ADEQ
Arizona Department of Environmental Quality

RESOURCE SUMMARY

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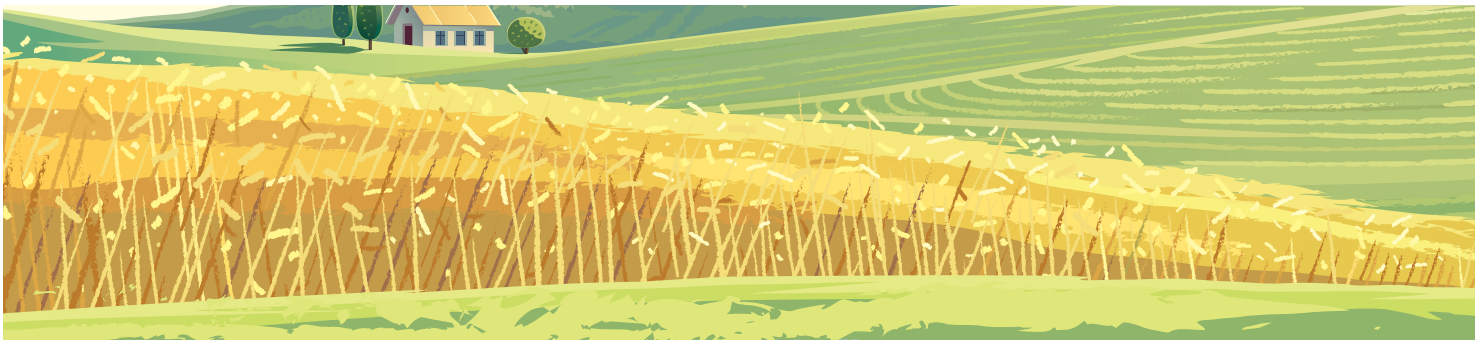
Pollution Prevention (P2): Irrigation Reduction in Agriculture



History of Arizona Water Usage

Ranching and agriculture help form the backbone of Arizona's economy, with 19,600 farms selling more than $3.7 billion worth of product per year.[1] However, the industry involves intensive water use and approximately 70 percent of the state's water is used in agriculture.[2] As this industry and the state's economy continue to grow, innovative farming techniques designed to reduce water consumption at the source will be increasingly important to decrease total water use for the agricultural sector.

Agricultural Management Practices for Water Quality Protection

The U.S. Environmental Protection Agency (EPA) outlines eight Best Management Practices (BMPs) for farmers to reduce water quality impact from agricultural operations.[3] These BMPs are sourced from two separate components: the CORE 4 program by the Conservation Technology Information Center (CTIC)[4] and EPA's National Management Measures to Control Nonpoint Source Pollution.[5] CORE 4 is an agricultural approach that seeks to benefit soil and water quality while boosting farm profitability.[4] Its practices include conservation tillage, crop nutrient management, pest management and conservation buffers. The four remaining BMPs include irrigation water management, grazing management, animal feeding operations management, and erosion/sediment control.

Irrigation Techniques

Improving efficiency in irrigation is one of the most effective ways to conserve water. Innovative irrigation techniques such as those outlined below can reduce water demand without impacting production.[6]

Subsurface drip irrigation systems -- These systems use water more efficiently by applying it below the surface of the soil, ensuring that as much water as possible is used by the crop rather than being lost to evaporation.

Real-time soil moisture and weather monitoring -- Data loggers and sensors can be used to gather information about soil moisture and weather conditions that can then be incorporated into irrigation scheduling. Proper scheduling allows the highest amount of water to be absorbed by crops and additional watering to automatically shut down when the desired soil moisture level has been reached--avoiding over watering, and conserving water while sustaining crop growth and development.

Rainwater harvesting -- This method offers a range of simple to complex systems, all designed to capture and filter rainwater from various hard surfaces, such as rooftops, to store for use in irrigation.[7] Captured rainwater can then be used in place of water drawn from an aquifer or other traditional sources. This can lead to cost savings and also allows for continued access to water when other sources are limited.

Soil Erosion Prevention

The amount of nutrients and sediment in runoff can be increased by soil erosion. This is ultimately transferred to surface water when runoff flows into streams or rivers. Prevention of soil erosion is therefore an important step in maintaining water quality near farmland and ensuring continued access to water sources free from pollution. There are a variety of techniques available to farmers working to prevent soil erosion, including conservation buffers, surface cover, and conservation tillage.

Conservation Buffers -- Using designated strips of land with permanent vegetation fixtures serves to slow runoff and enhance infiltration into the soil. The vegetation and soil capture some of the nutrients, sediment, and pollutants entrained in stormwater runoff. The Natural Resources Conservation Service describes various types of conservation buffers and their respective benefits.[8]

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Surface Cover (Cover Crops) -- Planting surface cover helps manage soil erosion, fertility and quality. Cover crops catch rainfall before it reaches the soil which means more water infiltrates within the soil and less flows away as runoff. This results in more sediment and nutrients remaining on site and less flowing into nearby surface water such as rivers and streams. The USDA provides detailed information to farmers on proper practices for cover crops.[9]

Conservation Tillage -- Crop residues from previous years can be left on the soil to achieve similar benefits of cover as mentioned above. This can either be conducted as a no-till system in which crop residues are left as is during planting, or as a strip-till system in which crop residue is left between rows after some tillage. [6]

Precision Agriculture Tools

Precision Agriculture (PA) is a farming management system that uses data about soil quality and crops to increase long term efficiency across an entire farm.[10] By gathering data and analyzing it as part of a regular decision making process over time, farms can measure the impact of new technology designed to optimize use of resources and crop yields. One example of precision agriculture technology with the potential to impact water demands is variable rate irrigation. This technology allows water delivery to vary based on unique crop and soil conditions across a field, so that each area is delivered the amount of water it needs and excess water use is reduced.

References

[1] US Department of Agriculture. *2017 State Agricultural Overview.*
[2] AZ Department of Water Resources. *Arizona's Water Supplies and Water Demands.*
[3] EPA. *Agricultural Management Practices for Water Quality Protection.*
[4] CTIC. *Core 4.*
[5] EPA. *National Management Measures to Control Nonpoint Source Pollution from Agriculture.*
[6] National Research Council. *Water Implications of Biofuels Production in the United States.*
[7] City of San Diego. *Rainwater Harvesting Information.*
[8] National Resources Conservation Service. *Buffer Strips: Common Sense Conservation.*
[9] National Resources Conservation Service. *Cover Crops -- Keeping Soil in Place While Providing Other Benefits.*
[10] National Resources Conservation Service. *Precision Agriculture: NRCS Support for Emerging Technologies*

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