Urban and Rural Land Management Options for Enhancing Runoff/Recharge

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Rural Land Management: Key Questions

1. How and where can the state of Arizona change management of forests and rangelands to enhance runoff and recharge in the context of climate change?

2. How do different methods of management and disturbances affect evapotranspiration and sublimation in the state?

3. Where are the potential source areas (opportunities) for reducing atmospheric water losses and diverting them to recharge areas?
Evaluating Ecosystem Water

- Estimate when or where recharge is occurring and/or can be enhanced through management
Verde Basin: modeled annual averages, 1985-2021

ET 335.10 mm

Surface runoff 3.54 mm

Precipitation 465.60 mm

PET 1665.20 mm

Deep aquifer recharge 4.25 mm

Shallow aquifer uptake 30.62 mm

Return and lateral flow 92 mm

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Evaluating Ecosystem Water

- Effects of land management and cover change
- Forest thinning leads to more snow on the ground for longer
ECOSTRESS Daily Evapotranspiration of Arizona HUC8 Watersheds 2019

Spring 2021 ET, 3 years post-thinning

EOCOSSSTE ET ALEXI (mm/pixel)

Thinned Non-Thinned

(mm)

0 1 2 3 4 5 6

a b
Management Opportunities

Leaky Weir
Sandbag Dam
Wood Log Jam
Gabion

Left images: Laura Norman, Western Geographic Science Center
Right image: Fern Bromley
The Strategy – Green Stormwater Infrastructure

Benefits of GSI:

• Water quality and quantity
• Air Quality
• Climate Resiliency
• Habitat and wildlife

(a) Retention Basin
(b) Drywell
(c) Permeable Pavement
(d) Infiltration Trench
Urban Management: Key Questions

• What are the Green Stormwater Infrastructures (GSI) we have?

• How much do GSI enhance the local groundwater recharge potential?

• Which is playing the major role in enhancing groundwater recharge in urban aquifer, future climate, or urban development?

Source: Diagram courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu).
Drywells Design

Source: What Is A Dry Well System And How To Build It? Michael Bowen  February 11, 2024

Retention-Detention Ponds

Drywells and Detected Ponds in Phoenix AMA

[Map showing the location of drywells and ponds in Phoenix AMA]
Drywell and Detected Pond Potential

Based on infrastructure capacity and design code, the drainage area for each one is ranging from 0.37 - 187.23 acres, 2019 total captured runoff at 264,635.66 AF.
Urban Development Impacts

- Population growth
- GDP growth
- Technology innovation
- Energy sector
- Resource management

Source: Harvestable rainwater at different watershed scales (City of Tucson Pima Country, 2009). Figure created by Dr. Evan Canfield (used with permission).