

# Defining the Water Needs of Freshwater Ecosystems

in a  
Complex and  
Uncertain World



# Biological Diversity in Arizona

3rd richest state in biological diversity

7th in number of species at risk



Stillman Lake, Verde River headwaters

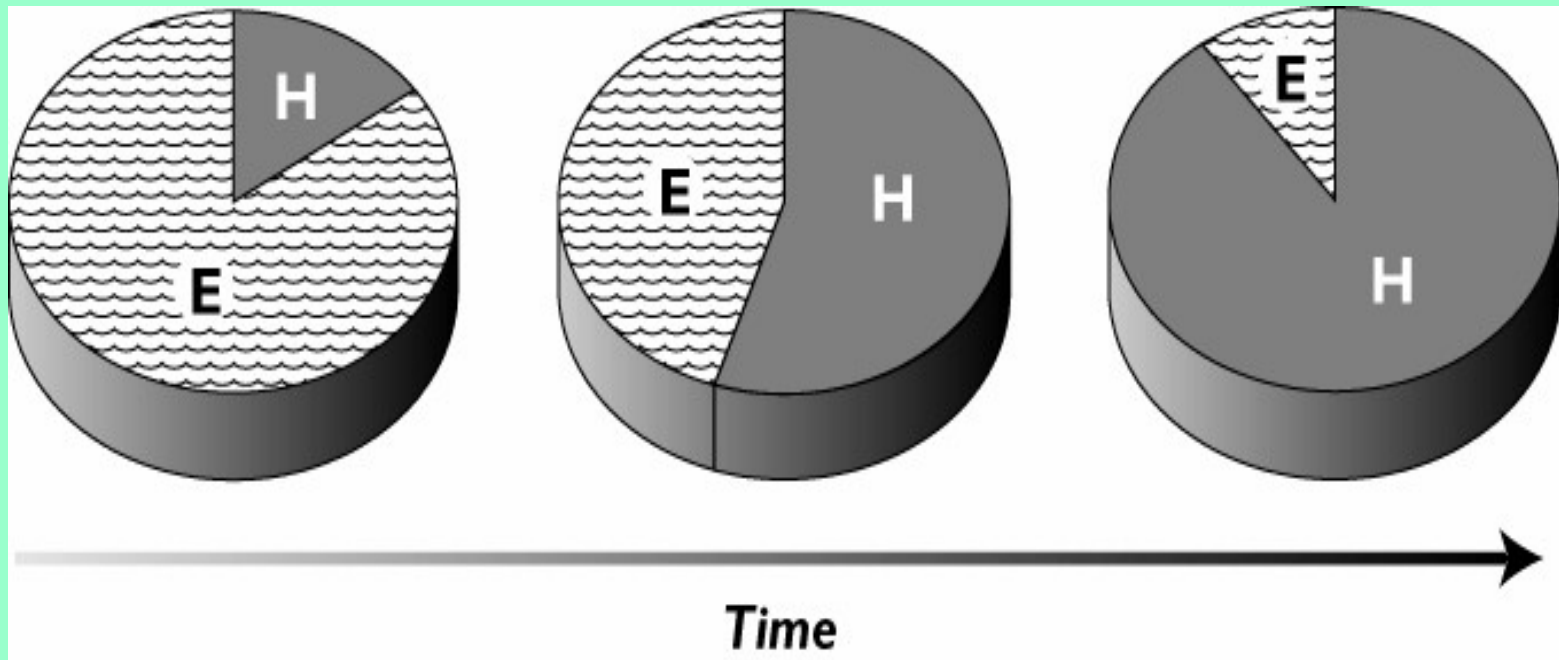
2nd fastest growing population in the nation

An arid land, our water resources are under increasing pressure



Oak Creek at Red Rock Crossing

# Traditional Approach to Water Management



**E = ecosystem support**

**H = human use**

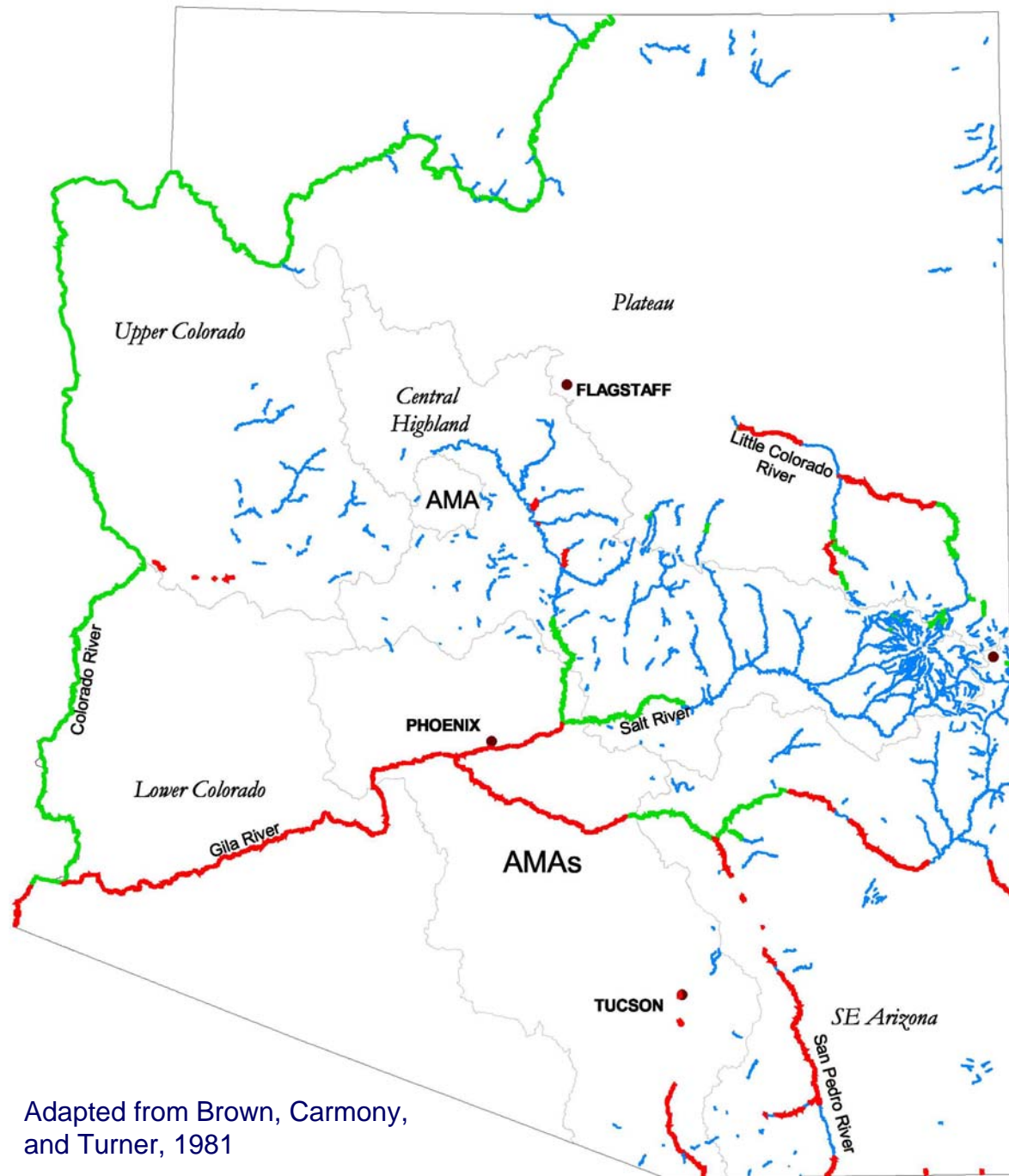


# Loss of Natural Flow in Arizona's Streams

- ◆ 91% of flow lost on "Big Rivers"
- ◆ 37% of flow lost on "Medium" rivers

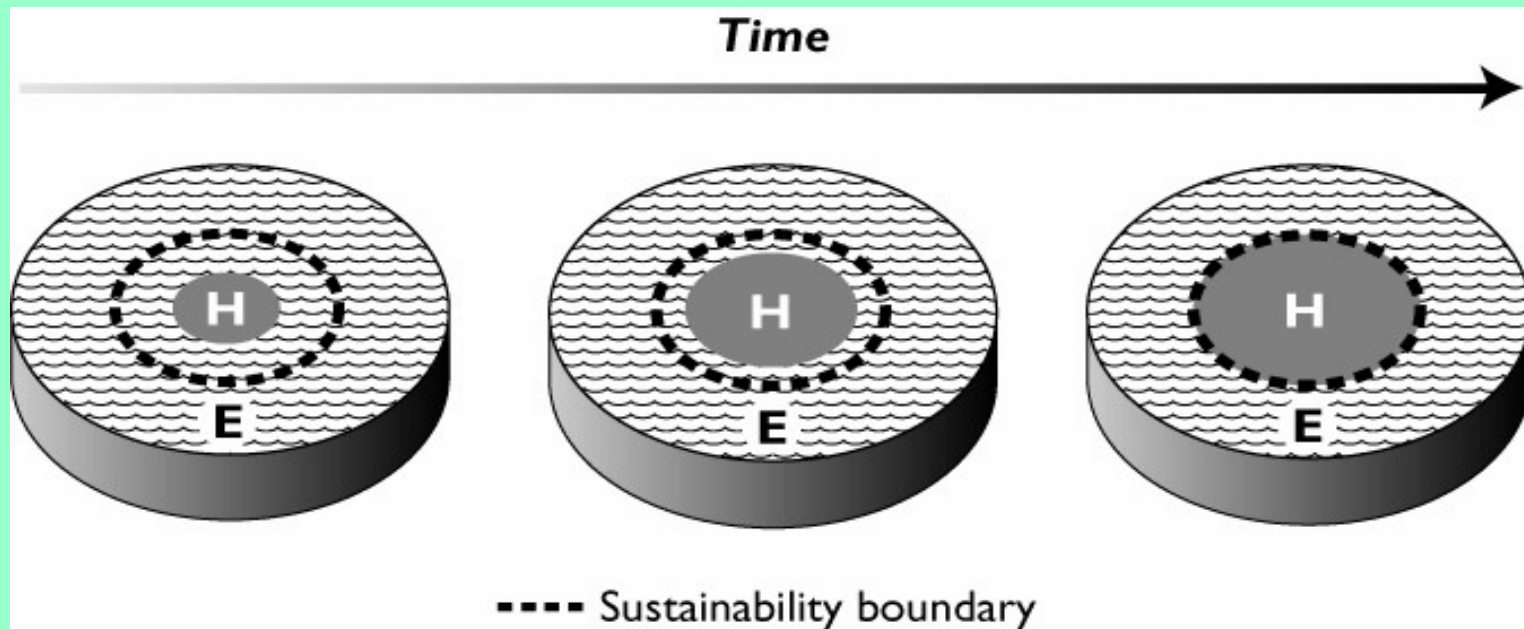
## Stream Flow Status

-  Perennial
-  Formerly Perennial
-  Regulated Stream



Adapted from Brown, Carmony,  
and Turner, 1981

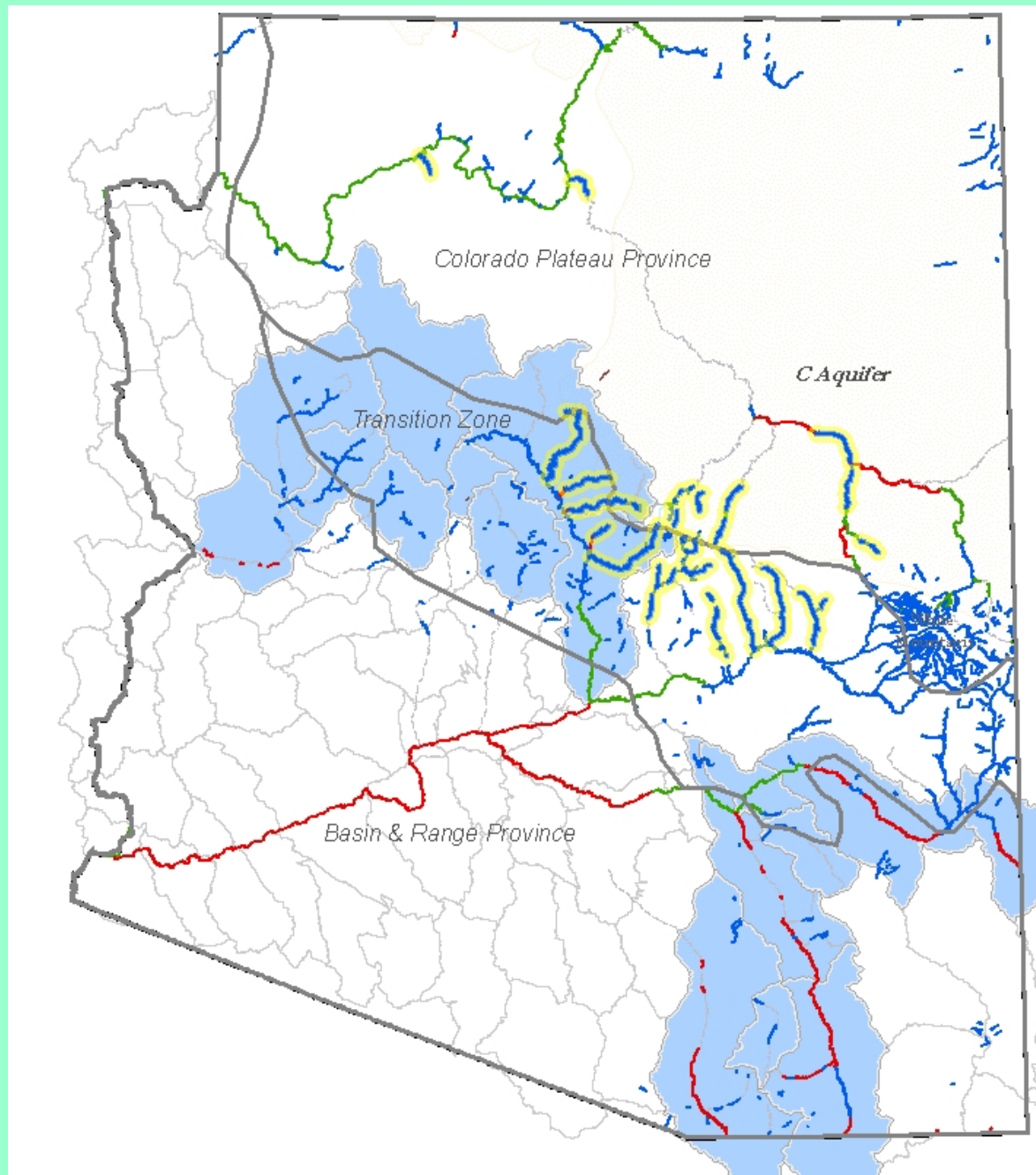
# A Sustainable Approach to Water Management



**E = ecosystem support**

**H = human use**

# Groundwater Dependence Of Streams and Creeks in Arizona



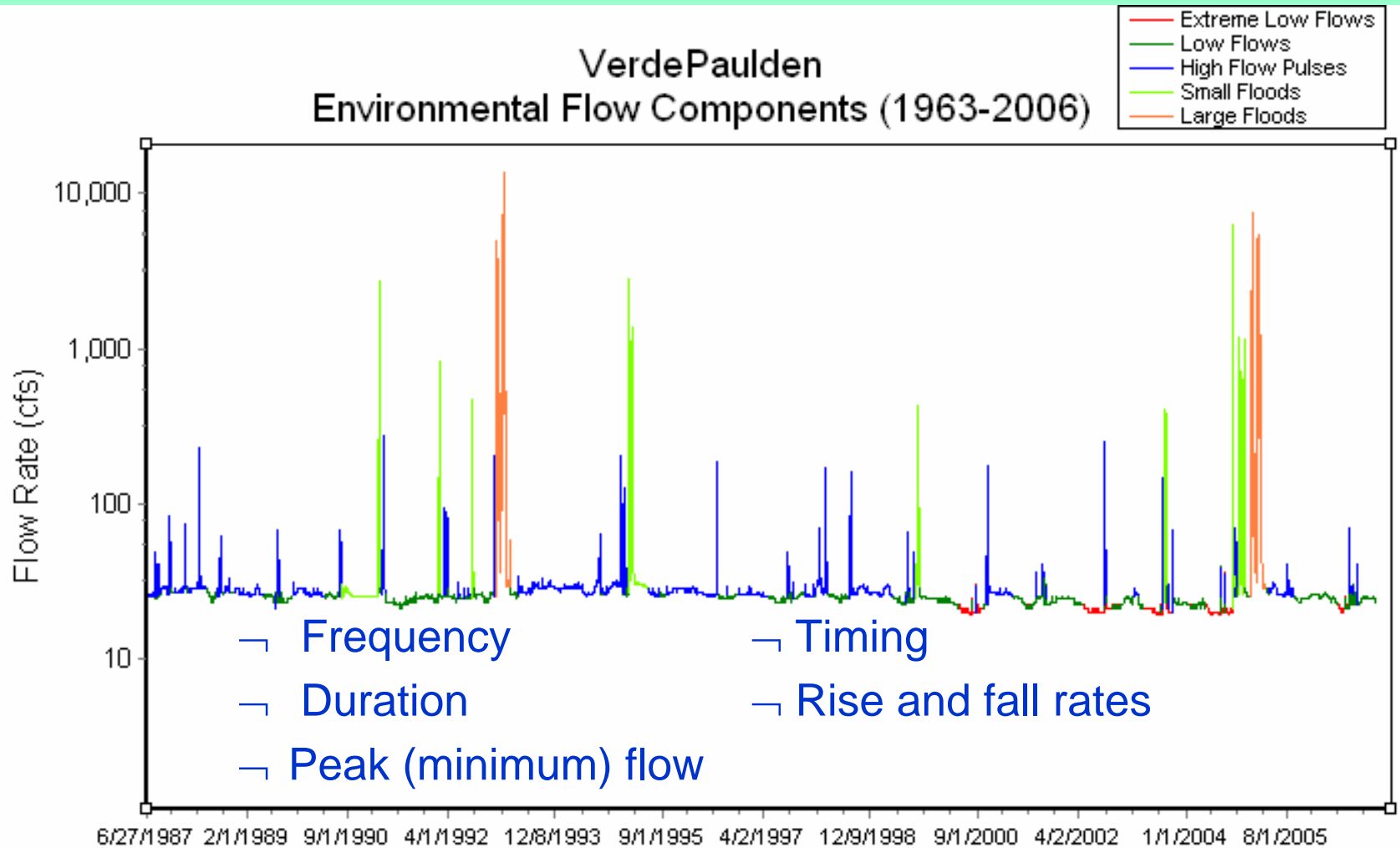
# **Environmental Flows**

- The **provision of water** in sufficient quality, quantity, timing and duration to **maintain freshwater ecosystems** and their benefits.
- The allocation of water to achieve a desired environmental condition.



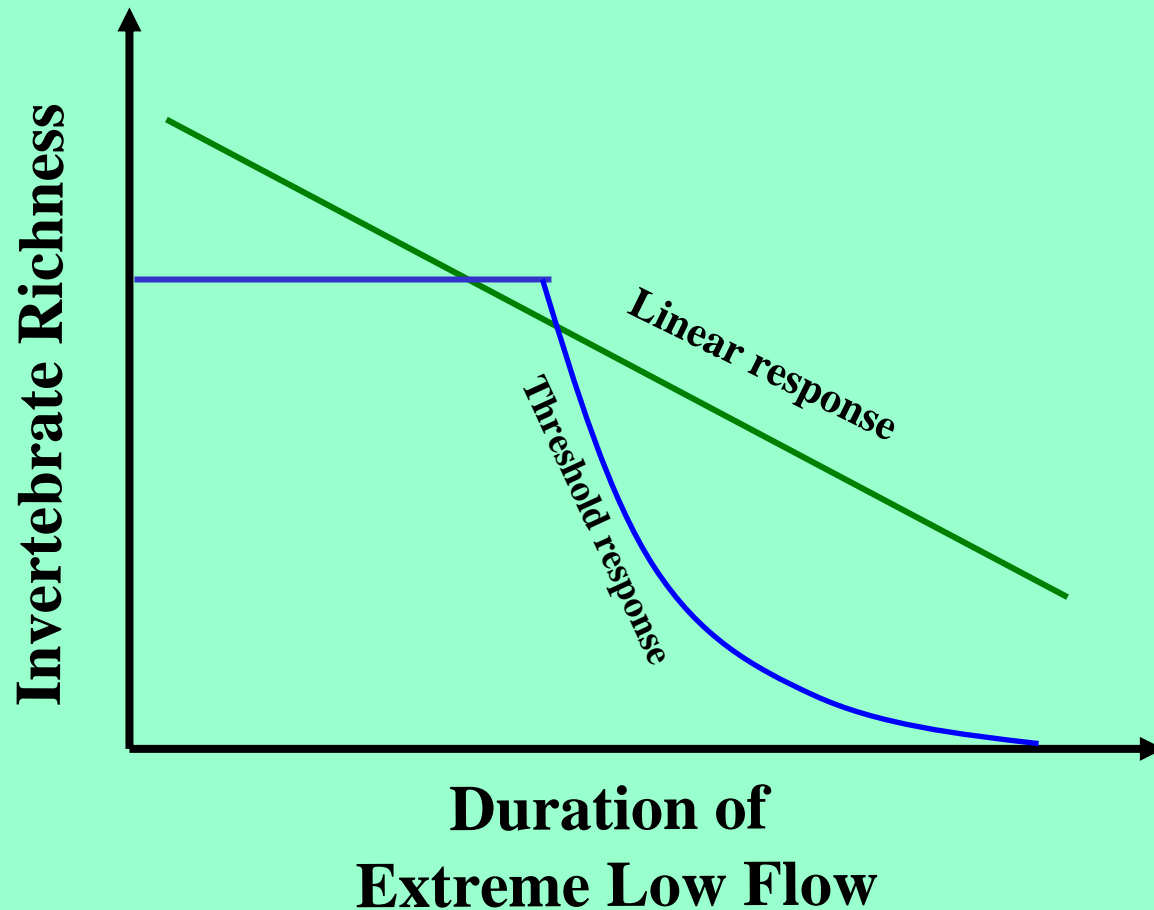


# Environmental Flows



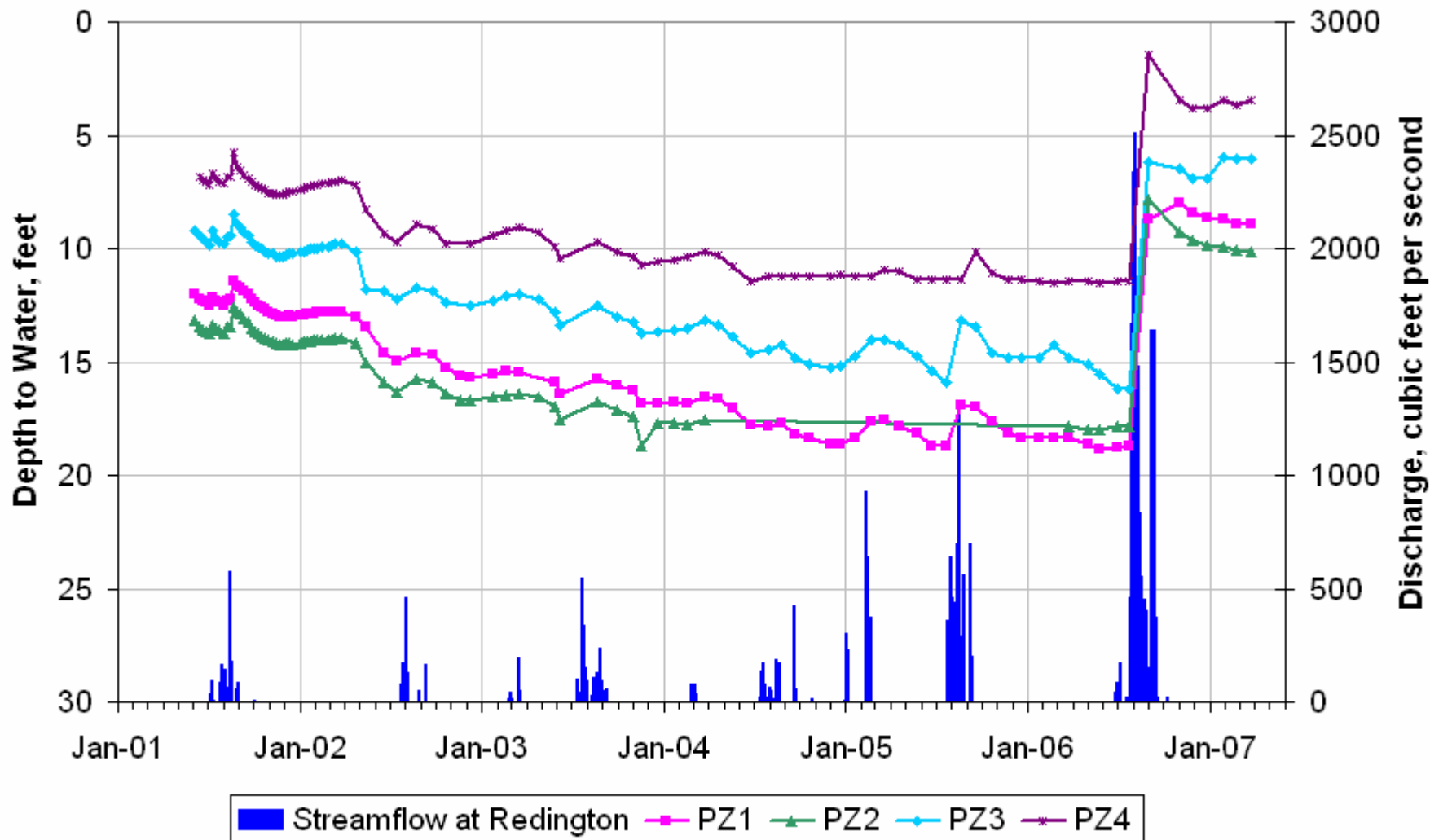
# Environmental Flows

Tying Biologic Needs to Hydrologic Conditions

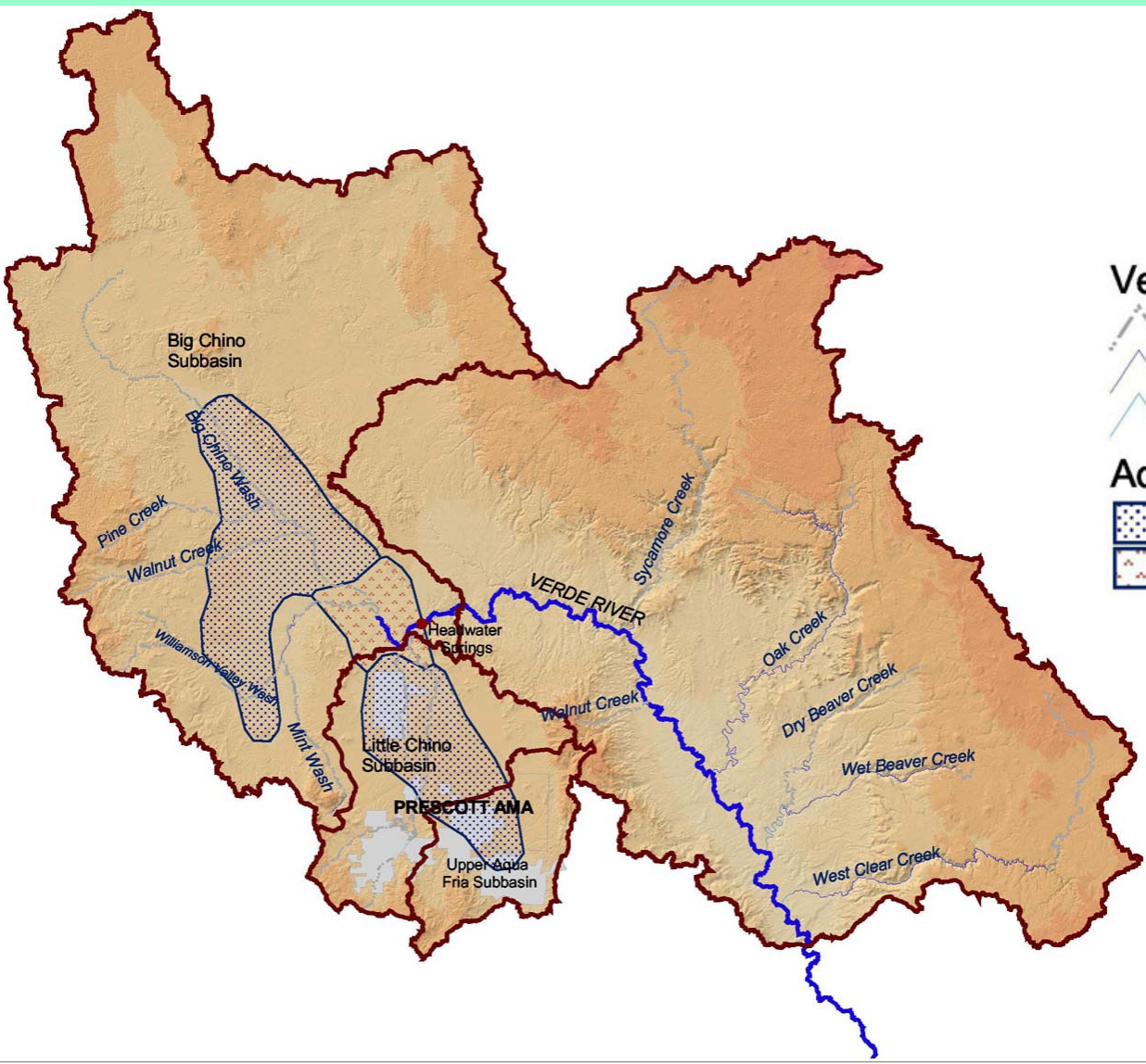







# H&E Farm Lower San Pedro River





# Case Study: Verde River Basin Prescott AMA and the Verde Valley



### Verde Basin Streams

-  Ephemeral
-  Perennial
-  Formerly Perennial

### Aquifers in Big and Little Chino Valleys

-  Sand and gravel
-  Volcanic







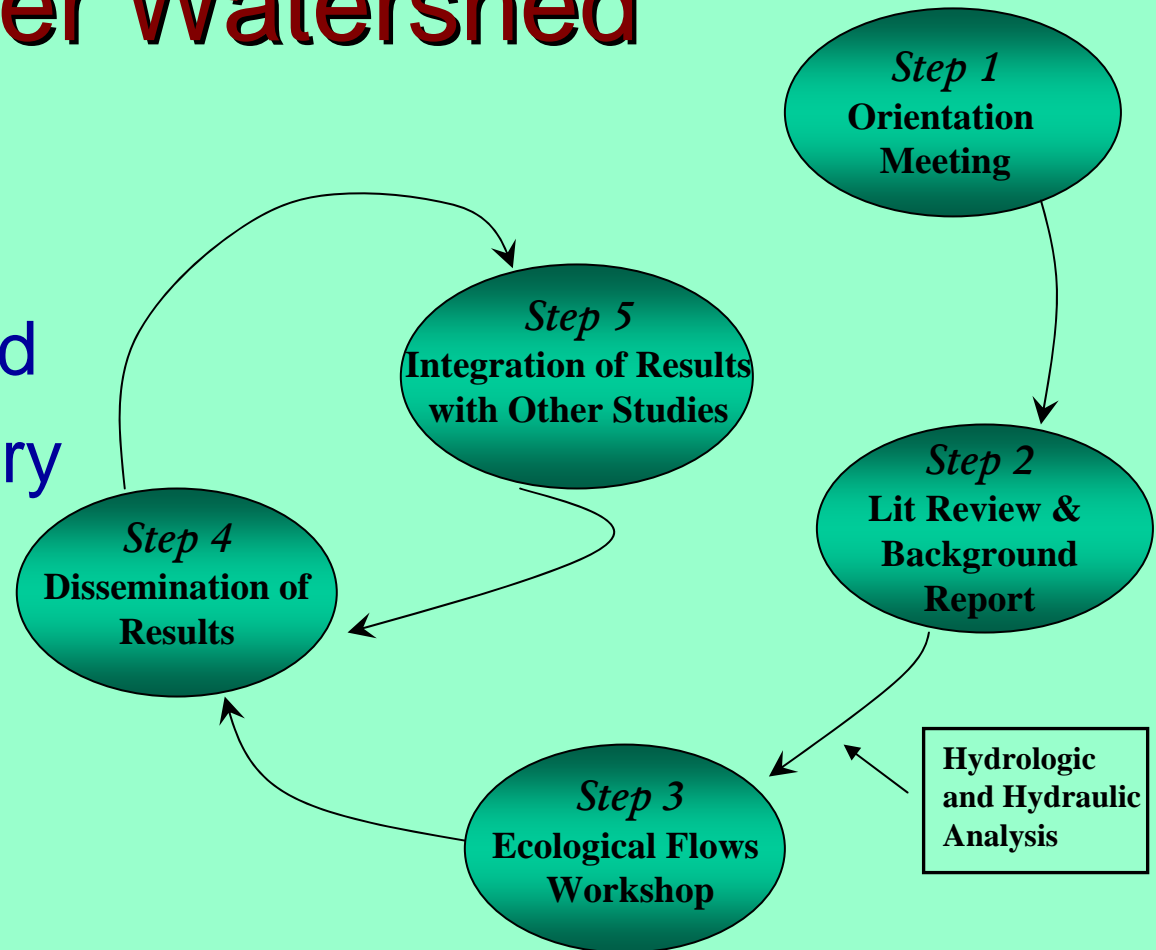






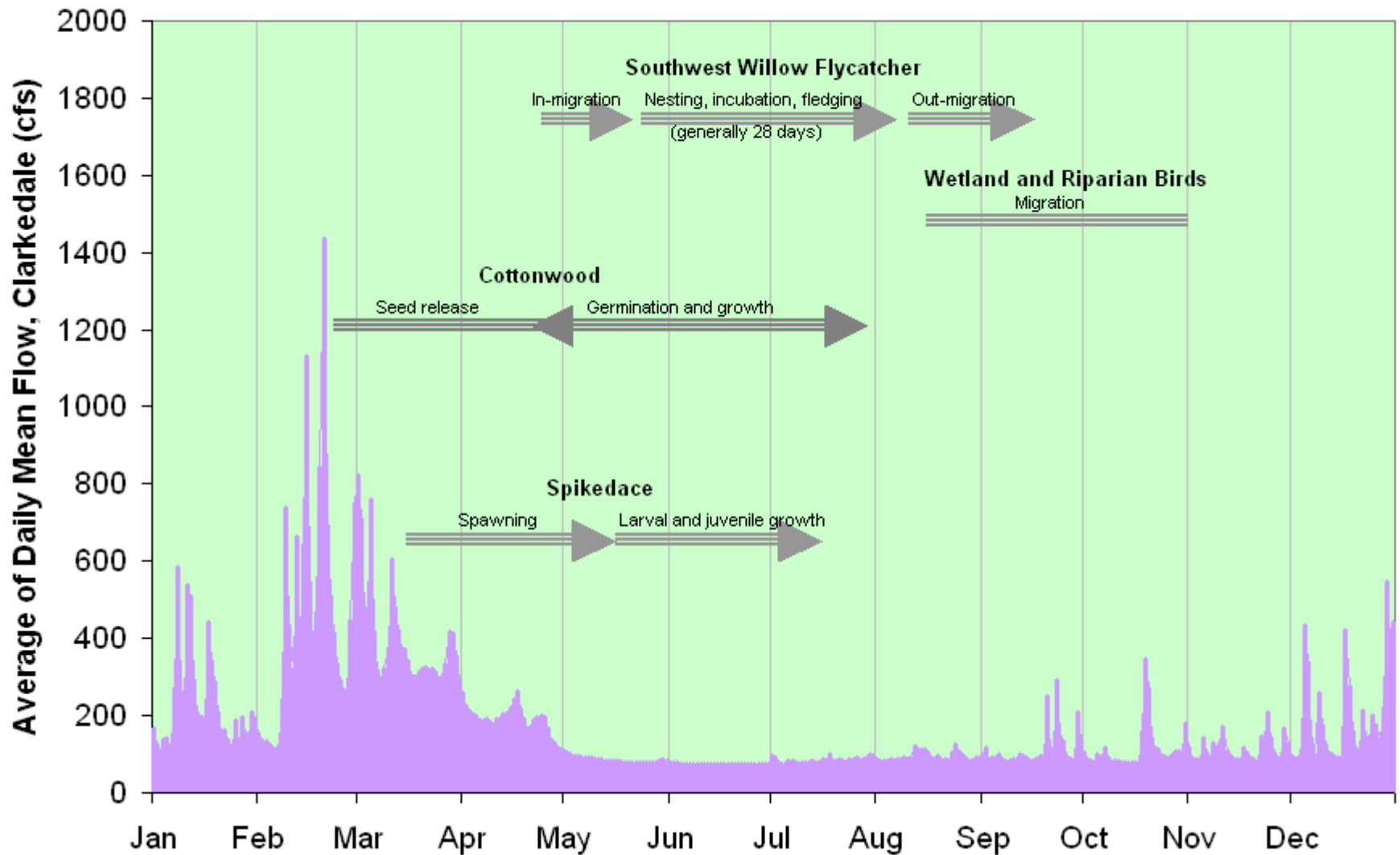
# Defining Ecological Flows Verde River Watershed

- Collaborative
- Science-based
- Interdisciplinary
- Adaptive

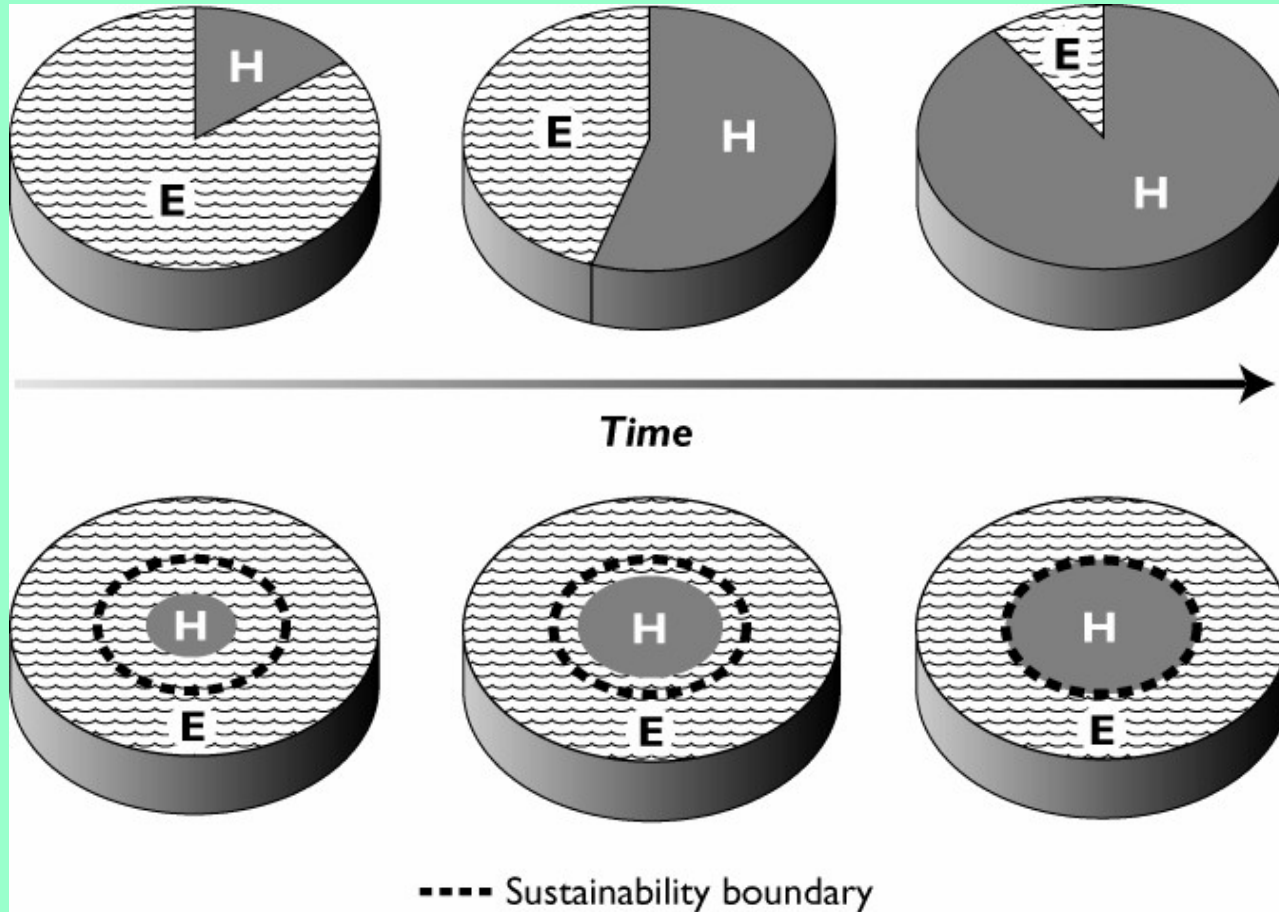


Result – informed decision making.

# Conceptual Ecological Model Southwestern River



# Finding The Right “Balance”



**E = ecosystem support**

**H = human use**





**The best way to predict the future  
is to invent it.**

*Alan Kay*



A scenic view of the Verde River at Beasley Flat. The river flows through a landscape of rocky banks and lush green vegetation. In the background, there are rolling hills under a clear blue sky with scattered white clouds. The foreground is dominated by tall, green grasses and reeds growing along the water's edge.

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