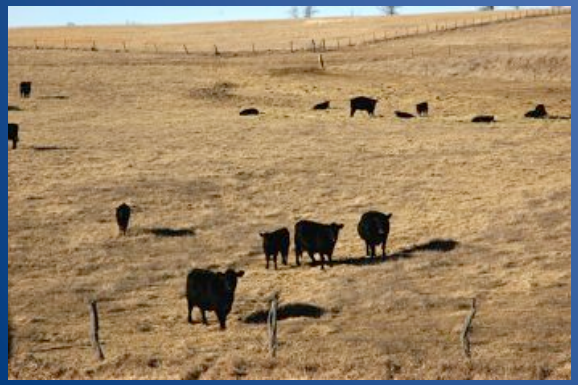
CLIMATE CHANGE IMPACTS ON SOUTH SOUND PRAIRIES

Dominique Bachelet
Conservation Biology Institute

Prairie/grasslands have been greatly affected by humans

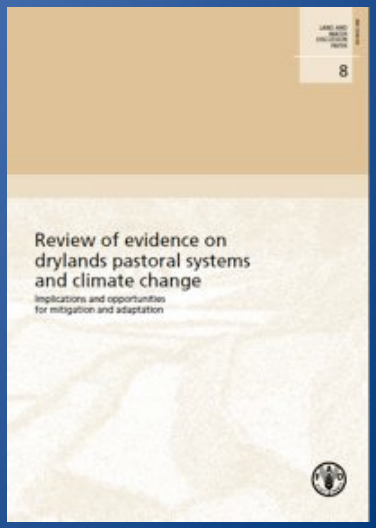
"Anyone can love the mountains, but it takes soul to love a prairie"



Past mismanagement has had severe consequences …

but grasslands may have become the poster child for climate change mitigation

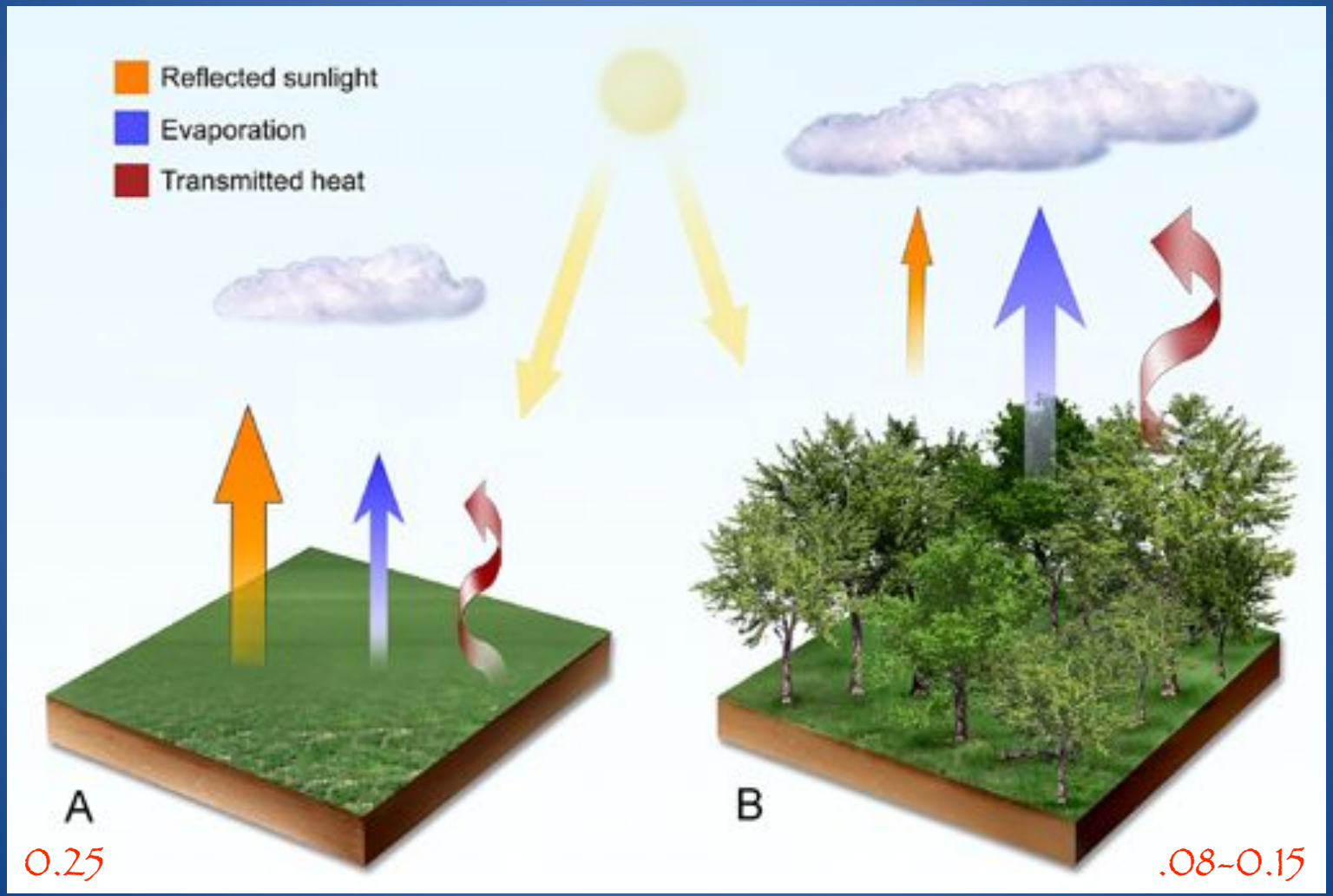
13 January 2010, Rome – Grasslands have vast untapped potential to mitigate climate change by absorbing and storing CO2, according to a new report by FAO. Pastures and rangelands represent a carbon sink that could be greater than forests if properly managed.



Grasslands are the poster child for CC mitigation

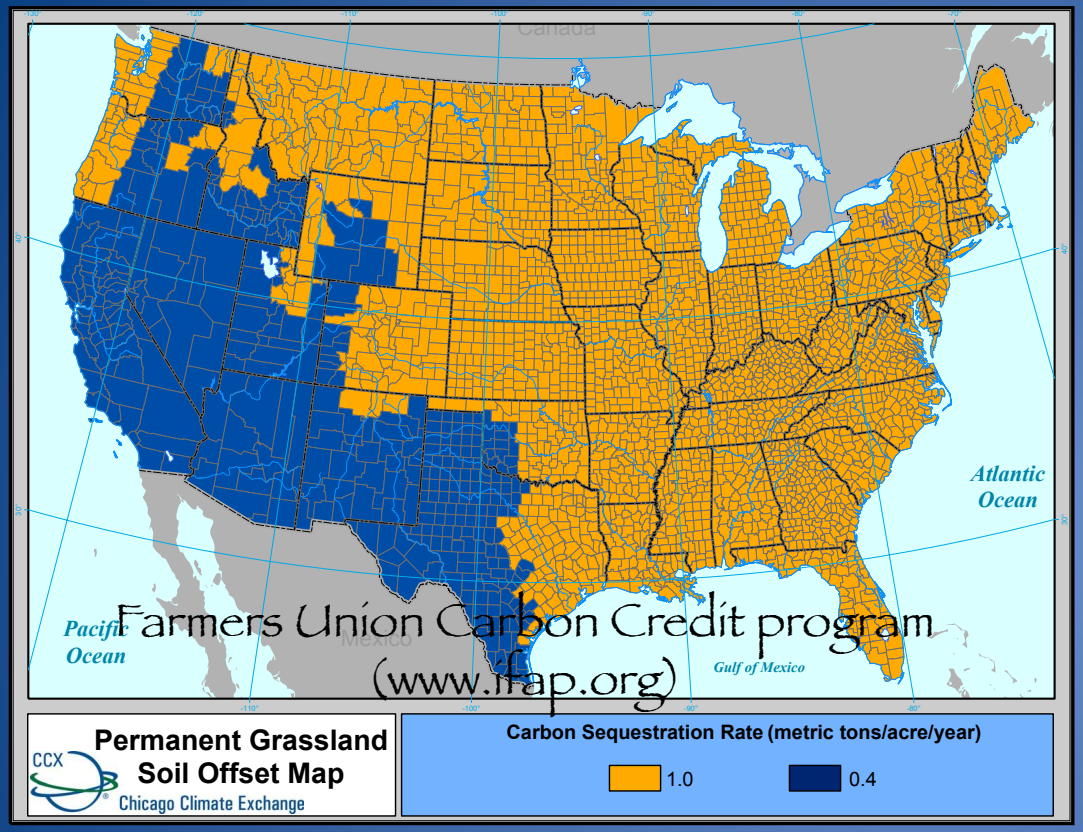
Albedo (snow = 0 .9, asphalt = 0.04)

Grasslands reflect more radiation than forests (cooling effect)
Grasslands emit less water vapor (ecosystem service, GHG) than forests



credit: Jackson et al., 2008, Env. Res. Lett.

Grasslands are the poster child for CC mitigation
Carbon sequestration



Globally, temperate grasslands soils contain 3 times as much carbon as forest soils. Overall, temperate grasslands store 58% more tons C/ha than temperate forests (243 vs. 153 t C/ha).

Now farmers can earn carbon credits for grassland offsets at the Chicago Climate Exchange

Global carbon stocks in vegetation and top 1 m of soils (based on WBGU, 1998).
(German Advisory Council on Global Change, Berlin)

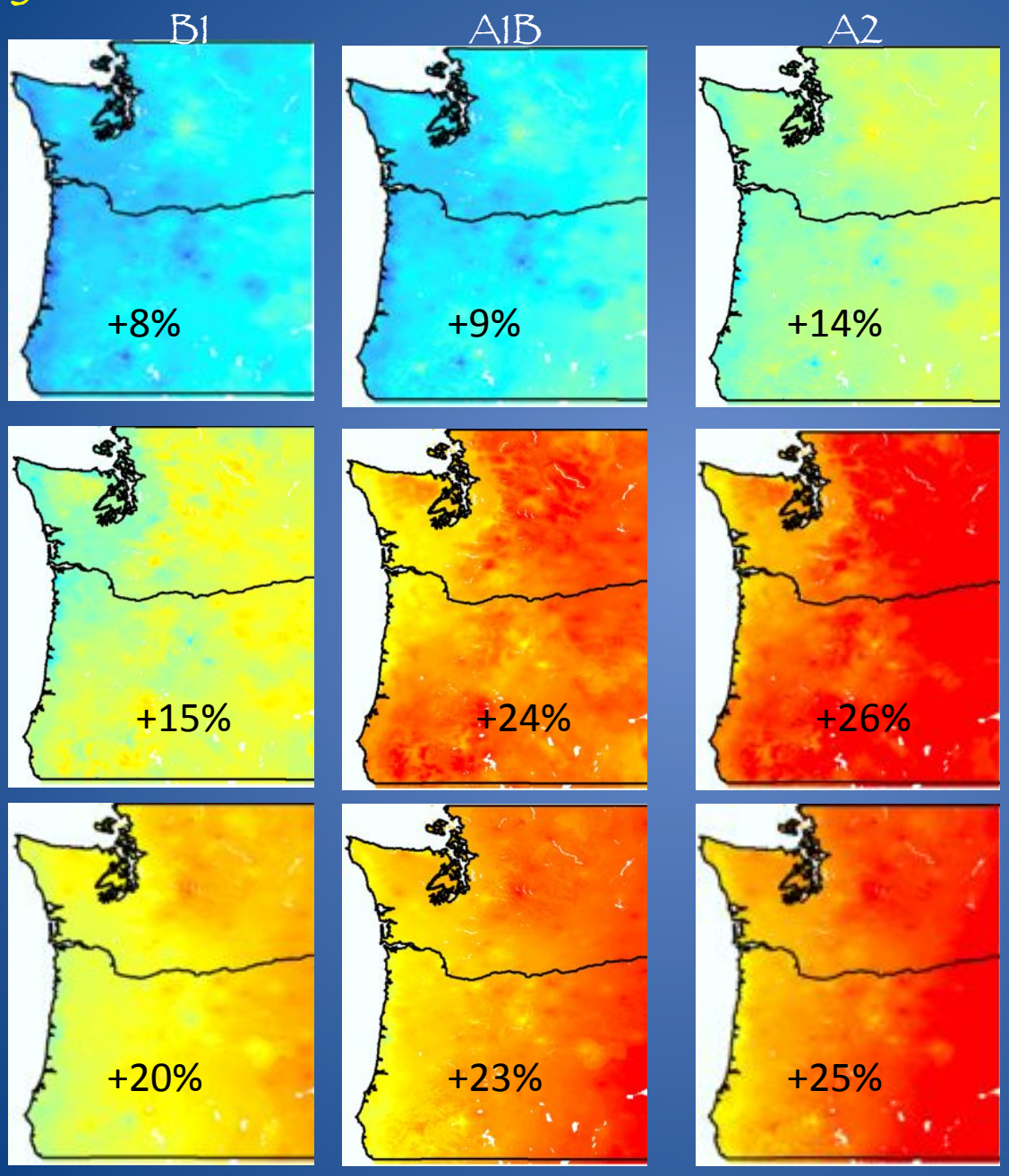
	Area (10^6 km2)	Carbon Stocks (Gt C)		
Biome		Vegetation	Soils	Total
Temperate forests	10.4	59	100	159
Temperate grasslands	12.5	9	295	304

Grasslands are also the poster child for CC adaptation

While forests take a long time to recover from fires, grasslands are adapted to frequent fires and regrow quickly.

What will future climate bring …

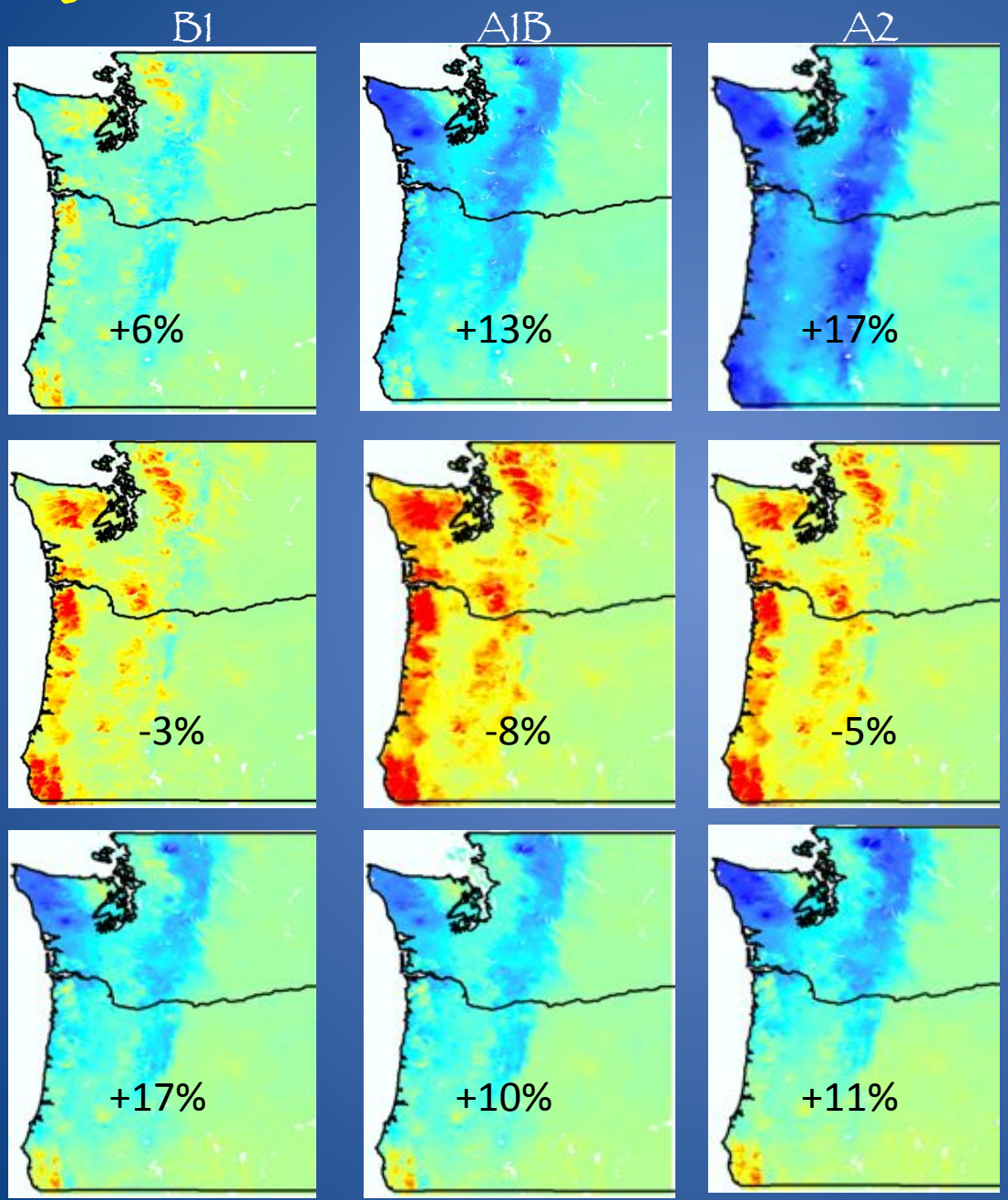
Projected Differences in Maximum Temperature (°C) in 2100

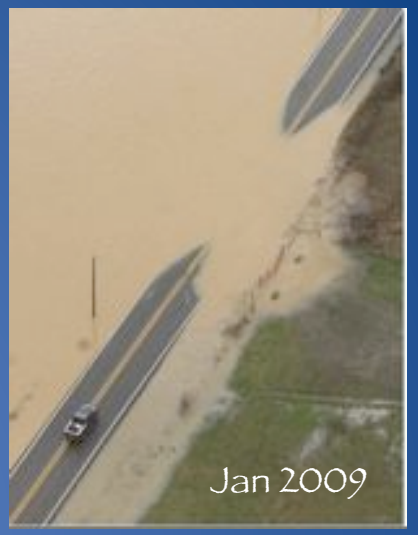


All the models project a general warming (% change for the WV-PT Bailey ecoregion) in the region by the end of the century.

credit: Brendan Rogers

Projected Precipitation Differences (mm/month) in 2100

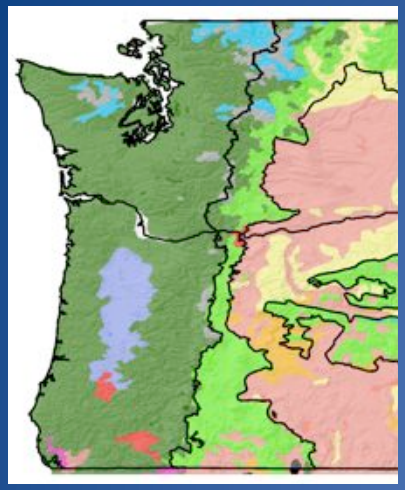




Will climatic extremes (pineapple express) rise in frequency and/or magnitude? No current trend in PNW, uncertainty in future (Cliff Mass)

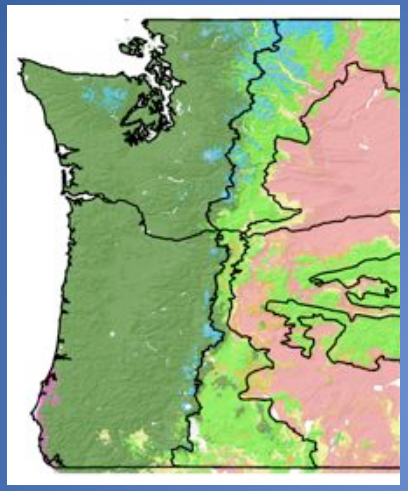
credit: Brendan Rogers

Prairies are the legacy of human land use



Kuchler 1975

MC1 simulation

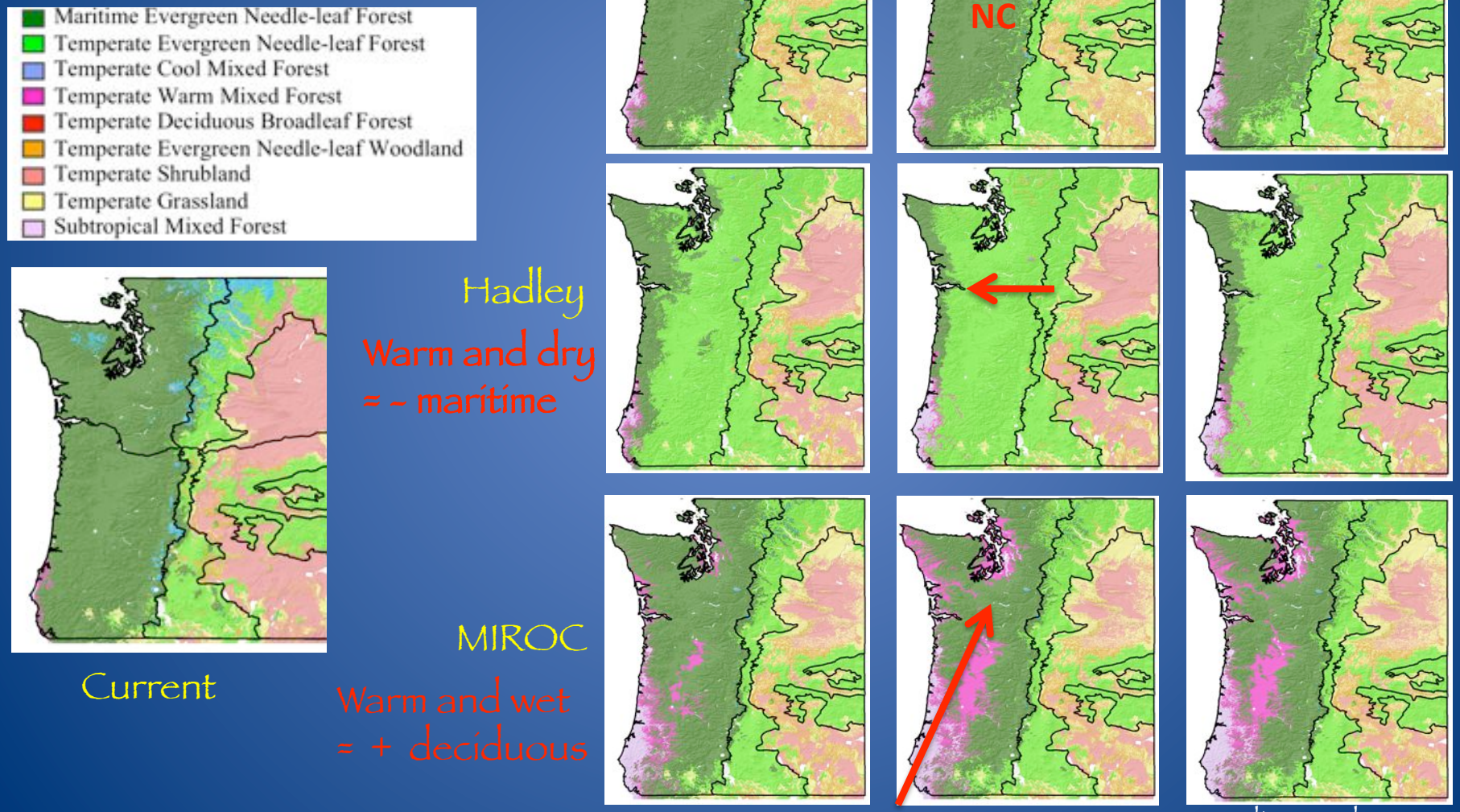


Potential vegetation maps

Despite the fact that prairies are human constructs in the Pacific Northwest, they render ecosystem services that have been and continue to be valuable to society and are worth protecting. And changes in climate may actually enhance prairie conservation

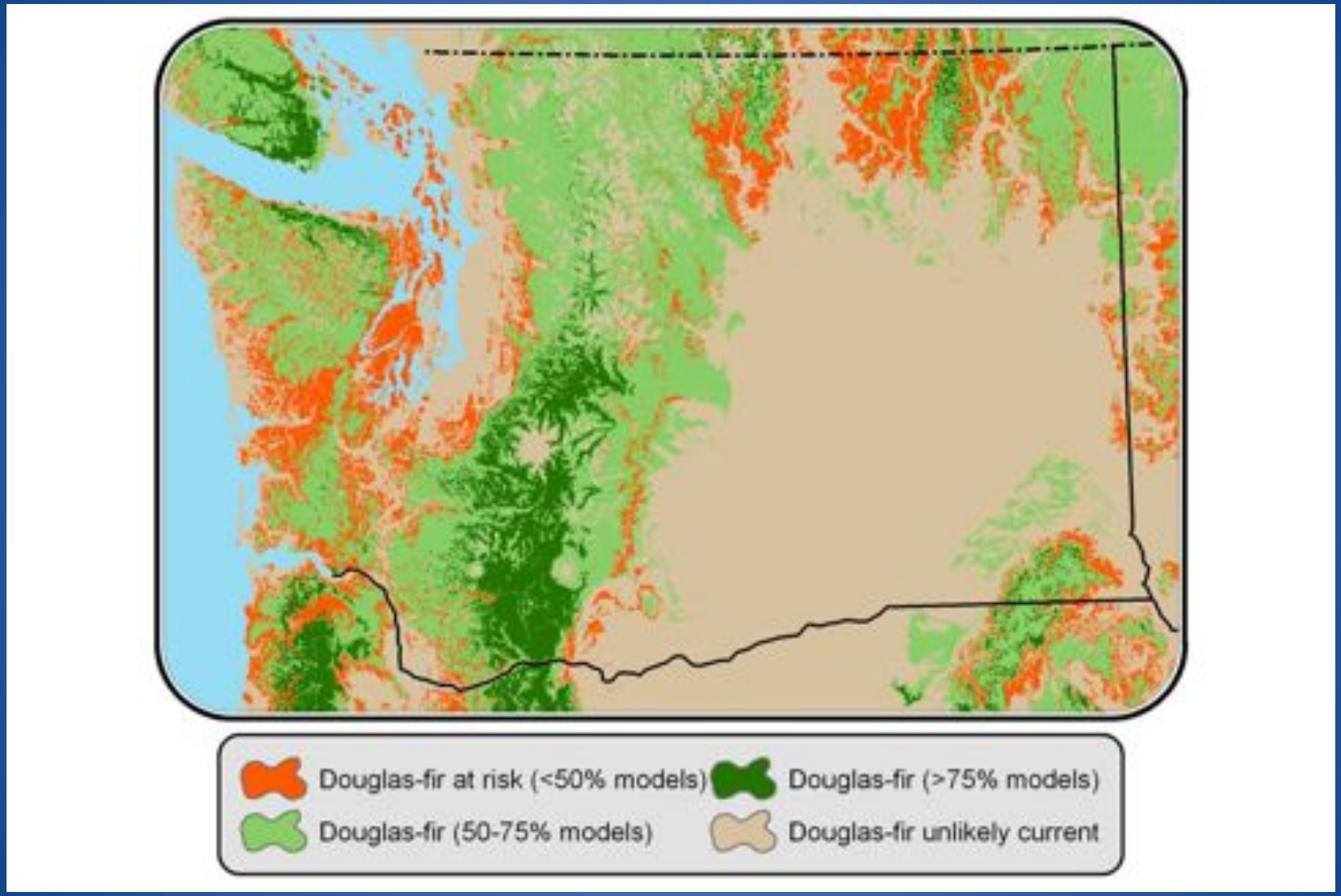
F. Remington, the grass fire, 1908

Projected potential vegetation in 2100



credit: Brendan Rogers

and the good news for prairies is: Doug fir likely more at risk …

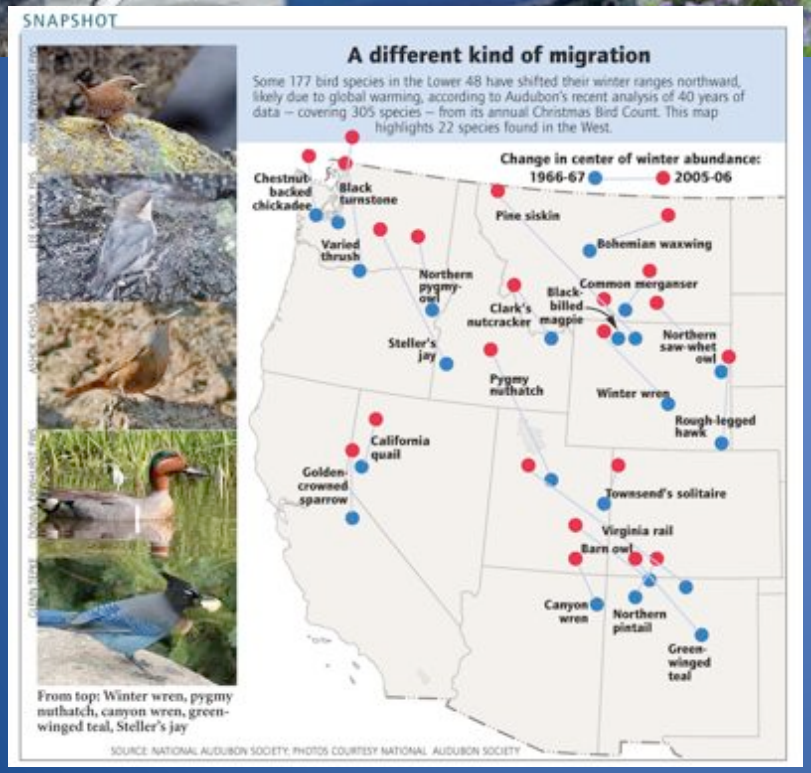


Climate envelope model results for Douglas-fir in the 2060s (Littell et al. 2009)

Climate Impacts on Vegetation

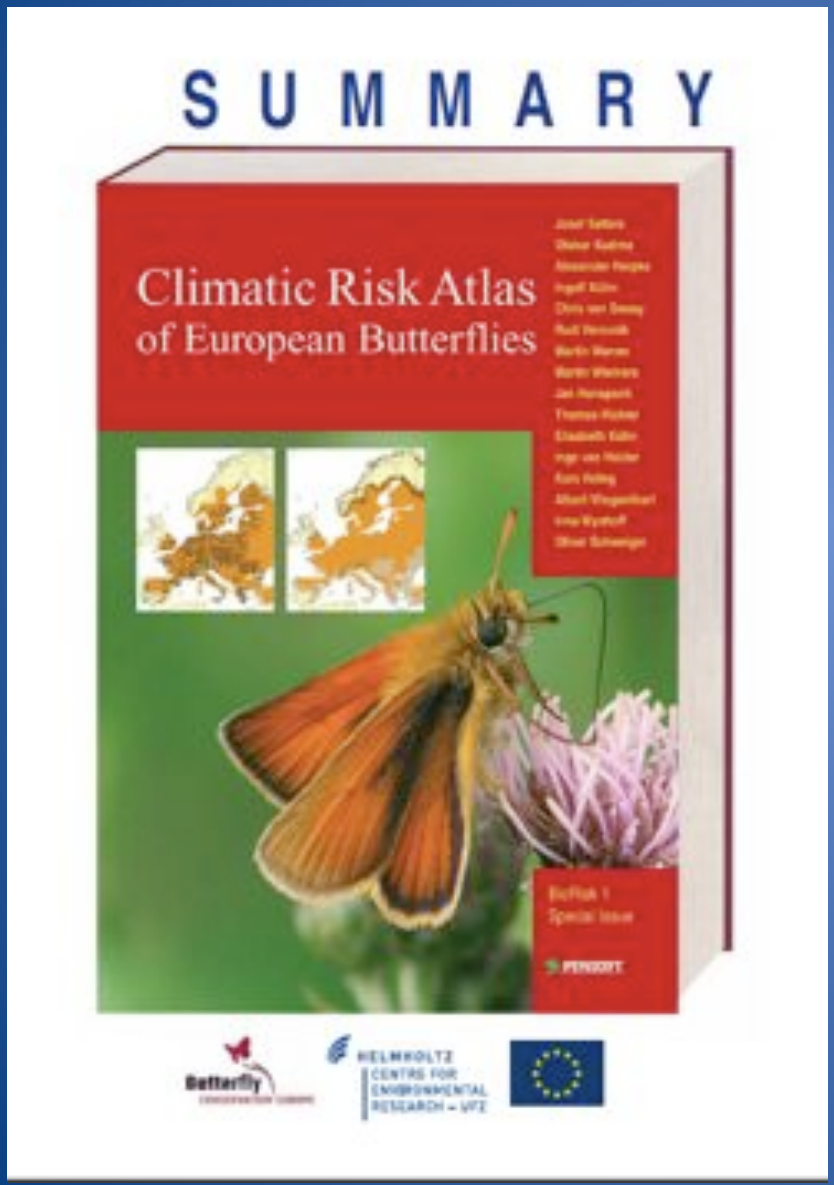
- Warmer and drier climate will favor grasses over tree
- A decrease in fuel moisture and increase in fire frequency will favor grasses over trees
- Extreme events will have long term consequences on trees (heat waves, floods, windthrow) not on grasses
- Carbon sequestration belowground reduces losses through disturbance
- but how does it affect the fauna that depends on prairies …

Prairie Fauna



When conditions change, species can either avoid the change by migrating (birds), they might become extinct if the change is above their physiological thresholds or they can adapt their behavior – morphology/ phenology – and even evolve. Monitoring on-going changes will keep us aware of on-going changes.

Prairie Fauna



When populations are small, disjunct because of landscape fragmentation, populations can disappear or they can survive by taking advantage of (micro) topographically diverse landscapes and corridors such as streams where conditions are buffered from warming. Conservation priorities should include protecting a diversity of habitats that can act as refugia for vulnerable species.

Conservation Priorities for Prairies faced with climate change

- Protect a diversity of sites with complex (micro)topography to allow for potential refugia (rocky outcrops, rolling hills)

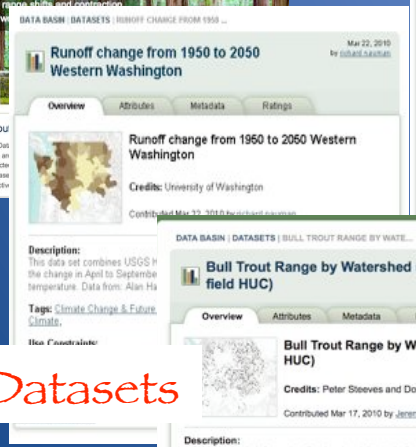
- Develop or protect corridors that provide connectivity between suitable habitats ex. rivers

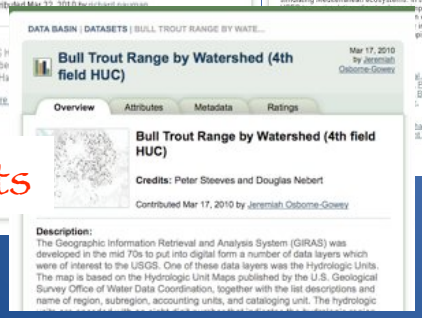
- Continuous monitoring using citizen science projects (BudBurst, PlantWatch, Xmas BirdCount, Rainlog.org) to detect and document changes

Making information available …

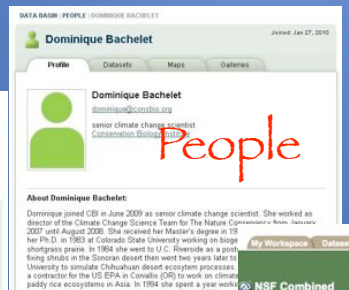
Conservation Biology Institute is developing a web site: Data Basin to provide open-access to datasets, mapping tools, and experts. It includes a Climate Center where future projections of climate impacts are collected as well as records of past climatic consequences. Contributing maps describing prairie community would be a great resource.

Centers

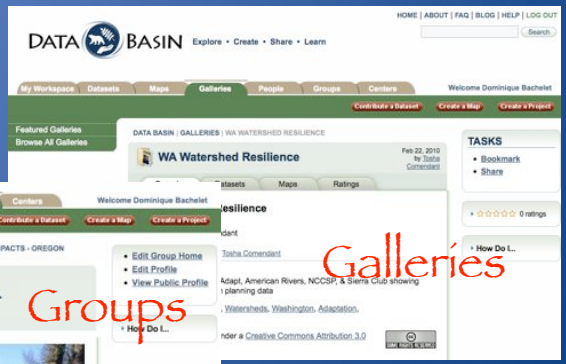




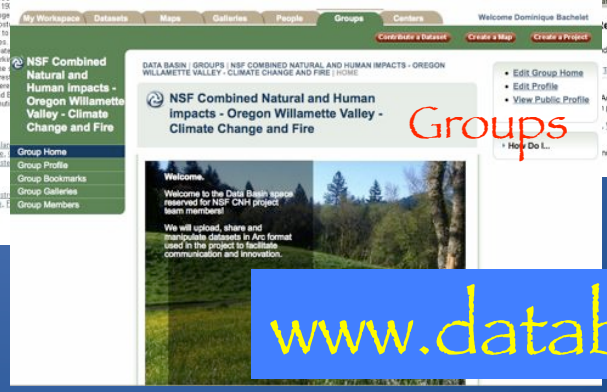
Datasets



People



Galleries



Groups

www.databasin.org

Brief Definitions

mitigation = extenuation, alleviation, the action of lessening the severity or intensity [of climate change]

adaptation = responsive adjustment to varying conditions.

Note: Responses to changes in AVERAGE CONDITIONS may differ from responses resulting from increased incidence of EXTREME events (short duration but beyond ability to acclimate) such as summer 2003 in Europe affecting trees (long term).