



Water use and supply trends within the Sunbelt: A comparative analysis of Arizona and North Carolina

Deborah Ayodele and Kelli Larson
School of Geographical Sciences and Urban Planning, Arizona State University



Introduction

- Many states across the Sunbelt area of the United States are experiencing stressed water supplies as a result of urbanization and climate change, which makes the implementation of targeted adaptation strategies crucial.
- This study uses water use and supply trend analysis to investigate the adaptation and water management strategies being employed within the Sunbelt by conducting a comparative analysis of trends across Arizona and North Carolina between 1985 and 2005 by county.
- The aim of this analysis is to increase understanding of the influence of state policies, urbanization, climate (specifically in the form of drought), and water management on the use and distribution of water in water-stressed regions.

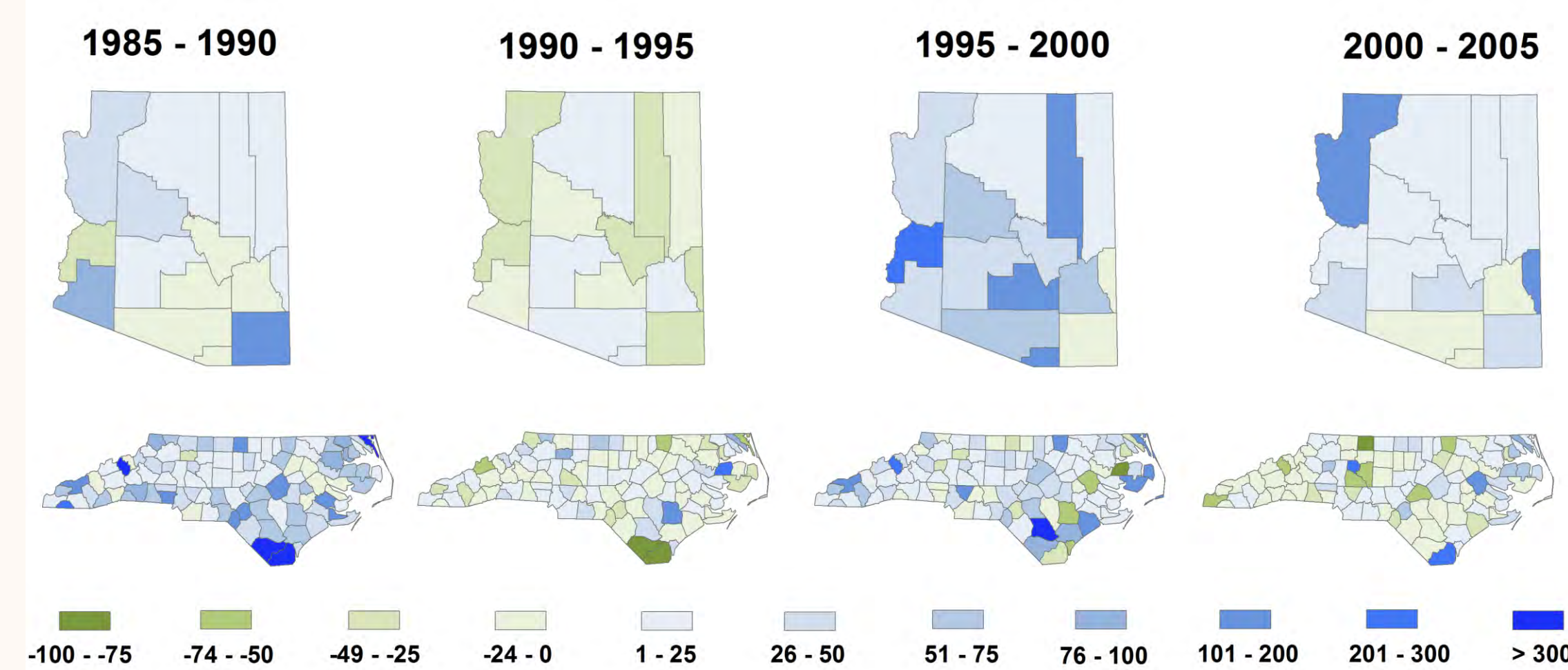
Methods

- The geospatial analysis of water demands was performed using a Geographic Information System (GIS) and the Statistical Package for Social Scientists (SPSS).
- With percent change data from the U.S. Geological Survey (USGS), municipal use, irrigation, groundwater and surface water supply variables are analyzed
- Neuse and Cape Fear basins in North Carolina and Verde basin in Arizona are incorporated into this analysis based on their hydrological and socio-political importance in the states under comparison.

Results

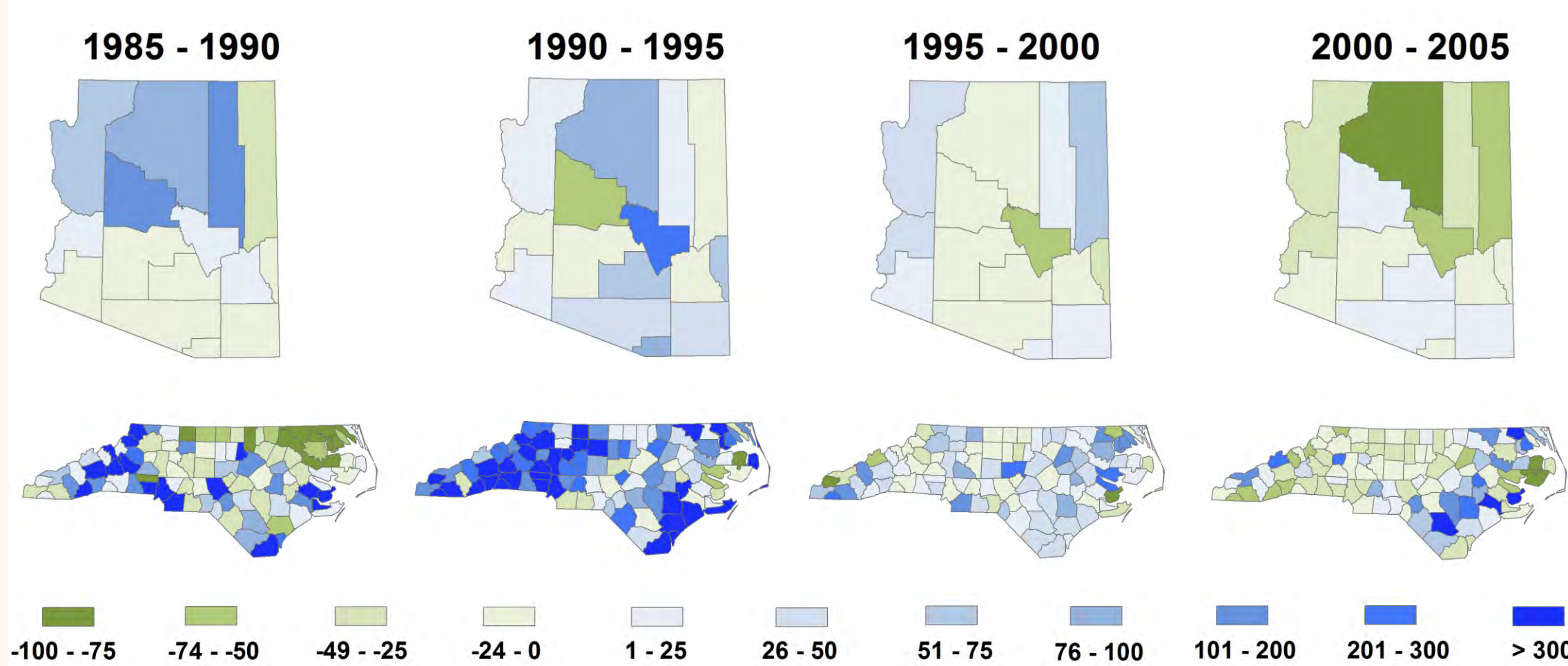
Water Use Trends

Percent Change in Withdrawals for Municipal Use



- Maricopa and Wake counties—where the capital cities are located—experienced relatively no change in municipal water use despite overall decrease across both Arizona and North Carolina from 1990-1995.
- The most intense municipal use in Arizona occurred from 1995-2000. This period coincides with the start of drought in 1996. From 2000-2005 and despite an ongoing drought, municipal water use across the state experienced significant decline in all counties except Mohave, Greenlee and Cochise.

Percent Change in Withdrawals for Irrigation

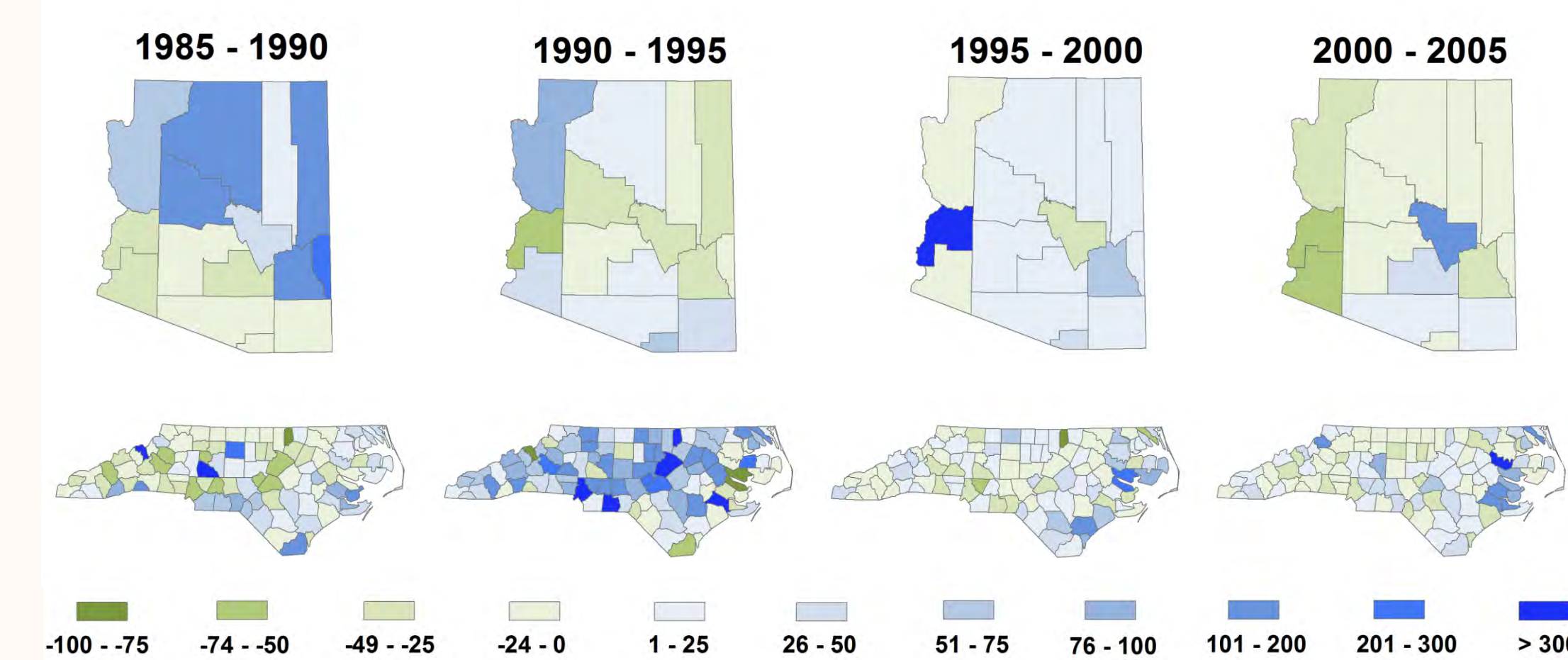


- From 1985-1990, Northern Arizona counties of Mohave, Yavapai, Coconino and Navaho increased their withdrawals for agricultural use while the AMAs (see Study Area map) recorded relatively no change in theirs, and from 1990-1995 withdrawals for agricultural use increased in all the AMAs except Phoenix and Prescott. Increase in Pinal County is a result of the aim of Pinal AMA to preserve agricultural economies¹
- In North Carolina, agricultural water use reduced on the western side of the state and increased on the south-eastern side from 1990-2005. The trend from 2000-2005 is observed in counties within both Cape Fear and Neuse basins

¹<http://www.azwater.gov/azdwr/WaterManagement/AMAs/PinalAMA/>

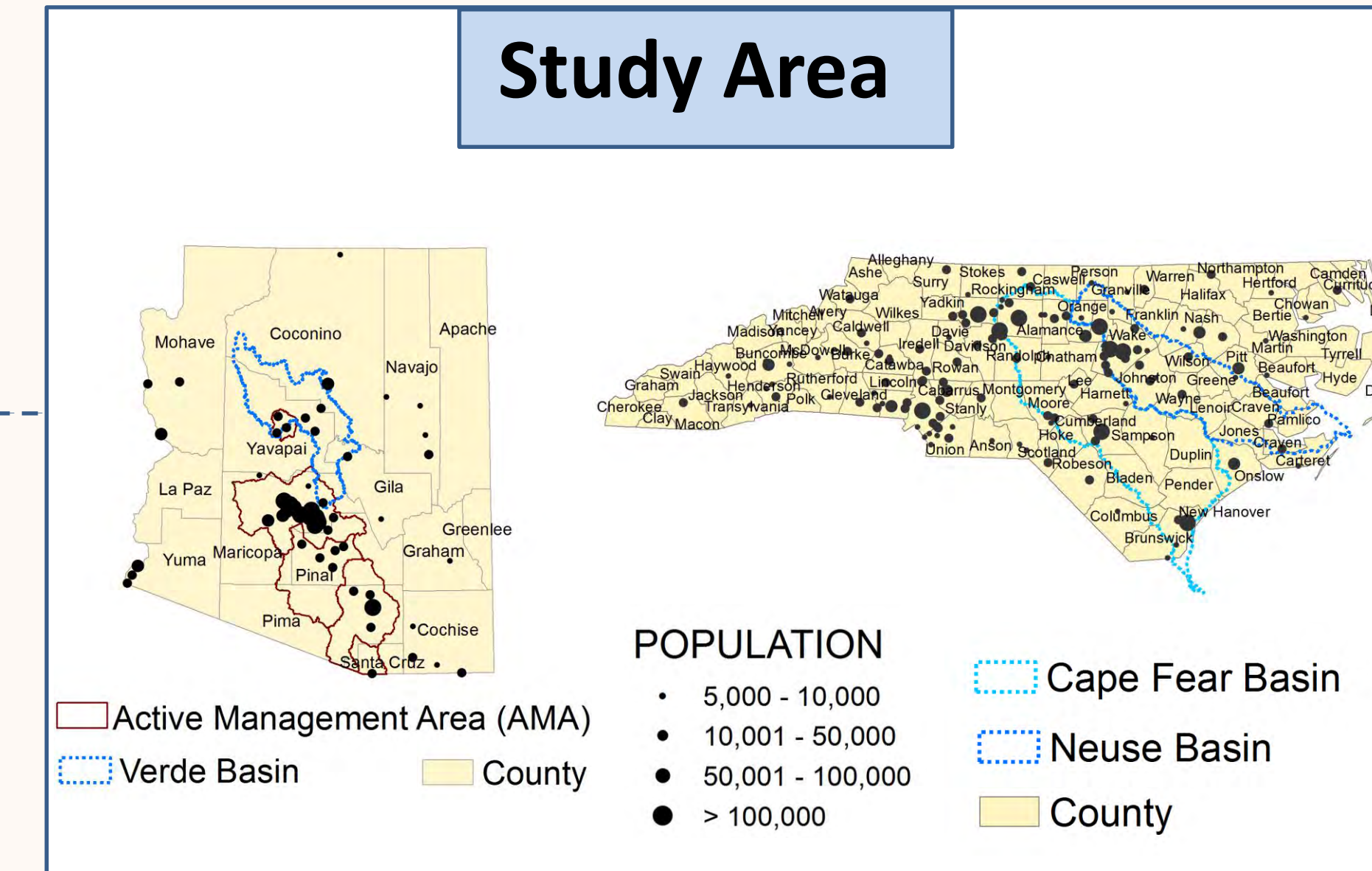
Supply Trends

Percent Change in Groundwater Withdrawals

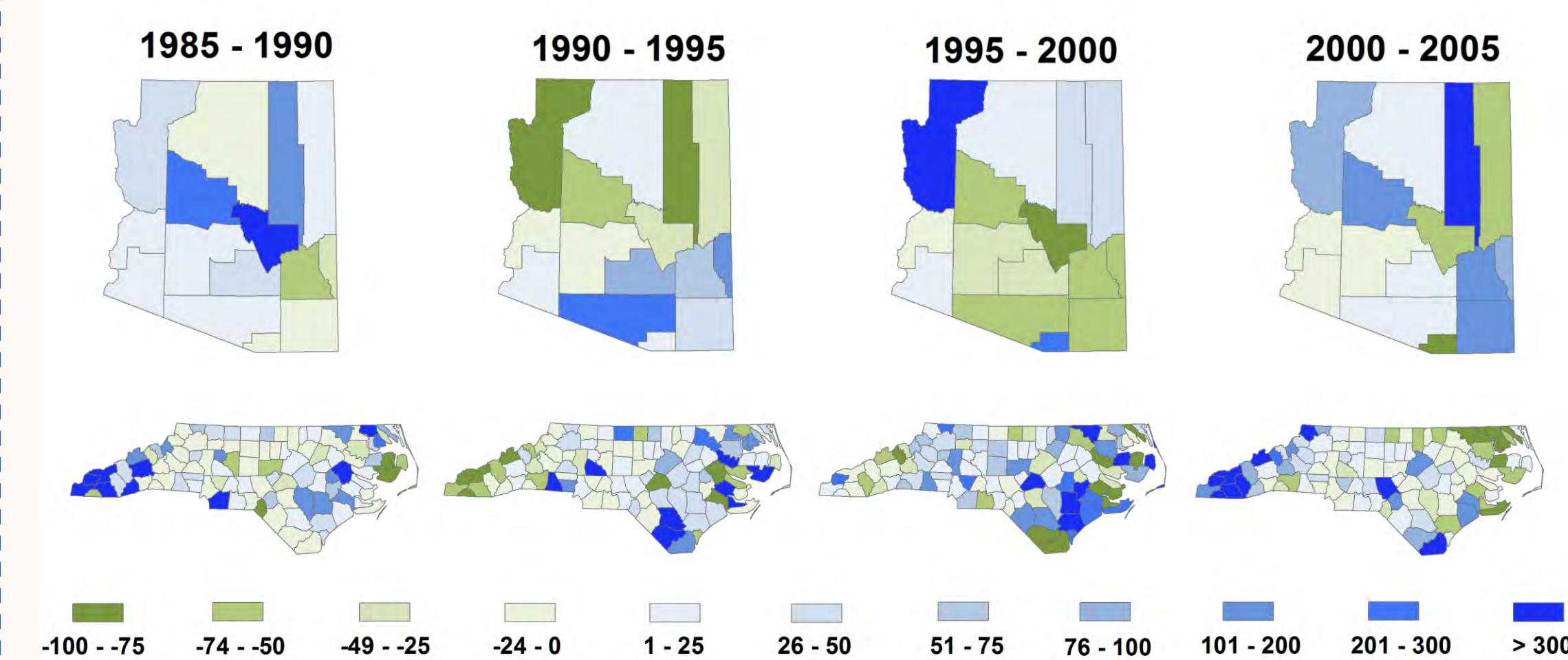


- The similarity in spatial and temporal trends of agricultural water use and groundwater withdrawals suggest that a large proportion of groundwater withdrawals could have been used for agricultural activities.

Study Area



Percent Change in Surface Water Withdrawals



- For both Arizona and North Carolina, 50% of counties that recorded high groundwater withdrawals, recorded low surface-water withdrawals. This trend shows how proximity, distribution and access to supply source determine the supply source and management strategies adopted by Counties. Temporally, surface water withdrawals in all study basins reduced from 1985-2005

Conclusion

The results show a high degree of spatial variation within and across Arizona and North Carolina, largely as a result of growth, drought periods, and water policies.

Compared to North Carolina, the southwestern state of Arizona tends to rely on non-renewable groundwater and water transfers (from agriculture to urban uses) to cope with drought and water scarcity.

These patterns—which are institutionalized by the state-wide Groundwater Management Act—may be detrimental over the long-run since the ‘fossil’ aquifers in Arizona will eventually be depleted, and the phasing out of agriculture over time will diminish the short-term flexibility of using water transfers to adapt to shortages.

Future Directions

Future directions in this research will include examining:

Other factors that may be responsible for the observed spatial and temporal trends in both Arizona and North Carolina .

Additional adaptation and management strategies used to cope with climate change, urbanization, and water variability.

Social-hydrologic dynamics—especially drivers of decision-making , water resource outcomes, and societal responses—using agent-based modeling.

Acknowledgements

We acknowledge funding from the National Science Foundation Water Sustainability and Climate programs. This research is a collaboration with scholars at North Carolina State University. Pls: Sankar Arumugam at NCSU and John Sabo at ASU.