October 16, 2018

Resolution 2018-____ in Support of the 2018 Sustainable Action Plan for County Operations

The County has a long history of protecting the environment and acting responsibly to do so. Our conservation efforts started with creating Catalina State Park in 1974. We have continued this tradition of conservation with the award-winning Sonoran Desert Conservation Plan, which is Pima County’s plan for balancing the conservation of our cultural and natural resources while maintaining an economically vigorous and fiscally responsible community. This final plan, completed in 2017 was started in 1998, or nineteen years later. It took a great deal of time to achieve community consensus on our conservation plan. The Plan succeeds because it seeks to balance growth and conservation to protect and preserve the natural and cultural landscape of the Sonoran Desert.

One significant outgrowth of the conservation plan was to additionally focus on sustainability measures to balance how best to achieve the social, economic and environmental well-being of the region, especially in light of ongoing climate change. The Southwest is already the hottest and driest region in the United States and, according to climate models; these trends will intensify in the coming decades. Harsh conditions coupled with other stresses—water shortages and a growing population in the greater Southwest (expected to increase by nearly 70 percent by 2050 according to the US Global Change Research Program)—have created a region acutely vulnerable to climate change impacts. In fact, the Southwest is considered one of the planet’s “climate change hotspots.”

Pima County acknowledges these climate challenges and has worked for the last 11 years to make its overall operations more sustainable. On May 1, 2007, the Board of Supervisors unanimously adopted Resolution No. 2007-84, which set forth a series of initiatives designed to promote and advance sustainability in County operations. This resolution provided the basis for the 2008 Sustainable Action Plan for Pima County Operations (SAPCO), which recommended a multi-faceted approach toward implementing more sustainable practices. The 2014 update to SAPCO further reaffirmed our sustainability commitments and created a more rigorous methodology for measuring progress. As a result of these ongoing efforts, the County has made important progress and realized a number of cumulative benefits since the adoption of the first Sustainable Action Plan for County Operations in 2008:

- 13.48 megawatts of solar photovoltaic installed
- 5 buildings have received LEED silver certification or higher
- Nearly 15,000 acre feet of reclaimed water used for groundwater recharge since 2008
- More than 170,000 Mt CO₂e emissions avoided
- Five County parks and 47.95 miles of trails established and served by reclaimed water
The Honorable Chair and Members, Pima County Board of Supervisors
Re: Resolution 2018- _____ in Support of the 2018 Sustainable Action Plan for County Operations
October 16, 2018
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- Addition of hybrid and fully electric vehicles in the County’s fleet
- Six percent decrease since 2012 in the percentage of County employee (self-reported) tobacco users
- 83,850 acres of natural open space lands conserved
- 604 acres of riparian areas restored
- Four historic properties restored or adaptively reused
- 17 percent increase in the beneficial use of RWRD biogas since 2008
- More than $14 million saved in avoided costs

Cutting Carbon Emissions

In 2017, following the United States withdrawal from the Paris Agreement, the Board passed Resolution 2017-39 and Resolution 2017-51, which committed Pima County to maintaining the United States goal to reduce national carbon emissions 26 to 28 percent below 2005 levels by 2025. As a result, I directed County staff to update the SAPCO accordingly, to reflect our new emissions reduction pledge and climate adaptation strategies outlined in Resolution 2017-51. Consequently, a major emphasis of the 2018-2025 Sustainable Action Plan (Attachment 1) is to reduce carbon emissions through energy conservation and alternative renewable sources and reducing waste.

Building Resilience

Moreover, recognizing that climate variability is already negatively effecting sectors of our environment, economy and community, and will continue to do so, the County has committed to implementing a number of adaptation strategies to bolster climate resilience. Resilience is the ability to prepare and plan for, absorb, recover from, and more successfully, adapt to adverse events that can affect infrastructure, natural systems and public health. SAPCO addresses building resilience through adaptive capacity in sections devoted to water and landscapes, and preparing our workforce for climate extremes.

Science-driven, Collaboratively Designed

In order to integrate the best available science into the new Plan, staff have been working with participating County departments and University of Arizona climate scientists who were invited to a “brown bag” discussion with County staff in the spring of 2018, which resulted in the attached climate brief (Attachment 2). Furthermore, to assure that the proposed sustainability, climate mitigation and adaptation targets in the Plan are practically and feasibly aligned with operations, the Office of Sustainability and Conservation (OSC) facilitated over 50 internal meetings with County Department Directors and key staff to gather their input and ideas. The resulting 2018 Sustainable Action Plan reflects the input by the many departments who will be responsible for implementing the strategies to work towards achieving the County’s sustainability targets.
The Honorable Chair and Members, Pima County Board of Supervisors

Re: Resolution 2018-____ in Support of the 2018 Sustainable Action Plan for County Operations

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The following departments that control and monitor specific operational functions that pertain to the SAPCO have been assigned lead responsibilities in achieving the plan’s goals and targets. They will identify the strategies they are using and provide data for their area of implementation. OSC staff will compile the data provided by departments and in collaboration with each department, prepare an annual report for the Board.

The departments with implementation responsibilities are: Attractions & Tourism (A&T), Community Development and Neighborhood Conservation (CDNC), County Administration (CA), Emergency Management (OEM), Environmental Quality (PDEQ), Facilities Management (FMD), Finance and Risk Management (Risk), Fleet Services (Fleet), Natural Resources Parks & Recreation (NRPR), Procurement, Regional Flood Control District (RFCD), Regional Wastewater Reclamation Department (RWRD), Sustainability & Conservation (OSC), and Transportation (DOT). Other departments may participate as grants or other opportunities arise.

As in the past, the success of the plan depends upon the active engagement of all departments and employees in concerted efforts to conserve water and energy, and to reduce waste, wherever and whenever possible.

This seven-year plan provides a practical framework to implement the County’s commitments to the Paris Agreement and further our overall sustainability objectives that help to create a more resilient economy, a healthier environment and a safer community for our workforce and residents.

Recommendation

I recommend that the Pima County Board of Supervisors adopt Resolution No. 2018-____ and the 2018-2025 Sustainable Action Plan for County Operations to guide the County’s sustainability efforts forward for the next seven years.

Sincerely,

C.H. Huckelberry
County Administrator

CHH/lab – October 3, 2018

Attachments

c: Carmine DeBonis, Jr., Deputy County Administrator for Public Works
   Linda Mayro, Director, Office of Sustainability and Conservation
RESOLUTION 2018 – ____
RESOLUTION OF THE PIMA COUNTY BOARD OF SUPERVISORS
ADOPTING THE
SUSTAINABLE ACTION PLAN FOR PIMA COUNTY OPERATIONS 2018–2025

The Board of Supervisors of Pima County, Arizona finds:

1. In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) adopted an international environmental treaty with the objective to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

2. In 2015, the Paris Agreement, as part of the UNFCCC treaty, was adopted by consensus by 196 state parties including the United States to reduce greenhouse gas emissions.

3. On May 1, 2007 the Pima County Board of Supervisors unanimously adopted Resolution No. 2007-84, which set forth a series of initiatives designed to promote and advance sustainability.

4. Subsequently, the Board of Supervisors unanimously adopted the 2008 and 2014 Sustainable Action Plans for Pima County Operations for implementation.

5. The 2008 and 2014 Sustainable Action Plans for County Operations were successfully implemented through collaboration of County staff and departments.


7. In 2017, the Board of Supervisors adopted Resolution 2017-39 and Resolution 2017-51 formalizing Pima County’s commitment to supporting the United States commitment to the Paris Agreement by pledging to reduce its greenhouse gas emissions 26%-28% below its 2005 levels by 2025 through energy efficiency, fleet electrification, and renewable energy projects; and to implement climate adaptation strategies including green infrastructure and tree planting.

8. Resolution 2017-51 directs County staff to prepare an update to the Sustainable Action Plan for County Operations to reflect the County’s alignment with the Paris Agreement.
NOW, THEREFORE, BE IT RESOLVED THAT THE BOARD OF SUPERVISORS OF PIMA COUNTY, ARIZONA:

1. Continues to support sustaining a livable community through implementing and promoting sustainable practices in County operations that protect the natural, social, and economic well-being of the County through energy and water efficiencies, renewable energy, green infrastructure, environmental stewardship and sustainable food production, green purchasing, waste reduction, and workforce resiliency and preparedness.

2. Adopts the 2018 Sustainable Action Plan for County Operations, a copy of which is attached to this Resolution as Exhibit A.

3. Authorizes and directs the County Administrator and staff to ensure that the 2018 Sustainable Action Plan for County Operations is implemented, beginning October, 2018, for the next seven years by County departments and organizational units.

4. Authorizes and directs the County Administrator and staff to prepare an annual report that summarizes the strategies being used and progress being made in reaching the goals of the 2018-2025 Sustainable Action Plan for County Operations.

Passed and adopted, this _____ day of October, 2018.

Chair, Pima County Board of Supervisors

ATTEST: 

Clerk of the Board

APPROVED AS TO FORM:

County Attorney

REGINA NASSEN

91469 / 00618187 / v2
Sustainable Action Plan for County Operations 2018-2025
The 2018 Sustainable Action Plan for County Operations (SAPCO) was made possible by the continuing support and commitment of the Pima County Board of Supervisors, County Administration, staff from multiple departments, and external experts who devoted time and resources toward updating this plan over the past year. It is through their ongoing work that Pima County has been able to achieve and surpass many of the SAPCO objectives first formalized in Resolution 2007-84.

Questions and comments may be directed to the Pima County Sustainability Manager at SustainabilityPrograms@pima.gov or 520-724-6940.
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The Southwest is already the hottest and driest region in the United States and, according to climate models, these trends will intensify in the coming decades. Harsh conditions coupled with other stresses—water shortages and a growing population expected to increase 70 percent by 2050—have created a region acutely vulnerable to climate change impacts. In fact, the Southwest is considered one of the planet’s climate change hotspots. As a result, Pima County’s economic robustness, environmental quality and public health are at risk. Fortunately, through decisive action to cut greenhouse gas emissions in operations and implement climate adaptation strategies, the County is working to build cross-sector resilience to current and future climate variability.
Human-driven activities have increased greenhouse gas concentrations to levels that are disrupting Earth’s biophysical systems. The rise in regional temperatures—at a rate more rapid than any other state in the contiguous U.S.—have been exacerbated by population growth and conventional urbanization. Unpredictable precipitation patterns and longer snow-free seasons, amplified by the hotter climate, increase the risk of severe and frequent wildfires as well as the prolongation of Arizona’s worst drought in over a century. These rapid shifts jeopardize the reliability of an adequate water supply as well as the vitality of our unique and diverse flora and fauna and consequently, place Pima County on a collision course with climate change.
The environmental consequences of climate change, if unmitigated or unprepared for, frequently translate to financial costs. Higher temperatures, less rainfall, and more extreme weather events often lead to increases in utility demand and prices; costs of goods and services; cost of emergency services; infrastructure repairs from heat-induced damage, flooding, erosion and more. Climate change is particularly detrimental to travel and tourism—Arizona’s number one export industry—which generated $3.09 billion in tax revenue and supported over 184,000 industry jobs in 2016 alone.4 These trends affect our residents’ cost of living, disposable income, and ability to support Pima County’s local economy. Employment opportunities may also suffer, as there is a negative association between temperature and the likelihood new employers will establish in an area.5 Inaction may not only affect economic growth but also increase the costliness of combating climate threats over time.

Projected percentage increase in Arizona’s peak summer electricity rates (from current rate of approx. 11¢ / kWh) by 2050

Cumulative revenue lost at Lake Powell and Glen Canyon from the visitation reduction that resulted from drops in water level at Lake Mead and Lake Powell from 1999 to 2003

Projected percentage of annual County GDP lost due to damages that result from climate change, by 2099

Projected percentage drop in crop yield produced in Pima County by 2099

Up to 350%

$60 million

More than 10%

Up to 50%
Public health is intricately tied with environmental health. Climate change has the capacity to undermine community wellbeing by increasing the incidence of heat-related illness, vector-borne diseases and premature death; jeopardizing food security and nutrition; worsening the inequalities felt by vulnerable communities; and increasing emigration to escape extreme weather events and to settle in other locations with greater resource and services reliability. Higher temperatures combined with particulate matter from smog, dust and wildfires contribute to poorer air quality and higher ground-level ozone pollution. This introduces and/or worsens health risks like allergies, asthma, lung cancer and other respiratory illnesses. Employee safety and productivity are also expected to decline, resulting in less hours worked for both low-risk (indoor) and high-risk (outdoor) employees. vii

Number of people who land in Arizona emergency rooms due to heat-related illnesses each year, making heat stress the leading cause of weather-related death in the Southwest viii

Projected number of additional climate-related deaths per 100,000 for each degree Celsius increase in Pima County by 2099 vii

Arizona’s asthma mortality rate per million residents – the fifth highest rate in the U.S. ix

The US EPA’s National Ambient Air Quality Standard for ground-level ozone pollution. As of July 2018, Pima County is in jeopardy of being designated as non-attainment by the federal government due to multiple exceedances of the ozone standard.
Pillars of Sustainability:
There are three tenets, or pillars, of a sustainable system: social well-being, environmental protection and economic development – informally referred to as people, planet and profits. These three pillars are mutually dependent; if any one pillar is weak then the system as a whole is unsustainable. A sustainable policy or practice will ultimately bolster all three. Building, protecting, and restoring the environment, the economy, and the community in a way that all three pillars work in harmony with each other as opposed to in conflict with each other is at the heart of any sustainable system.

Leading by Example:
People tend to model the behaviors and beliefs of their leaders. It is imperative that County operations reflect its beliefs and commitments in order to build trust with the community and make way for favorable social change.

Practicality:
Pima County’s sustainability policies and practices are based on evidence-based practices and pragmatic recommendations that have been fine-tuned for the County’s current or anticipated constraints, obstacles and circumstances.

Durability:
Developing policies and practices that have the ability to withstand unforeseen obstacles to achieve longevity and robustness is a priority.

Efficiency:
Achieving Pima County’s sustainability goals while utilizing the least amount of physical, financial, or labor resources possible, thereby maximizing the County’s ability to continue its sustainability initiatives.

Long-term Planning and Proactive Solutions:
Sustainability is long-term planning: meeting future demands by extrapolating from current demands and circumstances. Building a long-term trajectory that predicts forthcoming needs and risks and incorporates proactive instead of reactive solutions allows for more resilient and cost-effective operations.

Collaboration:
Sustainability policy is a multidisciplinary initiative. Successful development and implementation requires a horizontally and vertically diverse range of contributors. Interdepartmental collaborations from employees with various skill sets and roles is an integral part of the County’s sustainability program.

Accountability:
Pima County government is committed to accounting for its efforts toward sustainability, accepting responsibility for them, and disclosing the results in a transparent manner.
PIMA COUNTY’S VISION FOR SUSTAINABLE OPERATIONS

The ability of local governments to prepare for, adapt to, and mitigate changing climate conditions will greatly affect the severity and impact of climate risks. It is thus Pima County’s responsibility as first responders to climate change to protect and restore our County’s environmental integrity, economic durability, and public health and wellbeing.

Pima County has a long history of adopting strong sustainability policies and practices, starting with the award-winning Sonoran Desert Conservation Plan in 2001 to adopting the first Sustainable Action Plan for County Operations in 2007. The 2018 iteration of SAPCO extends the County’s commitment by integrating the goals and targets of the Paris Agreement as required by two resolutions adopted by the Board of Supervisors in 2017.

The Paris Agreement is a voluntary international agreement whereby nations identified and committed to reducing their carbon emissions to keep global temperature increases below 2°C (3.8°F). When the United States signed onto the Paris Agreement in 2015, the nation committed to reducing emissions 26% below its 2005 levels. However, when the U.S. rescinded its commitment in 2017, Pima County joined hundreds of local municipalities who came out in support of maintaining a commitment to the Agreement. Climate Resolution 2017-39, adopted in June 2017, formalized the County’s pledge to uphold the carbon-cutting targets established by the United States. Resolution 2017-51, passed one month later, specified the climate mitigation and adaptation measures the County would undertake to meet this commitment.

This plan outlines the specific targets and recommended mitigation strategies the County will pursue to reduce current greenhouse gas emissions from operations to 26%-28% below 2005 levels by 2025. Pima County will therefore need to reduce its projected 2025 emissions by 50% by 2025 through energy and fleet efficiency measures, and increasing its use of renewable energy.

### The Paris Agreement Objective

[Hold] the increase in the global average temperature to well below 2°C above pre-industrial levels and [pursue] efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change

### The Paris Agreement U.S. commitment

Reduce emissions by 26%-28% below U.S. 2005 levels by 2025

### Pima County Total Emissions (Mt CO$_2$e)

<table>
<thead>
<tr>
<th>Year</th>
<th>Emissions (Mt CO$_2$e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>106,530</td>
</tr>
<tr>
<td>2016</td>
<td>133,415</td>
</tr>
<tr>
<td>2025 (projected)</td>
<td>159,444*</td>
</tr>
</tbody>
</table>

### Emissions Target for Pima County Operations

(26% below Pima County 2005 levels by 2025)

78,832 Mt CO$_2$e or below**

---

* Assumes emissions increase by 2% annually, in accordance with historical trends.
**This calls for an approximate 50% cut in projected 2025 Pima County emissions, which is equivalent to cutting emissions by 80,612 Mt CO$_2$e
In accordance with the Paris Agreement, this plan also identifies specific focus areas and recommended strategies related to climate adaptation to safeguard infrastructure, the environment and residents from the impacts of climate change in Pima County.

**The Paris Agreement Objective**

[Increase] the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.

**Pima County Adaptation Commitment**

Implement climate adaptation measures in Pima County operations to support climate change preparedness and resiliency.

**Areas of Focus**

- Natural and Urban Areas
- Water Resources
- Workforce
- Food Systems
- Cultural Resources

**Pima County Climate Adaptation Targets**

- Protect and manage ecosystem resiliency in natural areas
- Plant trees and install green infrastructure in urban areas
- Promote sustainable use of potable and non-potable water
- Foster employee climate preparedness
- Protect and promote local food system resiliency
- Protect and conserve cultural resources

**What does sustainability mean for Pima County operations?**

The term *sustainability* can connote different meanings to different people. In this plan, sustainability refers to the management of building design, construction and renovation, land use and conservation practices, energy use, water and waste management, emissions, transportation, and procurement, with fiscal prudence in order to contribute to the long-term environmental, social and economic health of Pima County.
The 2018 Sustainable Action Plan for County Operations update provides a practical and holistic framework that deepens Pima County’s commitment to sustainability by adopting rigorous GHG reduction targets and expanding our efforts into new focus areas that previous iterations lacked. Moreover, unlike previous five-year versions, this plan will cover seven years in scope, from 2018-2025, to coincide with the GHG reduction deadline of the Paris Agreement.
The 2018 SAPCO update is comprised of the following chapters, each with specific goals, targets and/or monitoring and reporting requirements. These areas were selected based on opportunities to improve resource efficiency along with other associated mitigation and/or adaptation benefits.

1. Carbon
2. Water
3. Landscapes
4. Materials
5. Workforce

Focusing on these five diverse yet interconnected areas creates a multi-faceted approach to satisfying the County’s commitments toward sustainable operations and the Paris Agreement goals.

The diagrams below illustrate the major structural components of each chapter.
PLAN ARCHITECTURE

Built on a set of guiding principles that outline the County’s sustainability priorities, the SAPCO contains five chapters, each focused on an aspect related to mitigating and/or adapting to climate change. Each chapter is comprised of the following elements:

- **Goal**: A broad overarching objective or desired outcome outlined within a chapter.
- **Core Area**: A category in which resources, labor, and implementation efforts are focused.
- **Target**: An often-measurable milestone in pursuing the chapter goal(s), to be achieved within the timeframe of the plan. A few targets in the plan are dependent upon variable funding programs, in these cases targets are monitored and tracked for progress beyond the baseline, or at the minimum, no net loss of resources.
- **Recommended Implementation Strategy**: An internally vetted method of achieving a corresponding target, highlighted in the plan.
- **Performance Measure**: Quantitative or qualitative measures used to assess performance relative to a target.
- **Baseline**: A starting point or benchmark used to assess progress toward reaching a target.
- **Implementation Guide**: Outlines core areas, responsible parties, targets, performance measures, and recommended implementation strategies for each corresponding chapter.
- **Lead Department**: The primary department responsible for implementing appropriate sustainability strategies and overseeing the progress toward achieving target(s).
- **Supporting Department**: Departments responsible for supporting the Lead Department in implementing appropriate sustainability strategies and overseeing the progress toward achieving its target(s).

The Sustainable Action Plan is a collaborative and cross-departmental effort that aims to achieve a set of ambitious climate mitigation and adaptation targets for County operations.

The implementation strategies outlined in each chapter are based on new or existing departmental management plans and applicable best practices. Lead departments are responsible for successfully achieving the targets and serve as the primary points of contact for inquiries regarding specific core area(s) and performance. The implementation of specific strategies is at the discretion of the department(s) involved.

The Office of Sustainability and Conservation publishes an annual Sustainability Report Card to chart the County’s overall progress toward achieving the carbon reduction and climate adaptation goals adopted by the Board of Supervisors.

### Participating Pima County Departments

<table>
<thead>
<tr>
<th>Department</th>
<th>Acronym/Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractions and Tourism</td>
<td>A&amp;T</td>
</tr>
<tr>
<td>Community Development and Neighborhood Conservation</td>
<td>CDNC</td>
</tr>
<tr>
<td>County Administration</td>
<td>CA</td>
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<tr>
<td>Emergency Management</td>
<td>OEM</td>
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<tr>
<td>Environmental Quality</td>
<td>PDEQ</td>
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<tr>
<td>Facilities Management</td>
<td>FMD</td>
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<td>Finance and Risk Management</td>
<td>Risk</td>
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<tr>
<td>Fleet Services</td>
<td>Fleet</td>
</tr>
<tr>
<td>Natural Resources, Parks and Recreation</td>
<td>NRPR</td>
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<tr>
<td>Procurement</td>
<td>Procurement</td>
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<tr>
<td>Regional Flood Control District</td>
<td>RFCD</td>
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<tr>
<td>Regional Wastewater Reclamation</td>
<td>RWRD</td>
</tr>
<tr>
<td>Sustainability, Conservation and Historic Preservation</td>
<td>OSC</td>
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<tr>
<td>Transportation</td>
<td>DOT</td>
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</tbody>
</table>
Many human activities depend on fossil fuel-based energy, such as traveling, heating and cooling buildings, pumping water and processing waste. These activities result in the release of greenhouse gases (GHGs) – 80% of which are in the form of carbon dioxide (CO₂). These emissions raise global temperatures by trapping solar energy (heat) in the atmosphere, which in turn alter historic weather patterns, precipitation and temperatures.

Every individual, organization and community has a “carbon footprint” –the sum of greenhouse gas emitted through the production or consumption of materials, in transportation and through the generation of waste. Providing services to the community is often energy intensive and can produce significant greenhouse gas emissions. Pima County recognizes the importance of reducing the carbon footprint generated by its operations and is committed to complying with the targets established by the Paris Climate Agreement.
GOALS AND CORE AREAS

Implement policies and programs that reduce carbon emissions from County operations in accordance with the Paris Climate Agreement.

We aim to fulfill these objectives by focusing on the following core areas:

- **Buildings, facilities, and wastewater treatment**
  Includes all County operated facilities

- **County vehicle fleet**
  Includes all motor vehicles operated by the County

- **Solid waste**
  Includes all landfill waste generated by County operations

BENEFITS OF IMPLEMENTATION

- Reduces GHG emissions
- Improves air quality
- Saves money
- Decreases landfill waste
- Conserves energy
<table>
<thead>
<tr>
<th>CORE AREA</th>
<th>TARGET</th>
<th>PERFORMANCE MEASURE</th>
<th>RECOMMENDED IMPLEMENTATION STRATEGIES</th>
</tr>
</thead>
</table>
| Buildings, facilities, and wastewater treatment | Reduce carbon emissions from county facilities (including RWRD): 50% | Mt CO₂e              | 1. Improve building efficiency  
2. Expand renewable energy capacity  
3. Include beneficial use of biogas  
4. Improve employee energy conservation practices |
|                                 | Replace up to 120 gas sedan vehicles with fully-electric vehicles      | Number of fully-electric vehicles |                                                                                                        |
| County vehicle fleet            | Reduce carbon emissions from County fleet: 10% in non-electric vehicles | Mt CO₂e              | 1. Replace gasoline vehicles with electric and hybrid vehicles  
2. Reduce idling with surcharges for excessive idling  
3. Promote downsizing to compact trucks, SUVs, smaller sedans  
4. Surcharge for 4-wheel drive vehicles  
5. Implement recognition or incentive program(s) for employees who use alternative transportation |
| Lead department: Fleet Services | Supporting lead department: PDEQ                                      |                     |                                                                                                        |
| Solid waste                     | Reduce carbon emissions from solid waste generation: 10%              | Mt CO₂e              | 1. Increase recycling of office and industrial materials  
2. Decrease landfill waste (volume/weight)  
3. Buy reusable/ refillable items  
4. Implement employee education program |
| Lead department: FMD            | Supporting lead department: PDEQ                                      |                     |                                                                                                        |
Sustainable Action Plan for County Operations 2018-2025
Water is one of our most vital resources. It is essential to nearly every facet of life, from food cultivation to the generation of electricity. Yet, in the Sonoran Desert, it is also one of our most limited assets.

Under current and future climate scenarios, we will likely face growing challenges in meeting water demands that support agriculture, irrigation, urban expansion, and industrial and mining uses. The community at-large has made great strides in reducing the use of potable water. However, continuing drought, changing precipitation patterns, reduced snowpack and higher temperatures mean additional strategies will be needed.

Pima County is committed to continuing its efforts to reduce the use of potable water in its facilities. We will also continue to use a portion of our reclaimed water (treated effluent) to replenish groundwater supplies for future use.
Implement policies and programs that reduce the intensity of potable water use in County operations and continue allocating reclaimed water for groundwater recharge.

We aim to fulfill these objectives by focusing on the following core areas:

**Facility water use**
Includes all County operated facilities

**Groundwater replenishment**
Includes County allocations of reclaimed water for groundwater recharge

---

**Benefits of Implementation**

Conserves water resources
Saves money
Conserves energy
Restores aquifer
## Core Area: Water Use in Facilities

**Lead Department:** FMD

### Target

Reduce potable water use across all county facilities: 15%

### Performance Measure

- Gallons of water/ft²

### Recommended Implementation Strategies

1. Replace old fixtures with more efficient ones
2. Reduce use of open cooling systems during daylight hours
3. Replace aging water cooled chillers with air-cooled chillers
4. Sub-meter water systems during retrofits
5. Use grey water systems to decrease reliance on potable water for irrigation
6. Use rainwater collection tanks and passive stormwater harvesting to provide irrigation
7. Implement employee education and outreach programs

## Core Area: Groundwater Replenishment

**Lead Departments:** RWRD, RFCD

### Target

Monitor the use of reclaimed water for groundwater recharge

### Performance Measure

- Acre feet of County’s allocation of reclaimed water used for groundwater recharge

### Recommended Implementation Strategies

1. Continue reclaimed water recharge at existing sites (the Lower Santa Cruz Managed Recharge Project (LSCMRP) and the High Plains Constructed Recharge Project)
2. Continue to inventory uses of renewable water
3. Continue education and outreach efforts on water conservation and stormwater harvesting
Climate change threatens the iconic landscapes of our region. The County is heavily committed to managing open spaces, riparian corridors, and urban landscapes to promote and protect ecosystem health, cultural resources and historic landscapes, and local food production. These large-scale efforts are critical in mitigating and adapting to climate change.

Healthy landscapes provide climate adaptation benefits from rural to urban areas. Intricate multi-storied systems of trees, shrubs, cacti and grasses prevent erosion, support air and water quality, and provide cooling. The County’s restoration of riparian corridors and the installation of green infrastructure (engineered systems that mimic natural ecosystem functions) re-connect and restore the functions of rivers to protect against flooding and drought.

The resulting increased habitat for native species also provides outdoor recreation spaces for people, which promotes economic and health benefits.

Unequivocally, healthy landscapes also mitigate climate change. Plants and, by association, their vibrant microbial soil environs capture and store carbon dioxide.

County ranch lands, agricultural properties, and gardens provide conservation co-benefits (economic and cultural value) and climate resilience. These lands in turn support local food systems and help to reduce regional vulnerability to climate-related food security risks.

Cultural landscapes—historic and archaeological sites—underpin our community’s identity and are increasingly threatened by the effects of climate change such as flooding, heat and erosion. By conserving heritage assets, the County preserves linkages from the past to the present, passing down knowledge about resilience that can inform modern planning for climate variability.
Utilize the County’s on-going protection and restoration of extensive healthy landscapes as a strategy for climate mitigation and frontline adaptation by protecting native species and natural and cultural resources, installing green infrastructure and restoring riparian areas, and expanding support for local food systems.

We aim to fulfill these objectives by focusing on the following core areas:

**Natural areas**
Includes geographical areas that are undeveloped, i.e. no built structures, and the ecosystems within them in Pima County

**Cultural resources**
Includes the archaeological sites, historic buildings, and traditional cultural places within Pima County

**Urban areas**
Includes the boundary defined by AZ Pollutant Discharge Elimination System Stormwater Permit Area. This is where Pima County has the authority to implement changes in land use, open space and GI/LID

**Food systems**
Includes the network of activities, actors, resources, regulations and institutions required to produce, process, distribute and dispose of food that is supported or provided by Pima County government

**Benefits of Implementation**
- Protects ecosystems
- Protects cultural heritage
- Fosters a healthy and beautiful community
- Supports food security
- Reduces urban heat island effect
### Natural areas

**Lead departments:** RFCD, OSC, NRPR

#### Manage natural areas for resilient ecosystems

- **Performance Measure:**
  1. Linear miles of surface water wet/dry mapping Ginegra Creek Natural Preserve
  2. Groundwater depth
  3. Acres of natural habitat conserved
  4. County acres protected within AGFD linkages (annual, change driven by acquisitions)
  5. Miles of major riparian corridor added (County ownership – fee title and ROW) greater than 10,000 CCFs (centum cubic feet)

#### Core Area Target

- **Recommended Implementation Strategies:**
  1. Track and report surface water for wildlife and plants in key natural areas
  2. Monitor the trends of groundwater dependent ecosystems
  3. Track and report the level of shallow groundwater
  4. Increase total acres of natural areas conserved
  5. Increase total acres protected within Arizona Game and Fish Dept. (AGFD) Wildlife Linkages
  6. Acquire riparian corridor parcels
  7. Increase linear miles of major riparian corridor added each year

### Cultural resources

**Lead department:** OSC

#### Promote public outreach and education

- **Performance Measure:**
  1. Number of tours, presentations on County conservation lands

#### Core Area Target

- **Recommended Implementation Strategies:**
  1. Conduct cultural resources surveys
  2. Protect cultural resources from damage
  3. Collaborate with Tribes
  4. Administer oral history and archival studies
  5. Conduct public outreach and education
  6. Track and report areas inventoried
  7. Track and report sites protected

- **Core Area Target:**
  1. Build education and outreach plan
  2. Track and report number of activities
## Implementation Guide

### Urban areas

**Core area:** Plant at least 10,000 trees

**Target:** Install at least 40 green infrastructure sites

**Performance measure:** Maintain or increase acreage of restored habitat, vegetation and turf supported by renewable water

**Recommended implementation strategies:**
1. Utilize PAG GI Prioritization Tool (high heat/low tree canopy)
2. Implement Green Infrastructure Action Plan
3. Pursue policies to require RTA to install trees as part of 4% landscape budget allocation
4. Implement DOT Landscape Manual Standards (require developers and utilities removing trees in the right-of-way to replace them or pay in lieu fee)

### Food systems

**Core area:** Maintain or expand number of County properties with Farmer’s Markets

**Target:** Maintain or expand number of County sites with community or heritage gardens

**Performance measure:** Number of sites

**Recommended implementation strategies:**
1. Catalogue number of new or expanded farmer’s markets on County properties each year.
2. Identify areas to expand or extend the number of farmer’s markets on County properties
3. Track and report County properties with Farmer’s Markets
4. Identify appropriate County-owned parcels and right-of-ways for projects
5. Utilize PAG’s Food Desert Map to identify areas to expand or extend number gardens on County properties
6. Pilot a project to use reclaimed water for heritage trees
7. Pilot a project using local best practices for community engagement and sustainability
<table>
<thead>
<tr>
<th>Core Area</th>
<th>Target</th>
<th>Performance Measure</th>
<th>Recommended Implementation Strategies</th>
</tr>
</thead>
</table>
| **Food systems**                  | Maintain or expand number of County acres under cattle grazing leases | Number of acres     | 1. Continue rangeland inventories, monitoring and assessment  
2. Continue applying management practices to provide for ecosystem health  
3. Track and report County acres under cattle grazing leases |
|                                  | Maintain or expand number of County acres under commercial, niche and/or commodity agricultural production | Number of acres     | 1. Update the Range Management Standards and Guidelines for agricultural production  
2. Track and report County acres under commercial, niche and/or commodity agricultural production |
|                                  | Maintain or expand County-managed food and nutrition programs and associated technical training | Number of activities| 1. Catalogue the number food-related education and training programs conducted by staff or at County sites each year  
2. Track and report food and nutrition programs and technical training |
|                                  | Maintain or expand number of County sites with public access for harvesting native plant foods | Number of sites     | 1. Create a set of guidelines for harvesting native plant foods on County lands  
2. Identify potential sites for food harvesting on County lands  
3. Track and report County sites with public access for harvesting native plant foods |
|                                  | Maintain or expand food heritage activities                            | Number of activities| 1. Collaborate with the UA, City of Gastronomy, and other stakeholders to supply resources to include in map for self-guided visitor tours  
2. Track and report on supported food heritage activities |
|                                  | Maintain or expand number of County sites with composting and soil carbon amendment practices | Number of sites     | 1. Create a set of guidelines for composting and producing soil amendments to increase carbon sequestration on County lands  
2. Identify potential sites for composting on County lands  
3. Track and report County sites with composting and soil carbon amendment strategies |

5. Model Triple Bottom Line Cost Benefit Analysis (TBL-CBA) of Community Gardens with modeling tools  
6. Track and report County sites with community or heritage gardens  
7. Explore and identify general funds, grants and other resources for projects
Sustainable Action Plan for County Operations 2018-2025
The materials we purchase for County operations and the way we dispose of them have sizable impacts on the environment and surrounding community. Landfills produce greenhouse gas emissions, groundwater and soil contamination, and loss of land for species habitat or other forms of development. They also lower housing values and increase adverse health effects for people who live around them. Pima County has established targets to increase the recycling of materials, bolster our green purchasing efforts, and reduce the volume of waste generated.
GOALS
Adopt mindful purchasing practices that are preferential toward environmentally-friendly (or “green”) office products and equipment.

Adopt mindful disposal practices in which the landfill is the destination of last resort.

CORE AREAS
We aim to fulfill these objectives by focusing on the following core areas:

Solid waste
Includes the landfill waste and industrial waste produced by County staff and operations

Green purchasing (Office)
Includes all office products and equipment purchased on the vendor’s website

BENEFITS OF IMPLEMENTATION

- Reduces GHG emissions
- Decreases landfill waste
- Preserves natural resources
### Core Area: Solid Waste

<table>
<thead>
<tr>
<th>Lead department: FMD; Fleet</th>
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<tbody>
<tr>
<td><strong>Solid waste</strong></td>
</tr>
<tr>
<td>a) Landfill waste</td>
</tr>
<tr>
<td>b) Industrial waste</td>
</tr>
<tr>
<td><strong>Target</strong></td>
</tr>
<tr>
<td>Reduce volume/weight of landfill waste by 20%</td>
</tr>
<tr>
<td>Recycle industrial waste by 100%*</td>
</tr>
</tbody>
</table>

*In accordance with the EPA Resource Conservation and Recovery Act (RCRA) laws and regulations

<table>
<thead>
<tr>
<th>Performance Measure</th>
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<tbody>
<tr>
<td>Volume/weight of landfill waste produced (tons)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommended Implementation Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve waste reduction education</td>
</tr>
<tr>
<td>a. Paperless systems</td>
</tr>
<tr>
<td>b. Company take-back programs</td>
</tr>
<tr>
<td>c. Internal reuse of equipment and materials</td>
</tr>
<tr>
<td>d. Efficient printing practices (e.g. double-sided printing)</td>
</tr>
<tr>
<td>2. Reuse and repurpose existing buildings</td>
</tr>
<tr>
<td>3. Recycle building construction materials</td>
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</table>

### Core Area: Green Purchasing

<table>
<thead>
<tr>
<th>Lead Department: Procurement</th>
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<tbody>
<tr>
<td><strong>Green purchasing</strong></td>
</tr>
<tr>
<td><strong>Target</strong></td>
</tr>
<tr>
<td>Increase percentage of Preferred Products purchased by the County: 20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance Measure</th>
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<tbody>
<tr>
<td>Percent of office purchases that are listed on Pima County’s Preferred Product List</td>
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<table>
<thead>
<tr>
<th>Recommended Implementation Strategies</th>
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<tbody>
<tr>
<td>1. Expand education and outreach program for green purchasing practices and polices</td>
</tr>
<tr>
<td>a. Online trainings</td>
</tr>
<tr>
<td>b. Updated office vendor webpage</td>
</tr>
<tr>
<td>c. Engagement of Green Purchasing Representatives</td>
</tr>
<tr>
<td>2. Standardize product selection and purchasing practices</td>
</tr>
<tr>
<td>3. Include green specifications in vendor contracts</td>
</tr>
</tbody>
</table>
Climate change is increasing worker vulnerability to rising air temperatures and decreased air quality and acute climate-related events, such as extreme heat and storms. Studies show that for every one degree temperature of Celsius increase, there is a decline in hours worked of one to three percent. Providing pertinent training and education will improve the climate preparedness of Pima County’s workforce and create a safer work and home environment for employees.
**GOALS AND CORE AREAS**

**GOALS**

*Foster a safe work environment by preparing Pima County employees for climate change risks they may encounter at their work sites.*

*Provide the resources necessary to adequately prepare Pima County employees for climate change risks that may affect their home environment.*

**CORE AREAS**

We aim to fulfill these objectives by focusing on the following core areas:

- **Workplace preparedness**
  - Includes climate change readiness designed for acute and long-term risks in the workplace or work sites

- **Personal preparedness**
  - Includes climate change readiness designed for personal use and/or the home environment

**BENEFITS OF IMPLEMENTATION**

- Improves employee safety
- Fosters employee resilience
- Builds employee morale
## Workplace preparedness

**Lead Department:** Risk

**TARGET:** 100% of employees complete emergency trainings (annual)

### PERFORMANCE MEASURE

- Percentage of employees who complete the quiz on the trainings and/or submit a confirmation of a completed training

### RECOMMENDED IMPLEMENTATION STRATEGIES

1. Implement quarterly seasonal safety trainings and education campaigns, for example:
   a. Fall – fires, dust and air quality
   b. Winter – cold, winter flooding
   c. Spring – bees and venomous creatures
   d. Summer – heat related illnesses, air quality issues, summer monsoons/flooding
2. Promote through a variety outreach sources - Wellness Program, E-Scoop
3. Host annual safety classroom trainings for field departments i.e. NRPR, RWRD, DOT, PCSD, etc.

## Personal preparedness

**Lead Department:** OEM

**TARGET:** 100% employees download emergency checklist and information handouts (annual)

### PERFORMANCE MEASURE

- Percentage of employees who complete the quiz on the information downloaded and/or submit confirmation of completed training

### RECOMMENDED IMPLEMENTATION STRATEGIES

1. Implement an annual emergency preparedness campaign with an ADP prompt to:
   a. Download an Emergency Preparedness Checklist
   b. Download Neighborhood Climate Resilience Resource
2. Complete a quiz on at-home preparedness
3. Partner with Risk and Human Resource’s Wellness Team to promote information via events
**Adaptation (climate change):** Climate change adaptation helps individuals, communities, organizations and natural systems to deal with those consequences of climate change that cannot be avoided. It involves taking practical actions to manage risks from climate impacts, protect communities and strengthen the resilience of the economy.

**Air Quality Index (AQI):** An index for reporting daily air quality. It determines how clean or polluted air is and what associated health effects might be of concern. The AQI focuses on health effects that may be experienced within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each pollutant, EPA has established national air quality standards to protect public health. Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in this country.

**Air Quality Standards:** The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area. National Ambient Air Quality Standards are the federal standards for the minimum ambient air quality needed to protect public health and welfare.

**Alternative Transportation:** Refers to transportation modes other than driving a single-occupant vehicle, such as carpooling, mass transit, biking and walking. Choosing alternative modes of transportation provides many benefits such as cost and time saving, improved air quality, reduced congestion and less dependency on fossil fuels.

**Alternative Fuel Vehicles:** Vehicles that operate on fuels other than gasoline or diesel. Alternative fuel vehicles include those that operate using compressed natural gas (CNG), liquid natural gas (LNG), propane, electricity, hybrid of gasoline and electricity, and hydrogen.

**Baseline:** A starting point or benchmark used to assess progress towards reaching a target.

**Beneficial Use of Biogas:** Methane recovery and purification for use as a fuel source in power production or in vehicles as an alternative to natural gas.

**Best Management Practice (BMP):** Methods that have been determined to be the most effective, practical means of addressing a particular environmental or sustainability challenge.

**Biodiversity:** The variety of life, including the number of plant and animal species, life forms, genetic types, habitats, and biomes (which are characteristic groupings of plant and animal species found in a particular climate).

**Carbon Footprint:** The amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person, group, etc. in a given period.

**Carbon Dioxide Equivalent (CO₂e):** A metric used to compare the emissions from various greenhouse gases based upon their global warming potential. Carbon dioxide equivalents are commonly expressed as “metric tons of carbon dioxide equivalents” (Mt CO₂e).

**Carbon Sequestration:** Storage of carbon through natural or technological processes that can include using biomass, biochar or deep geological storage.

**Central Arizona Project (CAP):** A 336-mile-long system of aqueducts, tunnels, pumping plants and pipelines that divert water from the Colorado River from Lake Havasu near Parker into central and southern Arizona. The CAP is the largest
and most expensive aqueduct system ever constructed in the United States and is designed to bring about 1.5 million acre-feet of Colorado River water per year to Maricopa, Pinal and Pima counties.

**Clean Air Act (CAA):** Federal law designed to control air pollution on a national level. It requires the EPA to develop and enforce regulations to protect the public from airborne contaminants known to be hazardous to human health.

**Clean Water Act (CWA):** Primary federal law governing water pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the nation’s waters by preventing point and nonpoint pollution sources, providing assistance to publicly owned treatment works for the improvement of wastewater treatment, and maintaining the integrity of wetlands.

**Climate Change:** Changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events, and changes to other features of the climate system. Increased levels of atmospheric carbon dioxide produced through the burning of fossil fuels is the primary driver of climate change since the beginning of the Industrial Revolution (mid-1800s).

**Climate Variability:** Natural changes in climate that fall within the observed range of extremes for a particular region, as measured by temperature, precipitation, and frequency of events. Drivers of climate variability include the El Niño Southern Oscillation and other atmospheric phenomena.

**Core Area:** A category in which resources, labor, and implementation efforts are focused.

**Drought:** A period of abnormally dry weather marked by little or no rain that lasts long enough to cause water shortages for people and natural systems.

**Earth Systems:** Refers to Earth’s interacting physical, chemical, and biological processes and consists of the land, oceans, atmosphere and poles. It includes the planet’s natural cycles — the carbon, water, nitrogen, phosphorus, sulphur and other cycles — and deep Earth processes. Life too is an integral part of the Earth system. Life affects the carbon, nitrogen, water, oxygen and many other cycles and processes. The Earth system also includes human society and social and economic systems. In many cases, the human systems are now the main drivers of change in the Earth system.

**Ecosystem:** All the living things in a particular area as well as components of the physical environment with which they interact, such as air, soil, water, and sunlight.

**Effluent:** Treated or untreated wastewater that flows out of treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

**Effluent-Dependent Water (EDW):** A surface water that consists of a point source discharge of wastewater. Without the point source discharge of wastewater, it would be an ephemeral water.

**Energy Star Qualified:** An energy performance rating system administered by the U.S. government for consumer products. Devices carrying the Energy Star service mark generally use 20-30% less energy than required by federal standards.

**Emissions Scenarios:** Quantitative illustrations of how the release of different amounts of climate altering gases and particles into the atmosphere from human and natural sources will produce different future climate conditions. Scenarios are developed using a wide range of assumptions about population growth, economic and technological development, and other factors. In climate modeling, emissions scenarios are referred to as representative concentration pathways or RCPs.

**Evapotranspiration:** Evaporation of water from soil and plant leaves.

**Extreme Events:** A weather event that is rare at a particular place and time of year, including, for example, heat waves, cold waves, heavy rains, periods of drought and flooding, and severe storms.

**Feedback:** The process through which a system is controlled, changed, or modulated in response to its own output. Positive feedback results in amplification of the system output; negative feedback reduces the output of a system.

**Food Deserts:** An area where affordable healthy food is difficult to obtain, usually found in impoverished areas. This is largely due to a lack of grocery stores, farmers’ markets, and healthy food providers.
**Food Security**: When all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life.

**Food Systems**: A series of interlinked activities that aims to integrate food production, processing, distribution, consumption, waste management, and relevant governance structures in order to enhance the environmental, economic and social health of a particular place.

**Geographic Information System (GIS)**: A computer application that integrates hardware, software, and data for capturing, managing, analyzing and displaying all forms of geographically referenced information.

**Global Climate Models (GCM)**: Mathematical models that simulate the physics, chemistry, and biology that influence Earth’s climate system.

**Global Warming**: The observed increase in average temperature near the Earth’s surface and in the lowest layer of the atmosphere. In common usage, “global warming” often refers to the warming that has occurred as a result of increased emissions of greenhouse gases from human activities. Global warming is a feature of climate change; it can also lead to other changes in climate conditions, such as changes in precipitation patterns.

**Grey Water**: The relatively clean gently used water from baths, sinks, washing machines, and other kitchen appliances.

**Green Purchasing**: Purchasing products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance or disposal of the product or service.

**Greenhouse Gas (GHG)**: Any gas that absorbs infrared radiation in the atmosphere, preventing it from escaping into space. As the atmospheric concentration of GHGs increase, the average temperature of the lower atmosphere will gradually rise. Greenhouse gases include carbon dioxide, methane, nitrous oxide, ozone, water vapor, chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride.

**Goal**: A broad overarching aim or desired result outlined within a chapter.

**Groundwater**: The water beneath the surface of the ground, consisting largely of surface water that has seeped down. It is the source of water in springs and wells.

**Guiding Principles**: Fundamental tenets that provide a basis for decisions and define priorities.

**Heat Island Effect**: A “dome” of elevated temperatures over an urban area caused by structural and pavement heat fluxes, and pollutant emissions.

**Implementation Guide**: Outlines core areas, responsible parties, targets, performance measures, and recommended implementation strategies for each corresponding chapter.

**Invasive Species**: Non-native or alien species to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. In some locations, climate change is accelerating invasions by alien species. The U.S. currently spends $30 billion/year on eradication efforts.

**Kilowatt-hour (kWh)**: A unit of measure for energy typically applied to electricity usage and equal to the amount of energy used at a rate of 1,000 watts over the course of one hour. One kWh is equivalent to 3,412 Btu, or 3,600 kJ.

**Lead Department**: The primary department responsible for implementing appropriate sustainability strategies and overseeing the progress toward achieving its target(s).

**Life-Cycle Cost Analysis**: A technique to assess the environmental aspects and potential impacts associated with a product, process or service throughout its lifespan.

**Mitigation (climate change)**: Measures to reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere.
**Performance Measure:** Quantitative or qualitative measures used to assess performance relative to a target.

**Phenology:** The pattern of seasonal life cycle events in plants and animals, such as timing of blooming, hibernation, and migration.

**Potable Water:** Water that is safe enough to be consumed by humans with low risk of immediate or long-term harm.

**Preparedness (climate change):** Climate preparedness involves assessing risks and taking actions to provide a head start towards building resilience to future climate impacts whether they be extreme heat, future storms or associated economic shocks.

**Reclaimed Water:** Water that has been treated or processed by a wastewater treatment plant or an on-site wastewater treatment facility.

**Recommended Implementation Strategy:** An internally vetted method of achieving a corresponding target, highlighted in the plan.

**Renewable Energy:** Any energy source that is replenished at least as fast as it is used.

**Resilience:** A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

**Riparian Area:** Areas of interaction that include both terrestrial and aquatic ecosystems. They extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain into the water, laterally into the terrestrial ecosystem, and along the watercourse at a variable width.

**Riparian Corridor:** A management prescription area designed to include much of the Riparian Area. Within the riparian corridor, management practices are specified to maintain riparian functions and values. As a management prescription area, this includes corridors along all defined perennial and intermittent stream channels that show signs of scour, and around natural ponds, lakeshores, wetlands, springs, and seeps.

**Riparian Habitat:** The community of plant and wildlife found along the banks of a river, stream, lake or other body of water. Riparian habitats are ecologically diverse and may be home to a wide range of plants and animals.

**Scenario:** Sets of assumptions used to help understand potential future conditions such as population growth, land use, and sea level rise. Scenarios are neither predictions nor forecasts. Scenarios are commonly used for planning purposes.

**Snowpack:** Snow that accumulates over the winter, and slowly melts to release water in spring and summer.

**Stormwater:** Water that originates during rainfall events and snow or ice melt and runs off into water courses, lakes and other water bodies and sewers.

**Supporting Department:** Departments responsible for supporting the Lead Department in implementing appropriate sustainability strategies and overseeing the progress toward achieving its target(s).

**Sustainability:** The management of resources and/or disposal of waste that occurs in a way that does not damage the environment and maintains a healthy, diverse, and productive ecological, economic, and social balance indefinitely.

**Target:** An often-measurable milestone in pursuing the chapter goal(s), to be achieved within the timeframe of the plan.

**Urban Heat Island (UHI) Effect:** The tendency for higher air temperatures to persist in urban areas as a result of heat absorbed and emitted by buildings and asphalt, tending to make cities warmer than the surrounding countryside.

**Vulnerability:** The degree to which physical, biological, and socio-economic systems are susceptible to and unable to cope with adverse impacts of climate change.

**Wastewater:** The spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.


ix CDC (2018). Asthma: Most recent asthma state or territory data. Retrieved from https://www.cdc.gov/asthma/most_recent_data_states.htm
Board of Supervisors
Richard Elías, Chairman, District 5
Ally Miller, District 1
Ramón Valadez, District 2
Sharon Bronson, District 3
Steve Christy, District 4

Pima County Administrator
Chuck Huckelberry
Pima County Climate Brief
University of Arizona
Kathy Jacobs, Gregg Garfin and James Buizer
(contact information on final page)
Sept. 23, 2018

This climate brief was prepared as a service to Pima County by climate experts at the University of Arizona who have been engaged in international, national and regional climate assessments and climate adaptation programs over the last several decades. It provides an overview of major climate issues and opportunities for Pima County.

Background
In 2017, the Pima County Board of Supervisors passed two significant resolutions to address climate change. Resolution 2017-39 mandated that staff undertake work to align County operations with the Paris Agreement, and Resolution 2017-51 outlined the specific areas where the County should direct climate mitigation and adaptation efforts. Furthermore, a specific recommendation outlined in 2017-39 was the Board’s direction to take “a leadership role in regional collaborative efforts to develop solutions and policy recommendations to address the Fourth National Climate Assessment’s Southwest Chapter” (due to be released in December 2018).

As a result, County staff reached out to the University of Arizona, Institute of the Environment to request a presentation on climate risks and adaptation opportunities with the intention of better informing County departments and staff about current climate research and the implications for our region. As contributors to current and previous National Climate Assessments, we offered to provide a presentation at a lunch “brown bag” held on April 18, 2018. This written summary is a follow up to that presentation and addresses some of the questions that were raised and discussed.

Evidence the climate is changing
It is well documented that the climate is changing. It is the overwhelming consensus of scientists from the 195 countries involved in the International Panel on Climate Change¹, as well as the scientific community in the United States² that human activities, especially emissions of greenhouse gases, are the dominant cause of the average global temperature increases observed since the mid-20th century. Both the changes in the atmosphere and the associated global and regional impacts are now documented through evidence from multiple observing systems on every continent, in the oceans, and in the atmosphere¹.

…and why it matters:
More important than the fact that human-caused climate change is occurring is the fact that associated changes in the climate are dramatically increasing risks to state and national economies, and to our community in Pima County. The impacts are not only financial, they can be measured in terms of quality of life for Pima County residents. Many of the things we value
about living in Southern Arizona are at risk – including a reliable water supply, scenic vistas and clean air, efficient transportation systems, abundant recreational opportunities and wildlife, and a healthy economy. Increased risks associated with increased temperatures, include:

- “Chronic, long-duration hydrological drought”\(^5\),
- Intense storms and downpours\(^4\),
- Changes in air quality (e.g., see Anenberg et al. 2017,\(^6\) Spracklen et al. 2009,\(^6\) Val Martin et al. 2015\(^7\)),
- Outbreaks of insect pests and diseases\(^8,9\),
- Greater incidence of large wildfires\(^3\).

These risks are all associated with climate change and affect our quality of life. Climate variability and change are closely connected to increased risks to water supplies\(^10,11\), major wildfires\(^12,13\), health impacts due to higher temperatures\(^14\), and longer duration of the season for vector-borne diseases\(^15\), in Pima County. All of these impacts have associated costs, including costs associated with rising utility bills for cooling.

**Climate variability vs climate change:**

There has always been variability in weather and climate, and this will continue. The difference we are seeing between current conditions and those prior to the last century is that the variability is now superimposed on long-term climate trends driven by greenhouse gas emissions. The new “normal” for climate means increased energy in the atmosphere, because more of the sun’s energy is trapped within the Earth’s lower atmosphere due to increasing concentrations of greenhouse gases. More energy leads to higher temperatures, altered atmospheric circulation patterns, and more extreme weather events.

**Climate change and Extreme events:**

Most of the risk associated with climate change is not due to gradual long-term trends in temperature and precipitation. Rather, it is related to the extreme events that are already becoming more intense as a result of having excess energy in the atmosphere. Global warming makes some extreme weather events more likely or more severe, including heat waves, intense precipitation, droughts, and wildfires\(^4,16,17,3\). Sea level rise due to warming of the oceans and ice melt has also significantly increased risks along the coasts of the U.S.

**Climate change is a risk multiplier:**

Climate change is rarely, if ever, the only source of risk for communities, businesses, or the environment. Rather, there are underlying risks such as poverty, an aging population, changes in land use, invasive species, or poor resource management decisions that can be exacerbated by climate change. For example, land development policies that increase the area of paved surfaces and rooftops, without adequately managing the increased storm-water runoff, can lead to flooding—even in the absence of changes in the climate. However, with more intense precipitation associated with increasing heat in the atmosphere\(^4,18\), the risk of flooding is multiplied.

Many people tend to view the drivers of climate change—such as increases in temperature or more intense precipitation—as a series of unrelated factors. However, the climate system is interconnected; thus, increases in temperature have an effect on both precipitation and evaporation, and these climate “drivers” impact a range of environmental conditions. The impacts of climate changes also have impacts on linked human systems, including, for example:

- transportation,
• communication,
• electricity generation and transmission,
• health care,
• water supply and treatment.

When one component of these interconnected systems is affected by a climate impact, it can cause cascading effects. For example, if a wildfire damages the electricity delivery system for a regional power company, then all of the systems that are dependent on electricity may collapse, potentially for long periods of time, depending on how robust the power system is and how much of the grid is protected from broad-scale outages.

The good news:
The good news is that many of the increased risks of climate change can be managed in order to reduce the costs of impacts, including infrastructure costs, protection of public safety, and protection of natural resources. Moreover, as climate modeling capabilities have improved over the past several decades, climatologists are able to provide better information about future temperature and precipitation conditions. The scientific community understands the physics and the trends well, and can provide estimates of plausible changes for multi-decade periods.

Planning for Pima County's future in the context of climate change provides an opportunity to take an integrated look across programs, goals, departments and constituencies in a new light. It provides an incentive to think about investments in terms of both short- and long-term benefits and costs, and to incorporate sustainability and social objectives, while also increasing the benefits of public investments.

Big picture climate stressors and some opportunities for adaptation by Pima County
Given what we know from observations and from climate modelling at multiple scales, some key issues and opportunities associated with climate change for Pima County include heat, drought and flooding, as illustrated in the following table:

<table>
<thead>
<tr>
<th>Stressor: Heat</th>
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<tbody>
<tr>
<td>On average, more people in the United States die each year from heat-related illness than any other weather-related disaster, according to the National Climate Assessment. Climate models project substantial and statistically significant increases in temperatures in Pima County, including increases in the number of very hot days (days during which the maximum temperature exceeds 100°F) over the course of the 21st century. An increase in heat waves is also expected, consisting of longer periods of abnormally hot weather lasting days to weeks. Direct impacts include:</td>
</tr>
<tr>
<td>• impacts on health, such as heatstroke;</td>
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<tr>
<td>• increases in electric energy use and energy bills;</td>
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<tr>
<td>• increasing costs of field operations;</td>
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<tr>
<td>• and impacts on infrastructure such as roads and electric transmission lines.</td>
</tr>
<tr>
<td>Indirect impacts include:</td>
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<tr>
<td>• more intense and larger wildfires;</td>
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<tr>
<td>• increased particulates and ozone in the air;</td>
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<tr>
<td>• increased cases of asthma and respiratory disease (especially in children and the elderly);</td>
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<td>• reduced productivity of outdoor workers;</td>
</tr>
</tbody>
</table>
- reductions in soil moisture;
- increased water requirements for agricultural crops and landscaping; and
- loss of riparian habitat and biodiversity\(^2,21,22,23\).

### Heat-related Adaptation Opportunities

- Air quality warnings and cooling centers for at-risk people with asthma or heat stress;
- changing hours of outdoor activities for field operations to avoid the middle of the day;
- increased air conditioning;
- training of staff to recognize early signs of heat stress and heatstroke and to take appropriate action;
- design of roadways to use materials that are more resistant to heat stress and reduce the urban heat island effect;
- changes in landscape choices to more heat and drought tolerant species;
- changes in wildfire suppression techniques and in building construction at the urban/wildland interface; and
- planting trees to improve air quality by absorbing pollutants, intercepting particulates, and shade surfaces to lower local air temperatures.

### Stressor: Drought

The hydrological cycle is directly affected by rising temperatures. Through evaporation, precipitation and cloud formation, water and energy are redistributed across the globe. In the Southwest, higher temperatures are creating shifts in historic hydrological conditions and changing the nature of drought, floods and wildfires\(^3,10,11,13\). The current drought is considered exceptional in terms of the magnitude of warming and additional evapotranspiration stresses\(^24,25\).

#### Direct impacts include:

- Ongoing loss of snowpack at high elevations with increasing temperatures;
- loss of soil moisture due to increased evaporation;
- stress on wildlife, natural vegetation and riparian areas; and
- increased water demand for agriculture and urban landscaping.

#### Indirect impacts include:

- Amplified water shortages in the Colorado River\(^3,10,26\). The Colorado is a major source of drinking water for Pima County through the Central Arizona Project; and
- diminishing snowpack and reduced run-off threaten local groundwater recharge and water supplies;
- increased dust and particulates in the air; and
- reduced rainfall and runoff damage aquatic ecosystems as well as the overall health of our watersheds\(^11\).

### Drought-related Adaptation Opportunities

- Investments in water conservation are almost always the least expensive option for responding to drought, though there are a range of consequences that require consideration;
- use of reclaimed municipal wastewater, water harvesting, greywater use, artificial recharge of groundwater, and careful planning of groundwater recovery systems are already components of water management within Pima County but can be expanded;
- high density residential land use reduces per capita water consumption (because the amount of landscaping per person is reduced);
- careful selection of drought tolerant landscaping plants and agricultural crop varieties can reduce water use;
- green infrastructure can provide urban cooling, recreation and habitat improvements, and improved air quality;
- public transportation can reduce vehicle miles traveled and improve air quality;
- training in management of irrigation systems can improve efficiency of outdoor irrigation;
- managing vegetation to reduce fuel near possible ignition sources such as roads and campsites can reduce wildfire risk;
- assessing appropriate herd size on ranches can limit drought-related losses;
- changes in management of riparian areas can reduce impacts on habitat; and
- long-term water supply planning for the region is critical; for example, the Lower Santa Cruz River Basin Study is underway and will assess potential water supply shortages and optional changes in management practices or infrastructure investments

### Stressor: Flooding

While there is high confidence that temperatures will increase across the Southwest; scientists are less confident in projections of regional precipitation. However, basic physics tells us that rainfall intensity is likely to increase over time even if the overall average amount of precipitation on an annual basis is reduced\(^2,18\). Warmer air can contain more water vapor than cooler air, and rising temperatures have increased the amount of water vapor in the atmosphere, resulting in more intense precipitation nationally and globally. This is correlated with flooding—particularly flash flooding associated with summer convective thunderstorms in the Southwest and with wintertime atmospheric rivers—and can have consequences for multiple kinds of infrastructure, as well as for public safety and achieving resource management objectives\(^11,16\).

Direct impacts include:
- Erosion that can affect roads, bridges and a range of other built infrastructure;
- potential for loss of life during flood events;
- loss of habitat along floodways that currently stabilizes stream channels;

Indirect impacts include:
- Debris flows on slopes, especially after wildfire;
- siltation of reservoirs and riverbeds;
- increased potential for disease vectors to spread; and
- reduced water quality in aquatic systems.

### Flood-related Adaptation Opportunities

- Improving flood management, for example, through development of multi-purpose green infrastructure that provides more absorbent floodways and greenspace while enhancing recharge;
- reinforcement of bridge abutments and bank protection;
- improvements in the design of other infrastructure above and below ground;
- flooding also has the potential to increase groundwater recharge through scouring of riverbeds and increased transmission of water to the aquifer; and
new engineering standards are under development by the American Society of Civil Engineers that include consideration of higher temperatures and more intense storms (for selection of building and infrastructure materials), more intense precipitation (for design of floodways and culverts) and other climate impacts.

**Conclusion:**
The future will look different from the past: the changes associated with human-caused global warming require that we actively manage the risks in order to protect our economy, our community and our quality of life. Pima County’s efforts to build on previous sustainability efforts and address climate mitigation and adaptation at the local level are concrete steps in the right direction.

Our system of managing risk will have to prepare for a future unlike conditions that have existed in our lifetimes. Science can help with that; the University of Arizona is uniquely positioned to provide knowledge and information through conversations, partnerships and innovative projects. Moreover, there are opportunities associated with explicitly preparing for climate changes, including new ways to incorporate sustainability and quality of life objectives into Pima County programs and projects, and a multitude of ways to adjust management practices and infrastructure investments in order to reduce risks and maximize opportunities.
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References


