



Mapping Flood Risk at a Hyper-Local Level: Using Census Data to Identify Cultural and Socioeconomic Factors Influencing Mitigation Efforts

Erin Jordan, University of Arizona, PhD Candidate in Arid Land Resource Sciences
Committee Chair: Mike Crimmins

Graduate Interdisciplinary Program in
Arid Lands Resource Sciences

INTRODUCTION

Communities are the first and last line of defense against the harmful impacts of natural disasters. Using census and county assessor's data to determine hyper-local areas of current and future risk, residents and city managers can make better-informed decisions regarding mitigation of that risk to individuals and the community as a whole. But to effectively reduce risk, the information needs to be tailored to ensure the population is engaged in mitigation activities. Research shows varying degrees of socioeconomic status as well as cultural factors can influence individual and collective behaviors. Determining how these behaviors affect mitigation efforts before, during, and after a disaster allows governments and insurance companies to better direct resources intended to reduce loss.

OBJECTIVES

- Combine flood zone maps with census block and county assessor's data to gain insight about vulnerability within the community at a hyper-local level.
- Determine how race, cultural, and socioeconomic backgrounds vary within and between flood zone classifications.
- Create a base of knowledge by which to measure future changes in flood zone habitation and flood risk knowledge.



STUDY AREA

The study area was determined by 32 zip codes that make up the Tucson Metropolitan Area (TMA), the most densely populated portion of Pima County, Arizona. The majority of flood plains in this area are associated with ephemeral streams, which do not run year-round but instead only run during and immediately following precipitation events.



DATA AND METHODS

➤ Flood zone data were acquired from Pima County Geographic Information Systems (GIS). Four flood zone classifications were analyzed in this study. Two are defined by FEMA's Nation Flood Insurance Program (NFIP) and two are defined by the Pima County Regional Flood Control District (PCRFCD).

NFIP 100-Year: known as the Special Flood Hazard Area; 100-year flood plains as determined by Digital Flood Insurance Rate Maps (DFIRMS) issued by FEMA.

NFIP 500-Year: 500-year flood plains as determined by DFIRMS issued by FEMA.

➤ Census data for the year 2000 and 2010 were acquired from the U.S. Census Bureau and Pima County GIS. The Area Proportion Method was used to estimate flood zone populations.

Total: includes population of all races, ancestry, or ethnicity.

Hispanic: includes all people of Hispanic or Latino descent.

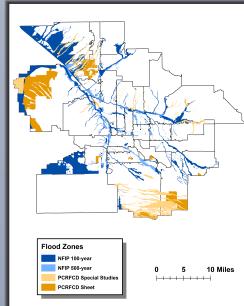
Median Household Income (MHI): determined by the American Community Survey 5-Year estimate 2006 to 2010.

➤ **Median Total Full Cash Value (TFCV):** obtained from the Pima County Assessor's Office and Pima County GIS; only land parcels with a Property Use Code indicating Single Family Residential (5 acres or less) according to the Arizona Department of Revenue were analyzed in this study; data updates range from 2006 to 2014.

➤ Esri's ArcMap 10.0 in ArcGIS and Excel were used for data processing and analysis.

PRELIMINARY RESULTS

TMA Flood Zone Map



Total TMA: 983.99 Mi²

Area Covered By:

FLOOD ZONE	AREA IN MI ²	% LAND IN FLOOD ZONE
100-year	104.11	10.58%
500-Year	16.75	1.70%
Special Studies	40.39	4.10%
Sheet	42.50	4.32%
All Flood Zones	203.70	20.71%

Note: There is 12.71% overlap of the 100-year and Special Studies. The overlap is non-existent or negligible between other flood zones.

Total Population

	2000	2010	% Increase
All TMA	765583	852216	10.17%
100-year	40515	49591	18.30%
500-year	29107	35313	17.58%
Special Studies	7517	8942	15.94%
Sheet	15698	17228	8.88%
All Flood Zones	92837	111074	16.42%

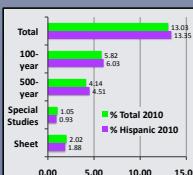
Hispanic Population

	2000	2010	% Increase
All TMA	231503	307507	24.72%
100-year	12469	18531	32.71%
500-year	9839	13873	29.08%
Special Studies	1652	2867	42.36%
Sheet	4280	5790	26.09%
All Flood Zones	28240	41060	31.22%

% Population Increase 2000 to 2010



% Population in Flood Zones 2010



% Population in Flood Zones

	2000 Total	2000 Hispanic	2010 Total	2010 Hispanic
100-year	5.29%	5.39%	5.82%	6.03%
500-year	3.80%	4.25%	4.14%	4.51%
Special Studies	0.98%	0.71%	1.05%	0.93%
Sheet	2.05%	1.85%	2.02%	1.88%
All in Flood Zones	12.13%	12.20%	13.03%	13.35%

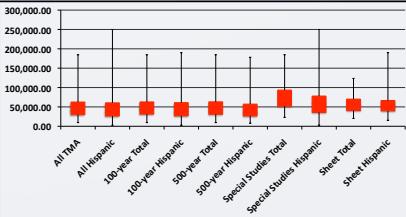
Median Household Income

Total Full Cash Value

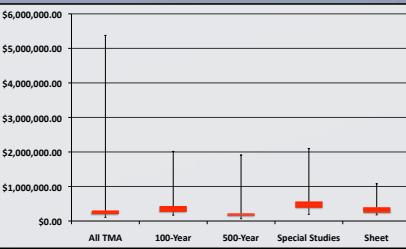
	Total	Hispanic
All TMA	\$42745.00	\$37980.50
100-year	\$44604.50	\$37937.50
500-year	\$43438.50	\$36719.00
Special Studies	\$73750.00	\$61063.00
Sheet	\$56287.00	\$54500.00
All Flood Zones	\$48295.00	\$42788.50

	Total
All TMA	\$131561.00
100-year	\$153418.00
500-year	\$119812.00
Special Studies	\$287656.00
Sheet	\$126130.00
All Flood Zones	\$135945.00

MHI Range for TMA Populations



TFCV Range for Total Population



SUMMARY

- Nearly 21% of the TMA land is covered by at least one flood zone classification. The additional PCRFCD flood zone mapping added 8.42% land to this total, which is over 40% of the identified flood zones in the TMA.
- Between 2000 and 2010 the TMA Total population increased by 10.17%, but the flood zone population increased by 16.42%.
- The Hispanic population had a larger increase with nearly 25% growth between 2000 and 2010 in the TMA. However, the increase of the Hispanic population in all flood zones was 31.22%, nearly twice the increase of the Total population for all flood zones.
- Between 2000 and 2010 all flood zones showed an increase of population for both Total and Hispanic populations.
- The percent of Hispanic population living in FEMA 100-year and 500-year flood zones was greater than the Total population. It was also greater for all the flood zone populations added together.
- The MHI and TFCV were greater for the PCRFCD Special Studies and Sheet flood zones compared to the FEMA 100-year and 500-year flood zones, plus the MHI and TFCV for the entire TMA.
- The Hispanic population MHI was lower for the TMA and all flood zones compared to the MHI for the Total population.
- There are large outliers in the MHI and TFCV data, which resulted in large margin of errors.

NEXT STEPS

- Meet with the Arizona Statistics Consulting Laboratory at the University of Arizona for assistance in additional analysis.
- Investigate why there is flood zone overlap and the possible impact on data.
- Conduct a residential survey about flood risk knowledge and perception, as well how different parts of the community view factors that could mitigate that risk. This survey will be targeted at neighborhoods at least partly located in flood zones.

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