

# Gila River Science Forum

R.J. Glass, C.N. Dahm, & D.E. Cowley  
*Science Coordinators*

## Task

"The Interstate Stream Commission recognizes the unique and valuable ecology of the Gila Basin. In considering any proposal for water utilization under Section 212 of the Arizona Water Settlements Act, the Commission will apply the best available science to fully assess and mitigate the ecological impacts on Southwest New Mexico, the Gila River, its tributaries and associated riparian corridors, while also considering the historic uses of and future demands for water in the Basin and the traditions, cultures and customs affecting those uses."

# Goals

- Present independent perspectives from scientists well versed in river and watershed ecosystem management to help inform decision making in the Upper Gila River Watershed.
- Review the Upper Gila River water management issues in context of similar watershed efforts in the US and internationally.
- Assist in the identification and prioritization of scientific and technical needs required to support water management decisions in the Upper Gila River Basin.
- Provide independent input for the development of strategies to meet those needs throughout the watershed.

# Presenters



Stuart Bunn

Dave Meko



Robert Wissmar



John Bolte



Dave Goodrich



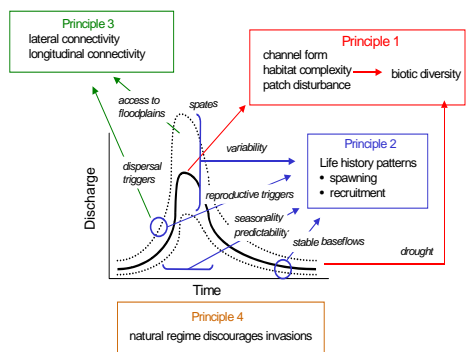
Julian Olden

## Key questions that were asked of the forum speakers included:

- what science needs to be done to inform the decision making process?
- what are potential gaps in scientific information that should be filled? and
- what are sensitive and useful measurements of the health and sustainability of river ecosystems?

## Environmental Flows & Australian Dryland Rivers

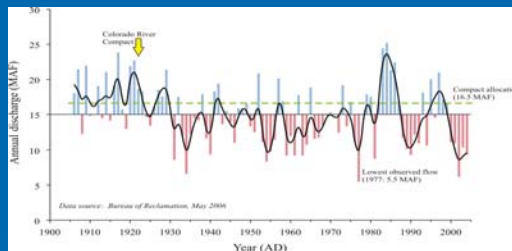
### Aquatic biodiversity and natural flow regimes



- Important environmental assets?
- How these are influenced by flow? (conceptual models)
- Which flow parameters?
- How much will they be altered?
- Understand the ecological response to flow change - are there thresholds?



# Long-term Variability of Stream Flow in the Southwest



Annual flows of rivers in the Southwest vary greatly from year to year and on timescales of decades to centuries

Tree-ring records suggest the 20th century was unusual in the context of the past 500 years for the extended wetness early in the century and drought in the 1950s



# Stream-Riparian Landscape Perspectives

- riparian areas are sustained by interaction of terrestrial & aquatic systems
- riparian systems change predictably in plant & animal species along the length of a river
- disturbances (e.g., fire, flood, diversion) can affect sustainability of riparian areas from local to regional scales
- adopt management actions that promote sustainability of watershed & stream systems



## Introduction, Establishment & Impact of Non-indigenous Species

- altered flow regimes, land use changes, and degradation of riparian zones can favor establishment of non-indigenous fishes
- Gila River fishes are vulnerable to non-indigenous species because the native fishes have high endemism and ecological specialization and low genetic adaptability to ecological change
- predicting change to the fishes with new water diversions requires knowledge of habitat associations & preferences of each species



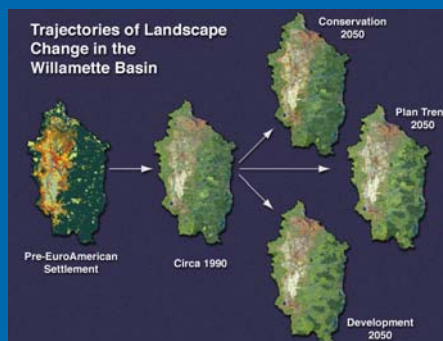
## Alternative Futuring in the Willamette River Basin

### Alternative Futures Projects

- Examine multiple scenarios of trends and assumptions about future conditions, generally using one or more models of change,
- Assist in incorporating stakeholder interactions to define goals, constraints, trajectories, drivers, outcomes
- Allow visualization of the results in a variety of types and formats
- Ultimately are intended to assist in improving land management decision-making

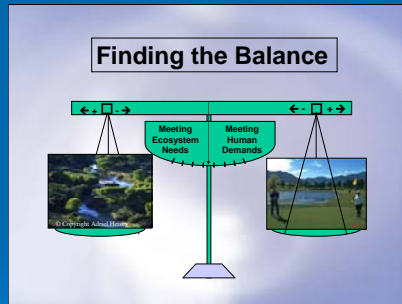
Evoland (*Evolving Landscapes*) is a tool for conducting alternative futures analyses

- A **spatially explicit**, GIS-based approach to landscape representation
- Actor-based (multiagent-based) approach to human decisionmaking that **explicitly represents real-world decision-makers with attributes and behaviors within the model**
- Actor decisions are guided by **"policies" that define, constrain potential behaviors**
- **Autonomous landscape process models** produce non-human induced (natural) landscape change



# Integrating Science & Decision-Making in the Upper San Pedro

- Successes in joint policy-research efforts have often occurred due to acute needs
- Trust is essential to the process (=time)
- Better knowledge of basin-scale water balance components and ecohydrology is essential for sound management in water limited areas



## Open Forum



## Gila River Field Trip



## Recommendations on Overall Process

- Successful water development or remediation projects from across the globe demonstrate that the process for fully including science within decision making must include
- 1) identifying current ecological, cultural, and economic assets,
- 2) developing a robust framework for integration and synthesis of scientific information,
- 3) ensuring ongoing stakeholder engagement, education, and information exchange, and
- 4) considering future conditions and scenarios for the river corridor and the human population in the basin.

If scientific studies are not directed in the context of this process, they will likely yield little of value to the decisions that are ultimately considered.

## Integrative Framework for Scientific Information

- In context of the overall process, a framework for integration and synthesis of scientific information must be formulated with ***clear guiding scientific principles*** that link hydrology to the biological components of the ecosystem and include anthropogenic modifications to each.

## Guiding Principles

a core set of guiding principles include:

- 1) flow is a major determinant of physical habitat, which in turn is a major determinant of biotic composition,
- 2) aquatic species have evolved life history strategies primarily in direct response to natural flow regimes,
- 3) maintenance of natural patterns of longitudinal and lateral connectivity is essential to the viability of populations of many riverine species,
- 4) the invasion and success of exotic and introduced species in rivers is facilitated by the alteration of flow regimes and
- 5) pressure from the human population will only continue to grow

## *Scientific information most useful*

- 1) reach based water budgets along the river and placement of the hydrology of the Gila in context of similar arid and semi-arid land river ecosystems,
- 2) high resolution characterization of the river and riparian zone (e.g., geomorphology, river width, depth, and variability, riparian zone width),
- 3) current distributions of fish species with emphasis on off-channel and tributary inputs and threats from non-native species,
- 4) high resolution landscape characteristics for the basin (e.g. topography, soils, land use/cover, human cultural attributes) and their projection along future scenarios,
- 5) historical and paleo-climatic data to constrain long term precipitation and discharge patterns, and
- 6) response of current ecological, cultural, and economic assets to flow magnitude and variability