Changes in Cropping Intensity in Phoenix, Arizona and Its Implications for Future Agricultural Water Use

Chao Fan[1], Baojuan Zheng[1], Soe W. Myint[1,2], & Rimjhim Aggarwal[2]

[1]School of Geographical Sciences and Urban Planning, Arizona State University; [2]School of Sustainability, Arizona State University

Central Arizona-Phoenix Long-Term Ecological Research
CAP LTER

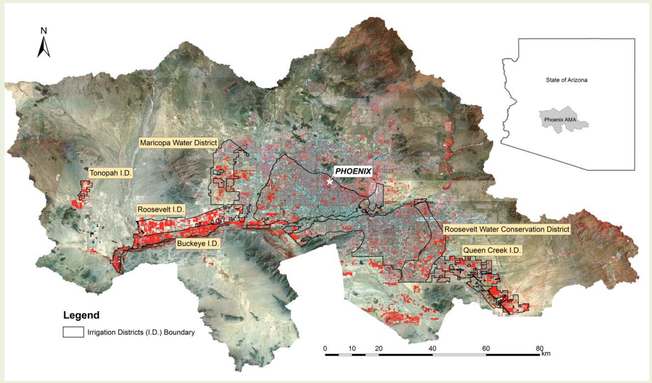
1. Introduction

Cropping intensity is defined as the number of crops per year in a unit area of cropland. The pattern of cropping intensity varies widely in space and time due to an array of factors such as land cover changes, socio-economic factors, water availability, soil type, and climate variability. The Phoenix Active Management Area (PHX AMA) has experienced dramatic land conversion from agricultural lands to urban land uses since 1970s. Our study aims to develop a systematic methodology for measuring changes in cropping intensity given the specific cropping patterns in this region. Improved understanding on agricultural practices, especially cropping intensity and its change over time may provide significant implications on resource management, food security, and ecological and economic planning.

2. Research Objectives

- Develop an effective methodology to identify and monitor cropping intensity using time series remotely sensed data.
- Examine how agricultural lands and cropping intensity in PHX AMA has changed from 1995 to 2010.

3. Study Area



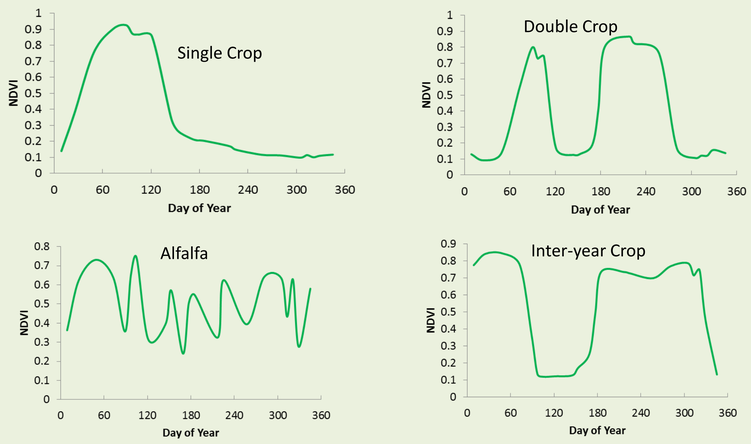
4. Materials and Methods

Materials:

- 12 Landsat scenes for 1995; an average of 22 scenes for 2000, 2005, & 2010
- Reference data come from local growers, USDA Farm Service Agency (FSA), and Cropland Data Layer (CDL) from NASS.

Methods:

- A peak detection algorithm was developed to identify cropping intensity in PHX AMA.
- Specialized procedures were implemented to address inter-year issues and to successfully distinguish double crops and alfalfa.



4. Results

Cropping Intensity Maps

1995

2000

2005

2010

Classification Accuracy

	Single crops		Double crops		n	Overall accuracies
	Producer's	User's	Producer's	User's		
1995	97%	100%	100%	78%	544	97.6%
2000	99%	99%	93%	88%	540	98.0%
2005	99%	98%	90%	96%	532	98.1%
2010	100%	99%	89%	96%	493	99.2%

Total Area of Croplands for 1995, 2000, 2005 & 2010

	Ag. Lands (m^2)	Double-crop lands (m^2)	Double-crop lands %
1995	814,988,700	68,460,300	8.40%
2000	607,719,600	62,351,100	10.26%
2005	567,656,100	57,322,800	10.10%
2010	439,294,500	38,761,200	8.82%

5. Conclusions

- We devised an effective peak detection algorithm to detect cropping intensity accurately with overall accuracies > 97%.
- The algorithm has yielded a higher classification accuracy for single crops than for double crops.
- The percentage of double-crop croplands increases from 8% to 10% from 1995 to 2000.
- The increases of double cropping practices from 1995 to 2000 suggest intensification of agricultural activities in the PHX AMA.
- The percentage of double-crop lands in 2010 dropped back to the level in 1995 possibly due to several major factors, such as climate condition, water availability, and agricultural market.

6. Future Work

- Conduct analyses on cropping intensity at irrigation district level.
- Examine how land and commodity prices, water availability, and climate variability may have impacts on spatial-temporal changes in cropping intensity and its implications on agricultural water use.

7. Acknowledgement

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