



## RANCH OWNERSHIP CHANGE AND NEW APPROACHES TO WATER RESOURCE MANAGEMENT IN SOUTHWESTERN MONTANA: IMPLICATIONS FOR FISHERIES<sup>1</sup>

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**ABSTRACT:** This article reports on a survey of ranch owners in high amenity areas in southwestern Montana that have experienced marked ownership change over the last two decades. Specifically, we focus on findings from a set of questions targeting water resource and riparian area management. After reviewing the results, we consider how new owners may be managing water resources differently than longtime owners and what the ecological implications of this shift in management might be for Montana’s prized wild fisheries. Uses more closely associated with new owners than with longtime owners include water reallocation to instream uses, aquatic and riparian ecosystem restoration, and fish pond construction. These uses have both positive and negative impacts on the region’s fisheries. Our findings suggest that current laws and institutions guiding the management of water resources and the aquatic and riparian ecosystems they support may not be adequate to address emerging conservation opportunities and challenges.

(KEY TERMS: land tenure; ranch management; rangeland; amenity migration; water allocation; restoration; water policy; fish; Greater Yellowstone Ecosystem.)

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### INTRODUCTION

An ownership transition with potentially significant implications for biodiversity and ecosystem function is underway on the ranchlands of the American West, especially in high amenity areas featuring critical wildlife habitat. The new cohort of ranch owners is by and large independent of the ranch for income and its members purchase ranches with an interest in environmental amenities, recreation, and real estate investment (Gosnell and Travis, 2005; Gosnell *et al.*, 2006). Because ranchlands represent the largest

parcels of privately owned – and mostly intact – land in the West, and because they are often associated with senior water rights and important aquatic ecosystems and riparian bottomlands, the fate of these landscapes is of great interest to ecologists, conservationists, and water resource managers (Riebsame *et al.*, 1996; Theobald *et al.*, 1996; Hansen *et al.*, 2000; Morrisette, 2001; Hansen and Rotella, 2002; Maestas *et al.*, 2003; Sayre, 2005a). Little is known about new ranch owners, however, or the factors that shape their decisions regarding land and water use practices.

This article reports on findings from a recent survey of ranch owners in high amenity areas in

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southwestern Montana that have experienced marked ownership change over the last two decades. Specifically, we focus on findings from a set of questions targeting water resource and riparian management by ranch owners in our case study landscapes. The article begins with an overview of fisheries and water management in southwestern Montana, focusing on three of the most serious threats to the region's fisheries: dewatered streams, degraded habitat, and the introduction of nonnative species. After reviewing our methods and results, we consider how new owners may be managing water resources differently than longtime owners and what the ecological implications of this shift in management might be for Montana's prized wild fisheries. We also offer some preliminary thoughts on the adequacy of current laws and institutions guiding water resource management to address emerging conservation opportunities and challenges.

### *Rationale*

Ranch owners in the American West have long played an important role in the management of water resources, riparian areas, aquatic ecosystems, and fisheries. They affect these resources through their decisions about livestock management, water usage and allocation for irrigation and stock watering, and alterations of physical hydrological features (e.g., bank stabilization, water storage features). Throughout the world, approximately 70% of freshwater consumption is for agriculture (Pimentel *et al.*, 2004). In the 19 western United States, that number rises to 90% (Solley *et al.*, 1998), and in Montana, irrigation accounts for 96% of consumptive water use (Gibbons, 1986). Thus, what happens on Montana's ranches has significant bearing on the fate of the state's waters and fisheries.

Ample research documents the linkages between agriculture and various aspects of water resource management, such as the effects of grazing and irrigation on water quality (Lovejoy *et al.*, 1985; Bohlke *et al.*, 2002; Chen *et al.*, 2003; Frisvold, 2004; Boyer, 2005; Miller, 2005); the impact on water quality of increasing residential development *vs.* more traditional agricultural activities (Stueber and Criss, 2005); and the effects of farmers' adoption of best management practices (BMPs) on water quality and fisheries, agricultural production and net income (Westra *et al.*, 2005). Other studies have documented the impact of cattle grazing on stream geomorphology (Magilligan and McDowell, 1997; Nagle and Clifton, 2003), riparian areas (Buckhouse *et al.*, 1981; Roath and Krueger, 1982; Kauffman and Krueger, 1984; Schulz and Leininger, 1991; Fleischner, 1994; Belsky *et al.*, 1999; Manoukian and Marlow, 2002; Krueper

*et al.*, 2003; Giuliano and Homyack, 2004; Lucas *et al.*, 2004; Holland *et al.*, 2005), aquatic ecosystems (Meehan and Platts, 1978; Platts, 1991; Li *et al.*, 1994; Harding *et al.*, 1998; Whiles *et al.*, 2000; Wang *et al.*, 2002), and fisheries (Rinne, 1999; Lyons *et al.*, 2000; Ballard and Krueger, 2005). But little has been written about emerging approaches to the management of water resources and riparian areas on the ranchlands of the American West, like reallocating water to instream uses, engaging in riparian and aquatic ecosystem restoration projects, or diverting water for recreational fish ponds, for example, or their ecological implications.

Freilich *et al.* (2003) point out that ranch management, more so than grazing *per se*, is the critical factor determining the health of western riparian and aquatic ecosystems. As ownership of rangeland in ecologically important areas shifts to a new cohort (Huntsinger *et al.*, 1997; Tanaka *et al.*, 2004; Gosnell and Travis, 2005; Gosnell *et al.*, 2006; Haggerty and Travis, 2006), anecdotal evidence suggests that new approaches to land and water resource management may be taking place, with a different set of impacts and benefits.

Sometimes called hobby ranchers, trophy ranchers, amenity buyers, even conservation buyers, this cohort of new owners has always been a part of the western ranch landscape (Gentner and Tanaka, 2002; Gosnell and Travis, 2005; Sayre, 2005b), hence in some ways, this ownership transition is nothing new. But with the accelerated rate of ownership change, these nontraditional owners are taking on a new importance disproportionate to their numbers, as they (1) take control of tens of thousands of acres with implications for wildlife and water management; and (2) often displace prominent ranching families with multi-generational tenure on the land, with significant implications for community dynamics, especially as they relate to the local management of natural resources.

This research builds on a 3-year study that resulted in the Center of the American West's report, "Ranchland Dynamics in the Greater Yellowstone Ecosystem" (available at <http://www.centerwest.org/ranchlands>), that documented rates of ownership change in 10 Greater Yellowstone area counties in Montana and Wyoming during the period 1990-2001. A central finding of this research was that the majority of large ranch sales were to "amenity buyers" – people who were not dependent on the ranch for income and who bought primarily for the recreational and environmental amenities related to the ranch (Gosnell *et al.*, 2006). In Greater Yellowstone, home to some of the most undisturbed and productive headwaters of the nation's major rivers, including the largest undammed river in the United States, the Yellowstone River, we concluded that

water management ranked high both in terms of ecological significance and in frequency as an anecdotal marker contrasting longtime residents with newcomers.

We found that many ranch purchases in the 1990s were driven by the specific goal of obtaining exclusive access to the region’s famed fisheries. In this study, we focus on three ranching counties in which this “River Runs Through It” phenomenon – so-named for the 1992 film based on Norman McLean’s fly-fishing memoir of a Montana childhood that was filmed near Bozeman, Montana – was especially pronounced. The flagship fisheries of Sweet Grass, Park, and Madison counties (Figure 1) – the Boulder River and the Middle Yellowstone, the Upper Yellowstone River, and the Upper Madison River, respectively – contributed to a ranch real estate market in those watersheds marked by phenomenal increases in the value of land and the acquisition of land by elite figures, most commonly CEOs from large corporations and their counterparts in the 1990s high technology boom in California, but also Hollywood actors, heirs and heiresses of industrial fortunes, and even U.S. ambassadors. Southwestern Montana’s ranch real

estate market is often considered to be the gold standard by which all other amenity markets are compared. Significantly, media mogul Ted Turner and his then wife actress Jane Fonda purchased two ranches in the area in 1988 and 1992, helping to establish the region’s caché among the ranch-owning elite.

This study attempts to identify differences between newcomers and longtime residents in their approaches to water resource management, with the goal of contributing to a better understanding of the ecological implications of the ongoing “amenity boom” in western ranchland. More specifically, are new owners changing land and water uses with their ranch purchases? What do these changes bode for southwestern Montana’s prized fisheries?

### FISHERIES AND WATER MANAGEMENT IN SOUTHWESTERN MONTANA

Southwestern Montana is famous for its outstanding trout fishing opportunities, many of them on

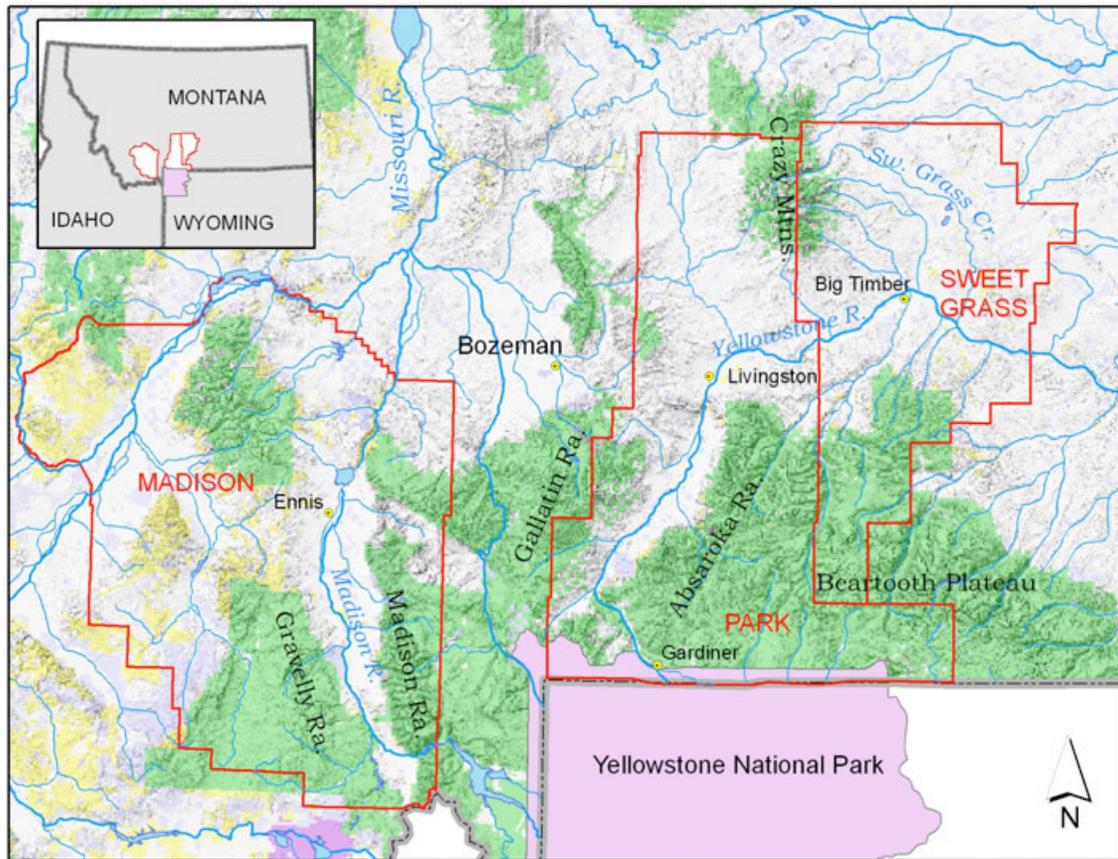


FIGURE 1. Location of Study Areas in Southwestern Montana.

“Blue Ribbon” streams (Duffield *et al.*, 1992; Probasco, 2000; Morey *et al.*, 2002). The Greater Yellowstone Ecosystem (GYE) contains the headwaters of the three forks of the Upper Missouri – the Jefferson, Madison and Gallatin Rivers – as well as the Yellowstone River itself, all of which support world-class fisheries (Van Kirk, 1999). Each of these rivers and tributaries contribute substantially to the ecological and economic values of the region. Duffield *et al.* (1987) estimated that these trout fisheries contributed over \$46 million to the region’s economy, translating to about \$77 million in 2005 dollars. Montana Trout Unlimited estimates the value of fishing to the state’s economy at between \$236 and \$532 million per year. According to Kerkvliet *et al.* (2002), fishermen in Greater Yellowstone place a value of between \$172 and \$977 on a day of fishing. They estimated the total value of angling in the Park as between \$67.5 and \$385 million. Duffield *et al.* (1992) analyzed the recreational value of instream flow in Montana’s Big Hole and Bitterroot Rivers (much of it related to fishing) and concluded that at some flow levels, reallocating water from consumptive to instream uses would be rational from a purely economic standpoint.

The fisheries of the GYE are the culmination of nearly a century of management, and include 40 nonnative, introduced species and 60 native species, 15 of which are designated as “of special concern.” The species most popular with anglers in southwestern Montana include nonnatives like brook, brown, and rainbow trout, while native species of special concern in the region include arctic grayling, Yellowstone cutthroat trout and westslope cutthroat trout. Over the past century several threats to both native and nonnative fisheries have emerged, the most significant of which are the dewatering of streams related to overappropriation of the region’s waters (primarily for agriculture); habitat modification often related to conventional ranch management practices; and the introduction of nonnative species (intentional introductions for sportfishing, which often have a negative effect on native species, and unintentional introductions of aquatic nuisance species (ANS) affecting all species). We briefly consider each of these threats here to establish the background against which new approaches to water resource management have been introduced.

### *Dewatered Streams*

A primary challenge of aquatic habitat protection has been maintaining adequate water quantity, or instream flow (Bunn and Arthington, 2002). The Montana Department of Fish, Wildlife and Parks (FWP) estimates that there are over 2,000 miles of

chronically dewatered streams in the state and has created a list of 278 such streams, identified as supporting important fisheries or contributing to important fisheries by providing spawning and rearing habitats. Most rivers and streams in southwestern Montana are overallocated for diversions for agricultural use (McKinney, 1990; Clifford, 1995). A lasting legacy of the 19th century is the network of manmade canals that divert water high up on tributary streams. In many cases, when these canals are in operation, entire streams below diversions can be temporarily dewatered. The dewatering of rivers, and especially tributary streams, by irrigation withdrawals (and drought) poses a particular problem for fisheries because tributary creeks typically provide important spawning and rearing habitat and are thus critical to successful recruitment and continuity for a number of salmonid species (Clancy, 1988; Fraley and Shepard, 1989; Reiman and Dunham, 2000).

The primary effect of flood irrigation on the hydrologic regime has been decreased summer flows because of diversions of surface water during the summer irrigation season, and increased flows during the late summer, fall, and winter as a result of return flows through aquifers. This shift in the hydrologic regime has had a significant impact on native fisheries (Van Kirk, 2005). As more efficient irrigation methods have become available, many ranchers in the GYE have shifted from flood irrigation to sprinkler irrigation (Haggerty, 2004). While this increased efficiency has some definite conservation benefits, it presents yet another challenge to the region’s fisheries in the form of reduced return flows. One potentially positive aspect of this shift, however, is the creation of “salvaged” water which can be reallocated to instream uses if the water right holder is so inclined.

While such uses were not historically permitted under the prior appropriation doctrine, the Montana Water Use Act of 1973 (Mont. Code Ann. § 85-2-101 *et. seq.*) established instream flow for recreational and other purposes as a beneficial use, eventually providing fisheries managers with tools, such as water reservations and leases for instream flow. The State of Montana executed major water reservations in the Yellowstone drainage in 1978 and the upper Missouri drainage in 1992 to protect remnant unallocated water for the purpose of instream flows to benefit fisheries (MT DNRC, 2004). In 1993, the state closed the entire Upper Missouri Basin – in which two of our three study areas are located – to further diversions of surface water in recognition of a potential crisis in water availability, again, due mostly to withdrawals for irrigated agriculture (MT DNRC, 2004).

### *Degraded Habitat*

A second challenge to aquatic habitats and fisheries in southwestern Montana has been degradation related in part to insensitive approaches to ranch management. Unrestricted cattle grazing in riparian areas can denude streamside vegetation, accelerate bank erosion and cause siltation (Marlow *et al.*, 1987; Belsky *et al.*, 1999). These effects degrade stream habitats by causing wide, shallow channels exposed to intense sunlight with little cover and spawning gravels choked with silt (Platts, 1991; Li *et al.*, 1994). Channelization of streams for flood control and irrigation is another source of aquatic ecosystem degradation.

In recent years the U.S. Forest Service has introduced stricter standards related to the management of riparian areas on some of its cattle allotments in southwestern Montana, resulting in some improvements in willow canopy along streams (Manoukian and Marlow, 2002).

### *Nonnative and Aquatic Nuisance Species*

Finally, a third threat to the GYE's prized fisheries has been the introduction of nonnative species to the state's waterways. While early introductions of exotic fishes were aimed at enhancing sport fisheries, subsequent introductions of bio-invasive species have been mostly unintentional. Trout have been cultured in hatcheries in Montana since the 1890s (Henshall, 1898). During the late 19th and most of the 20th centuries, dozens of nonnative fishes were introduced into lakes and streams with the intent of enhancing fisheries for the benefit of anglers.

Recognizing the potential threat to fisheries management goals, the state began regulating private ponds in 1945, and the Montana Legislature enacted the Stream Protection Act in 1963 and the Natural Streambed and Land Preservation Act of 1975 to prohibit disturbing the bed or banks of perennial streams without a permit, in an attempt to gain some control over the land and water management decisions of private landowners. But the negative impacts of historic introductions on native species were not fully acknowledged until the early 1970s when a series of studies on the Madison River indicated that stocking hatchery trout suppressed wild trout populations (Vincent, 1987; Quist and Hubert, 2004), a finding which led to a shift in management emphasis nationwide from stocking trout to population monitoring, harvest regulation, and habitat protection. The Montana Fish and Game Commission adopted a policy of "wild trout management" in 1973, which prohibits the stocking of hatchery-reared fish in waters capable of naturally self-sustaining fisheries, and

emphasizes habitat protection and restoration. While many nonnative salmonids remain the basis of recreational fisheries today, conservation efforts since the mid-1980s have focused extensively on restoring native salmonids and addressing conflicts between native and nonnative species.

In terms of ANS, the most serious and prevalent is whirling disease, first discovered in Montana in 1994. The disease is caused by *Myxobolus cerebralis*, a Myxozoan parasite indigenous to Europe that digests the cartilage of young trout and causes deformities that reduce fishes' ability to survive by impairing swimming and feeding ability. The disease has seriously impaired wild trout populations in Montana, especially rainbow trout (Vincent, 1996; Baldwin *et al.*, 1998). The disease is thought to have been introduced to the state through the illegal stocking of fish in the Madison River sometime in the early 1990s.

For all these reasons, the health of southwestern Montana's aquatic ecosystems and native fisheries were a major concern when ranch ownership change began to accelerate in the 1980s and 1990s. Our findings suggest that the change in landownership patterns, driven in part by the GYE's popular fisheries, have great relevance to the threats identified here and may be changing the nature of these threats in unexpected ways, while also creating potential conservation opportunities.

## METHODS

Three researchers interviewed 44 ranch owners and managers using a combination of coded and open-ended questions in Madison, Park, and Sweet Grass counties in January and February of 2005. Watersheds included the Madison, the Upper and Middle Yellowstone, the Boulder, and the Shields (Figure 1). We targeted landscapes where a combination of newcomers and longtime ranch owners own property, and sought representation from both groups in each watershed for comparative purposes. We identified interviewees using a combination of sales data from private appraisers, current ownership data, and snowball sampling (Robson, 1993; Babbie, 2004). Because many new owners are absentee or part-time residents and are often difficult to access, we designed our coded questions concerning land and water use to be answerable by either owners or their managers, depending on their availability. We interviewed 23 newcomers and 21 longtime owners. Two of the longtime owners did not complete the coded questionnaire, hence our results include responses

from 23 newcomers and 19 longtime owners. Interviews lasted anywhere from 1 to 3 h and were tape-recorded and transcribed.

Our conceptualization of newcomers versus longtime owners draws on studies in rural sociology that have sought to identify differences between the two groups. The most common division point for length of residence has been 10 years (Graber, 1974; Fortmann and Kusel, 1990); however, the 10-year distinction has less relevance in our study. Models that classify newcomers and longtime owners relative to the approximate year in which substantial immigration to the community commenced are more germane in the GYE (Graber, 1974; Blahna, 1985; Smith and Krannich, 2000). Though amenity migrants have been coming to the GYE for decades, it was during the 1980s that the current ownership transition gained momentum in our case study landscapes, marked by a strong increase in ranch real estate prices that put ranchland values well above agricultural values. Thus, we use 1980 as our cutoff between old and new, reasoning that because of the growing disjuncture between agricultural land values and ranchland values that emerged in the 1980s, buyers who purchased land after that date were more likely to represent amenity and recreational interests, and less likely to be interested primarily in livestock production.

To develop a series of questions targeting specific land and water uses, we enlisted the help and advice of local experts, e.g., the Natural Resources Conservation Service (NRCS), nonprofit environmental organizations, and local ranchers. These experts identified “sustainable” or “progressive” or “conservation-oriented” land and water management practices that were relevant to the particular landscapes we studied. The list of coded questions included questions about range management, public lands management, wildlife management, and water and wetlands management, among other things. We asked owners if the practice had been implemented by the previous owner, by the current owner, or not implemented. We also asked if the practice was under consideration. See Table 1 for a list of our coded questions related to water resource management. We report on the respondents as a whole, on longtime owners and newcomers as distinct groups, and on differences between longtime owners and newcomers.

## RESULTS

Among all owners, the most common water management practice implemented was building fences to control livestock access to riparian areas, an indica-

TABLE 1. Coded Questions Regarding Water Resource Management.

<b>Are the following practices currently implemented on your property?</b>
Center pivot (or other) sprinkler systems?
Irrigation pumps?
Irrigation wells?
Solar-powered water pumps for constant wildlife/livestock watering sources?
Lined, reinforced, or improved irrigation canals?
Construction of fish/wildlife ponds?
Alteration of ponds, riprap, dams, or canals or other attempts to restore “natural” hydrologic features?
Retirement of land from irrigation?
Planting of willows or other native plants to restore eroded stream banks?
Fences built to control livestock access to riparian areas (to keep cattle in/out depending on time of year)?
Adjusted water allocation with the goal of creating instream flows to benefit fish or other sensitive aquatic species?

Coded responses included: Implemented by previous owner; Implemented by current owner; Not implemented; Under consideration; Not applicable.

tion that this conservation practice has become fairly widespread (Table 2). Sixty-nine percent of respondents had implemented riparian fencing, though in some cases owners may have been referring to mandated fencing on their Forest Service allotments. Many ranch owners have upgraded irrigation infrastructure through the implementation of center pivots and sprinkler systems (45% and 44%, respectively), with lining, reinforcing, or improving canals close in rank (39%). Notably, nearly half (43%) had constructed fish ponds on their property.

TABLE 2. Most Common Water Resource Management Practices Among All Owners.

<b>Management Practices</b>	<b>Percentage (%)</b>
Built fences to control livestock access to riparian areas	69
Irrigation pumps	45
Center pivot (or other) sprinkler systems	44
Construction of fish/wildlife ponds	43
Lined, reinforced, or improved irrigation canals	39

Among longtime owners, the most common practices had to do with improving irrigation efficiency. After building fences to control livestock access to riparian areas, the most common actions were installing center pivots and/or irrigation pumps, lining canals, and retiring land from irrigation (Table 3).

In contrast, newcomers were more likely to engage in practices related to recreation, aesthetics, and conservation. After fencing out riparian areas, the most common practices in this group were building fish ponds, planting willows, installing irrigation pumps,

TABLE 3. Most Common Water Resource Management Practices of Longtime Owners With Comparison to New Owners.

Management Practices	Owners (%)	
	Old	New
Built fences to control livestock access to riparian areas	67	74
Center pivot (or other) sprinkler systems	56	35
Irrigation pumps	47	43
Lined, reinforced, or improved irrigation canals	47	32
Retirement of land from irrigation	35	30
Planting of willows or other native plants to restore eroded stream banks	35	43

adjusting water allocation to benefit aquatic ecosystems, and attempting to restore natural hydrologic features (Table 4). It is notable that new owners were much more likely to construct fish ponds than to engage in conservation measures, a finding that correlates with many of our interviews with managers of newer, absentee owners, who indicated that the primary concerns of their owners were aesthetics and recreation. “As long as the place looks nice, the owner is happy,” is something we heard repeatedly, though there were certainly several examples of new owners that were avid about conservation and restoration, too.

The questions regarding center pivots and fish ponds revealed the greatest contrast between the two groups. While 56% of longtime owners had center pivots, only 35% of newcomers had them (Table 3), suggesting that newcomers are less interested in investing in irrigation efficiency. While 61% of newcomers had fish ponds on their property, only 21% of longtime owners had them (Table 4). This is not surprising given the differing objectives that full-time ranch operators and absentee owners bring to ranch ownership as well as their fundamentally different circumstances. One longtime rancher we interviewed, for example, has spring creeks on his property that anglers pay \$100 per day to fish; but the rancher himself had not been fishing once in the previous year because of lack of time.

These new uses have the potential to significantly affect watershed health in the region, but also repre-

sent potential flash points for fundamentally different priorities about the use of water. In the next section, we consider in more detail what new owners are actually doing, and how their actions may be affecting Montana’s fisheries for better or worse. We also briefly consider how Montana’s laws and institutions surrounding water use act to facilitate or hinder these new uses.

## DISCUSSION

Our study revealed that changing ranch ownership patterns have a range of sometimes contradictory implications for water management. On the one hand, the concern that new owners bring for amenities, such as fishing and aesthetics together with substantial financial resources creates a space for progressive water management that may not have existed previously, for example when they hire water lawyers to help them figure out how to convert their water rights to instream use, or hire “river keepers” and environmental consultants to help them with aquatic and riparian ecosystem restoration projects. On the other hand, some new owners seem to be as single-minded about recreation as their predecessors may have been about livestock production. This single-mindedness has led to some poor decisions about water management, especially when it comes to the construction of artificial fish ponds. We consider three increasingly prevalent approaches to water resource management in the region here – reallocation of water rights, riparian and aquatic ecosystem restoration projects, and fish pond construction – and their implications for the welfare of the region’s native and nonnative fisheries.

### *Reallocating Water to Instream Use*

Whether the goal is biodiversity protection or simply compliance with regulations, agreement exists across the spectrum of science, government agencies,

TABLE 4. Most Common Water Resource Management Practices of New Owners With Comparison to Longtime Owners.

Management Practices	Owners (%)	
	New	Old
Built fences to control livestock access to riparian areas	74	67
Construction of fish/wildlife ponds	61	21
Planting of willows or other native plants to restore eroded stream banks	43	35
Irrigation pumps	43	47
Adjusted water allocation with the goal of creating instream flows	39	21
Alteration of ponds, riprap, dams, or canals or other attempts to restore “natural” hydrologic features	39	18

agricultural NGOs and advocacy groups about the importance of rehabilitating riparian and aquatic ecosystems through responsible ranch management (Sayre, 2001). A key component of habitat restoration in southwestern Montana is ensuring against chronic dewatering of streams. Thus, in many ways, the fact that landowners with the willingness and means to make significant changes to their water allocation regimes are more likely to be found in the category of newcomers suggests that with ranch ownership change comes the potential for a substantial ecological benefit in an area of significant concern. This potential can only be realized, however, if the laws and institutions surrounding water reallocation allow it.

Transferring water rights to new uses under the prior appropriation doctrine has never been easy, but there is evidence to suggest that things may be changing for the better with increased flexibility in institutions for allocating water (Wilkinson, 1991, 1992; Crammond, 1996; Tarlock, 2001). Still, there are many legal, institutional, and ideological barriers to the free flow of water to its “highest use” – which in many cases involves leaving water instream – when that use conflicts with community values (Blumm, 1996; Keenan *et al.*, 1999). Here, we briefly review the laws surrounding the reallocation of water to instream uses in Montana, and some of the associated challenges.

In 1989, the Montana legislature authorized a leasing pilot project that allowed the Fish, Wildlife, and Parks (FWP) to lease water rights on four streams. In 1991, the pilot period was extended to 10 years and the number of streams on which leasing was allowed was expanded. In 1999, its leasing program was renewed for an additional 10 years. Today, FWP leases irrigation water rights for instream flow on 10 streams to protect and enhance fisheries.

In 1995, Montana modified its water code to allow water rights holders to lease to another private individual or organization (like Trout Unlimited or Montana Water Trust), or transfer some or all of their water rights to instream use, rather than having to go through FWP to reallocate their water rights. Assuming a water right holder can prove no injury and the required change-of-use permit is attained, Montana water law allows water that is diverted for consumptive uses to be transferred temporarily (up to 30 years) to an instream use. So far, there have been only 12 conversions of consumptive rights to instream flow, and eight cases of private water leasing in Montana (Montana Water Project, 2005).

As mentioned above, a water right holder looking to reallocate part of his or her right must submit an “Application for Change of Appropriation Water Right” (Mont. Code Ann. §§ 85-2-407, 408), and

prove that the change will not adversely affect the use of other water rights or water quality (the “no injury” rule) (Sax *et al.*, 2000). That is, other users in the basin must agree to the transfer, which can prove to be a major barrier.

As law professor Michael Blumm observes in an attempt to demythologize the notion that Western water is subject to a free market, “the ‘no injury’ rule to third parties has worked to foreclose many transfers, as has the failure of the seller to demonstrate full use of his water right...Where the market conflicts with local community values, water market transactions are regularly thwarted, a reminder of the strong communal interest in Western water (Blumm, 1996, pp. 4-5).

Two examples from our findings serve to illustrate this point. In one of our study areas, newcomers purchased the ranch with the most senior rights on the stream and transferred their rights to instream flow, precipitating social conflict in the immediate watershed. Several longtime owners deeply resented the fact that the change in use deprived them of the opportunity to maximize diversion of water to their properties, located upstream of the ranch in question. In the same watershed, we interviewed the manager of a relatively new absentee owner who wants to transfer his right to instream flow, but has been facing opposition in the basin, and challenges about the validity of his right, which neighbors claim has been abandoned. The owner has hired a water lawyer to help him with this legal challenge, an indication of the time, money, and determination often necessary when embarking on a reallocation scheme meant to enhance instream flow.

Given that several studies have shown that maintaining instream flow for recreation and aesthetics can often be more economically beneficial for a region than diverting water for agriculture (Hansen and Hallam, 1991; Duffield *et al.*, 1992), and given the changing demographics in the state, and the changing values and priorities of ranch owners, it seems likely that the law will become more flexible eventually, allowing willing rights holders to reallocate their water to instream uses more easily (Johnson and Dumars, 1989; McKinney, 1990; McNally and Matthews, 1995; Tarlock, 2001). Frisvold (2004) estimates that where irrigation accounts for 90% of consumptive use (as is the case in Montana), a 1% reduction of irrigation water reallocated to other uses would increase water to other uses by 9%, while a 3% reduction and reallocation would increase water available to other uses by an impressive 27%. Thus, there is potentially great value to aquatic and riparian ecosystems in focusing on the laws and institutions surrounding water reallocation. Indeed, Bjornlund (2004) argues that a flexible water allocation system is an important part of establishing

sustainable rural communities and retaining “community cohesion.”

### *Restoring Riparian and Aquatic Ecosystems*

Much less controversial – and significantly, subject to less regulatory oversight – are new owners’ efforts to restore riparian areas with the planting of willows and other native vegetation; and projects that focus on turning simplified and modified stream corridors back into complex aquatic ecosystems through the restoration of natural stream geomorphology, riparian vegetation, and in-channel cover. Several studies have shown that the introduction or restoration of such complexity in streams positively impacts native fisheries (Pearson *et al.*, 1992; Li *et al.*, 1994). For example, healthy riparian vegetation maintains cooler water temperatures than reaches barren of vegetation and supports higher standing crops of fishes (Li *et al.*, 1994). Hydrologically complex streams are more resilient to flood events and support a greater diversity of fishes (Pearson *et al.*, 1992).

In a recent opinion piece in *Water Resources Research*, Wohl *et al.* (2005) identify several barriers to river restoration, some of which are more relevant than others in this context. One barrier cited was a “lack of political support” among stakeholders. In the GYE, it would seem that there is a growing group of well-connected, powerful stakeholders who want healthy aquatic ecosystems to support the fisheries that have drawn them there and who have the means to pay for such restoration.

Of more relevance in this context is Wohl *et al.*’s observation about the lack of agreement on the science of river restoration. We found that many new owners hire permanent river keepers – or environmental consultants on a contract basis – to help them with their restoration projects. In our interviews we found that new owners, unfamiliar themselves with many aspects of land and water management, were often frustrated and confused by the varying levels of expertise and knowledge among the environmental consultants and engineers offering their services in the area.

Local rules and regulations are generally not a major barrier to the types of stream restoration practiced by most new owners. Some projects require state and federal permits, like the Army Corps of Engineers’ 404 permit anytime dredging and filling is involved or the 310 permit required by the Natural Streambed and Land Preservation Act anytime a landowner intends to take an action that will disturb the bed or banks of a perennial stream, below the ordinary high water mark. A number of state and federal grant programs actively encourage stream

restoration on public and private lands by funding restoration projects, e.g., the Future Fisheries Improvement Program, administered by Montana FWP and focused on projects that directly benefit public fisheries, especially native species; and federal grant programs like the Environmental Quality Incentives Program (EQIP) and the Wildlife Habitat Incentives Program (WHIP); administered by the NRCS; the Private Stewardship Grant Program administered by the U.S. Fish and Wildlife Service; and the National Fish and Wildlife Foundation’s programs.

One way that Montana’s laws and institutions might better capitalize on the inclinations of new owners towards restoration has to do with encouraging a more collaborative watershed approach. Wohl *et al.* (2005) identify the “piecemeal” approach to restoration as a widespread problem, as in when individual landowners initiate projects with little knowledge or concern for circumstances upstream or downstream. Indeed, we found that many new owners are attracted to ranch ownership because of the privacy it offers, and have little involvement with neighbors or the wider community. Aquatic and riparian ecosystem restoration efforts could likely be strengthened and leveraged with a more holistic watershed approach. As Wohl *et al.* (2005) point out, restoration is as much a social activity as an ecological one, thus better incentives for encouraging collaborative projects may be necessary if comprehensive and effective river restoration is to take place.

### *Constructing Fish Ponds*

Along with restoration projects, many new owners opt to construct fish ponds on their property. Pond construction was encouraged in Montana as early as 1936, through the federal Resettlement Administration (Brown and Thoreson, 1958). Since 1945, when pond licenses were first required to stock private ponds, the number of licensed ponds grew gradually until the early 1990s. Figure 2 shows the extent to which private pond permits issued by the state have increased since licensing started.

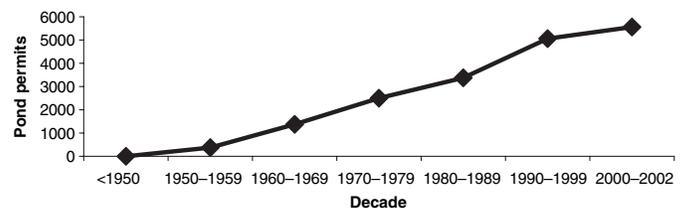


FIGURE 2. Cumulative Growth of Private Pond Licenses Issued in Montana, by Decade, From 1950 to 2003. Data provided by Montana Fish, Wildlife, and Parks.

Today there are over 5,000 permitted ponds in Montana, all managed by private landowners with varying levels of experience in water resource management. The proliferation of these ponds, while providing aesthetic and recreational amenities, also poses a threat to both native and nonnative wild trout fisheries and aquatic systems. Artificially constructed ponds can diminish water quantity and quality in adjacent streams, facilitate the spread of bio-invasives or ANS, and disrupt the hydrologic function of streams. The extent of a pond's impact is dictated by a number of decisions made by the landowner during construction, for example, whether it is constructed on-stream *vs.* off-stream. On-stream impoundments disrupt sediment transport, nutrient cycling, water temperature regimes, and natural hydrographs (Baxter, 1977); and they disrupt migrations and increase predation (Olsson *et al.*, 2001; Schrank *et al.*, 2001). Poorly placed off-stream ponds can have negative effects as well. Here, we look at some of the most common problems and how they can be mitigated with better decisionmaking.

**Water Quantity.** Off-stream ponds relying on ground water or surface water to maintain water levels often dewater streams, interrupt runoff, and lower the water table, thereby exacerbating problems caused by overapproximation and drought (Kinsella, 2004).

**Water Quality.** Small ponds lacking sufficient depth act as heat sinks, discharging warm water into adjacent streams causing thermal pollution. Native and wild cold-water fish are sensitive to water temperatures above 20°C (Coutant, 1977). In mid-summer, when streamflows are low and ambient temperatures are high, ponds discharging into adjacent streams can increase temperatures beyond ranges suitable for coldwater fishes. Another water quality problem arises when heavily stocked fish ponds (often supplemented with artificial feed) discharge nutrient-laden effluent into receiving waters, potentially leading to eutrophication (Helfrich, 1998).

**Disease/Pathogens.** Illegal, ill-conceived, and sometimes unintentional introductions of bio-invasives or ANS like New Zealand mudsnails and whirling disease can have profound effects on wild and native aquatic systems. In a Colorado study, Allen and Bergersen (2002) compared conditions in fish ponds near the Cache La Poudre River with the river itself and found significantly higher populations of *T. tubifex* (the intermediate host for *M. cerebralis*) and higher whirling disease infection rates among trout in the ponds. Significantly, they found increased whirling disease infection rates in trout in the river

near the pond outlets, suggesting that disease transmission was occurring between the ponds and the river.

**Nonnatives.** Abundance and biodiversity of amphibians, aquatic macroinvertebrates, and native fishes can be significantly altered by introductions of predatory fish (Vredenburg, 2004; Knapp *et al.*, 2001; Knapp and Matthews, 2000; Hecnar and McCloskey, 1997; Helfrich, 1998; Schrank *et al.*, 2001). In southwestern Montana, the main culprits are brook trout and brown trout (Shepard *et al.*, 2002). These species compete with natives like Yellowstone and westslope cutthroat trout by preying on their young and competing for key habitats (Dunham *et al.*, 2002). Rainbow trout may also compete for food and space with native fishes, and they also hybridize with native cutthroat trout, leading to another set of problems. Aquatic biologists agree that the increasing presence of nonnative, bioinvasive species has hindered efforts to restore native species and ecosystems (Quist and Hubert, 2004). The increasing number of private landowners managing their own fisheries has added to the many challenges already facing the state's fisheries managers.

The permitting process for private ponds aims to prevent many of these problems, but may be proving inadequate to the task. The statute regulating private ponds in Montana grants authority to Montana FWP to restrict fish species that can be stocked in a given pond and requires that ponds be adequately screened to minimize escapement of stocked fish. However, FWP has limited authority to penalize violators.

The Natural Streambed and Land Preservation Act of 1975 (HB310) prohibits disturbing the bed or banks of perennial streams without a permit. While the "310" permitting process gives some authority to FWP to restrict construction of on-stream ponds and minimize impacts of diversion structures, ponds built off-stream are unrestricted as long as water rights are secured. FWP and its partners have responded to this situation by engaging in an outreach and education program aimed at private landowners. One widely distributed pamphlet makes an obvious attempt to dissuade landowners from pond construction, citing all the potential complications, problems, and difficulties with maintenance (Montana Watercourse, 2005). Several alternatives are suggested, including encouraging wetland and stream restoration. For landowners determined to have their own pond, FWP has several suggestions for making them more innocuous, including locating ponds outside of floodways, installing inlet and outlet structures that minimize thermal loading and prevent stocked fish from escaping, and minimizing surface water consumption. To effectively minimize threats of private

fish ponds to wild aquatic systems, however, a more coordinated regulatory approach is necessary. At this point, it is mostly incumbent upon landowners to wisely manage their private ponds to avoid negative consequences to wild aquatic systems, and this may not be a sufficient approach to protect and enhance the region's fisheries.

## CONCLUSIONS

In sum, changing approaches to water resource management among new ranch owners have potentially significant ecological implications in southwestern Montana, both negative and positive. In many ways, the influx of amenity migrants to Montana's ranch landscapes has proven beneficial for the fisheries management cause. Newcomers with a passion for angling infuse money into local conservation organizations and the local fly fishing economy; and, as this research demonstrates, they engage in many land and water uses that benefit native fisheries. But the issue of angler preference for nonnatives and landowners' enthusiasm and passion for construction of private fish ponds has exacerbated several existing problems.

We argue that water resource managers and researchers should take a closer look at the ecological implications of these new water uses, as well as the social, political, and legal issues they raise. This study clearly shows that new landowners make both "good" and "bad" decisions from the standpoint of current thinking about best water management practices. Thus, research is needed on the motivations, constraints, and challenges facing new ranch owners, and the factors shaping their decisions to engage in or not engage in certain conservation behaviors. Both fish ponds and instream flow protection, for example, require a change of use permit to a water right, which can be a challenging and contentious process. Are Montana's current laws and institutions surrounding water resource management adequate to address existing and emerging problems related to fisheries management, specifically those related to private pond control and management? Do they provide adequate mechanisms and incentives for reallocating water to more ecologically beneficial uses?

We have observed that newcomers purchasing ranches in southwestern Montana often do so with a strong interest in privacy and exclusivity. When it comes to water management, however, their management decisions cannot be kept private – a fact that has surprised more than one new owner. Water rights subject the ranch owner and manager to an existing network of both legal and social codes, and water

management – as it has for over a century – often arises as a contested arena in which neighboring landowners discover the extent of their differences.

In closing, we would like to offer a caveat about our findings. This study was designed to understand how ranch ownership change may be affecting water resource management. While we present results about longtime owners and newcomers, our findings have more to offer about new ranch buyers than about the complexities governing the existing social and environmental landscapes into which these newcomers enter. With the exception of the construction of fish ponds, explaining why longtime owners prove to be less likely to execute certain water management practices remains out of our purview, and an important area for future research. What would be especially interesting would be to understand if, and if so the degree to which, the arrival of newcomers in a given watershed reconfigures the constraints facing longtime operators.

Our hope is to contribute to a better understanding of how institutions for managing land, water, fisheries, and wildlife resources might need to evolve to accommodate emerging challenges related to ranch ownership change in the rural West, and we urge other researchers to join us in this important effort.

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