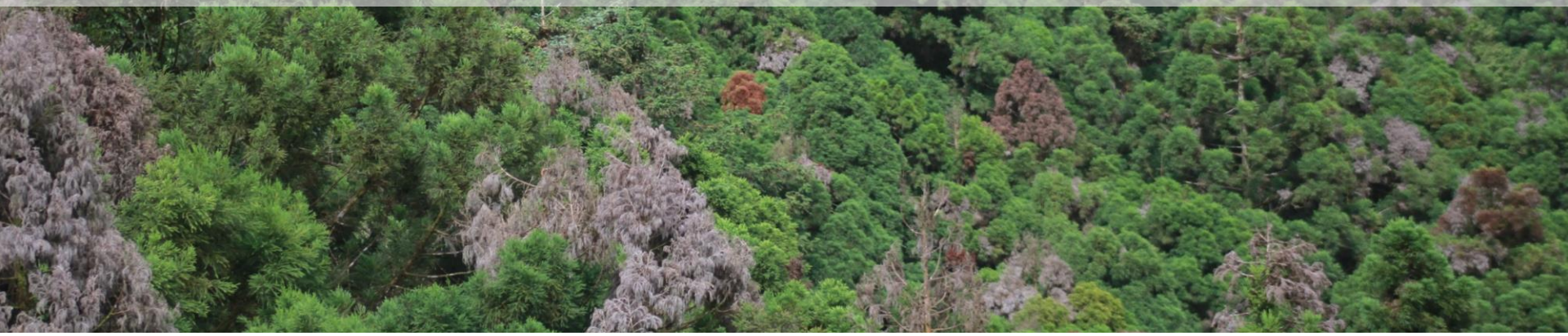
Forecasting impacts of climate change on plantation carbon sink capability


Hung-En Li

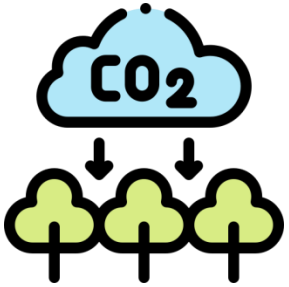

Su-Ting Cheng



EGU22 session ITS4.4/ERE1.10 – Nature-Based Solutions and Climate Engineering in Climate Governance

The need of reliable method to examine carbon sink capability in Taiwan

Motivation



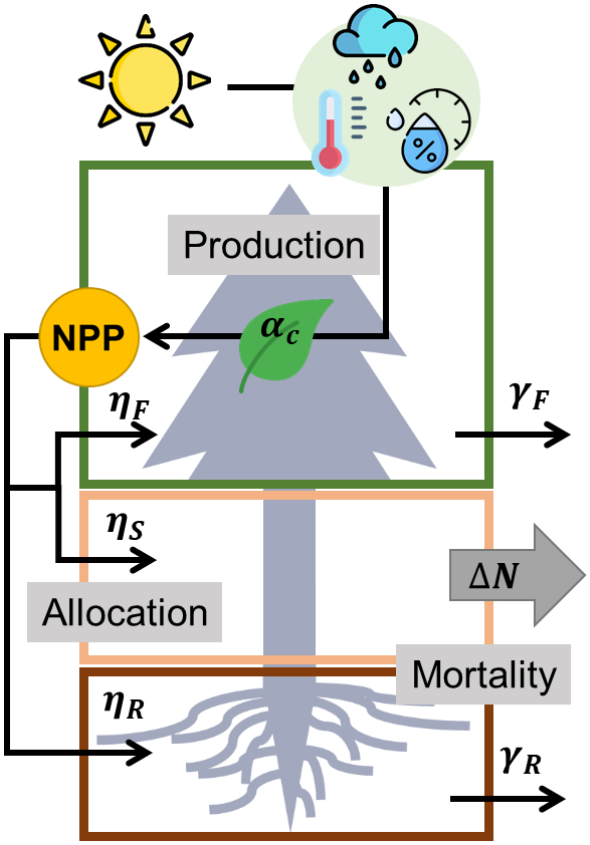
The lack of a reliable forecasting method to examine potential carbon sink capability of forest plantations under climate change.

Objective

Develop a process-based model to assess sugi stand growth under climate change and give management recommendation

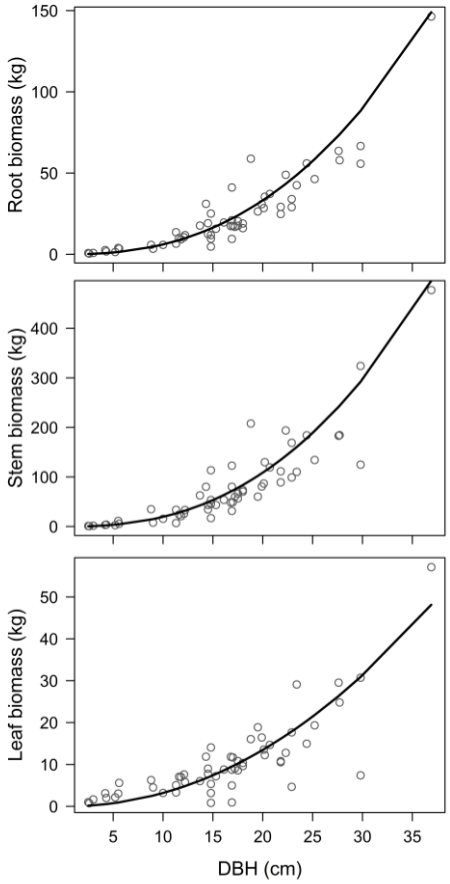
Stand growth model development

Model Structure



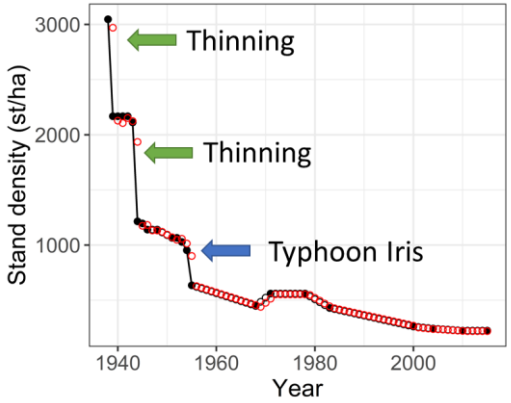
(Landsberg & Waring, 1997; Sands, 2004; Forrester, 2021)

Allometry

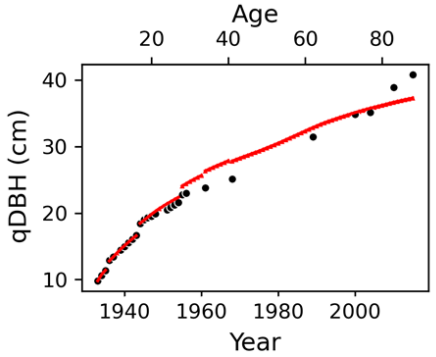


(SugiHinoki DB, Osone et al., 2020)

Mortality



Model calibration to growth data



Scenario analysis

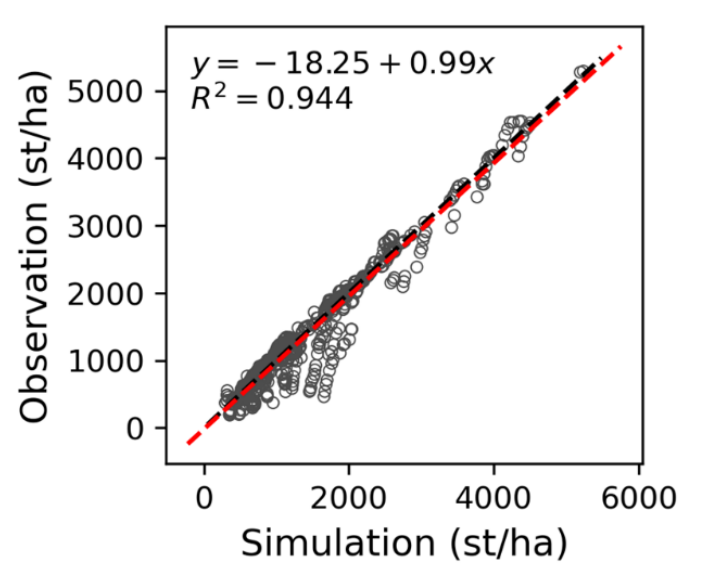
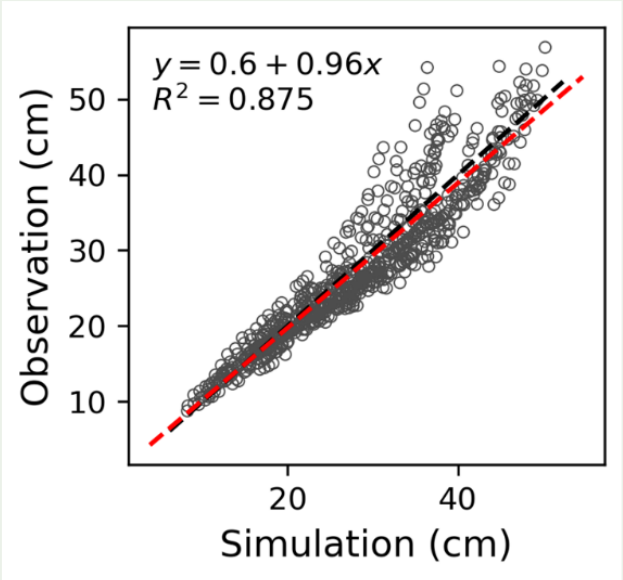
RCP2.6 RCP4.5 RCP6.0 RCP8.5

Continue to grow

VS

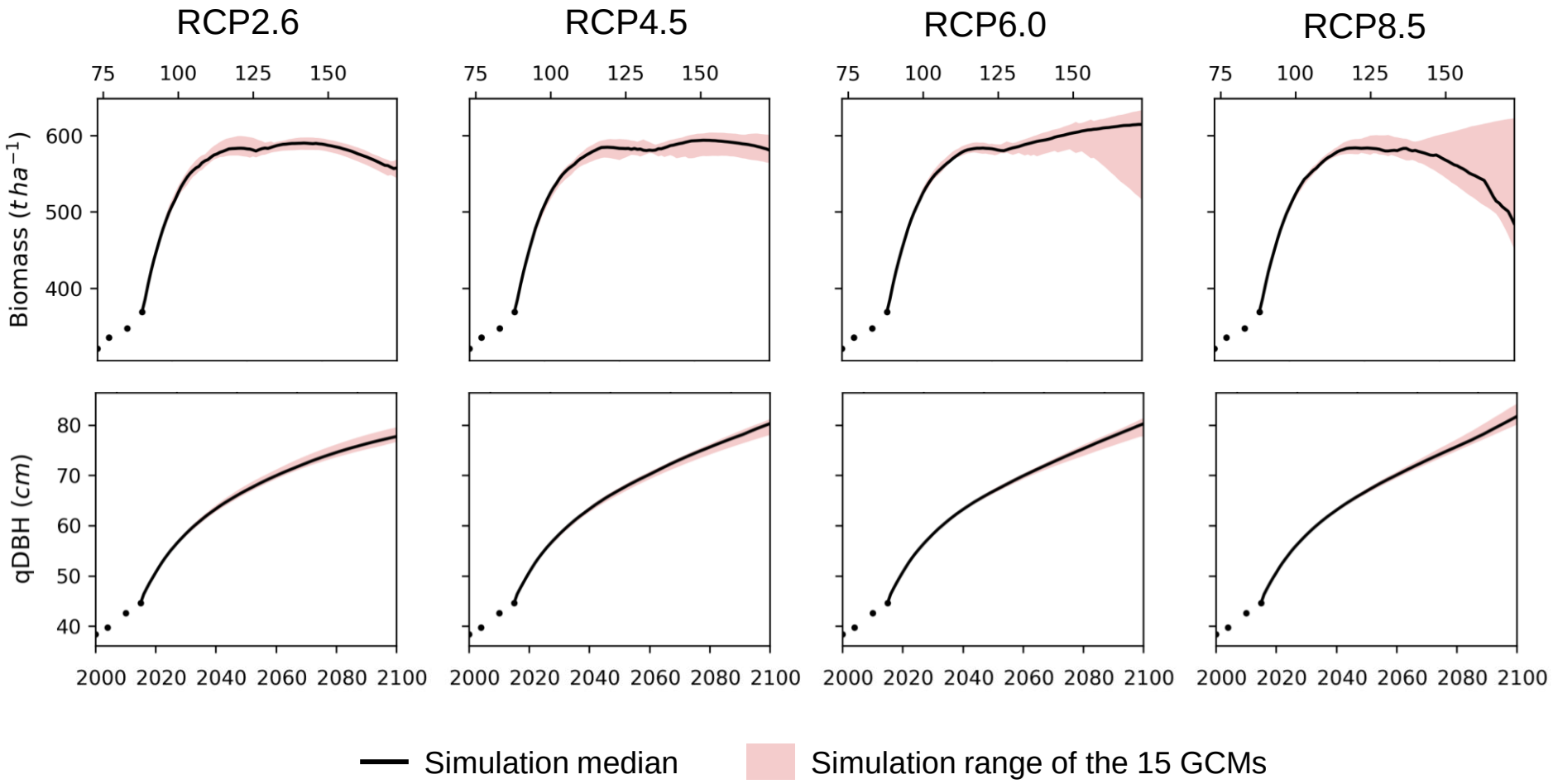
Artificial regeneration

Model performance

	Stand density	Quadratic mean DBH
Overall model error	RMSE = 215 st ha^{-1} MAPE = 16.6%	RMSE = 3.6 cm MAPE = 9.5%
Model explanatory power		

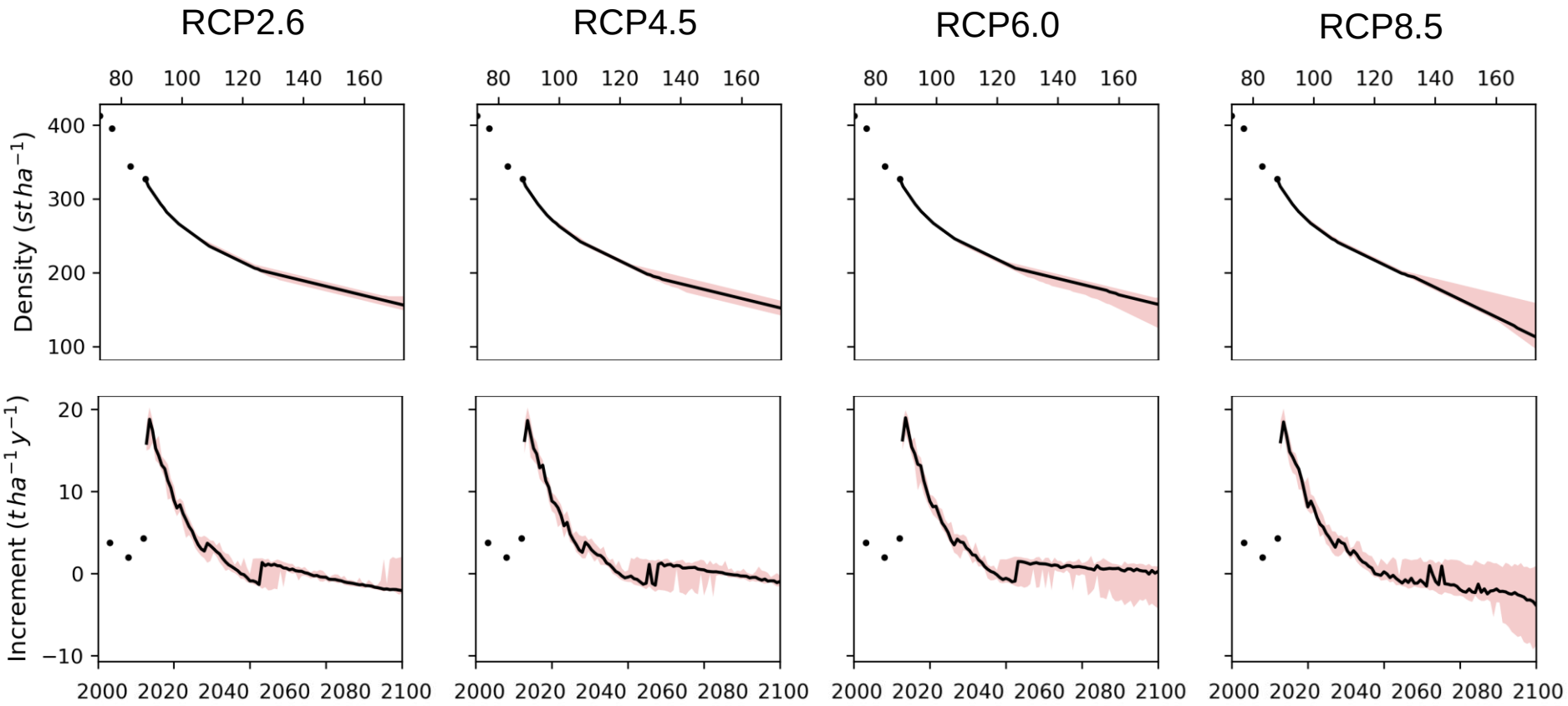
Annual increment decline in the near future without management

Future growth projection



Annual increment decline in the near future without management

Future growth projection



Anticipating rise in annual increment after artificial regeneration

Fig. A & B

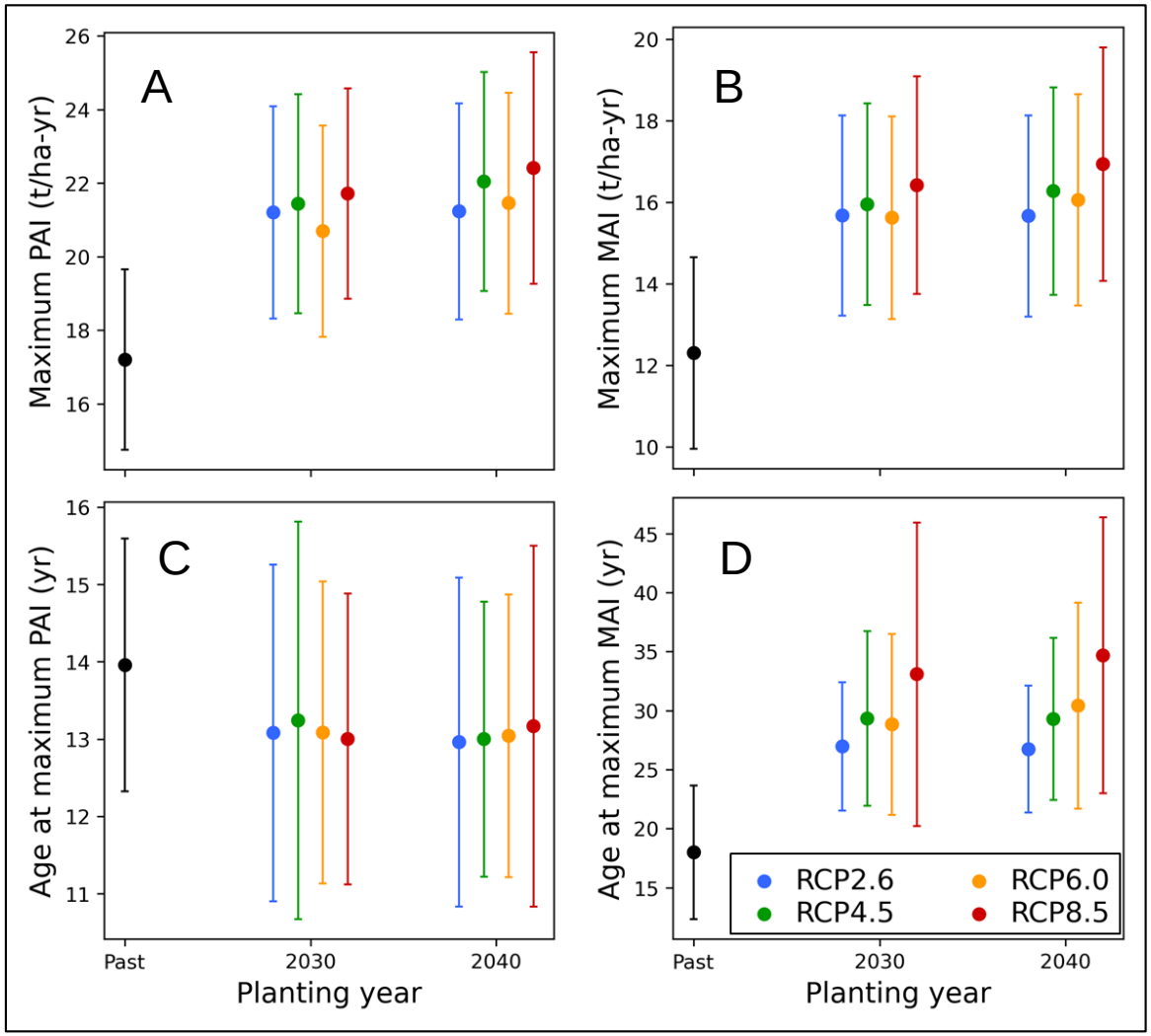
- Maximum PAI and MAI rise by 4 t ha^{-1} yr^{-1}.

Fig. C

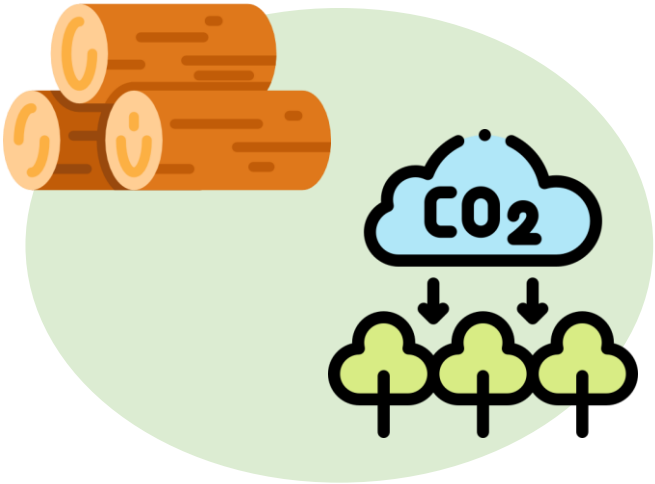
- Max PAI will be reached earlier.

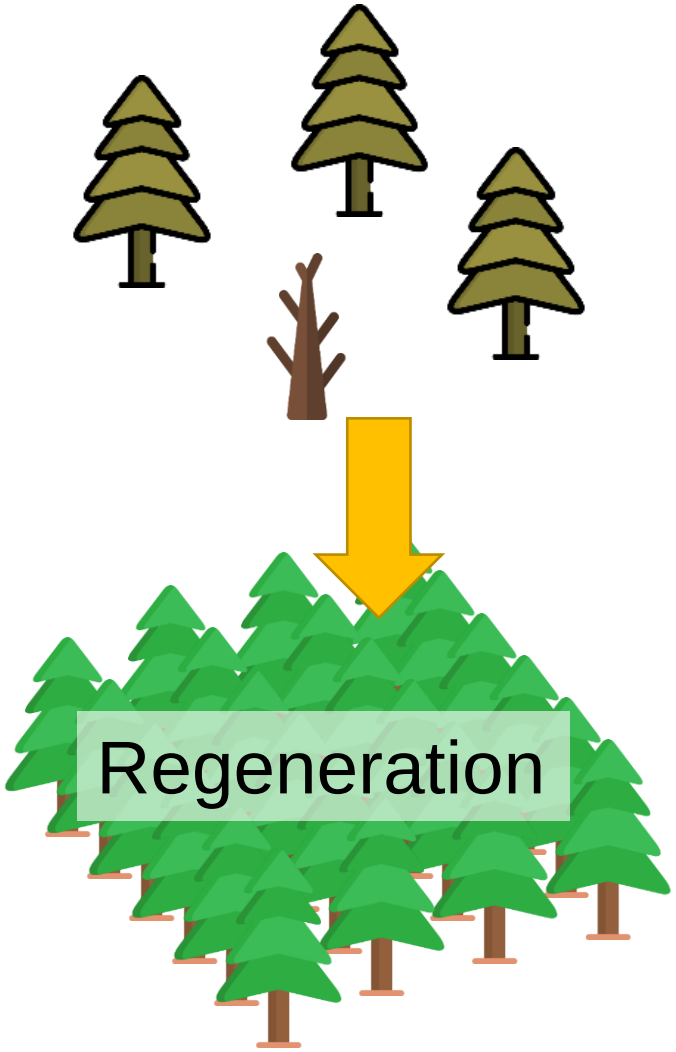
Fig. D

- MAI will decline later in age.



Management recommendation for the sugi plantations





If the management objective is timber production or carbon sink, artificial regeneration is recommended.

Acknowledgement

National Taiwan University Experimental Forest
→ The long-term growth data of *C. japonica*

Taiwan Climate Change Projection Information and Adaptation Knowledge Platform
→ Gridded Historical Daily Data (1960- 2019)
→ AR5 Statistical Downscaled Daily Data (1960-2100)

Ministry of Science and Technology
→ Funding - MOST 108-2621-M-002-010-MY3