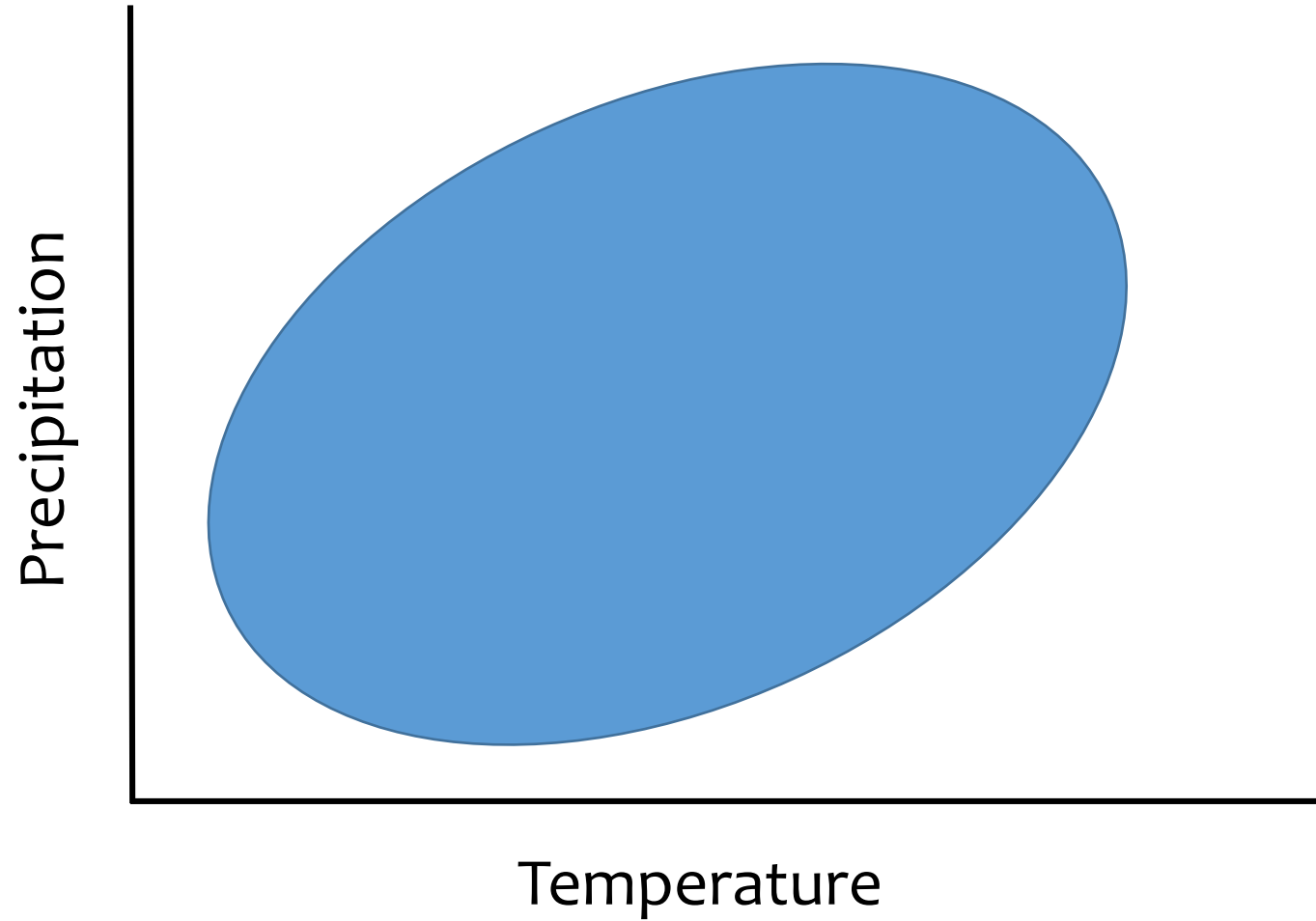


Post-fire climate Limits Ponderosa Pine and Douglas-fir Regeneration

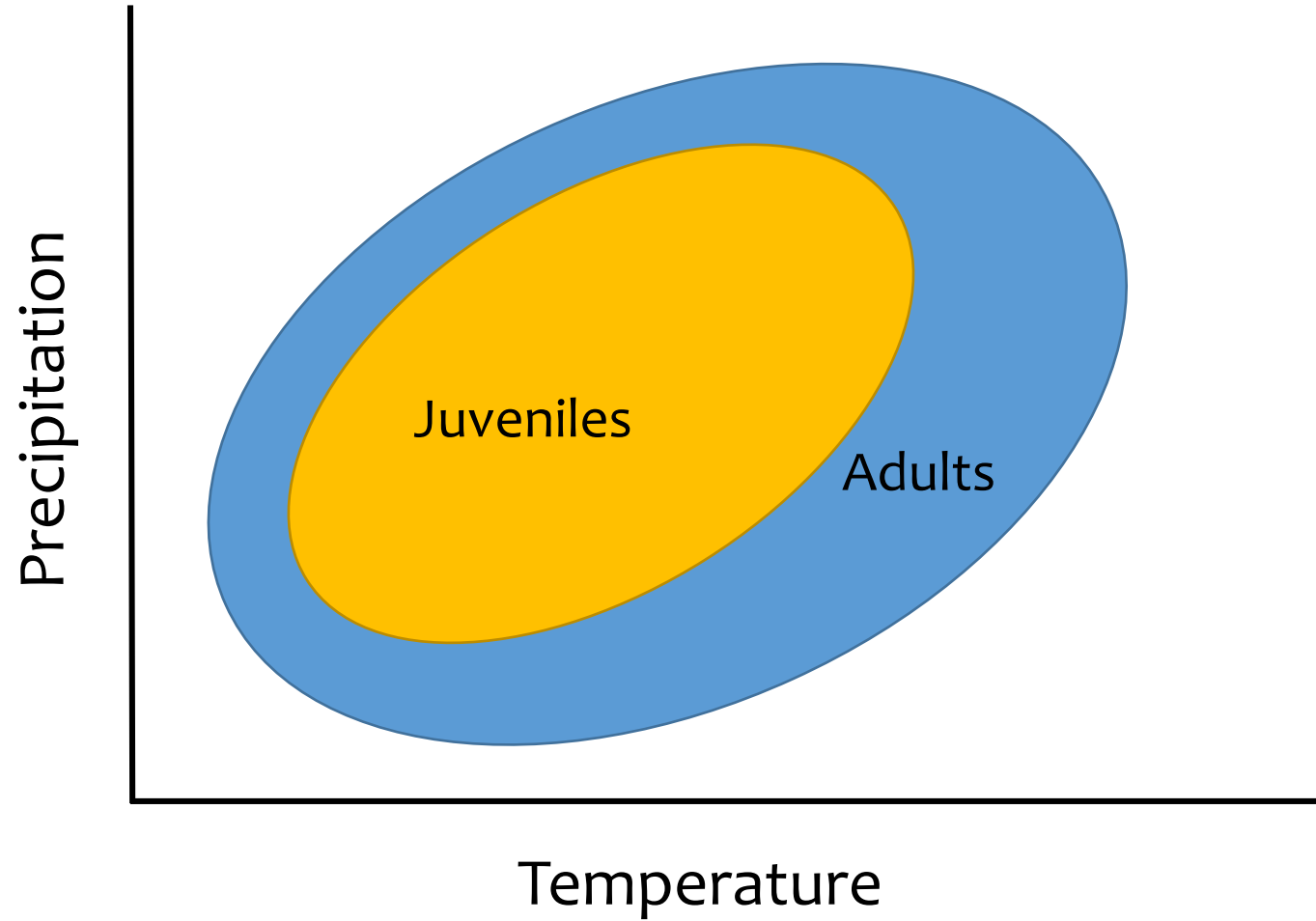
Kimberley Davis, Solomon Dobrowski, Philip Higuera,
Zachary Holden, Tom Veblen, Monica Rother,
Sean Parks, Anna Sala, & Marco Maneta



Regeneration niche



Regeneration niche

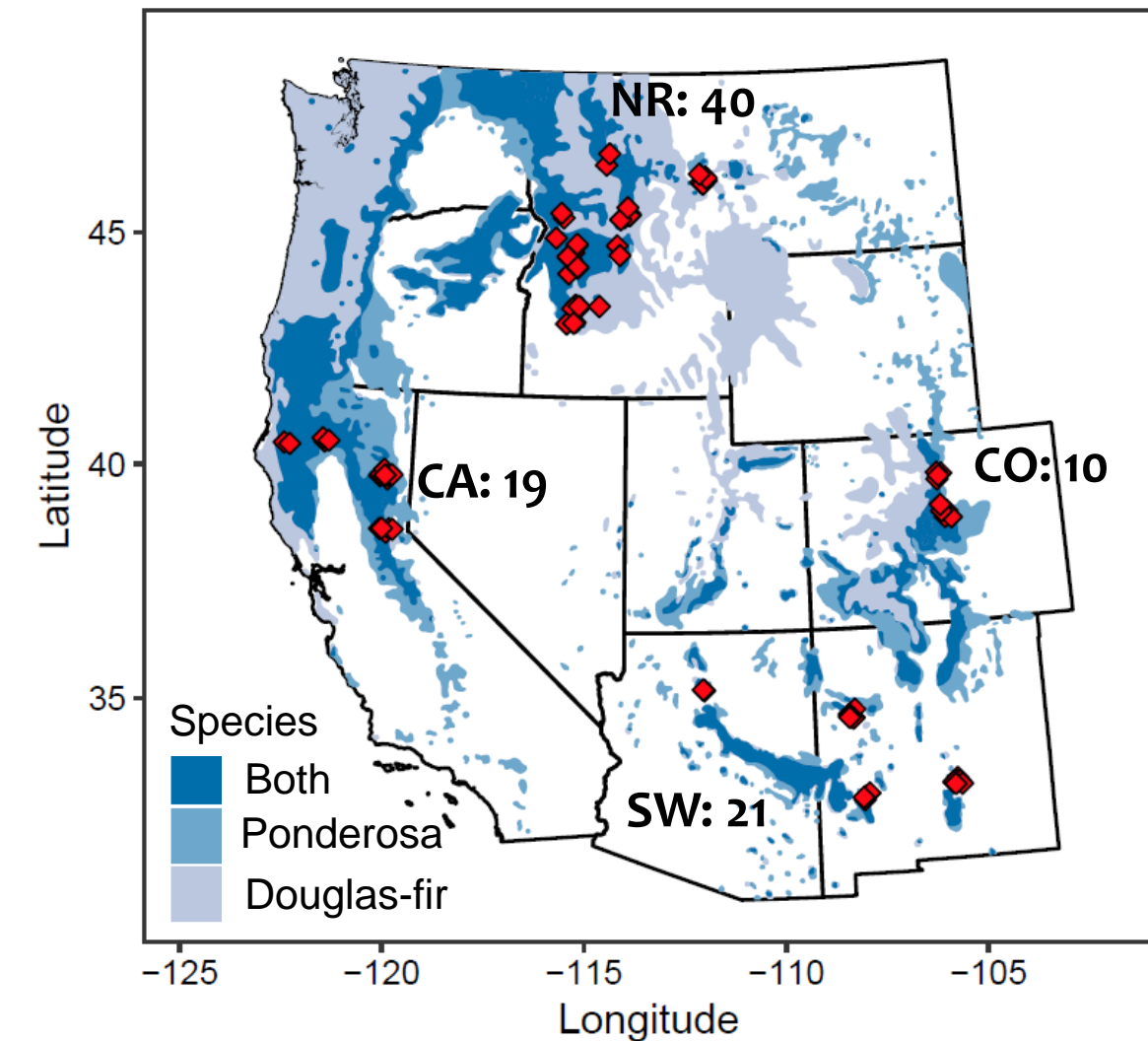




Research questions

1. How does annual climate affect post-fire recruitment?
2. How has climate suitability for post-fire recruitment changed over time?

Study sites and field sampling



CO data: Rother & Veblen 2017
Davis et al. 2019 PNAS

Lab processing and tree aging



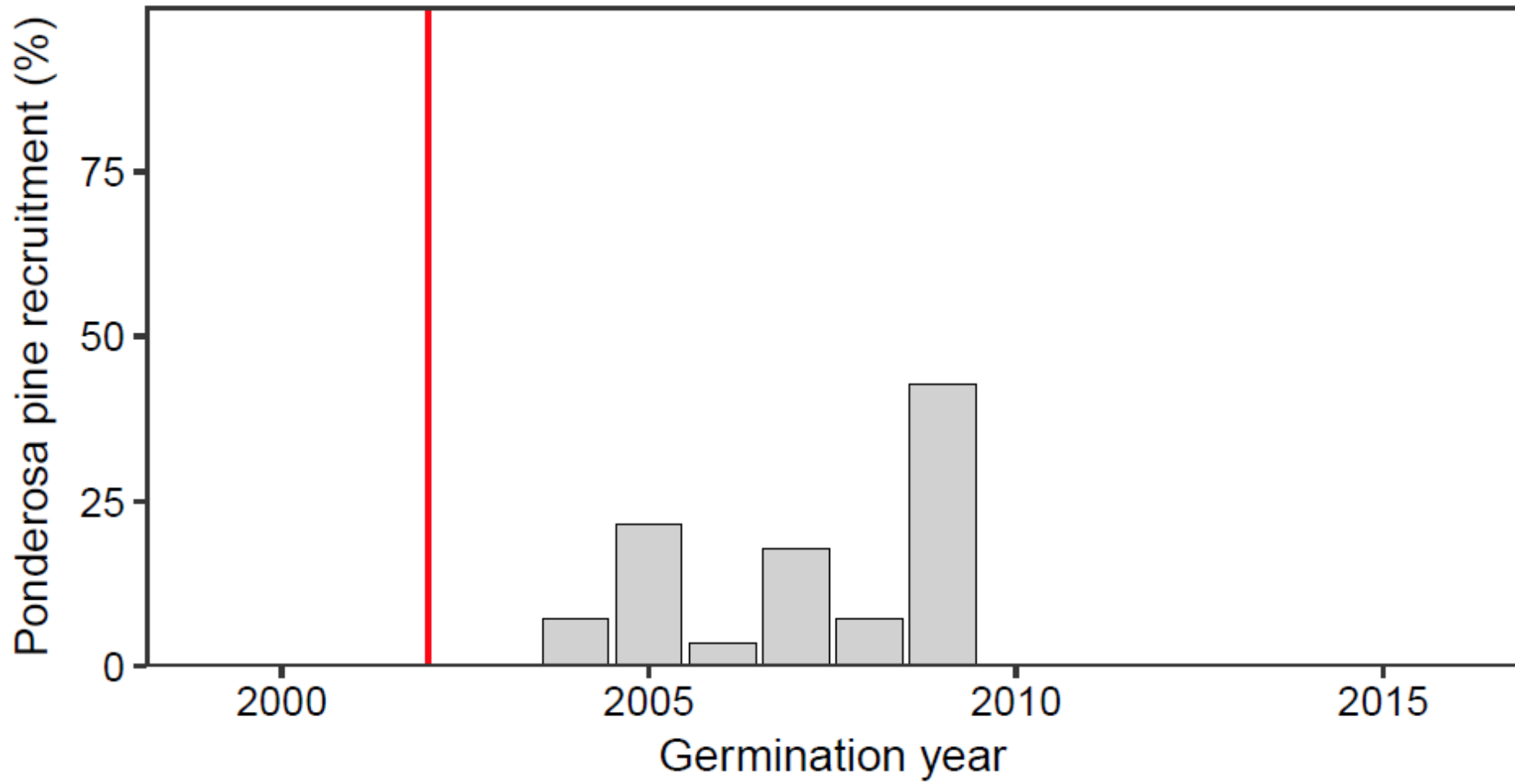
Sample size:

Ponderosa: 1662 juveniles

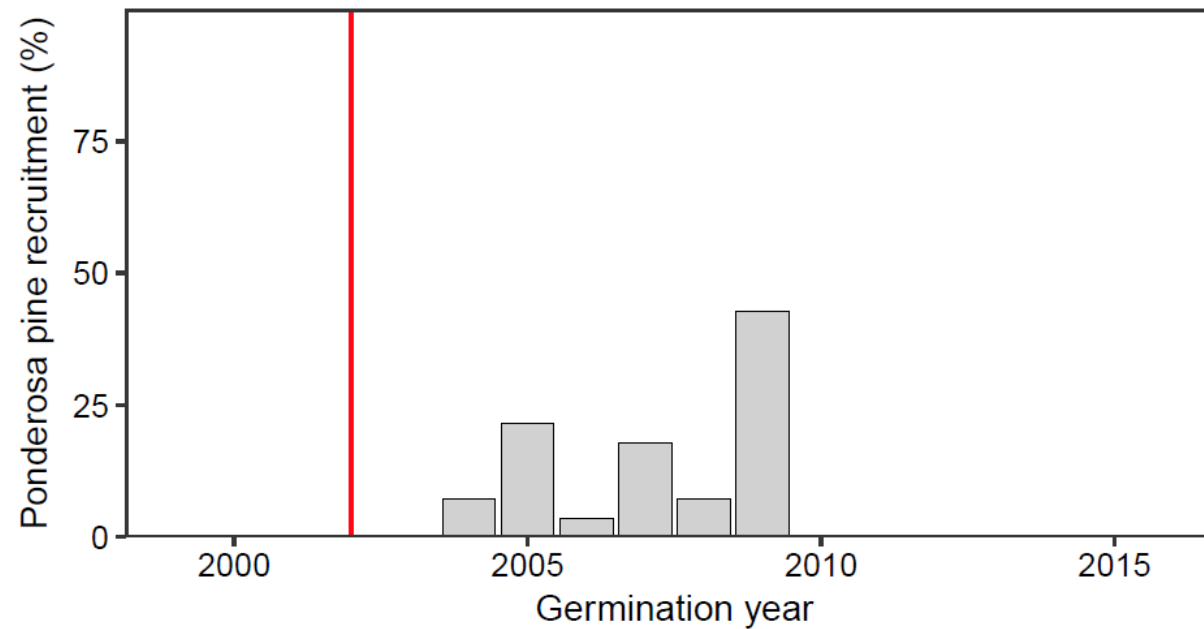
Douglas-fir: 1273 juveniles



Age structures



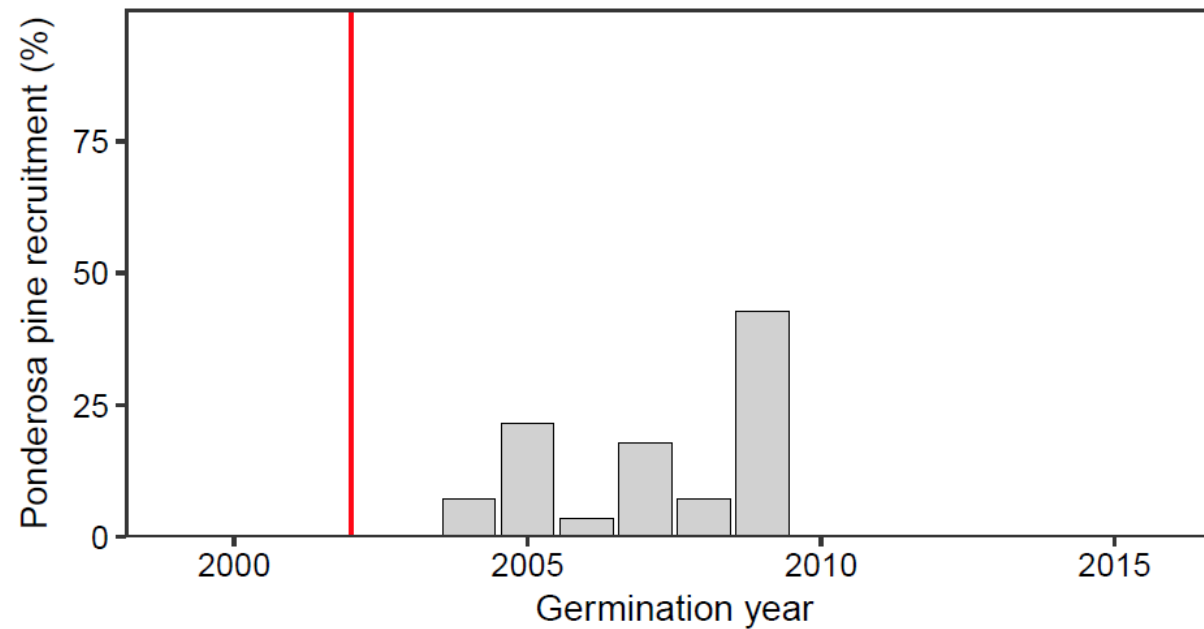
Age structures and modeling



Climate predictors	Non-climatic predictors
Mean June-August VPD	Time since fire
Soil moisture driest month	Distance to seed source
Max surface temperature	Fire severity
Spring soil moisture	



Age structures and modeling

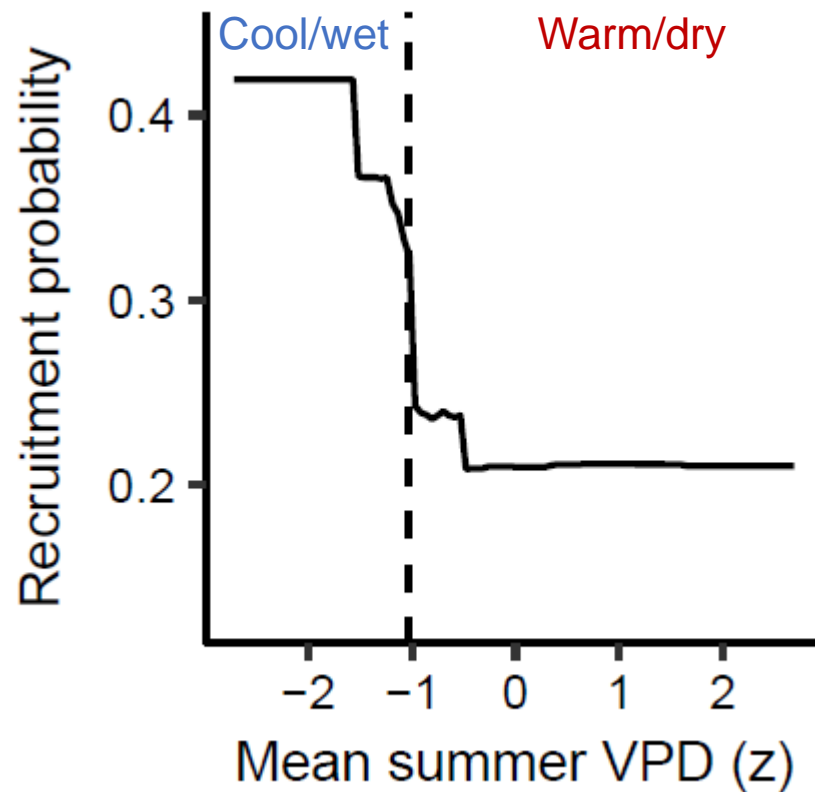


		Climate predictors	Non-climatic predictors
Ponderosa	{	Mean June-August VPD	Time since fire
		Soil moisture driest month	Distance to seed source
Douglas-fir	{	Max surface temperature	Fire severity
		Spring soil moisture	

Recruitment-climate relationships have thresholds

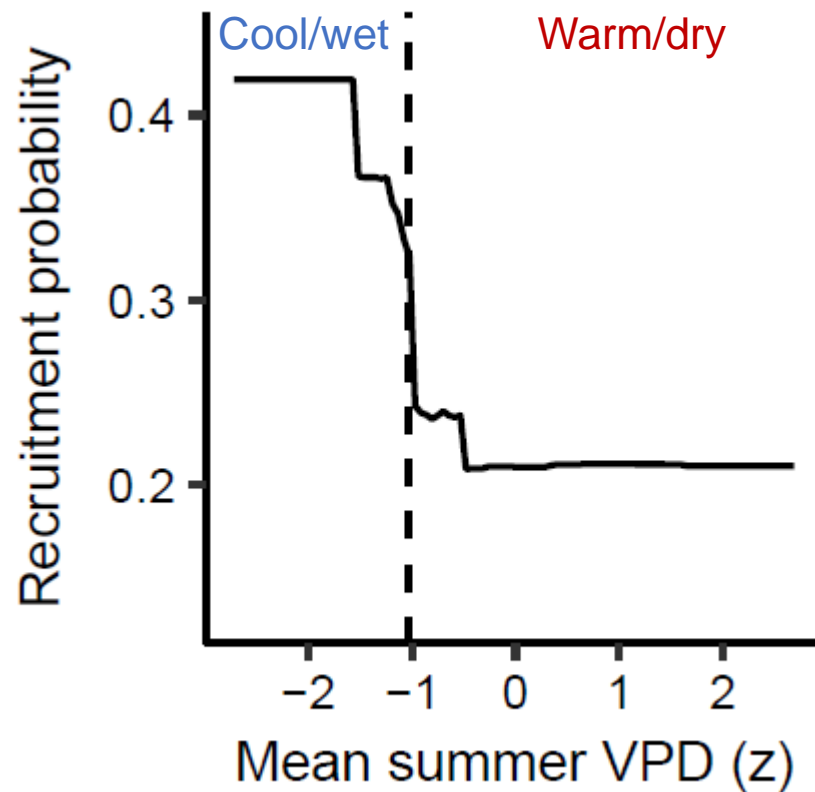
Ponderosa pine

Douglas-fir

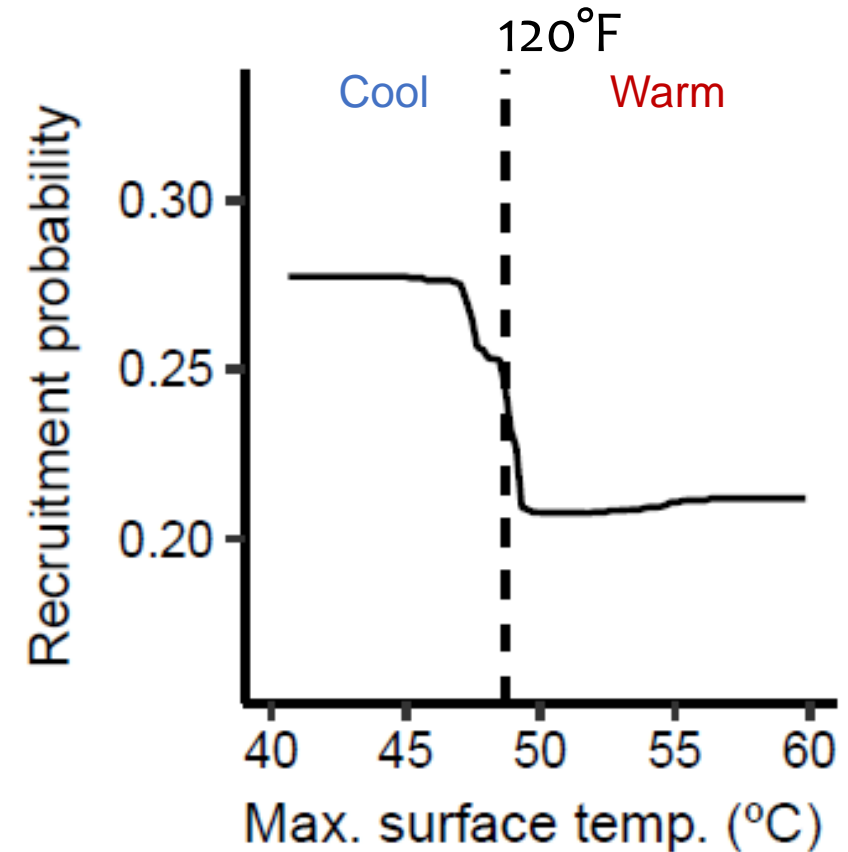


Recruitment-climate relationships have thresholds

Ponderosa pine

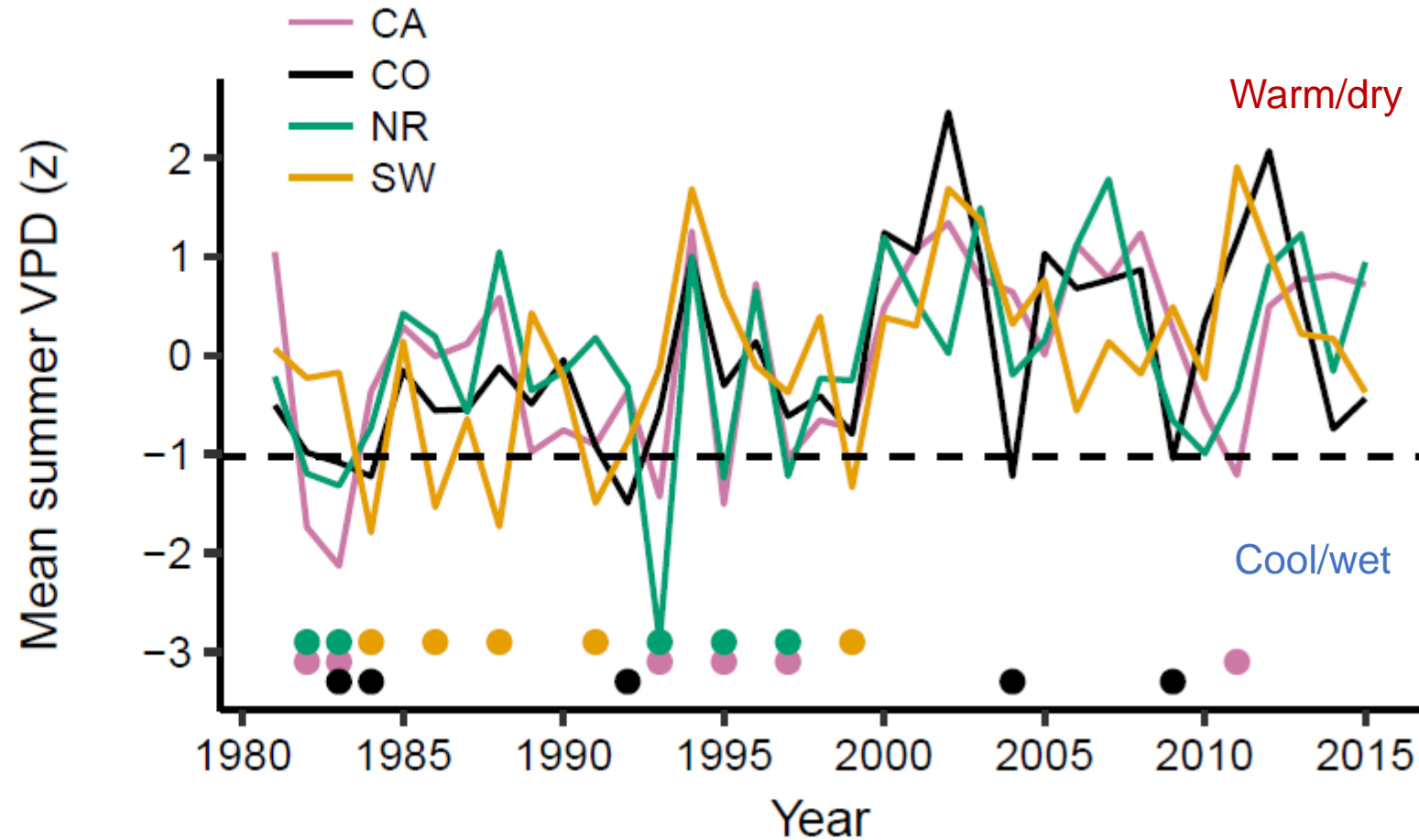
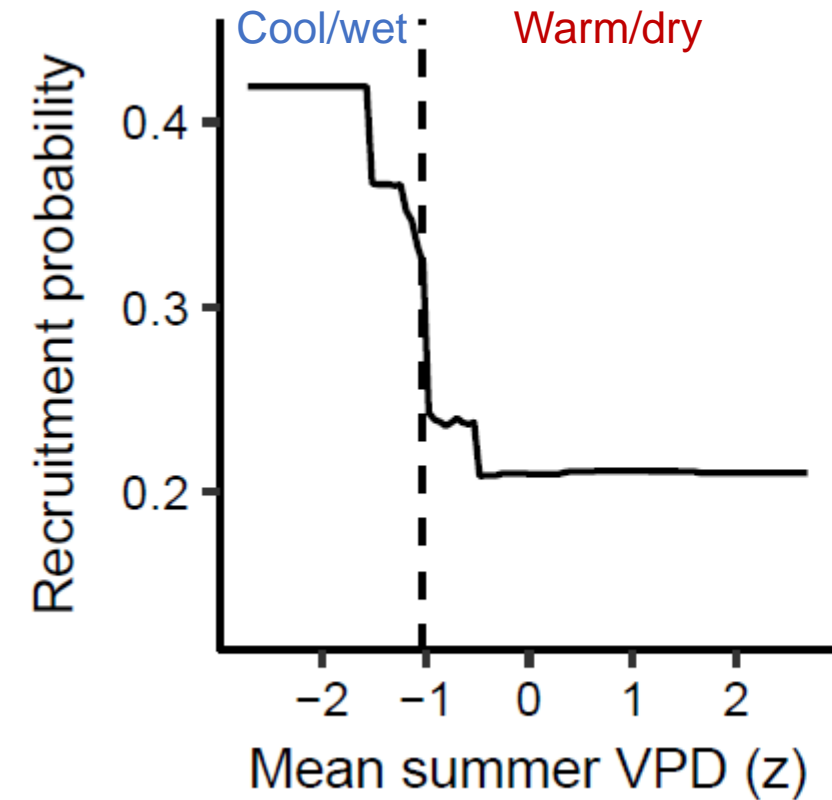


Douglas-fir



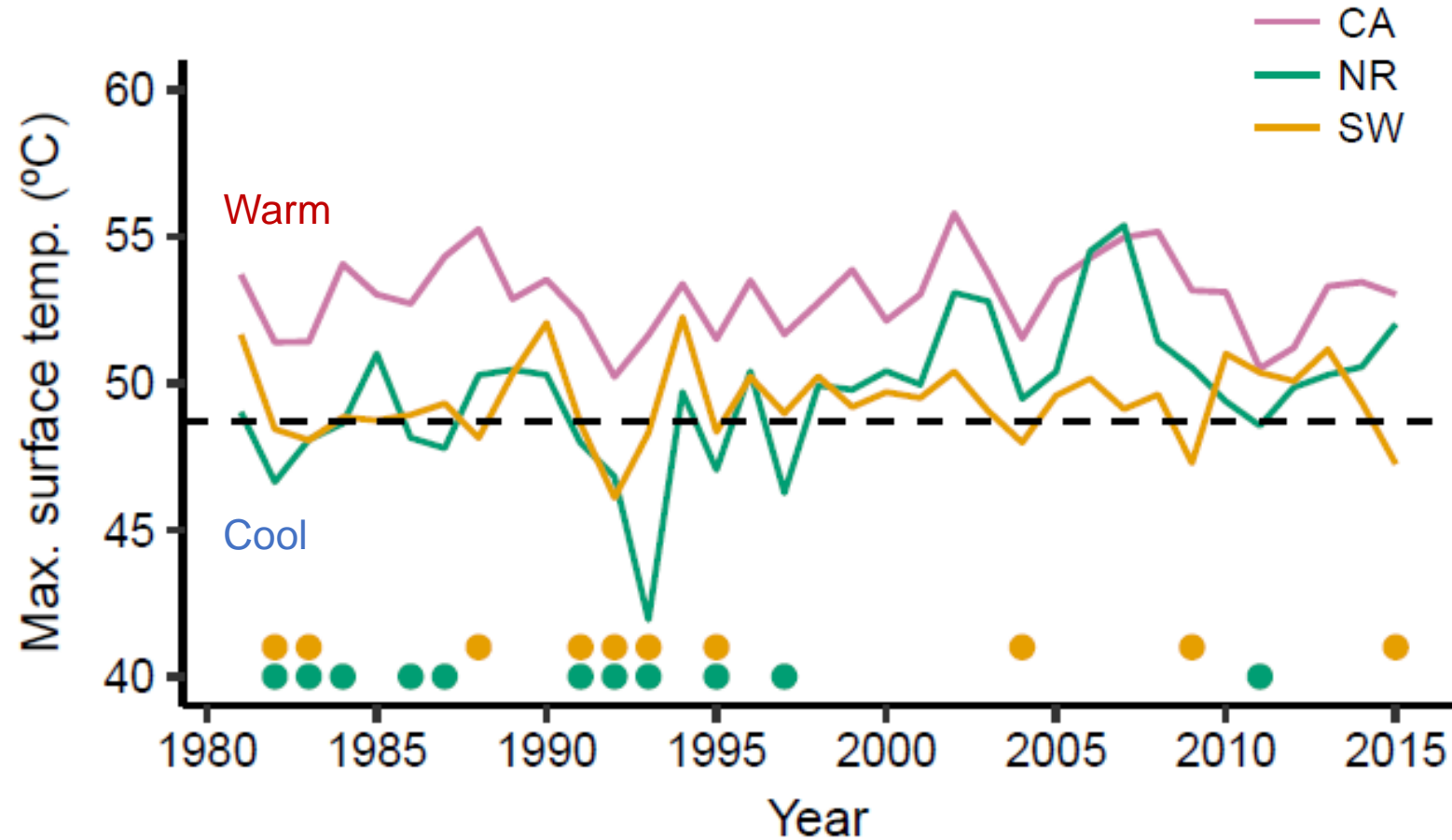
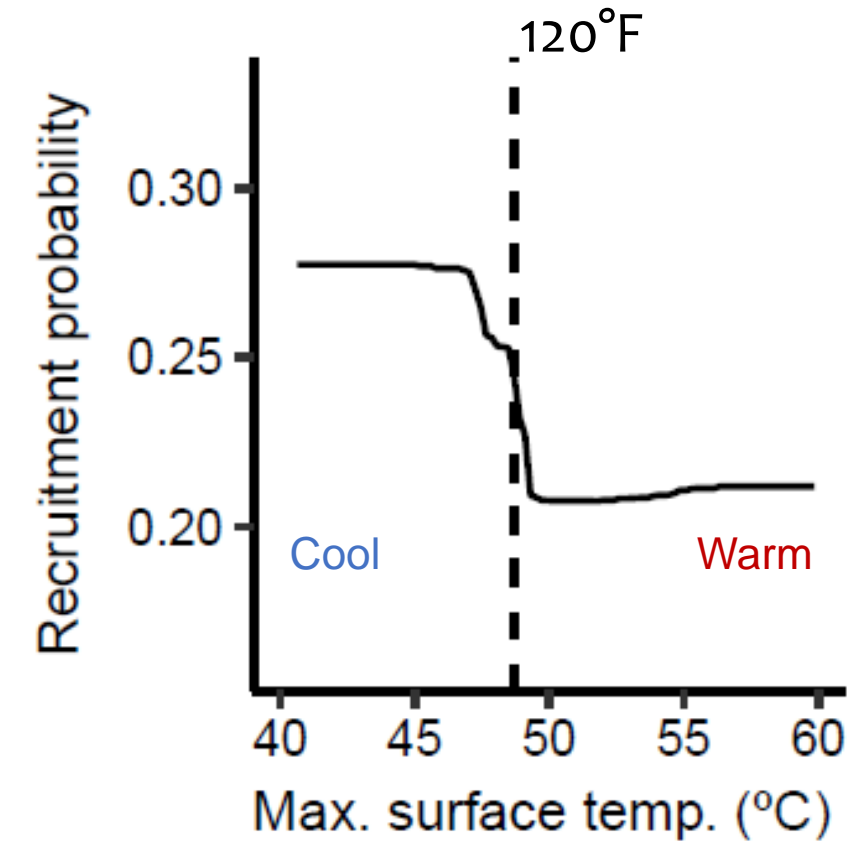
Climatic thresholds crossed in recent decades

Ponderosa pine



Climatic thresholds crossed in recent decades

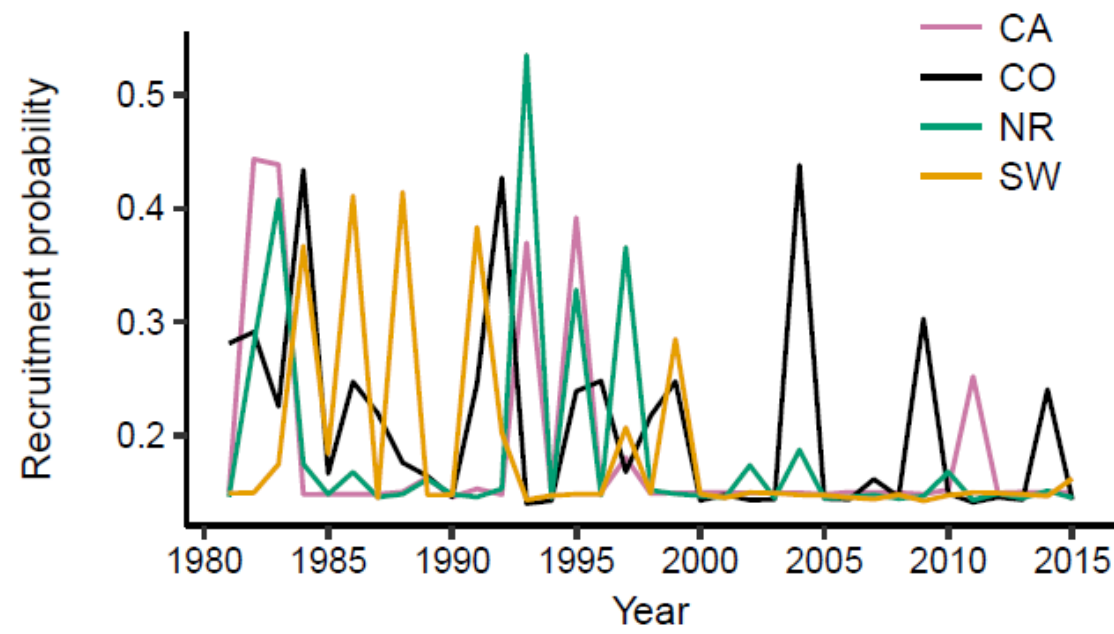
Douglas-fir





Recruitment probability declined in recent decades

Ponderosa
pine

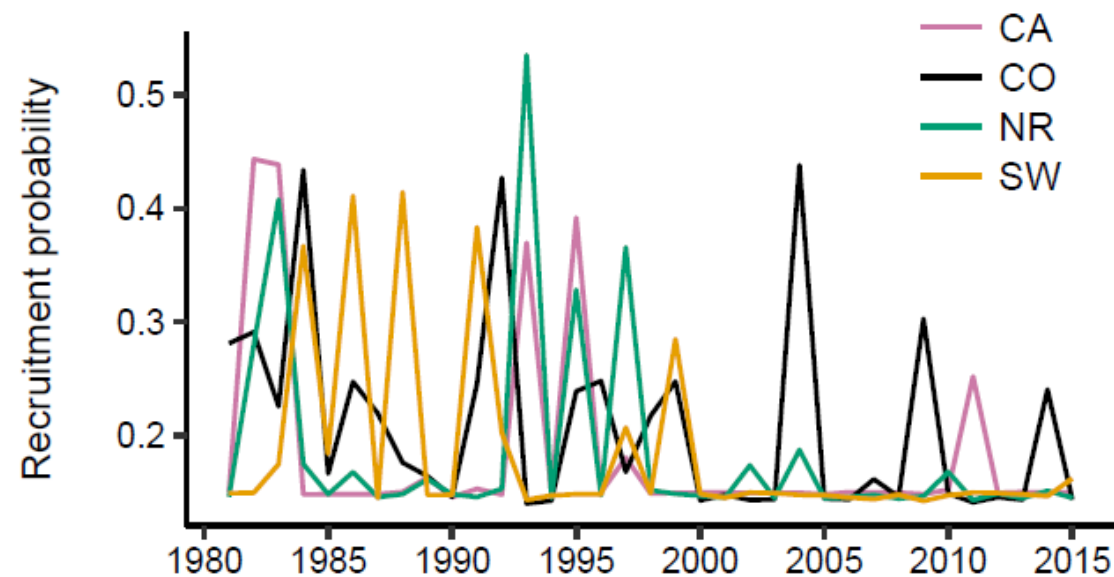


Douglas-fir

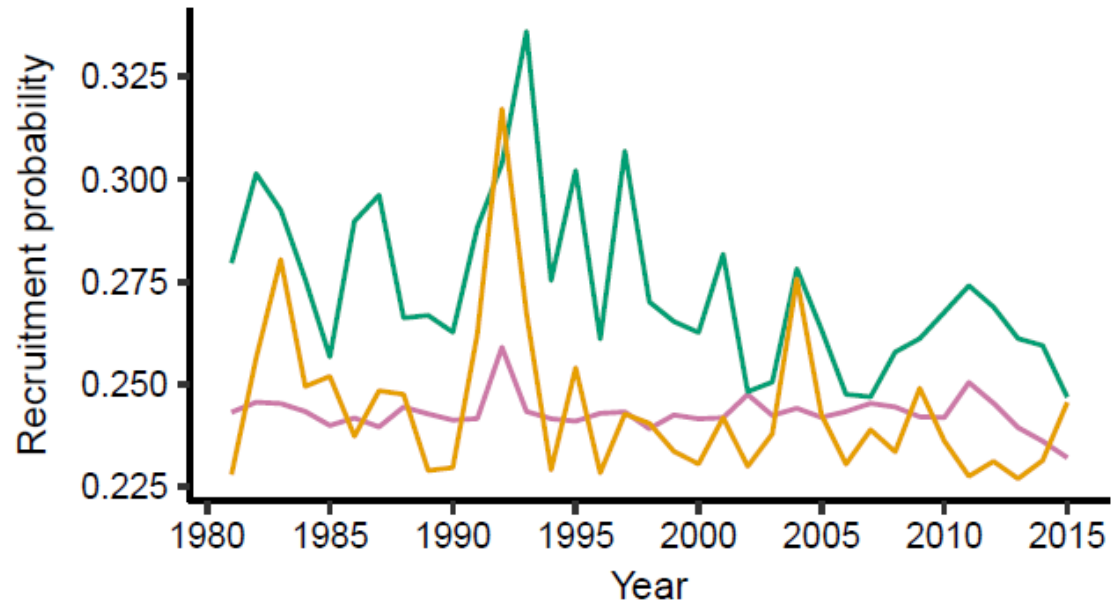


Recruitment probability declined in recent decades

Ponderosa
pine



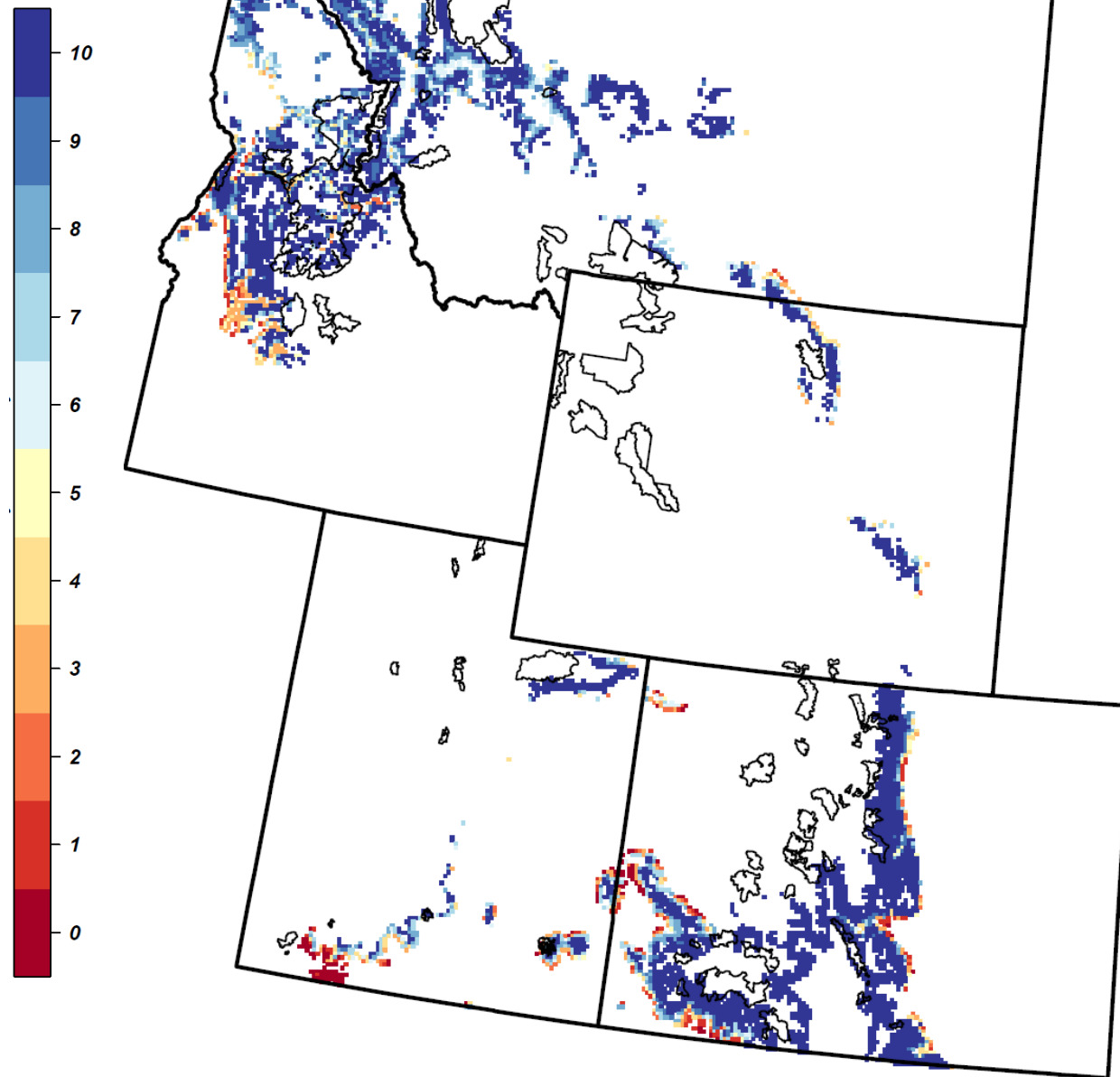
Douglas-fir



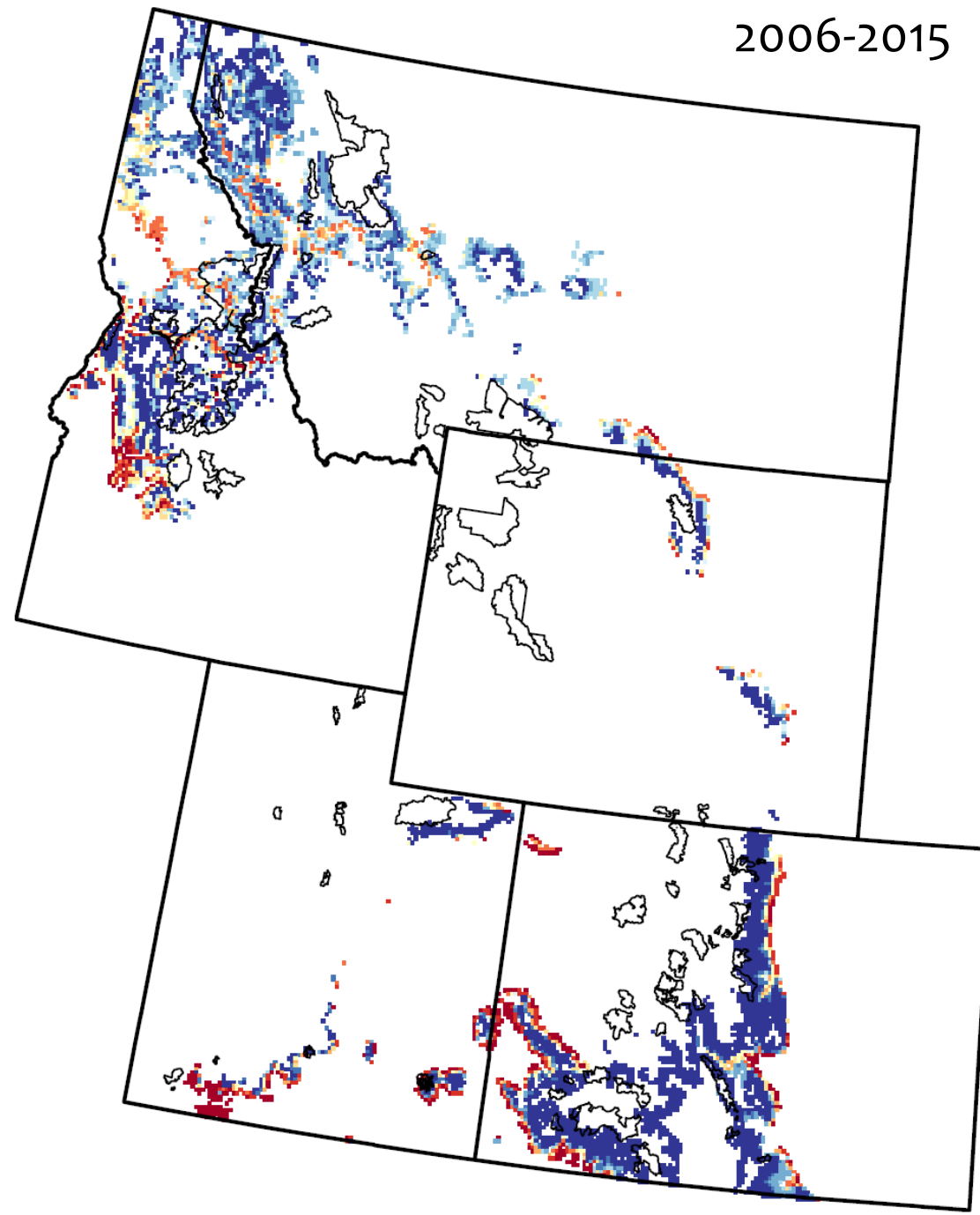


climatically
suitable years
for PIPO regen.

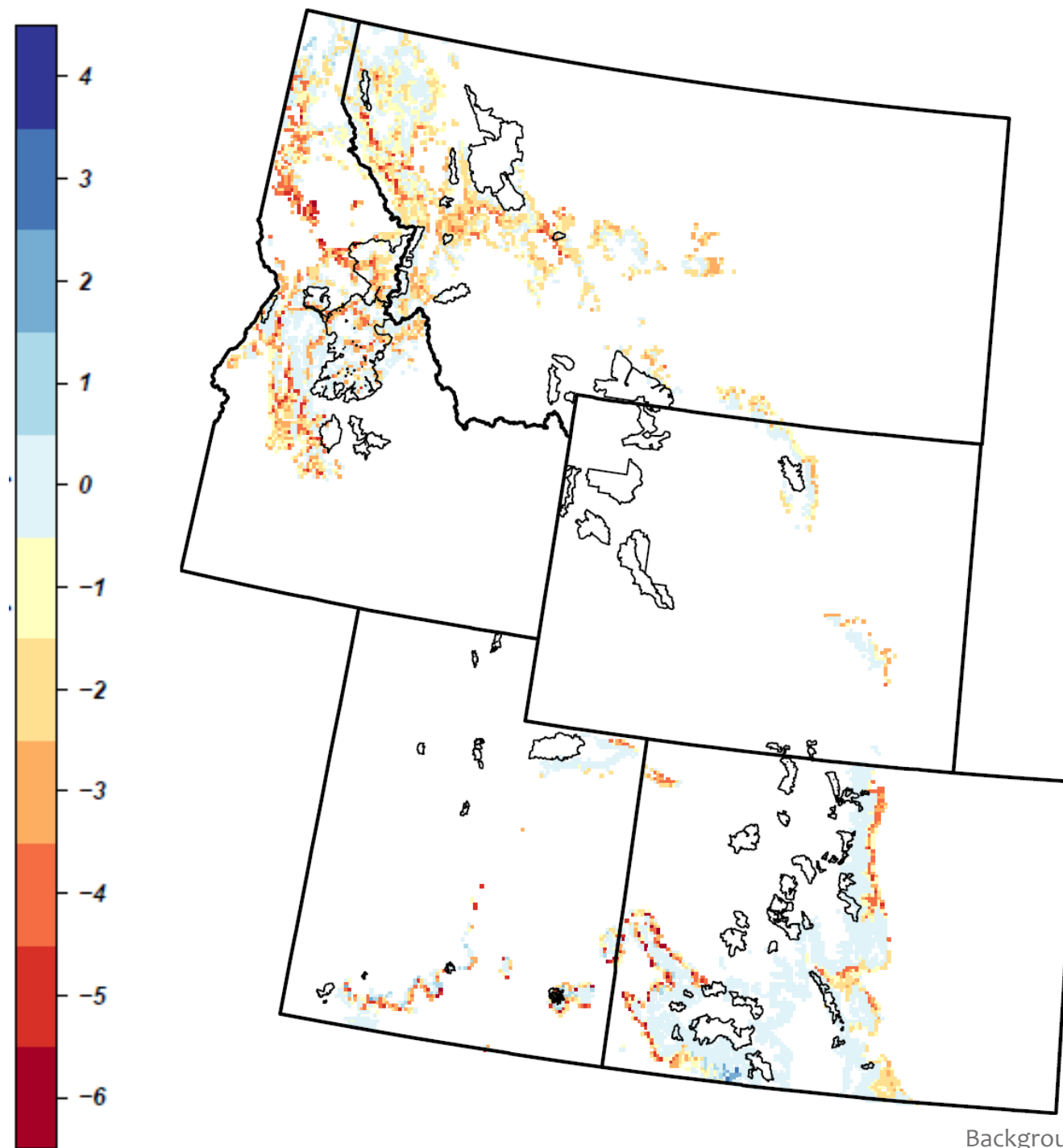
1986-1995



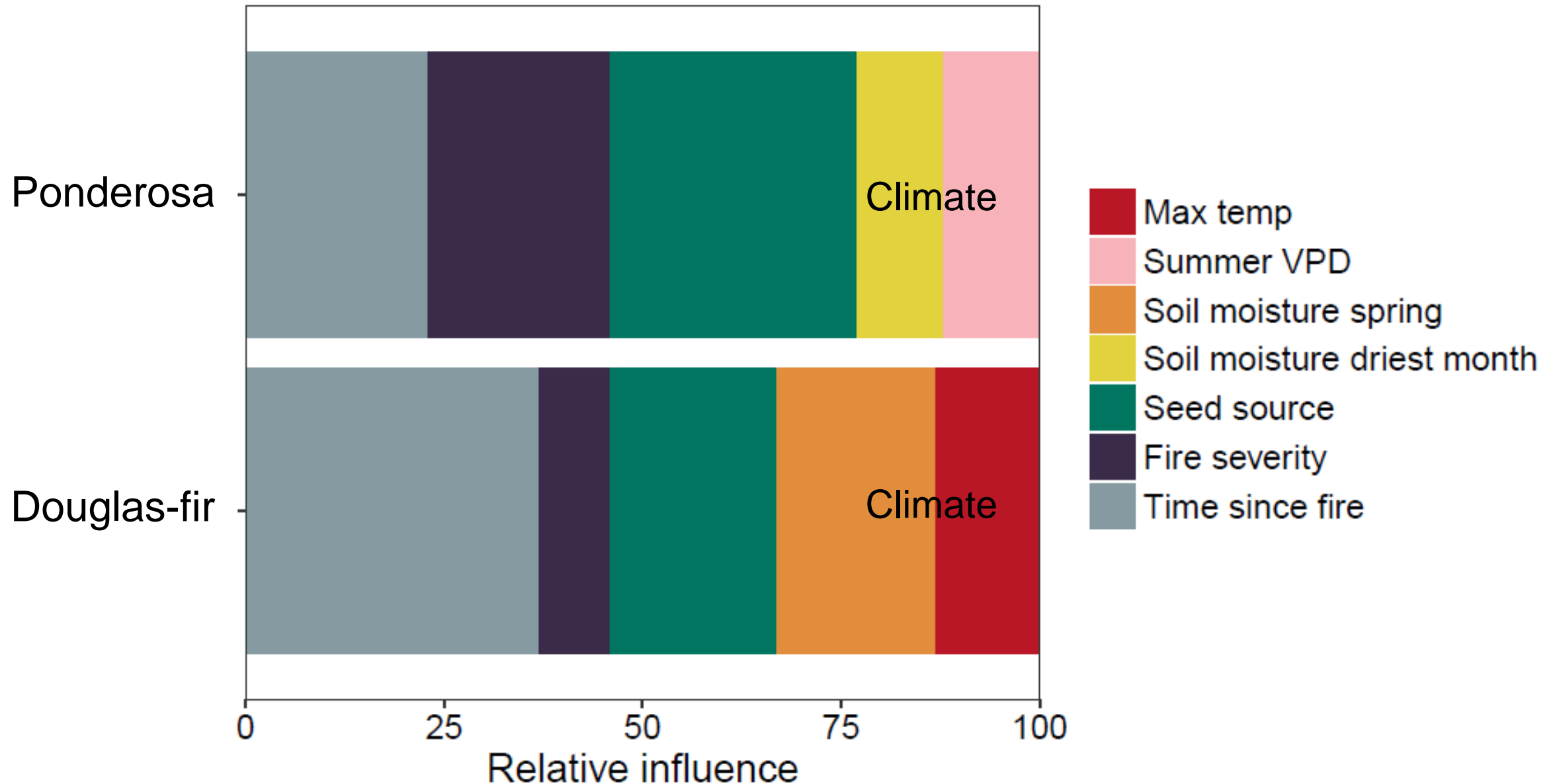
2006-2015



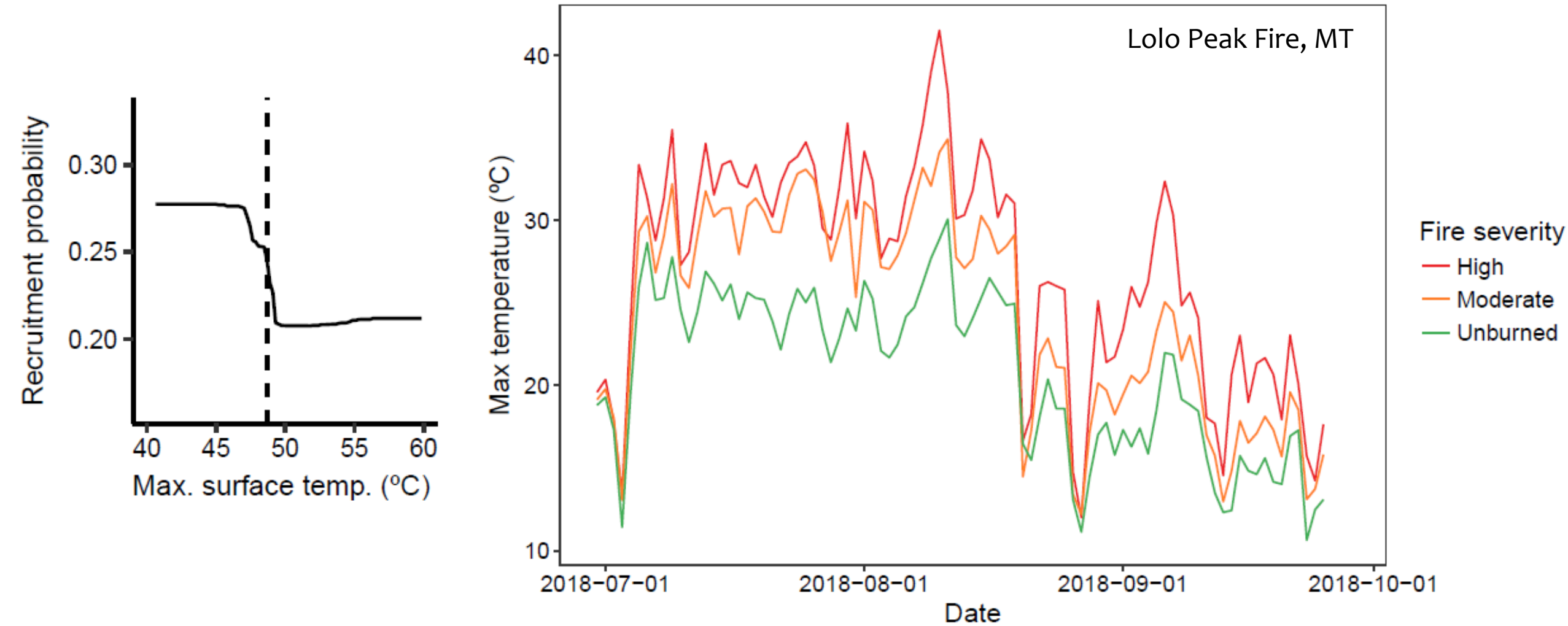
Difference in
climatically
suitable years for
PIPO from 1986-
1995 to 2006-2015



Non-climatic factors are strongly influential

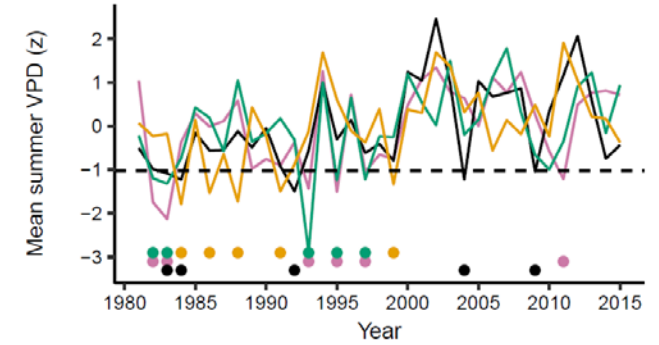


Wildfire alters microclimate



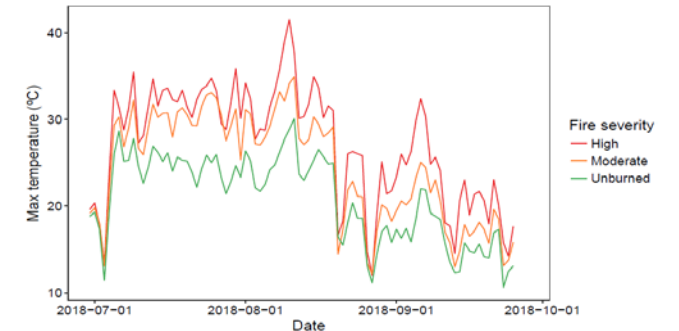
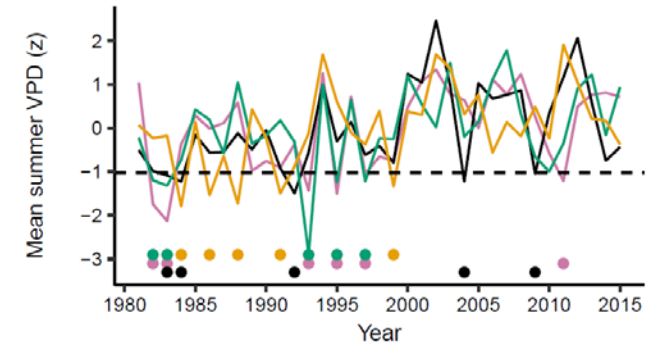
Conclusions

- Some low-elevation forests have already crossed climate thresholds for recruitment.



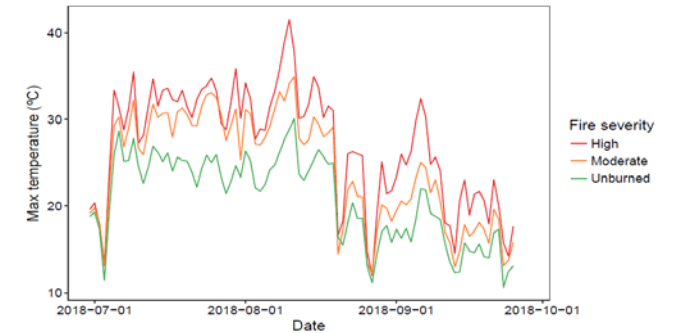
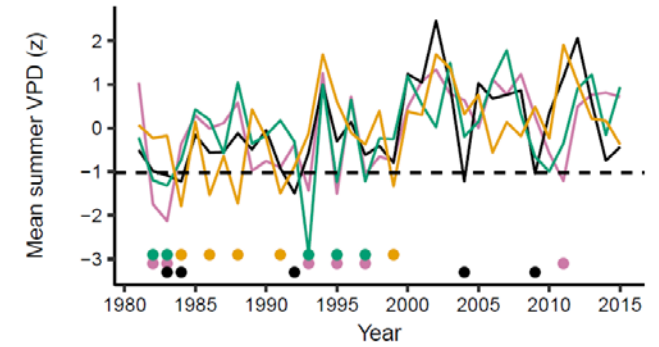
Conclusions

- Some low-elevation forests have already crossed climate thresholds for recruitment.
- Reduced fire severity can increase post-fire regeneration by maintaining seed sources and a cooler microclimate.



Conclusions

- Some low-elevation forests have already crossed climate thresholds for recruitment.
- Reduced fire severity can increase post-fire regeneration by maintaining seed sources and a cooler microclimate.
- May need to accept transitions to non-forest vegetation types in hottest and driest areas.



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CO data: Monica Rother & Tom Veblen

NR site selection: Kerry Kemp

Research assistants:
Steve Pracht, Lacey Hankin, Erika
Berglund, Lawrence Crofutt

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Joint Fire Science Program
(Project # 16-1-01-15)

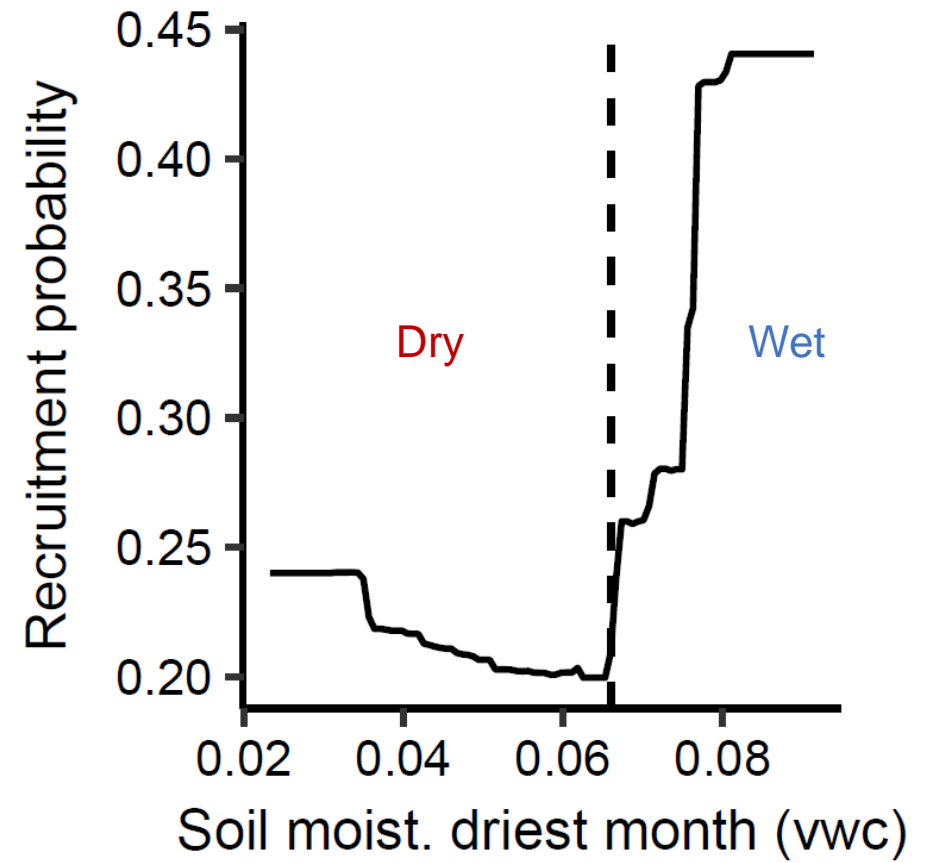
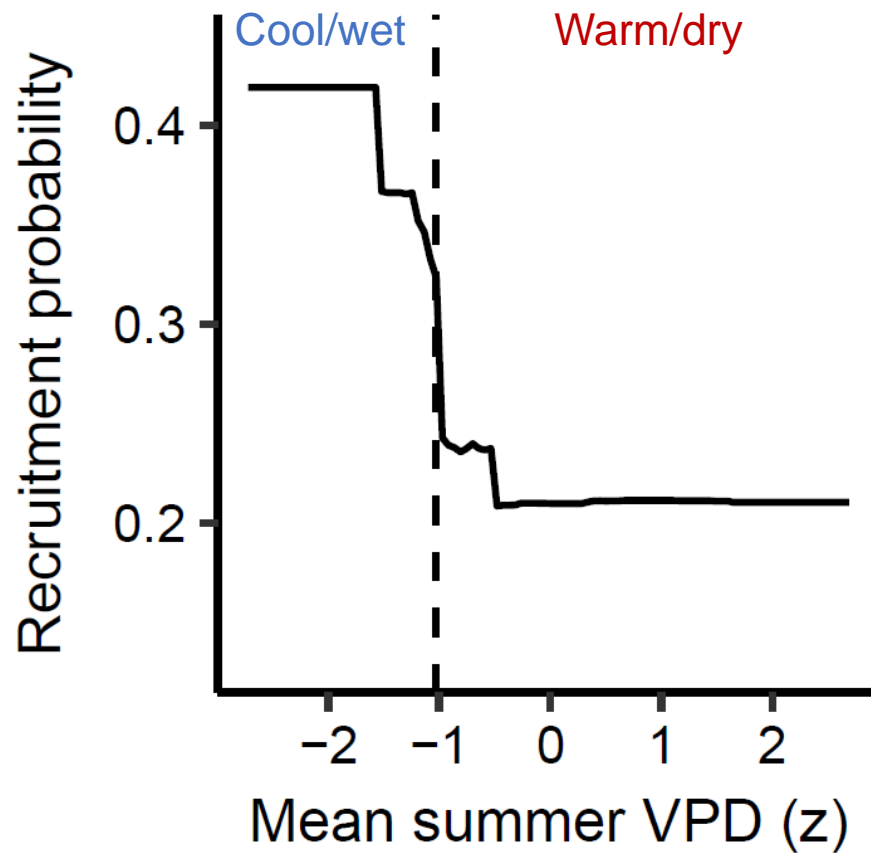
NSF (BCS 1461576)



Questions?

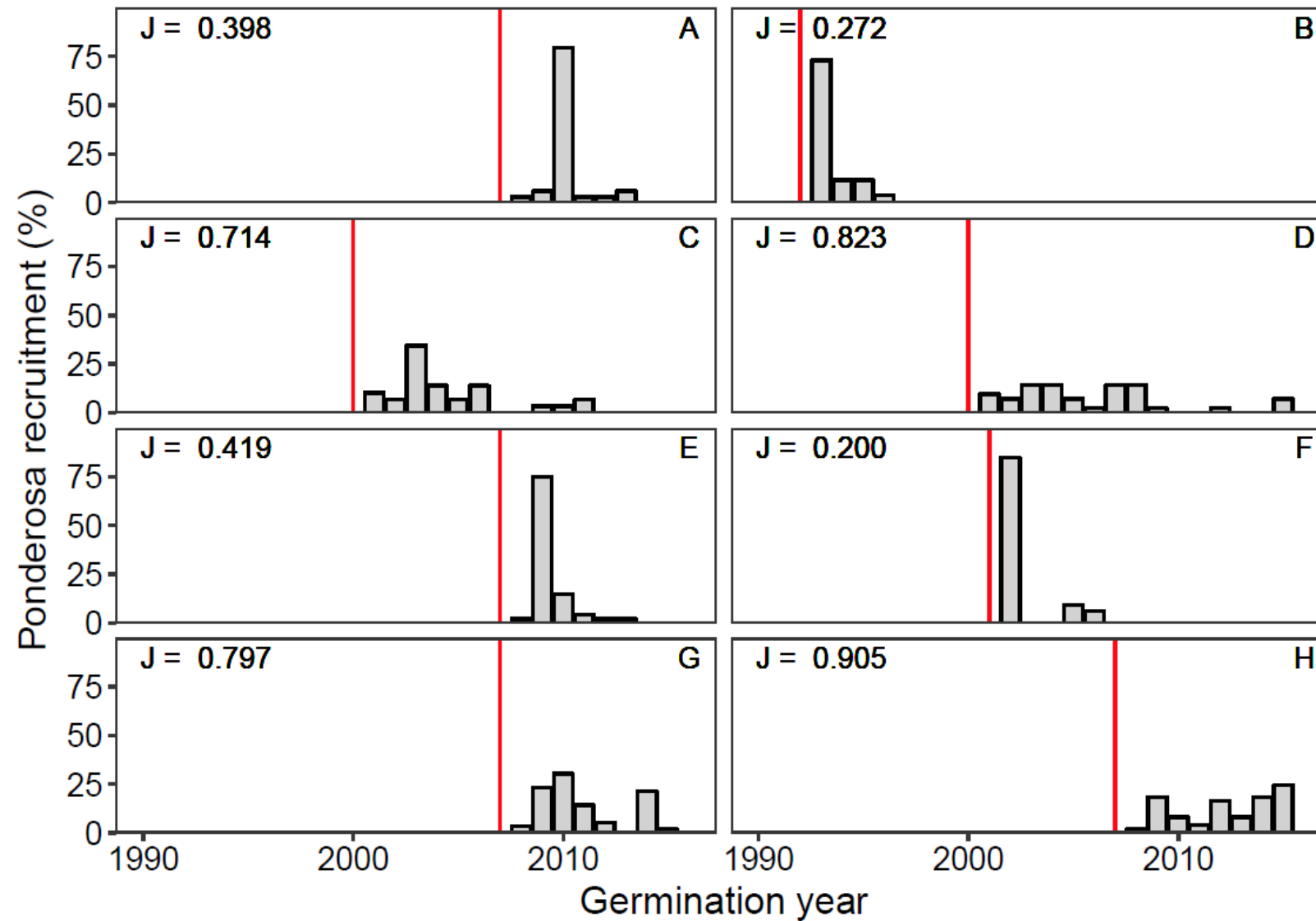


Recruitment-climate relationships are nonlinear



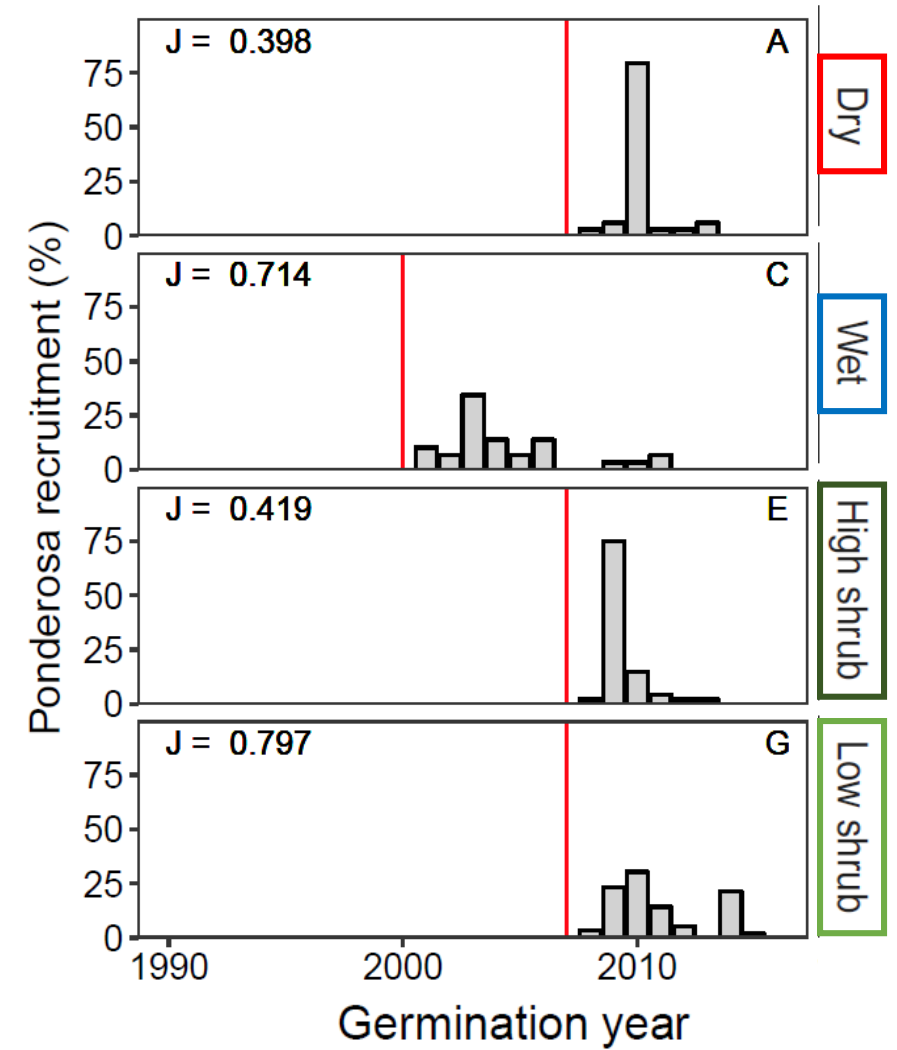
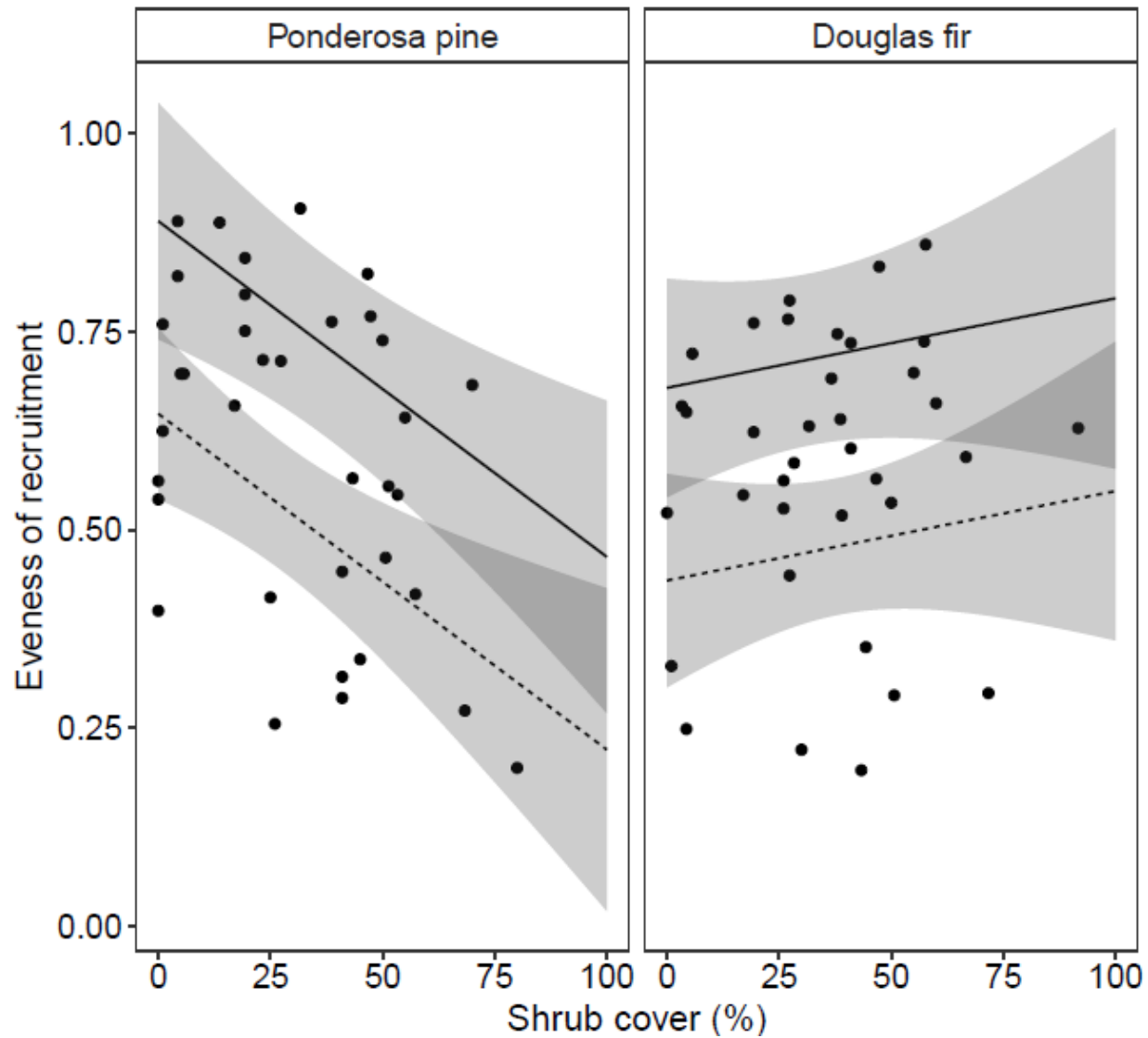


Evenness of recruitment over time



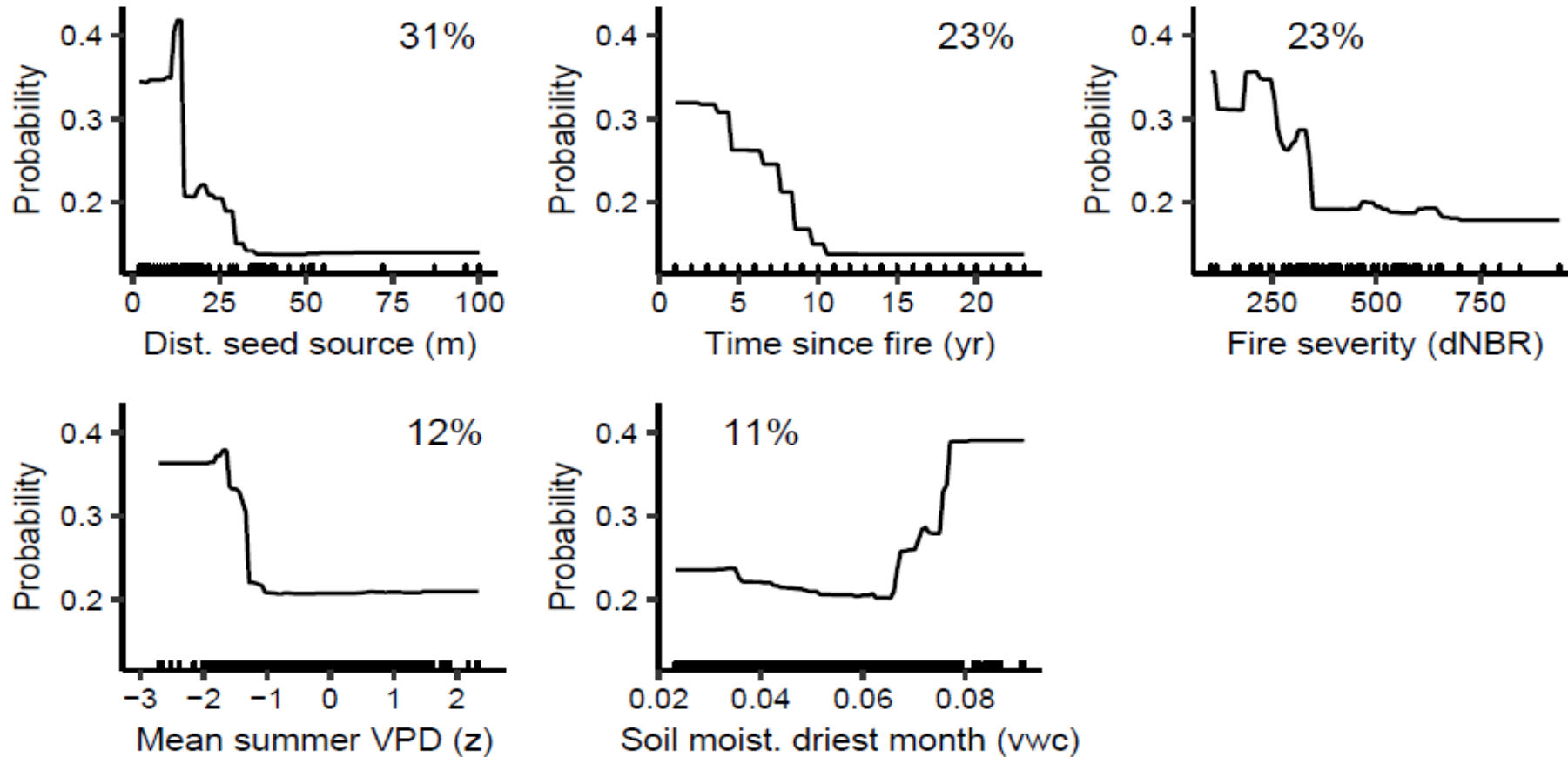


Evenness of recruitment over time



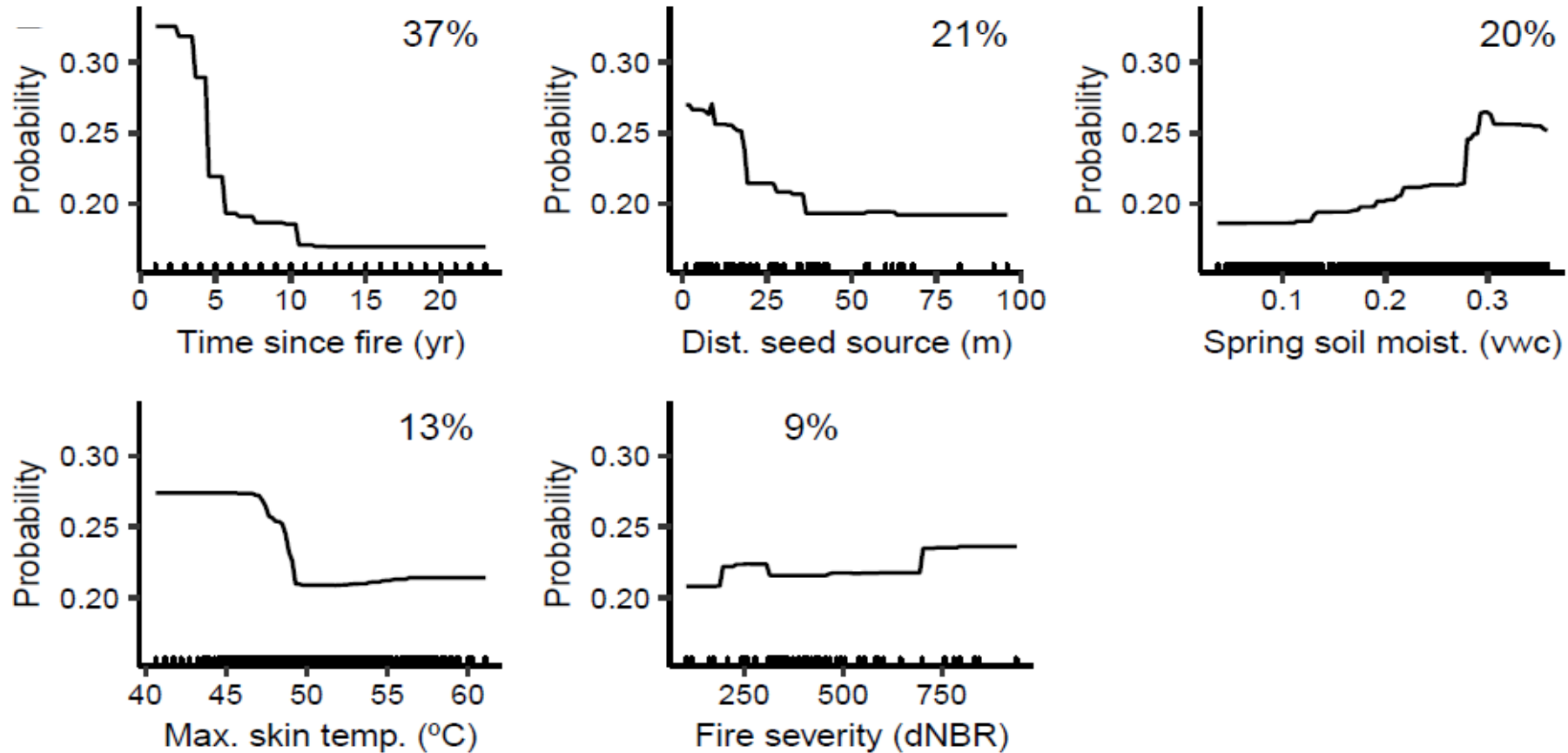
Non-climatic factors are strongly influential

Ponderosa pine



Non-climatic factors are strongly influential

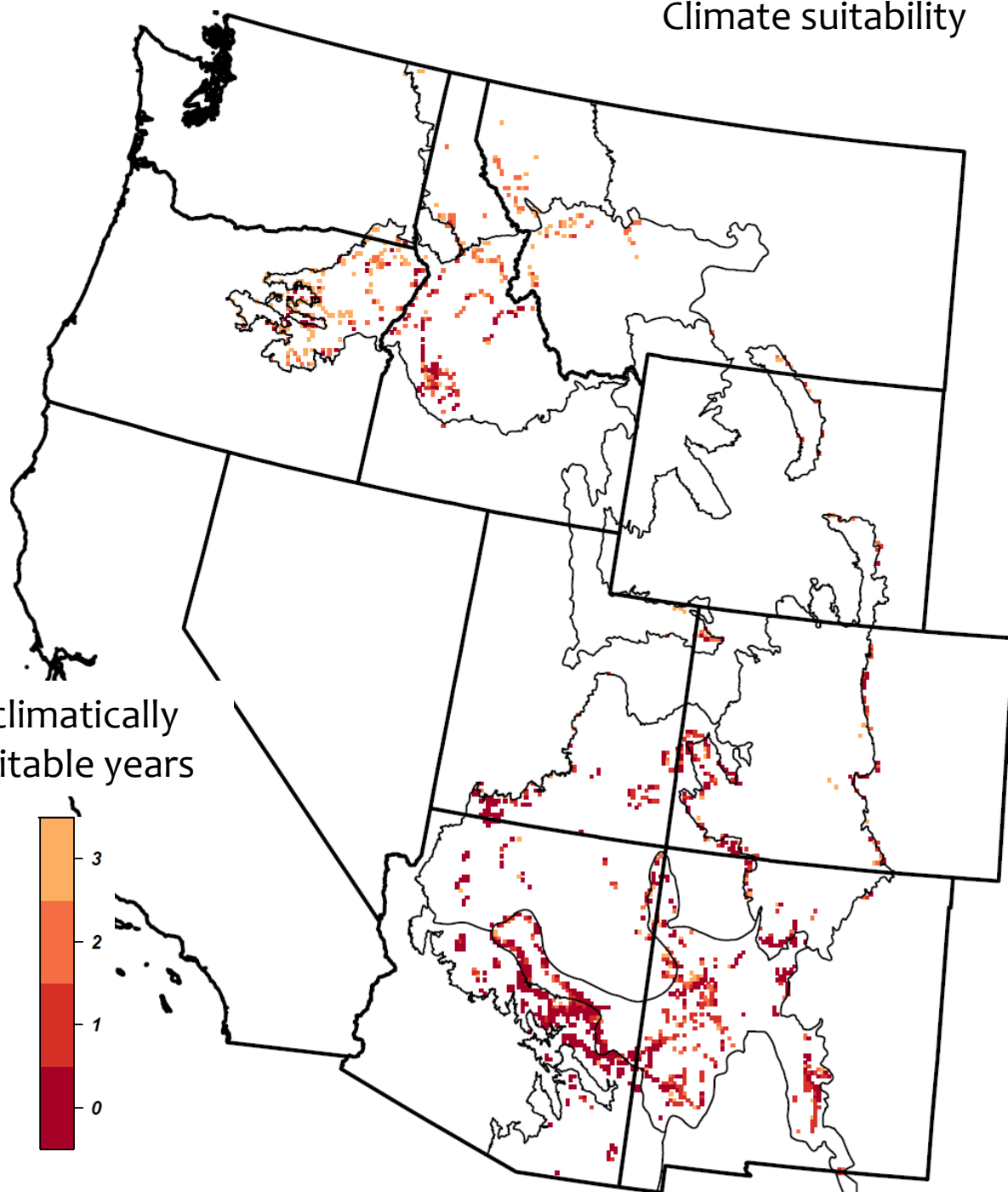
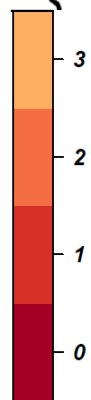
Douglas-fir





Climate suitability

climatically
suitable years



Stand replacing fire & climate suitability

