

The role of arid ecosystems in climate change mitigation depends on a carbon-energy trade-off

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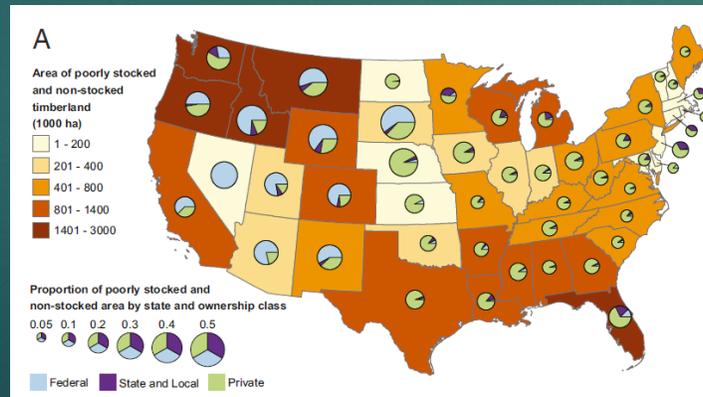
Vertically Integrated Project **BEST-CLIM**:

<https://uavip.arizona.edu/teams/air-teams/best-clim-best-ecosystem-structure-climate-mitigation>

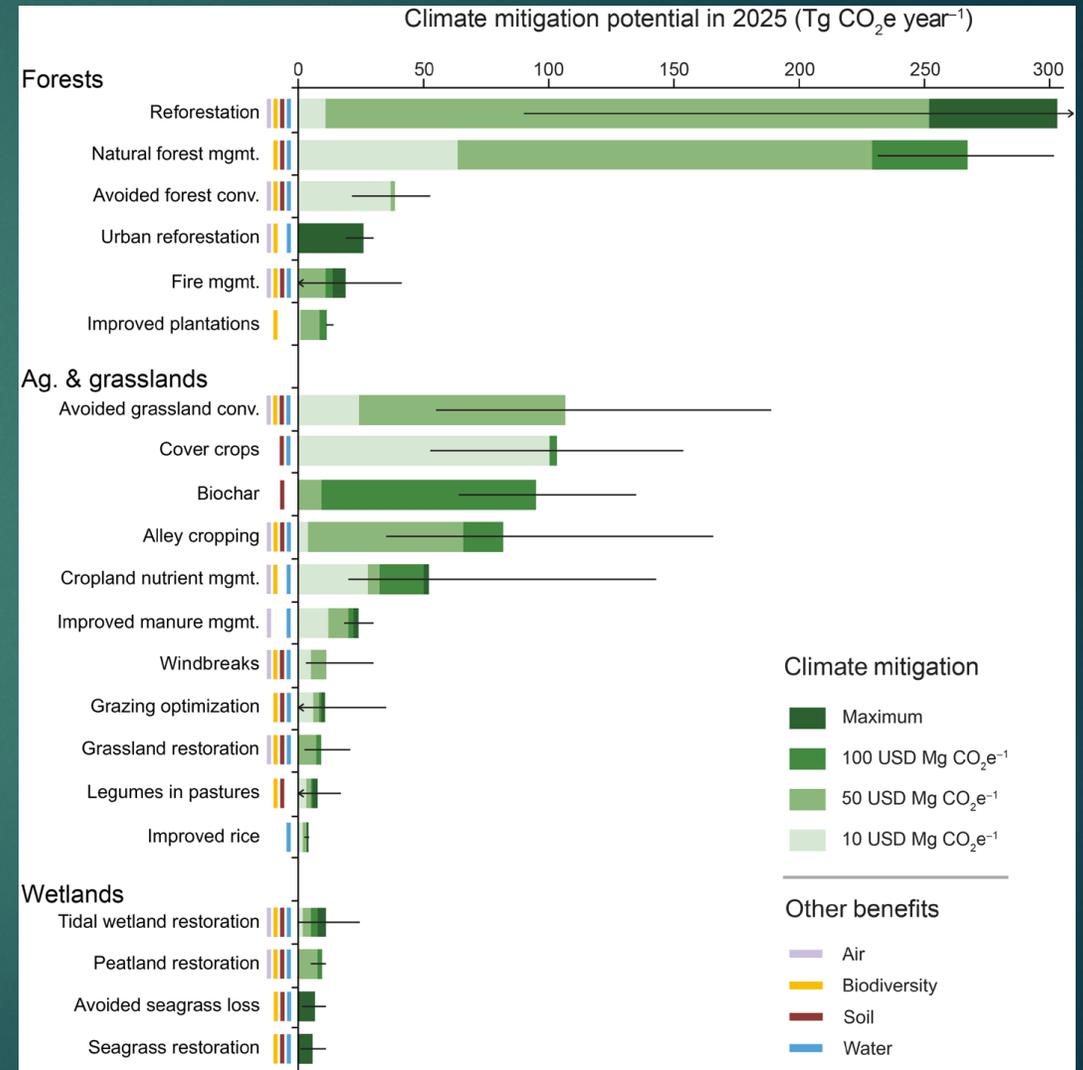


Context: Natural Climate Solutions

- Dense, tall vegetation is widely regarded as a powerful tool to combat climate change
- Countries and major corporations invest in afforestation to sequester and store carbon in woody biomass
- Forest carbon stocks are a growing business around the world
- But...



Domke et al. 2020, PNAS

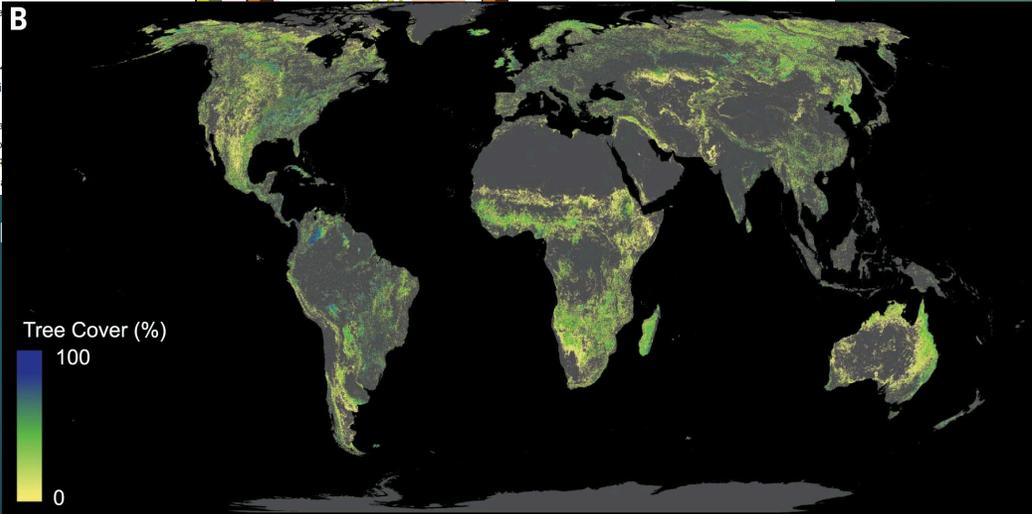
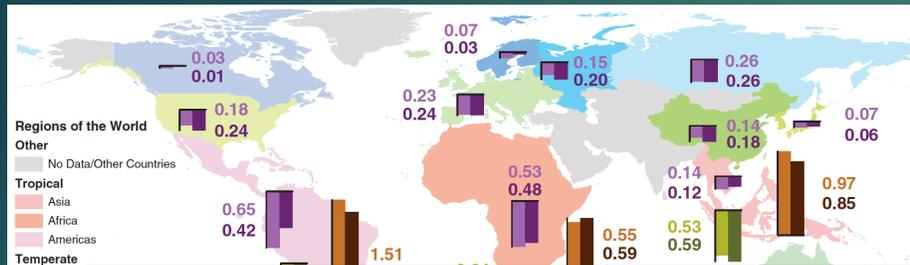


Fargione et al. 2018, Science Adv.

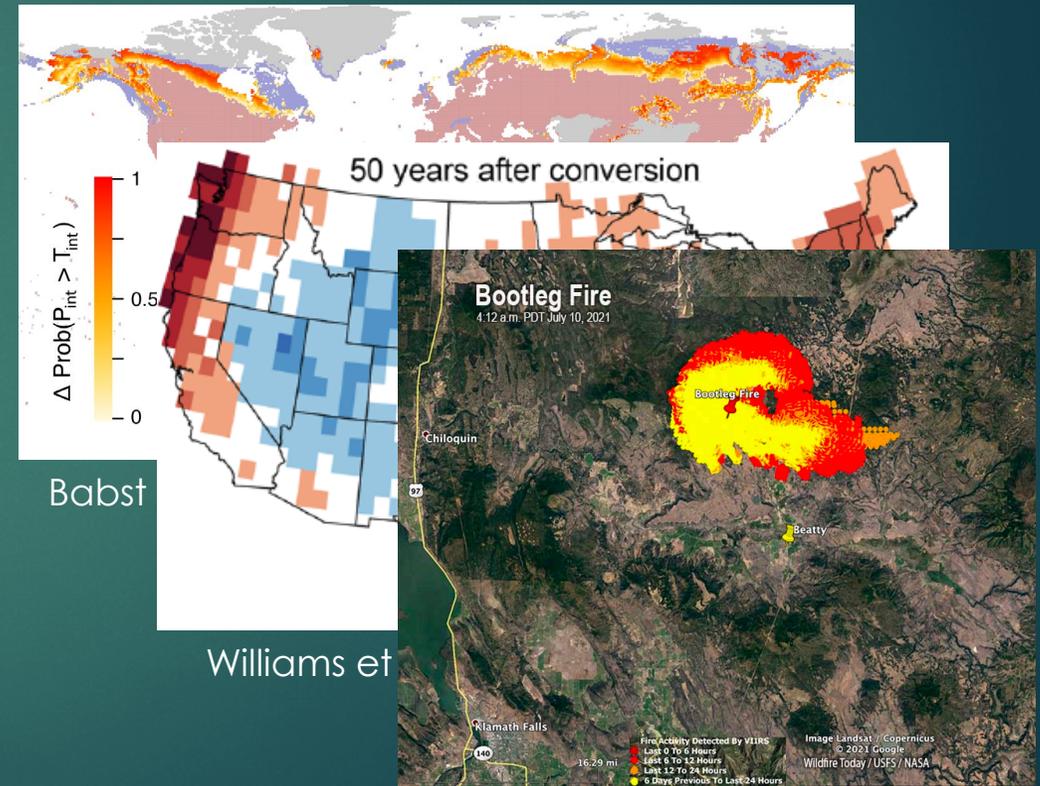
Is planting trees everywhere really such a good idea?

Yes

Not sure



Bastin et al. 2019, Science



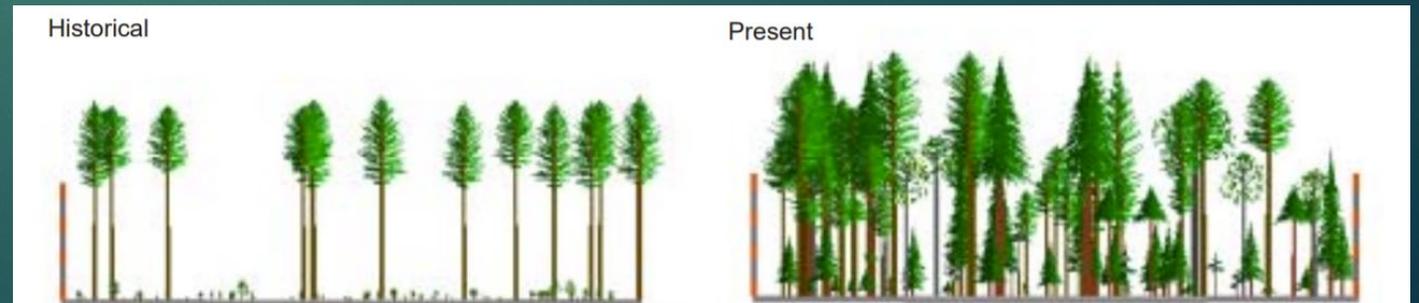
Wildfiretoday.com

Hypothesis

An optimal vegetation **structure, density, and composition** exists to:

- ▶ Maximize the resilience of ecosystems to rising temperatures and increasing water demand.
- ▶ Balance the climate benefits of higher carbon sequestration and evapotranspiration against the backdrop of higher energy absorption.
- ▶ Reduce the risk of high-severity fires.

In drylands, a mix of tree and shrub cover – as is created by low-intensity fires – is optimal for climate change mitigation.

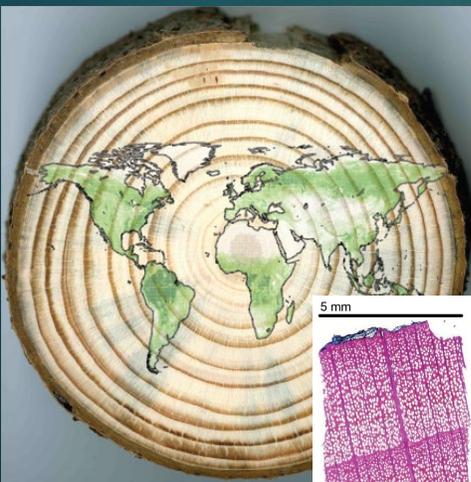


Approach

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Ecosystem structure, productivity, and climate change mitigation potential

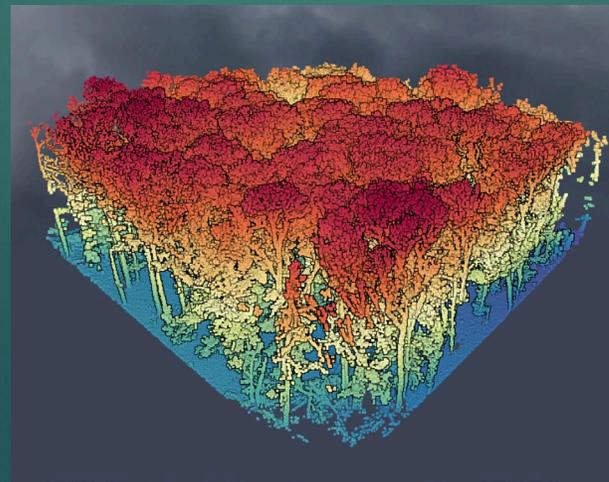
Growth



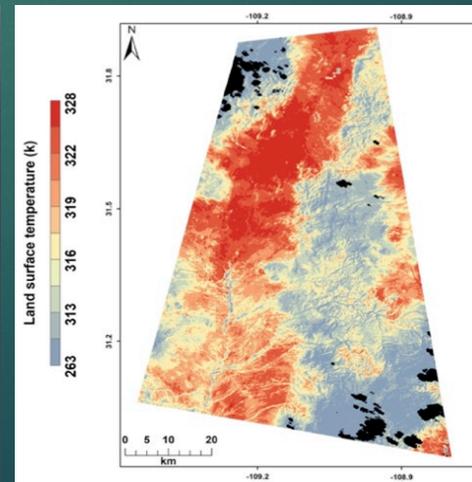
Biomass



Vegetation structure



Energy balance



Disturbances

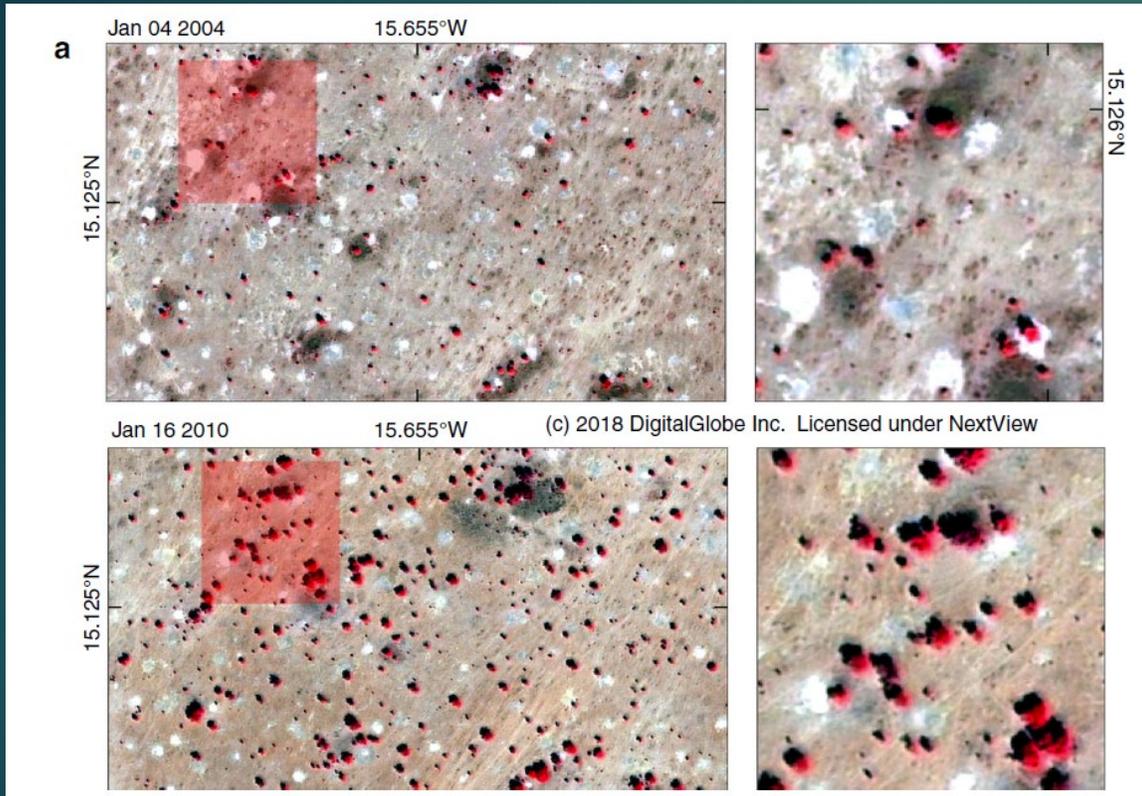


Goals

- ▶ Develop wall-to-wall **maps of desired vegetation conditions** for the US Southwest.
- ▶ Determine how these optimal conditions compare to **current conditions**.
- ▶ Develop forward-looking **scenarios of land-cover change** and disturbance dynamics to inform adaptive ecosystem management.
- ▶ Facilitate **climate-conscious decisions** across jurisdictions.
- ▶ **Advance natural climate solutions** in arid lands in the long term.

Outlook

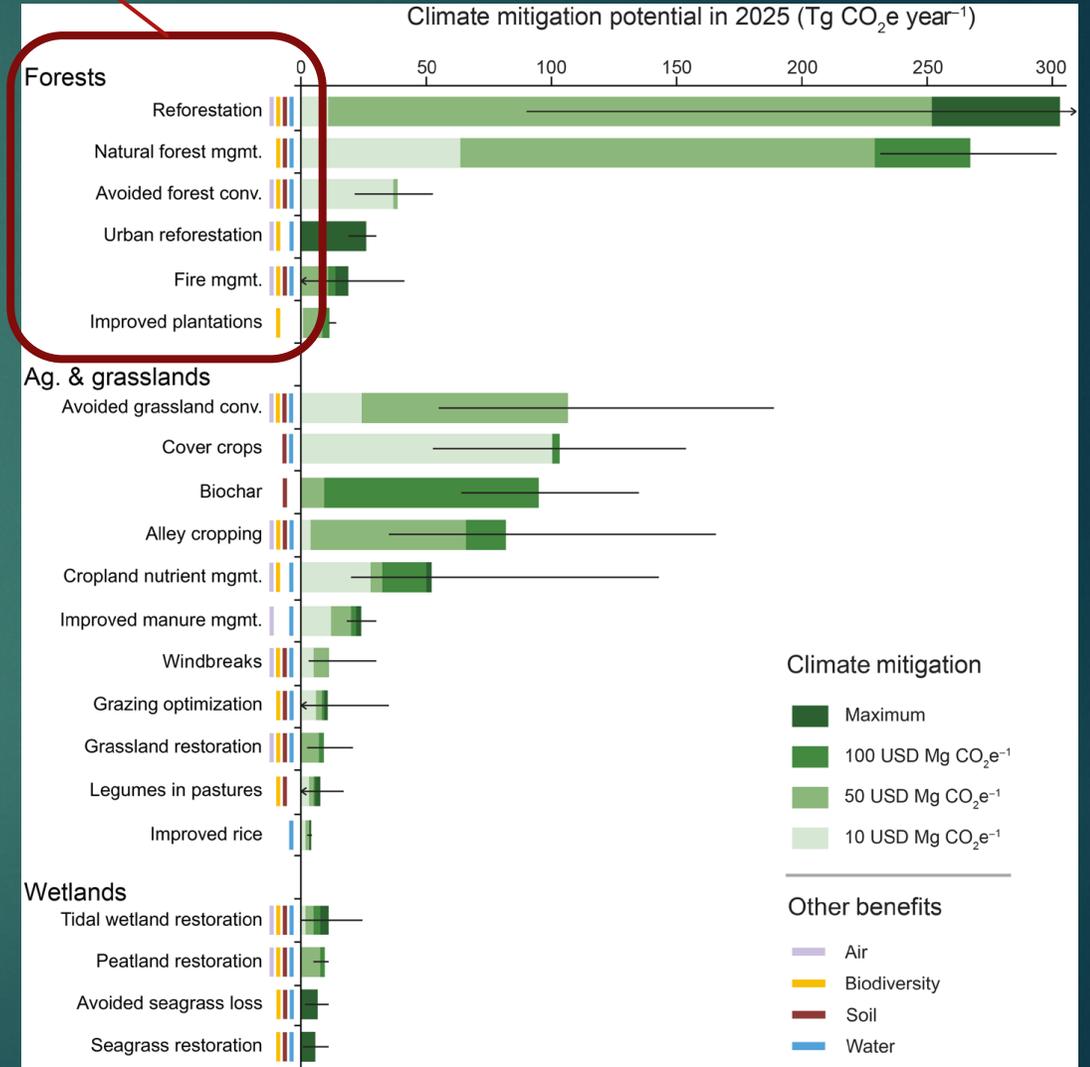
Shrubs?



Brandt et al. 2019, *Comm. Biol.*

Under favorable rainfall patterns, woody vegetation in drylands benefits more than herbaceous species.

→ **Carbon storage potential could be considerable!**



Fargione et al. 2018, *Science Adv.*

Thank you!

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Special thanks to:

