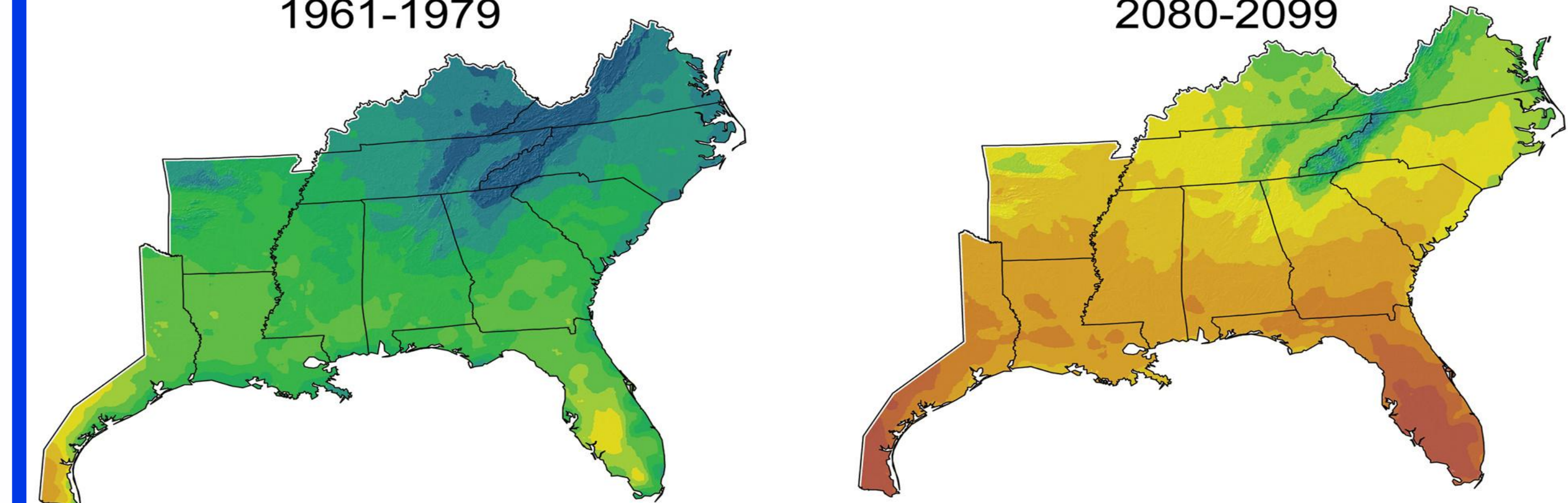


Introduction

Loblolly pine is adapted to grow across wide environmental gradients of soil and climate. The degree of genetic differentiation selected by climate is understudied. Current knowledge suggests, like annual crops, that mean monthly minimum winter temperature, is a key variable for seed movement. Important questions remain about the risks associated with moving local germplasm sources to different climatic zones, and whether additional climatic variables (i.e. rainfall, radiation, etc.) will become more important. Here we used different statistical methods (stepwise regression, LASSO, etc.) to select important climate variables.

1961-1979

2080-2099



Hypotheses



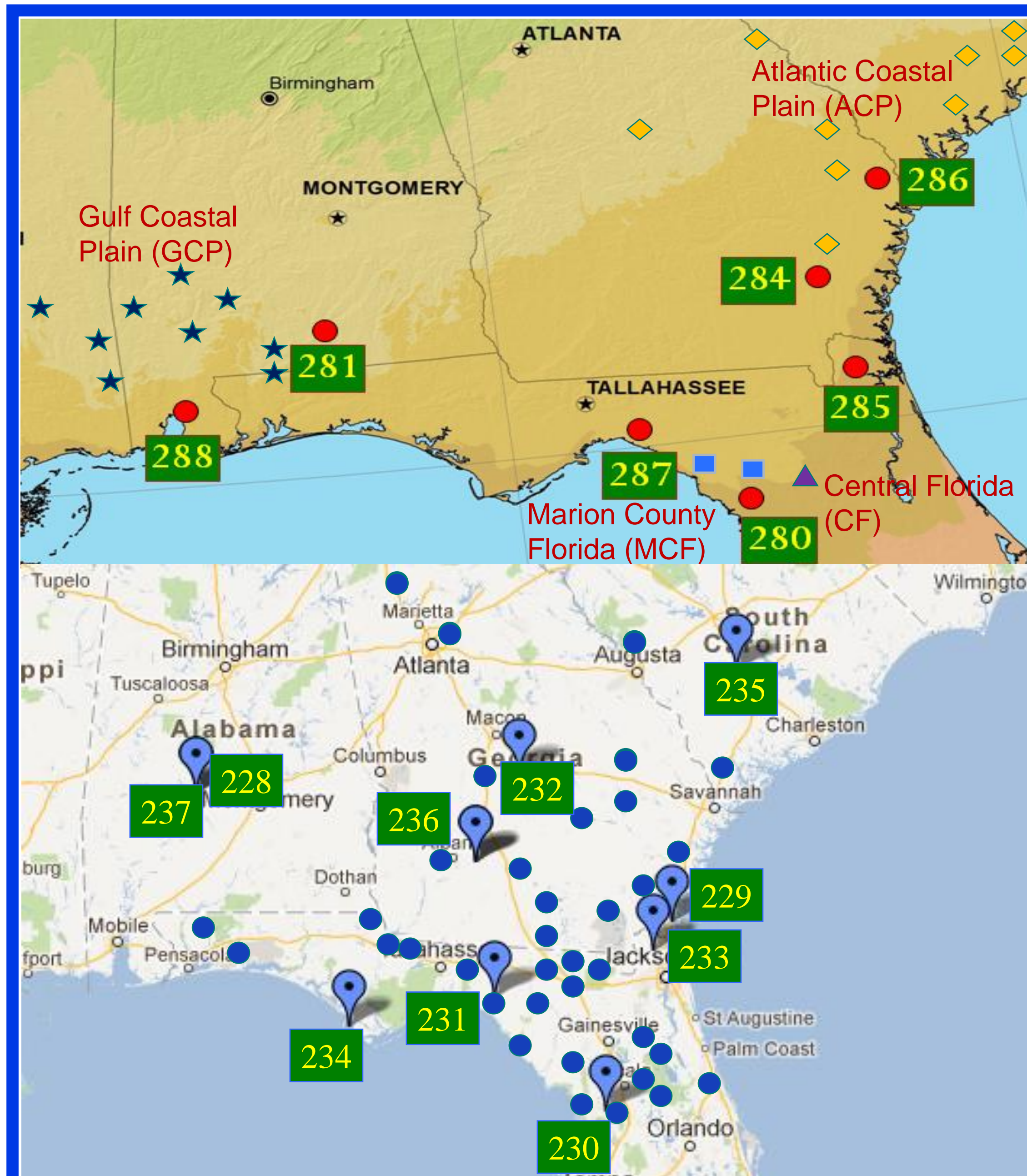
Objectives

Create a more robust set of seed deployment guidelines by creating universal response functions with different variable selection methods, and generate maps for matching optimum genetic materials with appropriate planting sites.

Acknowledgement

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Data



7 Provenance-Progeny Tests (PP) Established in 1982-1983 with 4 loblolly pine provenances: ACP, CF, MCF & GCP (58 fams). Height, dbh & Disease measured at years 5, 10, & 15, 10 trees row plot.

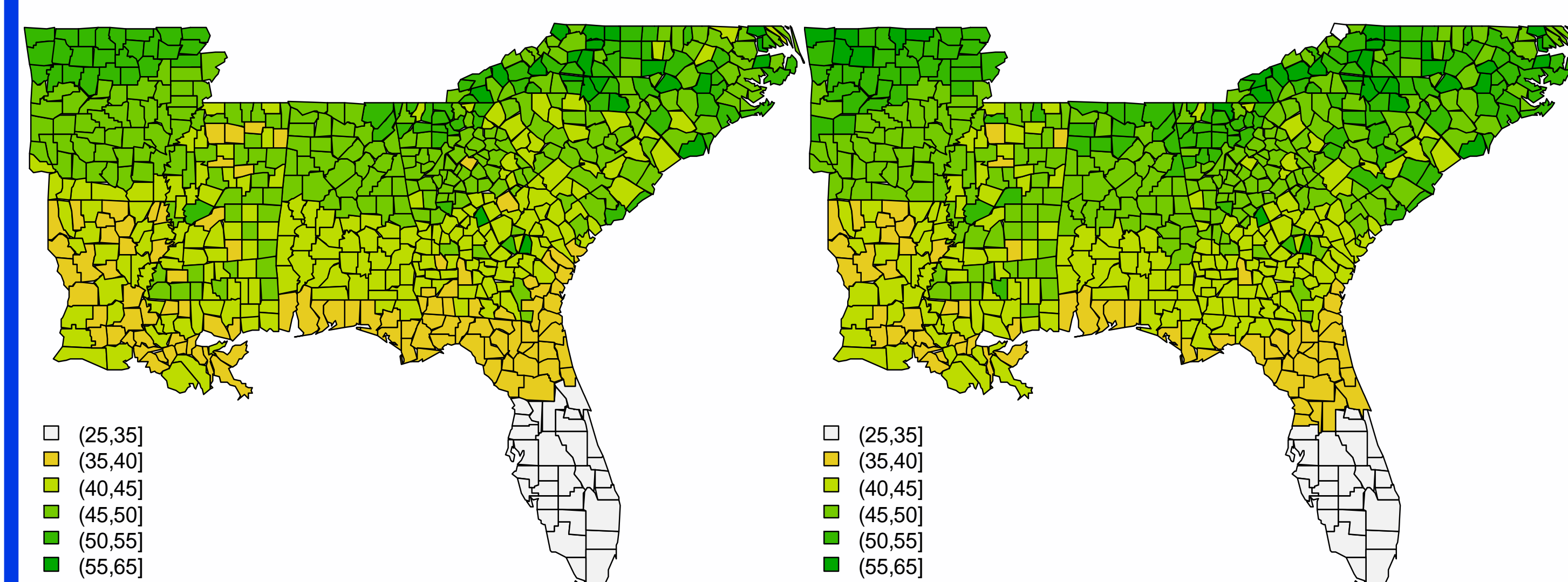
10 Florida Wild-Seed Tests (WS): Established in 2001-2002 in Florida, Georgia, South Carolina, and Alabama, with 216 families tested. Height, dbh & Disease measured at years 6, alpha-lattice design, 200 trees/rep with 15 replications.

Weather data: PRISM monthly weather data at county level, and SECC daily weather data at county level. Tree heights at age 10 (PP) were used as response variable for analysis. Site indexes of 7 PP tests had a wide range, so the heights were normalized by site indexes.

PRISM LASSO Regression (PP)

	Variable	Est.	Partial R2	Seq R2	VIF	Note
PRISM Data	Intercept	39.60	—	—	0	
	S_MCMT	-1.74	0.229	0.229	1.11	Mean coldest month temperature (test site)
	P_MCMT	0.91	0.122	0.351	1.14	Mean annual precipitation (test site)
	P_long	0.92	0.056	0.407	1.14	Longitude (provenance)
	S_MAP	-0.80	0.022	0.429	1.76	Mean coldest month temperature (provenan)
	S_MWMT	-0.44	0.008	0.437	1.89	Mean warmest month temperature (test site)

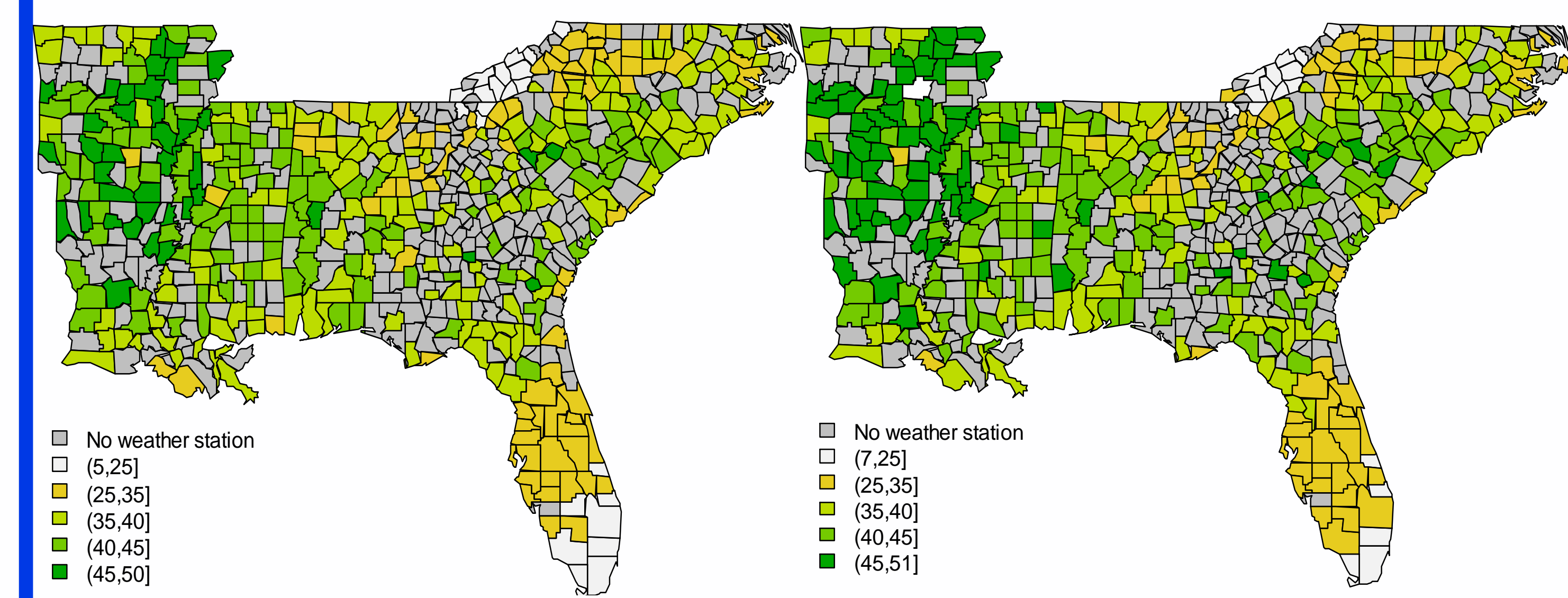
PRISM LASSO Regression Prediction for ACP PRISM LASSO Regression Prediction for CF&MCF



SECC LASSO Regression (PP)

	Variable	Est.	Partial R2	Seq R2	VIF	Note
SECC Data	Intercept	39.58	—	—	0	
	S_MCMT	-3.10	0.239	0.239	3.45	Mean coldest month temperature (test site)
	P_MCMT	1.05	0.133	0.372	1.16	Higher P_MCMT motivates tree growth
	P_long	-0.93	0.053	0.424	1.15	Western provenances grows slower
	S_MWMT	2.74	0.048	0.472	7.90	Mean warmest month temperature (test site)
	S_MAP	2.09	0.027	0.498	7.42	Higher mean annual radiation, faster growth
	S_MAP	1.36	0.026	0.525	5.82	More rain, more growth

SECC LASSO Regression Prediction for ACP SECC LASSO Regression Prediction for CF&MCF



SECC LASSO Regression (WS)

	Variable	Est.	Partial R2	Seq R2	VIF	Note
SECC Data	Intercept	24.16	—	—	0	
	S_MCMT	0.97	0.046	0.046	1.26	Mean coldest month temperature (test site)
	S_MAP	-0.64	0.031	0.077	1.26	Mean annual precipitation (test site)
	P_long	-0.46	0.020	0.097	1.00	Longitude (provenance)

Next Step

1. New model selection methods will be used to deliver more robust models, i.e. elastic net regularization, Bayesian methods, semiparametric regressions, etc.
2. The model validation and sensitivity analysis will be implemented to assist the creation of optimum deployment maps for SE US to adapt climate changes.

References

1. Sierra-Lucero, V., et al., Performance differences and genetic parameters for four coastal provenances of loblolly pine in the southeastern United States. *Forest science*, 2002. **48**(4): p. 732-742.
2. Wang, T., G.A. O'Neill, and S.N. Aitken, Integrating environmental and genetic effects to predict responses of tree populations to climate. *Ecological Applications*, 2010. **20**(1): p. 153-163.