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MISC
Montana Invasive Species Council

Climate-Driven Expansion of Nonnative Trout Species in Montana

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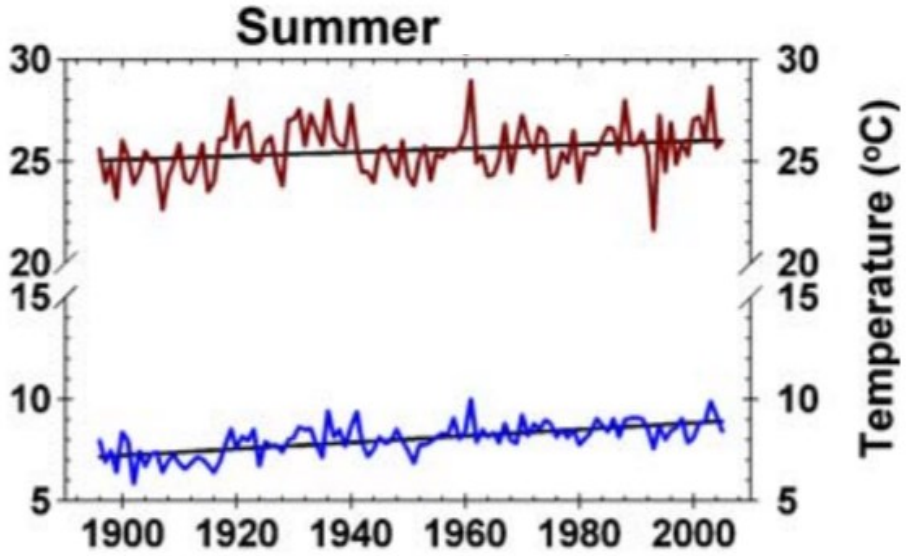
Climate impacts on freshwater fish

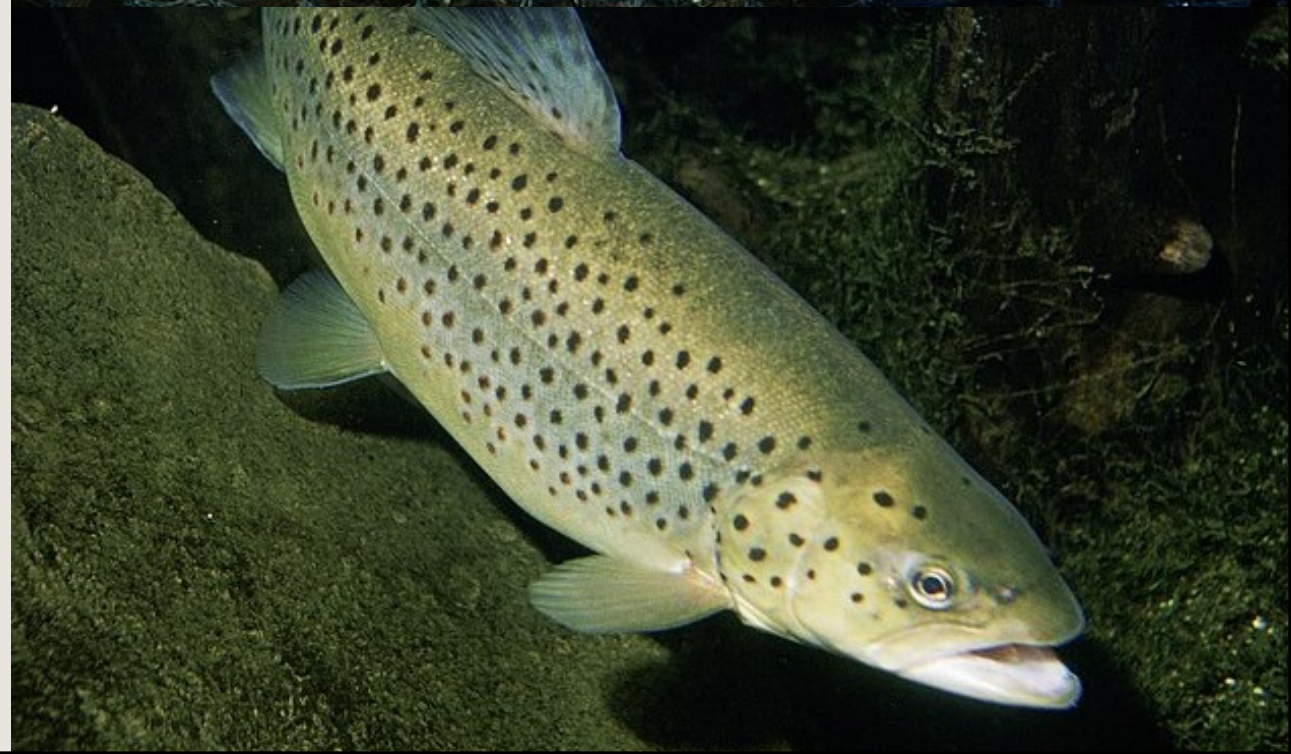
- Warm adapted species may benefit from rising temperatures
- Changing stream flows (drought and winter flooding) have variable effects
- Species interactions can be altered



Pederson et al., 2010

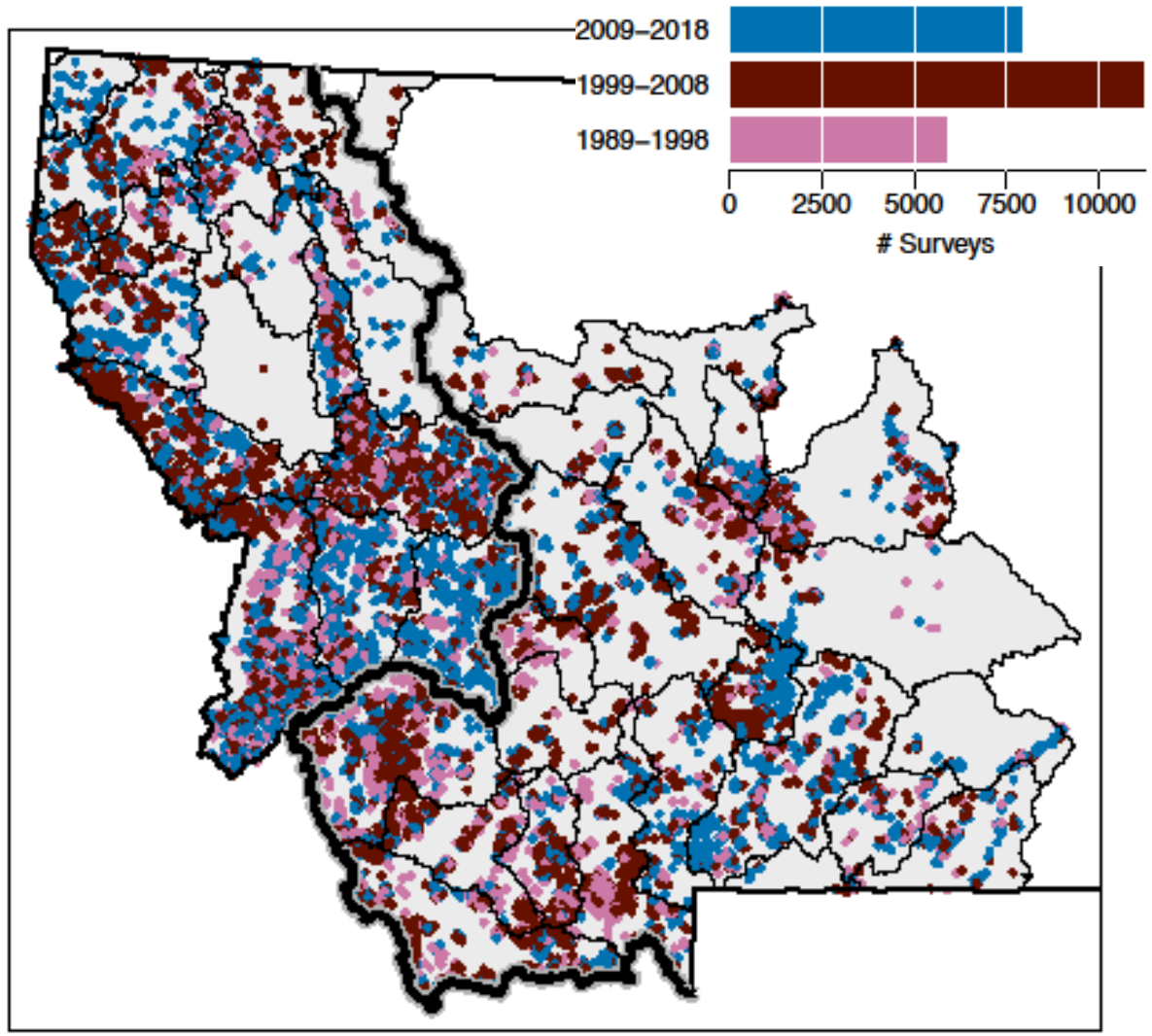
Nonnative trout in Montana

- **Rainbow**, **brown**, brook, and lake trout
- High recreational value
- Intensively stocked starting in the 1890s
- Potential harm to native trout species (hybridization, competition and predation)



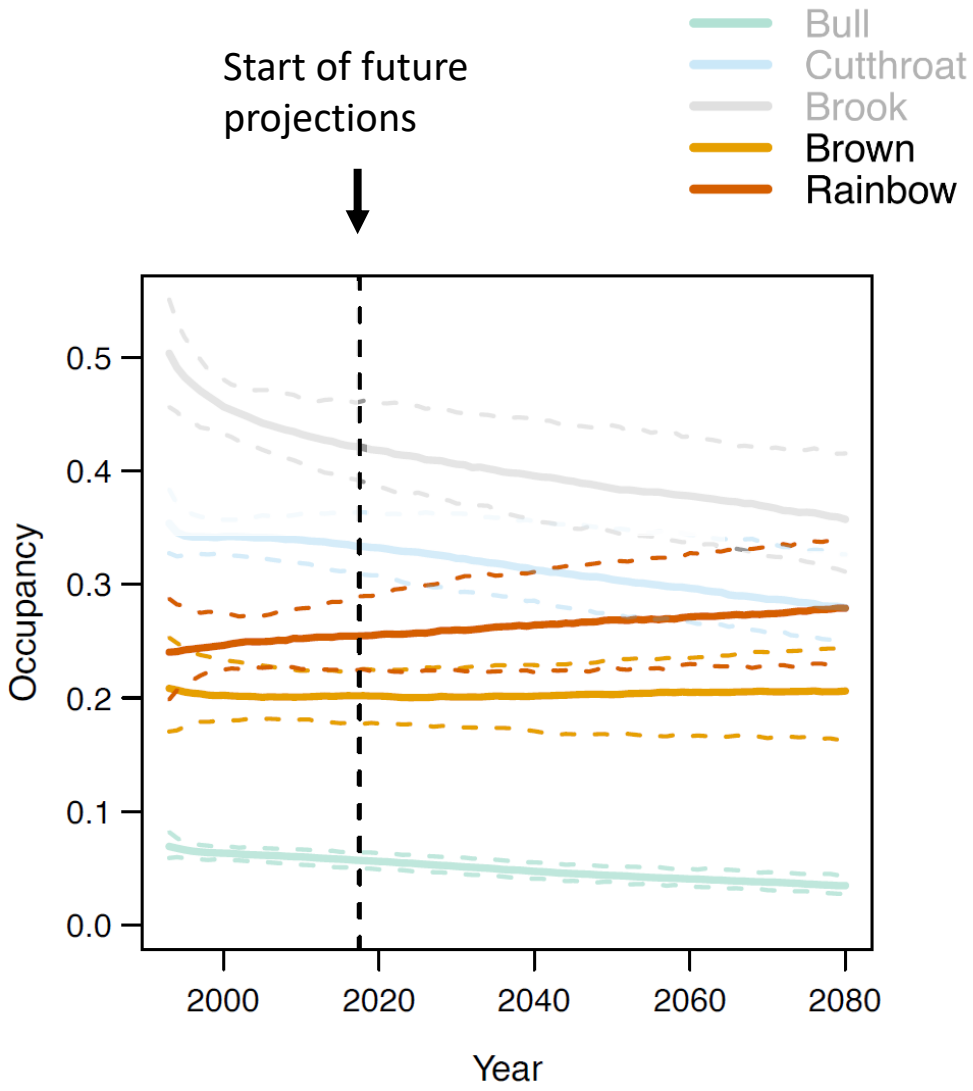
Distribution model of trout species in Montana

- > 25,000 electrofishing surveys collected over 30 years (1989-2018)
- US Forest Service stream flow and temperature projections (Wenger et al. 2010; Isaak et al. 2017)



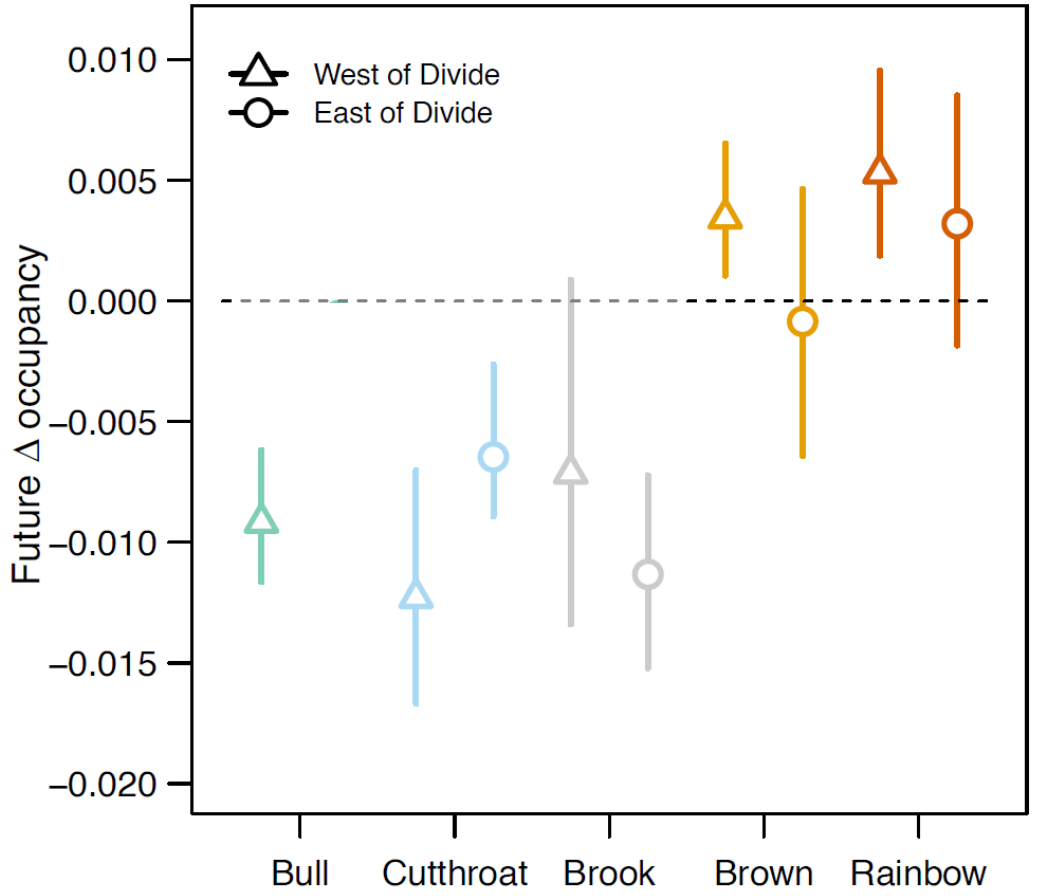
Predicted trends in distribution from 1993 to 2080

- Brown trout are expected to occupy **a similar amount** of habitat
- Rainbow trout are predicted to occupy **more** habitat

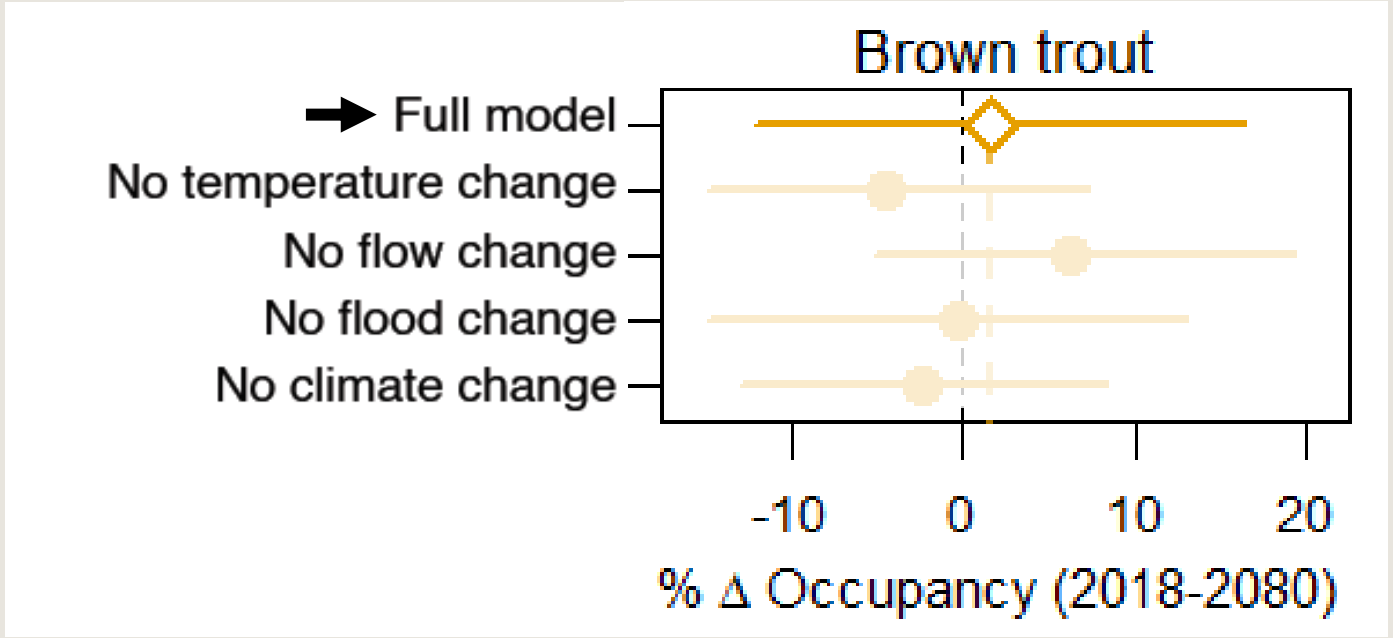


Nonnative species are favored more strongly west of the Divide

- Brown and rainbow trout are expected to have greater expansion west of the Continental Divide
- Other species are expected to decline



Factors driving range shifts



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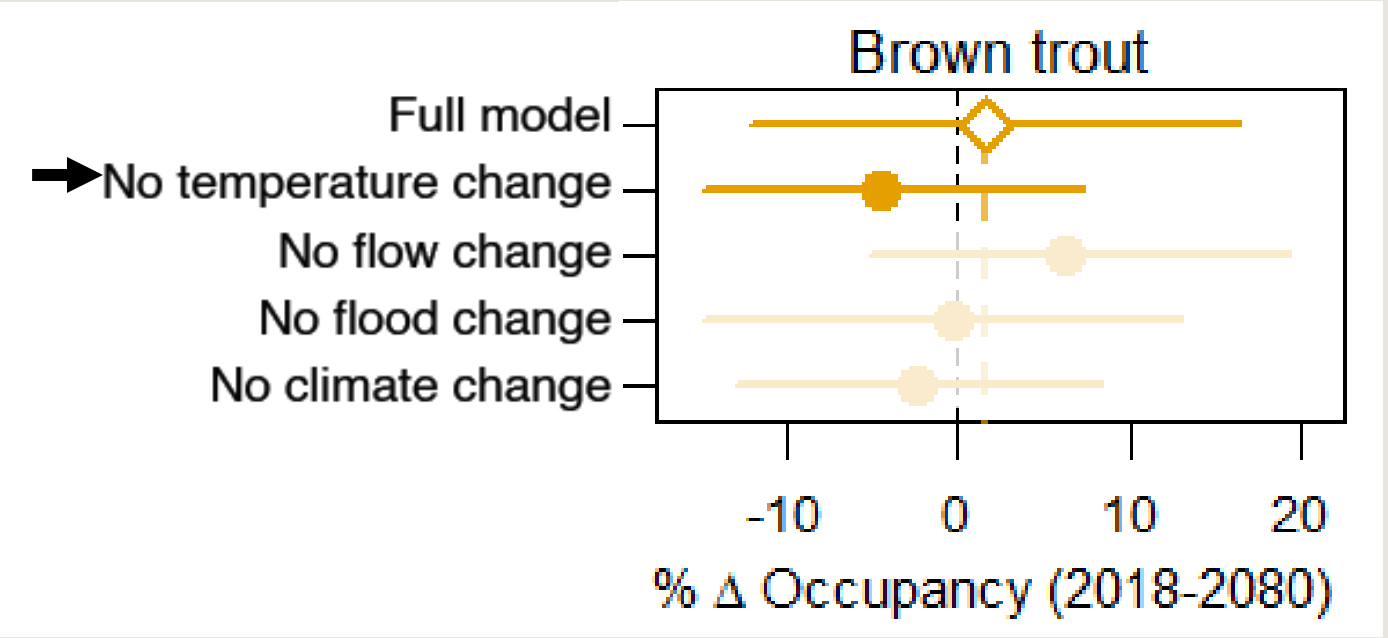

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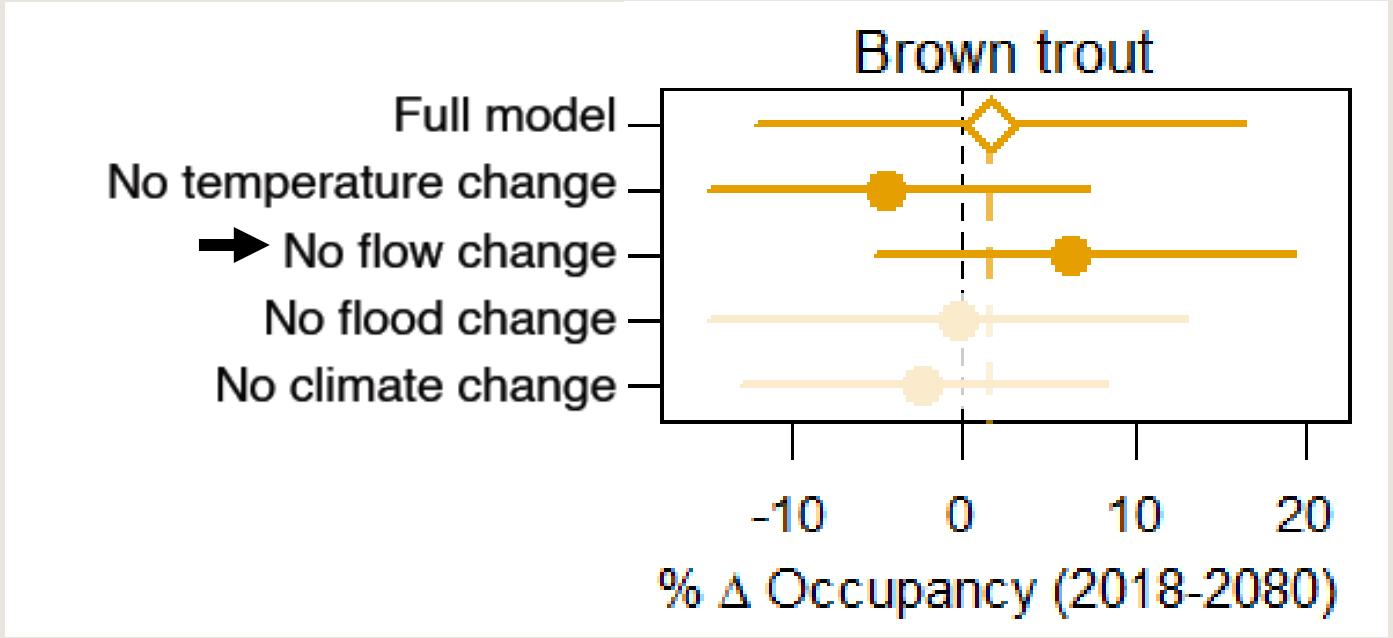

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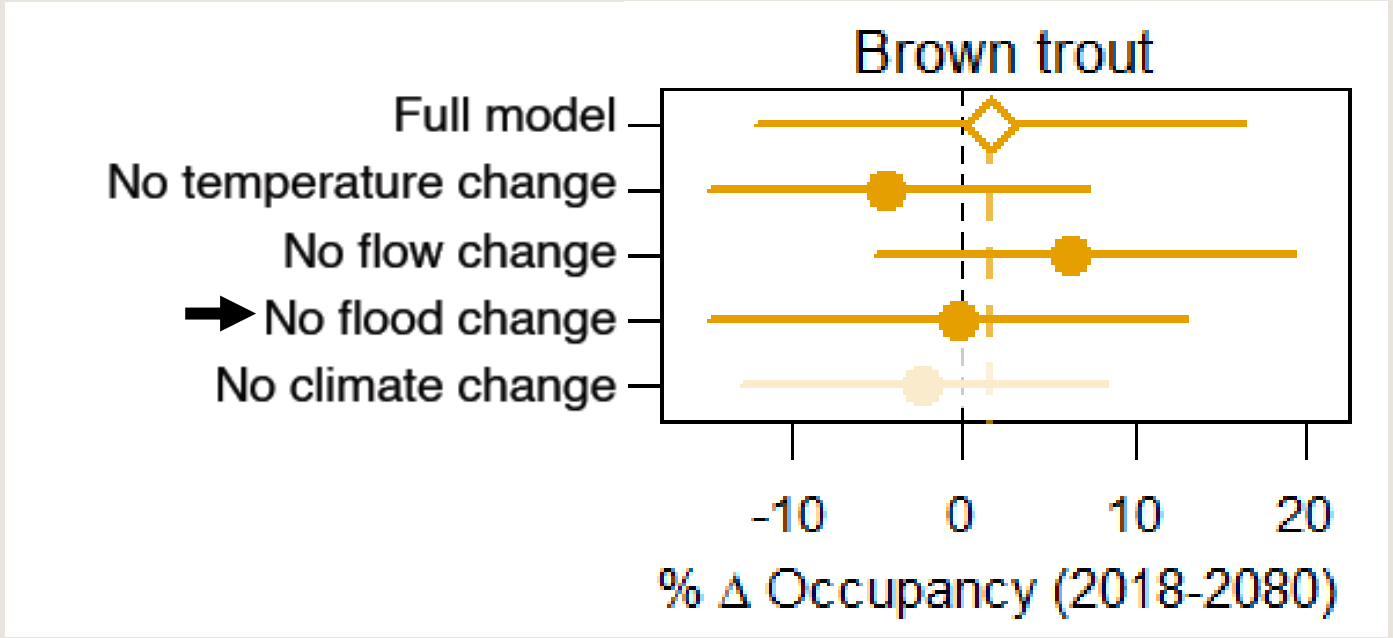

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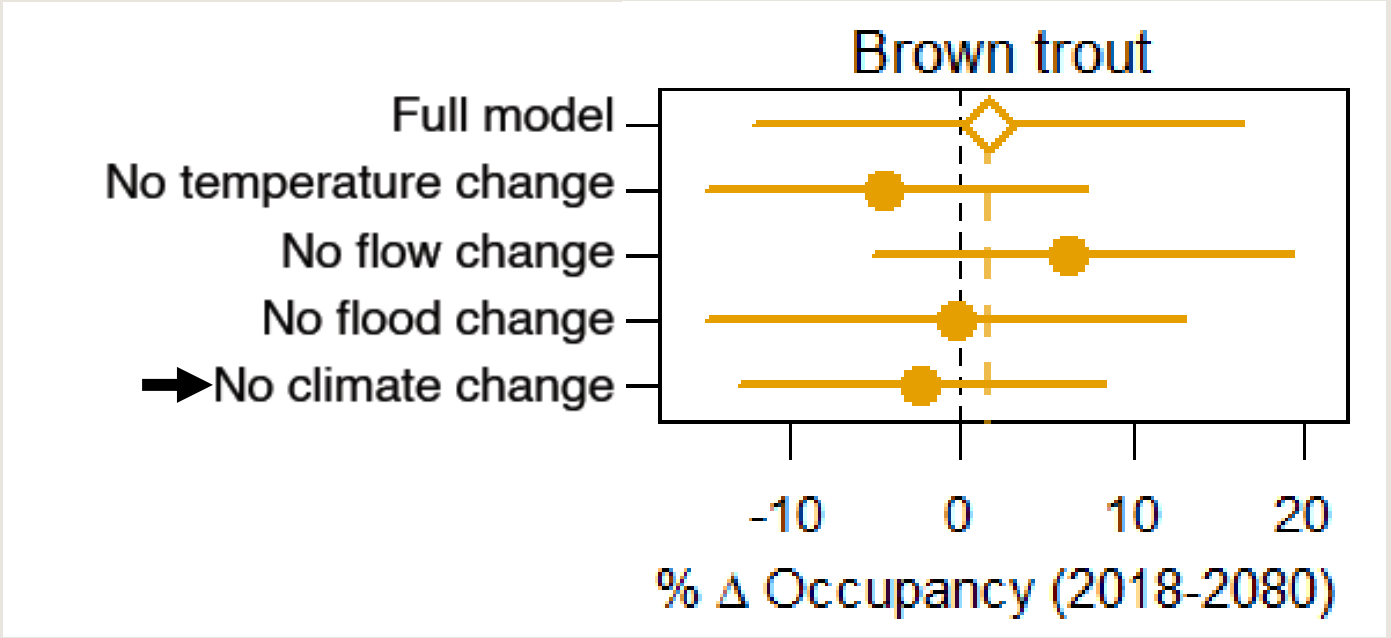

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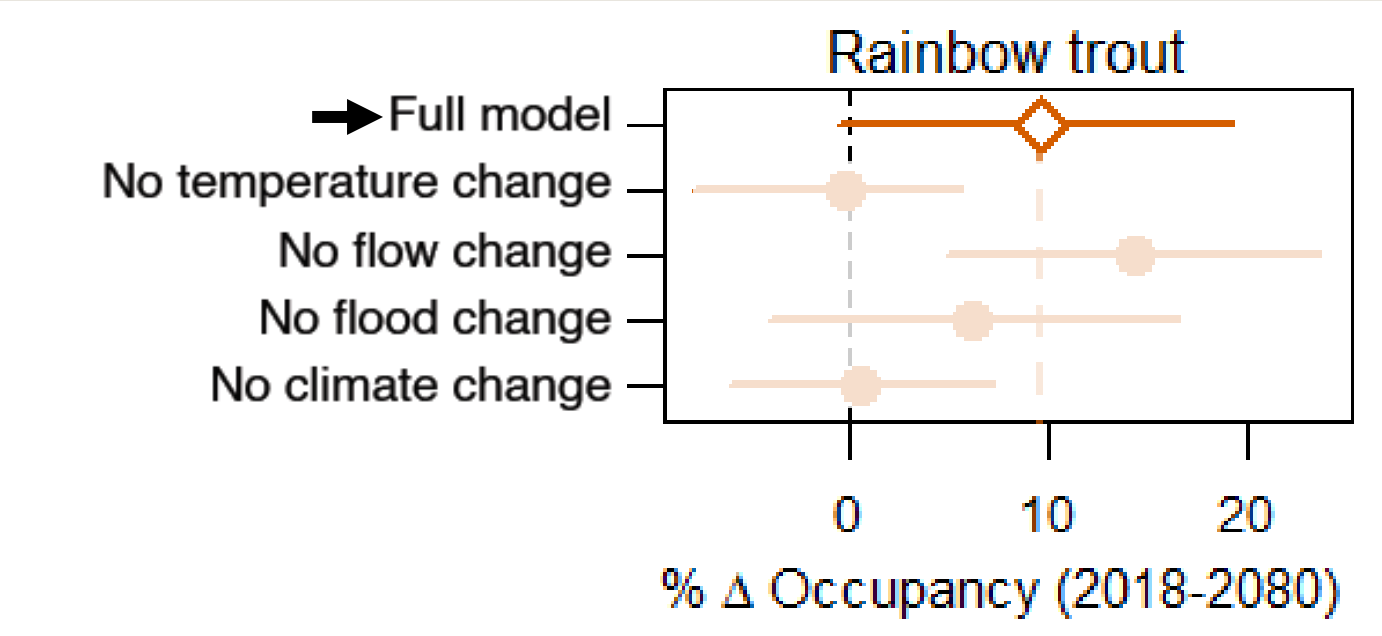

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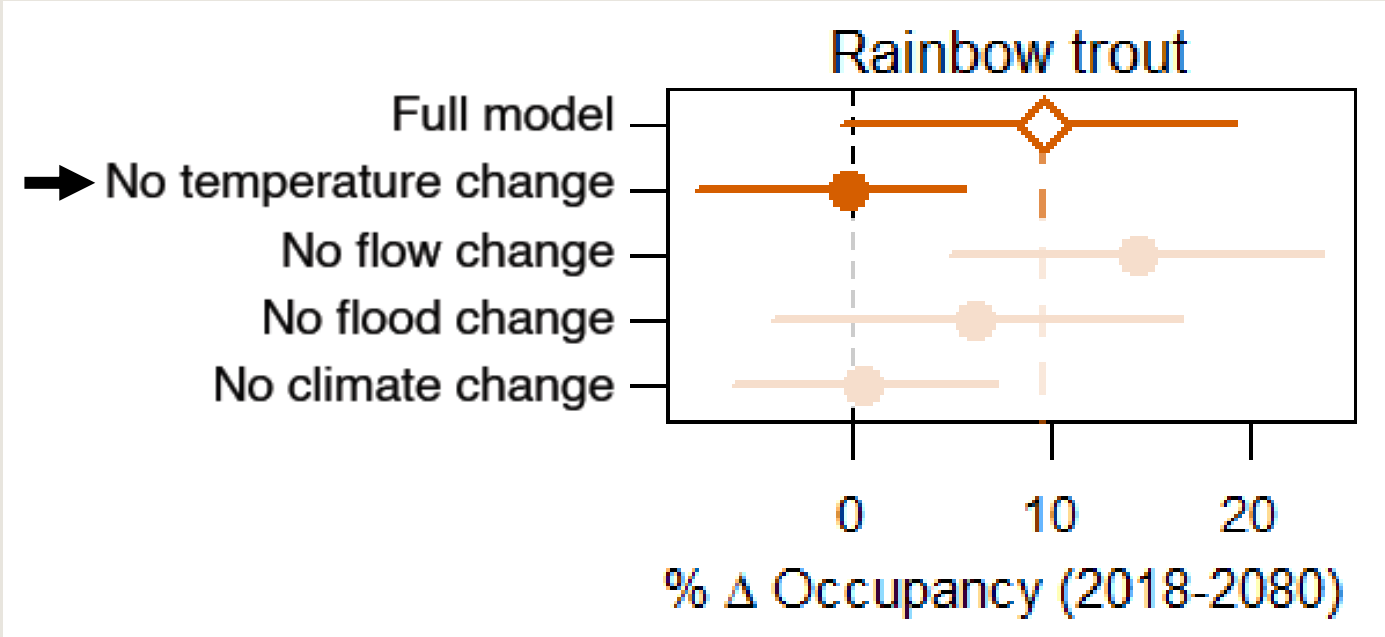

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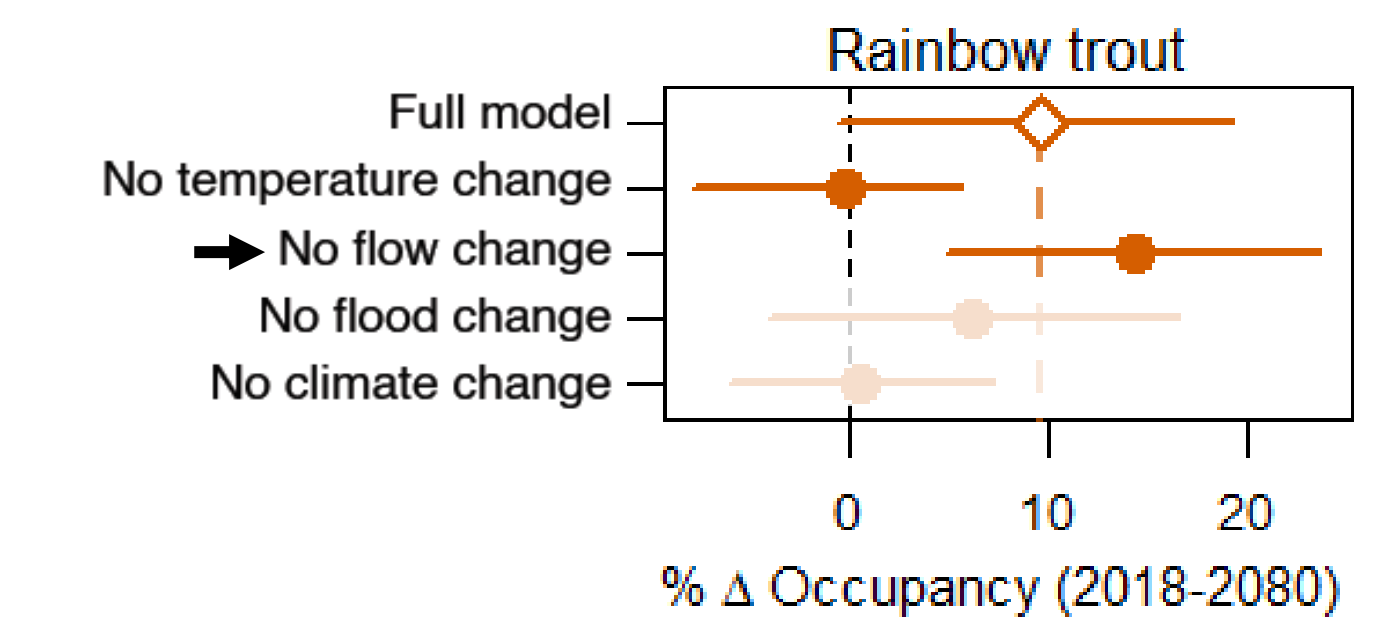

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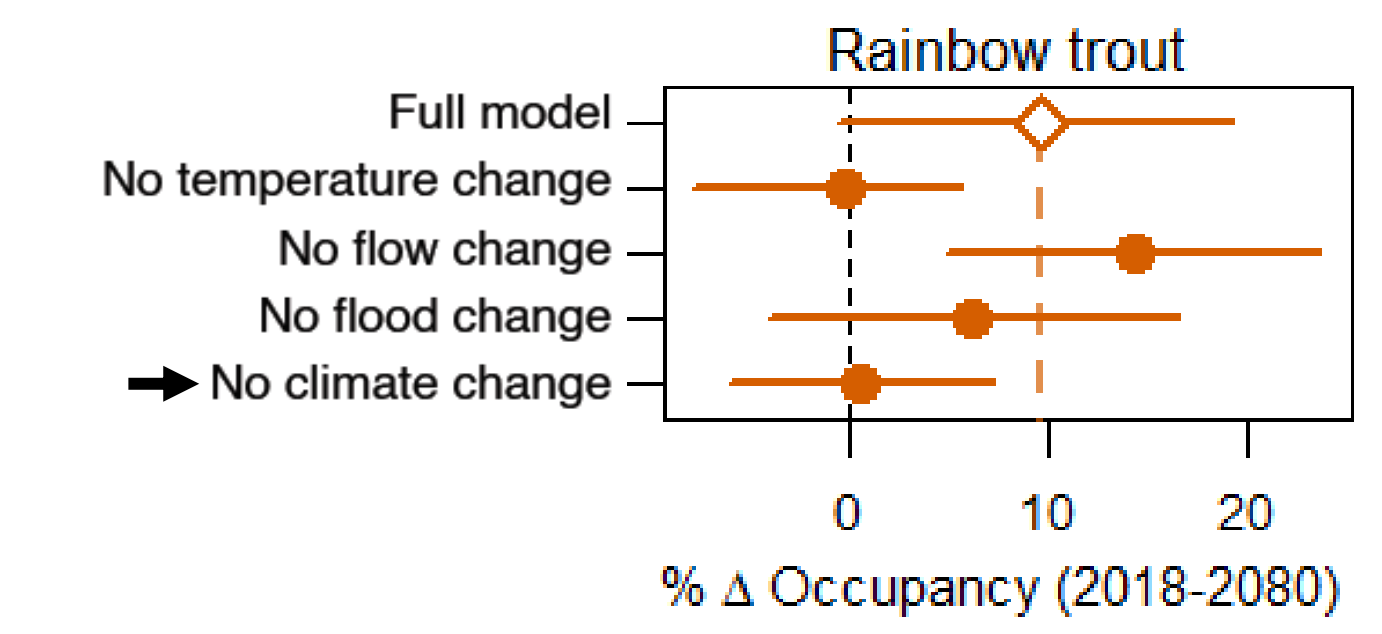
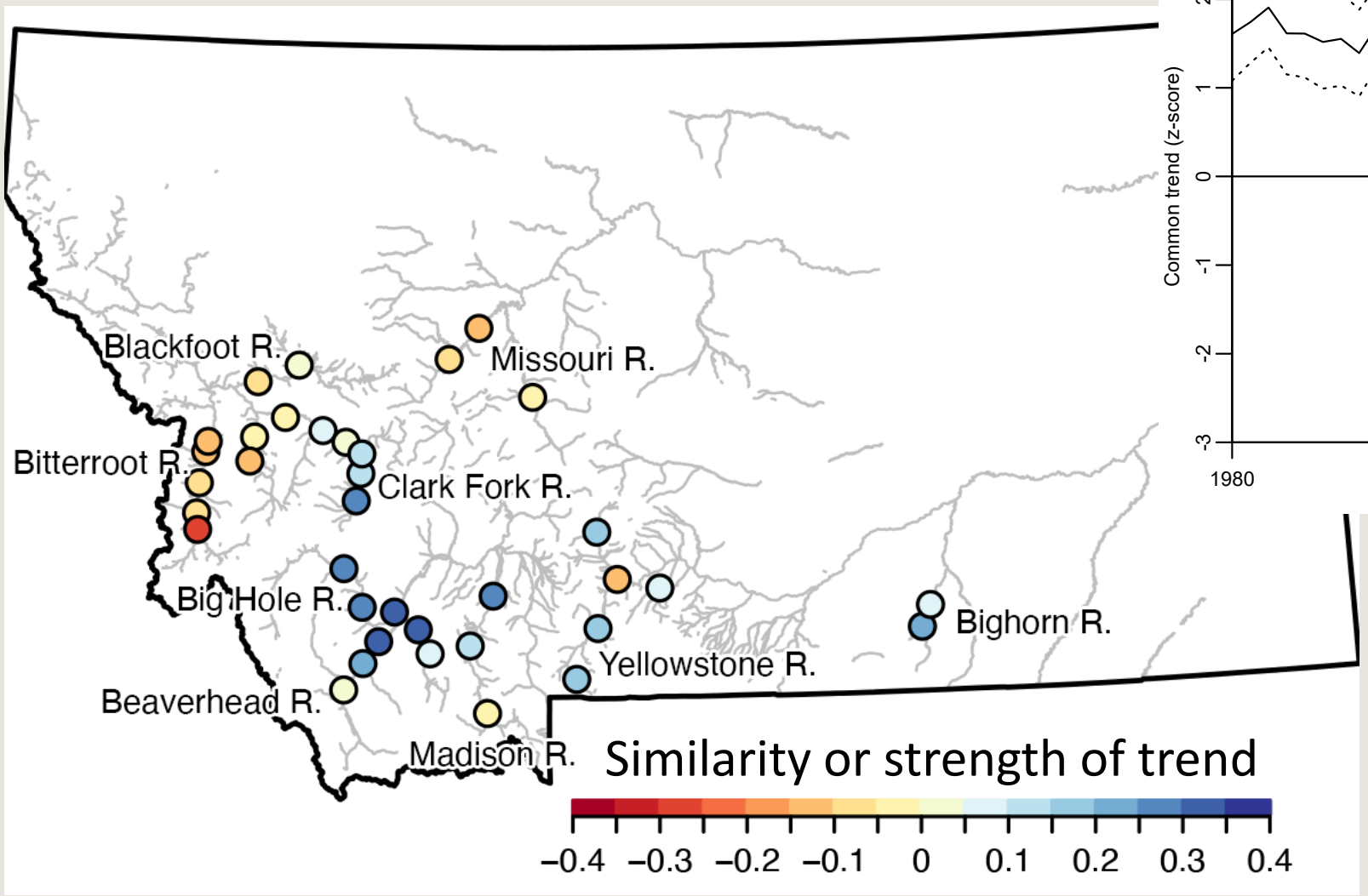


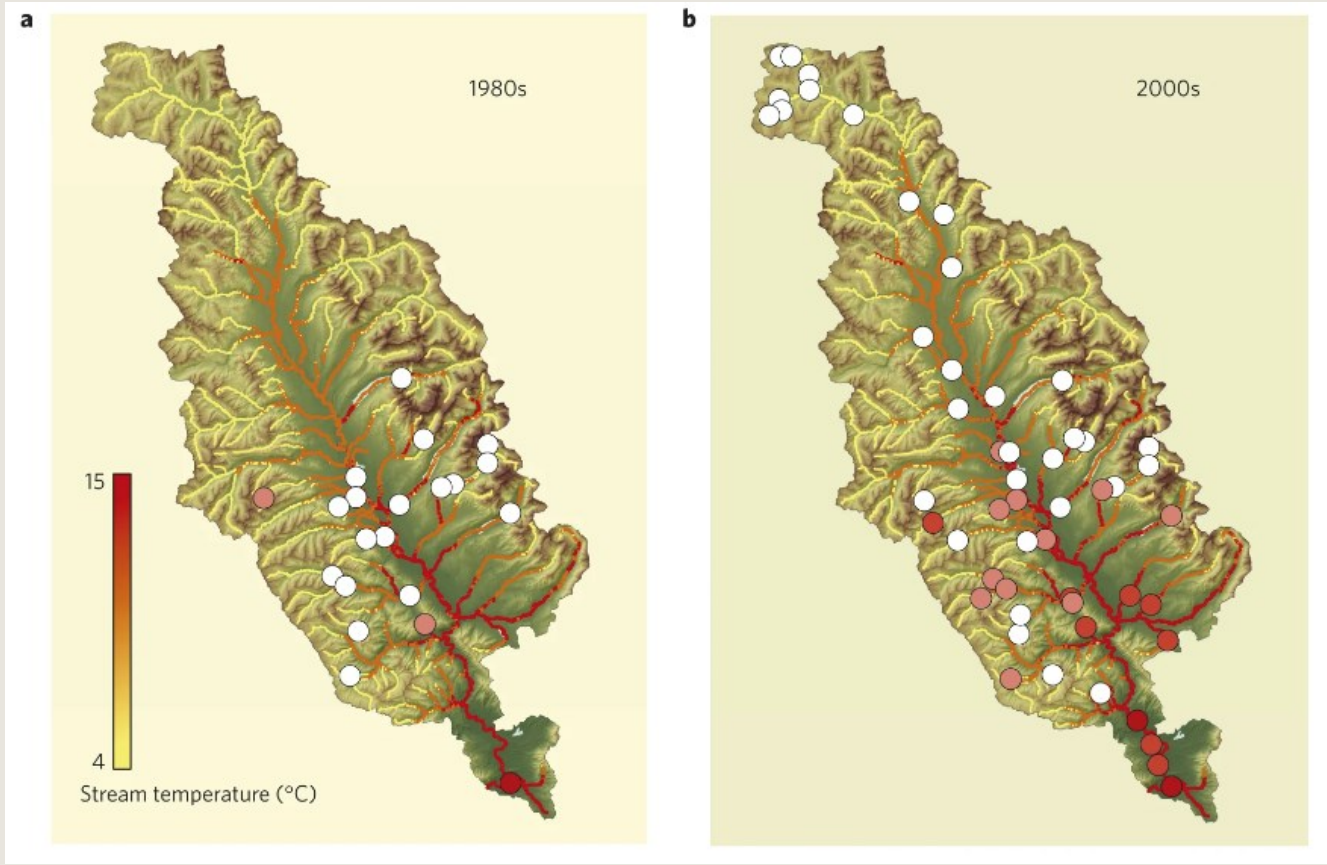
Trends in abundance of brown trout



Tim Cline, In preparation

Hybridization between rainbow and cutthroat trout

- Montana prioritizes conservation of nonhybridized cutthroat trout.
- Hybridization is increasing in some areas.
- Hybridization is spreading faster in areas with higher temperatures and lower spring flow.



Muhlfeld et al., 2014

Conclusions

- Brown and rainbow trout distributions are increasing in some watersheds
- Range and abundance changes vary by watershed
- Warmer temperatures benefit these species
- Drought and low summer flows are harmful
- Expansion threatens native bull and cutthroat trout