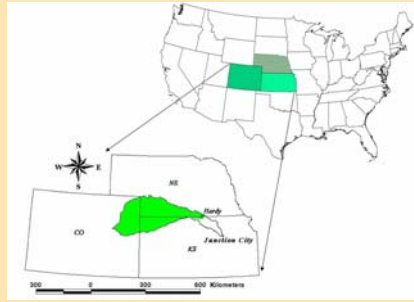


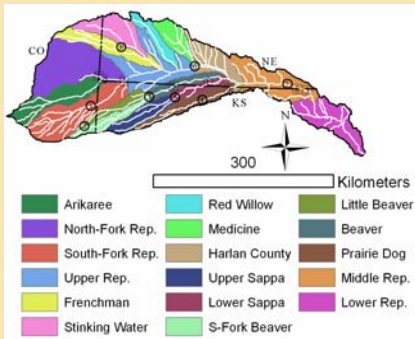
MODIS-AIDED WATER-BALANCE INVESTIGATIONS IN THE REPUBLICAN RIVER BASIN, USA



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Location of the Republican River basin



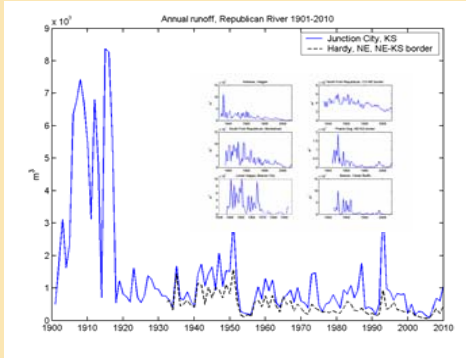
Precipitation stations (circles):

1. Bonny Dam
2. Burlington
3. Atwood
4. Keith Sebellus Res.
5. Oberlin
6. Cambridge
7. Guide Rock
8. Imperial

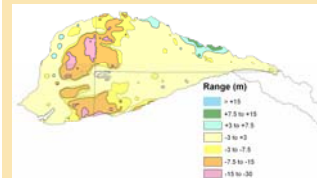
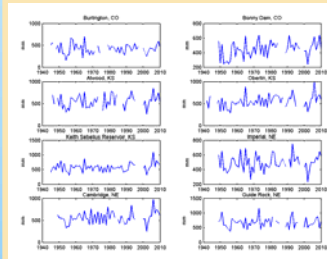
Gaging stations (squares):

1. Lower Sappa, near Beaver City
2. South-Fork Republican, near Benkelman
3. Beaver near Cedar Bluffs
4. Arikaree at Halgier
5. Republican near Hardy
6. Prairie Dog near Hartan Co. Res.
7. North-Fork Republican at the CO-NE border
8. Courtland Canal near Superior

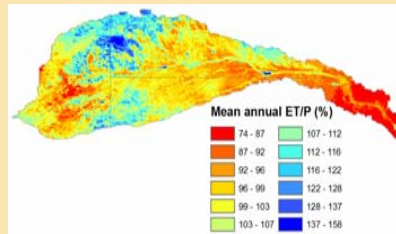
8-digit USGS subcatchments



Declining streamflow (R_o) and groundwater, steady precipitation (P)

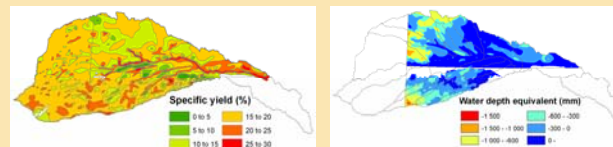


Groundwater-elevation change, predevelopment to 2007



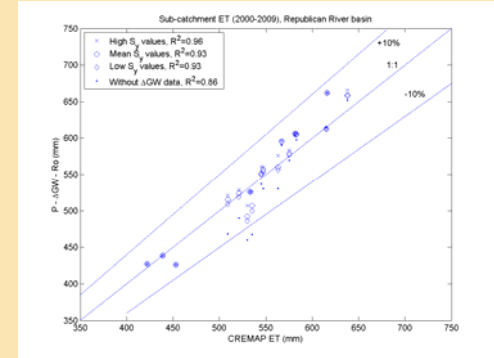
Elevated ET rates

CREMAP-derived ET (2000-2009) and measured precipitation ratios



S_y

Groundwater change (ΔGW) as water-depth equivalent (2000-2009)



Regression plot of the mean annual ET estimates versus the water-balance derived ($P - \Delta GW - R_o$) values

Basin area	"Undisturbed" native prairie ET (mm)	Present ET (mm)	P (mm)	P (mm) over native prairie	ET / P (%) undisturbed	ET / P (%) present	Change in ET / P (%)
CO	430	444	430	433	99.31	103.26	3.95
NE	557	576	563	559	99.64	102.31	2.67
KS	561	568	596	591	94.92	95.3	0.38
KS upstream of Hardy, NE	536	540	536	547	97.99	100.75	2.76

"Undisturbed" ET rates are taken over native prairie grass

CONCLUSIONS

Deviation of the current ET/P ratios from an "undisturbed" value may be indicative of the extent of accumulated (not climate-related) changes in the hydrologic cycle of the Republican River basin. The largest change (3.95%) can be inferred to have taken place in Colorado, followed by Kansas (2.76%), upstream of Hardy, NE, with almost the same extent of change in Nebraska (2.67%). This is in accordance with the study of Szilagyi (1999) showing that streamflow declined faster outside of Nebraska than within.

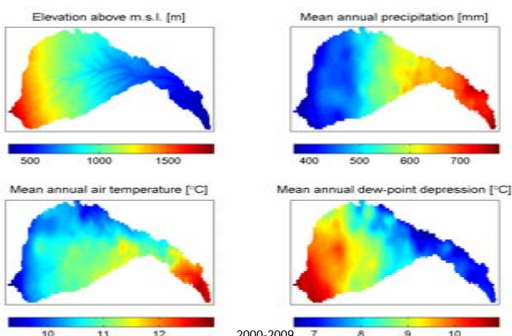
REFERENCES

Szilagyi, J., Streamflow depletion investigations in the Republican River basin: Colorado, Nebraska and Kansas, *Journal of Environmental Systems*, 27(3) (1999), 251-263.
 Szilagyi, J., Kovacs, A., Jozsa, J., A calibration-free evapotranspiration mapping (CREMAP) technique. In L. Labeledzki (ed) *Evapotranspiration*. InTech, Rijeka, Croatia, 2011, www.intechopen.com.

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Large east-to-west environmental gradients