

# Bamboo and Climate Change

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# Bioclimatic Modelling

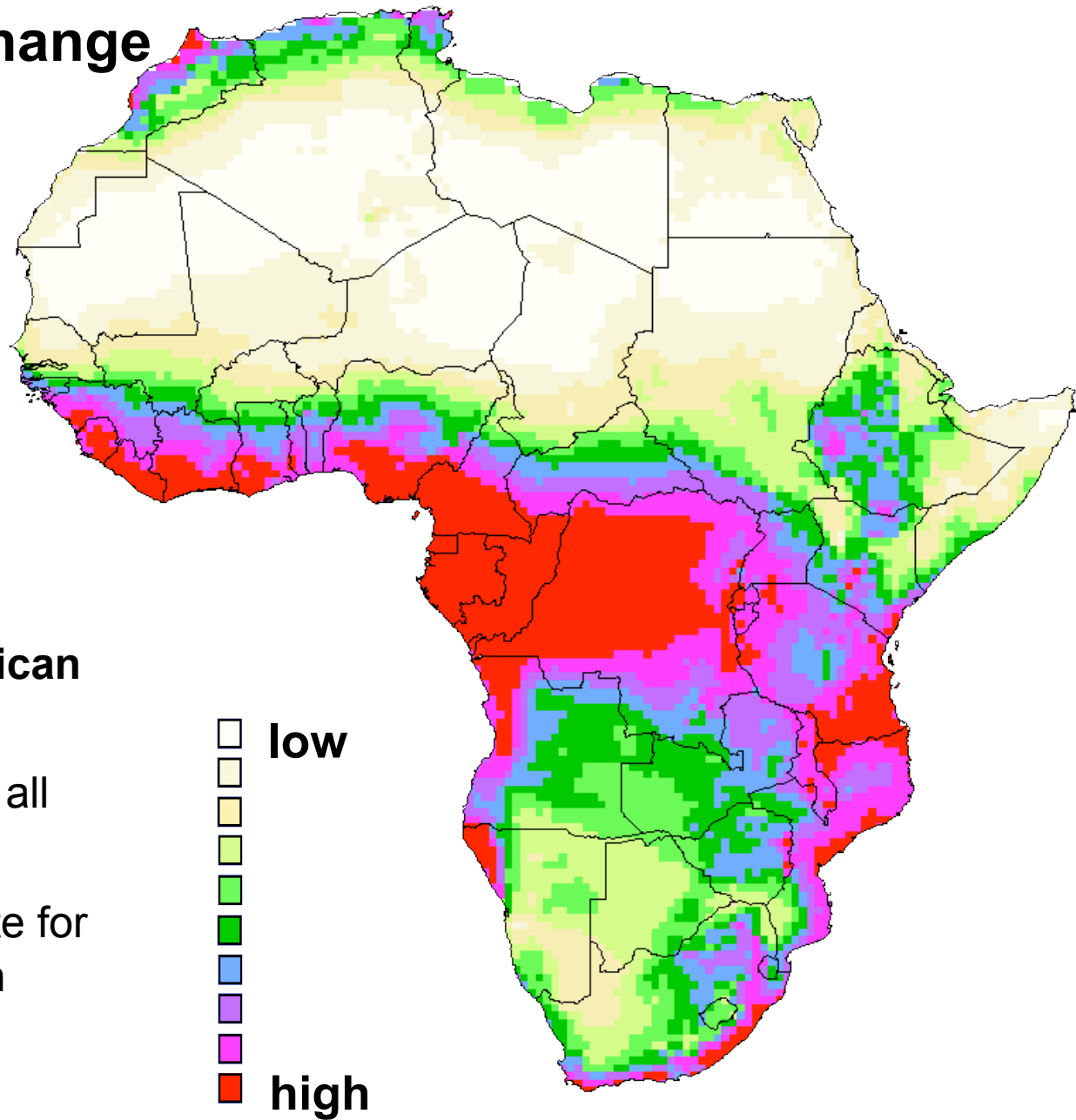
- Assumes species distribution is a function of climate
- Model creates a bioclimatic 'envelope' based on current climate
- Model envelope can be shifted under future/ past climates

# Effect of Climate Change Africa Example

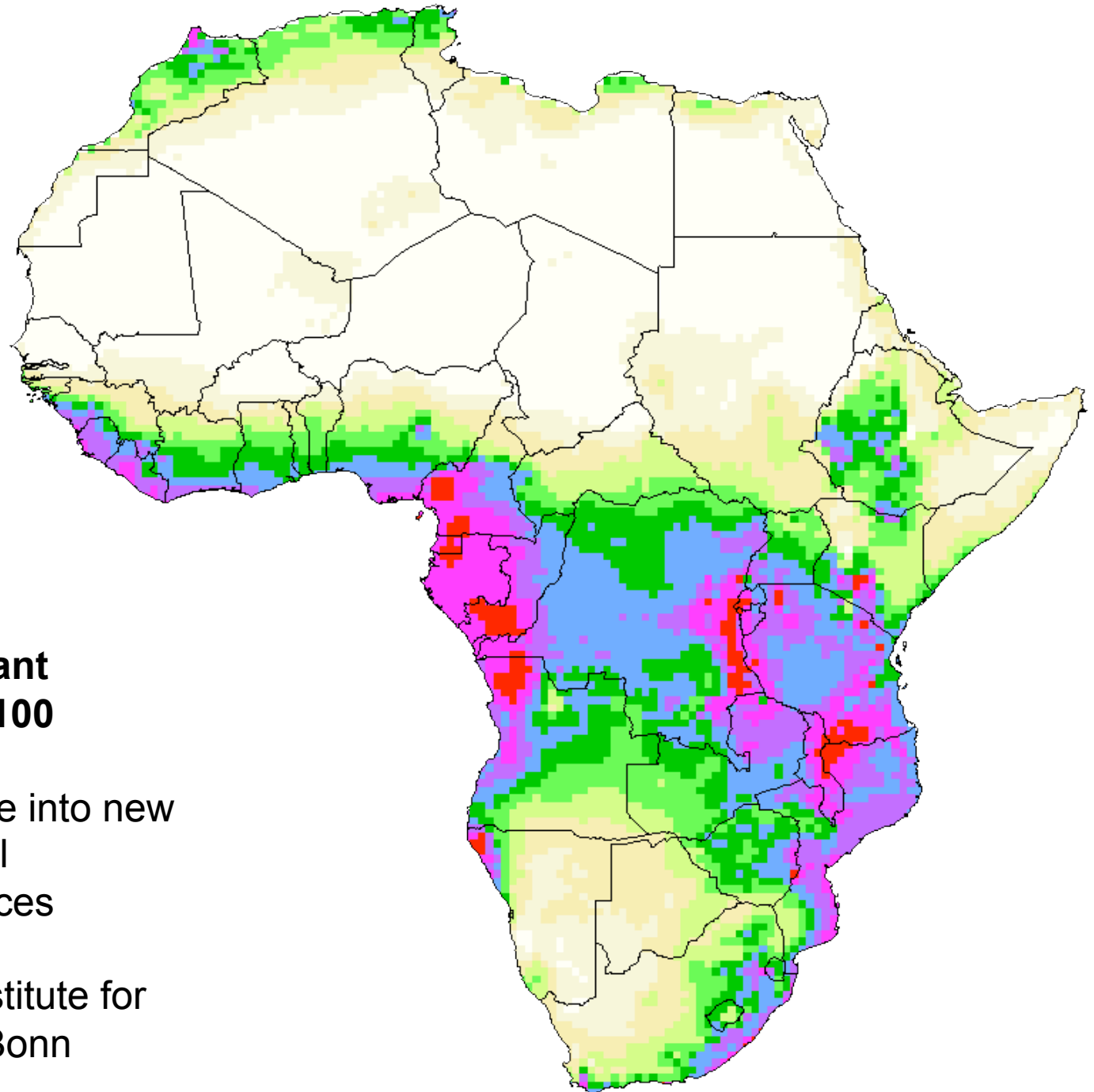
## Modelled present day African plant species richness

Assuming species occur at all  
climatically suitable places

Sommer et al. Nees Institute for  
Biodiversity of Plants, Bonn



# Effect of Climate Change Africa Example



## Patterns of African plant species richness in 2100

Assuming species move into new  
habitats and occur at all  
climatically suitable places

Sommer et al. Nees Institute for  
Biodiversity of Plants, Bonn

# Bamboo Data

- Thank you Zoe and team!
- 417 March 2008 field observations
- 172 herbarium records
- 472 survey sites selected

# Building the Model

- Place bamboo sites in 30 arc second raster (~ 1km x 1 km)
- Assume a cell with a record has been surveyed for all species to create presence/absence records.
- Assumption is questionable for herbarium records
- 10 bamboo species with more than 10 presence records used for the models

# Selected Species

Species no.	Species name	Panda food status	No. of presence cells
1	<i>Arundinaria faberi</i>	Major	25
6	<i>Chimonobambusa szechuanensis</i>	Major	13
7	<i>Fargesia angustissima</i>	Major	22
8	<i>Fargesia denudata</i>	Major	51
9	<i>Fargesia ferax</i>	Minor	19
10	<i>Fargesia nitida</i>	Major	16
11	<i>Fargesia robusta</i>	Major	29
12	<i>Fargesia rufa</i>	Minor	24
13	<i>Fargesia scabrida</i>	Minor	32
15	<i>Yushania brevipaniculata</i>	Major	16

# Climate Variables

- Derived from Worldclim climate surface interpolations of monthly min & max temp and precipitation
- Variables used for modelling:
  - *Absolute minimum temperature*
  - *Total annual precipitation*
  - *A moisture index*



# Modelling Approach

- Classification Trees
- Generalized Additive Models (GAMs)
- Generalized Linear Models (GLM)
- Bayes-based Genetic Algorithm (Yoga)
- Tested using training sets

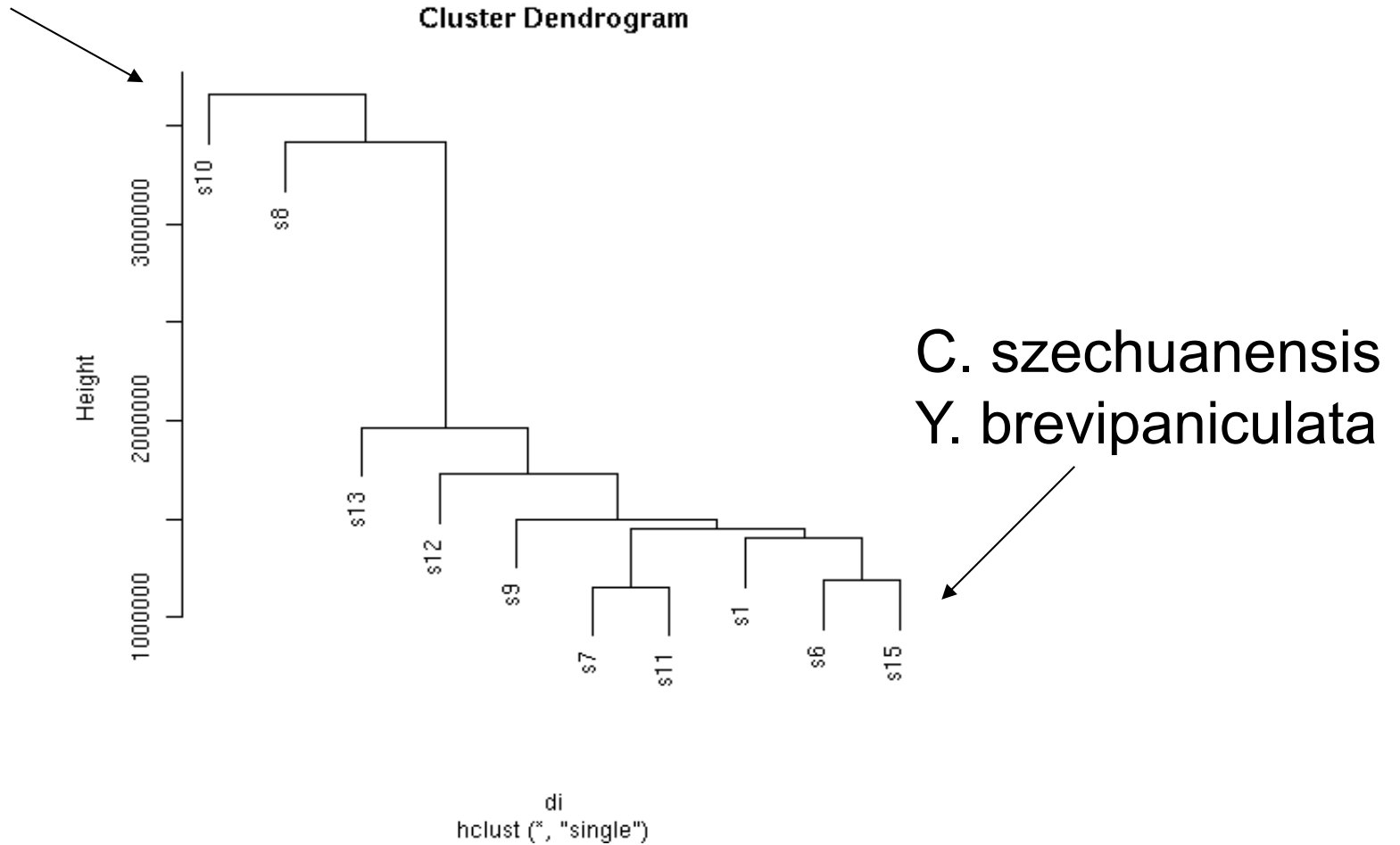
# Testing the Models

Species name	Training data				Test data				Full data			
	GAM	GLM	Tree	Yoga	GAM	GLM	Tree	Yoga	GAM	GLM	Tree	Yoga
<i>Arundinaria faberi</i>	0.94	0.88	0.75	0.88	0.79	0.81	0.72	0.79	0.91	0.88	0.73	0.87
<i>Chimonobambusa szechuanensis</i>	0.91	0.89	0.52	0.93	0.75	0.77	0.50	0.84	0.88	0.86	0.50	0.91

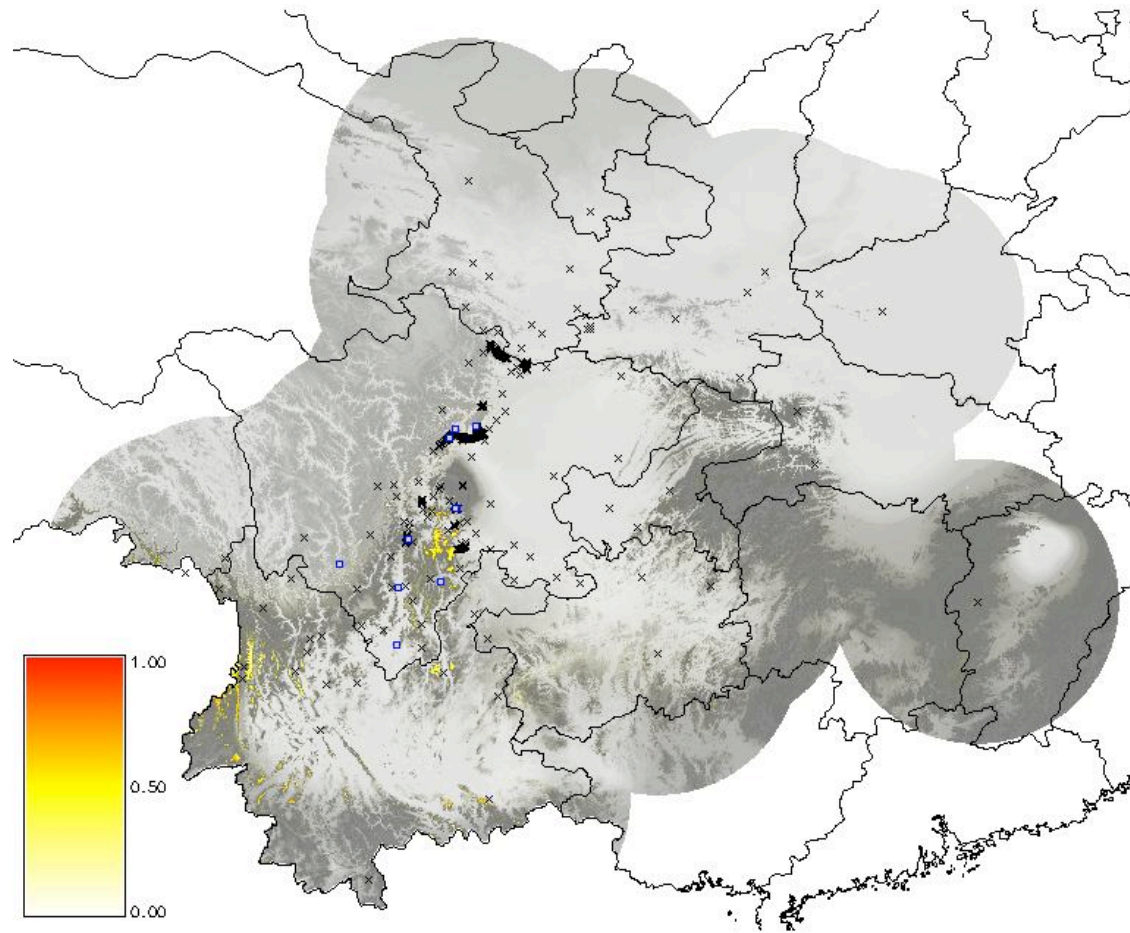
- Area Under the Curve (AUC)
- 1 = perfect prediction 0.5 = random

# Cluster Analysis

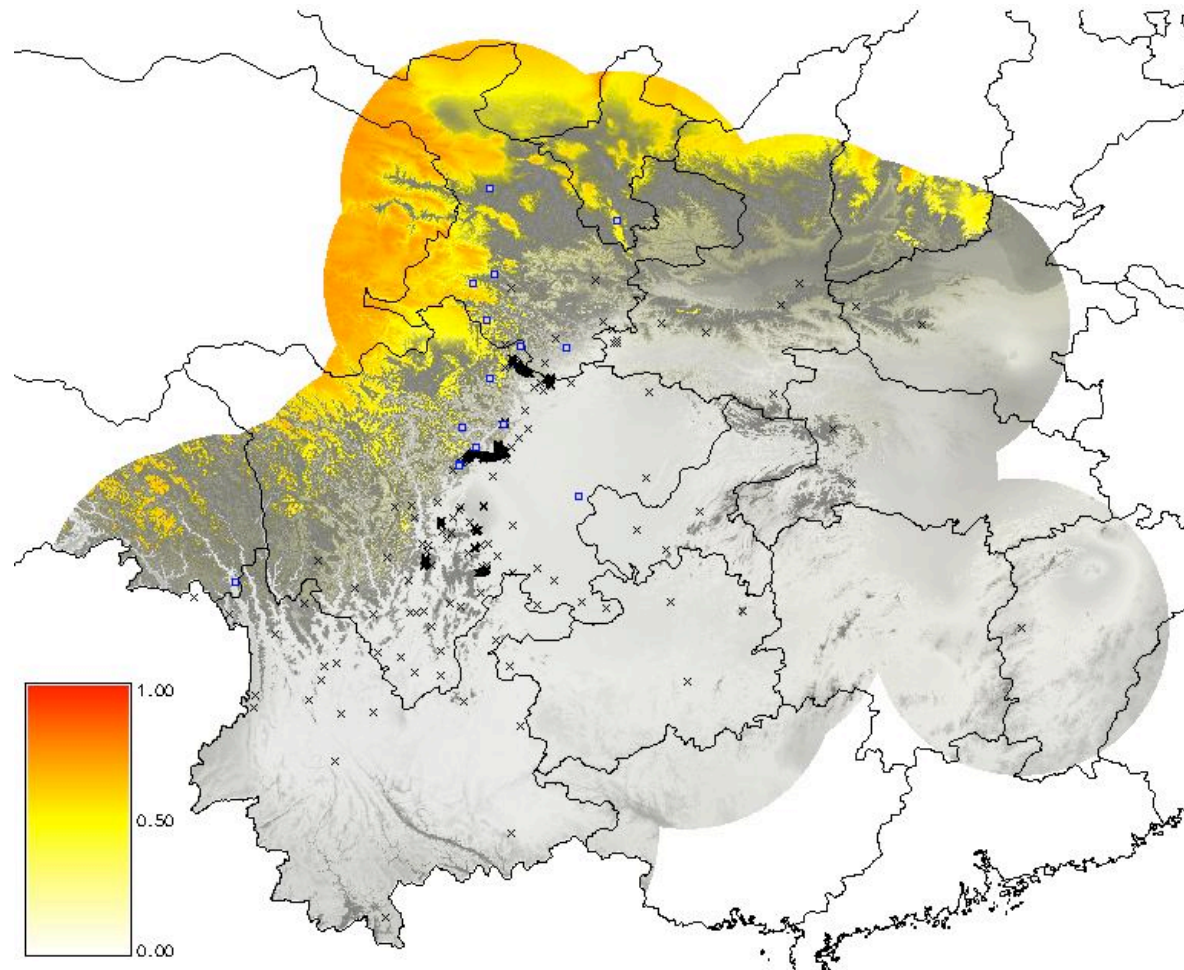
F. nitida  
F. ferax



# Yushania brevipaniculata



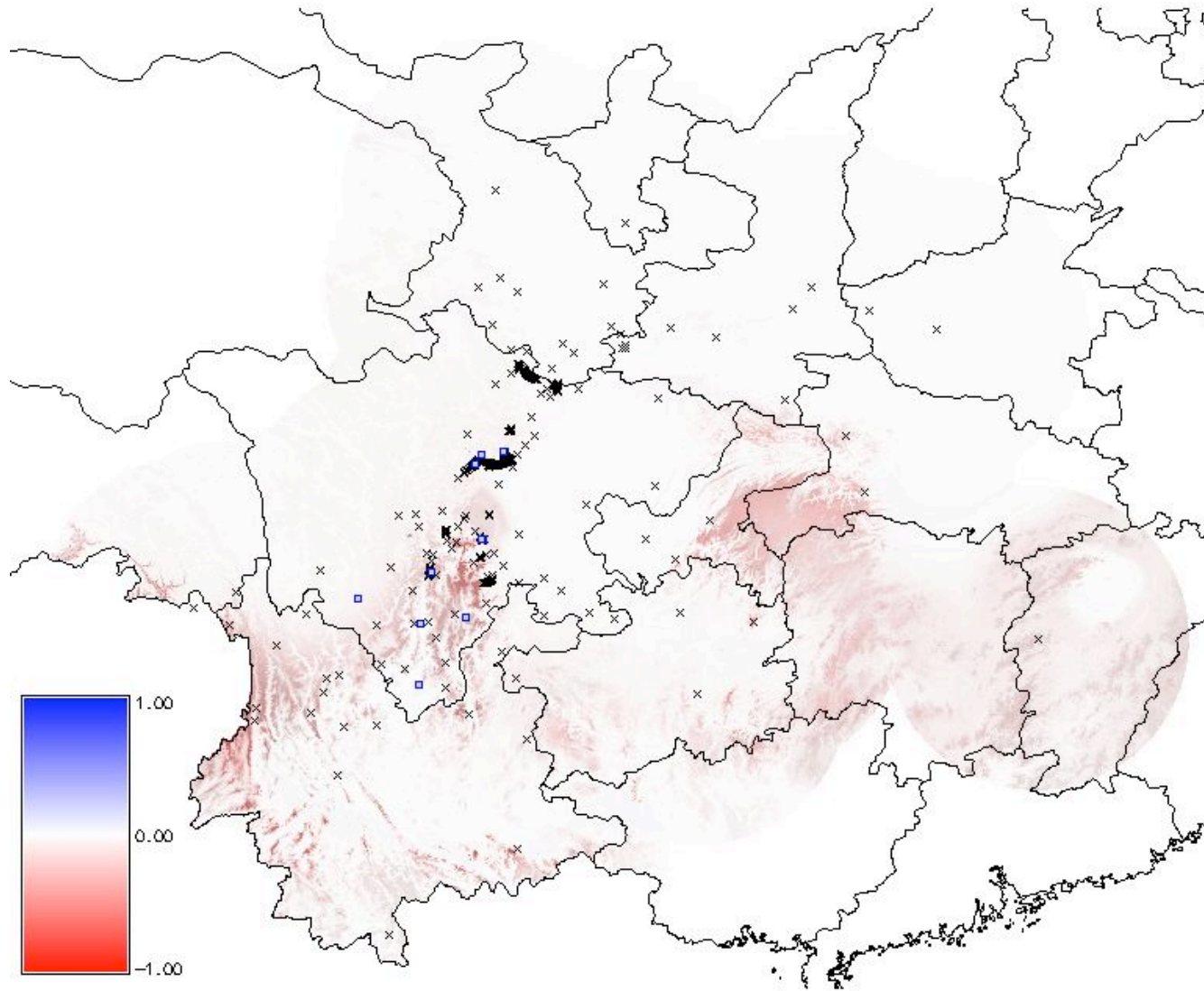
# Fargesia nitida



# Change Over Time

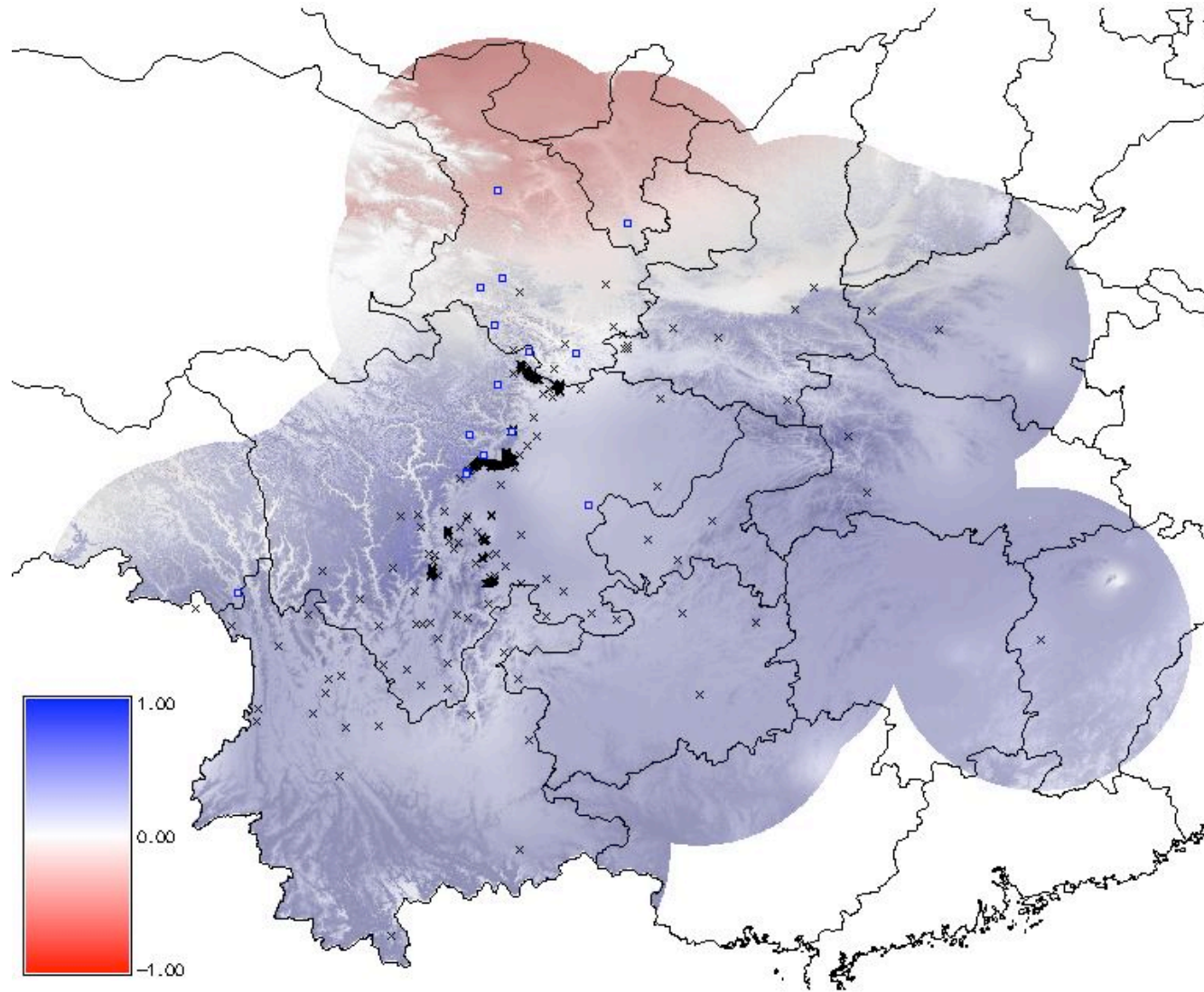
Species	Total Area						Protected					
	2020			2080			2020			2080		
	mean	min	max	mean	min	max	mean	min	max	mean	min	max
<i>Yushania brevipaniculata</i>	-79	-100	-60	-74	-100	-49	-86	-100	-72	-83	-100	-66
<i>Fargesia ferax</i>	-76	-100	-43	-78	-100	-48	-80	-100	-57	-83	-100	-65
<i>Fargesia angustissima</i>	-61	-100	-12	-67	-100	-25	-59	-100	-13	-60	-100	-15
<i>Fargesia denudata</i>	-59	-100	-24	-72	-100	-48	-66	-100	-18	-72	-100	-32
<i>Chimonobambusa szechuanensis</i>	-18	-99	47	-20	-100	36	-9	-99	86	0	-99	99
<i>Arundinaria faberi</i>	59	-100	172	71	-100	192	32	-100	168	35	-100	173
<i>Fargesia scabrida</i>	78	-95	532	48	-98	435	6	-96	621	16	-99	805
<i>Fargesia nitida</i>	138	5	267	96	-16	234	71	1	112	46	-17	96
<i>Fargesia rufa</i>	330	-6	602	270	-5	477	342	-5	736	480	16	1004
<i>Fargesia robusta</i>	447	-100	1192	511	-100	1354	342	-100	1483	448	-100	1887

# Yushania brevipaniculata





# Fargesia nitida





# Conclusions

- These are only models!
- Some species decrease in area
- Some species increase in area
- The modelling technique offers a useful supplement to other techniques
- More work is needed...