

Risks and Impacts to Natural Resources and Society from a Changing Climate

Adapting to a Changing Climate Training for Arizona Envirothon Competition

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Outline

- Arizona
- Around the Word
 - Ecosystems
 - Agriculture
 - Economy
 - Society
- Arizona

Impacts to Ecosystems



Credit: <https://www.sierradescents.com/2020/01/the-san-francisco-peaks.html>

Impacts to Ecosystems



Impacts to Agriculture



Impacts to the Economy



Beachfront road and boardwalk damaged by Hurricane Jeanne (2004)

Impacts to Society



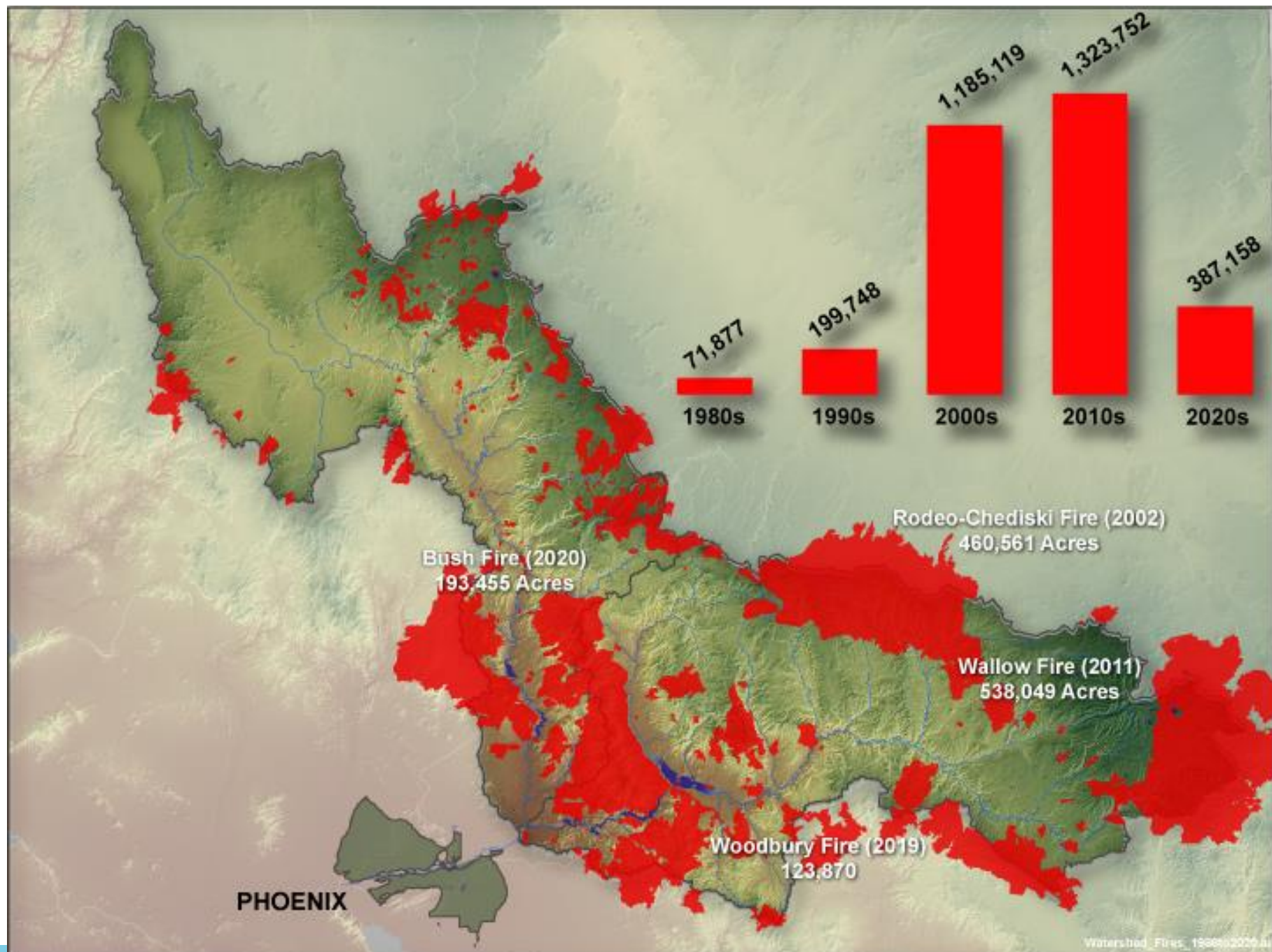
Impacts to Society



Back to Arizona



Unhealthy vs. Healthy Forests



Reservoir Capacity Loss

Damage to Infrastructure

Water Quality Degradation

Water Treatment Expenses

Consequences of Wildfire and Flooding





Forest Restoration Treatments



Mechanical Thinning





Salt and Verde Watersheds

SRP manages seven reservoirs; 6 on the Salt (4) and Verde (2) rivers in Arizona for a 13,000 sq. mile watershed (plus 1 on East Clear Creek)



SRP Reservoir System

Verde River Dams

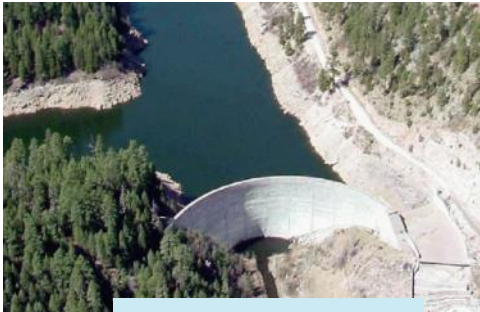


Horseshoe Dam
(1951)

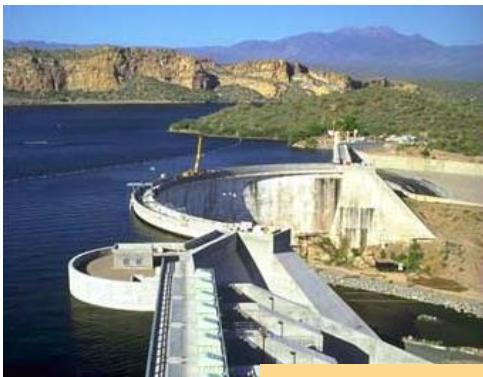


Bartlett Dam
(1939, 1997)

East Clear Creek Dam



C.C. Cragin Dam
(1965)



Stewart Mt Dam
(1930, 1992)

Salt River Dams



Roosevelt Dam
(1911, 1996)



Horse Mesa Dam
(1927)



Mormon Flat Dam
(1925)

Warming and Streamflow

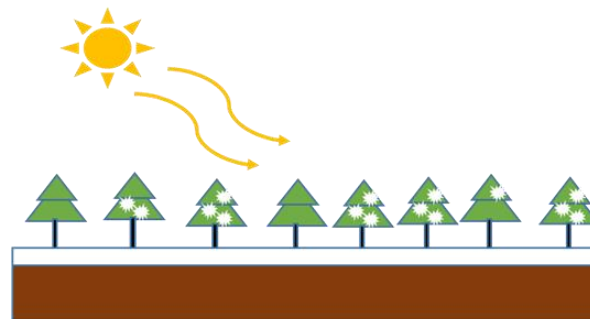
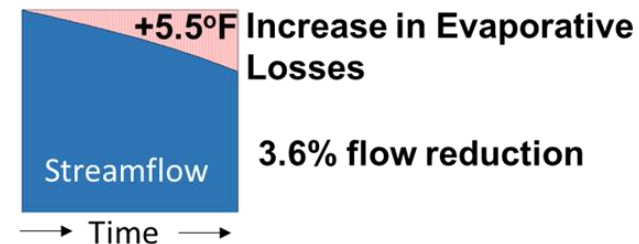
Climate Change: Salt-Verde vs Colorado River

The peak energy available for evaporative loss occurs 3 months after peak streamflow on the Salt-Verde (Robles et al. 2020).

This is not case for the UCRB partly contributing to a 5 times greater streamflow sensitivity to warming on the UCRB than the Salt-Verde (BOR 2020).

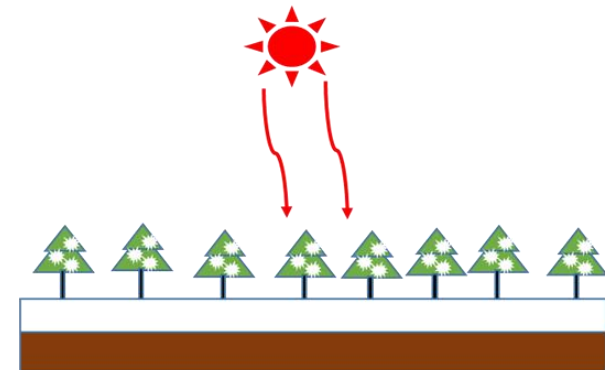
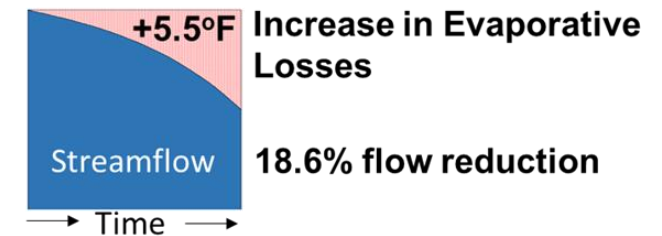
Salt-Verde Runoff Season

January-April



Colorado River Runoff Season

April-July



BOR 2020; https://www.usbr.gov/watersmart/pilots/docs/reports/Final_Reservoir_Operations_Pilot_Report-Salt_and_Verde_Az.pdf

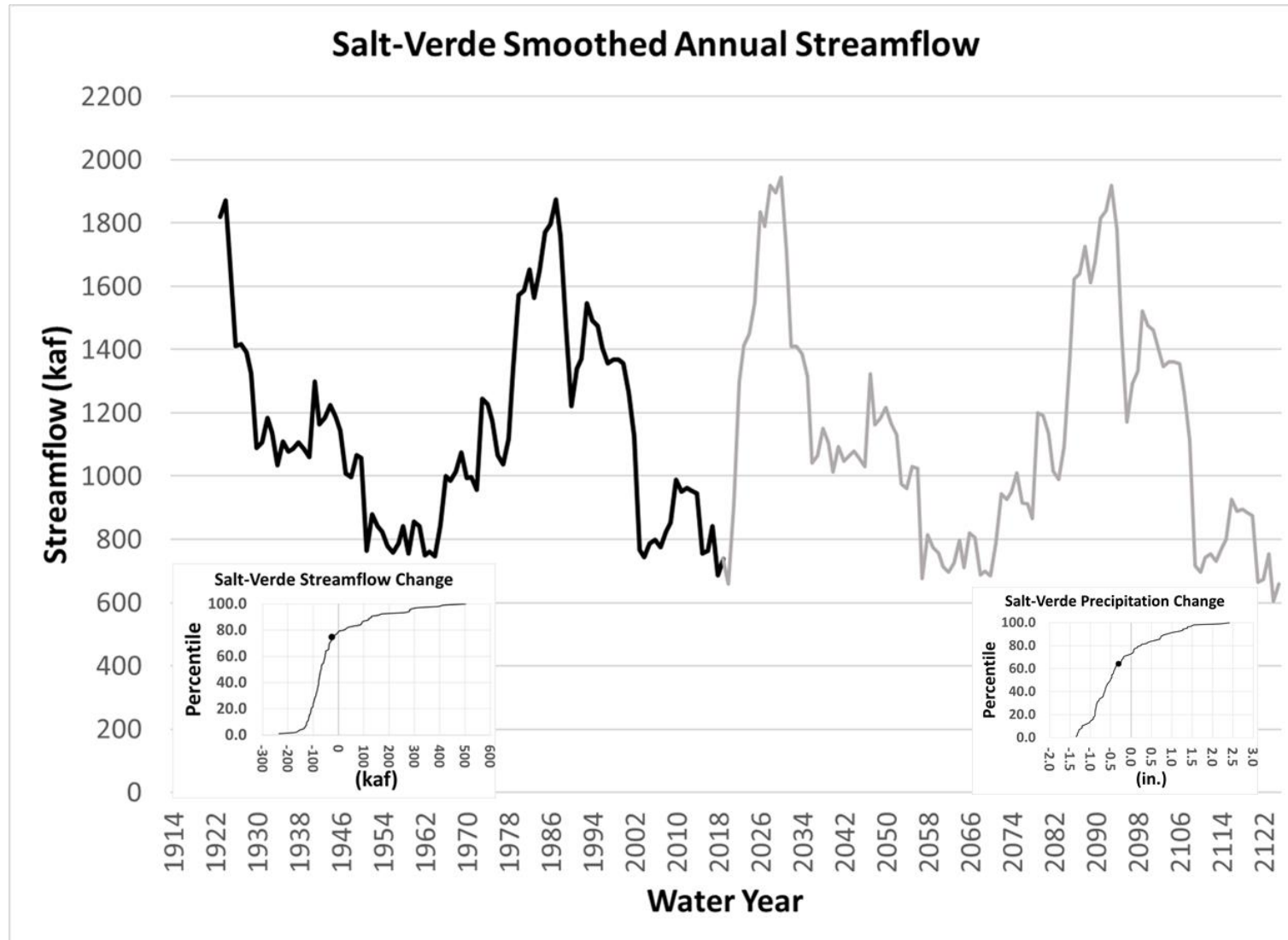
Robles, M. et al. 2020: *Water* 2021, 13(1), 3; <https://doi.org/10.3390/w13010003>

Woodhouse, C.A. and B. Udall. 2022. Upper Gila, Salt, and Verde Rivers: Arid land rivers in a changing climate. *Earth Interactions* 1, 1-14. <https://doi.org/10.1175/EI-D-21-0014.1>

Climate Change Impacts on Streamflow

What if the 20th century occurred in a warmer world?

1. 2.2% decrease in average flow
2. Deeper droughts (12% decrease in flow)
3. Wetter pluvials (4% increase in flow)



Summary

- Poleward and upward movement
- Critical to understand the problem and capitalize on future opportunities