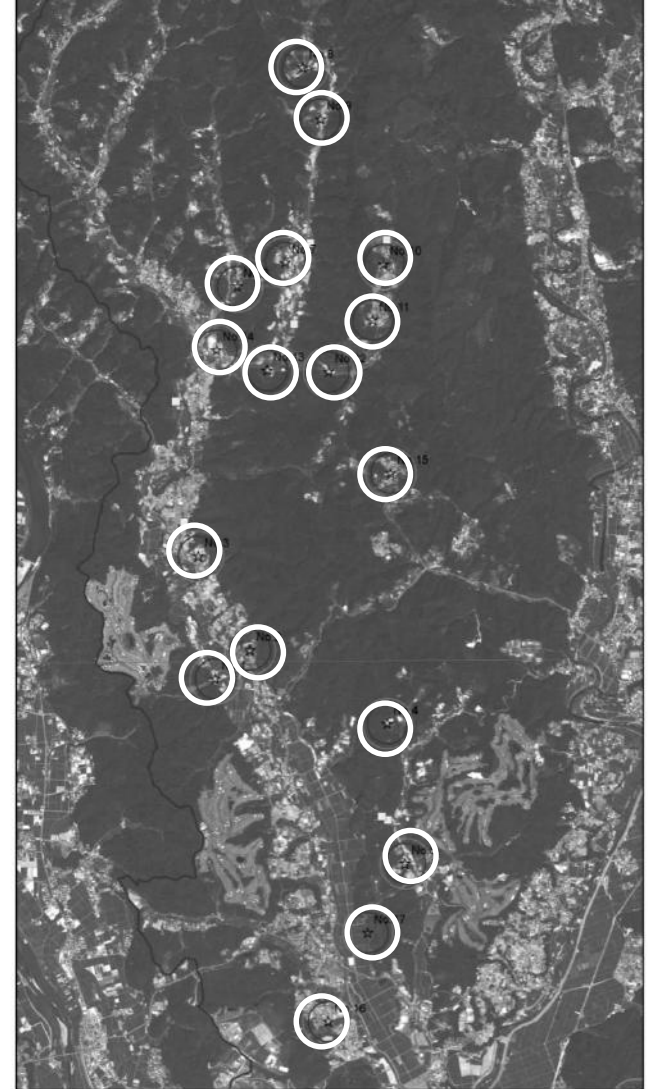
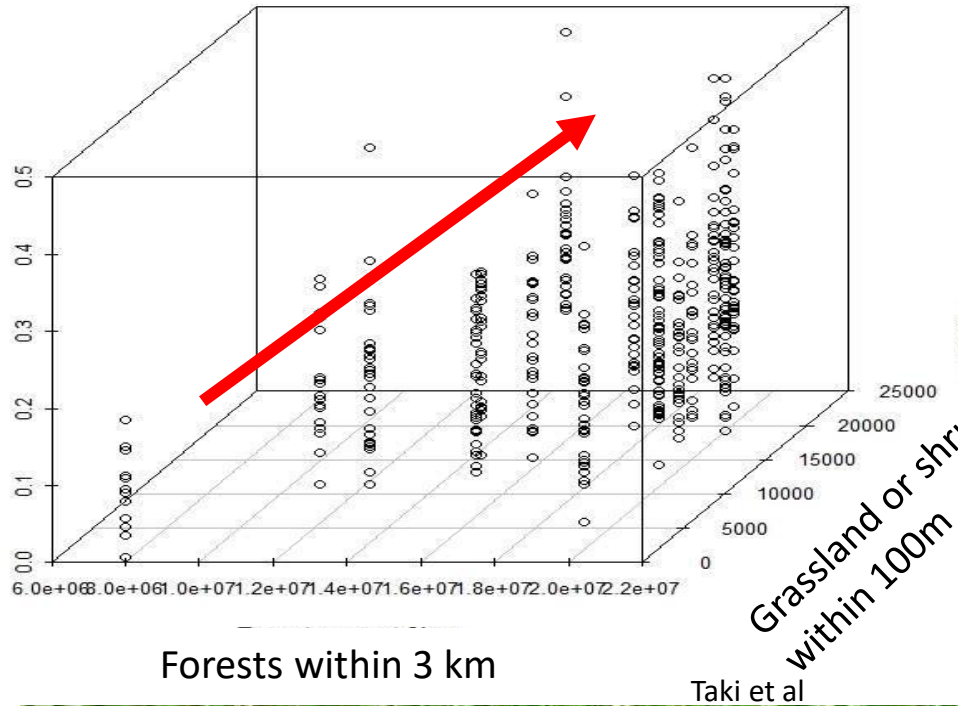
ESs estimated from the abundance of key spp.



Landscape and seed set of backwheat

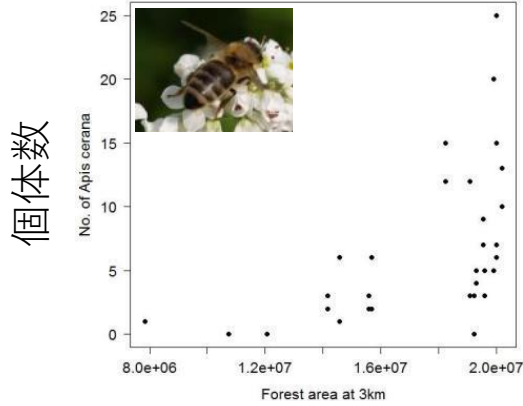


Seed set of backwheat



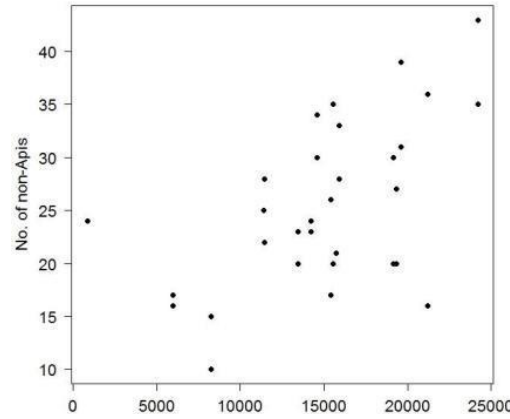
森林生物による送粉サービス・ローカルマップ

Honey bee abundance

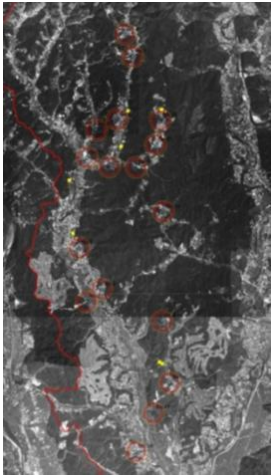


Forested area with in 3km from the filed (m²)

Abundance of other insects

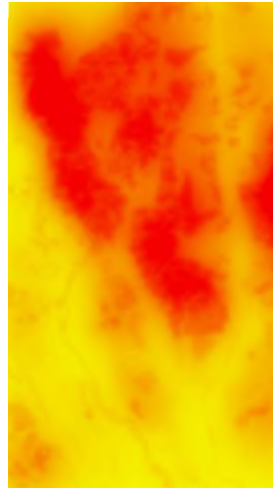


Grassland area within 100 m from the field (m²)



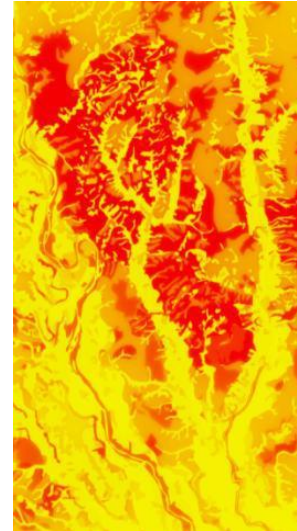
Landcover

+



Distribution of sampled individuals

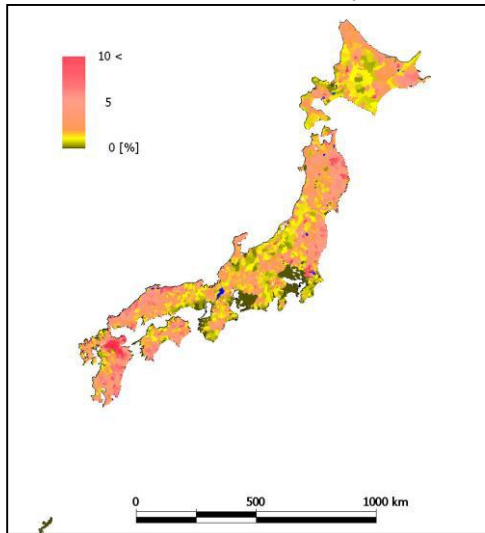
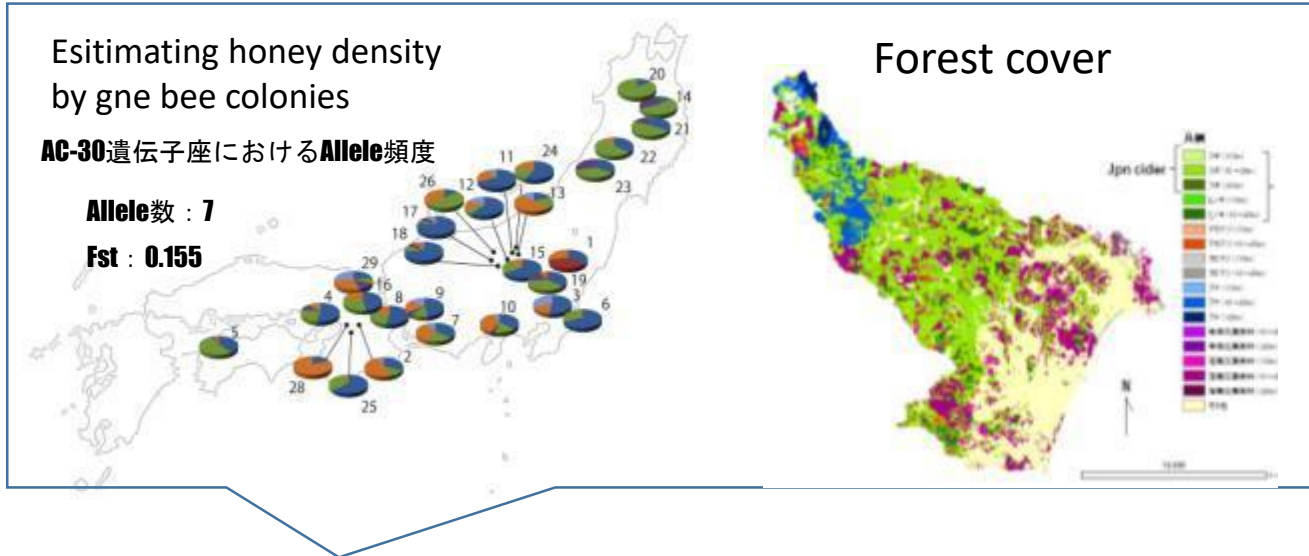
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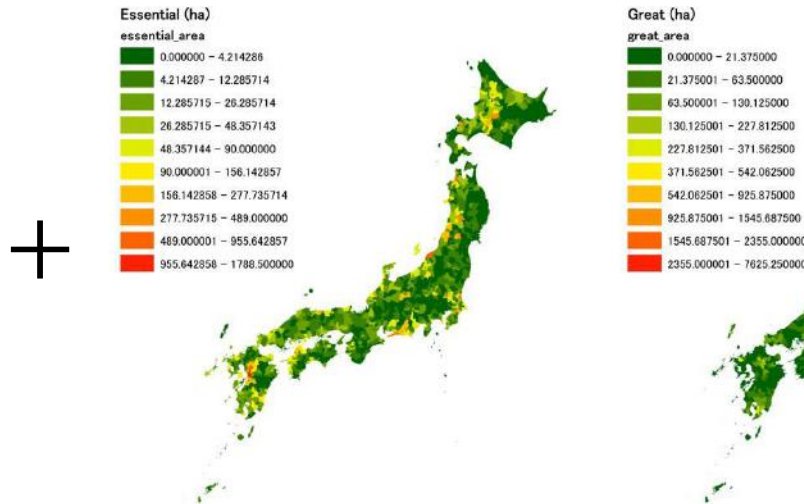
Estimated habitat of honey bee

- 1) Garibaldi et al. (2013) *Science*
- 2) Kennedy et al. (2013) *Ecology Letters*

Estimation of honey bee abundance



Potential capacity of honey bee pollination



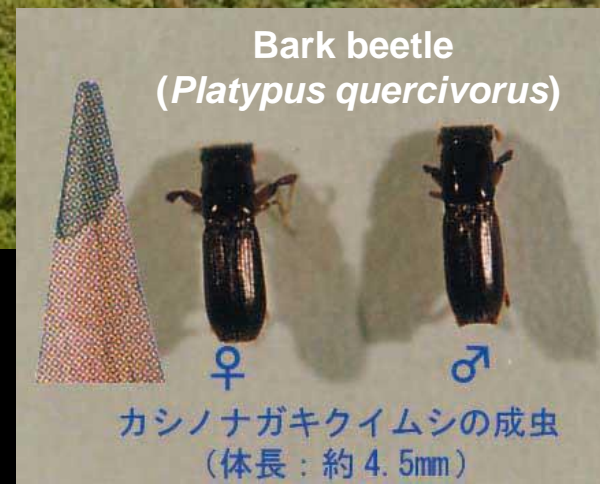
Cultivation of crops with different pollinator dependence

Actual supply of services

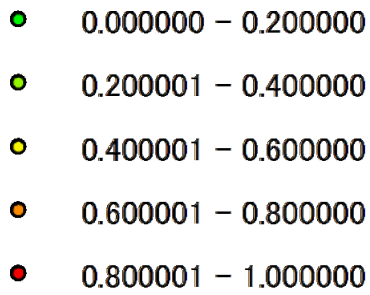
Wilting disease of Fagaceae trees

Factors	Estimate
(Intercept)	2.1082***
DBH (cm)	-0.0426***
Number of <i>Quercus</i> trees (r < 10m)	-0.1411***
% of broad leaf forests (r < 100m)	-0.0197***
% of vegetation other than forests (r < 1km)	0.0379*

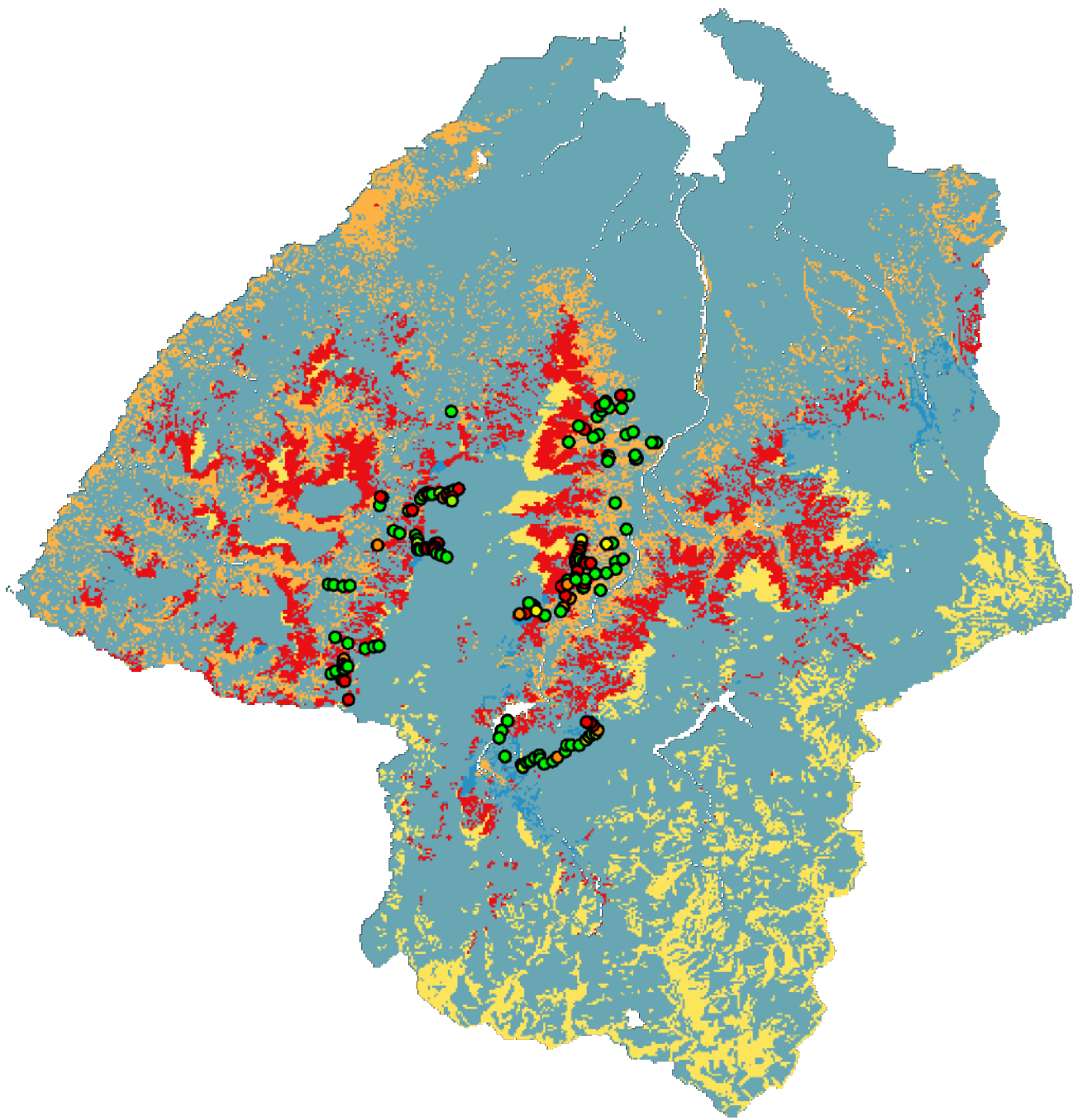
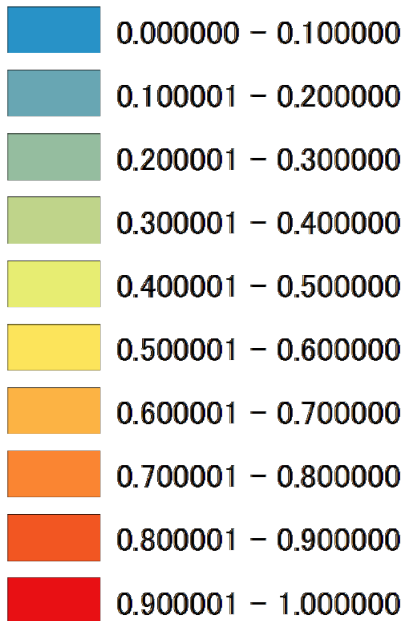
WP of Yamagata Prefecture



Observed Mortality of *Q. crispula* tree

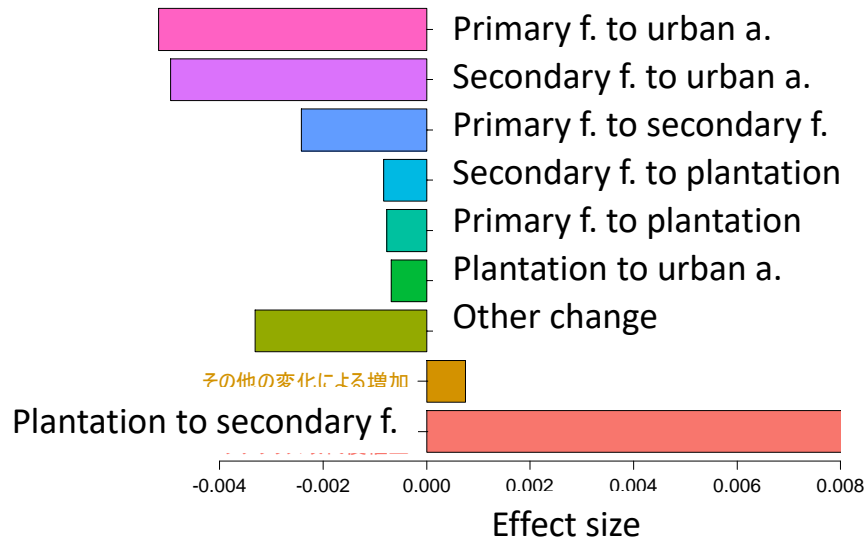


Estimated risk of Mortality of *Q. crispula*

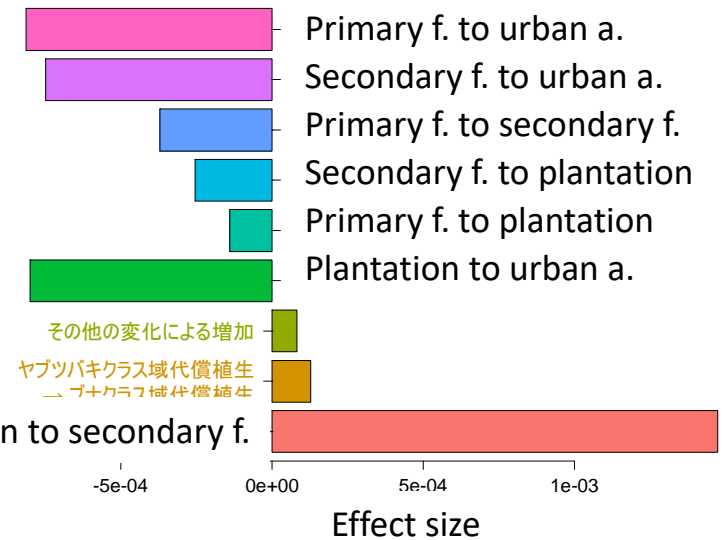


Vegetation change resulted in the change of Efs/ESs

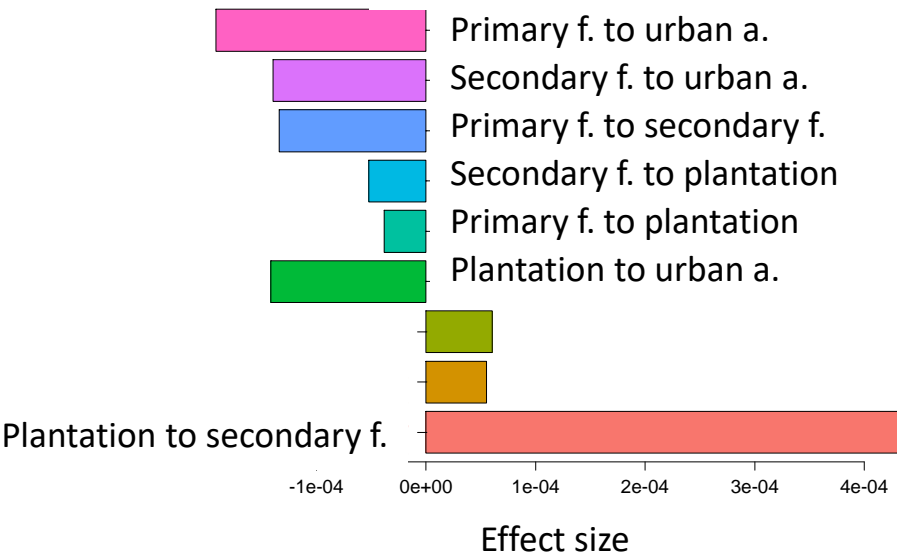
Photosynthetic rate



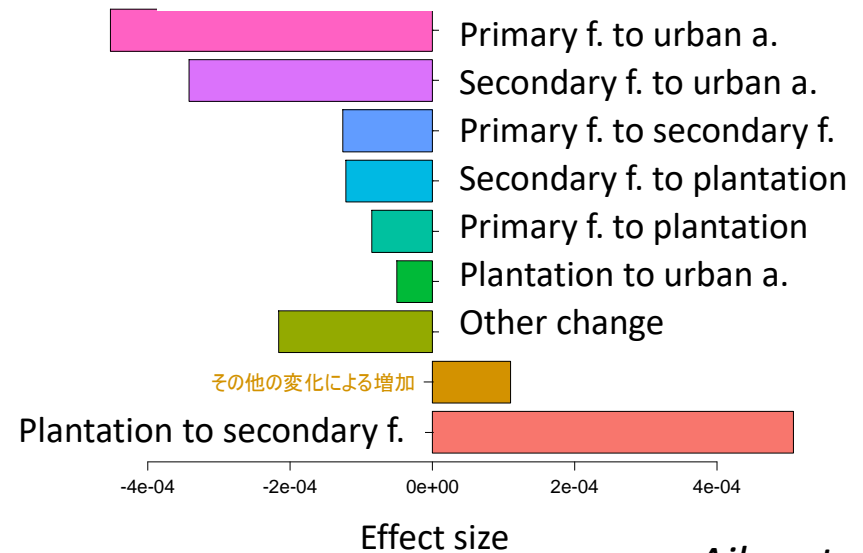
Tree biomass providing honey



Tree species richness

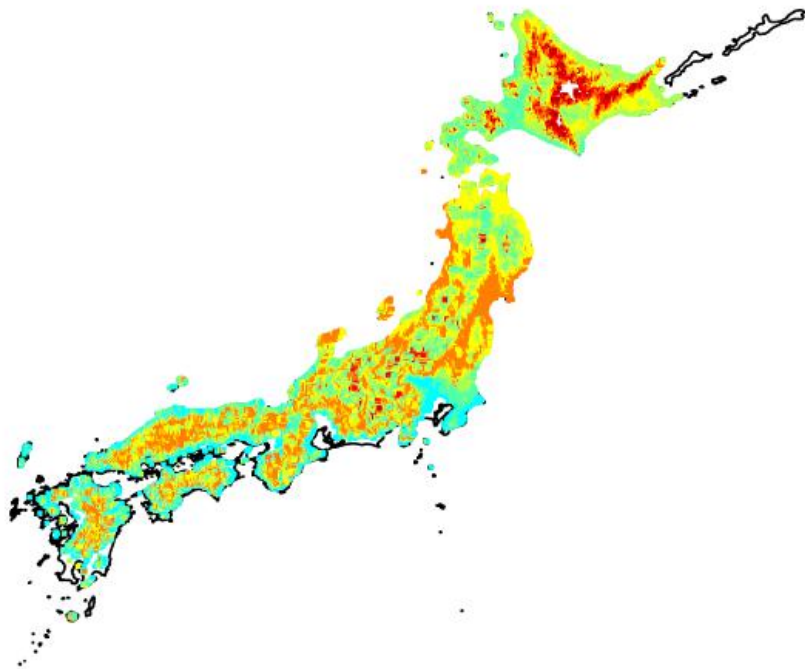


Richness in tree utilization

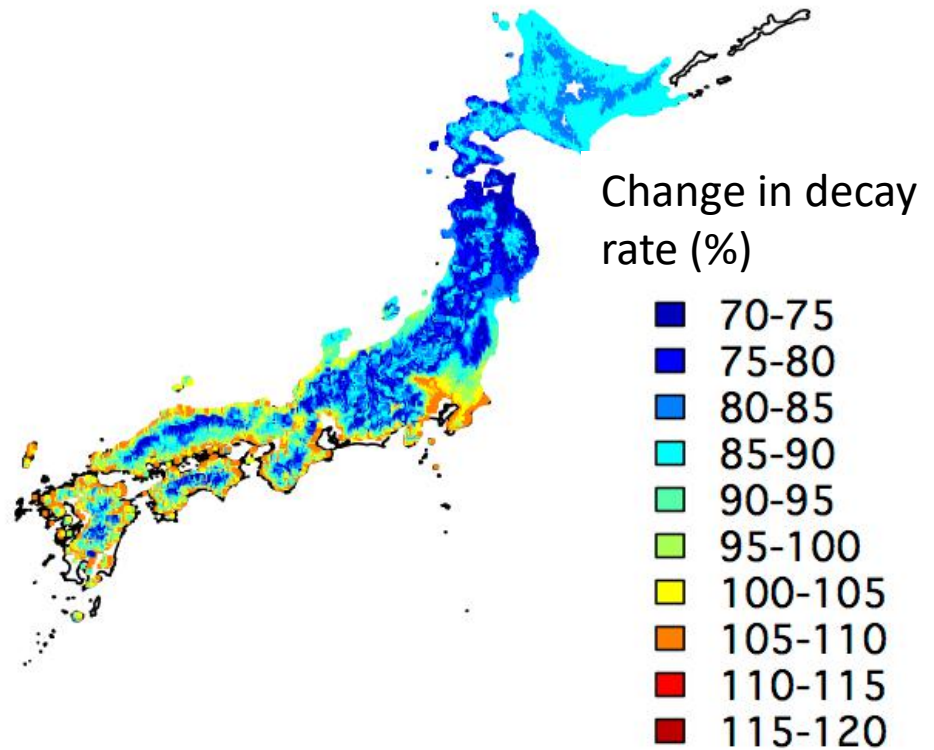


Land use change and ESs

Primary f. -> Secondary f.



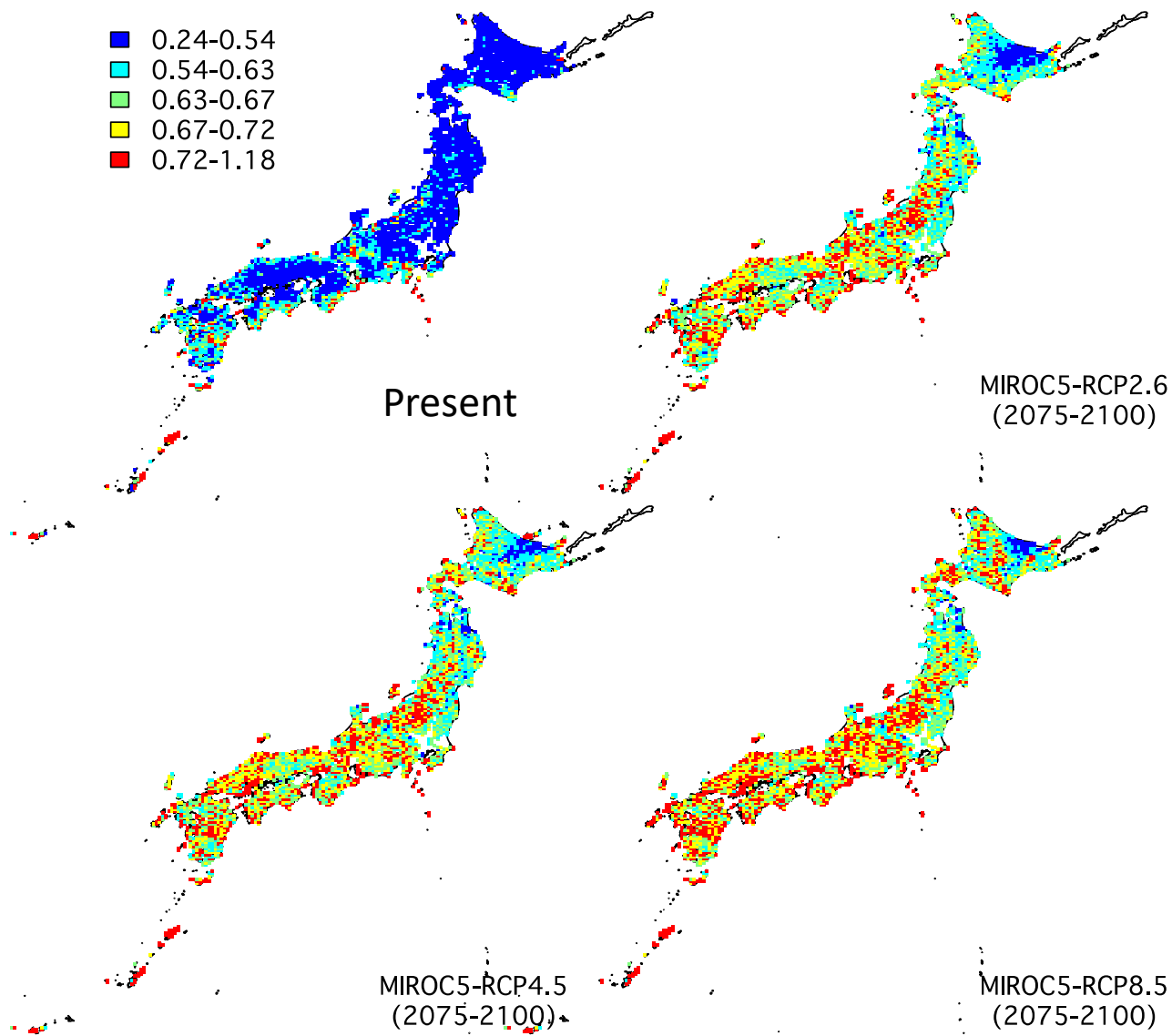
Primary f. -> Plantation



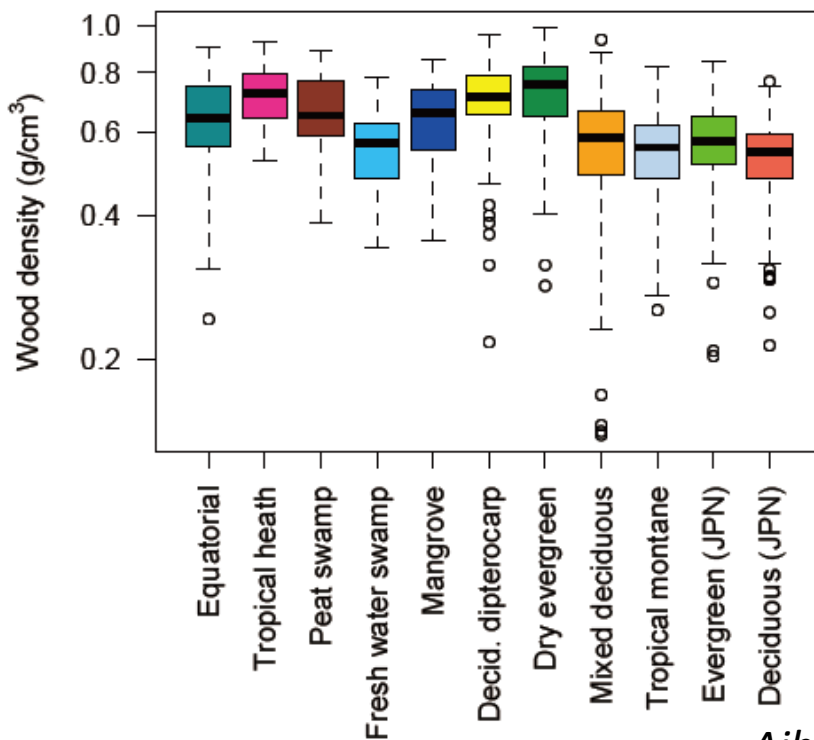
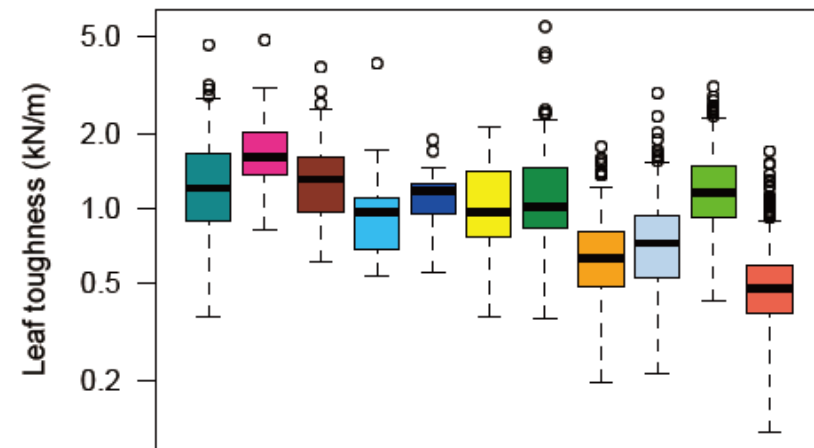
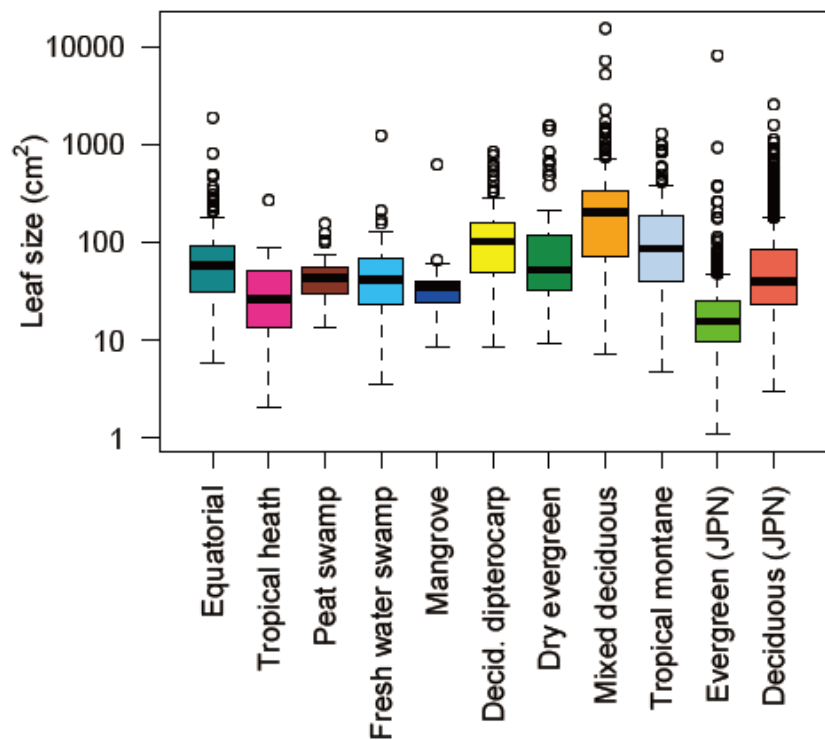
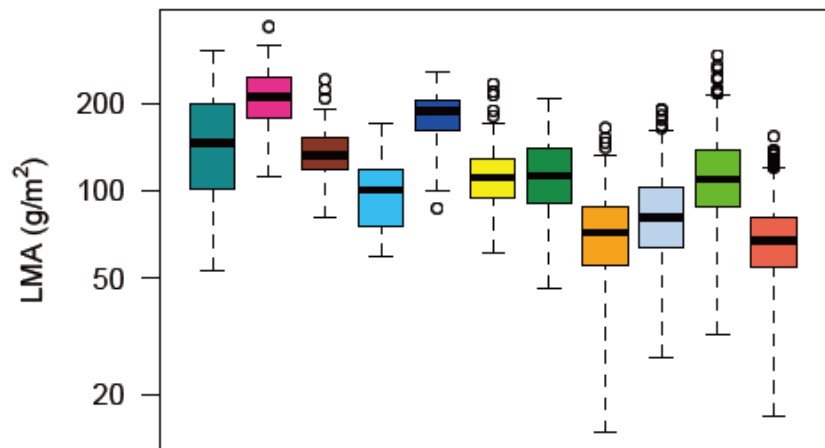
Effects of climatic change on ESs

Decay rate (yr^{-1})

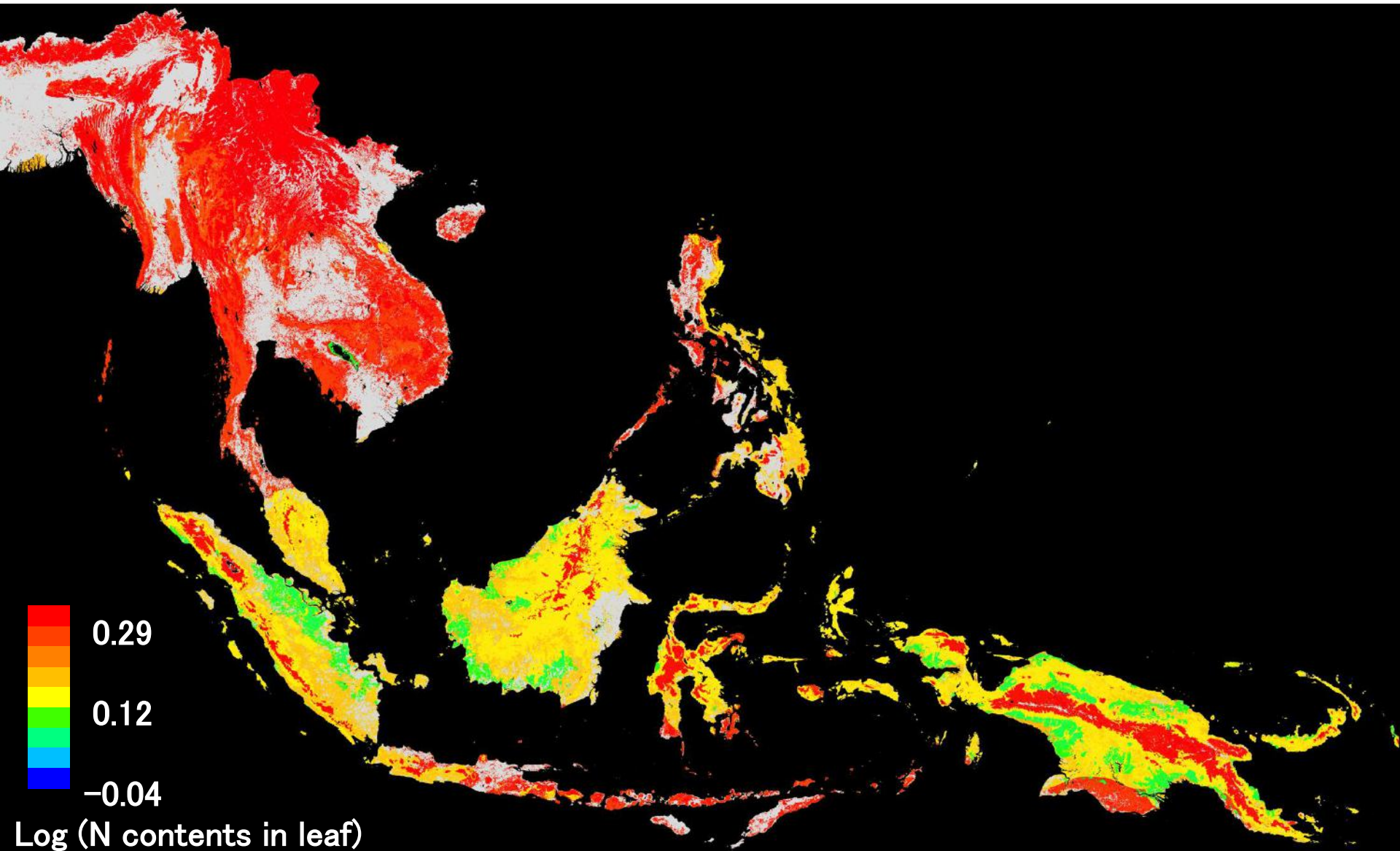
- 0.24-0.54
- 0.54-0.63
- 0.63-0.67
- 0.67-0.72
- 0.72-1.18



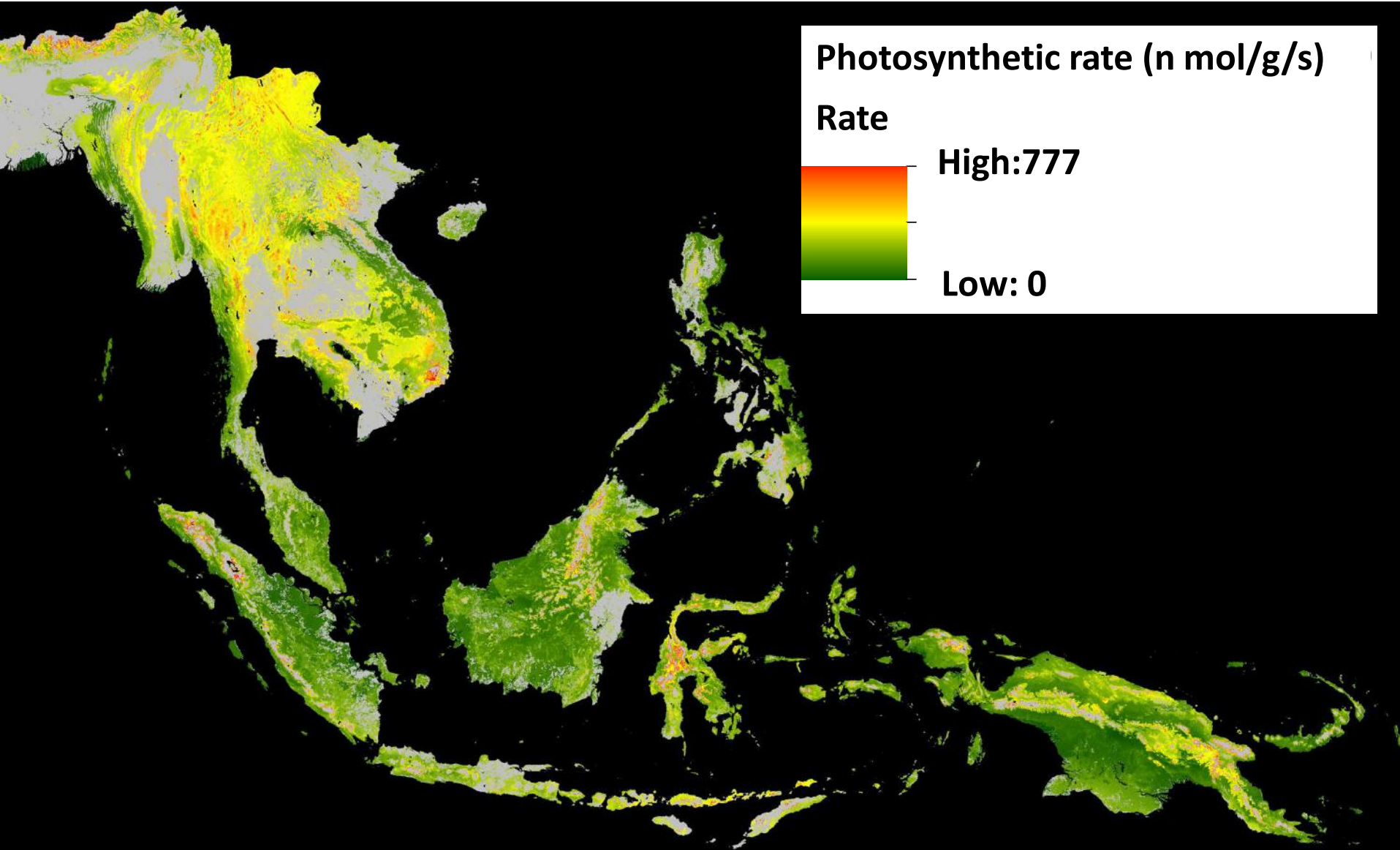
Community weighted mean of forest types in SE Asia



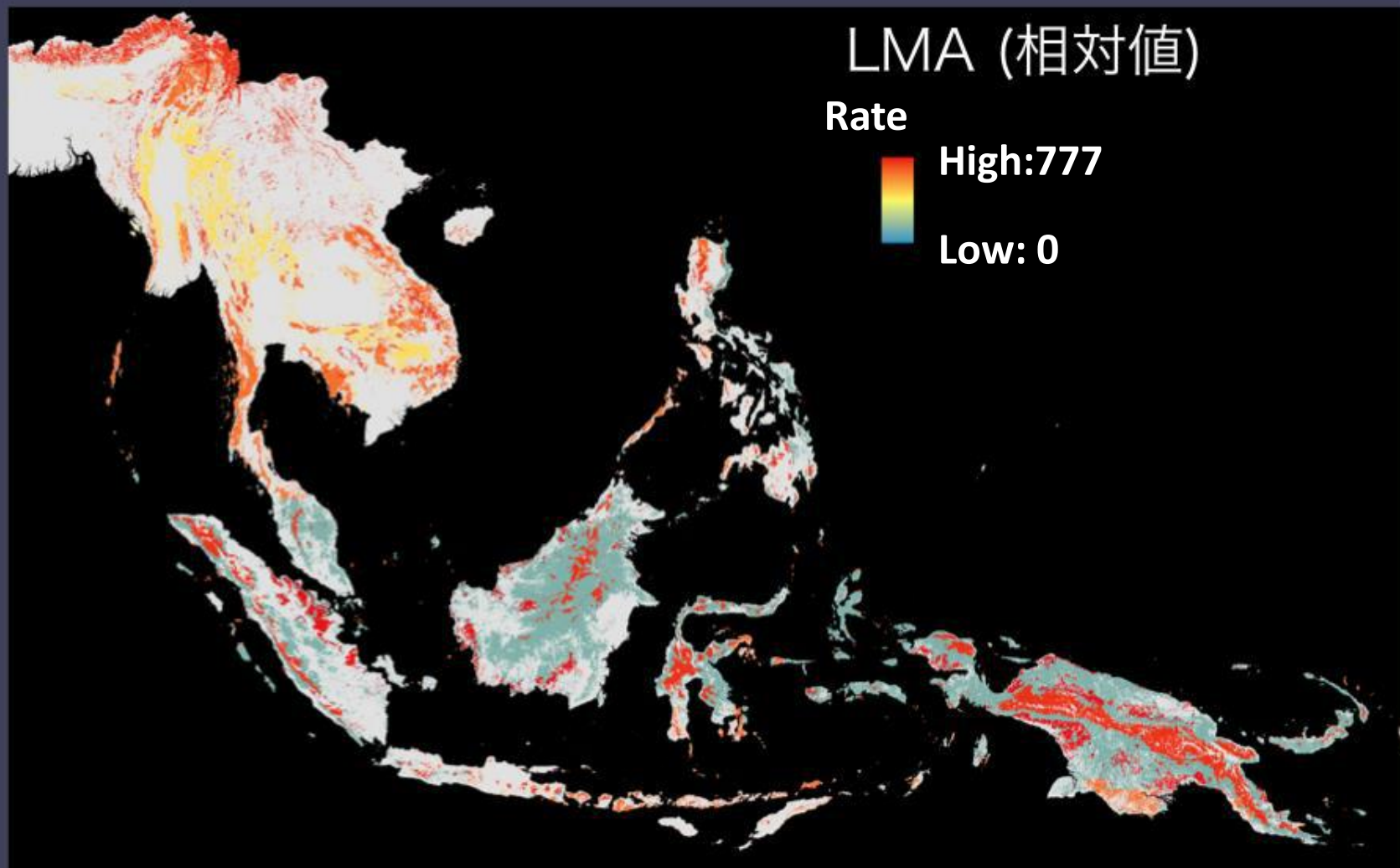
Mapping functional traits in SE Asia



Photosynthetic rates in Asian forests



The effect on FTs by transformation from natural to secondary forests



Community weighted means of natural forests were replaced by those of secondary forests of the same forest types

Biodiversity/ecosystem observation and ES assessment

- Quantitative assessment on ES/NCP including scenario analyses gives critical information on policy and decision making
- Combination of various databases gives great range of quantification and mapping of ESs
- Database on functional traits and abundance of key species which relate to ES are the expected to contribute greatly to quantification of ES
- Spatio-temporal resolution and accuracy of ES assessment are depending on information/database, and thus, observation



Thank you!