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Rationing the river: evaluating hybrid instream flow programs in Colorado and Montana

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RATIONING THE RIVER:
EVALUATING HYBRID INSTREAM FLOW PROGRAMS IN
COLORADO AND MONTANA

By

Zachary Bruning

Accepted in Partial Completion of the
Requirement for the Degree
Master of Arts

Moheb A. Ghali, Dean of the Graduate School

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MASTER'S THESIS

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Zachary Bruning
May 13, 2011

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A Thesis
Presented to
The Faculty of
Western Washington University

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Of the Requirements for the Degree
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ABSTRACT

Properly managing river water is one of the most important common pool resource issues in the Western United States. Historically, laws regulating water in the West have been biased toward diverting water out of stream for human consumption at the cost of de-watering and degrading rivers across the West. Several states have recognized the importance of leaving water instream and have taken action to support that cause. This study provides an examination of the hybrid instream flow programs used in Colorado and Montana to preserve and restore the health of rivers in those states. Using a case study approach each program is evaluated in relation to five criteria including, permanence, number of instream flows, funding, monitoring and enforcement, and barriers to private participation. The results of this evaluation are analyzed in order to draw out the strengths and weaknesses of each program as well as determine their overall effectiveness in establishing instream flows. Based on this analysis, suggestions are offered concerning how to best design effective instream flow programs.

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Introduction

Water scarcity in the Western United States creates an inherent tradeoff between water left instream for environmental purposes and water diverted for human needs. The laws that have historically managed water resources were created at a time when rapid development and settlement of the West were foremost in the minds of policymakers (Gillilan and Brown, 1997). These laws have led to the widespread diversion of water out of stream for human consumption and economic purposes. As a result, the aquatic habitats and the species that rely on sufficient water flows have suffered over time. The traditional laws governing water mostly ignored the environmental benefits that healthy rivers provide. These include, but are not limited to, soil fertility, nutrient transfer, biodiversity conservation, groundwater recharge, and water quality (Postel and Richter, 2003).

In the midst of the environmental movement of the 1960's and 1970's many Westerners started to recognize the impacts that decades of water diversion had on environmental factors like those mentioned above. In addition to this fact, Gillilan and Brown (1997) argue that during this time population growth and economic development in the West also led to a shift in "attitudes and values with respect to water use and the environment" (43). The authors explain that increases in leisure time, stemming from economic growth, meant that more people were spending time in nature and enjoying recreational opportunities provided by the outdoors. A result of this trend was increased pressure to enact policies "protecting fish and wildlife habitats, riparian areas, the aesthetic qualities of the environment, and environmental sustainability" (43). Alongside these changing values and attitudes toward river protection, the demand for out of stream water uses continued to grow. Beginning in the 1970's several state legislatures

responded by enacting instream flow programs as a way to balance the diversion of water for out of stream uses with a level of protection for rivers and their habitat.

In addition to shifting societal attitudes and values, the requirement to comply with the Endangered Species Act (ESA) has become an incentive for western states to make instream flows a priority. The ESA was passed by Congress in 1973 in order to protect many imperiled species from extinction. The ESA is considered one of the strongest pieces of environmental legislation in the United States due to its ability to temper economic growth and development for the purpose of species preservation. The ESA has a direct impact on instream flows because many of the species listed under the ESA rely on adequate flow levels in rivers that are deemed to be critical habitat (Gillilan and Brown, 1997). Colorado alone has five different fish species which are listed as endangered, in addition to various water fowl that are either listed as endangered or threatened (U.S. Fish and Wildlife Service, 2011). Instream flow programs provide states like Colorado a way to maintain adequate river flows required to protect aquatic species and comply with the ESA.

One final issue that has become a driving force for instream flow programs are the economic importance of outdoor recreation such as sport fishing. Over appropriation of rivers threaten this recreational industry in states such as Montana and Colorado. The sport fishing industry accounts for approximately 820 million dollars annually in each of these two states (Roberts and Grossman, 2008; American Fly Fishing Trade Association, 2011). In addition to the direct financial gains, the fishing industry also provides indirect benefits by providing thousands of jobs to private citizens. The economic importance of sport fishing in many western states creates a significant amount of support for the protection of rivers through instream flow programs.

Despite this increased recognition and support, there are still many challenges to preserving and restoring instream flows. Foremost among them is the fact that demand for out of stream water use continues to increase, putting more stress on an already heavily burdened resource system (Postel and Richter, 2003). There are also many individuals in the West who oppose the establishment of instream flows. Some see instream flow protection as a constraint on future development. In other words, the more water that is devoted to instream flows, the less available for future economic purposes. Another group who also generally opposes instream flows are agricultural interests, who currently hold the majority of existing water rights. Their main concern is that the dewatering of irrigated land will undercut the economic base of rural communities and threaten their livelihoods. One final challenge in establishing instream flows is the current institutions governing water management. The doctrines of prior appropriation and beneficial use, the two traditional laws regulating water in the Western United States, are biased toward out of stream water uses. Collectively, these factors create substantial barriers to any changes in water management that would promote the practice of leaving water instream for environmental protection.

The following study investigates the programs developed in Colorado and Montana to address the challenges associated with establishing and protecting instream flows. Like all states in the West, Colorado and Montana use the doctrine of prior appropriation to allocate water. Under the doctrine individuals are granted water rights from the state along with an appropriation date. Each year, water is allocated based on these appropriation dates in what is referred to as “first in time, first in right”. Those with earlier appropriation dates, or “senior rights”, receive their water before those with subsequent appropriation dates, or “junior rights”. It is possible that in years of drought those with junior appropriation rights may receive no water at all. The

other important part of water law in Colorado and Montana is the doctrine of beneficial use. This doctrine attempts to ensure that water allocations do not go unused. Water that is unused is subject to forfeiture in which the government can reclaim it and appropriate it to another purpose. The fear of losing a water right to forfeiture creates a “use it or lose it” mentality which encourages private water right owners to divert their total appropriation even if it is unneeded. MacDonnell (2009) points out that these original doctrines provide no legal protections for water left in its natural source. Furthermore, these laws have created a general perception amongst many traditional water users that any water left instream is wasted, and the only way to put value to water is to divert it for some type of consumptive use. As a consequence of these laws, a general indifference has risen amongst traditional water users toward the health of river ecosystems and critical habitat for aquatic species.

In the late 1960’s state governments in Colorado and Montana began to acknowledge the need for legal protection of water left in its original source. The challenge was to adjust the rules of prior appropriation and beneficial use to allow for the protection of water left instream (MacDonnell, 2009). By 1973 both the Colorado and Montana legislatures had created instream flow programs which enabled government agencies in both states to begin appropriating instream flows. By doing so they formally added water left instream for environmental purposes to the list of beneficial uses. This was an important first step because it enabled the governments in both states to begin slowing the trend of over-appropriation by making previously unused water unavailable for out of stream uses. In Colorado, the Water Conservation Board can appropriate new instream flow rights that hold the same protections as all other water rights in the state. In Montana any state or federal agency can apply for instream flow water reservations which set aside unused water for the protection of river habitat.

State	Year Instream Flow Program was Implemented
Oregon	1955
Colorado	1973
Montana	1973
Washington	1974
Arizona	1976
Idaho	1978
Wyoming	1986
Utah	1986
Nevada	1988
California	1991
New Mexico	1998

Table 1. The years that western states established their instream flow programs.

Even with these initial steps the doctrines of beneficial use and prior appropriation still present significant challenges to the protection of instream flows. First, because new government instream flow appropriations are still subject to the prior appropriation system; they are junior to existing consumptive rights. According to Scarborough (2007), this limits the ability to improve instream flows due to the fact that senior rights holders continue to divert their full appropriation. In addition, the original legislation in Colorado and Montana only allowed government agencies to hold instream flows. Private water users still had no incentive to leave water instream for fear of losing it to forfeiture.

In the late 80's both states broadened their instream flow programs in an attempt to overcome these limitations. Colorado and Montana passed legislation allowing private water

owners to sell, donate, and lease unused water to a state agency. This provided a way for the government agencies to acquire senior water rights to turn into instream flows rather than having to rely solely on new appropriations. These statutes also provided private water owners an opportunity to participate in the instream flow programs, giving them an option other than simply diverting their whole appropriation just to protect it from forfeiture. In 2005 Montana took private involvement to another level by allowing privately held instream flow rights. Private individuals and organizations have the ability to lease water for instream flows or to convert their diversionary right to an instream flow purpose. Colorado, up to this point, has been reluctant to allow privately held instream flows but continues to search for ways to promote private involvement in the program.

The evolution of the instream flow programs in Colorado and Montana parallels the development of the broader study of common pool resource management in many ways. A common pool resource (CPR) is defined as a resource which is extremely difficult to exclude individuals from using and is also subtractable, meaning that the use by one individual directly limits the use of others. Water, along with fisheries, grazing land, wildlife, forests, and even the atmosphere are all examples of CPRs.

In the early 1970's when the instream flow programs were first implemented they relied on strict government control which was consistent with the sentiment at the time concerning how to best manage CPRs. This sentiment was largely based on Garrett Hardin's influential essay, "Tragedy of the Commons", which supported government control as one of two viable methods of CPR management, with privatization being the other. The legislation allowing private water owners to participate in the instream flow programs in the late 1980's mirrored the changing attitude toward CPRs. This movement, largely spearheaded by scholars such as Elinor Ostrom,

called Hardin's conclusions into question, stating that unilateral government action alone does not guarantee the protection of CPRs. The 1990's and 2000's saw the rise of hybrid management plans which accepted the fact that no single approach can solve all CPR problems. Instead, programs began to be designed to include a level of government control, privatization, as well as involvement of local users. The instream flow programs that have developed in Colorado and Montana can be seen as examples of such hybrid programs.

This thesis provides an investigation of hybrid instream flow programs in Colorado and Montana. There are three main questions this study seeks to answer. 1) How has each hybrid instream flow program developed over time. 2) How effective has each program been in protecting instream flows. 3) What are the specific characteristics of each program that promote or inhibit their effectiveness in protecting instream flows. This thesis serves a practical purpose by outlining important aspects which should be considered in designing effective instream flow programs. On a broader level this thesis highlights examples of how hybrid programs have been used to manage a common pool resource. This is not to suggest that either the Colorado or Montana programs should be copied for other CPR situations, but it does provide some insight into how government regulation, privatization, and local user involvement can be brought together in a comprehensive hybrid system.

The thesis is divided into five chapters. Chapter one is a literature review that chronicles the development of Common Pool Resource Theory and explains how hybrid management has come to the forefront. Chapter two explains the methods used to evaluate the hybrid instream flow programs in Colorado and Montana. Chapters three and four provide case studies of the two programs. These chapters are primarily descriptive, with the goal of providing all of the necessary information for the analysis that follows in the final chapter. The analysis reveals the

strengths and weaknesses of the Colorado and Montana programs as well as highlights the specific features which improve or inhibit their effectiveness. Conclusions drawn from the analysis offer suggestions that should be considered when designing and implementing hybrid instream flow management programs.

Literature Review

Tragedy of the Commons Literature

Garret Hardin's article "The Tragedy of the Commons" in the 1968 publication of *Science* is often considered the catalyst for the widespread growth in the debate over the management of common pool resources. Using his well-known example of a Herdsman on a common pasture, Hardin argues that rational, self-interested individuals are compelled to exhaust shared finite resources at the cost of their long-term sustainability. He states that this behavior is individually rational in CPR systems due to the fact that each user receives all the benefits from an additional unit of use, while the costs of that additional unit are shared by all users. Upon recognizing the benefit that additional use can bring, other users will follow suit until the resource is exhausted. If all the users of a particular resource agreed to limit their use, it would be possible to sustain the resource in the long-term. However, Hardin argues that an individual who agrees to limit their use risks missing out on short-term gains if other individuals continue to overuse the resource. In this collective action problem, the rational decision for all users is to take the short term gains before the resource is exhausted.

Hardin's pessimism concerning individuals' ability to act collectively leads him to the conclusion that the only way to assure long-term sustainability is to restrict access to resources by imposing either government or private ownership of CPRs. Privatizing a CPR can limit access because when the use of that resource is monopolized it is no longer a common pool resource (Ostrom and Schlager, 1996). In this situation both the costs and benefits of overuse are fully realized by the single owner. As such, the private owner has the incentive to limit the use of a resource. Government ownership, on the other hand, creates a system in which resources are held in trust for the public and access to the resource is allocated through some type of agreed

upon standards. Hardin (1968) suggests that this could be done on a first-come, first-serve basis or some type of lottery-based system, but it could also be done through establishing harvesting seasons or quotas, as well as restricting the methods of harvesting. Whether access to CPRs is limited through private ownership or government control, the tragedy of the commons literature suggests that it is a necessary measure to halt the “rush to ruin” that is caused by unrestricted access to CPRs.

Critique of Tragedy of the Commons Literature

The influence that Garrett Hardin’s conclusions have had in the management of CPRs cannot be understated. In fact, many of the policies dealing with CPR management are reliant on government control, a clear reflection of this influence. Examples of this include government issued permits for timber harvesting and water diversions, fishing seasons and catch quotas for fisheries, and government owned and managed pasturelands. Subsequent scholars have examined Hardin’s work and crafted critiques of his conclusions; arguing that Hardin was incorrect in concluding that only private or government ownership could result in effective management of a given resource. Moreover, many studies point out that private and government ownership can be limited in their ability to conserve CPRs and at times lead to more damage than would have existed without such intervention.

Several case studies demonstrate the ability of local users to act collectively in managing a common resource without private ownership or government control. Acheson (1988), a study of lobster fisheries in Maine, shows that there were complex communal management systems in place that self-regulated harvests, controlled access to outsiders, and restricted the methods of fishing. McKay (1980) looks at fisheries in New York and New Jersey and finds a similar

situation where cooperative agreements were made between fisherman establishing quotas to limit use. Wade (1988) examines village communities in Southern India finding that in some cases villagers developed joint institutions for cooperative management of common property resources in grazing and irrigation. Ostrom (1990) provides several examples of long-standing communal CPR management systems including pasture management in Switzerland, forest management in Japan, and irrigation management in Spain and the Philippines. The results of these studies show that Hardin's conclusion may only be valuable as a "general theoretical structure" (Ostrom, 2001). That is to say, Hardin's theory presents a set of potential challenges associated with managing CPRs, but the ways that these challenges are addressed will vary from situation to situation.

In some cases, community based agreements have proved to be more effective in managing CPRs than regulations externally imposed by governments or private owners (Baland and Platteau, 1996; Bardhan, 1999; Ostrom, 2000). In a study examining pasture land along the borders of China, Mongolia, and Russia, satellite images showed that pastureland in Mongolia, where local commons management was still used, showed much less degradation than the privately owned pasture in China and the state owned pasture in Russia (Ostrom et al., 1999; Sneath, 1998). In another study looking at management of forests in third world nations, Ostrom (1990) finds that centralized regulation often led to more open access, and thus more overuse of the forest resource, than there had been under local control. She states that this outcome was not due to lax regulations placed on the use of forests, but, the inability of the government to enforce the regulations. When government bodies lack either the will or the resources to enforce regulations, their effectiveness in protecting CPRs is drastically limited and will often lead to overexploitation (Deitz et al., 2003).

Another weakness of government control is shown through studies indicating that local users are much less likely to abide by government regulations than they are local agreements. Bardhan (1999), in his study of different irrigation management systems in South India, finds that the level of compliance in systems where regulations had been agreed upon amongst the farmers was much higher than systems where regulations were imposed by the government. Deitz et al. (2003) finds a similar outcome in degraded inshore fisheries in Maine, where top-down government rules were not accepted by the fishermen and resulted in high rates of noncompliance. These examples indicate that in situations where local users have the capacity to self-regulate their use of a resource, regulations imposed by an outside force will likely be received in an adversarial way.

Hardin's other solution, privatization, is also limited in its effectiveness. According to Baland and Platteau (1996), privatization of CPRs will only increase efficiency if markets are perfect and competitive. The problem is that real life markets are rarely perfect. The authors explain that in an imperfect market the proper valuation of a CPR may not be reflected in the market value. That is to say, the benefit that forests have on air quality or the aesthetics of a mountain stream may not be properly signaled to private traders because these traits are nearly impossible to quantify in monetary terms. As a result, the authors conclude that access to private resources is often sold at a discounted rate which allows for higher levels of use and overexploitation.

Another critique of privatization is that while it can provide the necessary incentives to promote sustainable use, as Feeny et. al (1990) point out, this is not always true. The authors state that in certain situations "it may be economically optimal to deplete a resource rather than to use it sustainably" (9). This is especially true of resources that have a low rate of return due to

the relative length of time it takes the resource to replenish. The example the authors use is redwood trees which can be extremely valuable as lumber but take thousands of years to grow. In this situation the incentive scheme actually encourages the private owner to maximize the current value of the resource at the expense of its long-term sustainability.

While the preceding literature is critical of government and private control, it is not meant to completely discredit these institutions as important tools in protecting CPRs. Nor is it meant to suggest that communal management is a panacea for all CPR problems. The number of degraded commons ranging from pastures and forests to fisheries shows that collective action cannot be assumed to be a solution in all cases (Wade, 1987). It is important to note that effective communal management systems are most likely to take place in situations where resource systems have well defined boundaries, and user groups are small, clearly defined, and have a history of cooperation (Wade, 1988; Ostrom, 1990; Baland and Platteau, 1996). In a world of continuous population growth and increased globalization these ideal situations are becoming fewer and farther between.

What has become increasingly evident is that no single approach, government, private, or communal management can unilaterally deal with all the complex CPR situations that we face today (Dietz et al., 2003). However, as Ostrom (1990) points out, government regulation, privatization, and communal management do not have to be mutually exclusive. The influence of this body of literature is reflected in the current trend to develop hybrid management systems which use aspects of two or even all three approaches. The next section of the literature review looks at the potential benefits of using hybrid management programs and provides examples of hybrid programs that have been applied to real world CPR situations.

Rise of the Hybrids

The promise of hybrid policies has led to a concerted effort to decentralize authority over resources that have been historically managed through government command and control regulation. Under this new approach to managing resources the government has not been completely removed, but more opportunities for collaboration and cooperation have been included (Bryan, 2004). In other words, inclusion of citizen or private involvement supplements government regulation rather than supplanting it (John, 2004). This more inclusionary approach can provide an opportunity to build more consensus-based policies that can successfully manage CPRs and meet the needs of the local users, while also protecting the interests of the general public. The following are descriptions of the roles that government, privatization, and local users can play in hybrid management policies.

It is generally accepted that government policies must become more inclusive rather than relying on strict command and control regulation concerning resource management and environmental protection more broadly. In fact, since the early 1990's federal and state governments have in many ways tried to reinvent their systems of environmental protection by including more incentive-based policies, allowing for more collaboration, and increasing flexibility in rulemaking and enforcement (Vig and Kraft, 2003). Despite this shift in regulation, policymakers and scholars still recognize the important role that the government plays in the future of environmental protection and resource management. As Kraft (2007) explains, the participation of individuals and groups in the private sector is crucial to the future of environmental protection, however, the government still has an "essential role to play in resolving environmental problems" (12).

Government agencies can provide many essential services in hybrid regulatory regimes. One key role that the government plays is that of financier. Many of the collaborative efforts to create and enforce regulations rely on government dollars. When looking at the example of watershed management groups in Oregon, Lurie and Hibbard (2008), find that the effectiveness of these groups in improving the watershed is directly related to the level of funding they receive from the government. Another role the government can play is as a mediator who brings competing interests to the table and helps coordinate activities between various groups (Sabel et. al, 2000). This can assist in ensuring that groups do not work at cross purposes and that knowledge is shared amongst groups, thereby, making more efficient management of resources possible. One of the most important services the government provides in hybrid regulation is monitoring performance. Government oversight can aid in assuring that private individuals and groups live up to their commitments. As John (2000) explains,

“We need both the “good cop” of government, willing to empower and support local problem-solving efforts, and the “bad cop” of government, standing ready to enforce national standards if necessary”. Often the good cop is not persuasive if there is no bad cop waiting in the next room” (62).

In the case that hybrid policies fail to sustainably manage a resource, or private groups do not comply with the agreed upon regulations, then the government can step in to ensure that the environment is protected. Furthermore, the threat of government intervention provides an incentive for private groups to participate and comply because in most cases local users prefer self-regulation rather than command and control regulation.

One final role government involvement plays in hybrid programs is assuring that the interests of the general public are protected. Oftentimes the interests of a group of local users are quite different than the interests of the broader public. For example, a forest in the Pacific Northwest may provide a large number of logging jobs to local

individuals. As a result, locals might support the large scale harvesting of the forest. The broader public, on the other hand, might support the preservation of the forest because, for them, the value of the forest is in the biodiversity it provides. In order to balance these opposing interests the government acts as an intermediary which attempts to balance the interests of both communities relating to the common resource.

Calls for the reduction of government regulation over CPRs are often accompanied by an argument for an increase in the use of privatization. The promise that privatization offers is deeply rooted in its ability to seize upon the power of the free market. However, privatization is not the only way that free market policies have been used to manage CPRs. For the purpose of this study, privatization will fall under the broader umbrella of free market policies as just one way that this approach can be used. For example, free market policies can be implemented on a limited level by providing “market-like incentives” instead of the complete privatization of CPRs (Pennington, 2005). Many government agencies have experimented with using market-like incentives to get private individuals and groups to use CPRs in a sustainable manner. Examples include tax relief or credits, paying for compliance, and tradable permits. Increasing these types of incentives is seen by some proponents as the most pragmatic approach because they can be inserted into the government regulatory system that exists in the U.S. (Anderson and Leal, 2001). The benefit of these policies is that they can provide the necessary incentives for individuals and groups not only to meet regulations but to exceed them (Pennington, 2005). For example, if a government agency passes down a fixed quota regulating how much water can be taken out of a given resource then users will limit their use to meet that quota. Conversely, if a system is set up in which users are rewarded for their reduction in water use then an incentive exists for

individuals to not only meet a fixed quota but to go beyond the government specified mandates (Pennington, 2005).

While some proponents of free market policies are happy to make incremental changes to the regulatory system, others support the more radical approach of privatizing CPRs whenever possible. The basis for this argument is the belief that governmental agencies do not have the proper incentives to protect CPRs because they do not internalize the costs of inefficiency (Heal, 2000). In other words, if a government agency makes a bad decision and over-exploits a resource to the point of ruin, the cost of doing so is not incurred by policymakers or the agency's employees but by the general public. Anderson and Leal (2001) argue that the benefit of privatization is that it attempts to connect self-interest with the efficient use of a resource. They go on to explain that discipline is imposed in this system because the personal wealth of an owner is directly connected to the decisions they make. Put more plainly, if a private individual is personally, or more importantly, financially responsible for maintaining the quality of a CPR, good stewardship is more likely to result.

Another potential benefit of privatization is that it creates a situation where environmental entrepreneurs can devise innovative ways to efficiently use resources (Pennington, 2005). An example provided by Anderson and Leal (2001) is a land owner who can create a way to charge fishermen for access to the river running across his land. This situation creates an incentive for the owner to maintain or even improve the quality of the river due to the personal profits that can be attained. This is an example where privatization has both provided an economic incentive and protection of a resource simultaneously. This is possible because privatization internalizes the costs and benefits of maintaining the river.

Due to the limitations of the free market approach, most notably its reliance on perfect markets and its inability to properly value all of the benefits that a CPR provides, it cannot be relied upon solely to sustainably manage CPRs. However, when crafting hybrid approaches it is wise to recognize the influence that self-interest and financial incentives can have on behavior. Free market principles may not be enough to single handedly protect CPRs but their application in appropriate situations may be the best way to improve existing management regimes.

In addition to privatization and government regulation, local management has become another important part of many hybrid policies. Including local groups in CPR management has provided an opportunity for multiple interests to become involved. Many of these interests may have previously been unable to participate due to centralization of decision making. The inclusion of various groups such as local resource users, citizens, and business interests, makes it possible to design custom policies that fit the local circumstances (John, 2004). This makes the policies more credible and “provides the muscle to resolve local problems where it most matters—at the operational level” (227). In other words, those who are most affected by the regulations are empowered to assist in creating and carrying them out.

Another benefit of collaborating with local groups is the ability to include flexibility in how regulations are carried out. According to Fiorino (2004), government regulations are often inflexible due to their prescriptive nature. Regulations with specific rules limit the ability of local interests to use their experience and knowledge to create innovative solutions to problems. This type of regulation also makes it difficult for local users to adapt to any changes that may occur over time. Assuming that a government agency has the ability to determine the best way to solve complex and changing environmental problems is unrealistic (Fiorino, 2004). By allowing collaboration, Fiorino argues that a situation can develop where the

government acts as an overseer and local interests are free to use their experience and knowledge to develop unique solutions to resolve problems.

Bryan (2004) makes the claim that the disconnect between local users and command and control regulations limits the ability of these regulations to achieve positive environmental outcomes. He goes on to explain that when local interests are required to yield to the will of the government, they can become unwilling to comply and instead seek ways around regulations. Collaboration between local interests and the government, on the other hand, can create what Bryan calls “shared ownership”, or in other words, recognition of a common purpose and a sense of responsibility to take action toward that purpose. A way that this can be built is through offering local interests a level of influence by inviting them to the table when regulations are being created.

The previous paragraphs have outlined the opportunities that government regulation, market principles, as well as local involvement offer. Ostrom (1990) explains that different CPR situations will likely call for different solutions. As such, hybrid management programs need to be designed to seize upon the strengths of each approach, and apply them to a particular CPR system. Below are examples of four different hybrid programs which have been developed and implemented in an attempt to manage watersheds, fisheries, and wildlife.

Oregon Watershed Partnerships. The watershed management program in Oregon has increasingly replaced the reliance on top-down government regulation with more collaborative efforts (Gerlak, 2008). Bidwell and Ryan (2006), and Lurie and Hibbard’s (2008) examinations of watershed management in Oregon reveal the collaborative partnership between the government and local resource users that has developed. This program integrates top-down and

bottom up governance in an attempt to generate inclusive and effective watershed management (Lurie and Hibbard, 2008).

According to Bidwell and Ryan (2006), decreases in water supplies, mounting environmental degradation, and the need to comply with federal laws such as the Endangered Species Act, prompted the Oregon legislature to pass initiatives which promoted the creation of regional watershed partnerships. These partnerships are made up of a variety of local groups such as agriculturalists, businesses, citizens, recreationalists, and environmentalists. Each partnership receives government funding and is charged with planning and conducting environmental improvement programs for their watershed. This system does not transfer complete authority from the state to the local groups but it does allow them an opportunity to design action plans unique to their geographic, ecological, political, and social situation (Bidwell and Ryan, 2006; Gerlak, 2008).

Regulations passed by these watershed partnerships require “consensus decision making and joint learning procedures in the effort to develop mutual gains solutions” (Lurie and Hibbard, 2008, 431). Allowing local users to create regulations provides a level of credibility that government command and control regulations cannot offer. Without collaboration each local group affected by watershed management will most likely consider only their needs and will find ways to fulfill them even if it is at someone else’s expense. The watershed partnership approach enables groups to participate in learning about their role in the situation, understanding the needs of others, voicing their own needs, and coming together to create mutually agreed upon regulations. While a lot of influence is given to these watershed partnerships in creating management systems, the government still plays a vital role as an overseer ensuring that these

groups live up to their promises and that the regulations created are actually effective in protecting or improving the watershed.

Catskill Watershed Program. Another instance of a hybrid program used to manage a watershed is seen in the state of New York. Geoffrey Heal (2000), in his study of the Catskill watershed above New York City provides an example where financial incentives and collaborative agreements were used to improve the quality of the watershed. The Catskill watershed has long been a vital source of water for New York City and increased development in the watershed led to a decline in the quality of water that was being delivered to the city. Pesticides, fertilizers, animal waste from farms, and sewage from houses were all finding their way into the watershed making the water unsafe to drink. To solve this problem the government of New York City could have decided to use command and control regulation to limit access and restrict the activities permitted in the watershed. Instead the City decided to invest in the restoration of the watershed and provide incentives for the local population to participate.

Using bond money the city was able to begin buying land from private owners in vital parts of the watershed. This money was also used to pay for conservation easements in which private land owners agreed to limit future development in return for payment. To address the pollution that resulted from farms located in the watershed, the City entered into bargaining agreements in which they paid farmers not to grow crops or graze animals in certain critical areas. As Heal (2000) explains, by providing financial compensation to the local users in the watershed it gave them a “direct financial stake in conservation” (51).

Lobster Fishery Co-management Program. In addition to watersheds, fisheries are another CPR where hybrid management has been used. Acheson and Taylor (2001), examine the implementation of a co-management system to regulate lobster fisheries in Maine. Enacted in

1995 this system divided control over the management of fisheries between the State Department of Marine Resources (DMR) and local fisherman groups. While the DMR retains the majority of control, this new management scheme divided the lobster fishery into different zones which are managed by elected councils of licensed lobster fishermen. The main purpose of these zone councils is to recommend fishing regulations concerning rules of entry into a fishery as well as fishing standards, such as trap limits, to the DMR. The DMR reviews these recommendations and, if approved, enforces by them. Previous to this hybrid management system, the government had tried to establish regulations unilaterally but was continually met with opposition from the fishermen. By transferring the responsibility to create regulations to local fishermen the state freed itself of this highly contentious issue. According to Acheson and Taylor (2001), within five years all zone councils had established rules regulating fishing standards and four of the five zones had instituted limitations on entry. Allowing local fisherman the opportunity to participate in managing their fishery has resulted in regulations that have been generally accepted by the community.

Habitat Conservation Programs. A unique way that hybrid management has been used can be seen in the development of habitat conservation plans (HCPs). HCPs, a part of the Federal Endangered Species Act (ESA), were developed to assist in limiting the political and legal conflicts that are associated with endangered species protection (Thomas, 2001). These conflicts result from the fact that enforcement of the ESA usually requires the cessation of economic activity on public and private lands that are deemed to be critical habitat for endangered species. HCPs can alleviate this conflict laden situation by bringing economic and environmental interests together to construct agreements that benefit both parties. Under the laws of the ESA, when an HCP is created the applicant is responsible for both designing the plan

as well as implementing it. The government's role is to review the HCP application to determine if it meets legal standards, make sure the plan is implemented correctly, and intervene if the plan is not complied with.

Critics of HCPs argue that they compromise the protection of endangered species. However, Thomas (2001) points out that strict regulation does not guarantee the protection of endangered species either. What HCPs do offer is an opportunity for citizens to participate in conservation efforts and come up with flexible ways to protect endangered species without having to sacrifice all economic activity. By making collaboration between the government and private citizens possible, HCPs stand as an alternative to the standard adversarial command and control regulation of the ESA.

As these examples show, the shift away from strict government command and control regulation over CPRs toward more inclusive, flexible, and collaborative policies has led to the rise of hybrid management programs. For these programs to effectively manage CPRs, they need to be designed to fit the specific characteristics of the specific situation. These characteristics should be used to determine how features of government regulation, market policies, and communal management are included in hybrid programs. For example, a larger amount of government regulation is likely required to sustainably manage CPRs where a resource is large, has multiple users, and where cooperation between users is unlikely (Wade, 1988; Ostrom, 1990; Baland and Platteau, 1996). On the other hand, in situations where the resource and user groups are small and strong cooperation has historically existed, then government involvement may disrupt the sustainable management of the resource (Baland and Platteau, 1996; Bardhan, 1999; Ostrom, 2000). Including market policies in situations where incentives for users to limit their use can match the incentives of continuing to maximize use is a

powerful tool. However, in cases where the incentive to maximize use is so high that it cannot be reasonably matched, then some type of coercive regulation may be the only way to protect the resource (Feeny et. Al, 1990). The above examples are only a few of the issues that must be considered when designing hybrid programs. Government regulation, market policies, and communal management all have their strengths but they must be implemented in such a way that those strengths are fully realized.

Methodology

A case study approach is used in this thesis to review and evaluate the different hybrid instream flow programs that have developed in Colorado and Montana. The case study approach is appropriate for the investigation of a complex issue in its real life context (Yin, 2009). The Colorado and Montana cases provide the opportunity to evaluate two different hybrid management programs that have been created to fulfill the same purpose, protecting instream flows. Case studies are often criticized as being unreliable because they make generalizations based on a small number of samples. Countering this argument, Yin (2009) states the case study approach is valuable because it gives the researcher the ability to get a holistic and in depth analysis of complex issues that would not be possible using large sample studies. For this thesis the case study method provides a way to thoroughly investigate each program in order to see how they are designed, compare their relative strengths and weaknesses, and evaluate their effectiveness in instream flow management.

The Colorado and Montana programs were selected due to similarities in multiple variables related to water policy. For example, Colorado and Montana are both watershed states which supply water to numerous other states and millions of people across the West and the Midwest. Another similarity is that the presence of large agricultural interests weighs heavily upon policies dealing with instream flow in both states because they tend to be the most ardent opponents of instream flow policies and they hold most of the senior water rights in both states. At the same time, fishing is also an important economic component in both Colorado and Montana. The fact that this activity relies on adequate water supplies for critical habitat means that there is a constituency for the expansion of instream flow policies as well. One final similarity is that both states initially passed legislation allowing for instream flows in 1973. This

means that these two states have a similar amount of experience with instream flows and all of the complex issues that are associated with them. It is important to note that every state in the Western U.S. has unique political, geographical, environmental, and cultural characteristics concerning water management. These differences make it very difficult to make any kind of comparison between states. However, selecting two states which share several characteristics helps to make this study more informative by limiting at least some of the independent variables.

Yin (2009) suggests a four step process in creating a thorough case study. The first step establishes the overall design of the case study. For this study the design includes three main components. First, the unit of analysis is the state level instream flow programs of Colorado and Montana. Second, the primary questions that this study looks at are how the two different hybrid programs have developed, how effective they are in protecting instream flows, and what specific characteristics either improve or inhibit their effectiveness. Finally, five criteria are used as evaluative measures. The criteria, which are discussed in more detail later in this section, are permanence, number of instream flows, funding, monitoring and enforcement, and barriers to private participation.

The second step of Yin's process is to conduct the case study. The goal of the case studies is to provide all the background information necessary for an analysis to be completed. In order to assure the reliability of data collected in a case study Yin (2009) suggests that data be acquired through multiple sources. For this study the sources of information included books, articles, and studies that have documented the instream flow programs of Colorado and Montana. Archival records in the form of instream flow data and legal statutes from both states were also used. The final source of information was derived from interviews. A semi-structured interviewing technique was used to interview 8 individuals with direct experience with the

Colorado and Montana instream flow programs. Interview guides were employed to lead the conversation while still encouraging the interviewee to take diversions in the conversation in order to provide information that they felt was important. Due to the fact that semi-structured interviews can lead to diversions from the established questions, interviews were digitally recorded and transcribed after the interview was concluded.

After conducting the case studies the next step in the process is to analyze the information derived from the case studies. For this study the analytic strategy used was to evaluate the Colorado and Montana instream flow programs in relation to five criteria. These criteria were selected because previous literature on the subject indicated that they are some of the most important aspects of instream flow protection. The most effective programs are the ones that perform well in all of these categories. As mentioned before, the five criteria are *permanence, number of instream flows, funding, monitoring and enforcement, and barriers to private participation.*

Permanence. Charney (2005) states that the permanence of instream flows is important because long-term protection of rivers requires permanent instream flow appropriations. Covell (1998) explains that whatever method is used to establish instream flows, it should be able to ensure that an adequate amount of water will remain instream in the long-term. The challenge is that protecting river flows will become more difficult in the future due to increased demand on water resources resulting from growing populations and declining reserves from the effects of climate change. Finding water to leave instream will become a more difficult, if not impossible, task. Therefore, programs that have the ability to establish permanent instream flows are better suited to ensure some level of river protection into the future.

Number of instream flows. The number of established instream flows can help determine

the overall success of each program. However, it is also important to discriminate between different types of instream flows that are created. For example, a program may have a large number of new appropriations suggesting that the program has been successful in limiting new diversions of water from rivers and preserving the existing stream-flows. On the other hand, a large number of leases, donations, or purchases, show that a program has been successful in acquiring senior water rights to devote to restoring instream flows. It is important for a program to be able to establish instream flows that both preserve and restore adequate water flows in rivers. For this reason, the most effective programs will have high numbers of instream flows from new appropriations as well as acquisitions.

Funding. MacDonnell (2009) explains that the financial costs associated with instream flows means that any serious effort at flow protection requires a dedicated source of funding. Legal costs, engineering costs, staff, evaluative reviews, monitoring costs, enforcement, and other requirements all make instream flows expensive ventures. Even a perfectly-designed instream flow program is doomed to fail if funding is not adequate. In Colorado and Montana, money for instream flow programs comes from state government agencies such as the Colorado Water Conservation Board and the Montana Department of Fish Wildlife and Parks, as well as private groups such as Trout Unlimited and the Colorado and Montana Water Trusts. Government funding provides the large majority of the money for instream flow programs. Private funding is beneficial because it can help supplement what is available from the government. Programs which have consistent backing from government funding and have mechanisms to bring in private money are poised to be the most effective in establishing instream flows.

Monitoring and Enforcement. Merriman and Janicki (2005) explain that protection of

instream flows is equally important as establishing them. Without proper protection instream flow rights may provide little to no actual benefit to river health (Covell, 1998). Just establishing an instream flow does not guarantee that water will be there when and where it is needed (Charney, 2005, 26). Therefore, how well each state program protects instream flows, after they are established, is an important aspect. An instream flow must be monitored to ensure that it is being physically met, or in other words, that the proper amount of water is actually in the stream. This often involves both technological instruments, in the form of stream gauges, as well as human observation. If it is found that an instream flow is not being met, then the party responsible must place a “call”, in which a regional water commissioner will instruct junior water rights users to halt their diversions until the instream flow has been met.

Instream flows also need to be legally protected to ensure that the creation of new water rights or modification of existing water rights do not injure existing instream flows. The party responsible for the instream flow must monitor these water transactions to assure that they will not cause damage to the instream flow. If a proposed water transaction does threaten an existing instream flow then an objection must be made to that transaction. The best programs will be those which have a sophisticated monitoring system in place which assures that instream flows are being met, as well as mechanisms which enable the possessor of an instream flow to bring enforcement on both the physical and legal levels.

Barriers to Private Participation. Finally, the barriers that act as disincentives for private water owners to participate in the Colorado and Montana instream flow programs is an important issue. Boyd (2003) argues that the obstacles that individuals and organizations face can easily dissuade them from deciding to participate in an instream flow program. The inclusion of private individuals with senior water rights is important due to the fact that it provides an

opportunity to restore instream flows with water that has historically been diverted (Schempp, 2009). This is particularly important on heavily used rivers where new instream flow appropriations are not possible or are otherwise too junior to make a significant impact. This is the case for most of the rivers in Colorado and Montana that would benefit from instream flow protection. Programs which remove or at least reduce barriers will be much more likely to have participation from private owners, thereby, making more senior water rights available that can be used to restore river flows.

Once the case studies have been completed, the final stage in the process is to develop conclusions based upon the analysis of the case study evidence. The evaluations of how each program performs in relation to the five criteria are brought together in order to construct a summary review. This review provides a holistic observation and draws out the strengths and weaknesses of each program and identifies the characteristics which either improve or impede their effectiveness. The findings of this study have implications regarding how to best design hybrid instream flow programs in order to maximize their effectiveness and success.

Case Study: Colorado Instream Flow Program

Background of the Colorado Instream Flow Program

In response to growing competition over water and concerns about degradation of the health of rivers, the state of Colorado recognized the need to enact laws that would protect water left in its original source (Covell, 1998). In 1973, despite significant opposition, the Colorado legislature passed Senate Bill 97 which officially recognized water left instream as a beneficial use (Colo. Stat. 37-92-103) and established the state instream flow program (Merriman and Janicki, 2005). Previously, Colorado state law had only recognized rights that physically diverted water out of stream for some type of consumptive use. This bias toward out of stream uses in the law gradually de-watered and degraded many of the streams and rivers in Colorado. The statute allowing instream flow rights provided an opportunity to slow this trend, and with future amendments to the law, even restore some water to the rivers.

Senate Bill 97 gave exclusive rights to a state agency, the Colorado Water Conservation Board (CWCB), to hold instream flow rights. No other entities, including other state agencies or private individuals, are allowed to possess these rights. Although instream flow rights are unique in that they are exempt from the diversion requirement, they still go through the same process as out of stream water rights when created. This means that they must be decreed in the State Water Court system. Once formally established they are assigned a priority date and are “administered in accordance with the state’s water right priority system” (Merriman and Janicki, 2005, 1). Going through this process gives instream flow rights the same protection and permanence as any diverted water right that is created.

The initial law authorizing the establishment of instream flows was limited, but has broadened over time. For example, the original legislation only allowed the CWCB to establish

instream flows through new appropriations. New appropriations are new water rights that are created by devoting previously unused water for a specific purpose, in this case instream flows. Unused water must be available to create a new right, and as explained before, these new appropriation rights fall under the doctrine of prior appropriation. This means that in most cases new instream flow appropriations are junior to existing consumptive water rights, sometimes by many years. As a result, individuals with senior water rights can continue diverting water even if it means that the instream flow right will not be met.

In 1986 the legislature expanded the law to allow the CWCB to create instream flows from acquired water rights in addition to new appropriations. Under this revision the CWCB can acquire senior consumptive rights through “purchase, donation, or lease” from private owners to convert into instream flow rights (Colo. Stat. 37-92-102). This enables the CWCB to create instream water rights on rivers where new instream flow appropriations are not available or would be too junior to be able to preserve the environment.

The 1986 amendment allowing the CWCB to acquire and change senior consumptive rights went unused until 2001 due to legal limitations in the language in the initial instream flow law (MacDonnell, 2009). The original law authorized the CWCB to create water rights “required for minimum stream flows...to *preserve* the natural environment to a reasonable degree” (Colo. Stat. 37-92-102). This meant that the CWCB had the authority to establish instream flow rights to preserve but not enhance or restore the natural environment (MacDonnell, 2009). The result was a chilling effect on the CWCB’s willingness to acquire senior rights to be changed into instream flow because they would have constituted an enhancement rather than preservation and not been afforded legal protection (Boyd, 2003). In 2001 the legislature changed the law to allow the CWCB to establish water rights “required for minimum stream

flows...to *preserve* or *improve* the natural environment to a reasonable degree” (Colo. Rev. Stat. 37-92-102). The inclusion of the word, *improve*, gave the CWCB the legal backing to begin acquiring senior rights as a way to restore and enhance river ecosystems.

Two other modifications to the law were made in 2008 that had an impact on the instream flow program. First was a clarification of the law to assure that any private water rights, leased, loaned, or contracted to the CWCB as instream flows would be protected from abandonment (Colo. Rev. Stat. 37-92-402). This legislative action was completed to promote the participation of private water rights owners in the instream flow program. Prior to this clarification there was concern amongst private water right owners that their water right could potentially be subject to forfeiture if they elected to lease it as an instream flow rather than divert it. The other significant development in 2008 was the approval of a funding system for the CWCB to devote to purchases and leases of private rights. Before 2008, lack of funding meant that the CWCB had to rely on donations as their only means of acquiring senior water rights.

Since 1973 the law sanctioning instream flow rights has been clarified, changed, and expanded into its current form. Today the CWCB has, at its disposal, a two-pronged system that allows them to appropriate new instream flow rights, as well as acquire existing consumptive rights to be changed into instream flow rights. This has enabled the CWCB to make a concerted effort in “preserving and improving Colorado’s water-dependent natural environment” (Merriman and Janicki, 2005, 2). Below are descriptions of the processes that the CWCB must go through in order to appropriate new instream rights as well as change water acquisitions into instream rights.

How the Colorado Program Establishes Instream Flows

The ability to appropriate new instream flows enables the CWCB to preserve existing stream conditions. On rivers where unused water still exists the establishment of new instream flow appropriations can make that water unavailable for future diverted uses, thereby, limiting further depletion from the stream. New instream flow appropriations cannot limit the diversions made by senior rights holders, but they can restrict them from changing their water use in such a way that might alter stream conditions to the detriment of existing instream flow rights (Merriman and Janicki, 2005). For example, in a situation where a senior water right owner has a point of diversion below a stretch of river protected by an instream flow, that owner cannot move their point of diversion above the protected stretch of river if it means that the instream flow right will not be met. If an owner applies to the water court for such a change the CWCB can file a statement of opposition against it.

The procedure of appropriating new instream flow rights includes a few steps to ensure that they do not injure existing rights, that they will benefit the environment, and that they will be legally protected. First, the CWCB accepts recommendations of rivers in need of protection on an annual basis. These recommendations can be submitted by any person, public or private. All submissions are then prioritized by the CWCB staff.

The second step in the process requires scientific studies to be completed on the prioritized rivers. These studies are meant to determine if three requirements are met in order to justify a new instream flow appropriation in accordance with the law. First, it must be determined whether or not a natural environment exists that can be protected. Second, the minimum amount of flow that would be required to preserve the natural environment to a

reasonable degree must be calculated. Third, it must be determined whether or not enough water is available to be appropriated to meet the determined minimum flow requirement.

If the studies on the prioritized rivers show that a natural environment does exist and that water is available to preserve that environment, then the appropriation can move to the third step. In this final phase the CWCB submits an application to the State Water Court for a final decree. At this point any water user may raise an objection to the instream flow right on the basis that it will cause injury to their existing right. If the Water Court finds that the new appropriation does threaten an existing right then the application for the new instream flow must be modified to mitigate any injury that may be caused. If the instream flow right can be modified in such a way to assure no injury will occur, then it can be formally decreed, given a priority date, and afforded all legal protections.

Water acquisitions to be changed from consumptive use to instream flows go through a different process than new appropriations since each “water acquisition is a voluntary proposal initiated by a water right owner” (Merriman and Janicki, 2005, 3). The process for this type of instream flow right starts with an acquisition proposal submitted by a private water right holder. The CWCB must then evaluate the acquisition proposal to determine if it will meet certain requirements. Colorado law only allows private individuals to lease or donate the consumptive portion of their water right. When a private user diverts water from a river a certain amount is actually consumed while the rest returns to the river through run-off (return flow) or underground leaching (percolation). When an acquisition proposal is submitted the CWCB must assure that the water offered for acquisition does not exceed the historical consumptive use of the private right. In addition to this requirement, the CWCB must determine whether a natural environment exists and that the acquired water is enough to preserve or improve that

environment to a reasonable degree. If these requirements are met, then a contract is drawn up between the CWCB and the private individual. Term lengths may vary from case to case, as will compensation for leases. At this point a change of water right application is submitted to the State Water Court and must go through the same legal process as a new appropriation.

The Colorado program remains highly dependent on centralized government control due to the fact that only the CWCB can hold instream flow rights. However, there is a level of private involvement in the system. Anyone, including other government agencies, private organizations, and even citizens can submit recommendations for new appropriations to the CWCB, as well as review and comment on any submitted recommendations. There is also the provision in the law allowing “any person” to donate, lease, or sell their consumptive right to the CWCB. Although this is far from promoting a privatized or market based system, this provision is still an attempt to use financial incentives to encourage private water rights holders to participate in the program.

Other private involvement in Colorado has come from non-profit organizations such as Trout Unlimited, the Colorado Water Trust, the Nature Conservancy, and other similar environmental organizations. These groups have made contributions in support of the CWCB by helping to acquire senior water rights. The Water Trust has been instrumental in assisting private individuals, both legally and financially, in order to get them through the bureaucratic process of leasing or donating water to the CWCB. In addition, Trout Unlimited, the Colorado Water Trust, and the Nature Conservancy have all made efforts to acquire water rights, through purchase from private individuals, which they can then donate to the CWCB (MacDonnell, 2009).

Evaluation of the Colorado Program in Relation to Permanence, Number of Instream Flows, Funding, Monitoring and Enforcement, and Barriers to Private Participation

Permanence. Water rights created under the Colorado instream flow program have a significant amount of permanence due to the fact that they are fully adjudicated rights decreed by the State Water Court. The use of a water court makes the water allocation system in Colorado one of the most “regimented systems in the nation” (Boyd, 2003, 1172). As explained before, instream flow rights must go through the same process as private consumptive rights to be created. This process can be lengthy due to all the legal proceedings and costly because of the need for legal representation.

According to an employee of the CWCB, “operating within the court system can be time consuming and it can be costly, but it gives a level of permanence to the instream water rights. It’s value added in the sense that the costs are greater but what you get out of it is more permanent”. Being fully adjudicated court decrees, instream flows in Colorado are not subject to shifting political trends or changes in administrations. Once they go through all of the legal proceedings instream flows are permanent property rights under the law. As an employee of the U.S.G.S. explained, “If there is an instream flow right on a stretch of stream then that stretch will be pretty well protected into the future”. The CWCB may reduce an existing instream flow if it deems it necessary, however, to do so they must go through court proceedings and be subject to extensive public review (MacDonnell, 2009).

Instream flow rights that are supplied through water leased to the CWCB are temporary in nature. However, during the term that the leased water is decreed as an instream flow right it holds all the same protections as a permanently appropriated instream flow right. Also, long-term leases “do not require periodic review, as required in a few other states” (Charney, 2005,

40). This means that instream flow rights from water leases cannot be changed until the leasing period has expired. There are also no restriction on the duration of lease terms and leases can be reestablished an unlimited amount of times.

Overall Colorado’s instream flow program is well suited to create permanent instream flow rights. They are protected from administrative bias and are provided legal protection under the law. Working through the Water Court system does require significant time and money, but once instream flow rights are adjudicated they “are among the most permanent and secure of any state” (Charney, 2005, 40).

Number of Instream Flows. Determining the number of instream flows provides a way to assess how effective the Colorado program has been in quantitative terms. The table below provides the number of instream flow rights that currently exist in Colorado and delineates how many of them come from new appropriations versus acquisitions. Also provided is the number of miles of river that are currently protected by instream flow rights.

Number of Instream Flow Rights	Number of New Appropriations	Number of Acquisitions	Miles of River Protected
2025	1999	26	8840 (8.2% of total river miles in the state)

Table 2. Number of instream flows in Colorado. (Numbers acquired from the CWCB website, available at < <http://cwcb.state.co.us/environment/instream-flow-program/Pages/main.aspx>>.)

The total number of rights and the number of river miles protected indicates that the Colorado program has generally been very successful in creating instream flow rights. In fact, when compared to other states in the West Colorado is one of the leaders in this respect (Charney, 2005). The percentage of instream flow rights that are procured through new appropriations shows the CWCB’s clear willingness to use their administrative power to create

new instream flow rights. This number continues to rise as the CWCB appropriates new instream flows on an annual basis. The water acquisitions that Colorado has obtained come from both donations and leases. Of the 26 acquisitions, 20 have come from donations to the CWCB and 6 have come from leases. Acquiring water rights to change into instream flows is a much more difficult and costly process than new appropriations, but the low number of acquisitions that Colorado has been able to obtain reveals an area where the Colorado program could be improved. New appropriations are important in preserving rivers but the acquisition of senior water rights should be a high priority for the CWCB in order to effectively restore and improve the health of rivers.

Funding. The cost of appropriating instream flow rights has been noted many times in this study. This is because funding is one of the biggest limiting factors in creating instream flow rights. This is especially true in Colorado where legal costs are heightened due to the use of a Water Court system. The CWCB has had the legal authority to lease and purchase senior consumptive water rights to change into instream flows since 1986. However, the state legislature did not authorize funding for this purpose until 2008 (MacDonnell, 2009). Between 1986 and 2007 the CWCB had to rely on donations as their only means of acquiring existing senior water rights. This may be part of the explanation for the small number of leases that CWCB has entered into. The 2008 authorization set up two sources of funding for the CWCB. The two sources include an “annual replenishing one million dollars from the state construction fund and an annually replenishing five hundred thousand dollars from the Species Conservation Trust Fund” (Interview, Employee of the Colorado Water Trust, 2011). These funds have enabled the CWCB to seek out willing lessors and sellers in an attempt to enter into agreements with them.

Another source of funding has come from private organizations that have participated in the program. Groups like Trout Unlimited, Colorado Water Trust, and Nature Conservancy have brought private funding to the table in order to purchase private water rights that they can then donate to the CWCB for instream flows (MacDonnell, 2009). The Water Trust is also willing to assist private individuals in donating or leasing water to the CWCB. According to an employee of the Colorado Water Trust, “individuals who wish to put water into the instream flow program will actually incur costs, legal costs, engineering costs, and the Water Trust can alleviate some of that burden”. There could always be more funding to devote to instream flows, but the willingness of private groups to bring money to the table in addition to the establishment of government funding has put Colorado in a better situation than they ever have been before.

Monitoring and Enforcement. Instream flows require two levels of monitoring and enforcement. The first is physical protection of the right. In other words, making sure the decreed instream flow is actually being met. The CWCB accomplishes this through both physical measurements and informal observation. For the physical measurements the CWCB uses stream gauges that are linked to a satellite and provide real-time stream flow data. According to a CWCB employee, there is also a low flow alert system which notifies CWCB staff via email and text message in the event that a stream flow gets close to or drops below the decreed amount. If the instream flow is in priority, meaning that it is senior to other rights, then a call can be made on any junior rights holders diverting water to curtail their diversion in order to return the flow to the decreed amount (Merriman and Janicki, 2005). Informal observation is provided by water commissioners, division engineers, wildlife managers, members of Trout Unlimited and anyone else who regularly sees a stream and can call the CWCB if the flow level seems to be low (Charney, 2005).

The other level of monitoring and enforcement has to do with the legal protection of instream flow rights. Each month there are several water rights transfers, changes, and new appropriations filed in the Water Court. According to CWCB staff there can be up to 30 or more water applications per month submitted to the Water Court for various water rights transactions. It is the job of the CWCB to make sure that none of these transactions will cause injury to an existing instream flow right. In order to do this the CWCB has staff who review all applications submitted to the Water Court each month. If there is a transaction that will affect an instream flow, the CWCB submits a statement of opposition to the court. The water transaction in question must then be modified to assure that no injury will be caused to the instream flow. Even if an instream flow right is junior to a private water right being modified, it is still protected against any change that will be detrimental to the instream flow. This is according to state law entitling adjudicated water rights to stream conditions as they exist at the time of appropriation (Merriman and Janicki, 2005). The fact that instream flow rights are permanent and fully adjudicated property rights gives them legal standing in the Water Court which protects them from any injury from other users.

A former employee of the CWCB indicated that, monitoring and enforcement in Colorado is enhanced by centralized control over instream flow rights. The reason being that “when they [instream flow rights] are state held they [the state] know what’s there, there is somebody who is paid to monitor and track them and call the State Engineer when a right is in priority and make sure it is being administered” (Interview, former employee of CWCB, 2011). An employee of the Colorado Water Trust reinforced this claim by stating that “state agencies bring a level of resources, man power and money, as well as technology to the table that private groups currently cannot support”. Colorado’s monitoring and enforcement has proven to be

extremely active, has been successful on the two levels of protection, and is supported by a dedicated agency with advanced technologies.

Barriers to Private Participation. An employee from the Colorado Water Trust explained that,

“for someone to transfer water into the instream flow program it is a costly and time consuming process which has to go through the CWCB first and then through the water court. Individuals who wish to put water into the instream flow program will actually incur costs, legal costs, and engineering costs”.

The first barrier that stems from this process is the time that it takes to get an instream flow right completed from start to finish. When an individual wants to donate or lease water they must submit an application to the CWCB and then submit a water right change application to the Water Court (Merriman and Janicki, 2005). Getting the water right verified by the CWCB and then adjudicated by the Water Court is a lengthy process. This is especially true if someone issues an objection to the instream flow right that requires it to be modified. According to an employee of the CWCB the entire process can take anywhere from one to six years depending on the complexity of the transaction. Private individuals value their time and if the process to change a private right into an instream flow right is too complex and time consuming, they may decide that it is not worth their effort.

The second barrier is the cost that a private individual who wants to donate or lease water to the CWCB will incur. One financial cost comes from the need to hire a water attorney to help get through the legal process. Water law in Colorado is very complicated and private individuals rarely have the knowledge required to successfully navigate the system. Attorney's fees can be overwhelming especially since instream flow rights are complex and will require a significant number of hours to complete. Another cost comes with the need to hire a water engineer. When submitting an application to the CWCB it is the duty of the private individual to show the

consumptive use and return flow history of their water right. This information is required by the CWCB for them to make a determination on whether or not they will enter into a lease or donation. This information is also pertinent when the change of water right is going through the court system. According to an employee of Colorado Trout Unlimited the “court will require a pretty exacting engineering analysis”. In order to provide this information in a verifiable manner a professional water engineer must be hired. An individual who wishes to donate or lease water to the CWCB is going to have to be willing to incur potentially high costs. These costs are obviously a disincentive to many private individuals who may be willing to participate in the instream flow program.

Non-profits such as the Colorado Water Trust have attempted to reduce disincentives by working with private owners and agreeing to incur the costs associated with changing a right into an instream flow. An employee of the CWCB stated that, “when the Water Trust was up and running we really started to see some real activity. By partnering with the CWT we have been able to provide protection on maybe 3-5 streams per year”. Based on this statement, including private groups who can help alleviate some of the burden on private water owners should help increase participation in the program and make more water available to devote to instream flows.

The final barrier discussed in this evaluation is that Colorado law requires instream flow rights to be administered only by the CWCB. When privately donated or leased water is adjudicated as an instream flow right, full control of the right is turned over to the CWCB. For many private water users the fact that the water donor loses control of the water right while it is an instream flow makes the program unpopular (Boyd, 2003). Water rights in Colorado are an extremely valuable asset and private owners are unwilling to part with their rights, even temporarily. A 2008 survey given to 329 individuals in the Colorado agricultural community

found that only twenty percent (approximately 65) of the respondents were willing to consider leasing their water to the government for environmental purposes (Pritchett et al., 2008). The results of this survey support the fact that despite the attempts to ease the concerns of private water owners, a large percent remains wary about giving up any power over their water right for instream flows.

Summary of the Colorado Instream Flow Program

Colorado has been very active in appropriating instream flow rights since they were first established in 1973. The two-pronged approach used in the Colorado program allows for preservation of rivers through new appropriations, and restoration of rivers through acquisition of senior rights. The CWCB has been successful in pursuing new instream flow appropriations but has been limited in the number of water acquisitions to date. The legislative authorization of funding in 2008 should help the CWCB in obtaining more senior rights to change into instream flows. The fact that instream flow rights in Colorado are fully adjudicated by the Water Court makes the process time consuming and costly but also gives them significant legal protection and permanence. The CWCB's monitoring and enforcement procedure is effective in making sure the decreed instream flows are being met and that they are not injured by other users.

One way the Colorado program could be improved is by attracting more participation from private water owners. A possible option would be to allow privately held instream flows. Providing private water owners with the option to lease to a non-governmental organization, or allowing them to change their own water right into an instream flow, might be the only way to get some senior water rights owners to voluntarily participate in the program. However, even

with the limited private participation, Colorado has developed a strong program that has been successful in protecting instream flows in many of the rivers across the state.

Case Study: Montana Instream Flow Program

Background of the Montana Instream Flow Program

In 1969 the Montana state legislature approved the appropriation of 12 permanent instream flows, known as the “Murphy Rights”, on some of the most prominent rivers in the state including the Missouri, Yellowstone, and the Blackfoot. This action by the legislature was the first recognition of the need for protection of water left instream. In 1973 the legislation approving the Murphy Rights was replaced with Montana Code 85-2-316 which created a mechanism by which un-appropriated water in the state could be reserved for existing or future beneficial uses (MacDonnell, 2009). Although reservations can be created for out of stream uses such as future land development, they can also be created to protect instream flows. State agencies such as the Department of Fish, Wildlife, and Parks have seized upon this opportunity to create several water reservations devoted to the protection of instream flows (MacDonnell, 2009). Before the appropriation of the Murphy Rights and the reservation system, only diverted water rights were protected in Montana. This resulted from the same historical bias toward out of stream water uses as seen in Colorado. Like Colorado, Montana eventually recognized the need to protect water left instream and over the years has extended the original instream flow legislation passed in 1973.

From 1973 until 1995 Montana state law only allowed instream flows to be held and maintained by a government agency. However, unlike Colorado, any state or even federal agency can apply for instream flow reservations. Agencies such as the Department of Fish Wildlife and Parks, the Forest Service, the Bureau of Land Management, and the Department of Environmental Quality all hold instream flow reservations (MacDonnell, 2009). Another distinction between the Colorado and Montana programs is that water rights in Montana are

created through administrative rule rather than a water court decree. The state agency responsible for overseeing water use in Montana is the Department of Natural Resources and Conservation (DNRC). All applications for appropriation of water, both instream and diverted, must go to this agency for approval. This difference has important implications for instream flows in Montana. With the exception of the Murphy Rights, instream flows that are created through the reservation system are “not a perpetual commitment of water” (MacDonnell, 2009, 360). In other words, instream flow reservations are not fully fledged permanent property rights as in Colorado. These reservations are subject to review every 10 years and can be changed, modified or revoked by the DNRC every 5 years (M.C. 85-2-316).

Until 1989 instream flows could only come in the form of reservations that set aside un-appropriated water and devotes it to instream use. Like Colorado, Montana uses the doctrine of prior appropriation to allocate water. As such, instream flow reservations are given a priority date when created and are junior to any existing senior water rights. This means that reservations are useful for preserving but not restoring instream flows since users with senior rights can continue to divert large amounts of water. In 1989 the state legislature expanded the instream flow program to allow private individuals to lease their water to the Department of Fish, Wildlife, and Parks (DFWP) (Ziemer and Bradshaw; 2005; M.C. 85-2-408). The ability to lease senior rights meant that the DFWP could begin returning previously diverted water back to the river, thereby restoring river flows.

The leasing program was expanded again in 1995 when the state legislature authorized a ten-year pilot program allowing any individual or group, private or governmental, to lease water and devote it to instream flows . It also allowed any private owner to convert their water right to an instream flow without a lease. This was a major departure from the traditional law due to the

fact that prior to this time only a government agency could hold instream flow rights. The positive experience with the pilot program led to legislation in 2005, making the privatized leasing and conversion program a permanent part of the Montana instream flow program (MacDonnell, 2009). At first, leases and conversions were limited to ten year terms with the opportunity to renew three times. In effect this meant that leases were limited to thirty years. In 2008 the state legislature amended this law to allow an unlimited number of renewals (M.C.A. 85-2-316).

The government still plays a large role in the Montana instream flow program but over time an increasing amount of private participation has been incorporated. There are now two ways that an instream flow can be established in Montana including new appropriations created through the water reservation system, and water transfers in the form of leases and conversions. This dual approach between government and private entities has allowed Montana to create a program which recognizes the need to preserve and restore the state's rivers, as well as incentivizes the participation of private water users. Below are the processes through which instream flows are created in Montana.

How the Montana Program Establishes Instream Flows

The process of creating an instream flow water reservation begins with a state or federal agency identifying a river segment that could be preserved or enhanced by an instream flow reservation. The government agency must then submit an application to the DNRC to request a water reservation appropriation. Applications require information concerning the intended purpose of the reservation, the quantity of water requested, the quantity of water available, evidence that the reservation is in the interest of the public, and a management plan for the

reservation (Charney, 2005). Once the application is filed, the DNRC reviews and investigates the application. If the application passes review, the DNRC publishes a notification of the reservation in a local newspaper and contacts local water users who could potentially be affected by the reservation (Charney, 2005). At this point objections to the reservation can be submitted to the DNRC. If the DNRC finds that a proposed reservation threatens an existing water right, the reservation application must be modified to assure that no injury will occur. Upon completing this process the reservation is established and reviewed every ten years to assure that it is fulfilling its intended purpose. As explained before, after the ten year period the reservation can be changed, modified, or revoked by the DNRC. It is important to note that the majority of instream flow reservations were created in the mid 1980's and since then only around fifteen have been completed. This suggests that government agencies have largely moved away from establishing instream flows through this method.

In addition to reservations, leases and conversions are the other two methods of allocating water for instream flows in Montana. Leases are done on a voluntary "willing seller, willing buyer" basis. Both government and private entities can enter into leases and hold instream flows. Conversions, on the other hand, are unilateral decisions made by water owners to change their water right from a diversionary purpose to an instream flow purpose without a lease. For instream flow leases and conversions to be established they must go through the DNRC's change of use procedure. For both leases and conversions the owner of the existing water right must publish a notification of the change of use in local newspapers before submitting an application to the DNRC. The applicant must also provide evidence assuring that the change of use will not cause injury to any existing rights, show that instream flows will preserve or enhance a fishery, and present a management plan for the instream flow (Boyd, 2003). The application is then

reviewed and, if accepted, the DNRC publishes notice and allows objections to be submitted. If objections are submitted and the DNRC determines that a credible threat exists, the change of use application must be modified to assure that no injury is caused to existing water rights. The lease or conversion can then be approved for up to a ten year period. Once the term ends the individuals or groups involved in the lease or conversion must go through a new change of use application process to renew the lease or conversion.

Evaluation of the Montana Program in Relation to Permanence, Number of Instream Flows, Funding, Monitoring and Enforcement, and Barriers to Private Participation

Permanence. The permanence of instream flows created under the Montana program is limited by the fact that they are not fully adjudicated water rights and are subject to modification or repeal. This is most clearly seen through the requirement for ten-year reviews, at which time the DNRC can modify or revoke reservations. For example, if the DNRC finds that a reservation is no longer needed for its original intended purpose, that the reserved water has not been used, or if the need to reallocate the water outweighs the original purpose of the reservation, then they can change or revoke the reservation (Covell, 1998). This also means that reservations are highly susceptible to changes in administrative policies. An instream flow reservation that may have been created ten years ago by a conservation minded administration may subsequently be reviewed by a more development oriented administration that can revoke it and devote the water to out of stream purposes.

Instream flow leases in Montana are temporary by nature but are further limited by the ten-year review requirement. This means that lease agreements can only be created for ten year terms at which time they must be renewed through a lengthy process. Prior to 2008, leases could

only be renewed a maximum of three times but this was changed to allow an unlimited number of renewals. This change increased the potential permanence of leases, assuming that leases will be renewed every ten years, and that the statute authorizing unlimited renewals is not changed by the legislature (MacDonnell, 2009). The fact that leases and conversions are approved and reviewed by the DNRC means that they are susceptible to administrative changes and bias just like reservations. A lease or conversion may be approved by a conservation minded administration and then be denied renewal by a more development minded administration. If laws were changed it would allow for long term leases, and conversions could be permanent, but as they stand now they must be renewed on a ten year basis.

Another issue that affects permanence of leases and conversions is the fact that water is a valuable commodity and will only become more valuable as demand for water increases. This can have a detrimental effect on instream flow leases and conversions because, “in five years’ time a guy may get a great offer from a downstream city and decide that instead of the small amount of money he is getting for leasing his water he would like to sell his right for bigger money” (Interview, employee of DFWP, 2011). Unless comparable incentives can be provided to persuade private owners to leave their water instream, the enticement to sell water rights for out of stream uses will threaten the permanence of any lease or conversion. Groups like the Montana Water Trust, Trout Unlimited, and other proponents for instream flows simply cannot compete financially with groups who want to buy water for consumptive uses.

The requirement for ten-year reviews shows Montana’s cautious approach to instream flow appropriation. However, over time the Montana legislature has continually expanded the instream flow legislation signaling their support for the program. Under these circumstances it does not seem likely that the government will completely reverse its policy and begin to revoke

existing instream flow reservations, leases, and conversions. Nevertheless, the fact that instream flows cannot be permanently changed means that they “are uncertain in the long term and the legislature could for some reason decide to pull away from them” (Interview, employee of DFWP, 2011). Although this is may not be a concern presently, as water becomes more and more scarce, the policies of the government will likely come under pressure to meet consumptive needs before environmental needs. This issue, in addition to the threat of private water owners selling their water rights to developers rather than leaving water instream, signals a need for Montana to increase focus on securing permanent instream flow rights similar to the original 12 Murphy Rights.

Number of Instream Flows. As in the Colorado case study, the number of instream flows provides a quantitative measure of the accomplishments made by the Montana program. Below is a chart representing the number of instream flow reservations, the number of water rights that have a change of authorization to instream flow, and the total number of river miles protected.

Total instream flows	Total Instream Flow Water Reservations	Total Change of Authorizations	Miles of River Protected (2005)
533	413	120	2477 (1.4% of total river miles in the state)

Table 3. Number of instream flows in Montana. (Numbers acquired from the DNRC website, available at http://dnrc.mt.gov/wrd/water_rts/default.asp)

Montana has secured fewer instream flows than Colorado but it is important to point out that Montana is still a leader when compared to several of the other states in the West (Charney, 2005). Instream flow water reservations are held by a few different government agencies but the Department of Fish Wildlife and Parks controls a majority of them with 376 total. The number of change authorizations represents both leases and conversions. Unfortunately the Montana

instream flow records do not differentiate between which of these change of authorizations are leases and which are conversions. Knowing how many conversions compared to leases would be informative because it could provide some insight into which option is more preferable to private water owners. An employee of the DFWP explained that the agency is currently involved in ten leases, and the Montana Water Trust and Montana Trout Unlimited have entered into approximately thirty leases according to Schempp (2009). Obtaining private water to devote to instream flows has been an area of considerable strength in Montana and this can be partly attributed to the fact that instream flows can be held by private individuals.

Funding. Since Montana uses an administrative system rather than a water court system, legal costs to appropriate instream flows are reduced. Despite this fact, appropriating instream flows is still a costly venture. A large amount of information is required for an application for a reservation or change of use to be accepted. Some of this information necessitates professional analysis. For example, a hydrologic analysis is often needed to assure that an instream reservation, lease, or conversion will not adversely affect existing water rights (Boyd, 2003). The cost of hiring a water engineer in addition to fees associated with the application itself can be burdensome. There are also costs associated with monitoring and enforcing instream flows. The fact that Montana law requires periodic review of instream flows means that money is spent every ten years to evaluate whether or not a reservation is fulfilling its purpose. In the case of leases and conversions the parties involved must spend money to renew their agreements every ten years.

Funding for the costs associated with instream flows comes from many sources due to the fact that Montana state law allows any government agency to possess instream flow reservations, and any government or private individual or organization to enter into leases and conversions.

The main government agency involved in acquiring instream flow water reservations and leases is the Montana Department of Fish, Wildlife, and Parks (DFWP). Funding for the DFWP comes primarily from the Future Fisheries program which provides an annually replenishing \$750,000 from fishing license fees and taxes from the mining industry (Interview, employee from DFWP, 2011). In addition to the DFWP, the Montana Department of Environmental Quality, the Bureau of Land Management, and other government agencies also provide some funding for instream flows.

Due to the high level of private involvement in the Montana program, private funding has become a more important factor in appropriating instream flow leases. The fact that “state governments are limited by budgets” means that the inclusion of private money can be beneficial because it “takes some of the influence of the state budget out of the equation” (Interview, employee from DFWP, 2011). Comparatively, private groups spend less on instream flows in Montana than the state and federal government, however, private funding has continually increased in the last decade (Scarborough, 2007). The inclusion of private parties means that any group interested in instream flows becomes a potential source of funding (MacDonnell, 2009). Non-profits like the Montana Water Trust and Trout Unlimited have devoted funding and manpower to facilitating instream flows in Montana. These groups can be very good at using creative ways to find funding for instream flows. According to an employee with the Montana Trout Unlimited, “it is still hard to find money for this stuff” but non-profits can seek out funding from private foundations, public entities, and private donors. By including private entities the state of Montana has expanded the opportunities to find funding, and in the words of an employee of the DFWP, “the more parties who are interested in trying to create instream flows and search for funding, the better”.

Monitoring and Enforcement. Unlike Colorado, Montana does not have a centralized agency that retains all instream flow appropriations. As such, monitoring and enforcing instream flows in Montana falls upon several different public and private groups. When an instream flow reservation application is submitted to the DNRC one of the requirements is a management plan which includes a description of how the appropriation will be monitored and enforced (Interview, employee from DFWP, 2011). Instream flow reservations are monitored and enforced by the government agency that applied for the instream designation. The DFWP, the agency in possession of the most reservations, relies on USGS stream gauges to determine real-time stream flows. If a reservation is not being met, it is the duty of the DFWP to take action to enforce the instream flows by making calls on junior water users to stop diverting water out of the stream.

Like reservations, applications for leases and conversions require a management plan outlining how the instream flow will be monitored and enforced. For instream leases and conversions all costs associated with monitoring and enforcement are the responsibility of the owner of the original water right (Charney, 2005; M.C. 85-2-439). This includes installing measurement gauges, as well as any costs incurred by actually taking measurements, providing measurement records, and enforcing the instream flow. Under Montana state law it is also the responsibility of the private owner to monitor the flows and enforce them, if necessary. In other words, if Trout Unlimited enters into a leasing agreement with a private owner, it is still the responsibility of the private owner to assure that the instream flow is being met. Trout Unlimited can assist with monitoring the flow but under state law only the private owner has authority to legally enforce the instream flow appropriation. Usually what will happen is the leasing party, say Trout Unlimited, will actively monitor the flow and in the case that it is not being fulfilled

will ask the private owner to make an official call to stop junior users from diverting water. In most, if not all, situations the leasing party is willing to cover all costs associated with monitoring and enforcing an instream lease or conversion. This is an attempt to provide an incentive for private individuals to participate by removing the burden of incurring costs.

It is also important to protect instream reservations, leases, and conversions against new water right applications which could cause injury to the existing flow (Charney, 2005). Like in Colorado, this requires diligent monitoring to assure that no new water transactions threaten existing instream flows. In the case that a new application does threaten an existing instream flow then it is the obligation of the owner of the instream flow, to submit an objection to the new application. Government agencies like the DFWP have staff devoted to monitoring new applications and in the case of leases the leasing party, such as the Water Trust or Trout Unlimited, will usually take on this duty and notify the private owner if an objection needs to be made.

There is some debate concerning how well private individuals and groups can monitor instream flow leases and conversions. The fact that private individuals and groups spend a considerable amount of time and money establishing instream flows would suggest that they would be highly motivated to protect those appropriations. An employee of the DNRC stated that they “had not heard of any private entities having to send letters or make calls, which would indicate that there is not an enforcement problem at this point”. However, where most of the private leases have been accomplished indicates that monitoring and enforcement is difficult for private individuals. A respondent from the DFWP explained that,

“a lot of the private leases end up on streams where that [enforcement] is not an issue for you. In all honesty if you are in a situation where you need a water commissioner you’re probably going to struggle to make it work anyway. My experience is that you need to be leasing these waters where they are respected by people and on the stream and honored by people on the stream without having to get into legal battles”.

A statement from an employee of the Montana Trout Unlimited supported this claim stating that, “sometimes you are limited to certain streams. It isn’t worth it in a complicated place so we end up doing more senior water rights in simple situations. So you are kind of limited from that perspective”. The inability of private individuals and groups to monitor and enforce instream flows has implications concerning how much reliance can be placed upon private groups to protect rivers across the state. A majority of rivers that are in the most need of instream flow protection are heavily used rivers that have multiple users and would require diligent monitoring and enforcement.

Barriers to Private Participation. Provisions in the Montana program which allow private individuals to hold instream flows provides a huge opportunity for private interests to participate. Despite this fact, there are still barriers that private individuals must overcome if they wish to participate. One barrier is the cost associated with leasing water or converting it to an instream flow purpose. This is an area where Montana actually benefits from not using a water court system because legal costs are greatly reduced. However, it is often still necessary for a private owner to hire a lawyer to assist in drawing up leases or any other agreements. Furthermore, the law states that for private leasing or conversions the private owner incurs all costs associated with that venture. Granted, most of these costs are covered by the individual or group leasing the water but the fact remains that, in the end, the owner of the private right is responsible.

Another barrier is that leases and conversions can often take “large chunks of concentrated time” (Schemmp, 2009, 14). They do not have to go through a water court but they still have to be evaluated, and approved by the DNRC as well as pass public review. On average, from start to finish, a proposed lease or conversion may take two years to be completed (Zeimer and Bradshaw, 2005). Private individuals may not be interested in participating once they see how long of a process it can be.

One final barrier to private involvement is the required ten-year review on all leases and conversions. For some individuals this may actually be seen as a positive thing because it provides them a level of control over their water because they only have to enter into ten year agreements after which they can exit the lease if they choose to do so. However, private owners who wish to leave their water instream indefinitely must go through the burden of reapplying every ten years which requires significant time and money. This may be more of a factor for individuals or groups who are actually paying for the lease or conversion because the associated transaction costs may “outweigh the benefits of securing temporary instream flows” (Boyd, 2003, 1180).

Summary of the Montana Program

Montana has developed a dual approach in its instream flow program. The inclusion of both government and private involvement has increased the number of individuals and groups that can participate and with these different groups comes additional resources to put toward instream flows (MacDonnell, 2009). The reservation system has allowed the government to preserve rivers by limiting new diversionary appropriations on heavily used streams. The leasing and conversion program complements the reservation system by providing a way to return senior

water rights back to the river. One main improvement that could be made to the Montana program would be to remove the requirement for ten-year reviews. By removing this restriction, instream flows created in Montana would be more permanent and would assure the protection of rivers into the future. Another area of concern in the Montana program is that it currently relies heavily on instream flows created through the leasing of senior water rights. Although the program has been fairly successful in this respect, this is only a temporary solution and does not assure that rivers will be protected in the future. Despite these concerns, Montana has developed a program that has been successful in securing a large number of instream flows and continues to search for more opportunities to protect their rivers.

Analysis and Conclusion

Analysis

Based on the information provided in the case studies, the first part of this section provides a summary analysis of the Colorado and Montana instream flow programs. This includes a determination of how each program performs in relation to permanence, number of instream flows, funding, monitoring and enforcement, and barriers to private participation. Specific focus is given to the strengths and weaknesses of each program in order to identify the characteristics that either improve or inhibit their effectiveness. These characteristics are used in the second part of this section to provide six suggestions for the creation of effective hybrid instream flow programs.

According to Clemons and McBeth (2009), after completing an evaluation of different policies, some type of matrix should be used as a way to display the results of the analysis. Below is an adapted version of a Goeller Scorecard that represents the level of performance for the Colorado and Montana programs in relation to the five noted criteria. This helps identify the areas of strength and weakness of each program.

	Criteria					
		Permanence	# of Instream flows	Funding	Monitoring and Enforcement	Barriers to Private Involvement
State Instream Flow Programs	Colorado	High	High (2025)	Moderate	High	Moderate
	Montana	Low	Moderate (533)	Moderate	Moderate	High

Table 4. Note: Table indicates the performance level of each state instream flow program in relation to the listed criteria.

As out of stream demands for water increase with continual population growth in Colorado and Montana, the long-term health of rivers in these states relies on the ability to secure permanent instream flow rights. This is an area where Colorado has high level of performance. One of the main reasons for this is that in Colorado instream flow rights are granted the same standing and are afforded the same legal protections as all other water rights in the state. This is contrasted by Montana's system where instream flow appropriations are held to a different standard than all other rights. The requirement for reviews on all instream flow rights limits the effective permanence of any instream flow to ten years. Testimonies from individuals familiar with the Montana program suggest that this has not been a problem up to this point and that the government has gradually increased the possibility for long term instream flows. However, until the ten-year review requirement is removed and instream flows are given the same standing as all other water rights, there is no guarantee that established instream flows will last even into the near future.

The permanence of instream flows in Colorado is further enhanced because the CWCB has focused its energy and resources more on securing water that can be changed into permanent rights rather than temporary leases or conversions. Montana, on the other hand, has in recent years put more emphasis on acquiring water through temporary leases and conversions. Instream flows created through these methods are extremely valuable, but relying on private owners to continue to participate in instream flow leases or conversions in the face of significant financial incentives to sell their water elsewhere is a risky situation.

Colorado also has a high level of performance when it comes to the total number of instream flows and number of river miles that have been protected. The most recent data for the number of river miles protected in Montana, 2,477 miles, is from 2005. Unfortunately it was

impossible to find entirely comparable data, however, it can be inferred that in five years' time this number has not grown at such a rate to rival the 8,840 miles that have been protected in Colorado. Furthermore, Colorado has established just under 2000 new instream flow appropriations all of which are fully adjudicated permanent water rights. This shows the clear dedication of the CWCB to create instream flows using this method. Montana has performed moderately well in this category because, while it lags behind Colorado in total instream flows and total river miles protected, they do have a comparative advantage in the number of senior water rights that have been changed into instream flows either through lease, donation, or conversion. This is not insignificant considering the fact that changing senior water rights into instream flows is the only way to restore heavily used rivers. The allowance of privately held instream flows seems to assist in getting senior water rights owners to participate in the program. However, it is important to note that the CWCB has only had funding for leases since 2008. It remains to be seen how much this will improve the ability to acquire senior water rights in Colorado.

In terms of funding, the instream flow programs in Colorado and Montana have both performed moderately well. Both programs rely heavily on state government money. Each state has set up programs that provide annually replenishing funds to assist in appropriating new instream flows. However, because state governments are forced to allocate limited funding to numerous different programs, the budget for instream flows is limited. For this reason, both states have attempted to bring in additional money from private sources. One of the benefits of allowing privately held instream flows in Montana is that it expands the number of parties who can participate. Any individual who wishes to establish an instream flow can do so with full

support of the law. Several groups have responded, particularly, the Montana Water Trust and Trout Unlimited by entering into leasing agreements with private water owners.

Although the Colorado program does not allow privately held instream flows, the provision allowing private individuals and groups to lease or donate water to the CWCB does offer a way for private money to come into play. The Colorado Water Trust has been instrumental in acquiring senior rights that can be changed into instream flows. Other groups like Trout Unlimited and The Nature Conservancy have also become more involved in the program and have brought some money to the table in Colorado.

The allowance of privately held instream flows does provide the opportunity for different types of funding but the actual results in Montana have not shown a drastic increase in money to devote to instream flows. The respondent from Colorado Trout Unlimited explained that TU doesn't have the type of money independently to lease water. The respondent from Montana Trout Unlimited indicated that it is still hard to find money and that he has not seen a major increase in the pool of money for instream flows. Based on the case studies it is hard to argue that allowing privately held instream flows has made significantly more money available in Montana than Colorado has been able to procure by allowing private owners to lease water to the CWCB. Furthermore, groups like the Water Trusts and Trout Unlimited have had a similar level of activity in both states indicating that with or without privately held instream flows these groups are still interested in participating.

The government agencies in both Colorado and Montana have a high level of performance in relation to monitoring and enforcement. Agencies in both states have systems in place that ensure that instream flows are being protected on the physical level, making sure stream-flows are being met, as well as the legal level, making sure new water transactions will

not cause injury to existing flows. The fact that all instream flows in Colorado are monitored and enforced by the CWCB means that the program has an overall high level of performance in this area. The additional issue in Montana is how well private instream flows can be monitored and enforced. The government agencies in both states rely on a significant amount of manpower, as is required to review all new water transactions, and expensive technology in the form of stream gauges and satellite relays. It can be assumed that private individuals and groups who spend considerable amounts of money to establish instream flows would be highly motivated to protect them. However, the additional costs associated with monitoring and enforcing them may be more than private individuals or even organizations can deliver. This is supported by the fact that almost all private leases and conversions in Montana have been completed on streams where a high level of monitoring and enforcement is not required, thereby, limiting the areas where private groups can actually be successful in protecting instream flows. Due to the limitations of private groups to monitor and enforce instream flows, the overall performance of the Montana program is moderate in relation to monitoring and enforcement.

Acquiring water from private owners is an important part of instream flow programs. They not only enable preservation but also restoration of heavily used rivers. Furthermore, water acquisitions from private owners will become increasingly important as rivers become fully appropriated and the states lose their ability to make new instream flow appropriations or reservations. For this reason barriers for private owners to participate in the Colorado and Montana instream flow programs should be reduced. This is an area where Montana has shown a higher level of performance in comparison to Colorado.

By not allowing privately held instream flows the Colorado program creates a barrier to private participation. State law does allow for private individuals or groups to donate and lease

water to the CWCB, which has brought in some private participation. However, the requirement to give over control of the water right to the CWCB, even temporarily, is a large disincentive for many private owners. The current process also requires any private water owner to navigate through both the CWCB and the Water Court in order to lease or even donate their water. The costs and time associated with this are substantial and may lead to water owners deciding to sell their water for development purposes instead of instream flows. The relative success in acquiring private water since the establishment of the Colorado Water Trust shows that the involvement from private groups can be very beneficial.

Montana does allow privately held instream flows and for that reason they have had a higher level of private involvement than in Colorado. Private owners have a couple of options at their disposal including leasing or donating water to a government agency or a private group, as well as independently changing the use of their water to an instream flow purpose. Individuals who may be uncomfortable working with the government can seek out private groups such as Trout Unlimited, and individuals who are nervous about giving up control can apply to the DNRC for a change of use and hold an instream flow themselves.

The biggest barrier to private involvement in Montana comes as a result of the requirement for ten-year reviews. Some private owners may like the review because it only requires them to enter into a lease for a maximum of ten years, but for individuals who are interested in leaving their water instream for the foreseeable future, the review can be costly and burdensome. Every ten years private owners must spend time and money to go through a completely new application process. Private owners may choose to sell their water to somebody who wants to use it for an out of stream use rather than dealing with the burden of ten-year

reviews. By removing the requirement for ten-year reviews the Montana program could greatly decrease the barriers to private participation.

Although a comparison between the Colorado and Montana programs has been included in this study, the ultimate value of doing this is limited due to the fact that these programs are not necessarily transferrable. In other words, there is no guarantee that the success of one program would be realized if it were implemented in another state. The more valuable aspect of this study is identifying the specific aspects of each program which improve their performance in relation to permanence, number of instream flows, funding, monitoring and enforcement, and reducing barriers to private participation. Highlighting these aspects provides an opportunity to make suggestions in how to best design hybrid instream flow programs. Below are six suggestions based on the analysis of this study, as well as a table which indicates the areas where each suggestion can improve the performance of an instream flow program.

	Criteria					
		# of Instream Flows	Permanence	Funding	Monitoring and Enforcement	Barriers to Private Participation
Suggestion	Standing of Instream flows		✓		✓	
	Dedicated Government Agency	✓		✓	✓	
	Non-Profit Participation	✓		✓		✓
	Incentives for Private Participation	✓				✓
	Removing Barriers	✓				✓
	Not Relying on Private Instream Flows	✓	✓		✓	

Table 5. Suggestion and Criteria Table.

1. *Programs should provide instream flows the same standing as all other water rights in the state.*

Creating and administering instream flow rights in the same manner as all other water rights increases their enforceability and their permanence. The ability to enforce an instream flow right is improved because it will have a high level of legal standing. Legal standing enables owners of instream flow rights to protect their right against injury from other water users, and to legally enforce their right if it is going unfulfilled. In terms of permanence, increasing demand for water to devote to out of stream uses will continually threaten the existence of instream flows. For this reason, instream flow rights need to have the necessary legal standing to withstand the challenge from opposition groups who would like to see instream flow rights abolished in order to make more water available for diversion.

2. *Programs should include a state agency dedicated to instream flows.*

The inclusion of a state agency that has instream flow protection as one of its main priorities improves the effectiveness of a program. Such an agency could devote significant time and resources specifically to instream flows. This is in contrast to situations where instream flow protection is folded in under agencies with multiple priorities. In this case, instream flow protection will not receive the level of attention required for a program to be effective. The Colorado Water Conservation Board and the Montana Department of Fish, Wildlife, and Parks are examples of agencies that have staff and funding solely committed to instream flow protection. Having a consistent source of government money assures that some amount of funding is available to devote to instream flows. The benefit of having a staff dedicated to instream flows is twofold. First, it will lead to more instream flows being established due to the

fact that there are individuals constantly looking for opportunities to create new instream flows. Secondly, having a dedicated staff improves the ability to monitor and enforce instream flows because an individual can be appointed to remain vigilant and take action in the case that an instream flow is not being physically met or is legally injured by another water user.

3. *Programs should promote participation from private non-profit organizations.*

The potential of groups like the Montana and Colorado Water Trusts as well as Trout Unlimited can be seen by their considerable success in securing instream flows in Colorado and Montana. Including these groups can greatly expand the capacity of an instream flow program. These groups bring additional funding and manpower to devote to seeking out and establishing instream flows. This can produce a larger number of instream flows than would be established through government action alone. Furthermore, non-profits have been instrumental in working with private water owners in order to get them to participate in the instream flow programs. These groups often act as a middle-man meeting with private individuals and providing ways to limit the barriers that private water owners will encounter if they choose to participate in an instream flow program.

4. *Programs should provide incentives for private individuals to participate.*

An important part of instream flow programs is the ability to acquire senior water rights to devote to instream flow. However, getting senior water rights owners to participate in instream flow programs is difficult due to the fact that water rights are such a valuable commodity. Private owners expect to be compensated for any water that they devote to instream flows. Including financial opportunities, such as leasing options, can provide the necessary

incentive for some private water owners to temporarily give up a portion of their water. Being able to acquire senior water rights increases the total number of instream flows, but more importantly it returns water to the river that had historically been diverted out of stream.

5. Programs should work to reduce barriers associated with private participation

While financial incentives may be enough to entice some water owners to participate in instream flow programs, getting participation from others may require the removal of barriers associated with participation. For many water owners working with a government agency and/or giving up any control of their water right is something they are unwilling to do. Allowing privately held instream flows is one way to overcome this barrier. Owners wary about working with the government can enter into an agreement with a private organization instead. Owners who are unwilling to give up any amount of control over their water can apply for a change of use and hold an instream flows themselves.

The other barriers associated with participation, time commitment and financial costs are difficult to reduce. This is due to the fact that applications for transferring water to an instream flow must be fully reviewed to assure that no existing rights are injured by the change. However, programs can limit unnecessary processes that drive these transaction costs up. For example, avoiding processes like in Colorado where instream flows must go through both a government agency and the Water Court, or in Montana where ten-year reviews are required, would reduce the barriers associated with participation. Under these circumstances more private individuals may be willing to participate in the program and increase the number of instream flows that get established.

6. *Programs should not rely too heavily on privately held instream flows.*

Allowing privately held instream flows can be a powerful tool in promoting private participation and acquiring senior water rights to change into instream flows. However, it is by no means a “solve all” solution for instream flow programs. The Montana case indicates that privately held instream flows are only effective in places where little to no monitoring and enforcement is necessary. This is an ideal situation that is not found on many of the heavily used rivers that could benefit from instream flow protection. Furthermore, responses from employees of Trout Unlimited suggest that private groups do not currently have the type of money available to protect instream flows on a large scale. For these reasons, it is unlikely that relying solely on privately held instream flows will result in enough rivers being protected. This is not to say that allowing privately held instream flows is not valuable but this approach should be used as one tool in the larger toolbox of instream flow programs. Using a larger toolbox will help to ensure that a larger number of instream flows are established that have a high level and permanence and can be effectively monitored and enforced.

Conclusion

For several decades the only recognized beneficial use of water in the Western U.S. was diverting it out of stream for human consumptive purposes. Over time, this bias toward out of stream uses severely de-watered and degraded many of the rivers in the West. Recognizing the need to protect and restore the health of their rivers, Colorado and Montana both implemented instream flow programs in the early 70’s. Mirroring the evolution of common pool resource theory, these programs have developed into hybrid approaches which include government regulation, market policies, and inclusion of local users.

This thesis has provided a descriptive account of the Colorado and Montana instream flow programs. By highlighting the strengths and weaknesses of each program the specific features that promote or inhibit their success are drawn out. These features are then used to offer six suggestions that should be considered when designing hybrid instream flow programs. These suggestions are not meant to be an exhaustive list of issues that need to be considered, but they represent the findings derived from this study.

The findings of this study also support the broader shift in utilizing hybrid programs to manage CPRs. By applying CPR theory to instream flow protection this study suggests that relying solely on one approach is unlikely to yield environmentally sustainable outcomes. Government action alone has proved to be capable of preserving the existing condition of rivers on a large scale, but is limited in its ability to restore them. The use of privatization and market policies has helped increase the ability to restore rivers but has not shown to be capable of doing so on a large enough scale. Finally, river water as a CPR is far too large a system to rely only on communal management, however, getting local resource users is still critically important. To overcome their limitations, employing components of all three approaches can seize upon the strengths of each and make effective protection of instream flows a more possible outcome. This result largely corresponds to Dietz, Ostrom, and Stern's (2003) conclusion that a variety of institutions need to be used in order to sustainably manage CPR systems.

The value of leaving water instream for environmental purposes has generally been recognized in the American West. Moreover, many states like Colorado and Montana have taken action to preserve and restore many of their rivers. However, balancing water for instream and out of stream purposes is still a highly contentious issue, and will become even more so as water scarcity and demands for human consumption continue to increase. In this uncertain

future, well-designed and effective hybrid instream flow programs will have to be in place in order to protect the health of the rivers in the West.

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Interviews:

Employee of Colorado Trout Unlimited. Phone interview with author. 2/1/2011.

Employee of the Colorado Water Conservation Board. Phone interview with author. 2/4/2011.

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Employee of Montana Trout Unlimited. Phone interview with author. 2/7/2011.

Employee of the United States Geological Survey. Phone interview with author. 2/2/2011.

Former employee of the Colorado Water Conservation Board. Phone interview with author. 2/1/2011.

Appendix

Glossary of Abbreviations

CPR	Common Pool Resource
CWCB	Colorado Water Conservation Board
CWT	Colorado Water Trust
CTU	Colorado Trout Unlimited
MDNRC	Montana Department of Natural Resources and Conservation
DFWP	Montana Department of Fish, Wildlife, and Parks
MTU	Montana Trout Unlimited
USGS	United States Geological Survey

Interview Materials

In order to perform interviews for this thesis I had to comply with the rules and regulations set forth by the Western Washington University Office of Research and Sponsored Programs. The process required:

- 1) Successful completion of an online exam to gain certification from the National Institute of Health, Office of Extramural Research.
- 2) Completion of the Human Subject Research Exemption Form. The purpose of this form is to provide assurance that the study does not pose more than minimal risk to the research subjects. Also included are explanations of the purpose of the study, and the interviewing methodology that is used.
- 3) Acquiring signed consent forms from all subjects interviewed for the thesis.