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How Does Inter-Annual Snowpack Variability Impact Reservoir Storage in the Magic Reservoir?

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BACKGROUND

Reservoir storage plays a role in determining water use in agricultural areas. The aim of this project is to understand variables of importance for reservoir storage.

INTRO

- Snowpack does not necessarily correlate to reservoir storage
- Understanding variables for reservoir storage can help predicting in the future

STUDY AREA

- Magic Reservoir located in Blaine and Camas counties on the Big Wood River, south of Ketchum
- Big Wood and Camas Creek Watersheds

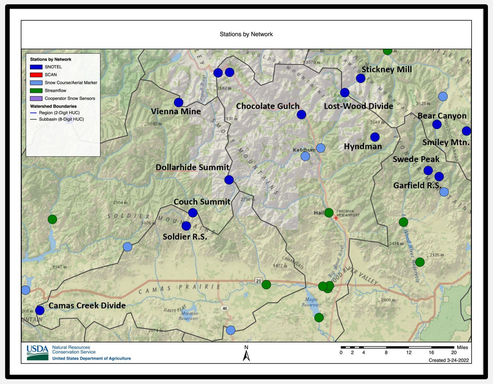

Figure 1. Site map with labeled SNOTEL sites

METHODS

1. Automated data retrieval using R
2. 46 variables were created: SWE*, Apr.-Jun. Temp, Nov.-Jan. Temp, and Stream Discharge
3. Automated parameter selection for linear regression models

*SWE: Snow Water Equivalence is the depth of water contained in a depth of snow

DATA

Data Source	File Name
USGS	Streamflow
USGS	Reservoir Storage
NCRS	SNOTEL data
Idaho Power	Streamflow

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Initial Analysis

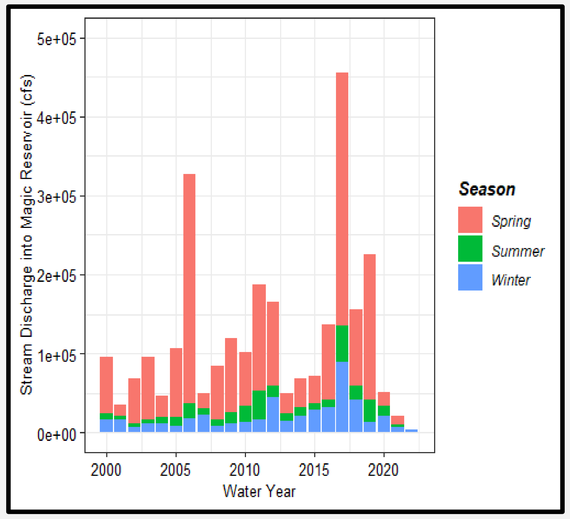


Figure 2. Seasonal contributions of stream discharge into Magic Reservoir each water year.

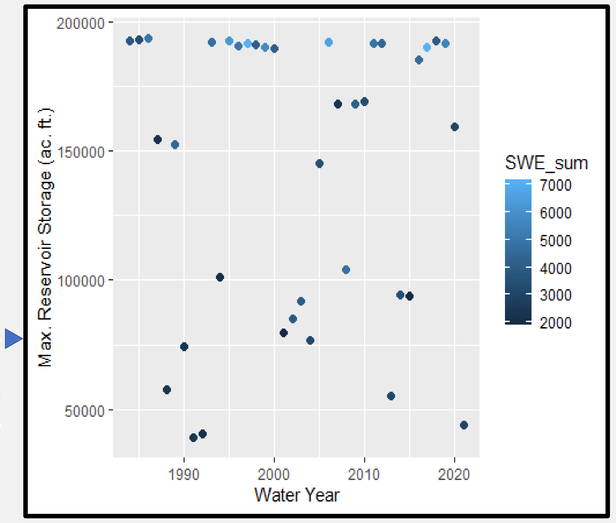


Figure 3. Cumulative SWE per water year versus maximum reservoir storage

Results

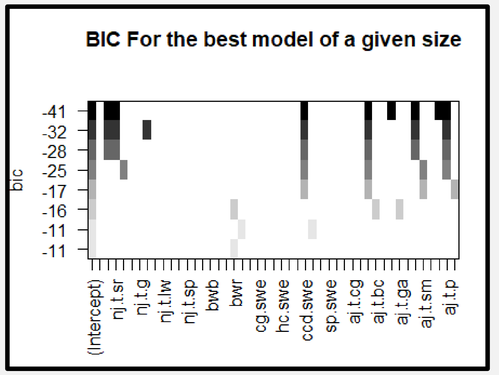


Figure 8. BIC results from model selection with all variables included.

*Bayesian Information Criteria (BIC): Model selection method, lower BIC represents more parsimonious model.

Spring temperatures, Winter temperatures, and Snow Water Equivalence are major drivers of Magic Reservoir storage.

- Spring temperature parameters are the majority (5/8 variables)
- Highlights the importance of variability in spring temperatures

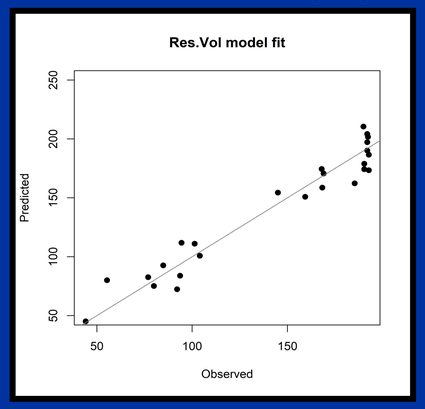
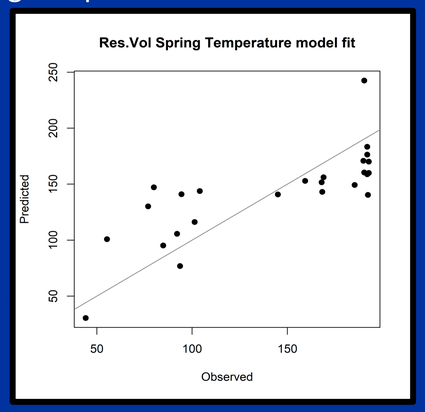


Figure 4:

Model fit with all variables included. R2 = 0.91 , highlights higher uncertainty at higher reservoir fill

Figure 5:

Model fit with only Spring Temperatures. R2 = 0.65 , highlights higher uncertainty at lower reservoir fill



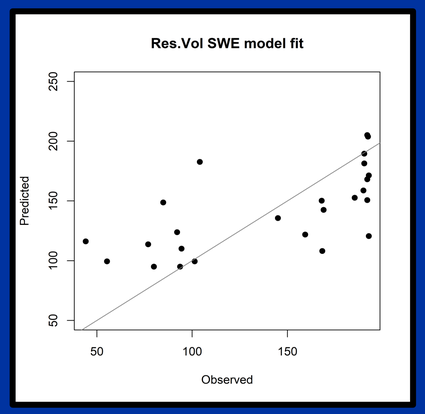
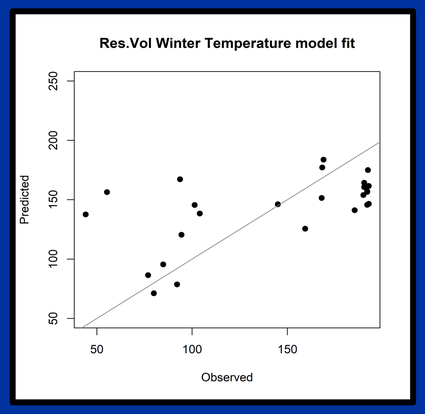


Figure 6:

Model fit with only SWE data. R2 = 0.5 , highlights higher uncertainty at lower reservoir fill

Figure 7:

Model fit with only Winter Temperatures. R2 = 0.37 , highlights uncertainty at all levels



Variables	Adjusted R^2	BIC
All	0.91	-41
Only Spring Temperature	0.65	-9.8
Only SWE	0.5	-7.8
Only Winter Temperature	0.37	-0.6

CONCLUSIONS

- Existing environmental data can predict reservoir storage
- Spring temperatures are particularly important in addition to SWE and winter temperatures
- If irrigators want predications of reservoir storage prior to planting, predicting April-June temperatures would be necessary

FUTURE DIRECTIONS

- Determine if a linear models could be developed without spring temperatures for forecasting purposes
- Quantify variability of snowpack within the watershed