5th SWAN Progress Meeting 2014

Towards a Framework for a Transatlantic Dialogue on Water: What Role for The University of Arizona?

University of Arizona – Scientific Progress

Zhao Yang

Francina Dominguez

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Kremena Boyanova
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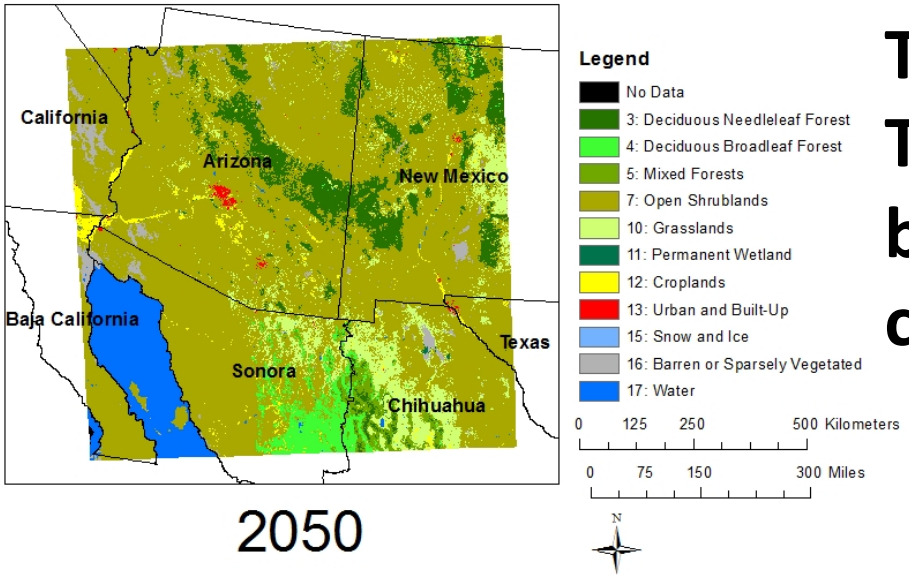
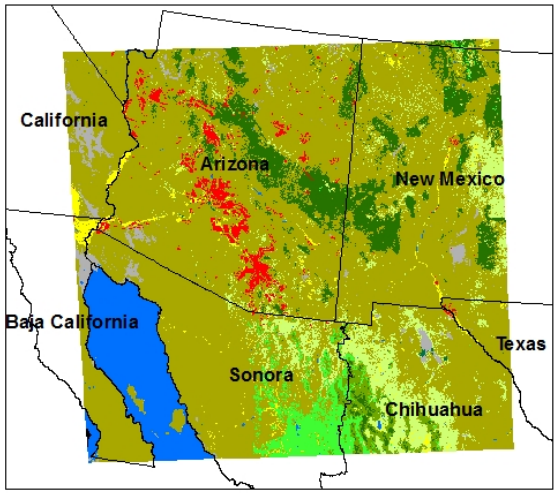
2005



2050



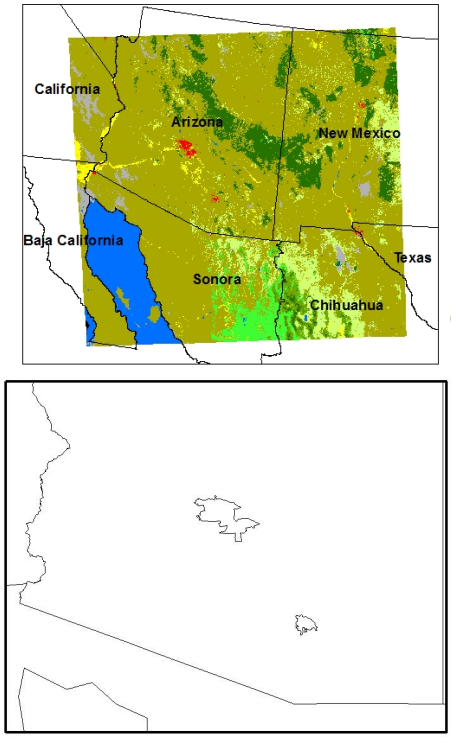
The cities of Phoenix and Tucson are projected to become one urbanized corridor by the year 2050

What are the potential impacts on climate? (Zhao)

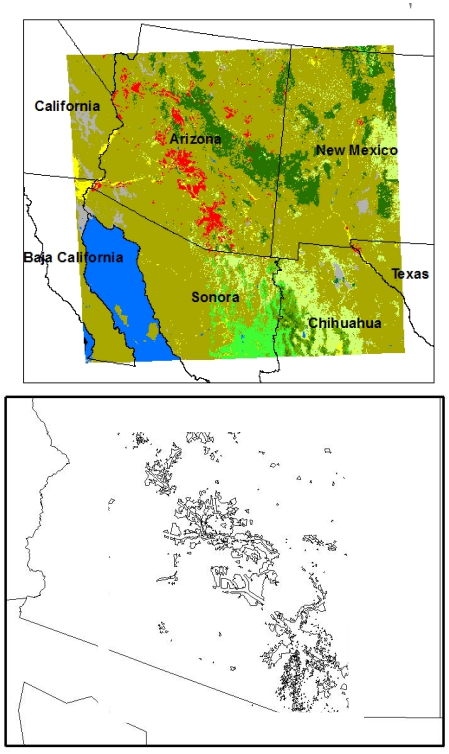
What are the potential impacts on hydrology? (Kremena)

Our goal with this project has been to understand how urban expansion affects climate in the region.

Phoenix and Tucson - 2005



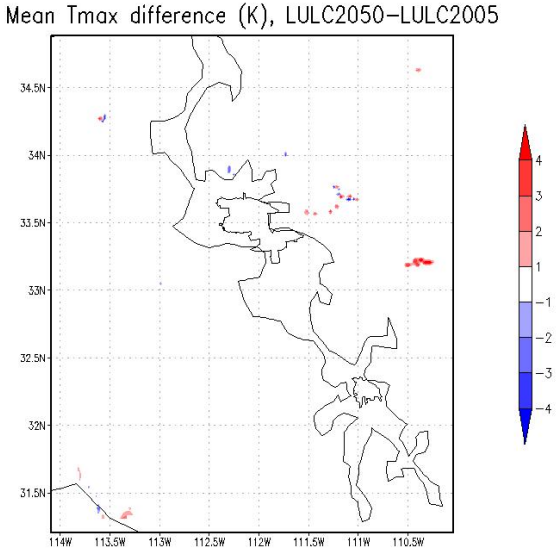
Phoenix-Tucson Corridor - 2050

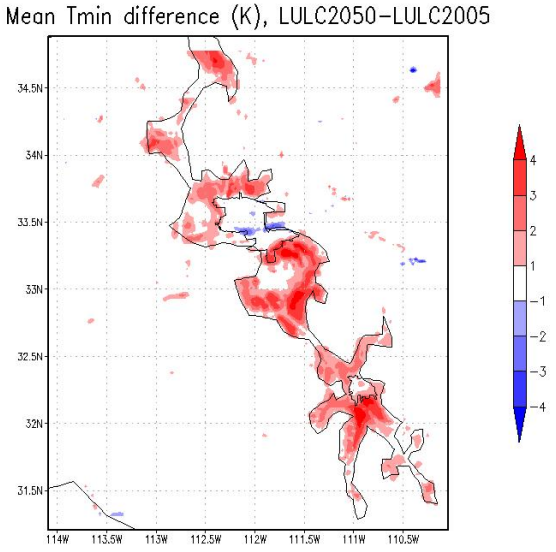


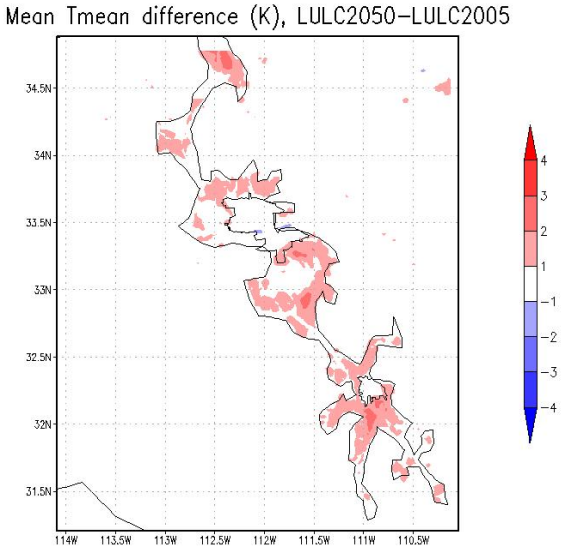
Future climate projections had to be modified to be ingested into WRF.

To tackle this question we use the projected land use changes and the WRF regional climate model.

We find that the urbanized regions have a statistically significant increase in minimum and mean temperatures.

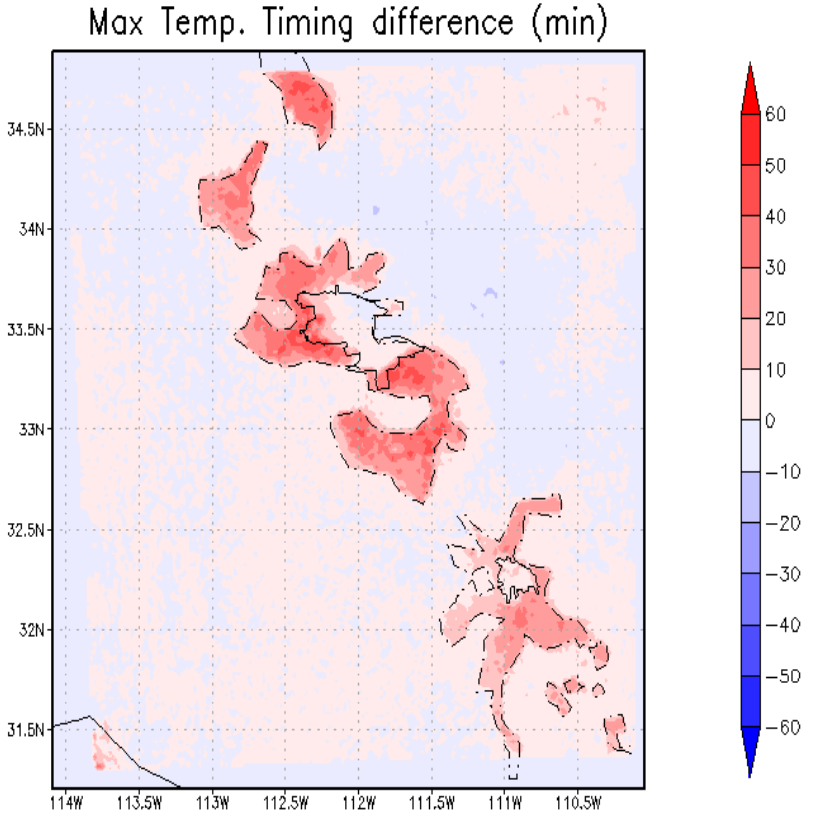


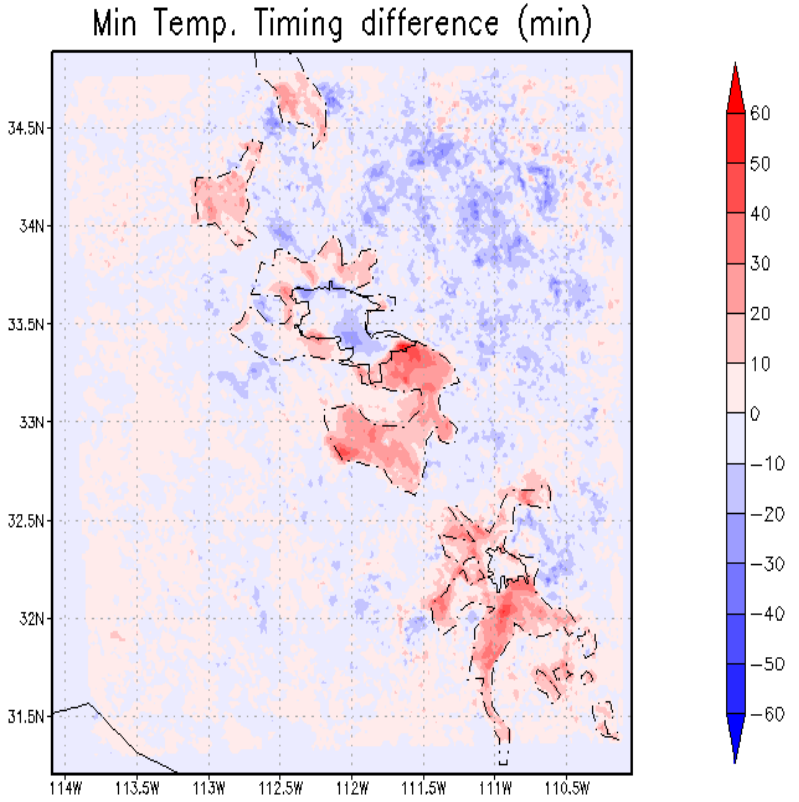




Daily maximum T (occurs during daytime) no increase at all.
Daily minimum T shows an increase pattern over urbanized area.

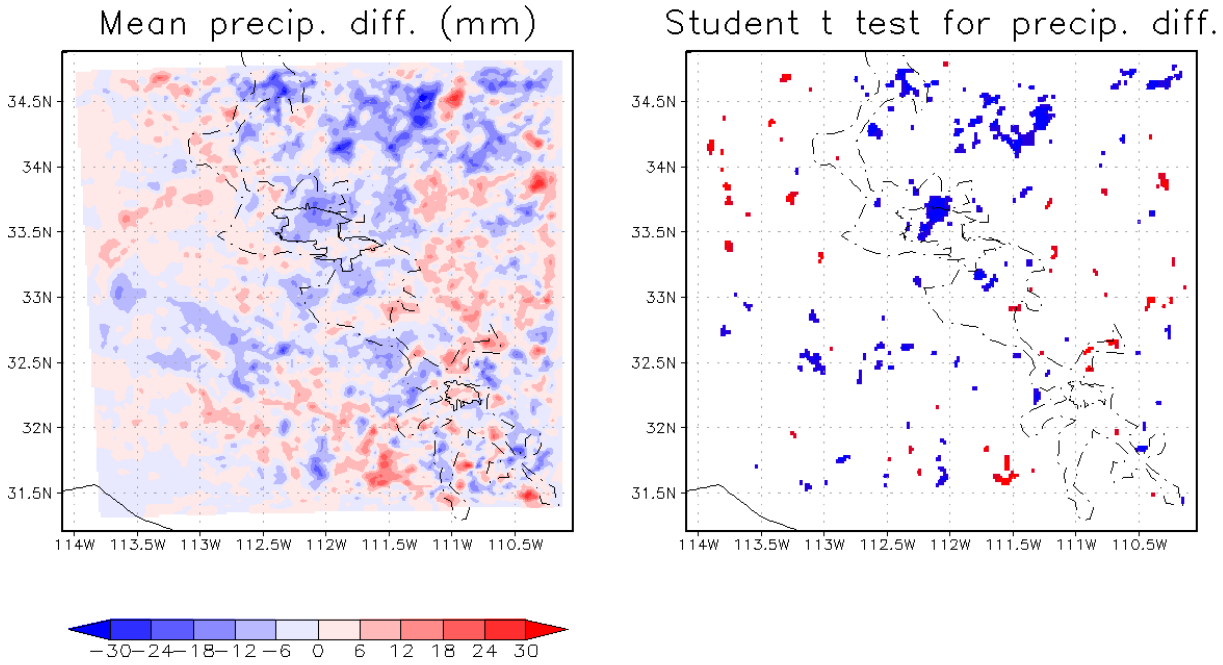
Timing of the minimum and maximum temperature has been delayed.





About 40 mins for maximum temperature, 20 mins for minimum temperature.

We hypothesized that the extension of the urban region would increase precipitation downwind of the city.



However, mean precipitation shows no significant change.

In terms of linking to social sciences we are:

1. **Evaluating the changes in "heat index".**

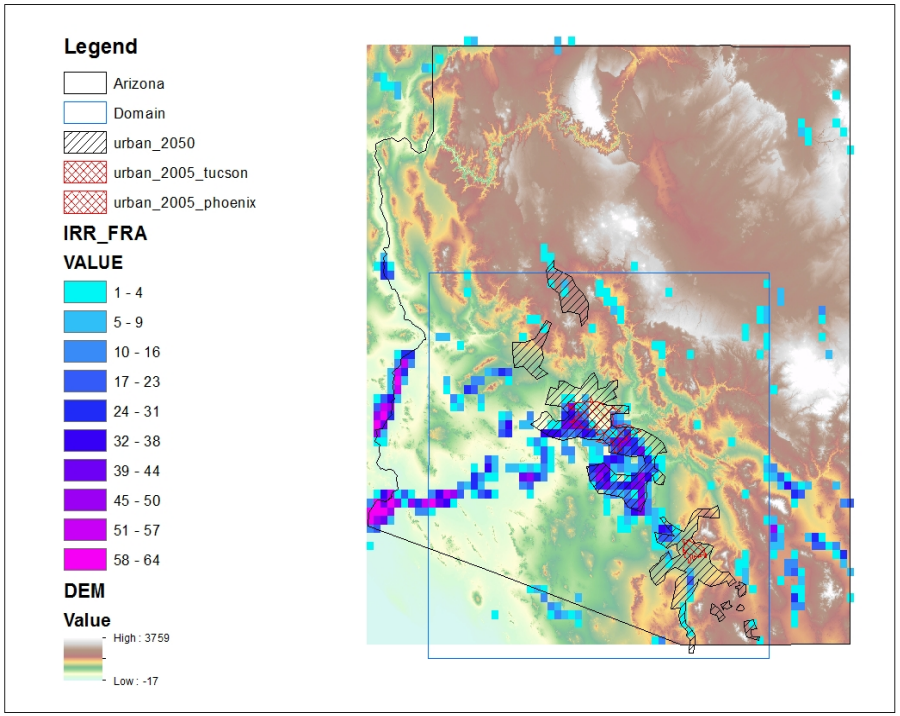
2. **Incorporating ideas about changes in energy consumption and water consumption.**

3. **And including new parameterizations about irrigation.**

However, mean precipitation shows no significant change.

Why don't we see changes in precipitation?
Other studies have found that urbanization in Phoenix tends to increase precipitation downwind. What are we not including?

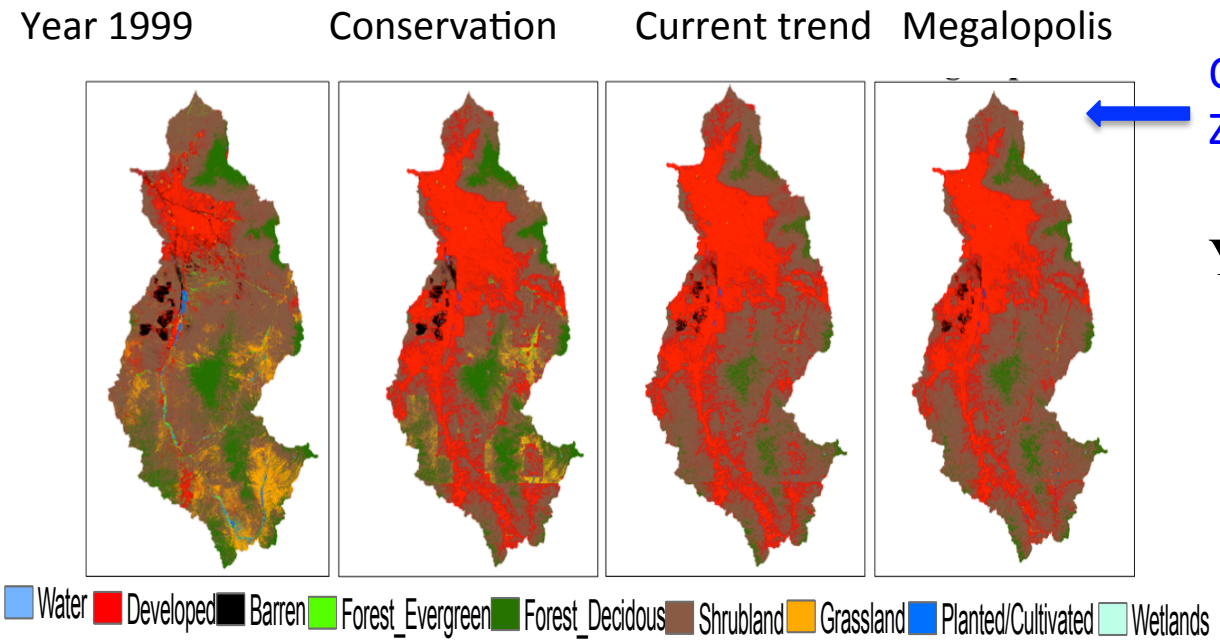
Irrigation.



Zhao is in the process of including irrigated areas into the WRF simulation.

Methodologically we are lacking the **hydrological** modeling, which is needed to make the jump from **climate modeling to water management**

LULC change will affect climate…but perhaps it will affect hydrology more directly.



One used by Zhao.

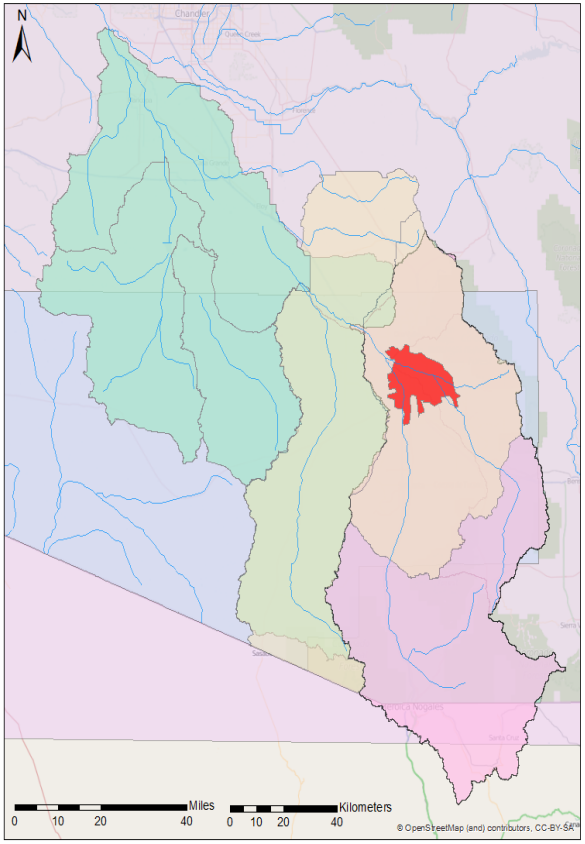
Year 2050

	Current 1999	Conservation 2050	Current Trend 2050	Megalopolis 2050
Urban	11.82	35.02	38.45	34.09
Evergreen Forest	14.55	11.95	5.19	6.18
Shrub/Scrub	59.1	47.37	54.95	58.07
Grass	9.17	3.59	0.38	0.45

The LULC scenarios for the Santa Cruz Watershed are developed by Norman et al., (2012) with the SLEUTH (Clarke et al., 1997; Clarke and Gaydos, 1998) urban growth model.

How will climate and land cover change influence the hydrological cycle and ecosystem services supply in the area?

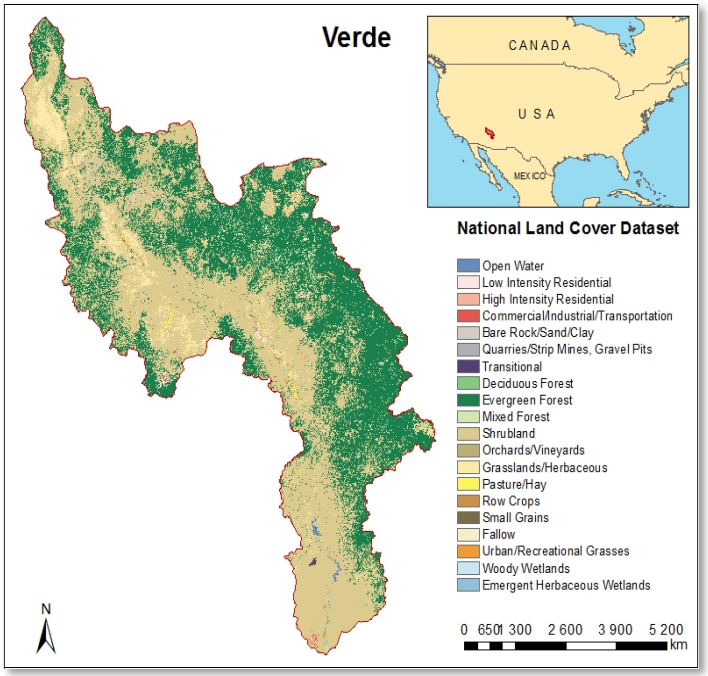
- Kremena will evaluate the hydrology of the **Santa Cruz Basin**
- **Using LULC scenarios for the future**
- **SWAT** Hydrologic Modeling
- **(leveraging from existing work).**
- She will focus on understanding the **hydrological cycle**
- And the **Ecosystem services.**

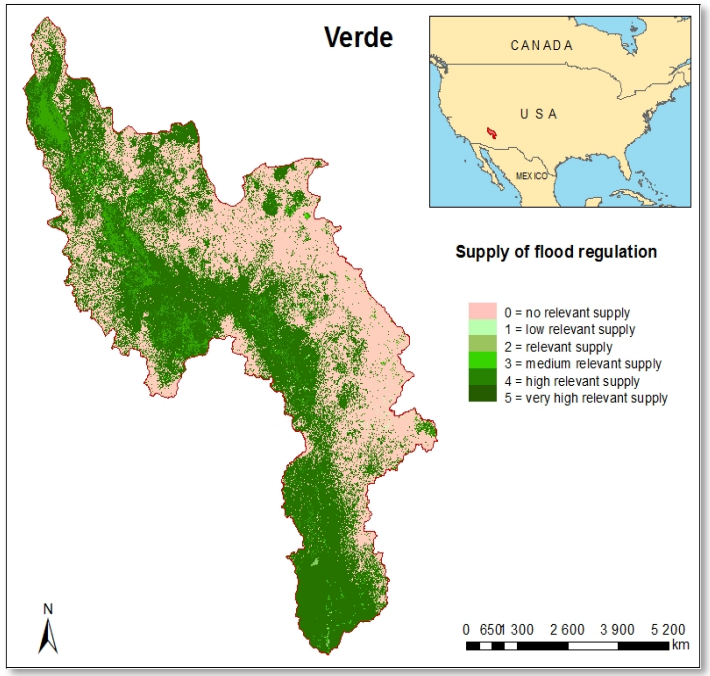


Key services in the area are groundwater recharge and riparian vegetation protection which are both dependent on the hydrological cycle

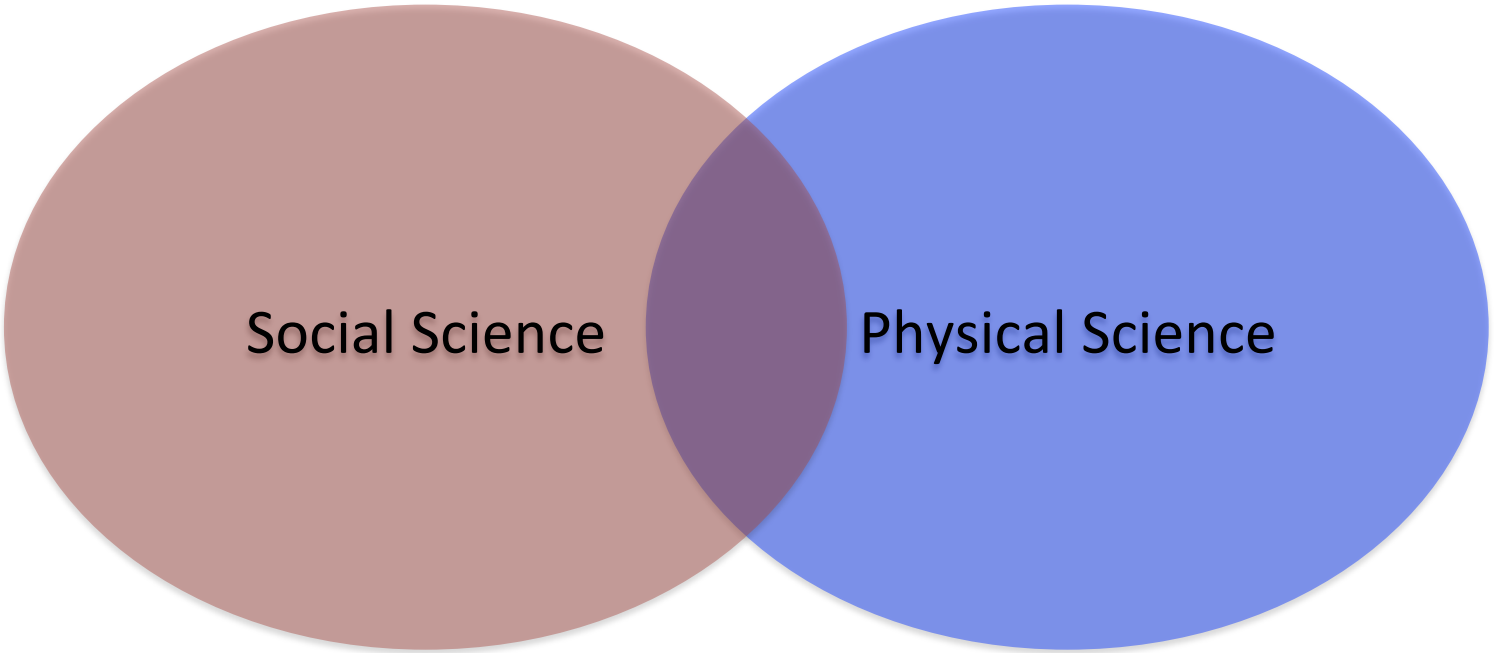
Application of VIC Hydrological Model for Quantification and Mapping of Flood Regulating Ecosystem Services in Arizona, USA: Land and Water Management Implications

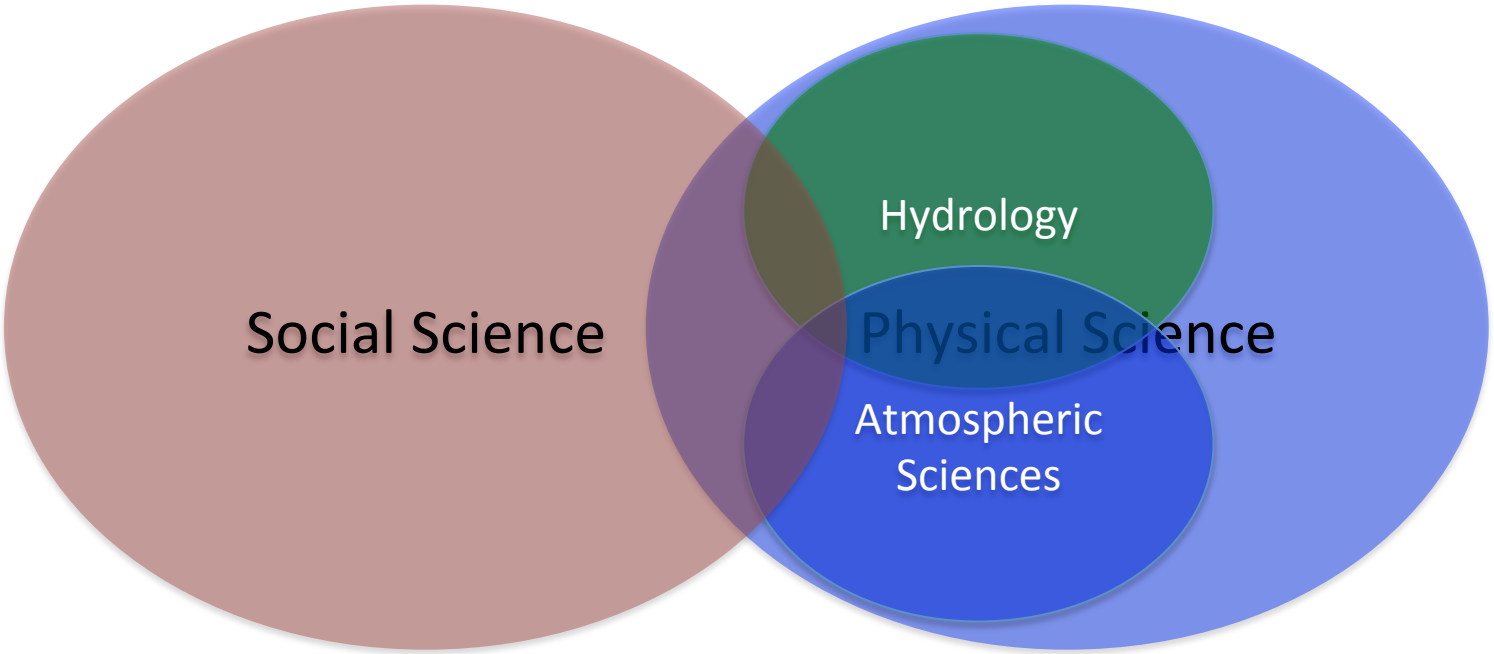
- Assessment of the capacity of different land cover types to regulate floods in semi-arid areas
- Application of the VIC hydrological model for quantification of those capacities

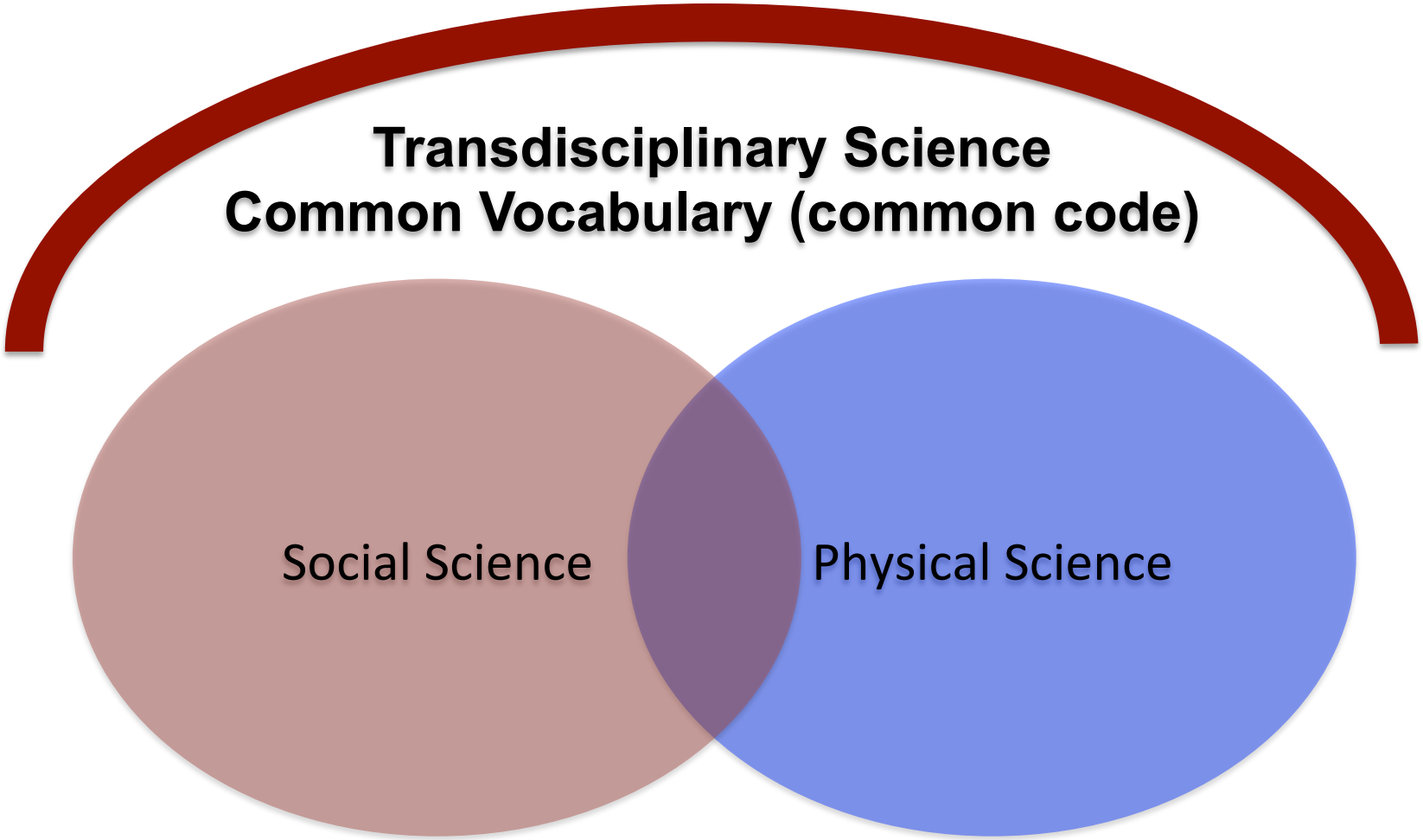




NLCD National Land Cover Dataset	Verde
11 Open Water	5
21 Low Intensity Residential	5
22 High Intensity Residential	3
23 Commercial/Industrial/Transportation	5
31 Bare Rocks/Sand/Clay	3
32 Quarries/Strip Mines, Gravel Pits	4
33 Transitional	2
41 Deciduous Forest	1
42 Evergreen Forest	0
43 Mixed Forest	0
51 Shrubland	5
61 Orchards/Vineyards	4
71 Grasslands/Herbaceous	4
81 Pasture/Hay	5
82 Row Crops	5
83 Small Grins	4
84 Fallow	4
85 Urban/Recreational Grass	3
91 Woody Wetlands	5
92 Emergent Herbaceous Wetlands	3


Social Science
Physical Science


Social Science
Hydrology
Physical Science
Atmospheric Sciences


Transdisciplinary Science
Common Vocabulary (common code)
Social Science
Physical Science