Projecting agro-hydrological outcomes using the APEXgraze Model and various climate scenarios from Global Circulation Models

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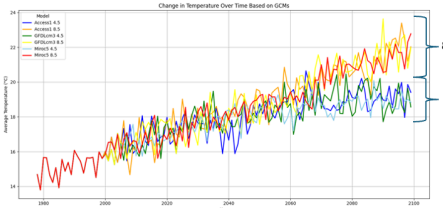
Research Objectives

- Create projections of agricultural watersheds utilizing a calibrated APEXgraze (Agricultural Policy/Environmental eXtender) model and various Global Circulation Models.
- Investigate the impacts of grazing activities on grasslands and croplands under different climate scenarios.

Background

As general climate trends predict warmer weather, it is important to improve agricultural management strategies to reflect the needs of the land. When coupled with historical data such historical land use, precipitation, and temperature measurements, climate models can project agro-hydrological outcomes and allow users to develop sustainable plans of action.

Yearly Average Temperature



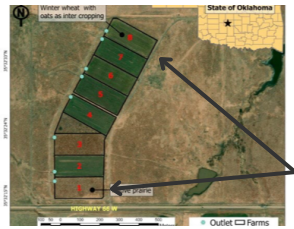
8.5 GCM variations represent "Business as Usual" practice (shown in warm colors).

4.5 GCM variations represent incorporating climate change mitigation techniques (shown in cool colors).

Global Circulation Models (GCM) are mathematical models that simulate the Earth's climate system to understand general climate trends and project future changes in climate including temperature and precipitation of a given region.

- Access 1 4.5 and 8.5
- GFDLcm3 4.5 and 8.5
- Miroc5 4.5 and 8.5

Study Site

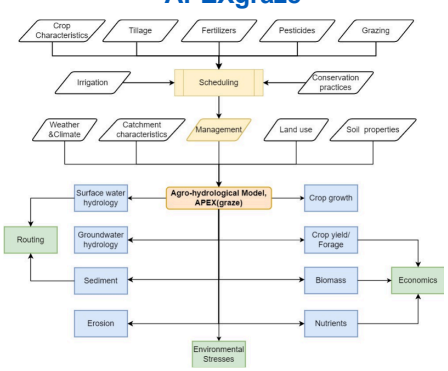


USDA-ARS Oklahoma and Central Plains Agricultural Research Center (1977-1999)

- Located near El Reno, OK
- This study uses two watersheds:
  - WRE 1: Native Prairie Grasslands
  - WRE 8: Cropland with winter wheat and oats.

Methods

Agricultural Policy/Environmental Extender APEXgraze



Obtain sample site's GCM data from open source IPCC website.

Combined historical temperature and precipitation data with GCM data.

Run the APEXgraze model using concatenated data.

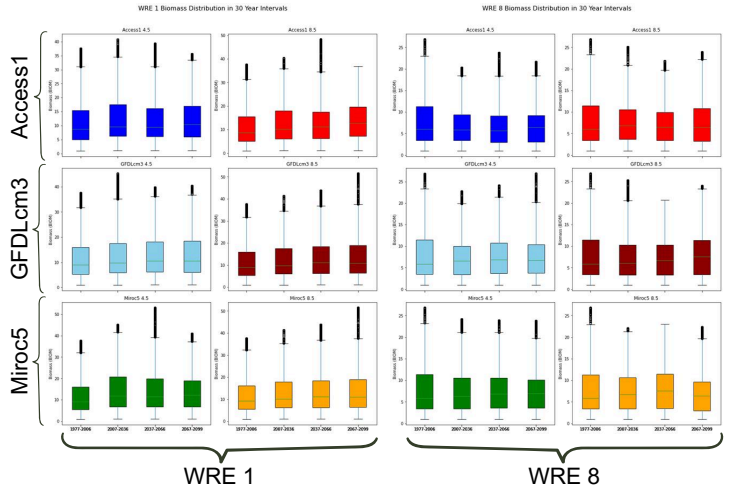
Model outputs and visualization.

Results

	30_Year_Period	Nitrogen	Phosphorus	Water Yield	Precipitation	ET
WRE 1						
Access1 4.5	1977-2006	0.8235	0.6416	0.3838	2.5059	2.0516
	2007-2036	0.9233	0.6236	0.1587	2.0835	1.8951
	2037-2066	0.8534	0.7353	0.1473	1.9641	1.8016
	2067-2099	0.7883	0.7402	0.1108	1.8927	1.7638
Access1 8.5	1977-2006	0.8236	0.6385	0.3793	2.4845	2.0472
	2007-2036	0.8058	0.7039	0.1793	2.114	1.9011
	2037-2066	0.7539	0.7745	0.1194	1.9087	1.7702
	2067-2099	0.7806	0.6517	0.1598	2.0237	1.857

	30_Year_Period	Nitrogen	Phosphorus	Water Yield	Precipitation	ET
WRE 8						
Access1 4.5	1977-2006	0.6072	0.6734	0.2999	2.4804	2.0991
	2007-2036	0.6364	0.6713	0.1073	2.0863	1.9396
	2037-2066	0.6491	0.673	0.1132	1.9851	1.8413
	2067-2099	0.6439	0.6668	0.0597	1.9149	1.8105
Access1 8.5	1977-2006	0.6075	0.6735	0.2964	2.4603	2.0937
	2007-2036	0.6364	0.6696	0.1266	2.1149	1.9412
	2037-2066	0.6321	0.6716	0.0764	1.8928	1.7947
	2067-2099	0.6301	0.669	0.1151	2.0377	1.89

Changes in Biomass Production 30 Year Increments



Conclusion

Output from this model can be used to aid in land management systems by providing a foundation for suggesting sustainable agricultural practices under different climate scenarios and creates a platform for future research.

The preliminary projections indicate:

- **Native Prairie Grasslands** observe lower biomass production, nitrogen, and phosphorus with warmer business as usual temperatures than in cooler temperatures.
- **Cultivated Croplands** observe an increase in nitrogen with consistent phosphorus and biomass production both climate scenarios.
- Overall decrease in water yield, but higher levels are observed in warmer temperatures.

Acknowledgements

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References

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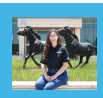

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