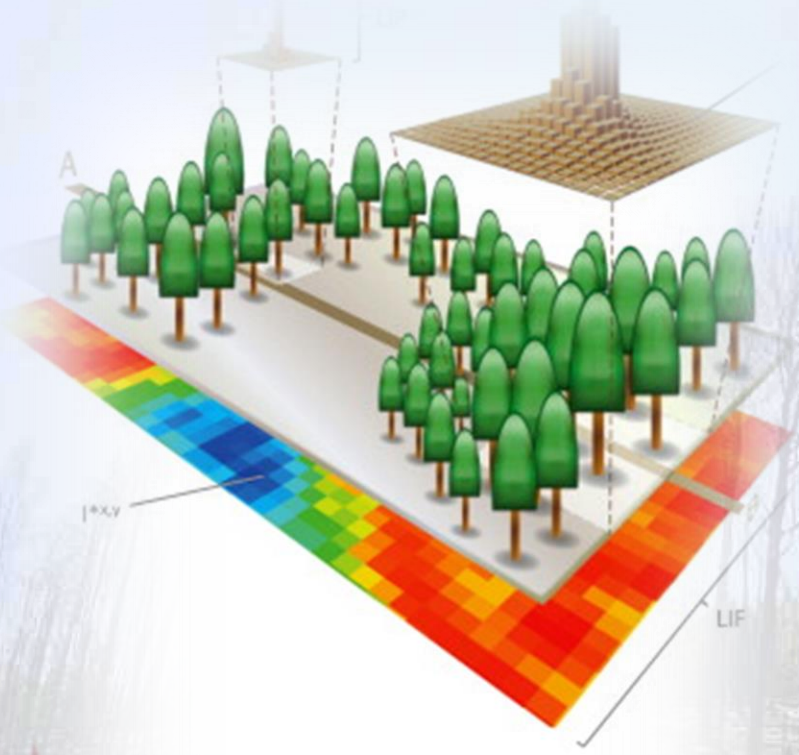

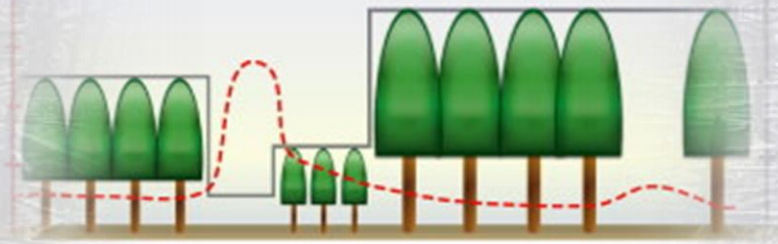

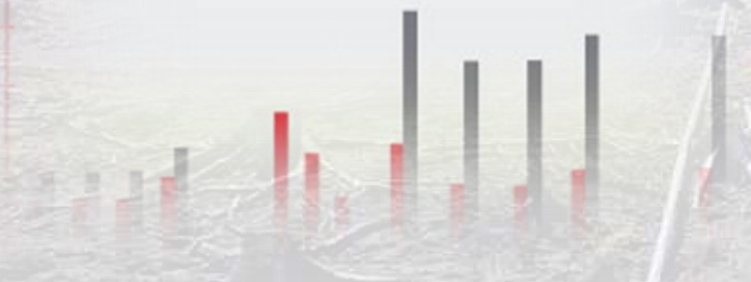

Ecosystem Dynamics in Arid Conditions: Evaluating iLand Model in Spanish Pine Forests

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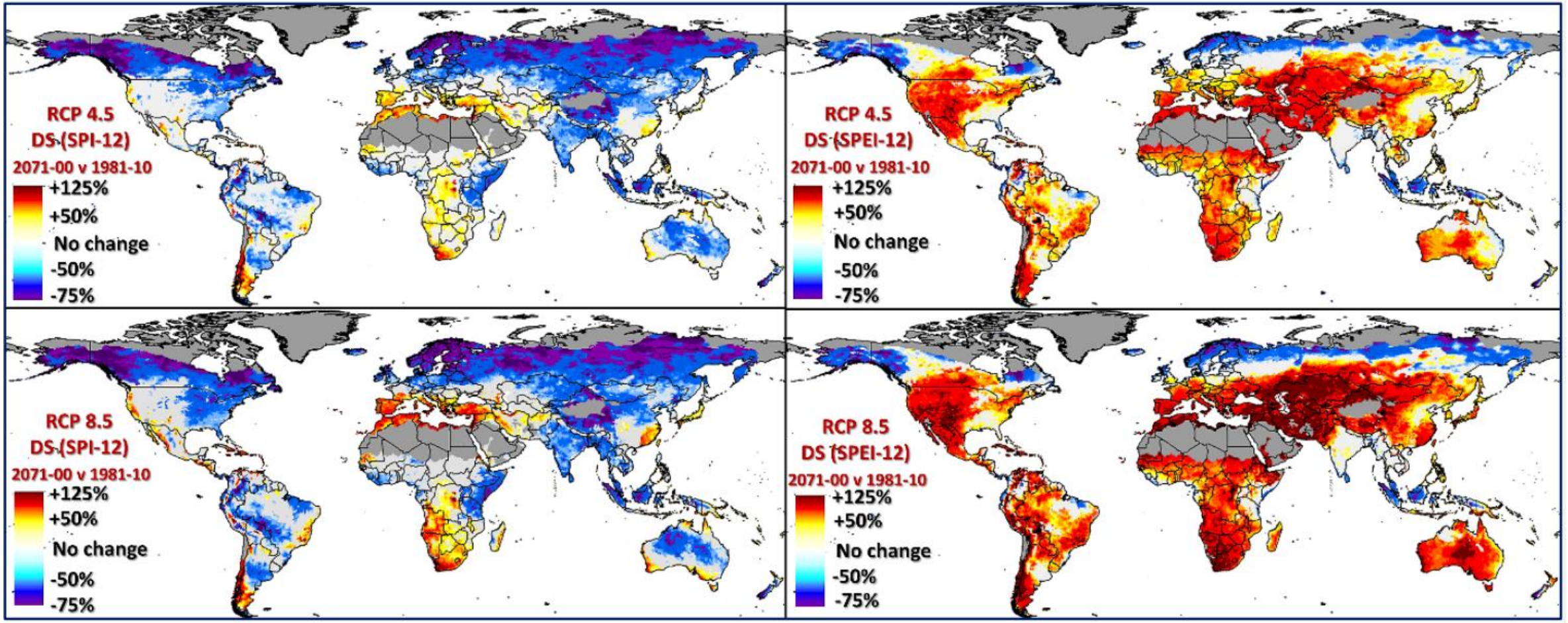
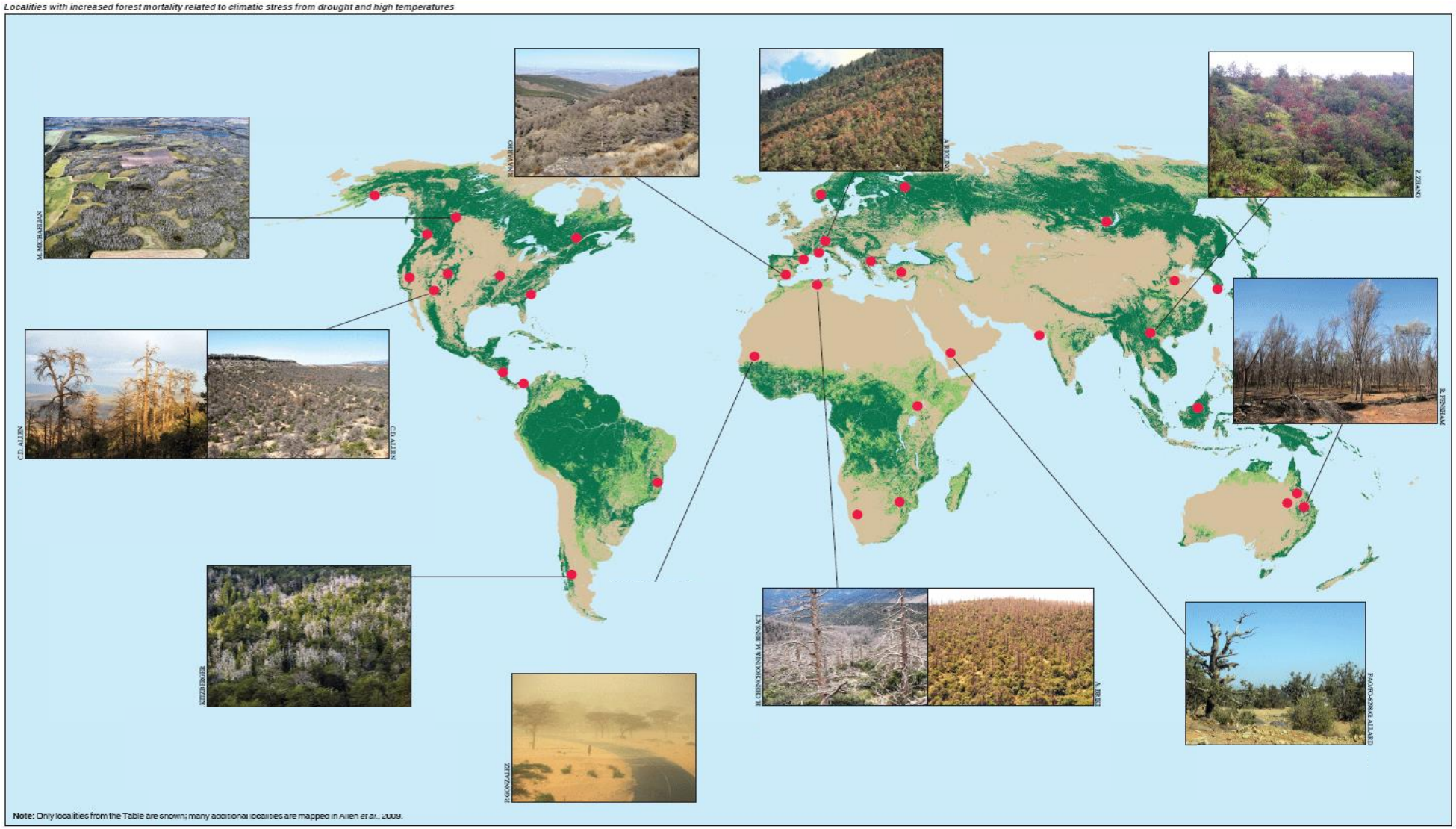
Background



Drought severity based on SPI- 12 and SPEI- 12 (2071-2100 vs 1981-2010) under RCP 4.5 and RCP 8.5 (Vogt et al. 2018*)

*Vogt, J. V., Naumann, G., Masante, D., Spinoni, J., Cammalleri, C., Erian, W., ... & Barbosa, P. (2018). Drought risk assessment and management: A conceptual framework.

Background



Allen, 2009*; FAO, 2009

*Allen, C. D. (2009). Climate-induced forest dieback: an escalating global phenomenon. Unasylva, 231(232), 60.

What can ecological modelers do?

- Test models' capacity to simulate ecosystem dynamics in emerging drought-sensitive conditions.
- Address the gaps in the models for more accurate and realistic simulation outputs.

What did we do?

- Employed the individual-based climatically sensitive process-based model, iLand (Seidl et al. 2012*) on drought-affected forest plots.
- To examine model´s ability to capture the impact of arid conditions on ecosystem dynamics we analysed the simulated (a) productivity and (b) mortality.

*Seidl, R., Rammer, W., Scheller, R. M., & Spies, T. A. (2012). An individual-based process model to simulate landscape-scale forest ecosystem dynamics. Ecological Modelling, 231, 87-100.

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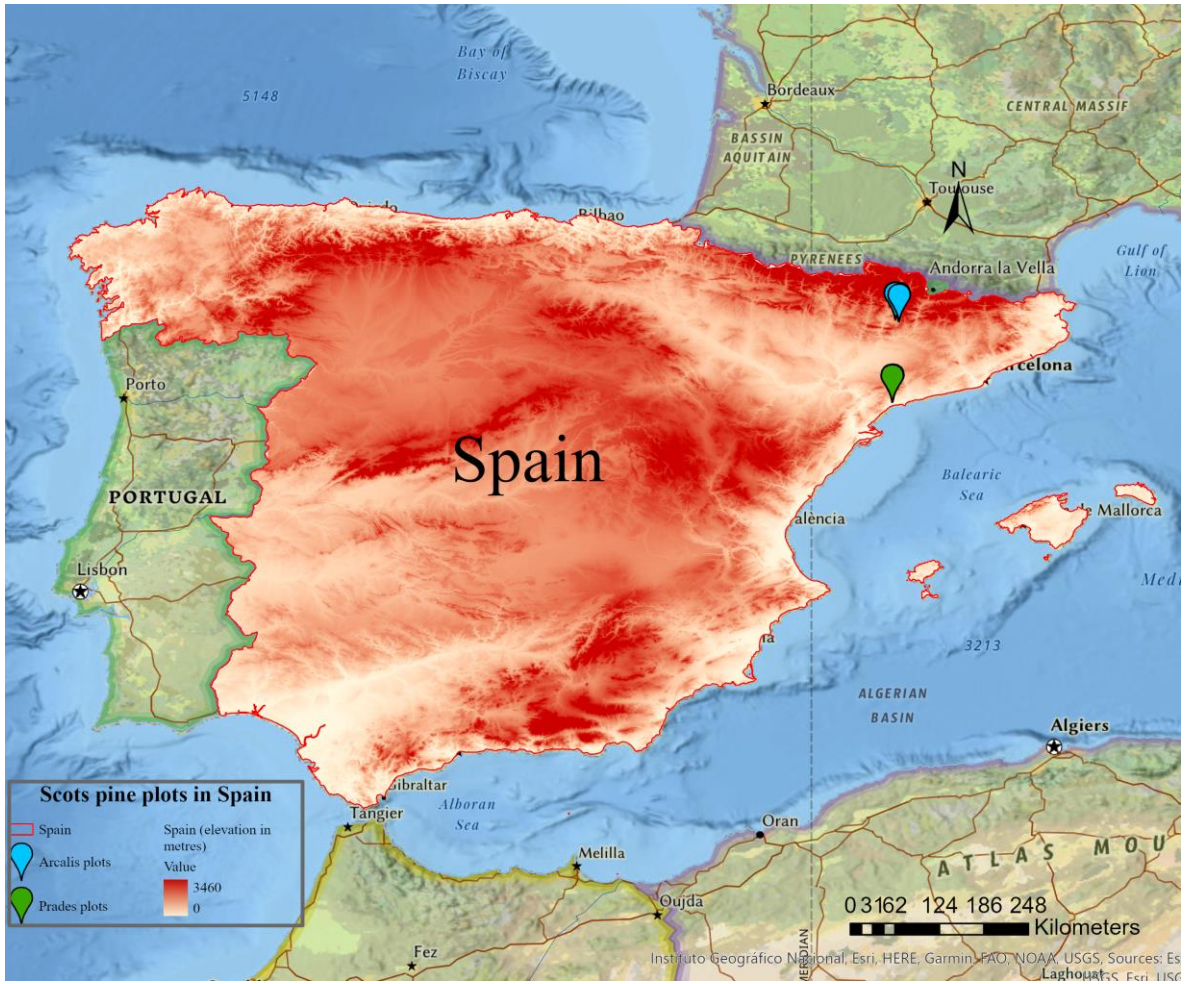
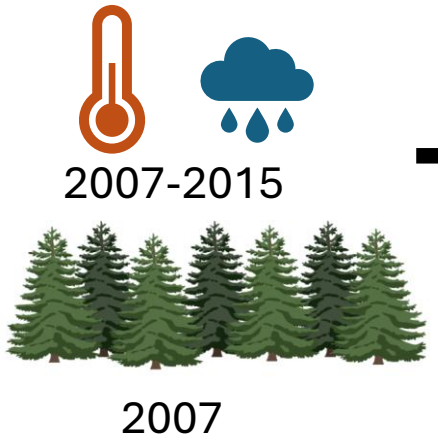
Where was the model used?

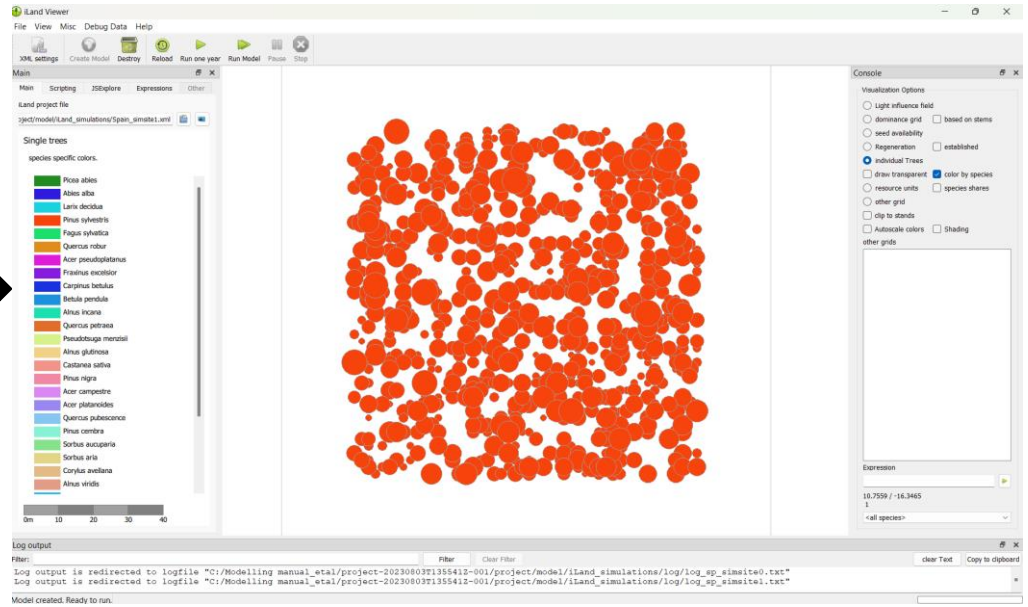


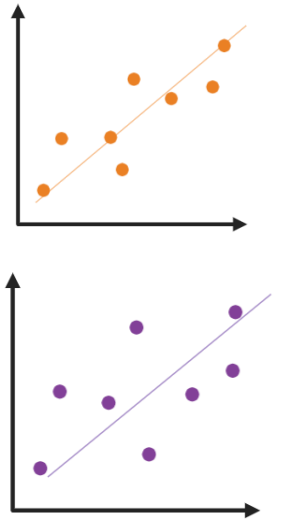
- 55 *Pinus sylvestris* (Scots pine) stands in Spain across elevation gradient of 645-1364m a.s.l.
- Stands experienced drought-induced forest mortality between 2007- 2015.
- Five simulation sites were designed from the 55 Scots pine stands for the study.

Experimental and simulation design

Initialization → Simulation with the model → Statistical models → Assessment of model performance







- Daily climate time series from 2007-2015 used.
- Initial stand conditions of 2007 used to initialize the simulations.

- Simulations with the iLand model for 9 years to allow comparisons between simulated and observed outputs.
- Productivity calculated in terms of total volume production during the simulated period.
- Mortality calculated in terms of the percentage volume of trees which died during the simulated period.

- Statistical models to observe consistency between simulated and observed outputs.
- Statistical models to analyze the consistency in drivers of simulated and observed outputs.

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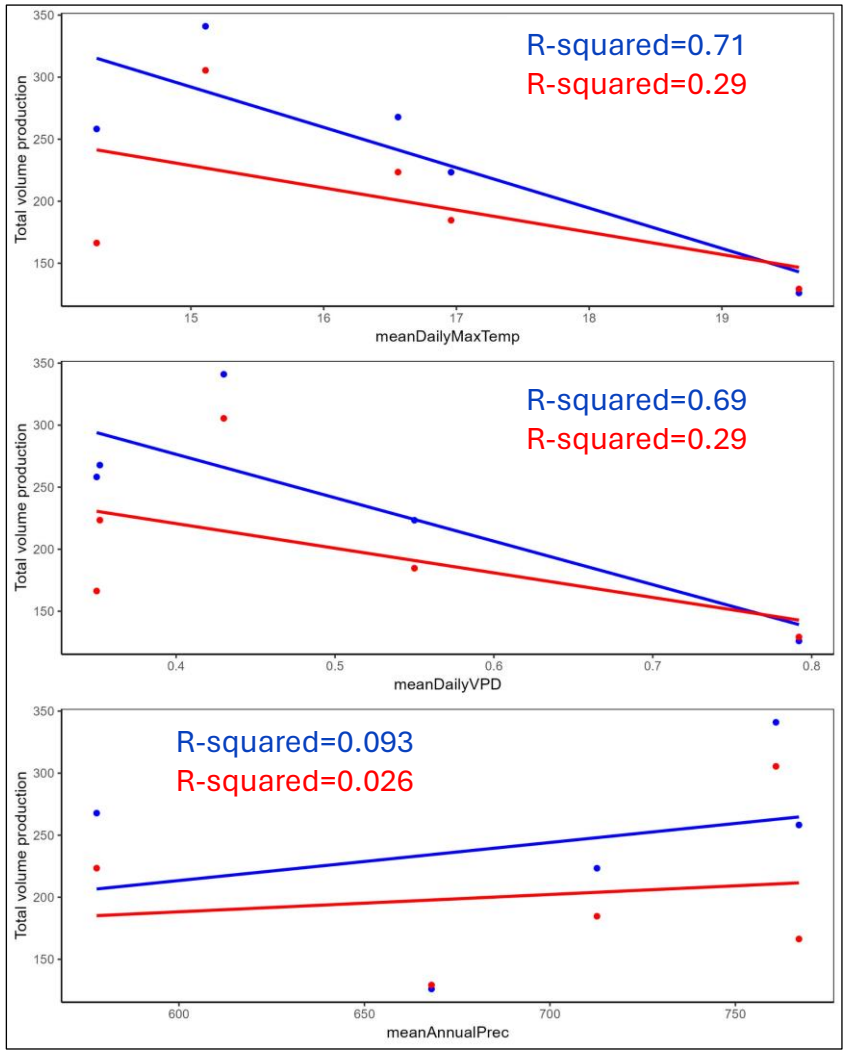
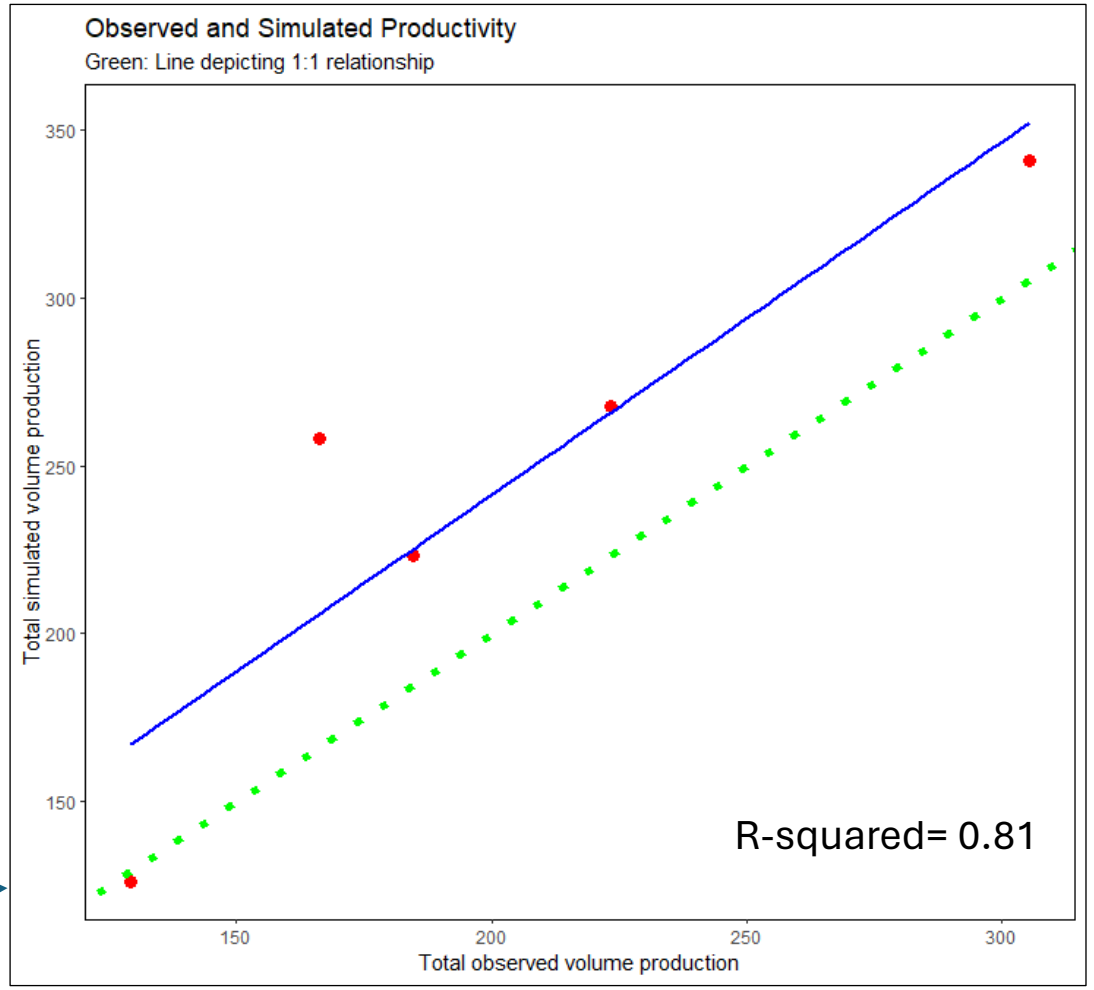
Productivity dynamics

Blue: Simulated productivity
Red: Observed productivity

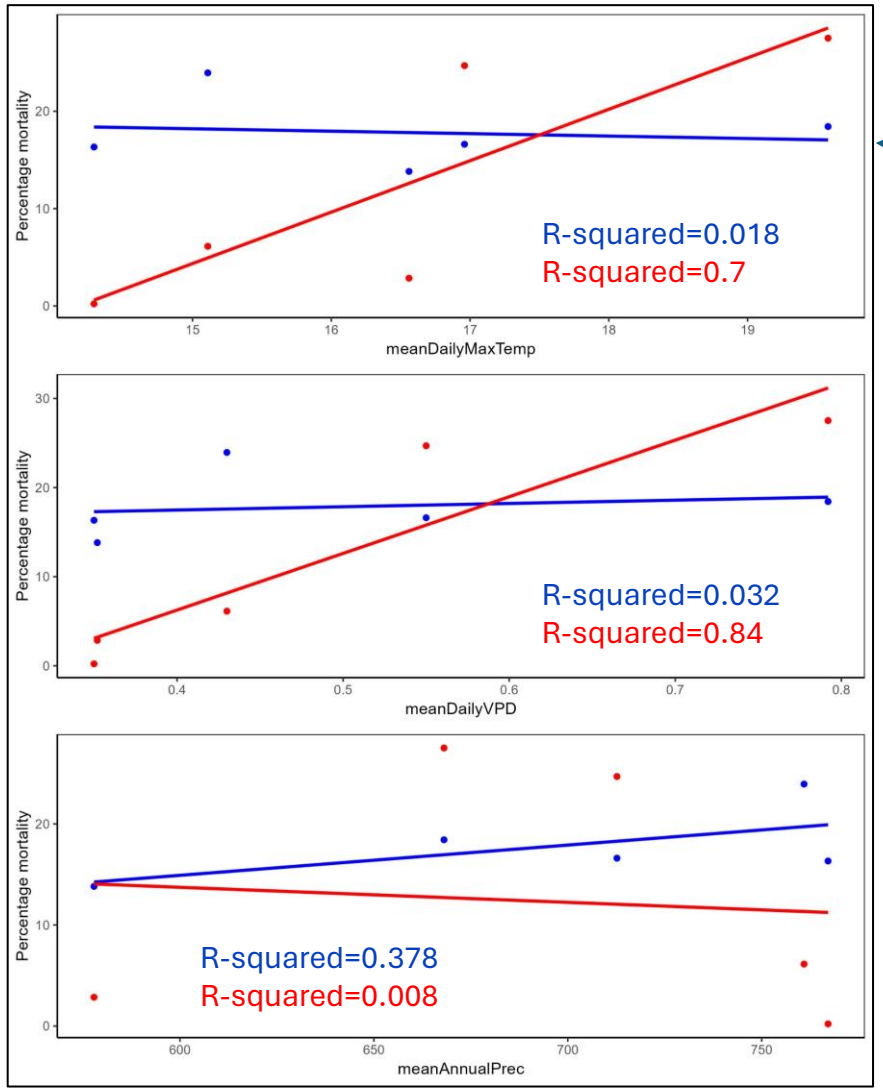


- Productivity was associated strongly with climatic drivers in both the model and in real-time observations.

- Simulated and observed productivity were strongly associated with each other.
- The productivity was overestimated in the model.

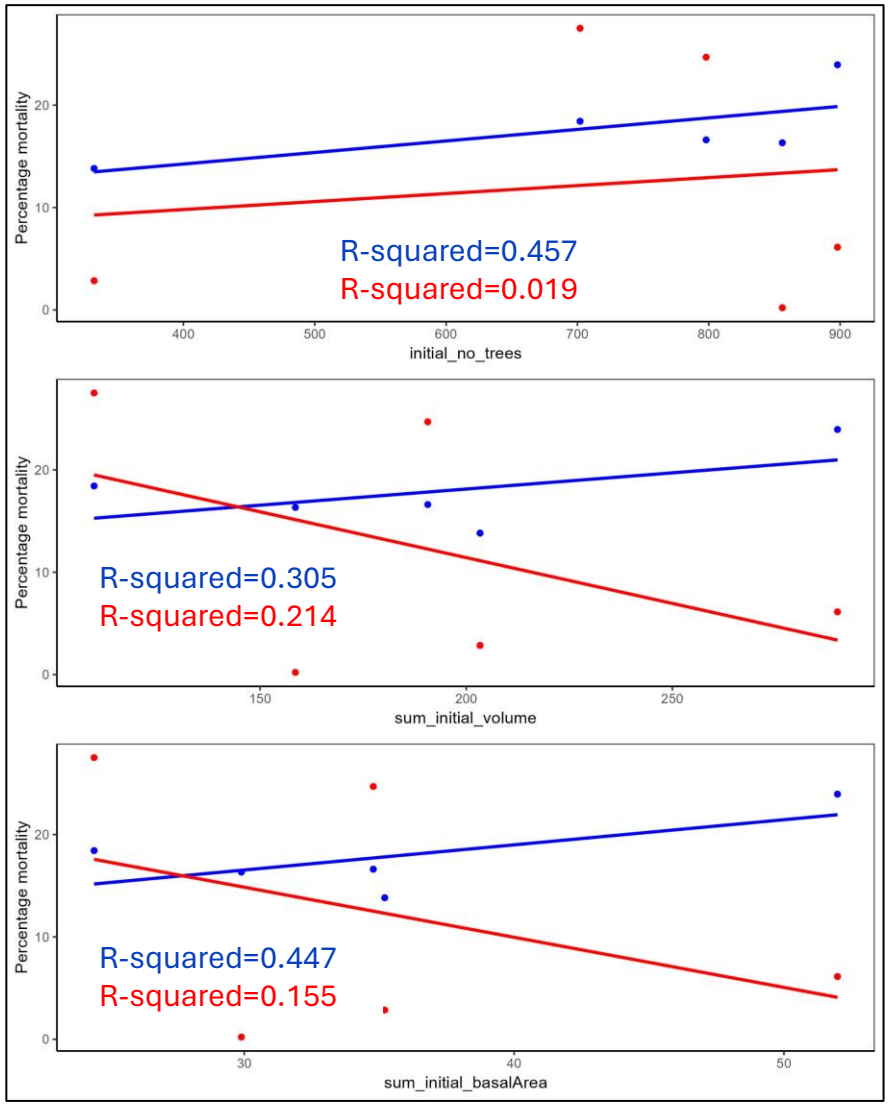


Mortality dynamics

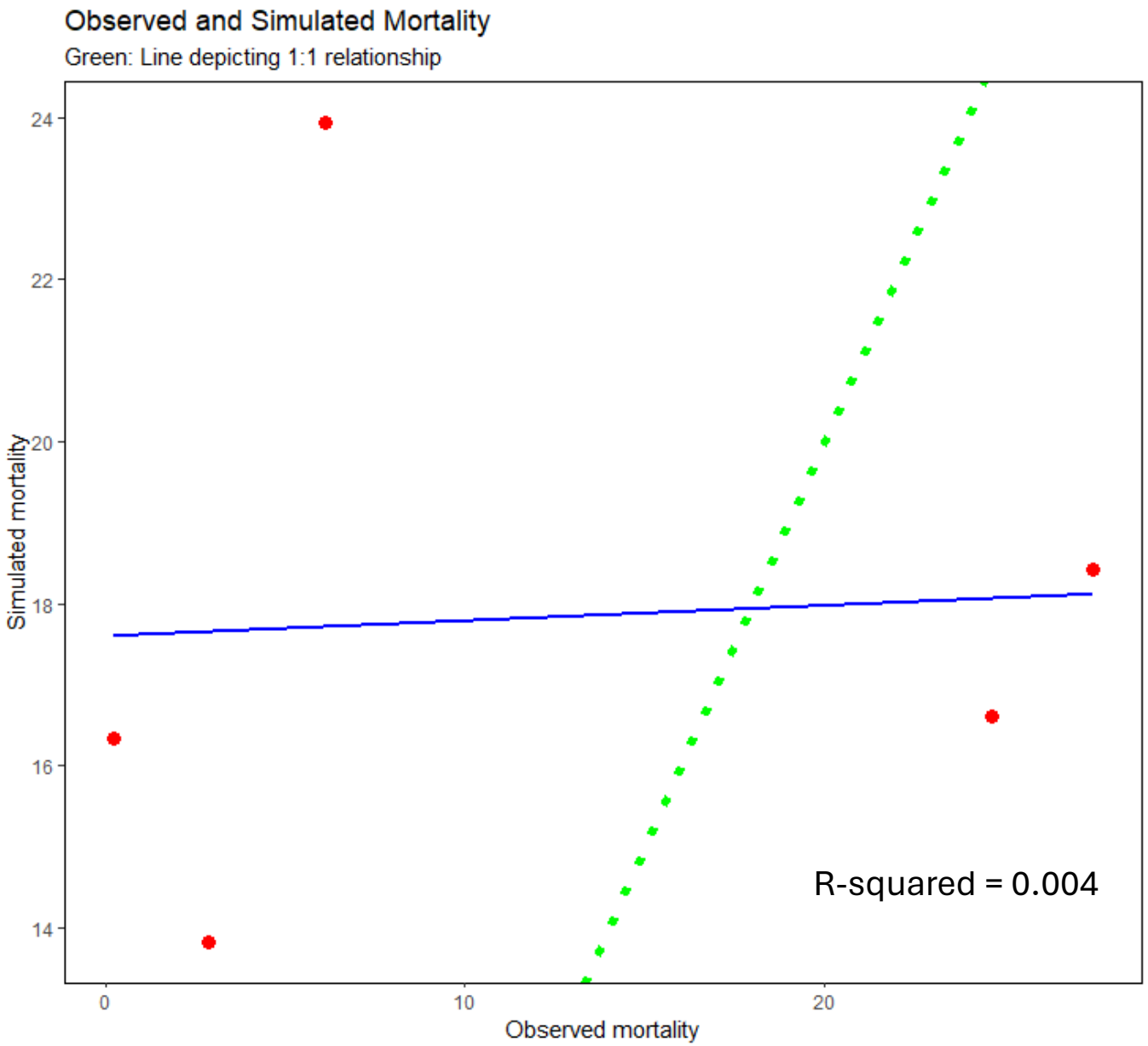


Blue: Simulated mortality
Red: Observed mortality

- Observed mortality was strongly and positively associated with climatic conditions (daily maximum temperature, daily vapour pressure deficit).
- Simulated mortality positively associated with the initial stand density.



Mortality dynamics



- The model overestimated the mortality during the period of 2007-2015.
- Very weak association was observed between the Simulated and Observed Mortality.

Key messages

1

The simulated productivity dynamics across space was consistent with the observations.

2

The simulated mortality is driven by different factors than the observed mortality.

3

Model simulates forest growth well outside the parametrization domain; mortality should however be interpreted carefully.

Way forward

Testing the model performance at more drought-affected plots.

Comparing multiple model performances at drought-affected plots.

Simulating future dynamics of the drought-affected plots under various scenarios of climate change.


Thank You.