

Providing water to meet the needs of riparian and aquatic ecosystems in the desert watersheds of the United States and Mexico remains a significant challenge for land and water resources managers



The Desert Flows Methodology Guidebook provides this information and directs users to a variety of methods that can be applied under different physical or temporal constraints. Based on evidence from cases in the desert southwest and around the world, this Guidebook provides access to verifiable techniques and synthesizes far-ranging data, so that on-the-ground projects are able to benefit from the latest research in determining environmental flow targets.

Methodology

This guidebook was developed through review of the more than 400 articles included in the Desert Landscape Conservation Cooperative (DLCC) Desert Flows Database as well as interviews conducted with members of federal and state agencies and Non-Governmental Organizations (NGOs). The questions covered how in-stream flow targets have been determined and established, and how they can be maintained in light of future climate variability and land use change.

Key Findings

- In arid regions, there is a strong need for increased understanding and high-quality, quantitative data to determine how best to manage for current and future stressors to riparian ecosystems.
- Regardless of data needs or cost limitations, numerous methods are available to determine target flows for environmental systems.
- System-specific ecohydrological data are needed to accurately model how changes will impact surface water flows.
- Case studies can provide valuable information to water resource managers, as they identify not only effective environmental flow programs, but also the processes and key elements needed to achieve similar successes.
- **Community education** on the value and purpose of environmental flows can help build enthusiasm, understanding, and long-term support for the projects.
- Involving the public or key players in monitoring programs and adaptive management actions can help increase acceptance and understanding of how the environmental flows project is helping achieve community objectives.
- Generally, there is a scarcity of inter-basin and international agreements for water management and environmental flow allocations in the region. Without these formal and informal understandings, parties can often be limited in their ability to implement environmental flows programs.
- An institutional framework or enforceable agreement may be needed to generate the cost support essential for implementing environmental flows programs.
- Limited water resource availability, future socio-economic and climatological uncertainty, and lack of trust between controlling parties is preventing the forward progress of regional water planning.
- Improved goodwill and trust among parties is needed to advance water management discussions and improve long-term natural landscape function.

The Desert Flows Methodology Guidebook

A tool for determining environmental water needs of riparian and aquatic ecosystems

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Methods for Determining Environmental Flows

Method Type	Subtype	Method Name	Min . data req.	Extensive data req.	Incorporates depth to groundwater and legal req.	Incorporates groundwater, surface water and species	Include species adaptation to drought, landscape and climate change	Robust for ongoing drought	Limitat
Look-up Table	Hydrological Ecological	Flow Duration Curve	Х						Not site specific (Dyson
		Hydrological Index	Х						
		Natural Flow Index	Х						flows (Acromon 2005)
		Tennant Method	Х						nows (Acreman, 2005).
Desktop Analysis	Hydraulic Ecological	Wetted Perimeter	Х						Requires long time seri
		Richter Method		Х					data collection (Dyson
		Daily Water Accounting	Х						Does not reflect the ful
		Streamflow Depletion Model	Х						variability (Mathews an
		Sustainable Yield Estimator	Х						Does not consider mod
		Lotic Invertebrate Index for Flow Evaluation		Х					theories (Smakhtin et a
Habitat Modeling	Ecological	Range of Variability Approach (RVA)	Х						
		Flow Events Method	Х						
		Instream Flow Incremental Methodology		Х	Х				Data expensive to colle
		Physical Habitat Simulation Model		Х					Scanlon, 2003). Flow re
		River Hydraulics and Habitat Simulation Program		Х					cannot be used for enti
		Riverine Habitat Simulation Program		Х					and Carlson, 1980; cite
		Computer Aided Sim. Model for Instream Flow Requirements		Х					King, 1998). Difficulty in
		River System Simulator (RSS)		Х					of target species.
		Riverine Habitat Assessment and Restoration Concept		Х					
		Coupled Reservoir Operation and Water Diversion (CROWD)		Х					
Holistic Analysis	Hydrological- hydraulic- ecological	Expert Panel Assessment Method	Х						
		Adapted Ecological Hydraulic Radius Approach (AEHRA)	Х						
		Building Block Methodology (BBM)		Х		Х	Х	Х	Data expensive to colle
		Holistic Approach		Х			Х	Х	employ a variety of exp
		Habitat Analysis and Water Flow Restoration Methodology		Х					Scanlon, 2003). Judgme
		The River Babingley Method		Х			Х	Х	variety of people, thus
		Ecosystems Function Model		Х					subjective and consens
		Indicators of Hydrologic Alteration		Х					reached (Tharme and K
		Ecological Limits of Hydrologic Alteration		Х					
		Downstream Response to Imposed Flow Transformation (DRIFT)		Х					

Environmental Flows Supporting Vulnerable Ecosystems



The Chiricahua leopard frog is a vulnerable species, native to Mexico, Arizona, and New Mexico. Is dependent on desert springs and surface flows for survival and reproduction. (Photo credit: USFWS)

Impact of drought conditions on Lake Mead between 2001 (left) and 2015 (right). The lake elevation dropped from 1,196 to 1,075 feet, a decline of 121 feet. Long-term impacts of extended drought conditions on Colorado River reliant systems are uncertain. (Photo credit: US DOI)



Sedimentation can cover cobble and gravel beds necessary for aquatic species nesting and survival. Pulse flows of varying intensity can help redistribute sediment, flush accumulated salts, and replenish nutrients in the floodplain. (Photo credit: USGS)



For full study please visit: https://wrrc.arizona.edu/publications/guide-books/desert-flows-methodology-guidebook



Decreased and lower quality surface flows can negatively impact an "overlooked economic giant", the outdoor recreation industry. In 2012, 56% of Arizona residents participated in outdoor recreation (OIA, 2012). (Photo credit: US DOI)

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