

A Development of Future Scenario Simulation System of Natural Capital and Ecosystem Services on LANDIS-II

—Linking Qualitative Scenarios and Landscape Change Model in Japan—



PREDICTING &
ASSESSING
NATURAL
CAPITAL &
ECOSYSTEM
SERVICES

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Introduction

Background: Linking Scenarios and Models

Overuse of Natural Resources × Climate Change

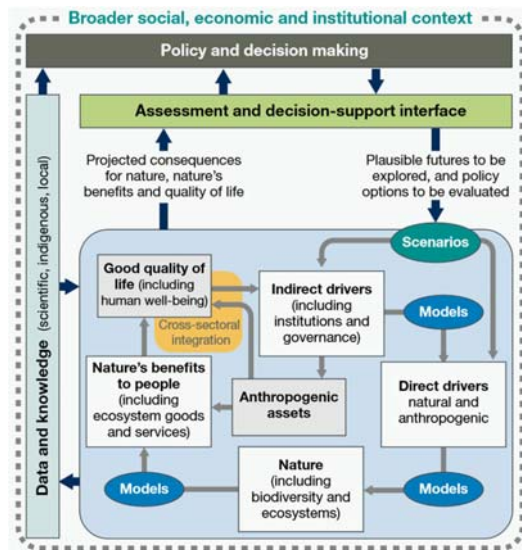


Fig. 1: ipbes: scenarios and models¹⁾

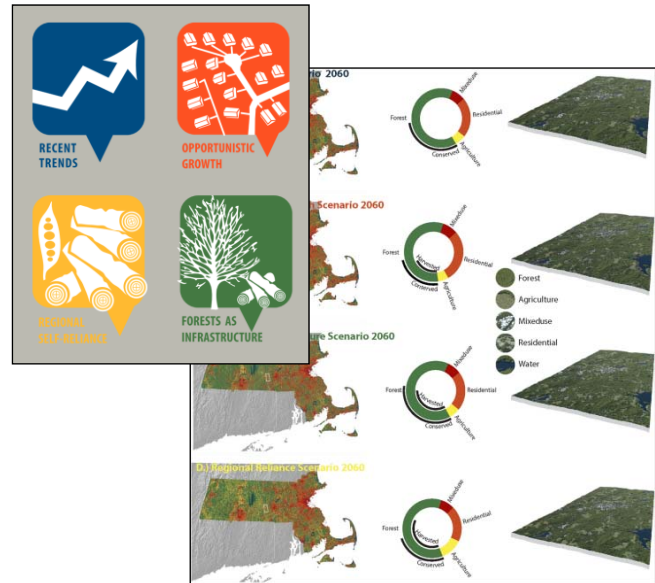
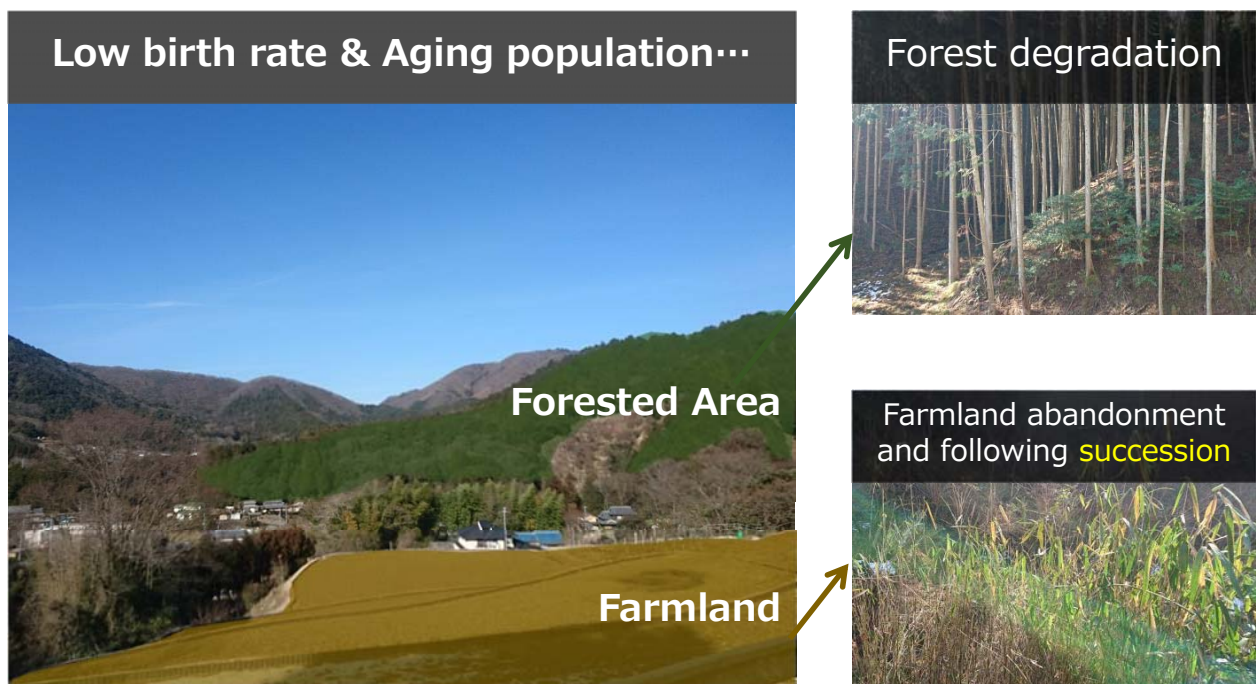


Fig. 2: The consequences of four land-use scenarios for forest ecosystems and the services they provide²⁾

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In Japanese Societal Context, ...

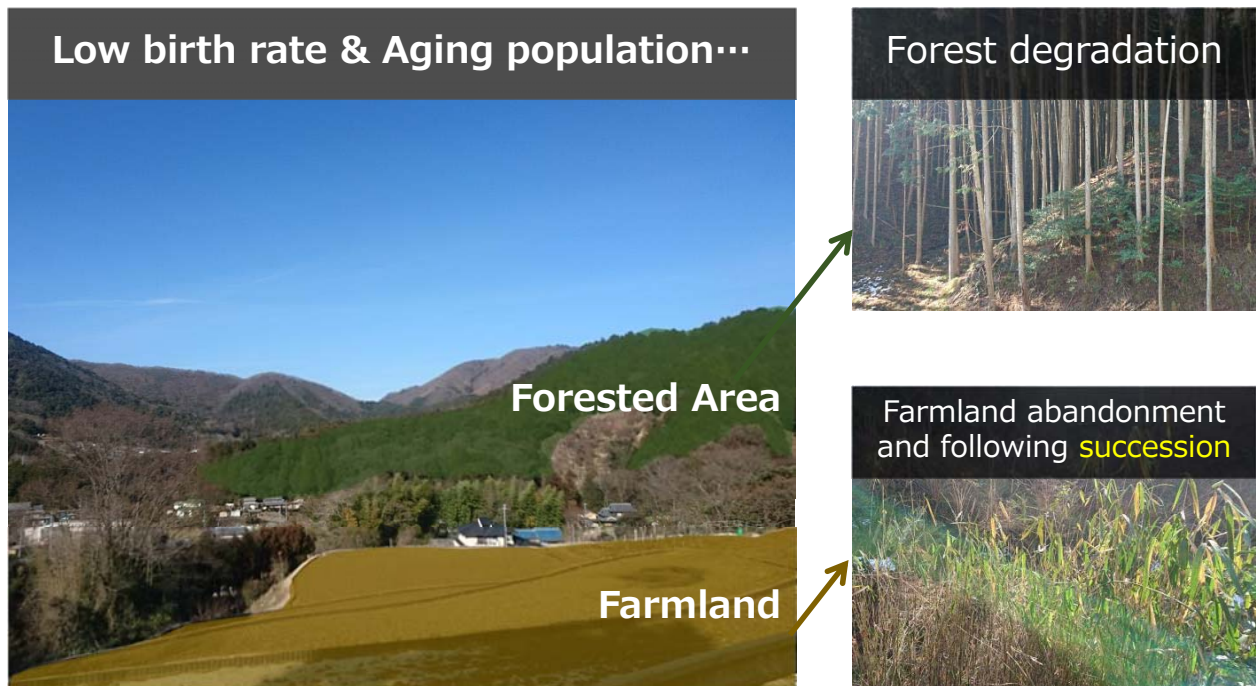
Underuse of Natural Resources × Climate Change



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In Japanese Societal Context, ...

Vegetation Dynamics will Alter Natural Capital & ESs



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Purpose of this Study

Goal:

Development of Simulation System of Natural Capital & Ecosystem Services **in Japan**

Required Specifications:

1. **Link** between plausible future storylines and the model
2. **Simulate** effects of management & climate change
3. **Evaluate** natural capital and ESs

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Overview of the Simulation System

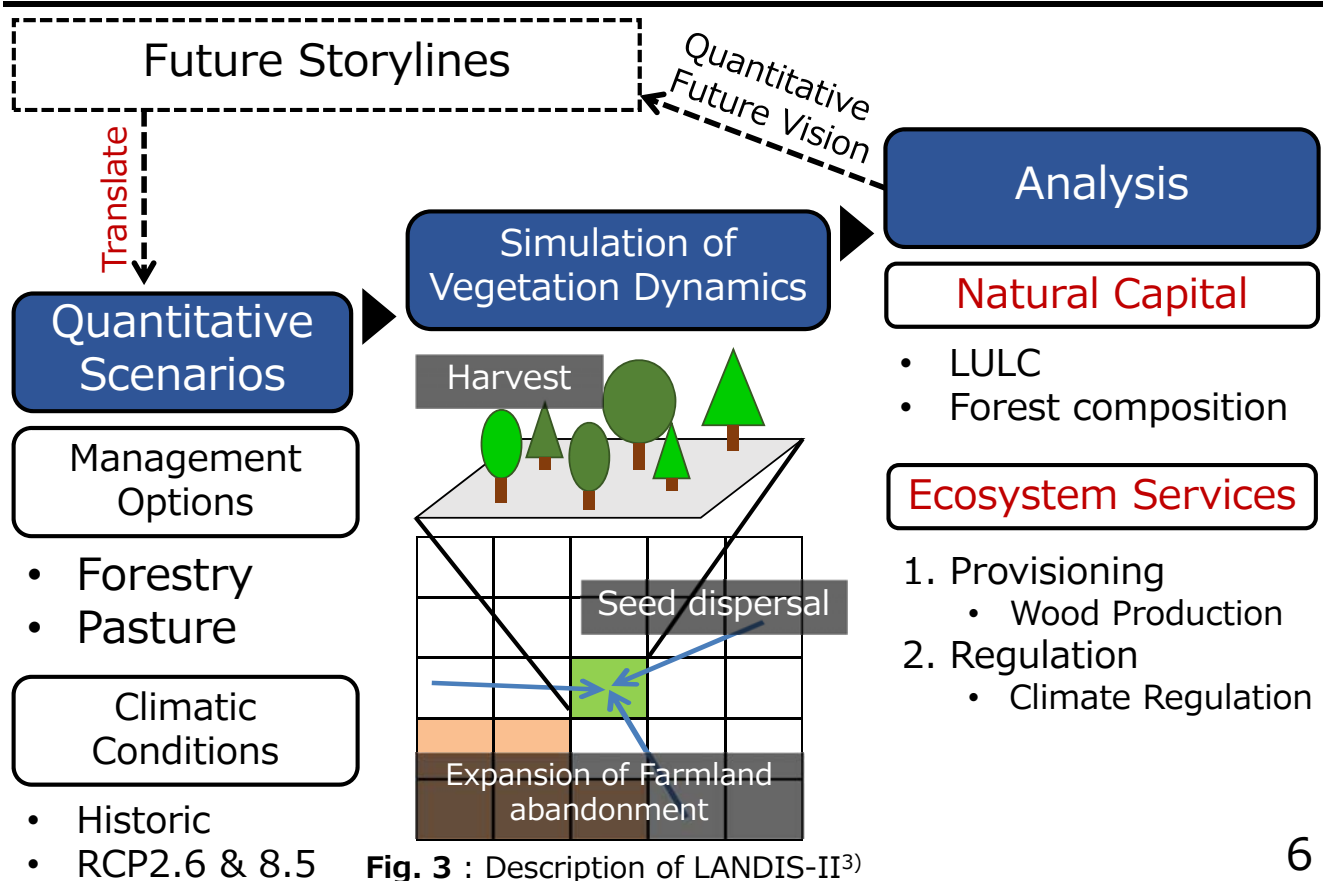


Fig. 3 : Description of LANDIS-II³⁾

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9th ESP World Conference @ Shenzhen, China

14 Dec. 2017

T5 Future Scenarios and Modelling of Natural Capital and Ecosystem Services

Method

- 1: Description of Forest Landscape Model
- 2: Target Area
- 3: Future Scenario
- 4: Simulation Conditions

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Description of Landscape Change Model, **LANDIS-II**

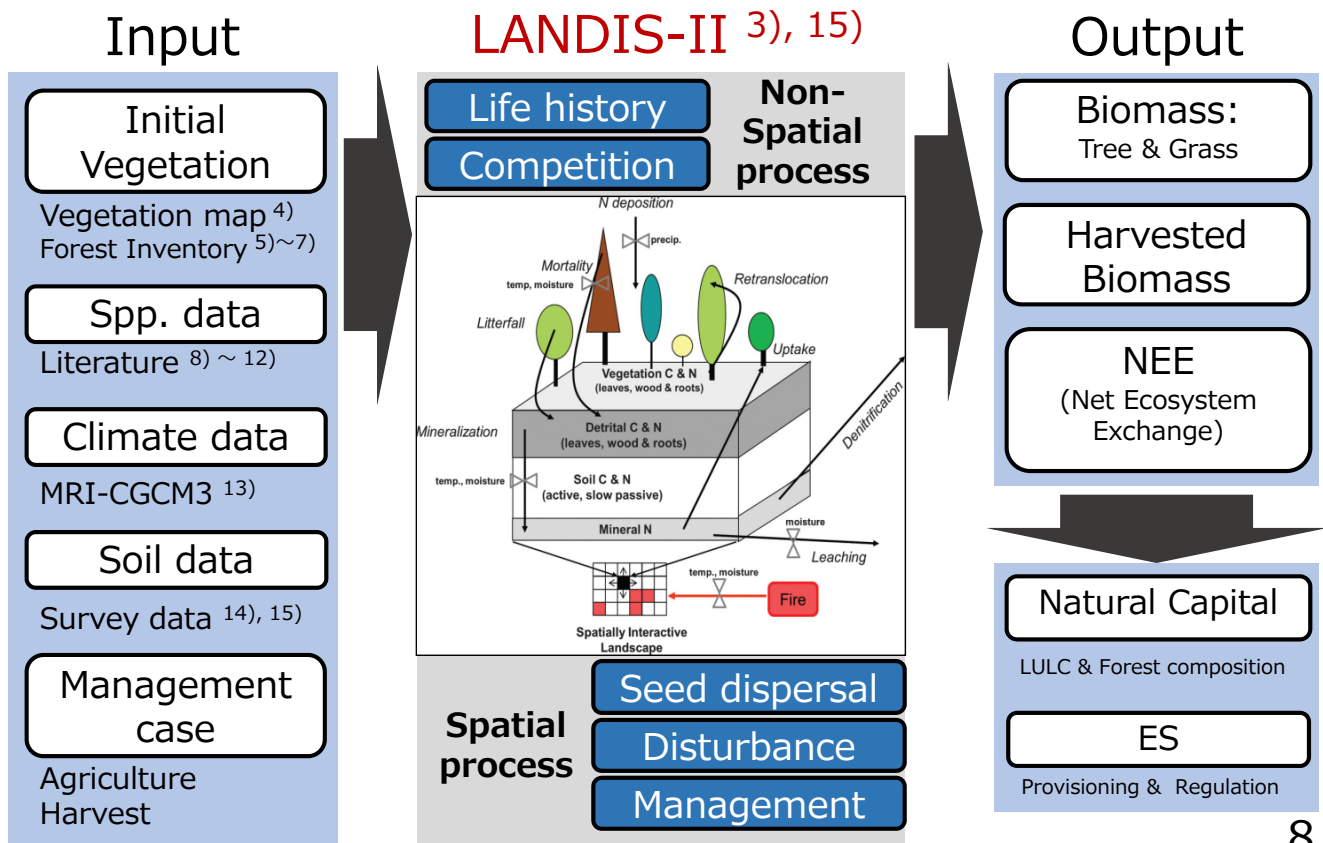


Fig. 4: Lucash Melissa S. et.al., 2014.

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Target Area: Bekaubeushi River Basin, Hokkaido

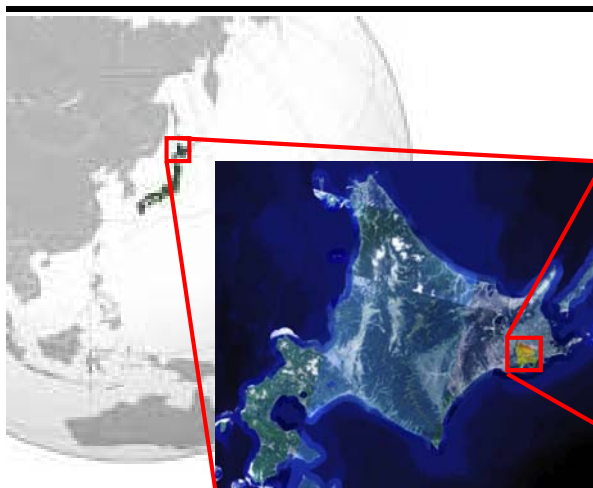


Fig. 5: Location of the target area (Modified from GSI tiles ¹⁶⁾)

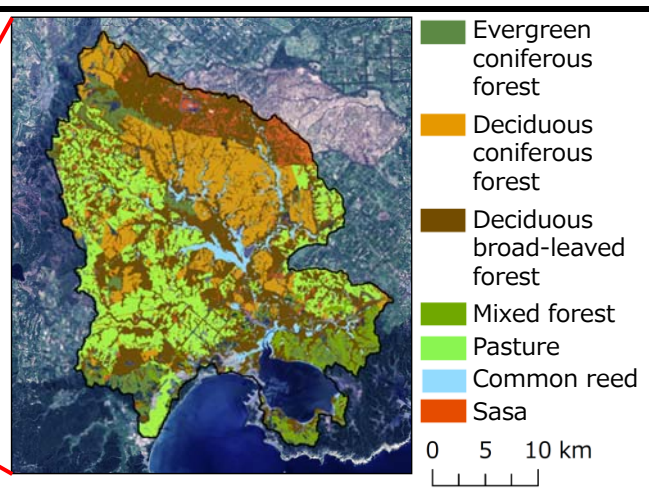


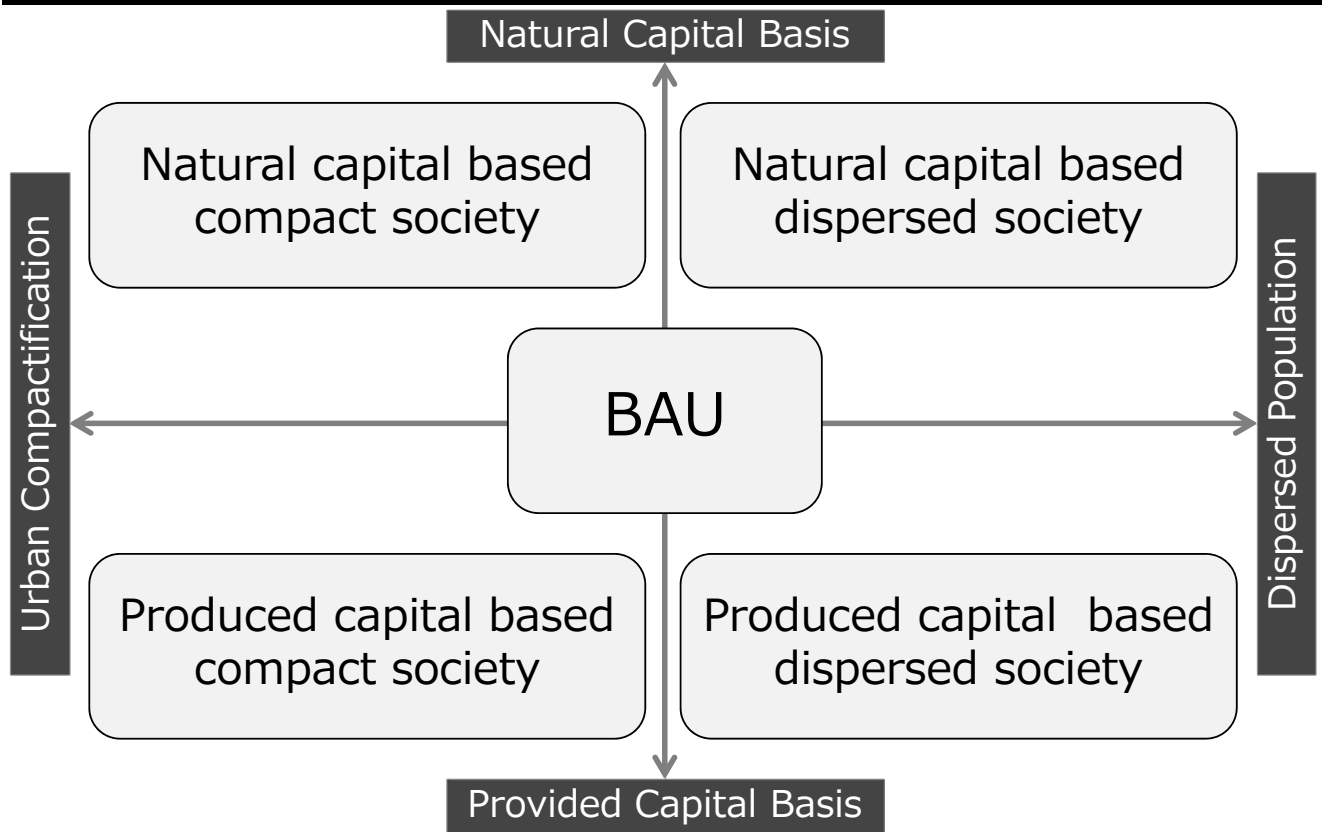
Fig. 6: Bekaubeushi river basin (Modified from GSI tiles ¹⁶⁾ and Vegetation survey ⁴⁾)

Table 1: Overview of the basin

Item	Condition
Total area	About 700 [km ²]
Land use	Forest: 70 %, Pasture: 20 %
Population	10,016 (Akkeshi town ¹⁷⁾)

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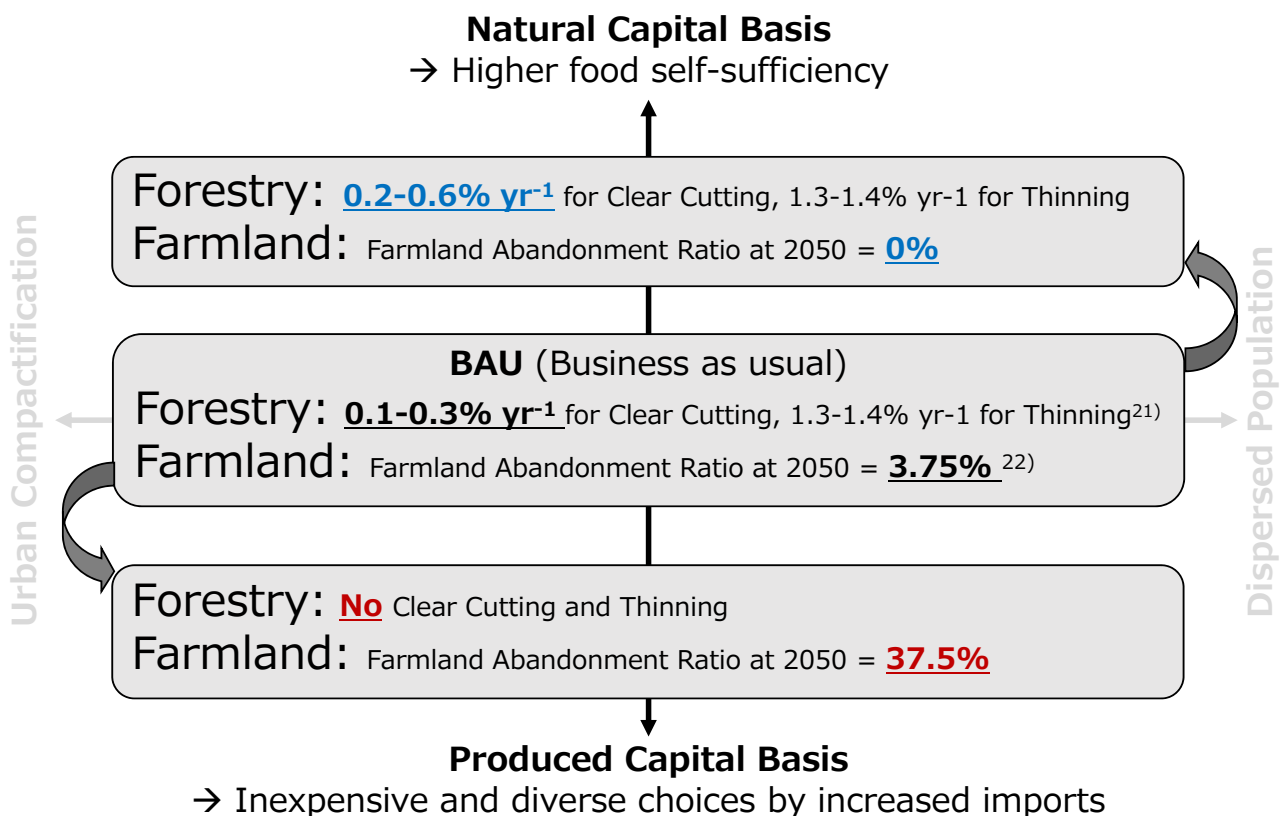
5 Future Scenarios



18) Osamu Saito: Overview and Progress of "Predicting and Assessing Natural Capital and Ecosystem Services"(PANCES) Project, ESP9, T5 Future Scenarios and Modelling of Natural Capital and Ecosystem Services, 2017.

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Management Options: Natural or Produced?

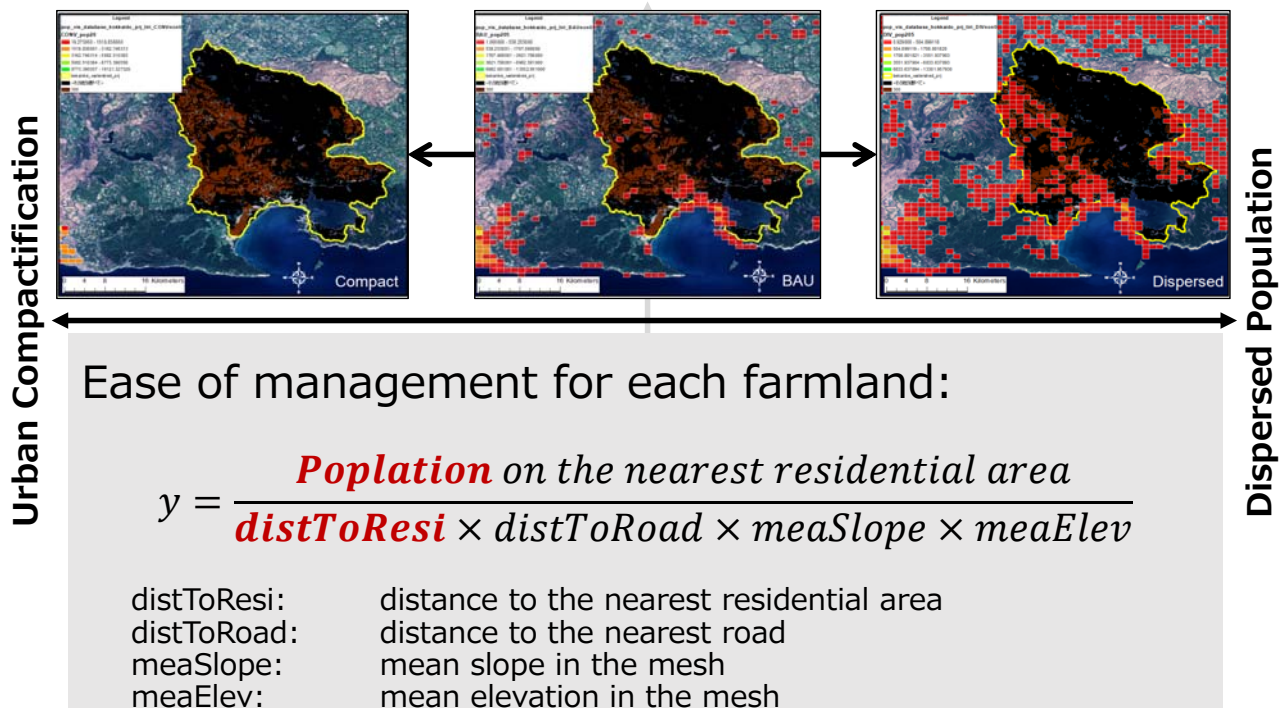


19) Hokkaido: Statistics of forestry, 20) Ministry of Agriculture, Forestry and Fisheries: Census of Agriculture and Forestry

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Management Options: Compact or Dispersed?

Distribution of the population in 2050 ¹⁸⁾



18) Osamu Saito: Overview and Progress of "Predicting and Assessing Natural Capital and Ecosystem Services"(PANCES) Project, ESP9, T5 Future Scenarios and Modelling of Natural Capital and Ecosystem Services, 2017.

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Simulation Conditions

Table 2: Simulation Conditions

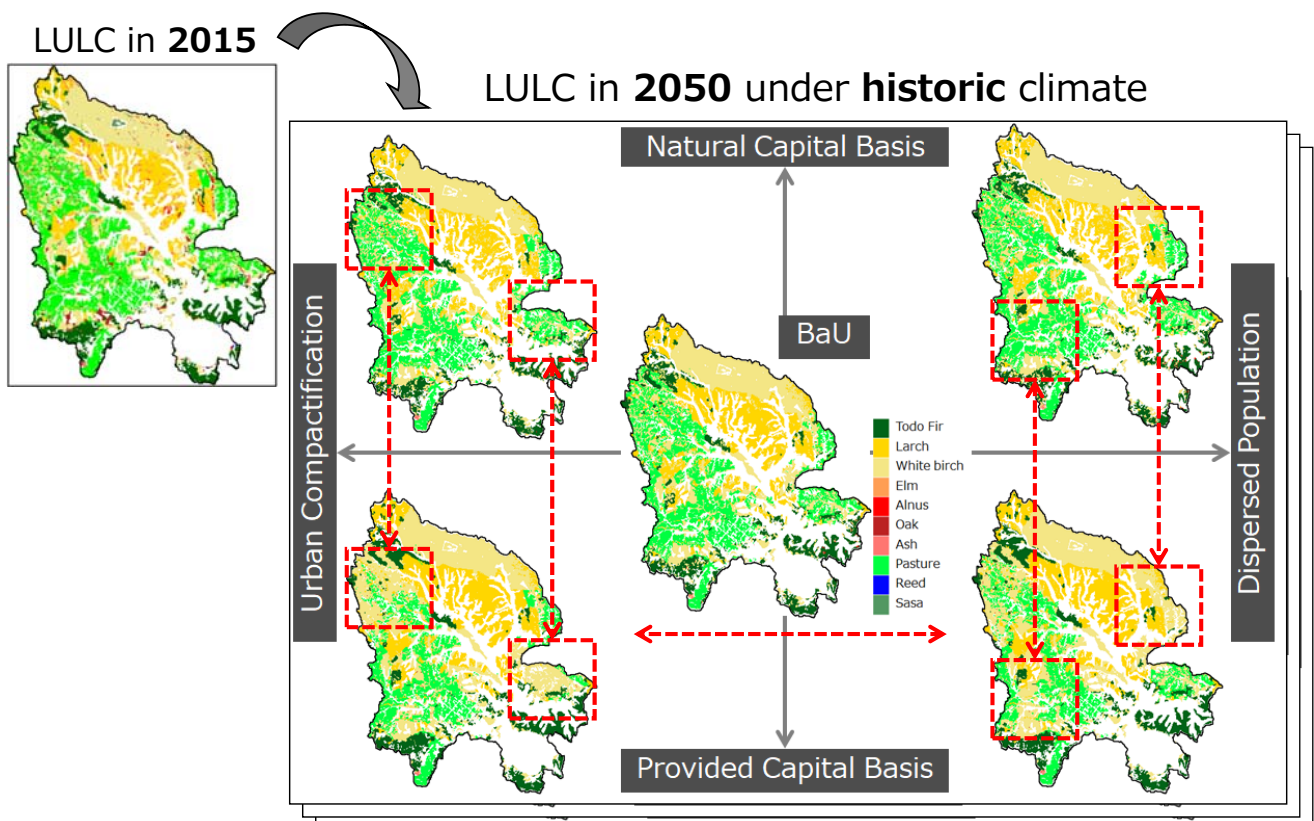
Condition	
Study area	Bekanbeushi basin, Hokkaido
Scenario variables	<u>3 climate conditions</u>
	• Historic, RCP2.5 & 8.5 from MRI-CGCM-3
	<u>5 management options</u>
	• Forest management
	• Farmland abandonment
Duration	35 years (2016 to 2050)
Temporal resolution	1 year (tree growth: monthly)
Spatial resolution	100 m

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Results & Discussion

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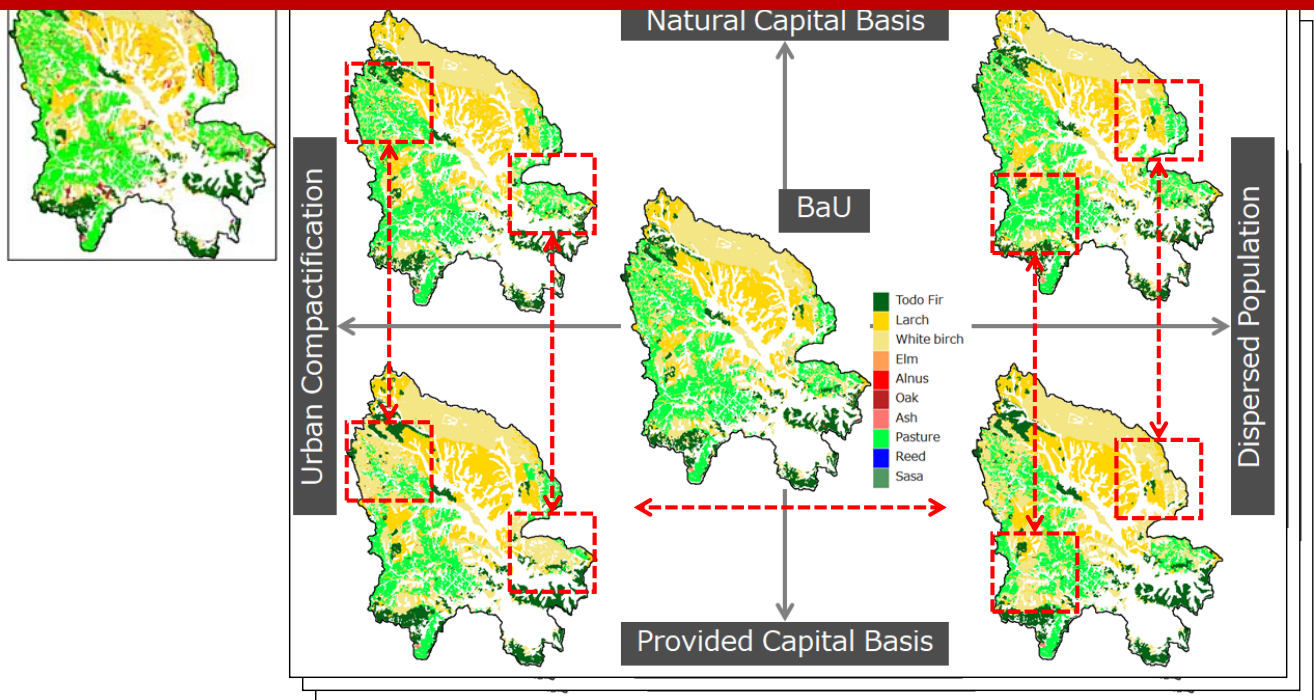
Result 1. Natural Capital: LULC Change during 2015-2050 (historic)



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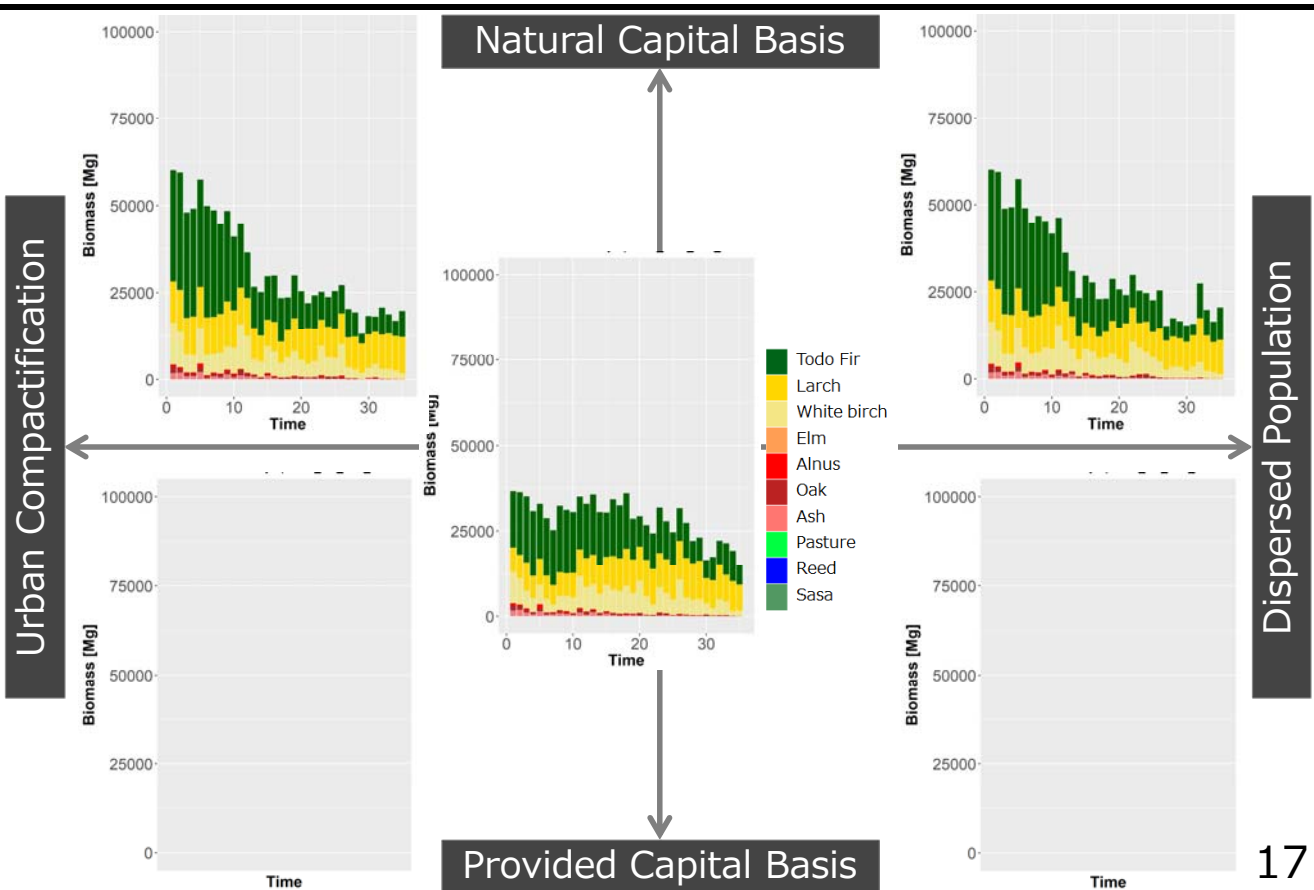
Result 1. Natural Capital: LULC Change during 2015-2050 (historic)

Successfully translated differences among scenarios into LULC change.



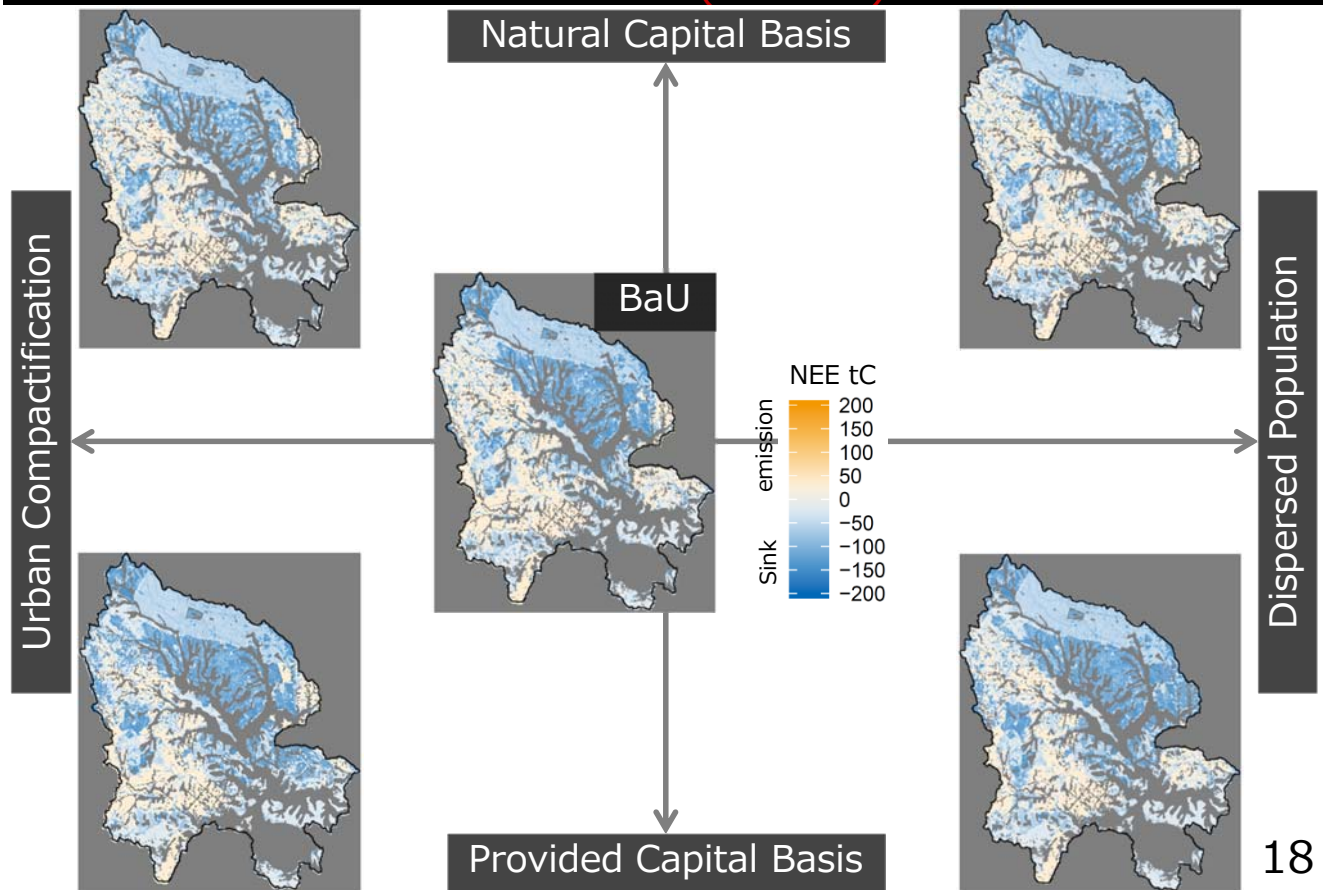
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Result 2: Provisioning Service: Timber production



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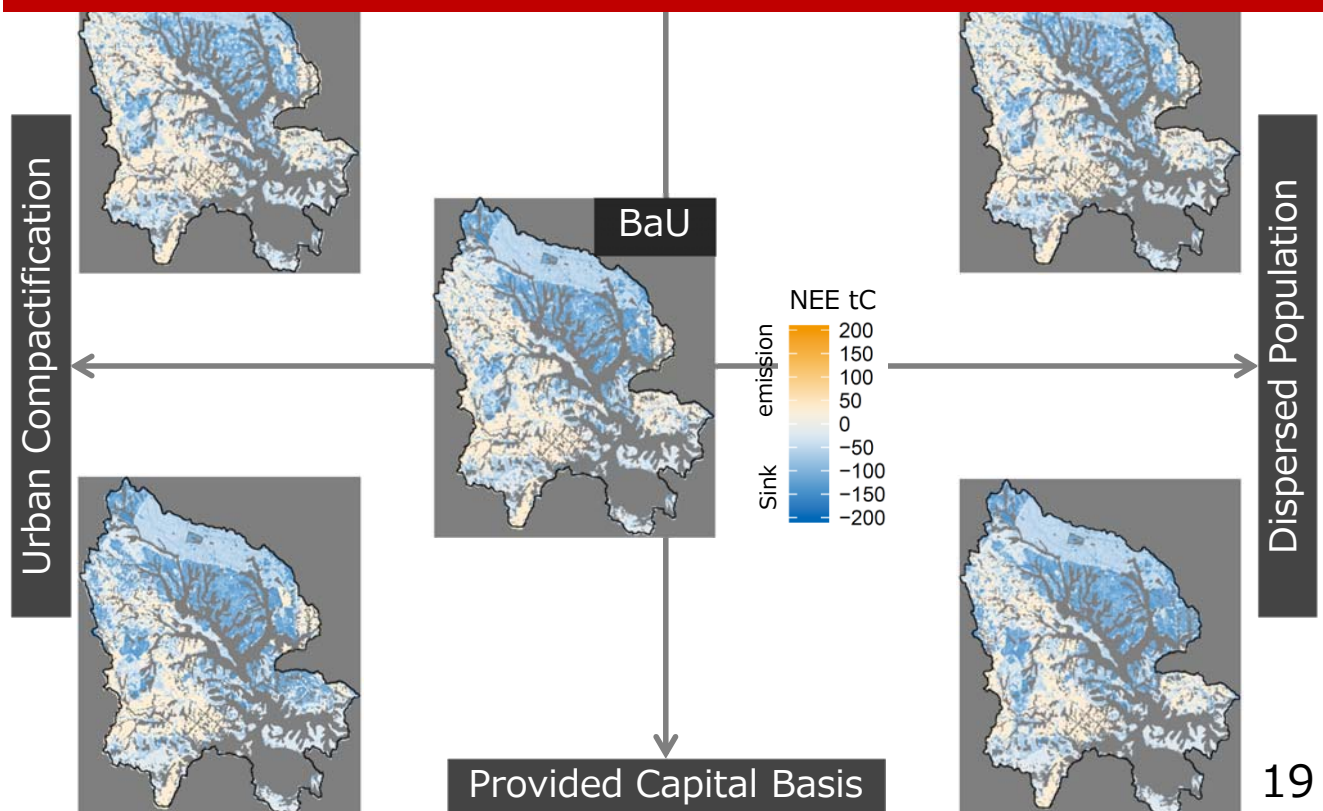
Results 3. Regulation Service: Carbon Sequestration during 2015-2050 (historic)



18

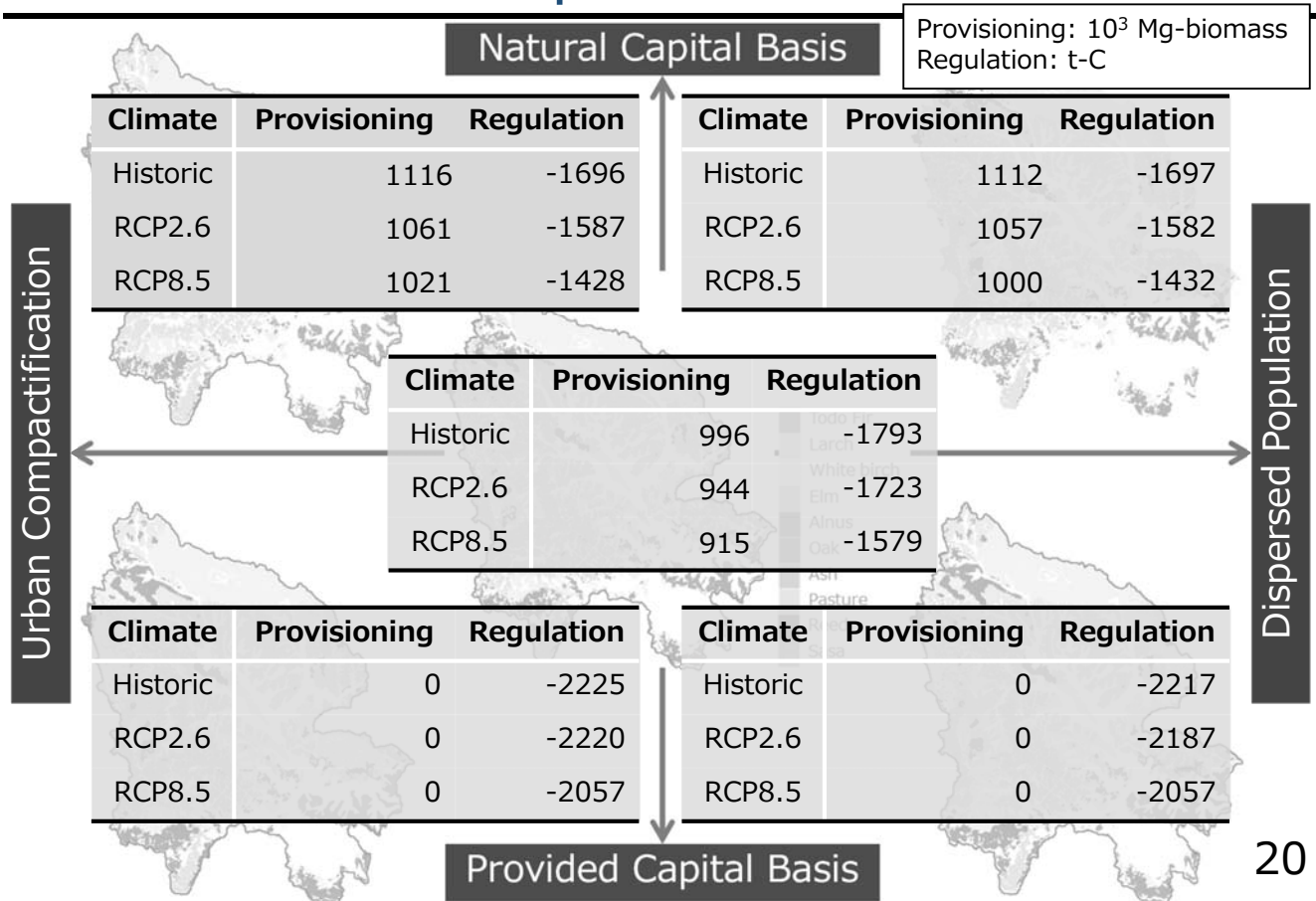
Results 3. Regulation Service: Carbon Sequestration during 2015-2050 (historic)

Net: Sink (Forest: sink, Pasture: source of emission)

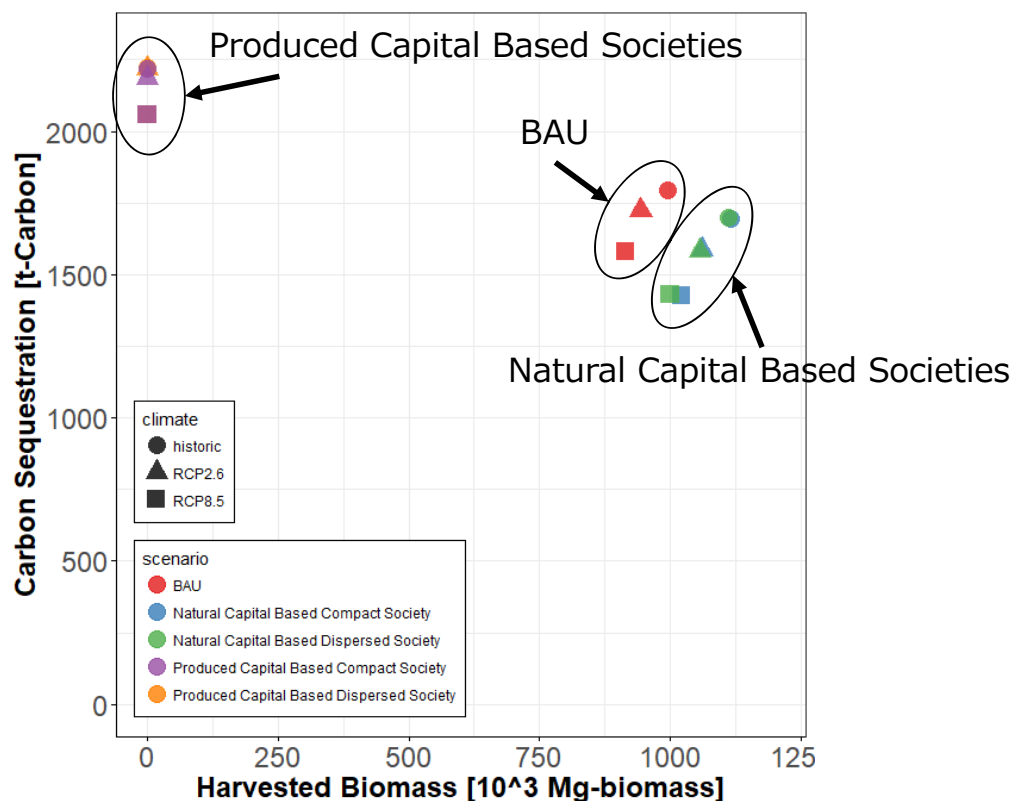


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Results 4: Comparison of 5 Scenarios



Results 4: Comparison of 5 Scenarios



Conclusion

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Conclusion

- We developed a simulation system of natural capital & ecosystem services for underuse problems.
- We linked scenarios and model considering preference and distribution of population.
- We could visualize the consequences of future scenarios.

Future Tasks

- Communication with local people to set future scenarios
- Quantify uncertainties of the model simulation
- Refine evaluation process of multiple natural capitals & ESs

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Thank you for your attention!

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17. Akkeshi Town : Akkeshi Town Statistical Report in H27, <<https://www.akkeshi-town.jp/file/contents/1399/11804/h27toukeisho.pdf>> (2017.02.09 Accessed)
18. Osamu Saito: Overview and Progress of "Predicting and Assessing Natural Capital and Ecosystem Services"(PANCES) Project, ESP9, T5 Future Scenarios and Modelling of Natural Capital and Ecosystem Services, 2017.
19. Hokkaido: Statistics of forestry
20. Ministry of Agriculture, Forestry and Fisheries: Census of Agriculture and Forestry

Appendix

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Climatic Conditions of Target Area

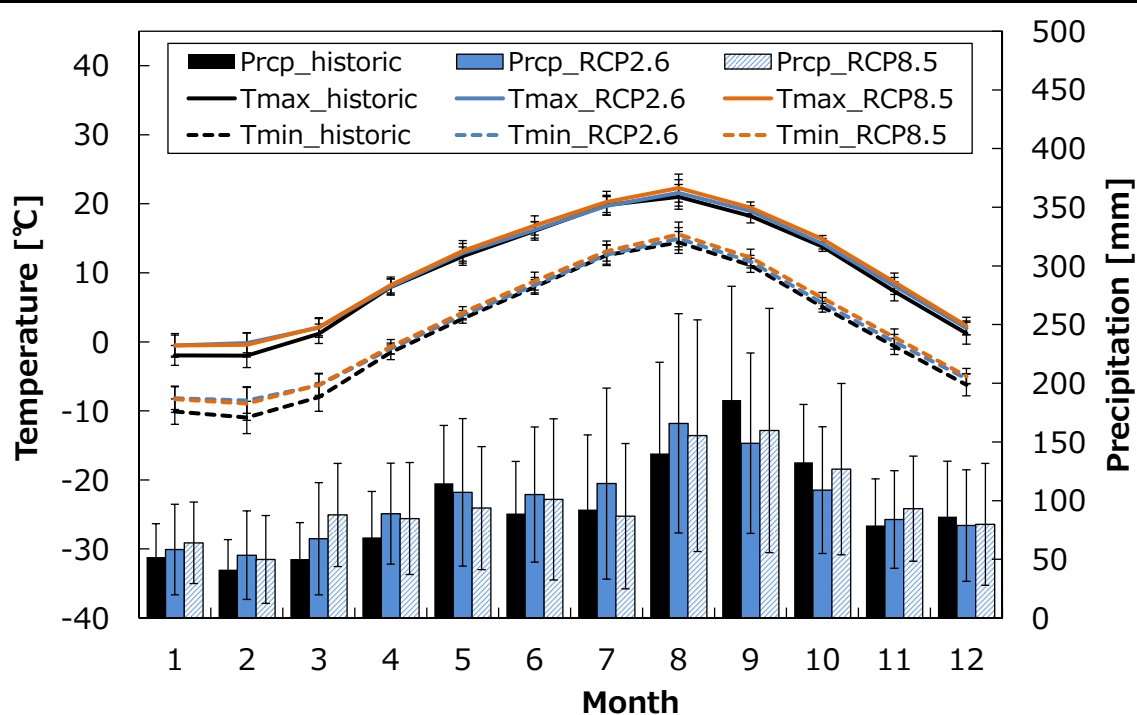
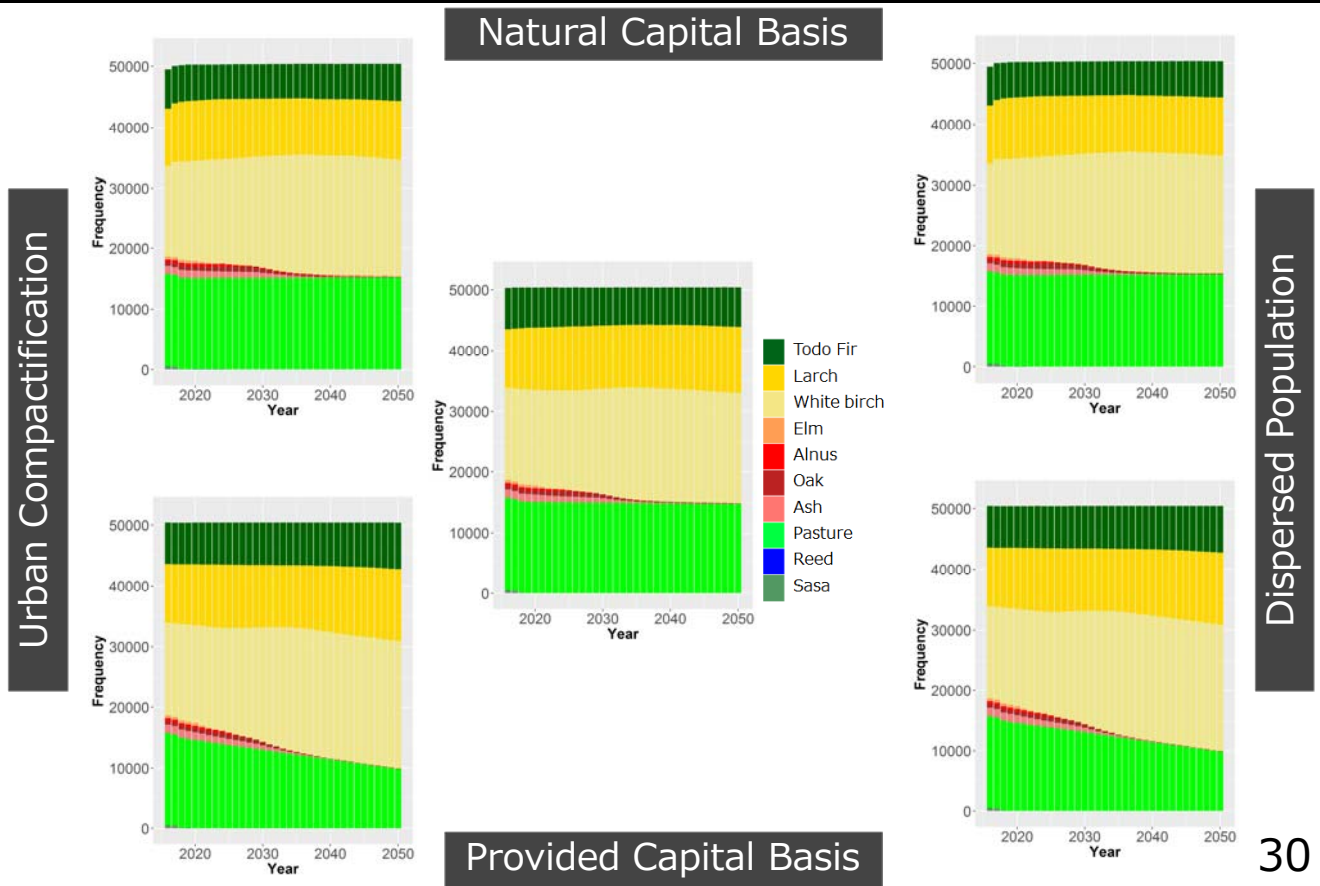


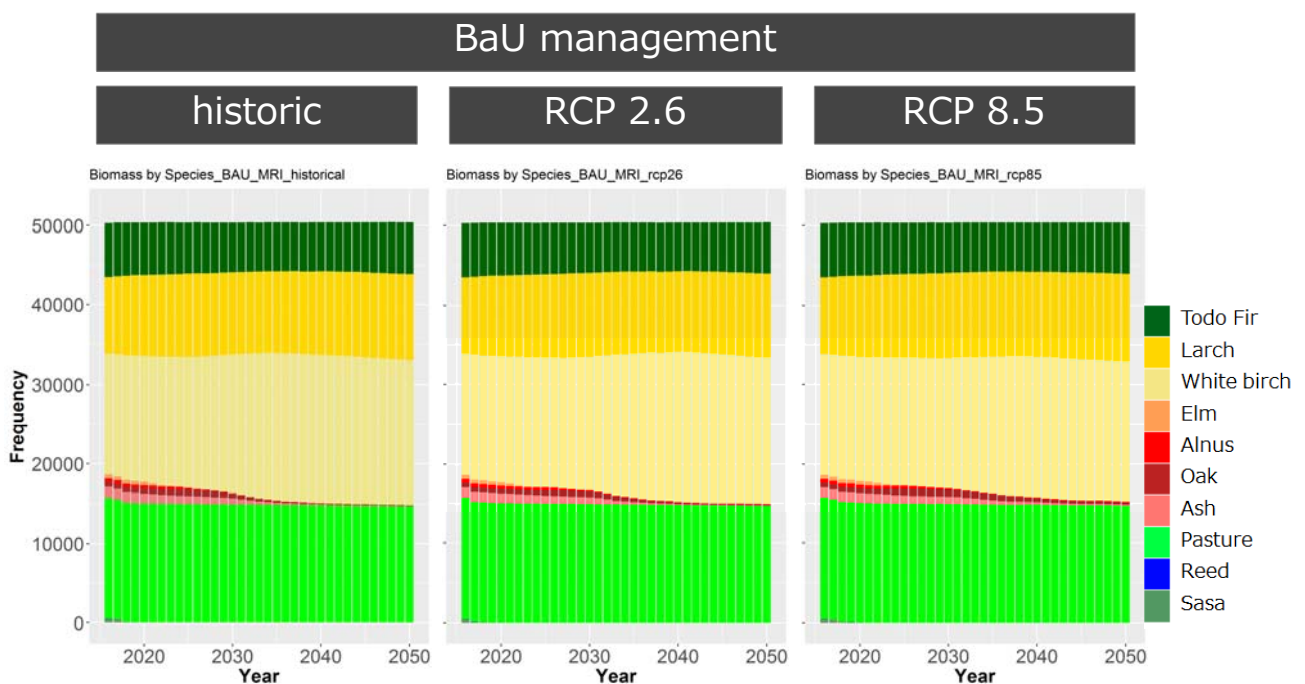
Fig. Monthly averaged temperature and precipitation of MRI-CGCM3 (historic: 1978-2005, RCPs: 2015-2050). Bias was corrected by cumulative distribution function of observed climate data during 1978-2005.

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Result 1. Natural Capital: LULC Change during 2015-2050 (historic)



Result 1. Natural Capital: Changes in LULC by Climate Scenarios (BaU management)



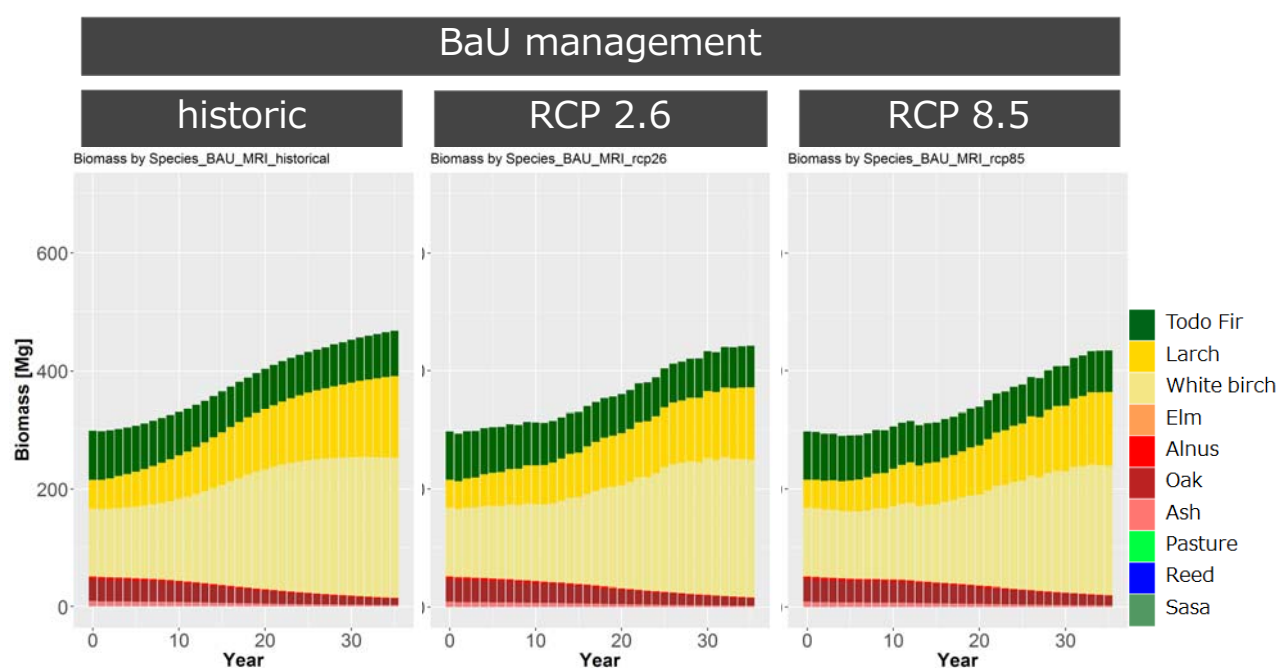
Result 1. Natural Capital: LULC Change during 2015-2050 (historic)

Table 1 : Cross tabulate table under BAU management and historic climate [ha]

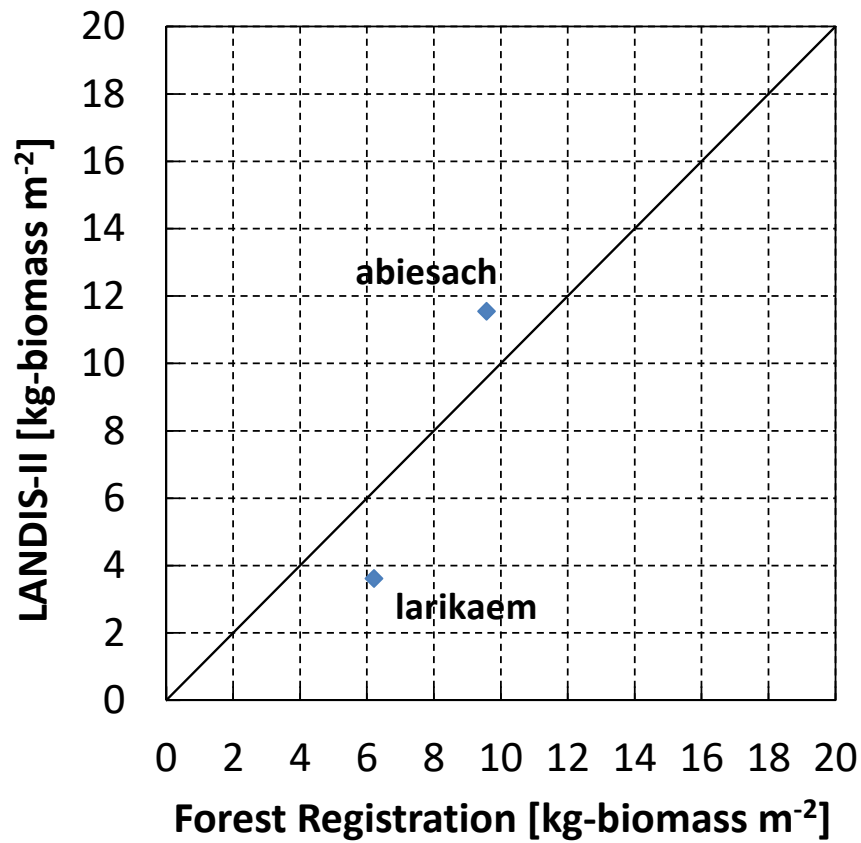
2015		2050											
		Todo fir	Larch	White birch	Alnus	Ash	Oak	Elm	Pasture	Reed	Sasa	None	Total
	Todo fir	5602	119	937	13	11	52	0	4	0	0	15	6753
	Larch	9	8627	1060	0	1	1	0	0	0	0	2	9700
	White birch	728	1326	13141	0	0	1	0	0	0	0	0	15196
	Alnus	0	133	337	0	3	0	0	0	0	0	1	474
	Ash	53	596	702	0	28	1	0	0	0	0	1	1381
	Oak	45	3	517	0	0	0	0	0	0	0	0	565
	Elm	2	36	438	0	0	0	0	0	0	0	0	476
	Pasture	0	3	551	2	0	0	0	14715	0	0	0	15271
	Reed	5	1	24	0	0	0	0	0	0	0	0	30
	Sasa	4	5	436	0	0	1	0	0	0	0	0	446
	None	25	33	65	0	0	0	0	0	0	0	79473	79596
Total	6473	10882	18208	15	43	56	0	14719	0	0	79492		

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Result 2. Natural Capital: Changes in Total Aboveground Biomass (BaU management)

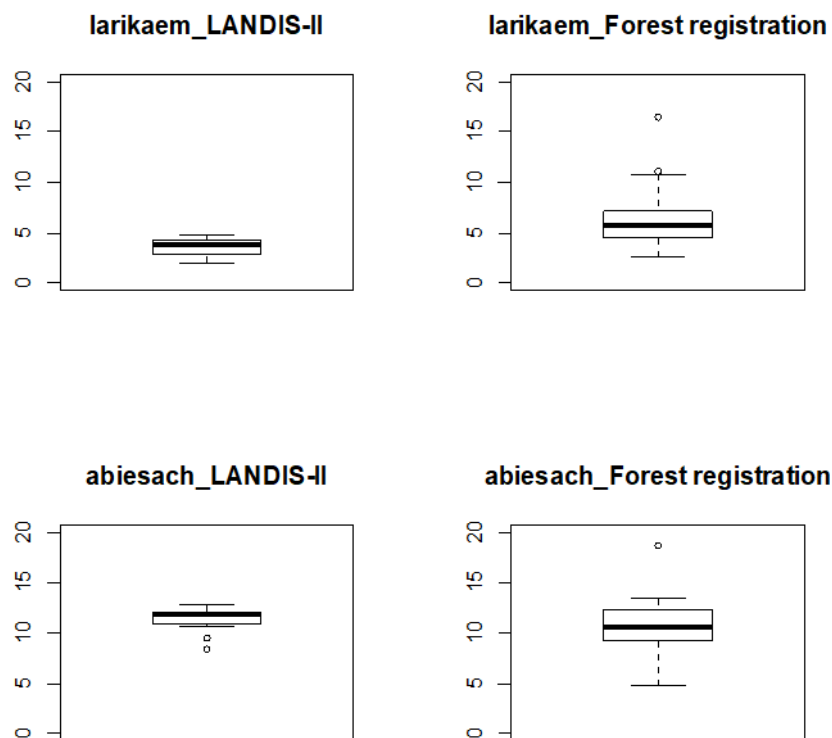


Validation: Comparison of Averaged AGB in 2015



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Validation 2: Comparison of AGB for each cells in 2015



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