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LOCAL FIRST ARIZONA
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MarCo

Education & Engagement
Work Group

Agricultural Water Use in Maricopa County

Maricopa County, the fourth most populous and fastest growing county in the United States,[1] has a desert food system facing unique challenges. Home to over 4.5 million residents, including a portion of the Gila River Indian Community (GRIC), the region faces daunting land, water, and development challenges. While municipal water rights are high priority and have an ensured supply for the next 100+ years, agricultural water availability is subject to a different future.

Recognizing local food production as a priority for land and water use is imperative to safeguard community health and local food security. In light of increasing pressures on community farmers, the Maricopa County Food System Coalition (MarCo) has prepared this agricultural water brief to highlight key findings from the 2019 Comprehensive Regional Food Assessment[2] and summarize preliminary findings from the 2019 report, 'Local Food in the Sonoran Desert: How Water And Land Influence Production'.[3] The purpose is to educate and empower Coalition members and civic leaders to be informed advocates of urban agriculture and a strong local food system.

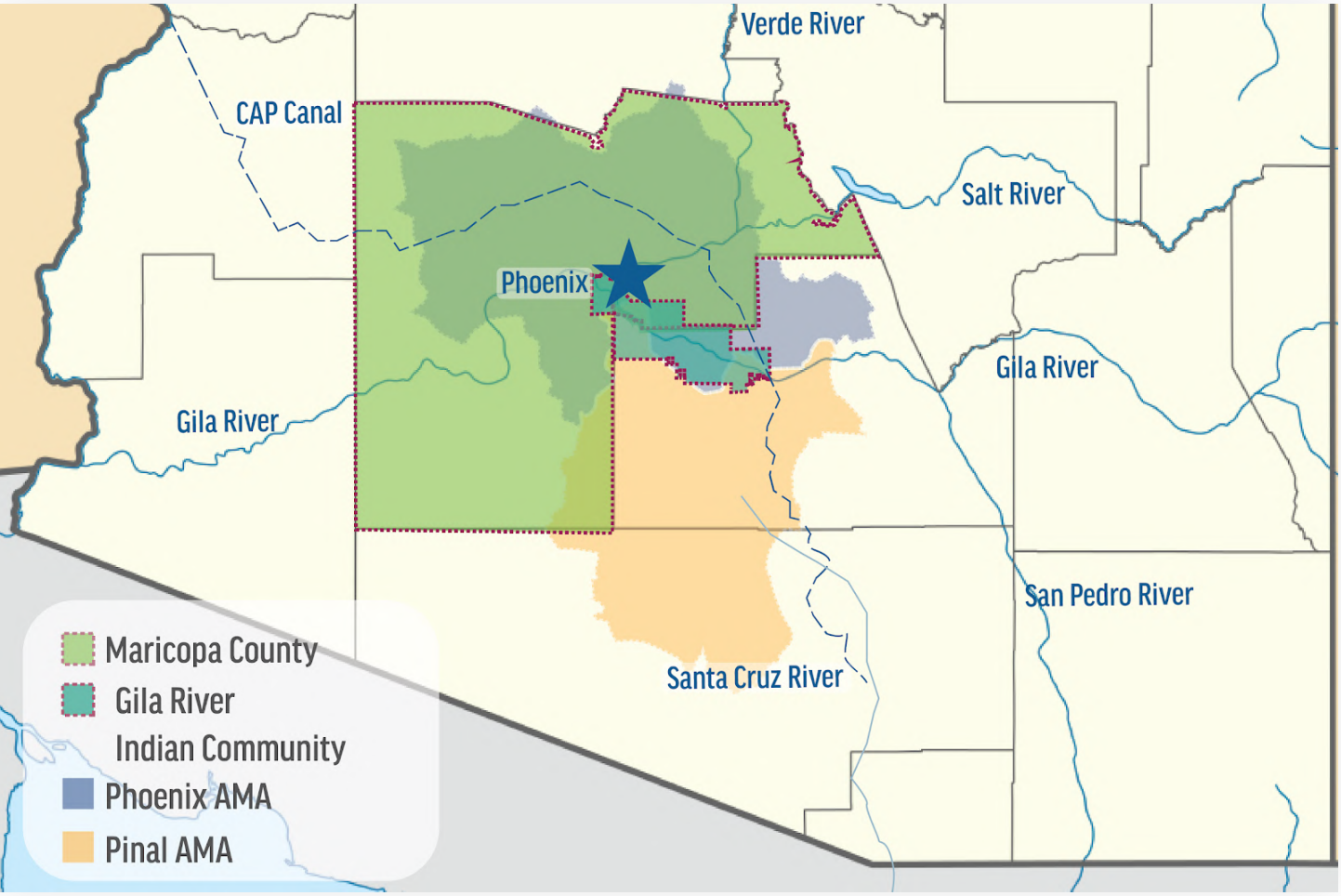

Figure 1. Regional map of South Central Arizona, depicting regional surface waterways, county and GRIC boundaries, and overlapping Active Management Areas (AMAs).

[1] United States Census Bureau. March 2020. Most of the Counties with the Largest Population Gains Since 2010 are in Texas. Retrieved from https://www.census.gov/newsroom/press-releases/2020/pop-estimates-county-metro.html [2] Maricopa County Food System Coalition. 2019. A comprehensive food assessment for Maricopa County: A desert food system facing unique challenges. Retrieved from https://marcofoodcoalition.org/assessment-2020/ [3] Falvo, G. 2019. Local Food In The Sonoran Desert: How Water And Land Influence Production. Retrieved from https://grantfalvo.wixsite.com/sonorandesertreport

The Lay of the Land:

A Brief History

Maricopa County spans the confluence of multiple watersheds, including those of the Agua Fria, Gila, Salt, and Verde Rivers. The timeline on the right highlights key events that have influenced the present-day agricultural water landscape. It is important to also consider the central role indigenous peoples play in this history.

As early as 300 BCE, the Hohokam peoples began to establish robust agricultural operations across the region, constructing a network of over 500 miles of irrigation canals by hand. This network became the foundation of the modern-day canal system that serves the region. They were succeeded by the Akimel O'odham ("river people") who thrived as an agriculturally based community intimately connected with the waterways.[4]

Over the next few centuries, the Akimel O'odham (Pima) continued to thrive and allied with the Piipaash (Maricopa) tribe, with whom they shared space, resources, and continued to develop irrigation systems for agriculture. Following the Gadsden Purchase in 1854, American settlers arrived and developed structures to divert much of the water of the Gila River that supported native agriculture, leading to a loss of self-sufficiency and mass starvation. This drove a group to migrate 30 miles north to the Salt River for survival. By 1883, the Akimel O'odham and Piipaash were confined to the Gila River Indian Community and Salt River Pima-Maricopa Indian Community reservations.[5]

300 BCE to 1450 AD

Hohokam peoples establish robust irrigation and agricultural systems. They are succeeded by the Akimel O'odham peoples.

Mid 1800s

The Akimel O'odham allied with the Piipaash tribe, with whom they shared space, resources, and continued to develop irrigation systems for agriculture.

Late 1800s

American settlers arrived and diverted much of the water of the Gila River that supported native agriculture. The Akimel O'odham and Piipaash were confined to the Gila River Indian Community and Salt River Pima-Maricopa Indian Community reservations.

1903

Settlers form the Salt River Water Users' Association, now known as the Salt River Project (SRP). This results in 7 dams and 131 miles of canals that bring water from the Verde and Salt Rivers to the Valley.

1922

Arizona (along with California, Colorado, Nevada, New Mexico, Utah, and Wyoming) enters into the Colorado River Compact.

1973

Construction begins on the Central Arizona Project (CAP) Aqueduct to divert Colorado River water to the Phoenix and Tucson metro areas.

1980

Following the depletion of water from unregulated wells, the Groundwater Management Act is passed, creating Active Management Areas.

2004

After decades of legal challenges by the Gila River Indian Community in response to water deprivation, the Arizona Water Settlements Act is signed into law, guaranteeing water rights and funding for water infrastructure for tribal communities.

[4] Gila River Indian Community. 2007. Animal O'Odham - Pee Posh: Our Community Our Future. Retrieved from: http://gilariver.org/pdfs/exec/GRIC-PressKitMagazine-FALL2007.pdf [5] Gila River Indian Community. 2007.

By the late 1800s, drought conditions and an increase in the region's population and agricultural water demands led to water shortages. To secure access to a greater volume of water, settlers involved in farming and ranching banded together to pledge these newly claimed lands as collateral to obtain federal financing through the National Reclamation Act. Together, they formed the Salt River Valley Water Users' Association in 1903. Later to be known as the Salt River Project (or "SRP"), the collaboration operated and maintained the waterways and distribution of water, ultimately building 7 dams and 131 miles of canals that brought water from the Verde and Salt Rivers to the Valley. SRP's planning and vast infrastructure played a key role in supporting the agriculture that dominated the region.[6]

In 1922, Arizona entered into the Colorado River Compact along with California, Colorado, Nevada, New Mexico, Utah, and Wyoming, ensuring the state access to 2.8 million acre-feet of water per year. As the state's population grew, settlers also drilled wells to draw upon groundwater. By the mid-20th century, civic leaders needed to address the major depletion of groundwater from these unregulated wells.

In 1973, construction began on the Central Arizona Project (CAP) Aqueduct to divert Colorado River water to the more populous Phoenix and Tucson metro-areas, and reduce the use of groundwater for agriculture and other activities. The CAP is the largest renewable water supply in Arizona. It delivers water to a variety of users including municipal, agricultural, and indigenous communities by way of a 336 mile aqueduct that terminates near Tucson.[7] To further protect groundwater resources, the state passed the 1980 Groundwater Management Act, which strictly regulates the use of groundwater in newly created Active Management Areas (AMAs). Two AMAs are located within portions of Maricopa County: the Phoenix AMA and the Pinal AMA (Figure 1).[8]

Following years of famine and mass starvation, the Gila River Indian Community pursued decades of legal challenges against the U.S. government.[9] This resulted in the Arizona Water Settlements Act of 2004. This federal legislation guaranteed the Gila River Indian Community water rights and provided funding for infrastructure to utilize their guaranteed water allocation, primarily from the CAP.[10]

[6] Salt River Project. 2017. The Story of SRP: Water, Power, and Community. Retrieved from: https://www.srpnet.com/about/history/StoryofSRP_HistoryBook.pdf [7] CAP: Background & History. 2016. Retrieved from: https://www.cap-az.com/about-us/background [8] Arizona Department of Water Resources (ADWR). 2010. Arizona Water Atlas. Volume 8: Active Management Areas Water Atlas. Retrieved from https://infoshare.azwater.gov/docushare/dsweb/Get/Document-10433/Volume_8_final.pdf
[9] Gila River Indian Community. 2007. DeJong D. 2014. [10] Navigating the Maze: The Gila River Indian Community Water Settlement Act of 2004 and Administrative Challenges. American Indian Quarterly. Winter. vol. 38, no. 1.

Current Agricultural Water Use

Farmers in Maricopa County use a combination of three main water sources: (1) groundwater, (2) Colorado River water through the CAP, and (3) surface water from the Salt and Verde Rivers through the SRP. Some farms also have access to highly treated wastewater known as effluent, though this is a small percentage of total water use (Figure 2).

The water sources that a farmer uses for irrigation vary across the county, but depend largely on the parcel's proximity to surface water sources and the CAP. For example, East Valley farms tend to irrigate with surface water, while West Valley farms depend largely on groundwater. CAP's agricultural water users consist primarily of large irrigation districts that deliver water to farmers. Irrigation districts may utilize different water sources due to cost, availability, and to ensure that they meet conservation requirements within the AMAs. SRP is the largest irrigation district within the Phoenix AMA.[11]

Over time, Maricopa County has seen a decline in agricultural water use that corresponds directly with farmland being taken out of agricultural use (Figure 3). Additionally, the county has had a high degree of concentration in agricultural water users for nearly a century: since 1925, about 50 farms have controlled two-thirds of the county's agricultural land, or approximately 340,500 acres based on the 2017 Census of Agriculture.[12] Each of these farms is larger than 2000 acres, and most grow predominantly water intensive crops, such as alfalfa and cotton.

It is important to note that water used for agriculture is not all consumptive: the Arizona Department of Water Resources, the state agency tasked with securing Arizona's water future, estimates that one-quarter to one-third of all water that falls on or is spread on agricultural fields recharges the aquifer below.[13]

Furthermore, from community gardeners to production farmers, water is a chief input cost for growers. Margins for farming are extremely low, and thus it is most often in a farmer's best interest to conserve water to minimize the costs of production.

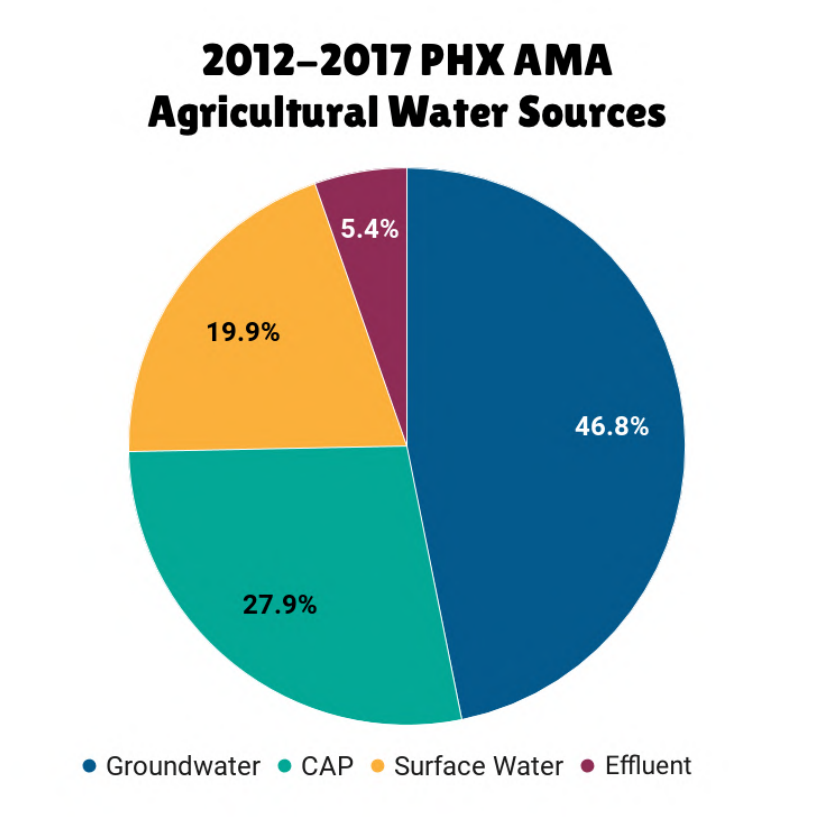

Figure 2. Average annual portfolio of agricultural water use in the Phoenix AMA from 2012 to 2017. *Note: Reprinted from Local Food In The Sonoran Desert: How Water And Land Influence Production, by Grant Falvo, 2019. Retrieved from https://grantfalvo.wixsite.com/sonorandesertreport*

[11] ADWR. 2018. Arizona Department of Water Resources. Phoenix Active Management Area Annual Water Use Data Historic Template and Summary 1985-2017. Retrieved from https://new.azwater.gov/ama/ama-data [12] USDA National Agricultural Statistics Service, 1900-2017 Census of Agriculture. [13] Arizona Department of Water Resources (ADWR). 2018. Phoenix Active Management Area Annual Water Use Data Historic Template and Summary 1985-2017. Retrieved from https://new.azwater.gov/ama/ama-data

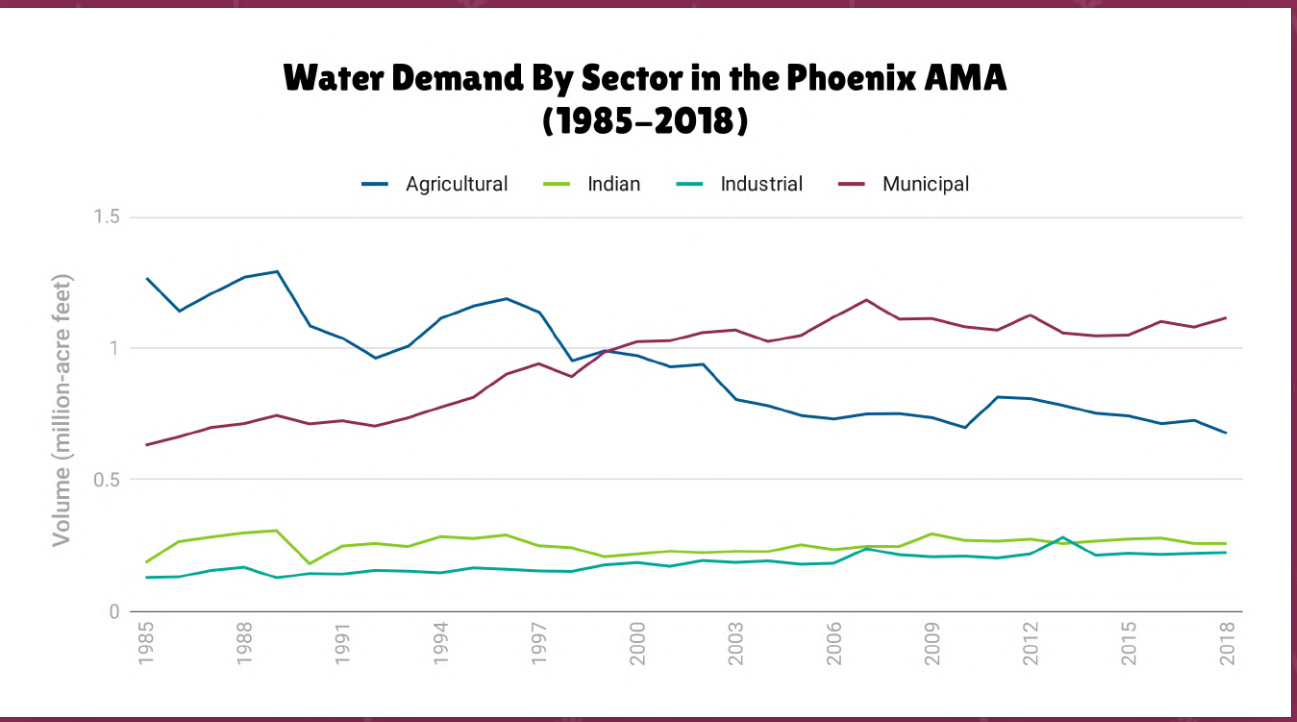

Figure 3. There have been significant shifts in water demand by sector since 1985. Decreases in overall agricultural water demand and increases in municipal water demand reflect population growth and land use trends *(Source: Arizona Department of Water Resources).*

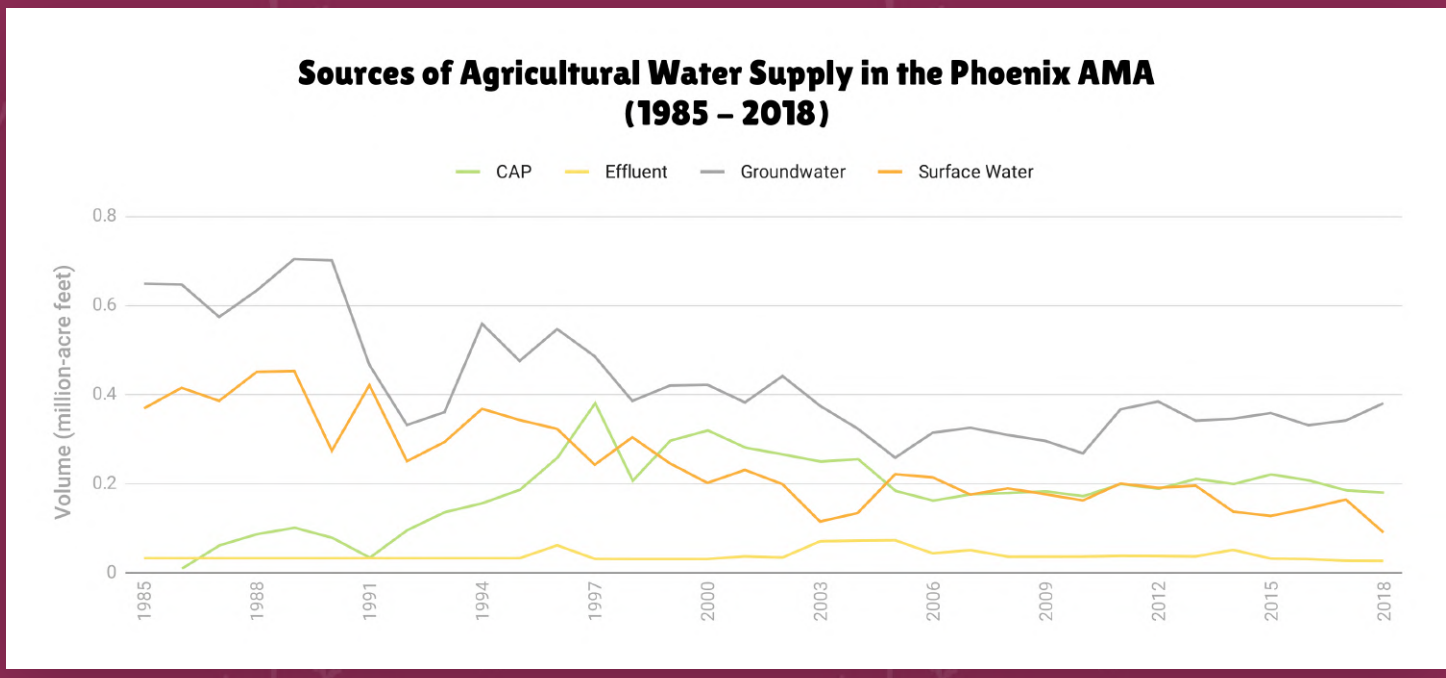

Figure 4. Since 1985, there has been an overall decline (~50%) in the use of groundwater and surface water. About a third of this decline is abated by the increased use of CAP water *(Source: Arizona Department of Water Resources).*

Threats to Water Access for Local Farms

There are policy and climate change related threats to all three of the county's primary sources of agricultural water. Relevant threats and implications for each source of water are outlined in the table below.

	Policy	Climate Change
Surface Water	Farmers that have land in the service district recognize that access to SRP gives their land a high value, as do developers and land speculators.	Though historically a renewable and reliable source for water, a study of the potential effects of climate change-induced temperature and precipitation regimes projects that the Salt and Verde watersheds will yield substantially less runoff than they historically have by mid-century, largely due to increased evapotranspiration due to an increase in temperature.[14]
Groundwater	The 1980 Arizona Groundwater Management Act (GMA) was adopted to safeguard the region's water supply. This significant regulation for county farmers can be summarized as follows: groundwater pumping on a parcel of land greater than 2 acres in size for agricultural purposes is illegal within the Phoenix AMA unless the land has an irrigation grandfathered right (IGR) which must have been legally obtained by proving productive irrigation use from 1975-1980 and must not have been taken out of use since. If taken out of agricultural use (excluding agricultural land left fallow), the irrigation right is extinguished permanently. The GMA also prohibits irrigation of new agricultural lands within AMAs, sets maximum annual groundwater allotments, and requires farmers to show improved irrigation efficiencies over time. These regulations, coupled with population growth, have resulted in the urbanization of over 130,000 acres of agricultural land in the Phoenix AMA since 1984.[15]	The region's groundwater has been pumped out more rapidly than it is being replenished by nature, leading to overdraft and aquifer compaction resulting in ground subsidence. According to the Arizona Water Atlas,[16] "Over time, groundwater declines can lead to increased pumping costs, declining water quality, riparian damage, land subsidence, land fissuring and permanent compaction of the aquifer." The annual temperature of the Phoenix Metro Area rose 6.5°F between 1895 and 2018, exacerbating groundwater decline.[17] The majority of this increase can be attributed to the urban heat island effect, as evidenced by relatively lower temperature increases in rural municipalities during the same time period.[18] As temperatures continue to rise, water used for farmland will likely recharge the aquifer (groundwater stores) less efficiently.
CAP Water	Within the CAP system, water is distributed to users based on a priority scheme. Native American communities and municipal and industrial customers have high priority. Agricultural users are part of the lowest priority category of excess water, or water not ordered under long-term CAP-contracts. The Colorado River Basin Drought Contingency Plan (DCP) was adopted in 2019 in response to the high likelihood of impending water shortages at Lake Mead. When activated, the DCP places limits on water allocated to Arizona agriculture. This cut will amount to 21.3% of Arizona's CAP water and 11.4% of Arizona's total Colorado River water allocation. This will increase the cost of agricultural water for some Maricopa County farmers (by approximately 21-28%)[19] and will disproportionately impact growers with access to less water, fewer entitlements, and insufficient capital to afford CAP water. Native American communities such as the Gila River Indian Community will not experience these early water cutbacks as they share higher-priority CAP supplies and have received water settlements from the federal government.[20]	The DCP will become increasingly restrictive as the water level in Lake Mead continues to drop. This problem is likely to get worse given warming climate trends. Severe drought conditions and rapid evaporation have contributed to the declining water supply at Lake Mead. Continued drought conditions are expected to occur in the coming decades, and streamflow on the Colorado river is projected to decrease over the next century. Estimates of the exact decrease vary dramatically from less than 10% to 45%.[21]

[14] Ellis A, Hawkins T, Balling Jr. RC, Gober P. 2008. Estimating future runoff levels for a semi-arid fluvial system in central Arizona, USA. Climate Research. Vol. 35: 227-239. [15] ADWR. 2010. Arizona Water Atlas. [16] Ibid. [17] National Ocean and Atmospheric Administration (NOAA). 2019. Phoenix, Arizona Online Weather Data. National Weather Service Forecast Office. Retrieved from NOWData at https://w2.weather.gov/climate/ [18] NOAA. 2019. [19] Central Arizona Project Finance and Accounting Department. 2017. Comprehensive Annual Financial Report For the Fiscal Year Ended December 31, 2016. Retrieved from https://www.cap-az.com/documents/departments/finance/2016-Comprehensive-Annual-Financial-Report-CAFR.pdf [20] CAP: Colorado River Issues. 2016. Retrieved from: https://www.cap-az.com/departments/planning/colorado-river-programs/colorado-river-issues. [21] Vano, J., Udall, B., Cayan, D., Overpeck, J., Brekke, L., Das, T., Hartmann, H., et al. 2014. Understanding Uncertainties in Future Colorado River Streamflow. American Meteorological Society. January, 59-78.

Despite these threats, many community farmers interviewed for the Comprehensive Regional Food Assessment reported having ample water access at the time, if only because they farm on leased land with secured water rights.[22] However, as most community farmers in Maricopa County lease their lands and few are landowners themselves, several are imminently losing, or at risk of losing, their farmland due to development pressures. For those forced to move their farm operations due to land sale or loss of lease, finding new parcels within the county with suitable soils and water rights becomes more challenging by the day.

[22] Meter, K., Goldenberg, M., & Ross, P. 2018. Building Community Networks Through Community Foods. Retrieved from http://www.crcworks.org/azmaricopa18.pdf

Food for Thought

Water is one of the most critical resources for food production. However, a number of threats to water access will ultimately limit Maricopa County's capacity to increase urban farming and sustain local agriculture. As the population grows and environmental factors such as climate change and drought reduce water availability, agriculture must compete with urban development – which uses considerably less water than farmland – to hold on to the water and land it needs. Both of these resources are regulated in favor of urban development.

Since 1980, water use in Arizona has decreased as a result of retiring agricultural lands, conservation efforts of farmers and municipalities, and the increased use of reclaimed water.[23] While managing our precious water resources is vital in face of this continued growth, losing the county's farms entirely would have grave consequences for our community's health, environment, and local economy. If we wish to preserve our diverse agricultural heritage and grow a food system that is healthy, equitable, sustainable, and thriving, decision makers will need to take steps to prioritize both water and land for food production to serve local markets.

MarCo identifies the following opportunities to address threats to water access for farms in Maricopa County. In this process, it is imperative to uphold tribal water rights and recognize tribal sovereignty in making decisions for water use.

[23] Eden, S., M. Ryder and M.A. Capehart. 2015. Closing the Water Demand-Supply Gap in Arizona. Arroyo. University of Arizona Water Resources Research Center, Tucson, AZ. Retrieved from http://wrrc.arizona.edu/publications/arroyo-newsletter/arroyo-2015-Closing-Demand-Supply-Gap

Advance policies, programs, and incentives that conserve agricultural land.

Urban agriculture – including the urban land and water required for it – is critical to the future of Maricopa County. Stakeholders should explore urban development models that can accommodate both a growing population and prevent the loss of farmland to support that population. Conserving agricultural land is one of the most effective ways to preserve water access for community farmers. Examples of conservation strategies and policies include land banking, agricultural land easements, the transfer or purchase of development rights, community land trusts, and farmer to farmer land title transition incentives. Identifying appropriate local solutions will require invested participation from land holders, farmers, and civic leaders.

Elevate local food production as a priority for water use.

Urban farms increase access to fresh and affordable foods, preserve green space, strengthen social integration, safeguard environmental health, and provide essential regional food security. Despite the fact that land in agricultural production requires more water resources than land under housing developments, urban farms are integral to the well-being of individuals and communities in Maricopa County.

Prioritizing urban agriculture in Maricopa County is not just about community health and creating vibrant community spaces. Agriculture has also been a significant source of the county's revenue and jobs. According to a 2017 economic contribution analysis completed for MarCo's Regional Food Assessment, on-farm agriculture in Maricopa County is a $1.95 billion per year industry. On-farm agriculture directly and indirectly supported roughly 14,200 jobs in the Maricopa County economy, of which an estimated 9,190 were directly supported on-farm.[24] If there is no land on which to farm with access to reliable water sources, these jobs and this revenue will at best, move, and at worst, disappear.

Urban farms that grow fruits and vegetables to serve local markets (such as Farmers Markets, Community Supported Agriculture (CSAs) and local schools, hospitals, and restaurants) provide many economic and community health benefits and should be prioritized accordingly.

Explore incentive programs for investing in sustainable and innovative water conservation efforts by community farms.

Farmers are continuously developing and implementing new practices to reduce water use, such as installing drip irrigation lines or making other improvements to irrigation systems, planting low-water use and drought-tolerant crops, applying compost and mulch, or implementing other strategies that increase water retention capacity of fields. However, as farm incomes have steadily declined over the years, it may be financially difficult for some community farms to make additional investments in water conservation. Incentive programs, such as tax rebates that reward conservation efforts, can help offset the sometimes prohibitive costs of these investments.

Additionally, farmers need support in order to shift production to low water-use and drought-tolerant crops. Many crop varieties, such as tepary beans and i'itoi onions, have proven ideal for the harsh desert conditions of the Sonoran Desert and are excellent sources of nutrition; however, they are lesser-known by the general public (and therefore the farm's customer base) and so require extensive consumer, chef, and market education to be a profitable shift for farmers.

[24] Duval, D., A.K. Bickel, G. Frisvold, X. Wu, and C. Hu. 2018. Contribution of Agriculture to the Maricopa County and Gila River Indian Community Economies. Department of Agricultural and Resource Economics Cooperative Extension, The University of Arizona.

Ultimately, addressing threats to agricultural water availability will require civic leaders and residents alike to assign their own value to urban farms and prioritize accordingly.

While growth is an inevitable and encouraged trajectory for Maricopa County, we have lost over 50% of the region's farmland and we will continue to lose farmland to urban development unless action is taken to address this issue.

The Maricopa County Food System Coalition urges recognition of the fact that our cities would not exist were it not for the vast water infrastructure installed, specifically to support agriculture. This infrastructure can safeguard our strong agricultural heritage, our long-term food security, and ensure that Maricopa County is a healthy, sustainable, and delicious place to live for generations to come.