

INSTREAM FLOW PROTECTION AND RESTORATION: SETTING A NEW COMPASS POINT

BY
RUTH MATHEWS*

At this fifty year mark commemorating Oregon's 1955 Act establishing the State Water Resources Board, an historic step toward legal protection for instream flows in the West, it is important to step back and take stock of the progress that has been made to date toward securing water in rivers for river-dependent biodiversity and the ecosystems they inhabit. In 2005, the Nature Conservancy commissioned a survey of state and federal agency and NGO staff involved in state instream flow programs to assess the status of instream flow protection and restoration and to identify broad recurring themes that could provide direction for future activities. The survey explored five areas: capacity in staff and funding, legal and regulatory framework, public and legislature awareness, science and technical tools, and monitoring and enforcement. The responses are summarized in this Article, which highlights the cumbersome nature of instream flow laws and their implementation. While survey respondents resoundingly reported that the legal and regulatory framework was the primary obstacle to instream flow protection and restoration, most respondents concluded that education of both the public and legislators was the essential key to improving their ability to accomplish instream flow objectives. Looking forward to the next fifty years of instream flow protection and restoration, this Article recommends changes that will enable NGOs, private sector groups, and local, state, and federal governments to protect the public's interest in river, floodplain and estuarine ecosystems.

* © Ruth Mathews, 2006. MS Water Resource Management and Planning 1996, Colorado State University. Ruth Mathews founded River Matters in 2004 to provide services that support the implementation of ecologically sustainable water management (ESWM) practices. Formerly, she worked for The Nature Conservancy where she led the application of the ESWM framework in the Pacific Northwest and represented the Conservancy in water allocation formula negotiations for the Apalachicola-Chattahoochee-Flint River Basin. The author would like to thank The Nature Conservancy and the Instream Flow Council for their support in conducting this survey of state instream flow programs. The author would also like to acknowledge the many survey participants who gave generously of their time. We all benefit from their dedication to protect and restore rivers. Even in the most difficult settings, their passion for rivers has not dimmed.

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I. INTRODUCTION

Rivers, lakes, and aquifers are the source of freshwater for human needs from drinking water to irrigation for industrial uses, and for many other uses. They also provide water for a wide range of species, including fish and other aquatic plants and animals that live in river, estuarine, groundwater, lake, and wetland ecosystems; terrestrial plants and animals that inhabit floodplain and riparian ecosystems; and the many animals that move to and from these areas during their lives. These freshwater-dependent ecosystems, which support a rich biodiversity with many complex interactions and interdependencies among species, can be hydrologically connected, thereby linking the rise and fall of river flows, lake, and aquifer levels. As humans utilize water, either withdrawing it from rivers, lakes, and aquifers or manipulating the flow regime in rivers, water is no longer available to native species in the manner to which they have adapted. An instream flow, or environmental flow as it is commonly referred to in many countries, is the quantity of water allocated to remain in a river to conserve the biodiversity dependent upon these diverse and interconnected ecosystems.

At this fifty-year mark commemorating Oregon's 1955 Act establishing the State Water Resources Board,¹ a historic step toward legal protection for instream flows in the West, it is important to step back and take stock of the progress that has been made to date toward securing water in rivers for river-dependent biodiversity and the ecosystems this biodiversity inhabits. In the fall of 2005, The Nature Conservancy (TNC) commissioned a survey of state instream flow programs to assess the status of these programs and identify, if possible, key strategies for making them more successful and

¹ Act of Mar. 26, 1955, ch. 707, § 10(g), 1955 Or. Laws 924, 927–28.

effective in protecting and restoring instream flows.² Since the advent of legal protection for instream flows, varying amounts of public and private resources have been dedicated to setting, securing, and enforcing instream flows in each state, and each state has developed its own legal and institutional history of instream flow protection and restoration. While each state has a unique context within which instream flow protection and restoration occurs due to the particulars of the legal, institutional, geographical, cultural, and economic histories, and the current political climate, broad themes were expressed repeatedly throughout the interviews. While TNC will use this information to guide its own involvement in instream flow protection and restoration activities, it is offered here to provide the larger community, already actively involved in instream flow issues or considering involvement, with a useful assessment of state instream flow programs. As we compare where we are today to where we need to be in protecting and restoring instream flows, we can see that ensuring the long-term maintenance of healthy river, floodplain, and estuarine ecosystems, and the native species they support, will be a mammoth task. We can also discern the focal areas in which to direct the limited resources available for this work.

A. Water for Instream Values

When evaluating the efficacy of instream flow policy implementation, advancements in the scientific understanding of the role river flows play in maintaining the health of river, floodplain, and estuarine ecosystems must be considered. The species that depend upon these ecosystems for their survival have, over millennia, evolved in response to the full range of flows—low flows, high flows, and floods—and their intraannual and interannual variability.³ Each species has developed life history traits that take advantage of specific flow levels, as well as the timing, duration, frequency, and rate of change of these flow levels.⁴ With critical aspects of their survival such as reproduction, feeding, and movement between habitats closely tied to the long-term historical patterns of dynamic variation in flows, maintaining the natural range of variation of the flow regime is necessary to sustain the rich diversity of species found in river, floodplain, and estuarine ecosystems.⁵ Reaching far beyond the common practice of

² Ruth Mathews, Survey of State Instream Flow Programs (Feb. 2006) (unpublished manuscript, on file with author). To request a copy of this survey, address an email to the author at riverspeaker@earthlink.net.

³ See Brian D. Richter, Jeffery V. Baumgartner & Robert Wigington, *How Much Water Does a River Need?*, 37 FRESHWATER BIOLOGY 231–49 (1997) (describing new “Range of Variability Approach” (RVA) for setting streamflow-based river ecosystem management targets).

⁴ See Brian D. Richter et al., *A Method for Assessing Hydrologic Alteration Within Ecosystems*, 10 CONSERVATION BIOLOGY 1163, 1163–74 (1996) (introducing “Indicators of Hydrologic Alteration” method for assessing degree of hydrologic alteration of an ecosystem attributable to human influence).

⁵ See N. LeRoy Poff et al., *The Natural Flow Regime: A Paradigm for River Conservation and Restoration*, 47 BIOSCIENCE 769, 769–84 (1997) (arguing that natural flow is crucial in

establishing a minimum flow level for a single species or even a particular life history trait of that species, river scientists have firmly established that naturally varying river flows are central to ecosystem health and species survival.⁶

Traditionally thought of as minimum flows, instream flows have primarily maintained a level of flow below which a river will not go. This flow quantity can be considered a critical low flow that provides species protection during periods of drought or high water use. At these times of extreme low flow, instream flows can provide species an essential buffer between life and death. However, instream flows that solely protect the minimum or extreme low flow fall short of the level necessary to ensure the long-term viability of these ecosystems. Furthermore, providing a single flow level for an individual species or a specific life history trait is not sufficient. For ecosystem maintenance and biodiversity conservation, instream flow levels that minimize the departure from all components of the natural flow regime—low flows, high flows, and floods—are the goal.⁷

In addition to biodiversity conservation, flows that sustain healthy river, floodplain, and estuarine ecosystems provide a wide range of ecosystem services that benefit people. These benefits include: provision of water supplies, provision of food, water purification and treatment, flood mitigation, provision of habitat, soil fertility maintenance, nutrient delivery, maintenance of coastal salinity zones, provision of beauty and life-fulfilling values, and recreational opportunities.⁸ Often invisible, ecosystem services and their value to society are frequently ignored when determining the allocation of water to instream flows. If included, ecosystem services would further underline the importance of dedicating water to instream flows beyond just the minimum flow. Degradation of river, floodplain, and estuarine ecosystems through alteration of the flow regime results in lost opportunities for individuals and society, opportunities inherent in healthy ecosystems. Therefore, ecosystem services must be considered in the determination of instream flows if society is going to have access to the full benefits available from these ecosystems.

sustaining biodiversity and ecosystem integrity in rivers and discussing river management policies and effects of river exploitation).

⁶ There is a growing body of literature documenting the relationship between the flow regime of a river and ecosystem health and species survival. In addition to literature already cited, the following and their citations are good sources. See Stuart E. Bunn & Angela H. Arthington, *Basic Principles and Ecological Consequences of Altered Flow Regimes for Aquatic Biodiversity*, 30 ENVTL. MGMT. 492, 492–507 (2002) (reviewing literature on mechanisms linking hydrology and aquatic diversity and discussing impacts of flow regimes); SANDRA POSTEL & BRIAN RICHTER, RIVERS FOR LIFE: MANAGING WATER FOR PEOPLE AND NATURE 13–26 (2003) (discussing the impact of disrupted natural river flows and examining river management paradigms).

⁷ See generally ANNEAR ET AL., INSTREAM FLOWS FOR RIVERINE RESOURCE STEWARDSHIP (rev. ed. 2004) (covering the entire field of instream flow administration and application).

⁸ See POSTEL & RICHTER, *supra* note 6, at 8 (listing ecosystem services provided by rivers).

B. Out-of-Stream Uses

Water use, whether in the water scarce regions of the arid West or in the relatively water rich areas in other parts of the country, has historically developed to serve human purposes that remove water from a river or otherwise alter its flow. Water is diverted or extracted from rivers, lakes, or underground aquifers for a wide variety of purposes, including mining, irrigation, and stock watering, as well as for industrial, municipal, or individual water supply. River flows and lake levels are manipulated for water storage, navigation, flood control, and hydroelectric power generation. Beyond these direct water uses, a variety of other human activities can also alter the flow regime of rivers. For example, building levees to protect low-lying areas from flooding, installing rip rap to stabilize shorelines, and removing native vegetation from riparian and floodplain areas can change river flow dynamics. Conversion of upland areas of watersheds from their natural land cover by human activities, such as logging, mining, or agriculture, or to provide space for human populations and their associated infrastructure, can also fundamentally change the flow regime of a river.

C. Legal Protection for Instream Flows

The historical bias toward water and land uses that manipulate the natural environment is represented in the legal protections afforded these uses in both the prior appropriation water rights system of the West and the riparian system of water permitting. Both of these systems, and their hybrid forms developed in some states, initially excluded protections for water remaining in a river for ecosystem needs and did not consider the allocation of water for the provision of ecosystem services as a beneficial use. As river flows have been altered by these out-of-stream or flow-altering water uses, however, there have been significant levels of degradation of river, floodplain, and estuarine ecosystems followed by the attendant loss or diminishment of native species.⁹ Recognizing these losses led states across the country to pass laws affording legal protection for instream flows. These state laws ensure varying degrees of legal protection for instream flows.

Legal protection for instream flows occurs at different points along the continuum of water use from pristine rivers with no flow-altering water uses to fully, or even over, appropriated river reaches or basins. For example, high elevation tributary rivers on public lands may have no historical water use, while in much of the arid West rivers were already over allocated decades before instream flow laws were passed. Application of instream flow laws thus results in two forms of instream flow activity: protection and restoration. Instream flow *protection* occurs when there has not been

⁹ See Brian Richter et al., *Ecologically Sustainable Water Management: Managing River Flows for Ecological Integrity*, 13 *ECOLOGICAL APPLICATIONS* 206, 206–24 (2003) (advocating framework for an ecologically sustainable water management program that includes meeting human needs for water while maintaining ecosystem integrity).

substantial flow alteration through human activities, and the goal is to maintain a healthy river, floodplain, or estuarine ecosystem, or all three. Thus, instream flow protection legally secures the necessary river flows and protects rivers from future water uses impinging upon these flows. In cases where there have already been substantial alterations in river flows and the ecosystem is degraded, water must be reallocated away from other uses and *restored* to the river, lake, or aquifer. In other words, restoration of instream flows is the reallocation of water from flow-altering uses to flow maintenance.

Instream flow protection and restoration, then, is a water allocation question. On one hand, setting and legally protecting instream flows determines how much water stays in the river for ecosystem maintenance, sustaining native species, and provision of ecosystem services. On the other hand, the water that is not protected as instream flows determines how much flow alteration will be allowed through water diversion and use, flow manipulation, river channel, riparian or floodplain habitat alterations, and land use and land cover changes. Historically, there were no limits on the latter category of uses, but with the advent of instream flow laws, society is now asking this allocation question.

II. SURVEY OF STATE INSTREAM FLOW PROGRAMS

A. Survey

State instream flow programs are primarily housed in the state fish and wildlife agency, with regulatory functions of water use housed in a sister agency. State fish and wildlife agency staff were contacted using information supplied by the Instream Flow Council.¹⁰ In addition to staff from state fish and wildlife agencies, staff from state regulatory agencies, federal agencies, and non-governmental organizations (NGOs) were also interviewed. Thirty-three people from twenty-one states across the country were interviewed. The survey was conducted over the phone and most of the conversations lasted more than one hour. Survey participants had a range of experience in instream flows and related fishery issues from one to forty years. The state programs surveyed also spanned the range from well funded to woefully inadequate, and from actively engaged in instream flow protection and restoration to stymied in all attempts. The goal of the survey was not to provide a statistically credible or comprehensive analysis of state instream flow programs, but to hear about the struggles, challenges, successes, and failures of instream flow programs from the people who are working on a daily basis to protect and restore instream flows.

Each survey participant was asked to describe the status of their state's instream flow program in five areas: capacity, legal and regulatory framework, public and legislature awareness, science and technical tools,

¹⁰ Instream Flow Council, <http://www.instreamflowcouncil.org/> (last visited Nov. 12, 2006).

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and monitoring and enforcement. Participants were asked the following five questions:

1. Do you have the necessary staff and funding to protect and restore instream flows in your state?
2. Do you have the legal and regulatory framework necessary to protect and restore instream flows?
3. Do the public and the legislature understand the importance of instream flows and the need for their protection and restoration?
4. Do you have the science and technical tools for determining the flows necessary to protect river-dependent biodiversity?
5. Do you have compliance and monitoring mechanisms in place to make sure, once instream flows are set, the water is in the river and are you able to enforce these flows?¹¹

After answering the five questions, the survey participants were asked to rank which of the five areas was most in need of improvement to increase their ability to protect and restore instream flows. Finally, they were asked what needed to happen for this change to occur and how TNC and the greater community could work to bring about this change.

B. Survey Results

The results presented in this Article are a synthesis of all the comments received in response to the survey questions. Every attempt has been made to reflect accurately the intent and meaning of the survey responses. No comment can be attributed to any individual involved in the survey and any errors in representation of survey responses are mine alone. Summarized below are broad recurring themes extracted from the interviews that represent critical challenges to instream flow programs. It is nonetheless important to remember that not all of the points presented apply to each state at all times.

1. Capacity¹²

Given the wide spectrum of human activities that have the potential to impact the flow regimes of rivers, including water diversion and use, flow manipulation, river channel, riparian or floodplain habitat alterations, and land use and land cover changes, it is easy to see that decisions are being made constantly that affect how much water is in a river at any given time. In general, respondents reported that instream flow programs within state

¹¹ Mathews, *supra* note 2, at 1.

¹² See *id.* at 1 (asking “Do you have the necessary staff and funding to protect and restore instream flows in your state?”).

fish and wildlife agencies are most likely to be under funded or not funded at all. Therefore, these agencies lack the staff necessary to participate in all the legal and regulatory processes where decisions affecting river flows are made and to provide the scientific data and analysis required to determine the water needs of river, floodplain, and estuarine ecosystems and their native inhabitants. Because of these staffing shortages, agencies make many decisions affecting the flows in a river without considering the impacts on the ecosystem.

The capacity needs, that is, the needs that must be added to instream flow programs to enable the programs to provide their expertise to the plethora of decision making processes affecting instream flows and to effect greater protection and restoration of river flows, can be boiled down to five areas: 1) add more staff, 2) add staff with different areas of expertise, 3) increase access to training, 4) increase the amount of data collection (by having more staff and funding to dedicate to it), and 5) establish or increase funding for water rights or land acquisition, or both. In many states, there is only one person working on instream flows for the fish and wildlife agency and doing so is only one job duty among many. Even states that have more than one person working on instream flow protection and restoration do not have sufficient staff to meet their needs. In fact, there were only two states that reported enough staff to address the current level of demand for science and technical support for setting instream flows. With a small staff, there are areas of expertise that are not represented, commonly resulting in flow recommendations based on a single species or life history trait. Moreover, regulatory proceedings, such as Federal Energy Regulatory Commission (FERC) relicensing of dams, can be so time-intensive that an agency does not have staff to participate in other water use and management decisions. The lack of funding can also limit training opportunities for staff, making it difficult for them to keep up with the tools and science used in instream flow protection and restoration. In addition to funding for staff and data collection, funding for restoration and protection activities—buying water rights or land—is not available in many states. This lack of funds severely restricts the application of market approaches to protecting or restoring instream flows.

Funding for fish and wildlife agencies has primarily come through user fees, such as fishing and boating licenses, and this has a direct impact on the funding available to support instream flow programs within these agencies. Because funding comes from user fees, fish and wildlife agencies focus their efforts on hatchery operations and stocking of game fish in support of recreational and commercial fishing interests. Instream flow programs are not seen as directly tied to these traditional funding sources; therefore, agency budgets are unlikely to allocate sufficient funds to these programs. In addition to restricted funding, the customer base of recreational and commercial anglers drives data collection almost exclusively toward game fish. This hampers fish and wildlife agencies' staff when making decisions about instream flow levels and the regulation of activities that alter a river's

flow regime because they do not have current or historical data on non-game fish for analysis of flow needs and impacts due to flow alteration.

With no direct ties to the funding stream of user fees, instream flow programs are often an add-on to existing programs that have historically been the focus for these agencies. States with funding sources from outside the United States Fish and Wildlife Agency, such as the Salmon Recovery Fund in Washington, the Bonneville Power Administration in the Northwest, and the Heritage Initiative in Arizona, are at an advantage in building instream flow programs. For instream flow protection and restoration activities to increase, the priorities of fish and wildlife agencies need to shift from investing in fish to investing in water for fish. This investment in water will require a shift in the culture of fish and wildlife agencies, as well as a redirection of funding to instream flow programs. This shift could occur, in part, by building a non-user customer base through the promotion of healthy rivers as providing ecosystem services that benefit us all and increase our quality of life.

*2. Legal and Regulatory Framework*¹³

Every state has a completely different legal and regulatory framework within which instream flow protection and restoration activities occur. The bulk of the survey interviews were spent discussing the specific idiosyncrasies of the legal and regulatory framework within a state and the implications this has on the ability for state fish and wildlife agency staff and others to protect and restore instream flows. The tools and methods used to protect and restore instream flows depend, in large part, on the legal structuring of instream flows in relation to other water uses. For instance, laws concerning the acquisition, leasing, or transfer of water rights for instream flows, and their administrative and judicial interpretation, may encourage or hinder the protection strategy of applying for instream flow water rights or the use of water markets to restore water to instream flows. Where laws allow them, water markets can be an important tool, and agency staff and NGOs, specifically water trusts, may be actively involved in these transactions. On the other hand, laws may hinder the use of water markets to reallocate water from out-of-stream or flow-altering uses to instream flows, thereby limiting the tools available for instream flow restoration. Where the use of water markets for instream flow restoration or the filing of instream flow water rights is unavailable or improbable, fish and wildlife agency staff may be limited to commenting on water rights or permit applications made for out-of-stream uses from the perspective of potential fish and wildlife impacts. This may occur on a case-by-case basis or, in some basins, be done as part of comprehensive planning efforts that address multiple water uses including instream flows.

¹³ See *id.* at 1 (asking “Do you have the legal and regulatory framework necessary to protect and restore instream flows?”).

Fish and wildlife agency participation in instream flow protection and restoration activities is further conditioned by the fact that while it is responsible for managing fish and other freshwater-dependent resources for the public good, it has no regulatory authority over one of the most critical habitat components—water. In most states, the regulatory authority for water is in a completely separate agency, which puts fish and wildlife staff in the position of working through another agency to achieve instream flows and thereby habitat protection and restoration. The quality and characteristics of the relationships between fish and wildlife agencies and the agencies responsible for the regulation of water rights or permits range from wholly antagonistic, where comments made by the fish and wildlife agency are blatantly ignored, to congenial, where the regulatory agency looks to the fish and wildlife agency for consultation on the science and technical aspects of instream flows. In many states, the regulatory agency has historically been charged with the development of water resources for economic purposes. This further hampers the ability of fish and wildlife agencies to accomplish their goals for instream flows, since the mindset within the regulatory agency is to develop water for economic purposes, not to leave it instream. In some states, the combination of the legal and regulatory framework and the relationship with the regulatory agency deters fish and wildlife agencies from participating in *any* activities that would directly benefit instream flows.

It may also be the case that sound instream flow laws are not implemented by the regulatory agency, enacting instead a narrower interpretation of the statutes than may have been intended. This can result in a reasonable legal protection for instream flows being administered by the regulatory agency in a manner that limits its application and benefits. The regulatory agency can become a “captive” agency, catering to the interests of the individuals it is meant to regulate. This is likely to occur when economic interests are well organized, have political influence and active lobbyists, and no entity, such as an NGO, is present to provoke judicial review of the administrative interpretation of statutes. Although passage of a good instream flow law is an excellent step forward, it is not sufficient. All three parts of instream flow policy must be working together: statutory, administrative, and judicial.

Additionally, instream flow laws were passed long after out-of-stream uses were well established, placing instream flow protection subordinate to historical uses.¹⁴ In prior appropriation states, instream flow water rights are likely to be junior to, that is, lower in priority for being met than, the prevailing flow-altering uses, so much so that they may never be met in even the wettest years. In states with permitting structures, the hierarchy is established between those water withdrawals with no conditions versus those that are interruptible based on minimum, or passby, flows. As instream flow laws are passed, the existing uses have been “grandfathered”

¹⁴ See *id.* at 8.

in, exempting them from the conditioning of passby flows.¹⁵ Whether in the West or the East, these existing uses with supremacy over instream flows can effectively make any legal protection of instream flows null and void.

Instream flow laws and their promulgation through administrative rules can also dictate which methods are used to determine the quantity of water to be dedicated to instream flows. The laws and regulations used to protect instream flows in many states are still based on the concept of providing the minimum flow necessary for species survival. This is likely to be interpreted as the minimum amount of water needed to cover the backs of fish as they move about in their preferred habitat. However, this interpretation does not provide water for ecosystem functions equally important to fish survival such as food production or habitat formation. In the East, states may rely on 7Q10 levels (the lowest seven-day flow with a ten-year recurrence interval) for their water permit conditions.¹⁶ Neither of these approaches to determining instream flow levels provides adequate levels for aquatic biodiversity conservation but, in many cases, fish and wildlife agencies are limited to recommending these levels by law or its administrative interpretation. While instream flow laws may provide low or baseflow protection, there is no protection for the high or flood flows, leaving ecologically important components of the flow regime unprotected. Even in river systems that are not regulated enough to lose the flood flows, the mid-range of flows may be altered due to the lack of protection mechanisms.

Many see instream flow protection as a threat or at least counter productive to economic and development interests. Many of the limitations in the legal and regulatory framework for instream flows and its application are staunchly guarded by the economic interests that benefit from unfettered water use. These interest groups—agriculture, industry, municipal water supply, etc.—can have powerful lobbies helping them to influence legislatures, state, and local politics. Many user groups hold the perception that water kept in rivers is taken away from their use, and threatens their livelihood and way of life, even though the water is kept in rivers for the benefit of freshwater-dependent ecosystems and all the species which are supported therein. This perception, combined with the interest groups' political power, can result in strident opposition to any changes to instream flow laws and their administration, rendering a dismal outlook for movement from the status quo.

¹⁵ *Id.*

¹⁶ See, e.g., CARL VINSON INST. OF GOV'T, UNIV. OF GA., BALANCING INSTREAM AND OFFSTREAM USES: INSTREAM FLOWS, SURFACE STORAGE AND AQUIFER MANAGEMENT 65–66 (2006), available at <http://www.cviog.uga.edu/services/policy/environmental/policyreports/balanceinstream.pdf> (explaining Georgia's continued use of the 7Q10 standard as a water use permit condition).

3. Public and Legislature Awareness¹⁷

The overwhelming response to the third question was no. Overall, respondents thought the public had very little awareness of instream flow issues. Some may appreciate the beauty of flowing rivers, but most individuals do not know how water is managed and used and what this means to river, floodplain, and estuarine ecosystems. While it may be obvious that fish need water to survive, the public does not have a sophisticated understanding of river ecology and the requirements of a healthy fishery. Most people are not familiar with the variety of river-dependent biodiversity, cannot relate its importance to their lives, and take no pride in this natural treasure. The public is unaware of the number of dams on rivers and their impacts on river, floodplain, and estuarine ecosystems below them. This lack of concern for a dam's impact on the downstream ecosystem is shown most pointedly in areas where reservoirs have become lakefront properties. The lakefront residents tend to be concerned solely about lake levels and ignore the impacts to downstream ecosystems. In some areas, water conservation can be seen as an imposition on private property rights instead of a way to protect public resources and may not be embraced as a viable alternative to fish kills and river ecosystem degradation. Instead, the public, through their actions, place the use of water for green lawns as a higher priority than healthy fish communities.

With few exceptions, the public is not adequately informed or articulate enough to be effective advocates for rivers in public forums. In fact, the presence of an informed and interested public advocating for instream flow values is dismally low in most public forums. A few state fish and wildlife agencies are actively involved in public education, but this is more the exception than the rule.

State legislatures respond to the public's concerns about water use and management laws and regulations. Without an educated and engaged public advocating for instream flows and the protection of river-dependent biodiversity, legislators prioritize funding for schools, roads, and public health issues over funding for instream flow protection and restoration. When there has been dedicated effort on the part of specific groups, such as conservation NGOs, business, and citizen organizations to educate legislators, the legislature is more likely to understand the importance of instream flows and support the passage of instream flow laws and regulations and funding for instream flow programs. In some states, there has been notable progress in garnering support for instream flow issues through long-term relationships with the legislature. Unfortunately, these can be temporary gains due to high legislator turnover. Legislature education goes both ways. The legislature is also more likely to have a negative opinion of instream flows than the general public due to the lobbying efforts of powerful water-user groups and therefore may actively block any legislation

¹⁷ See Mathews, *supra* note 2, at 1 (asking "Do the public and the legislature understand the importance of instream flows and the need for their protection and restoration?").

that would improve the ability to protect instream values. Overall, states where a specific high profile and longstanding issue, such as salmon restoration or estuary inflows, has brought instream flow protection and restoration to the forefront of public debate, have a much higher level of public and legislator understanding of the importance of instream flows and support for funding instream flow programs.

4. Science and Technical Tools¹⁸

Given the complexity of river, floodplain, and estuarine ecosystems and the wide variety of biodiversity they support, it would be reasonable to expect that having access to science and technical tools sufficient for the task of determining instream flows would be a limiting factor in instream flow protection and restoration. However, there is an active international community of river scientists engaged in advancing the wide range of disciplines supporting instream flow determination.¹⁹ Somewhat surprisingly, respondents reported that the scientific understanding of river-dependent ecosystems and individual species and the availability of technical tools used in setting instream flow levels is rarely the limiting factor in the success of instream flow protection and restoration activities. Nonetheless, it is important to remember that methods used in determining instream flow levels are dictated, in part, by the legal and regulatory framework and may not assess the full range of flows needed to maintain ecosystem health and the survival of all species.

Many different methods for determining instream flow levels are used—from well-established desktop methods to extensive site-specific studies. The methods selected depend upon the level of economic and ecological risk associated with the instream flow recommendations, and are chosen, in part, for their standing as evidence in a court of law. Regardless of the method used, adjustments are often made to fit the location and type of application. Respondents identified a variety of needs in tool and method development where the current array of tools falls short due to the peculiarity of specific sites and applications. Field staff faced with these limitations in the application of technical tools to river systems that are outside the scope that the tool or method was developed for may not have the time or resources to develop an alternative. In some cases, agency staff may collaborate with academics or consultants to resolve these discrepancies. However, the lack of a sufficiently comprehensive gauging network, especially on unregulated systems, is a prevalent concern given that instream flow recommendations based on synthesized data of uncertain accuracy will be applied indefinitely. Moreover, staff in some states are unable to keep up with the latest advances in instream flow science and technologies due to lack of funds for travel and training purposes.

¹⁸ See *id.* (asking “Do you have the science and technical tools for determining the flows necessary to protect river-dependent biodiversity?”).

¹⁹ *Id.* at 14.

While fish and wildlife agencies' staff are not substantially hindered in setting instream flow levels by the availability of the science and technical tools they use in making these recommendations, the inherent uncertainty in the results from their application can be used by water users to delay implementation of these instream flow levels. An inordinate amount of time can be spent in decision making processes concerning instream flows on questioning the veracity of the results from instream flow methods and models. This not only puts the burden of proof on the public instead of the private interests, but it also stalls even incremental progress toward protection and restoration of instream flows. Water users may also position themselves in control of the science and technical tools by using their more substantial resources to hire experts in appropriate fields. Agency staff do not have the time or resources to dedicate to reviewing and challenging models or results produced by these experts. This places the agency at a disadvantage by having to accept the outcomes as determined by the expert hired by the water user. Without being able to do due diligence in assessing these outcomes independently, the public's interest may be put at risk.

*5. Monitoring and Enforcement*²⁰

Monitoring and enforcement mechanisms for instream flows are woefully inadequate, understaffed, and underfunded. This is the Achilles' heel of instream flow programs. In the West, the status of monitoring and enforcement depends on whether the basin has been adjudicated and a watermaster assigned to manage water diversions. When this is the case, water withdrawals may be tightly managed. When a basin has not been adjudicated, illegal use can be rampant. In the East, stream gauges used to determine if flow levels are adequate for withdrawals to occur are often not maintained and not functional. Violations of permit requirements are often left up to the water users to report on an annual basis. Permit requirements may not be followed up on by the regulatory agency. Enforcement is often simply reactionary, with regulatory agencies responding after damage has occurred, for example, after fish kills. Moreover, when violations do occur, the penalties are slight—a letter or a small fine. When fines are levied, the money may go into the general fund instead of benefiting the fish and wildlife agency. While the current levels of monitoring and enforcement are substandard, as water becomes a more valuable resource, it is expected that monitoring and enforcement activities will increase to levels that are more appropriate.

6. What Most Needs to Be Changed

By an overwhelming majority, the statutes and administrative rules governing instream flow protection and restoration are seen as the primary

²⁰ *Id.* at 1 (asking "Do you have compliance and monitoring mechanisms in place to make sure, once instream flows are set, the water is in the river and you are able to enforce these flows?").

obstacle to doing a better job of protecting and restoring instream flows. The laws themselves, the way the laws are implemented by the regulatory agency, and the institutional culture within which instream flow protection and restoration occur all reflect the carefully guarded bias toward out-of-stream and flow-altering uses and the lack of public understanding and support for instream flows. Instream flow protection and restoration are contradictory to these established norms and have not been given equal legal standing. Without this, instream flows are often not met even where water rights have been dedicated to this purpose. In many cases, laws are structured in such a way as to effectively block any efforts to dedicate water to instream flows.

Even in states with progressive instream flow laws, the legal and regulatory framework that fish and wildlife agencies and others are working within to protect and restore instream flows strongly favors the use and management of water for out-of-stream and flow-altering uses. Although the scientific community has established the vital importance of all components of a river's natural flow regime, legal definitions of instream flows are limited to species survival and do not include maintenance of river, floodplain, and estuarine ecosystems. Increasing the legal standing of instream flows and expanding the flexibility for dedicating water to instream flows within the legal structure of water rights and permitting, as well as improving regulatory support for instream flows, are critical to achieving a future with healthy river, floodplain, and estuarine ecosystems.

Respondents' collective emphasis on making necessary changes to the legal and regulatory framework far outweighed their desire to make changes to other areas included in this survey. While respondents highlighted capacity needs in almost all interviews, the pervasive sentiment, with a few exceptions, was that adding more staff would not result in additional instream flow protection and restoration success without creating new opportunities through changes to the legal and regulatory framework. As noted earlier, respondents also indicated that the level of effort applied to advancing the science and developing technical tools used in determining instream flows is sufficient, although the use of more advanced and sophisticated tools is often limited by funding and legal constraints. Finally, respondents acknowledged that monitoring and enforcement mechanisms for instream flows are inadequate, but that advancements in monitoring and enforcement should follow improvements to the legal protection of instream flows. In other words, you can only monitor and enforce what you have.

7. How Will this Change Occur?

Respondents identified improving the legal and regulatory framework for instream flows was identified as the most critical area in need of change to enable fish and wildlife agencies and others to accomplish greater instream flow protection and restoration. However, public and legislator education is seen as the essential first step. Agencies and legislatures both respond to the public's priorities, and currently the most vocal public are the water users. Very few water users speak up for dedicating water to instream

flows, but as shown in states where a critical issue has actively involved the public, it is possible to develop an informed and engaged public supporting instream flows. This is critical in developing the political will for the statutory and regulatory changes necessary to protect and restore instream flows. An educated and engaged public can represent the public's interests in water use and management decisions that are currently dominated by representation from the water user and development community.

The political will for instream flow reform will need to be built from the grassroots up through long-term relationships. Legislators, agency staff, water users, and the general populace must understand how they benefit personally from healthy river, floodplain, and estuarine ecosystems by understanding the ecosystem services that provide benefits to individuals and society. One aspect of this is to communicate that healthy fish communities, although holding an inherent value in and of themselves, are a surrogate for healthy ecosystems and clean water. Establishing this link can break down the conflict between allocating water for fish versus water for people that often pervades discussions about instream flows. By placing instream flow protection and restoration within the context of benefits to their interests, members of the water user community and the public can become leaders in instream flow reform. In many states, certain public sectors of the water user community are pivotal in making improvements to instream flow laws and regulations.²¹

Strengthening the legal and regulatory framework for instream flow protection and restoration through an educated public that values instream flows will set off a cascade of returns with one improvement leading to another. When the legislature recognizes the value the public is placing on instream flow protection and restoration, funding will be increased for instream flow programs. More funding will result in more staff. With more staff, more protection and restoration activities will be accomplished. This will require more data collection and the use of better tools and methods for determining instream flow levels. Finally, with an increased value on instream flows, there will be more monitoring and stricter enforcement.

III. THE NEXT FIFTY YEARS

There is much to be learned from these survey results as we look toward the next fifty years of instream flow protection and restoration. The trends of river, floodplain, and estuarine ecosystem degradation and declines in or extinction of native species populations will continue and worsen unless there is significant reform of instream flow policy and implementation. While not included in this survey, a review of the quantity of water legally protected as instream flows in rivers across the country would most likely demonstrate a startling lack of instream flow protection. This analysis would highlight the discrepancy between the quantity of water

²¹ *Id.* at 11 (explaining the level of public awareness and responses from legislators in a number of states in understanding the importance of instream flow protection).

protected through instream flows and the quantity of water needed for ecosystem maintenance and biodiversity conservation. Add to this the likelihood that these instream flows may not be met in most, or even all, years and the picture becomes even more dismal. Spanning this gap between river flows currently secured for instream values and the river flows needed to maintain healthy, sustainable fish communities and viable river, floodplain, and estuarine ecosystems into the future will require a fundamental shift in priorities. This kind of monumental change in cultural values does not come easily, as it goes to the heart of lifestyle, quality of life, and economic choices.

The staff of state and federal agencies and NGOs interviewed in this survey collectively recognize the importance of education in facilitating this change. Without the public behind them, without the public knowing what instream flow proponents know—that instream values are a symbol for much deeper quality of life issues and that healthy fish communities are the canary in the coalmine—instream flow programs will always be a sidelined stepchild of fish and wildlife agencies, and protection of instream flows will remain inferior to prevailing water uses. The transformation that needs to occur in the public, including legislatures and water user communities, can be likened to the change that has happened in the scientific community since the introduction of the natural flow paradigm.²² The natural flow paradigm moved scientists from thinking about water needs for rivers in terms of a single minimum flow level to understanding the importance of the full range of interannual and intraannual variability in flows. Making this change required stepping back from looking at a specific location on a river at a particular time to seeing the whole river and all its interconnections that have evolved over millennia. This same shift of perspective needs to occur in the public so rivers become more than water moving downstream, essentially conveyance structures, and are seen as dynamic, variable ecosystems filled with life.

Bringing the life in river, floodplain, and estuarine ecosystems to the surface through education will help people connect to and marvel at this natural heritage. There is a practical side to this education because individuals need to understand the linkages between their lives and water in a river, lake, or aquifer to place the value of protecting fish or other species above other economic interests. Questions about the relationship between instream flows and the value they provide to an individual need to be addressed. What does this water use (instream or not) mean to the quality of life for a person in this state? What does it do for future generations? What does it do for a specific individual? What is it going to do for a person's pocketbook? How is it better to have water in the stream than some other water use? How does instream flow translate to tourism dollars? What does it mean to have an intelligent view of water management? What are new and innovative ways to use and manage water? This education process must

²² See N. LeRoy Poff & J. David Allen, *The Natural Flow Regime*, 47 *BIOSCIENCE* 769, 769–70 (1997) (explaining the natural flow paradigm, that effective river management must consider the natural flow of the river and must fit within that natural scheme).

reach beyond the already converted to those who do not yet recognize the value of healthy rivers, so more people will advocate for protecting instream values.

Only by prioritizing instream flows as a valuable water use usurped only in the rarest occasions will the public trust held in river, floodplain, and estuarine ecosystems be protected. Therefore, elevating the status of instream flows to equality, if not primacy, with other non-essential water uses is of utmost importance.²³ This would ensure water for instream values would remain in the river in all but the most extreme, and hopefully rare, conditions. The legal definition of instream flows and the practice of setting instream flow quantities also must change to reflect the latest science. Instream flow protection and restoration must go beyond protecting nothing more than an extreme low or minimum flow, which, while important, is not sufficient. Instream flow protection must be expanded to include all components of the flow regime—low flows, high flows, and floods—necessary for conserving all native species and maintaining all aspects of the ecosystem including habitat formation and maintenance.²⁴

To make progress toward this goal, local, state, and federal government, NGOs, private sector groups, and academics need to work together to resolve the conflicts inherent in this kind of shift in societal values. Water use choices made today, such as watering a lawn or irrigating a low value crop, may take opportunities for human health and quality of life away from this and future generations. Assessing the personal and societal impacts when the fabric of an ecosystem is taken beyond its own capacity to heal will help bring attention to the tradeoffs associated with the allocation of water to out-of-stream or flow-altering uses versus instream values. However, any reallocation of water from one use to another or limit on future development of water has direct consequences and is felt, sometimes very personally. These impacts must be taken into consideration alongside the impacts of removing water from a river. Ultimately, the value of water uses to society, whether instream, out-of-stream, or flow-altering, need to be reevaluated from the perspective of looking toward the future instead of adhering blindly to historical use patterns. By understanding the transfer of benefits of ecosystem services from the public as a whole to an individual—who may, in turn, return these benefits to the public through food production, etc.—individuals and society can make informed choices about where to place costs and benefits. It may be that distributing water use and

²³ Essential uses can be considered those required for human health and safety.

²⁴ One way to maintain the shape of the natural hydrograph is to use the “percent of flow” approach. Instead of allocating a specific quantity of water to instream flows, a percent of each day’s flow remains in the river. See Nicole Silk et al., *Turning Instream Flow Water Rights Upside Down*, 7 RIVERS 298, 299–300, 303 (2000) (discussing the use of the percent of flow approach for instream flow water rights, but referring to the approach as “upside-down instream flow water rights”). Allocating a percent of the daily flow to instream values may be a particularly useful approach as global climate change alters the timing, amount, and characteristics (e.g., rain instead of snow) of precipitation patterns. Attention must be paid, though, to the impacts of additional climate-driven hydrologic alteration on species and ecosystems that have already been stressed by existing flow-altering water uses.

flow alteration such that no river's flow regime is altered beyond its capacity to maintain the integrity of the ecosystem and the viability of all native species is impossible, but facing the consequences of going beyond this standard may at least temper an individual's and society's choices.

A full suite of tools will be necessary for instream flow protection and restoration to be successful. Statutes, administrative rules, and case law must work together to open the doors of opportunity for activities that will protect and restore instream flows. Legislatures and agencies need to make the changes necessary to bring ease to, and prioritize funding for, protection and restoration activities. An informed and engaged public advocating for instream flows can encourage these changes and NGOs can play an important role in pushing for judicial review of statutes and administrative rules. With greater access to the tools of instream flow protection and restoration, fish and wildlife agencies can be actively involved in the business of water by using water markets and other mechanisms. However, instream flow protection and restoration does not end with legally protecting quantities of water for instream values. This must be combined with land acquisition, whether by land trusts or public agencies, conservation easements, land use and management changes, and watershed protection. Only an integrated view of the land and water management and use activities that affect instream flows will lead us on the path toward healthy river, floodplain, and estuarine ecosystems and viable populations of native species. Through this holistic approach, instream flow programs can transition from the stepchild to the poster child of a new era of water and land use and management.