

Climate Change Trends and Vulnerabilities for Park Planning at Mojave National Preserve

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Historical Trends

Temperature has increased across North America in the 20th century (Figure 1) and shown a statistically significant increase in the 150 km x 150 km area that includes Mojave National Preserve (Figure 2, Table 1, Mitchell and Jones 2005, Gonzalez et al. 2010). Spring warming has advanced across the western U.S., including at the park (Ault et al. 2011). Precipitation has decreased across the southwestern U.S. (Figure 3), but increased slightly in the area including the park, although the trend is not statistically significant (Figure 4, Mitchell and Jones 2005, Gonzalez et al. 2010). Analyses of causal factors attribute 20th century temperature and precipitation changes to greenhouse gas emissions from vehicles, power plants, deforestation, and other human activities (Intergovernmental Panel on Climate Change (IPCC) 2007, Bonfils et al. 2008).

Future Projections

The Intergovernmental Panel on Climate Change (IPCC) has coordinated research groups in projecting possible future climate under defined greenhouse gas emissions scenarios (IPCC 2007). For the three main IPCC emissions scenarios, temperature could increase five to eight times the warming already observed (Table 1, Mitchell and Jones 2005, Gonzalez et al. 2010). Precipitation could decrease in the 150 km x 150 km area surrounding the park (Mitchell and Jones 2005, Gonzalez et al. 2010), but, for the area of the park, 6 out of 18 General Circulation Models project increases in precipitation for IPCC emissions scenario A2 (Figure 5; historical average from Mitchell and Jones 2005, Hijmans et al. 2005; projections from IPCC 2007, Tabor and Williams 2010, Conservation International; analysis by P. Gonzalez).

Potential Vulnerabilities

Spatial analyses of climate requirements and future climate projections indicate that desert tortoise (*Gopherus agassizii*) (Barrows 2011) and Joshua tree (*Yucca brevifolia*) (Cole et al. 2011) are vulnerable to future range shifts and range contractions in southern California Mojave desert ecosystems.

References

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Table 1. Mojave National Preserve. Historical and projected climate (mean $\pm$ standard deviation (SD)) for the 150 km x 150 km square area that includes the park (Mitchell and Jones 2005, IPCC 2007, Gonzalez et al. 2010).

	mean	SD	units
Historical			
temperature 1901-2002 annual average	18.4	0.6	°C
temperature 1901-2002 linear trend	0.5	0.2	°C/century
precipitation 1901-2002 annual average	170	70	mm/year
precipitation 1901-2002 linear trend	10	12	%/century
Projected			
IPCC B1 scenario (lower emissions)			
temperature 1990-2100	2.7	0.4	°C/century
precipitation 1990-2100	-11	20	%/century
IPCC A1B scenario (medium emissions)			
temperature 1990-2100	3.5	0.6	°C/century
precipitation 1990-2100	-7	20	%/century
IPCC A2 scenario (higher emissions)			
temperature 1990-2100	4.1	0.8	°C/century
precipitation 1990-2100	1	20	%/century

Figure 1.

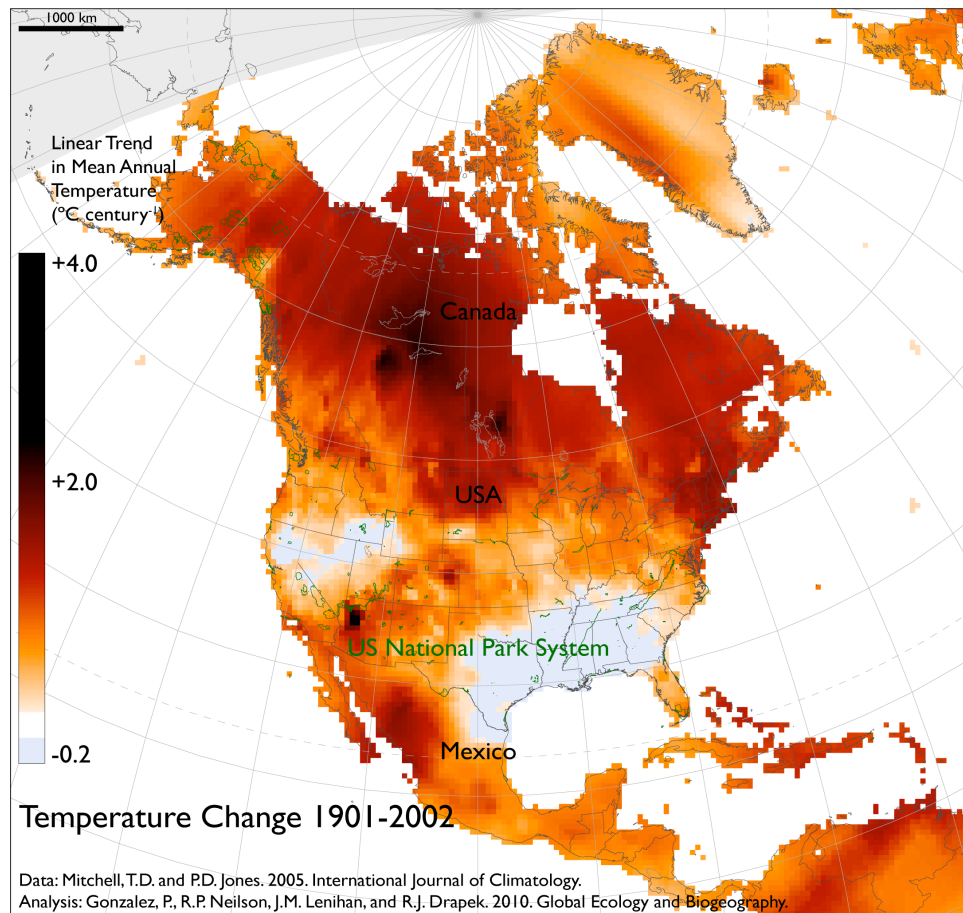


Figure 2.

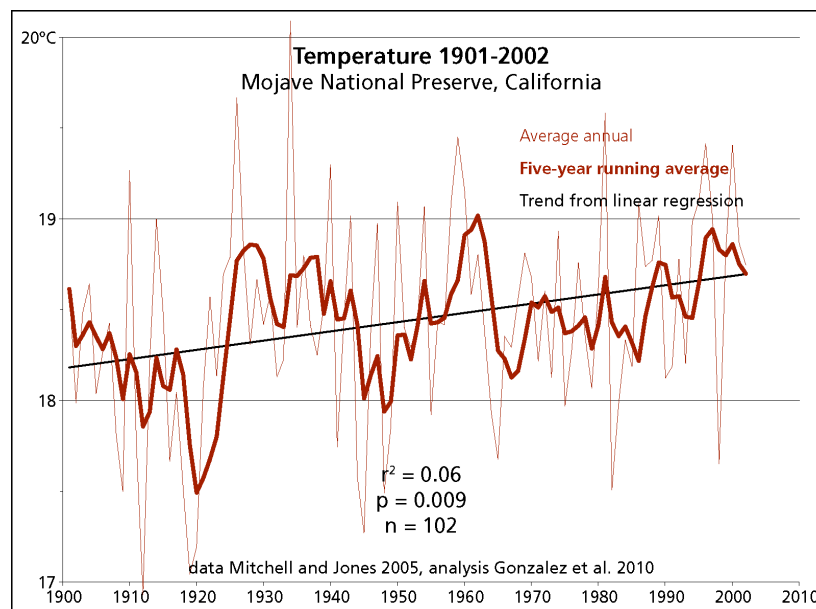


Figure 3.

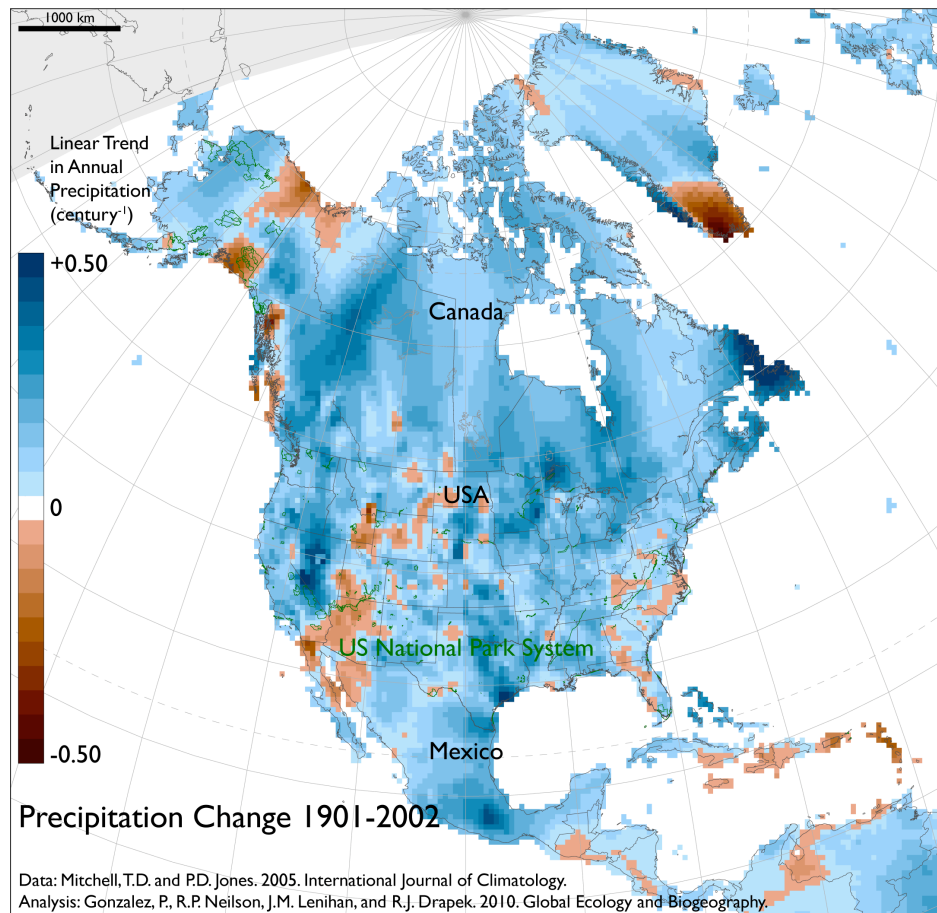


Figure 4.

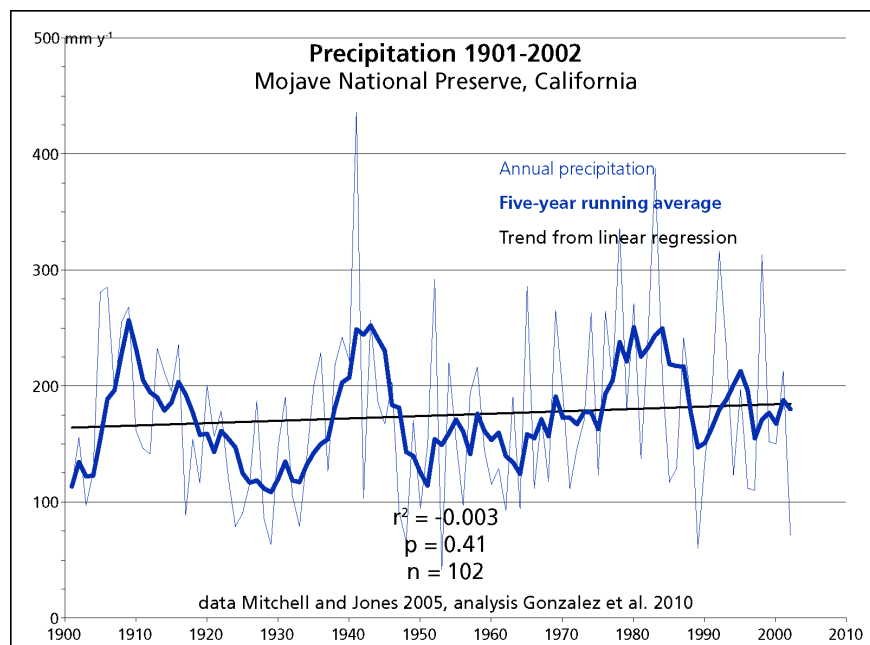


Figure 5.

