



Juniper's Effects on Soil and Weathered Bedrock Water Dynamics in Sonora, TX

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What are the implications of WPE for the water cycle?

ECOHYDROLOGICAL IMPLICATIONS OF WOODY PLANT ENCROACHMENT

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Evapotranspiration
is generally higher
in woodlands than
in grasslands



Alteration of hydrological processes and streamflow with juniper (*Juniperus virginiana*) encroachment in a mesic grassland catchment

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Juniperus virginiana can decrease streamflow and groundwater recharge in more mesic zones



Eastern red cedar (*Juniperus virginiana*)

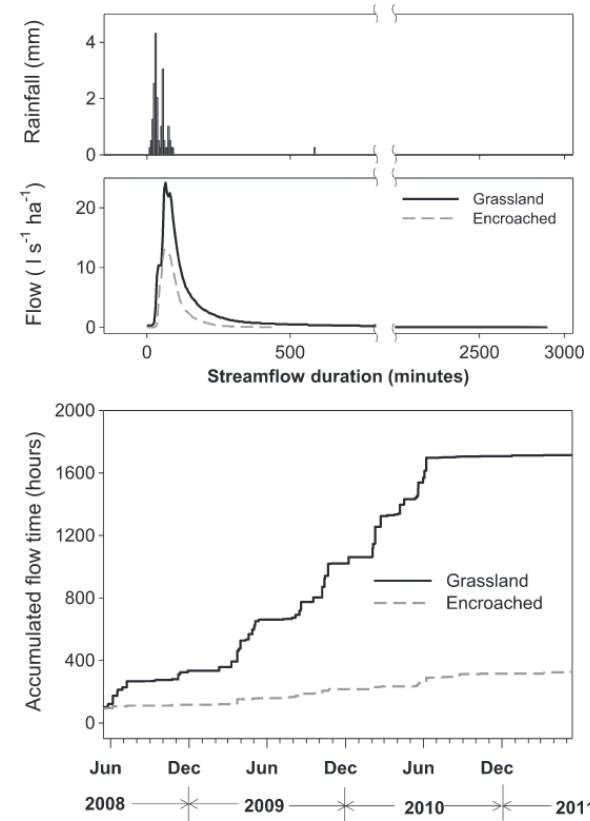
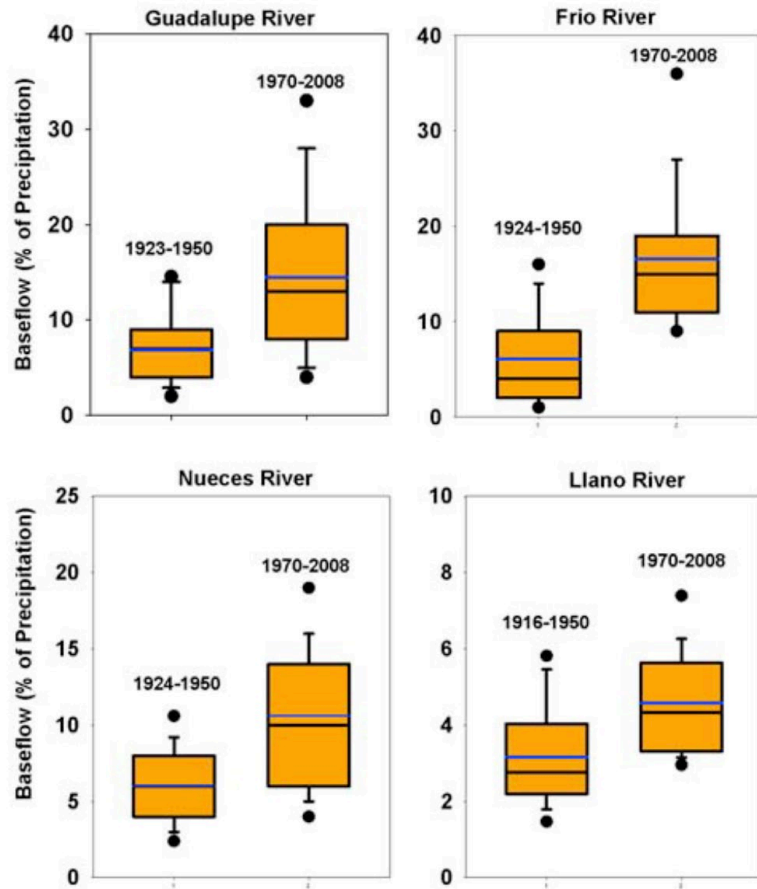


Figure 5. Hydrographs of grassland and encroached catchments of a single, storm event of 76 mm on 19 May 2010 to illustrate magnitude and duration of flow (A) and the 3-year accumulated flow for the period of 15 May 2008 to 14 May 2011 (B)

Along with woody plant cover, streamflow has increased in many watersheds of the Edwards Plateau since the 1970s



Frio River

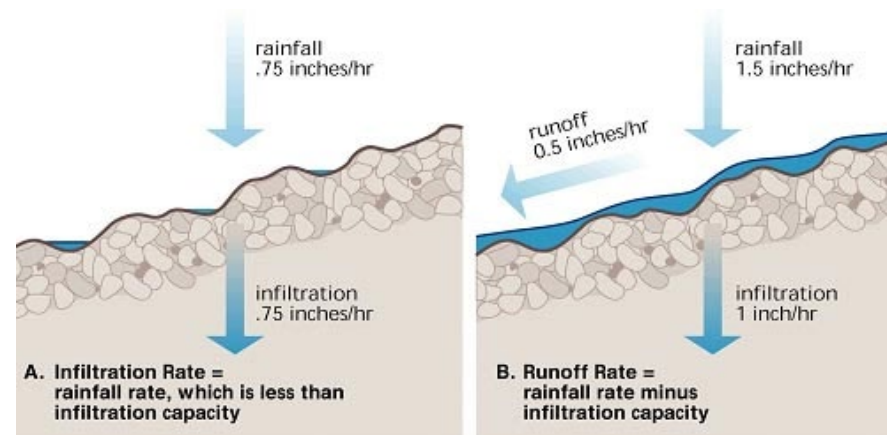
WPE in the Edwards Plateau



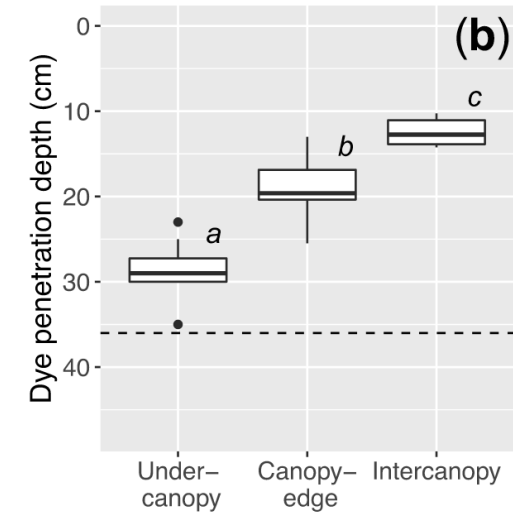
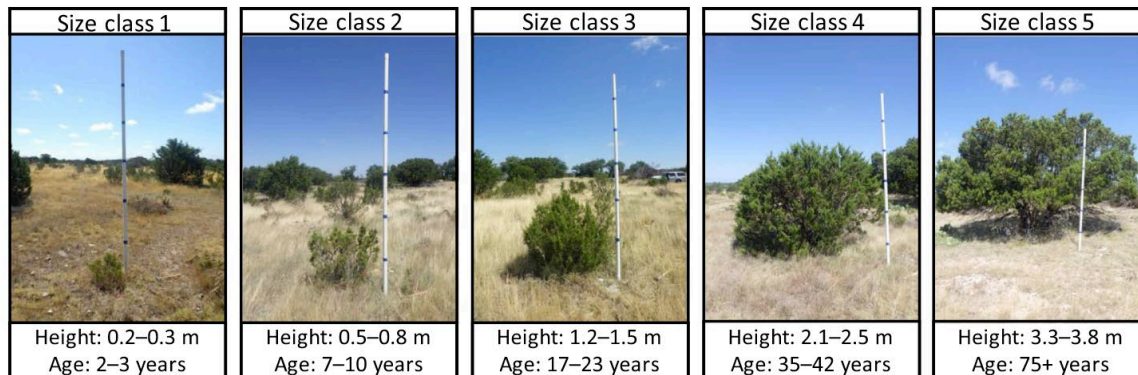
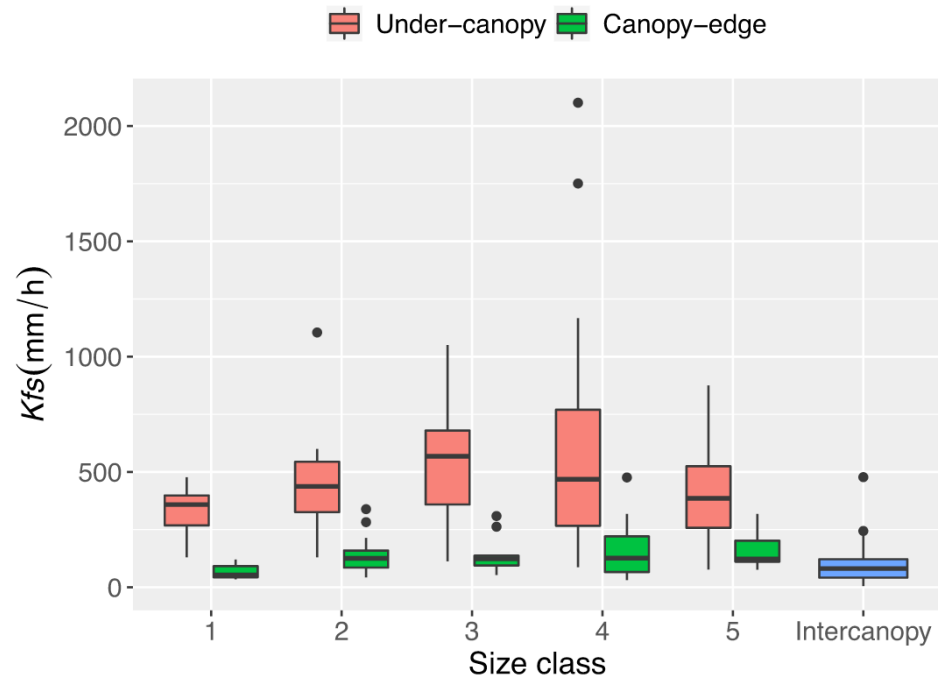
Hypothesis:

WPE helped with the recovery of soils in the Edwards Plateau

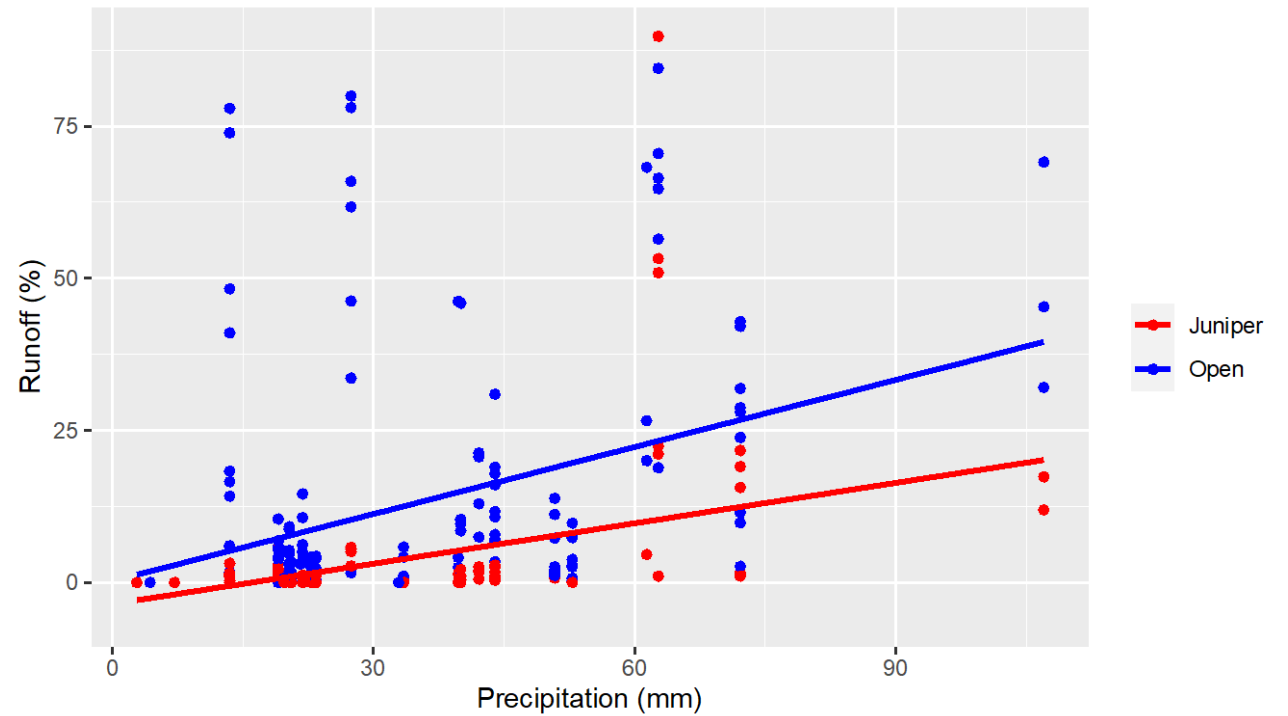
Infiltration capacity



3–5 X faster infiltration under juniper of all sizes

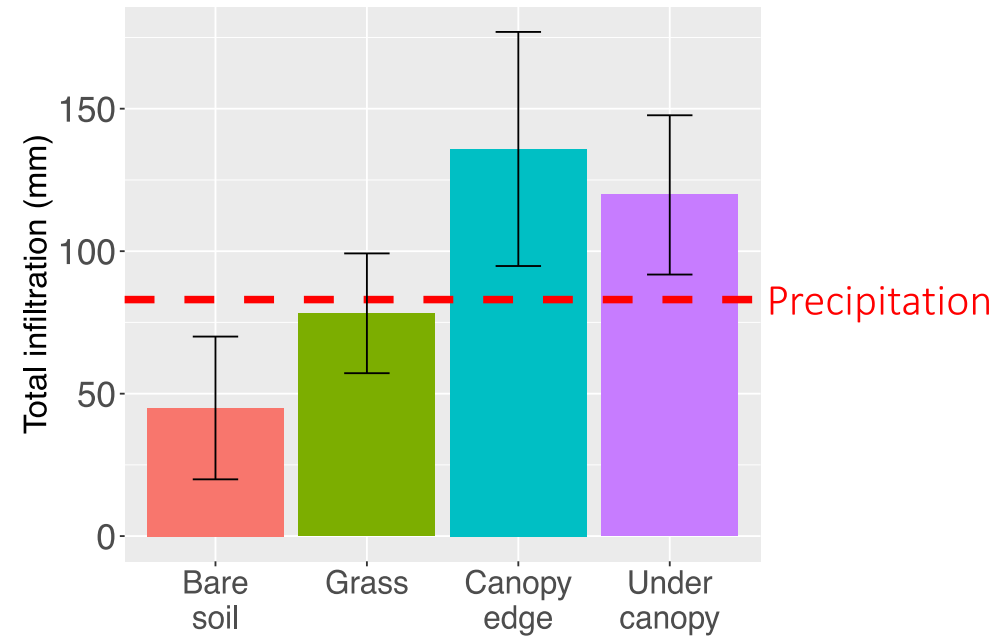
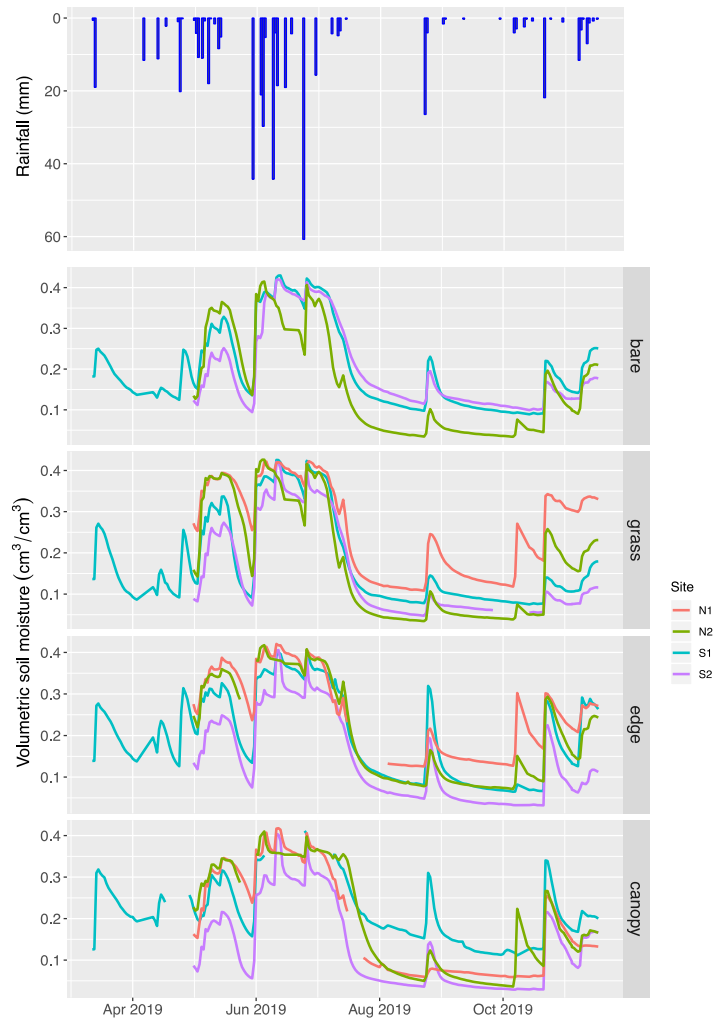


3x less surface runoff under Juniper compared to open patches

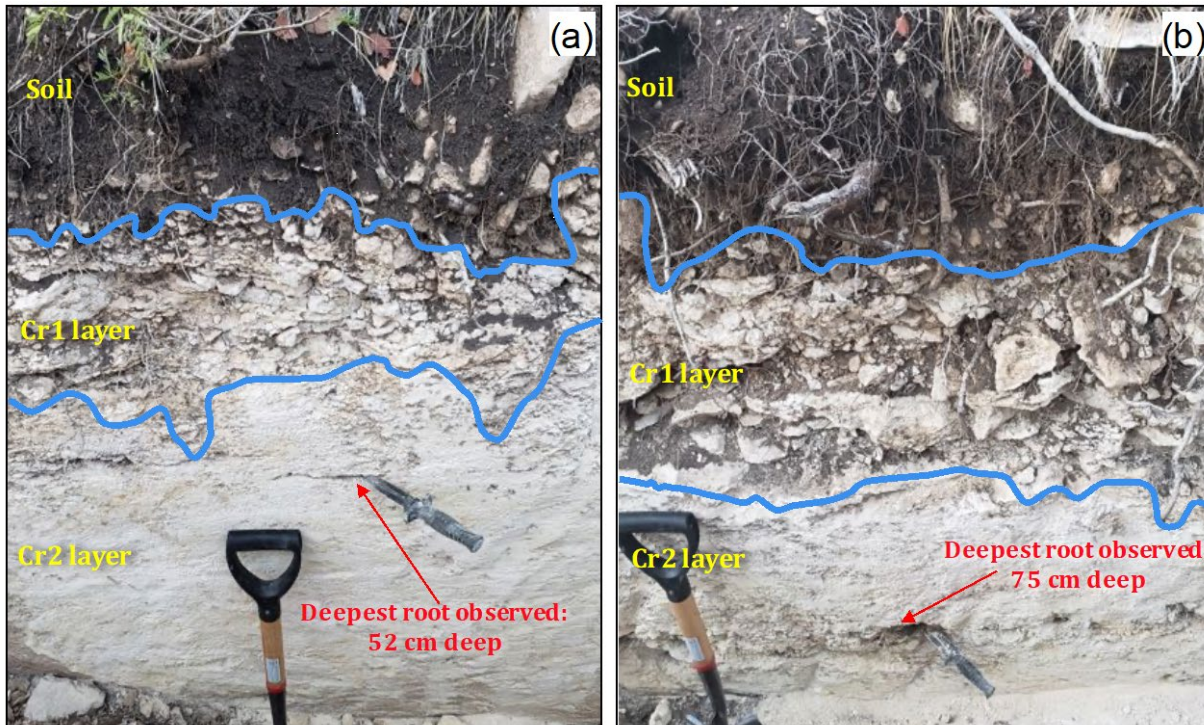


- On average, surface runoff under juniper was 4.5% of the water budget compared to 13.1% of the water budget on open areas.

Juniper captured runoff generated in open patches



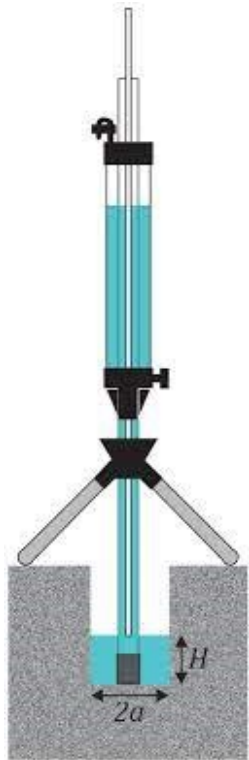
Evidence of bedrock weathering under Oak-Juniper woodlands



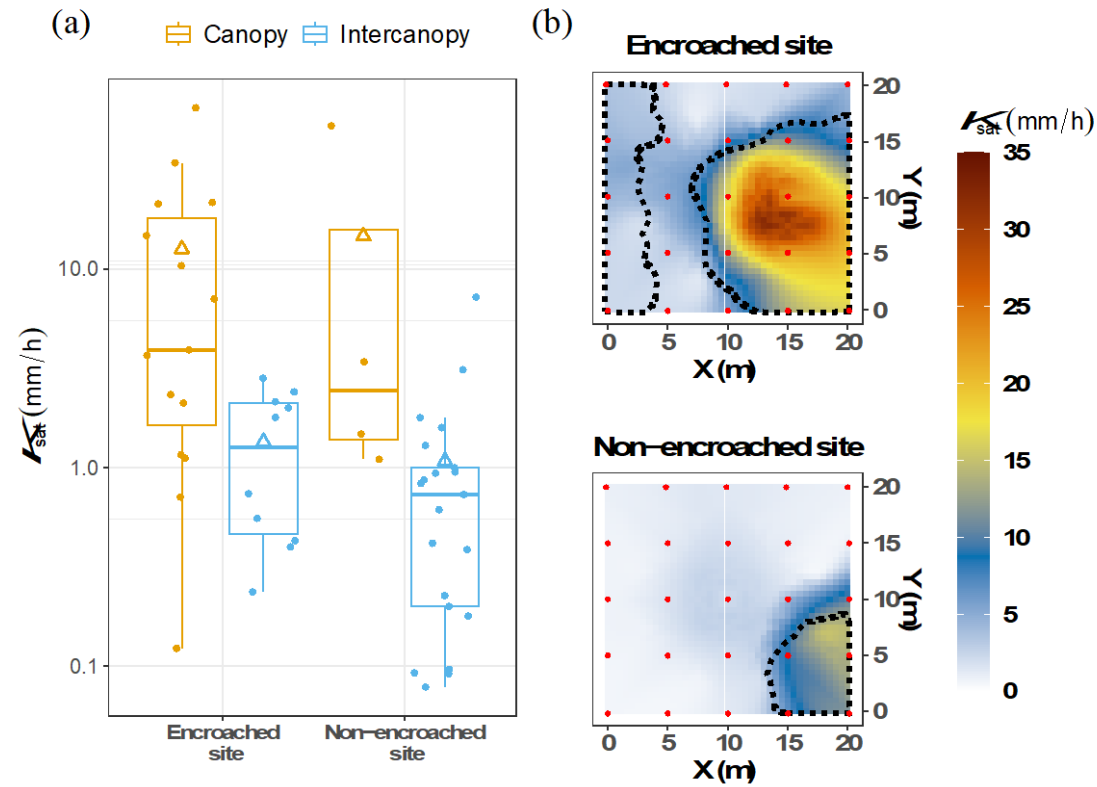
Deeper weathering profile

24–44% higher porosity

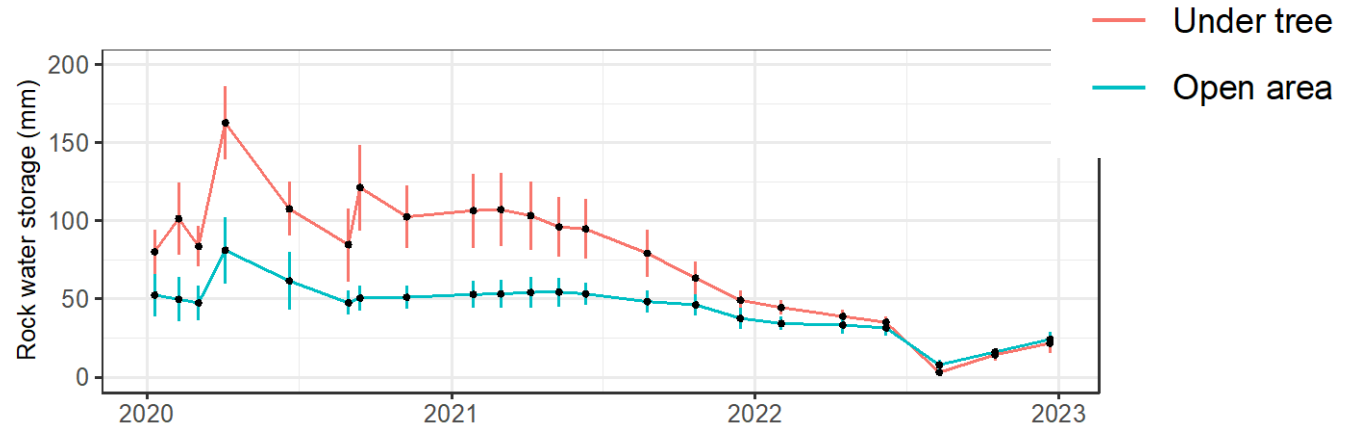
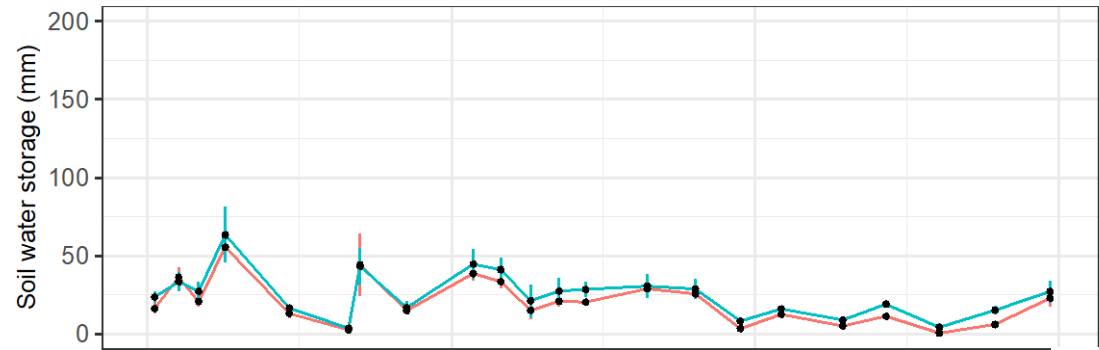
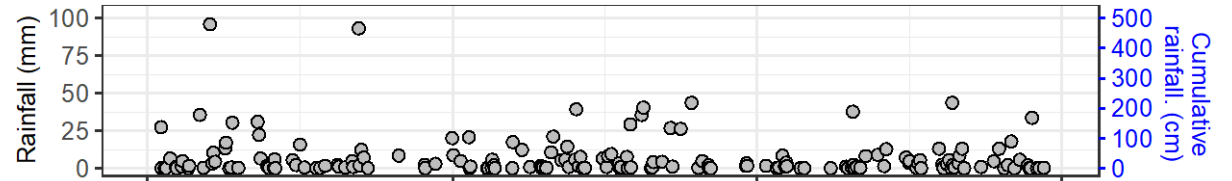
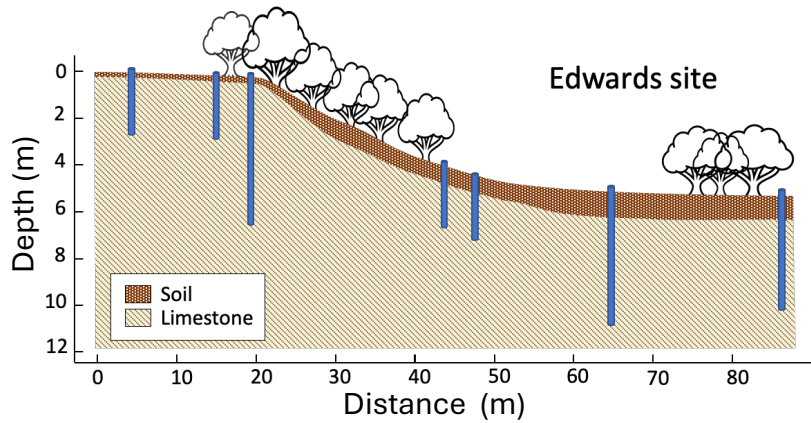
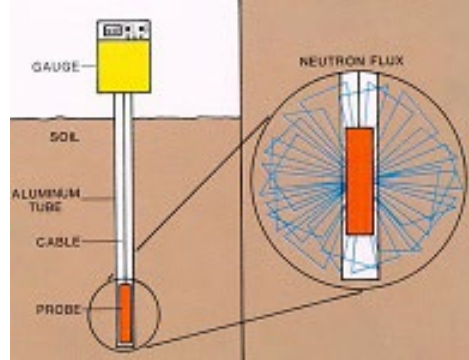
Order of magnitude higher limestone permeability under woody plants



Borehole permeameter

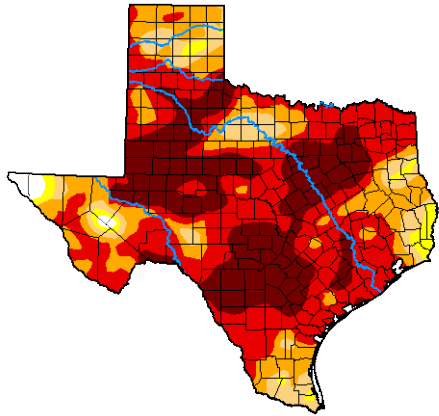


Higher limestone water storage under trees



Rock moisture is a long-term reservoir for tree transpiration

U.S. Drought Monitor
Texas



August 9, 2022
(Released Thursday, Aug. 11, 2022)
Valid 8 a.m. EDT

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	1.03	98.97	98.30	87.50	88.21	29.09
Last Week 08-02-2022	0.32	99.68	97.14	87.92	81.80	21.31
3 Months Ago 05-09-2022	10.54	89.46	79.23	88.09	92.98	24.53
Start of Calendar Year 01-01-2022	7.80	92.20	79.03	54.25	18.89	0.00
Start of Water Year 09-01-2021	49.57	54.43	7.28	0.27	0.00	0.00
One Year Ago 08-09-2021	92.04	7.96	1.35	0.00	0.00	0.00

Intensity:
 None (White) D0 Abnormally Dry (Yellow) D1 Moderate Drought (Orange) D2 Severe Drought (Red) D3 Extreme Drought (Dark Red) D4 Exceptional Drought (Black)

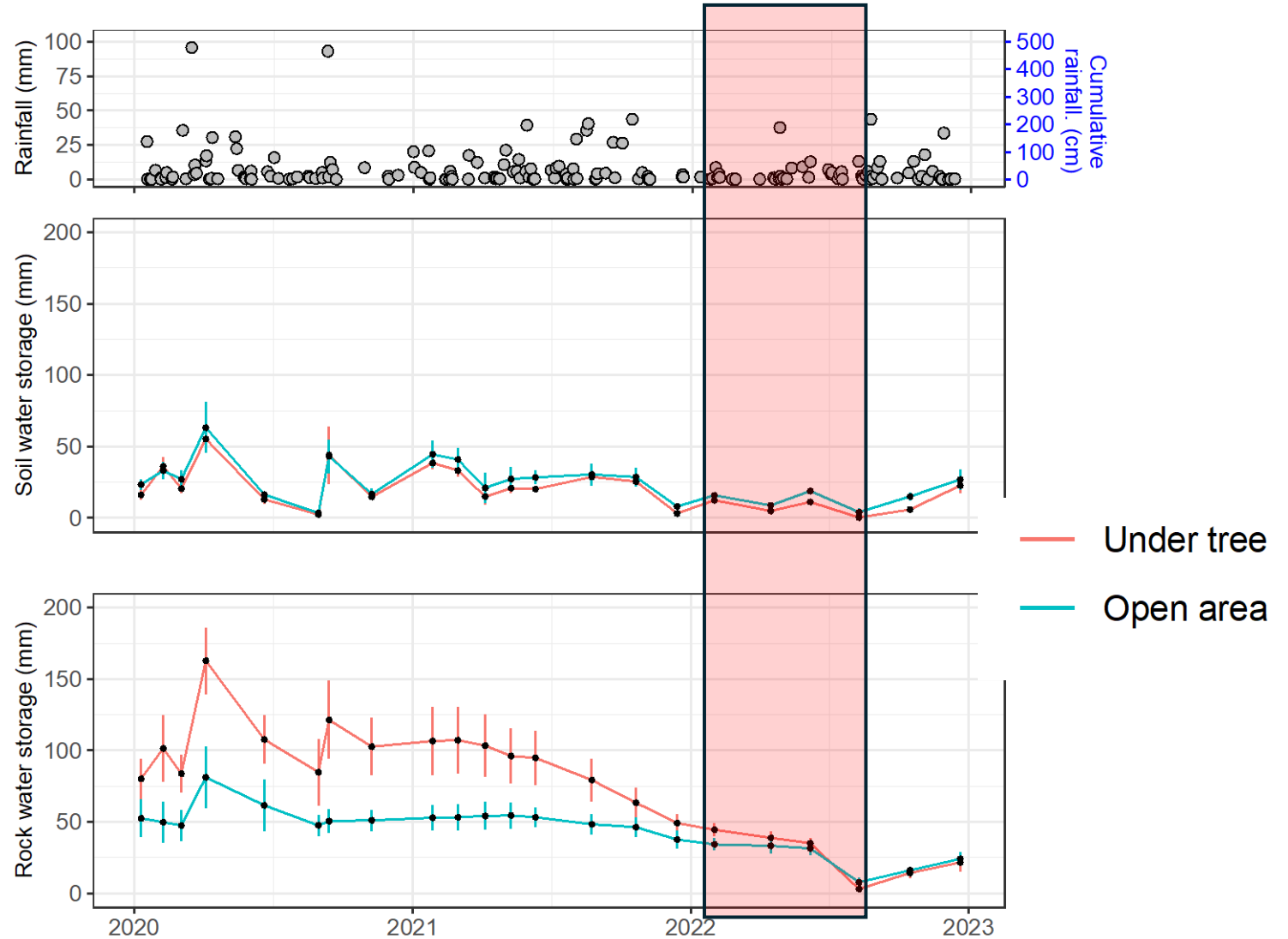
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/>

Author:
Richard Tucker
CPC/NOAA/NWS/CEP

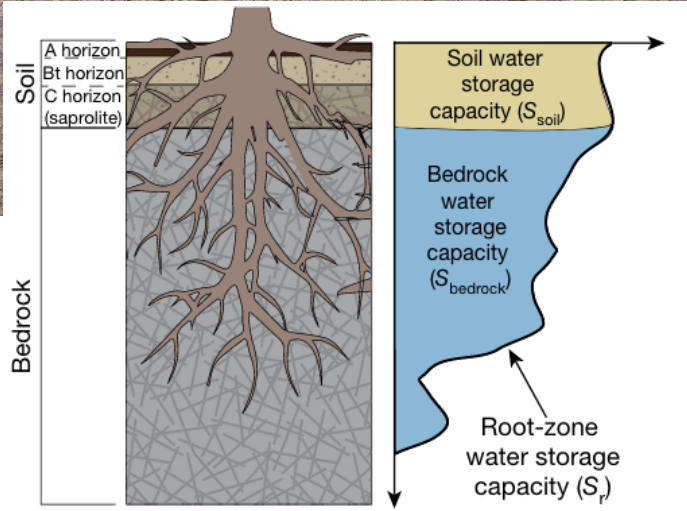
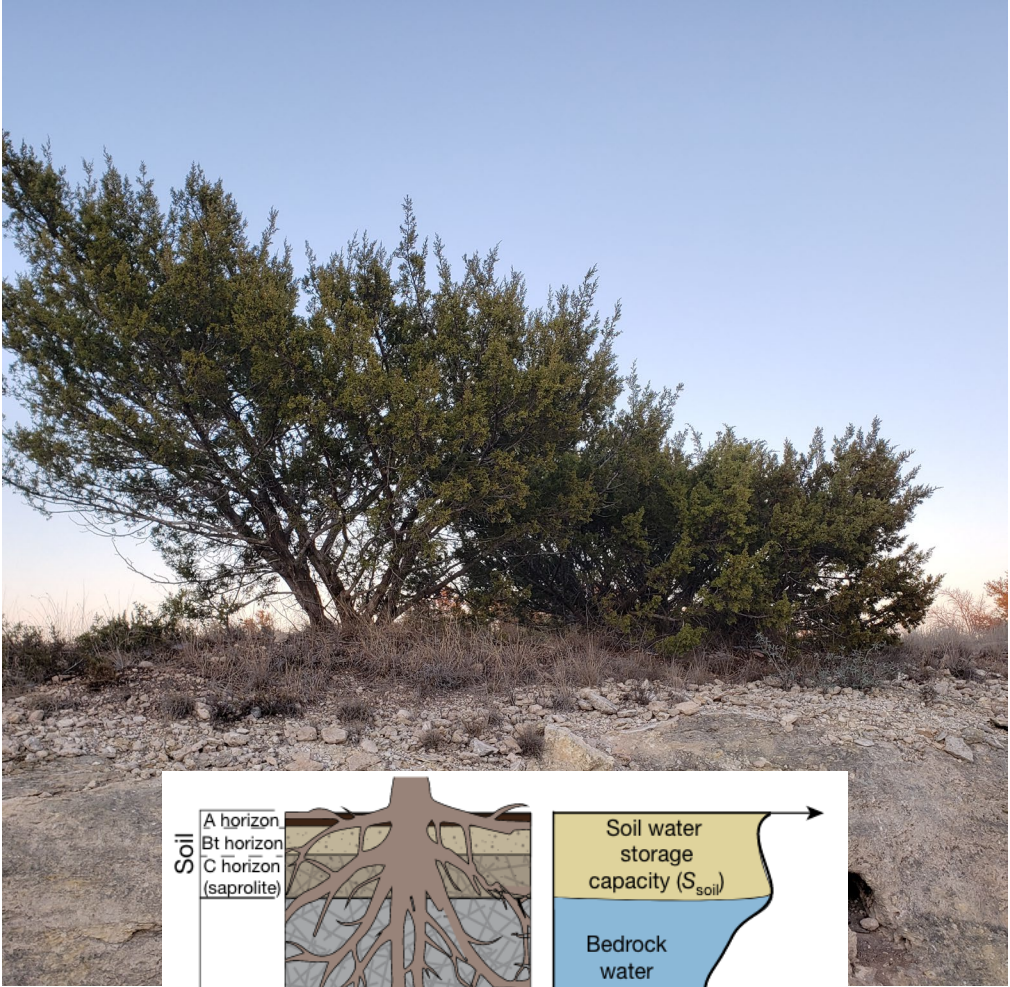


droughtmonitor.unl.edu

2.5+ years old

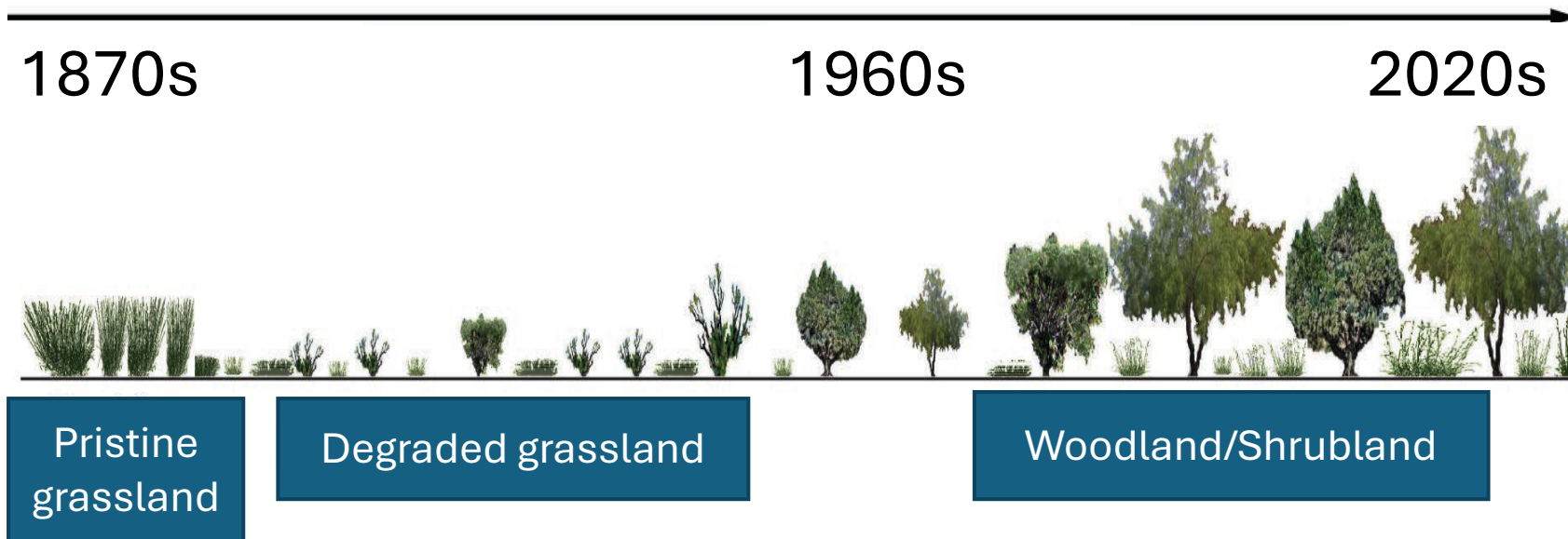


The ability of Juniper not only to use rock moisture but also to enhance infiltration and storage capacity could help explain their proliferation and resilience in Edwards Plateau.

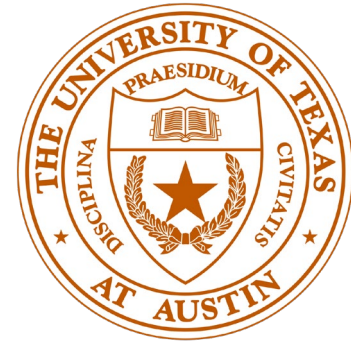
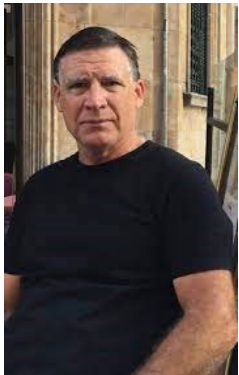


McCormick et al (2021)

More functional than previously degraded landscapes



Thank you!



Aridity increases towards the west

