Finding a Modern Role for the Prior Appropriation Doctrine in the American West

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9.1 Introduction

U.S. Interior Secretary Gale Norton called western water supply conflicts "one of the greatest challenges facing the nation in the coming decades" (Hanson 2003). Water supplies fall short of satisfying all of the demands placed upon them, even absent drought. In one example, the federal government's decision to shut down irrigation during the 2001 season in Oregon's Klamath Basin to preserve fish species listed under the Endangered Species Act sparked great consternation on the part of irrigators and agricultural communities (Millstein 2002a). Alternatively, the federal government's decision to provide water for irrigation during the 2002 season, and its possible role in causing the massive die-off of 20,000 to 30,000 adult migrating salmon in the Klamath River due to inadequate river levels, greatly alarmed fishing and environmental interests (Millstein 2002b).

Western water supply conflicts have their roots in the set of laws and institutions governing western water use, and the manner in which these laws have been implemented. The prior appropriation doctrine has provided the foundation of this law for over one hundred years. Historically, the doctrine promoted the rapid development of the American West by securing water to irrigated agriculture when that sector constituted the major portion of economic activity and social welfare. Indeed, the doctrine has permitted irrigated agriculture to appropriate the vast bulk of dependable river flows in the west (80-90 percent). However, in modern times, the prior appropriation doctrine has proven to be a liability in reallocating water to emerging non-appropriative uses whose contribution to social welfare increases as irrigated agriculture's historic contribution declines.

This chapter will: (1) discuss the central tenets of the prior appropriation doctrine; (2) investigate how intrinsic flaws in these tenets, and the way in which they are applied, render the doctrine inflexible for satisfying the full range of modern water needs; and (3) consider the extent to which the prior appropriation doctrine can be modified for increased flexibility, and can work compatibly with emerging alternative doctrines protecting non-appropriative uses, principally the public choice doctrine.

9.2 The Prior Appropriation Doctrine

The prior appropriation doctrine has its roots in the rule of capture characterizing western mining law: "first in time, first in right." (Wilkinson 1992). A person obtains a user's (usufructuary) right to the quantity of publicly-owned water first diverted to a beneficial use on a fixed tract of appurtenant land. The quantity of water under the right is called the "water duty." In the case of irrigation, it is measured by the amount of water needed to irrigate an average mix of crops on the appurtenant land with the irrigation technology prevailing when the water right was granted. The priority of the right reaches back to the date of the first diversion. When water supplies fall short, the earliest ("senior") appropriators receive their full entitlements until supply is exhausted. The rights of later ("junior") appropriators are either curtailed or completely cut off. Senior appropriators seeking to expand their diversionary rights beyond the water duty must execute a new water right having the most junior priority ("no expansion of use"). Water that is not beneficially used is forfeited and available for re-appropriation by another user ("use it or lose it").

Elwood Mead, an early pioneer in western water policy, described the protection that prior appropriative water rights theoretically offer senior and junior water users as follows:

"As scarcity of water led to the adoption of the doctrine of priority, the two led to the necessity of defining the quantity of water to which an appropriator should be entitled. While the early appropriators were entitled to protection in their use of water, the later comers had an equal claim to protection from enlargement of those uses. The first appropriator had the first right, but he had not the right to take all the water he might want at any future time. His right must, in justice to others, be defined as to quantity as well as to time. In theory, beneficial use has been made the measure of a right. That is, each appropriator has a right as against a subsequent appropriator to a continued use of whatever quantity of water had been put to a beneficial use at the time of the acquirement of the subsequent right." (Mead 1903 quoted in Gould 1988).

The protection described in this quote depends on the maintenance of complicated interrelationships created among water users due to the flowing nature of water. Crops generally do not consume all of the water that is diverted from a stream. The unconsumed portion can return to the stream as surface runoff or as underground spring flow after deep percolation to an underlying aquifer ("return flows"). Alternatively, it may escape by the same means to a second water course, or be irretrievably lost due to, for example, surface evaporation ("escape flows"). Return flows and escape flows (that are not irretrievably lost), along with natural flows, supply a significant portion of the water required to satisfy water rights in the west. One study estimated that return/escape flows constitute almost half of all water diverted in the west (Pulver 1988). Consequently, as discussed below,

water rights depending on return/escape flows may be impaired if some users are allowed to make changes in water use that reduce the level of these flows.

9.3 Flaws in Principle and in Application

Most would agree that the prior appropriation doctrine played an important role in promoting the rapid economic development of the West. Some contend that the doctrine continues to provide important benefits in allocating water by: (1) encouraging the full utilization of water where needed without tying its use to the ownership of riparian land; (2) discouraging wasteful use with the beneficial-use and use-it-or-lose-it requirements; and (3) stimulating economic investment in water resources by providing for secure water rights, allocating water in a fair way, and being relatively easy to administer (Gopalakrishnan 1973; Gould 1988).

This section investigates how the prior appropriation doctrine has ceased to provide these traditional benefits on a consistent basis. One major reason is that the nineteenth century doctrine has not adapted well to change. It functioned best when circumstances remained as they were when appropriative rights were granted, but, of course, circumstances inevitably have changed. In particular, the widespread and gradual adoption of improved agricultural water application technologies has been eroding the security of prior appropriative rights and increasing the pressure on already scarce water supplies. In addition, the doctrine has proven to be too inflexible to provide a reliable water supply for emerging instream flow uses in the modern era. A second major reason that the doctrine has ceased to provide its traditional benefits is a problem of application, in particular, a lack of enforcement. This section discusses how states have not been vigilant in policing illegal appropriations and enlargements of water rights.

This section contends that, in the face of responding to these challenges, the doctrine's principles devolve into a tangled web of inconsistencies that conceals allocation problems and frustrates the formulation of rational water allocation policies. As a result, water rights holders are looking to state legislatures, agencies, and courts to provide protection beyond that offered by prior appropriation doctrine.

9.3.1 Response to the Adoption of Improved Irrigation Technologies

The west has witnessed gradual and widespread increases in the efficiency with which water is applied in irrigation. Irrigation scientists calculate on-farm irrigation efficiency (IE) as the ratio of the water consumptively used by crops (C) to the total water diverted for irrigation (D), i.e., IE = C/D (Wade 1986). Nineteenth century irrigation technologies and management skills resulted in low irrigation efficiencies in the neighbourhood of 25 percent. For example, a consumptive use

requirement of 2 units of water would require the farmer to divert 8 (= 2/0.25) units to the field. The remaining 6 (= 8-2) units of water would constitute return/escape flows supplying a portion of the water diverted by other appropriators. Farmers have improved irrigation efficiency by applying water in a more timely and uniform manner across their fields. Conversions of traditional gravity flow irrigation systems to sprinkler technology have increased efficiency to 75 percent and above.

Farmers increasing irrigation efficiency can have deleterious impacts on the return/escape flows relied upon by other water users if the farmers are not restricted to the level of consumptive use characterizing their original water rights. We use the streamflow diagrams in Figure 9 to demonstrate how such impairment can occur in a hypothetical river basin. Figure 9(a) depicts status quo circumstances in which an average weather year provides 16 units of stream inflow to the basin during the irrigation season. There are two farms, A and B, each of which irrigates with a traditional gravity-flow technology at 25 percent efficiency that existed at the time that their water rights were granted. Farm A has a right to divert all 16 units of inflow that is senior to Farm B's right to divert 12 units. Farm A's crops consume 16(0.25) = 4 units (encircled quantity), and the difference between the diversion and consumptive use is 16-4 = 12 units. These 12 units return to the stream, and supply the quantity of water needed to fill Farm B's water right. Farm B's consumptive use is 12(0.25) = 3 units. The ensuing return flow is 12-3 = 9 units, which constitutes the stream flow at the bottom of the basin.

Now consider the impact on Farm B's water right if Farm A alters the status quo by adopting a modern irrigation technology that increases efficiency to 75 percent. Farm B's irrigation efficiency remains at 25 percent. We look at two scenarios. In the first [Figure 9(b)], Farm A is allowed to expand its consumptive water use at the expense of Farm B and instream flow levels at the bottom of the basin. Farm A might expand consumptive water use by making other changes away from the status quo, such as growing more water intensive crops or increasing acreage beyond that appurtenant to the original water right (i.e., water spreading). In particular, Farm A's crops now consume 16(0.75) = 12 units, and return flow is reduced by 12-4 = 8 units compared with the status quo. As a result, Farm B's water right is curtailed by these same 8 units (i.e., it only can divert 4 instead of the original 12 units), and consumptive water use by B's crops is reduced by a third (i.e., from 3 units to 1 unit). In sum, the 8 units of increased consumptive use on Farm A is funded by reductions of 2 units of consumptive use on Farm B and 6 units of reduced stream flow at the bottom of the basin.

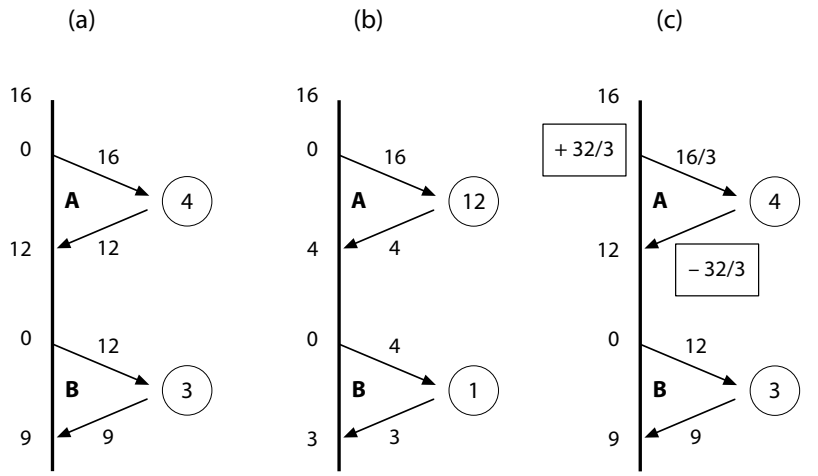

Fig. 9.1 Increases in on-farm irrigation efficiency: (a) status quo with 25 percent efficiency, (b) farm A increases efficiency to 75 percent and is allowed to increase consumptive use, (c) farm A increases efficiency to 75 percent but is held to status quo level of consumptive use.

In the second scenario [Figure 9(c)], Farm B appropriative right is unimpaired because Farm A is held to its status quo level of consumptive use. In particular, increased efficiency means that Farm A can reduce the diversion required to generate 4 units of consumptive use by a third (i.e., 16 units to 16/3 = C/IE = 4/0.75 units). This increases stream flow at Farm A's point of diversion by 32/3 units [boxed quantity], but reduces return flow by the same amount [other boxed quantity]. The result of this offsetting change is to preserve Farm B's status quo in Figure 9(a). There are 12 units of water available to provide for Farm B's full appropriative right, and 9 units of water remain at the bottom of the basin.

In the real world, policy makers have not preserved the status quo for other appropriators and instream uses because they have allowed efficiency-increasing farms to spread water over additional acreage. One example is the Columbia Basin Project in Washington state. It is an irrigation project run by the United States Bureau of Reclamation that initially defined lands adaptable for irrigation based on the flood irrigation technology prevailing in the 1940's. The water duty for these lands was established in excess of 5 acre-feet of diversion per acre. The large water duty, along with shifts to centre-pivot irrigation, now permits irrigation of many acres previously judged to be non-irrigable. Water spreading occurs without challenge from state or federal institutions, thereby politically validating the enlargement of the original water rights to include more land and greater water consumption.

Another example is provided by upper Snake River Plain aquifer. Traditional flood-irrigation practices were highly inefficient, which allowed a large quantity of unconsumed irrigation diversions to percolate into the aquifer. This substantially increased historic aquifer levels and augmented downstream flows in the Thousand Springs reach of the Snake River. A switch to more efficient irrigation practices has caused a precipitous decline in aquifer levels and subsequent recharge of the lower portion of the Snake River. Appropriators diverting water in this stretch of the river find their rights impaired (Johnson et al. 1999).

Why water administrators have not protected other appropriators and instream-flow rights from impairment by restricting efficiency-improving appropriators to their traditional level of consumptive use, as in Figure 9(c)? A major reason is that the basic principles of the prior appropriation doctrine do not compel such a solution, and, in fact, create contradictions that seem to justify allowing impairment.

Contradiction arises because the water duty, defined in terms of diversionary quantities, fails to account for the impact of consumptive use on return flow. Consequently, efficiency-improving irrigators can claim ownership over the portion of the diversionary quantity no longer required to meet the original level of consumptive use as part of the original water duty [i.e., the 32/3 units of water in Figure 9(c)], and thus legal entitlement to spread it over additional crops. Otherwise, they can contend that the unused portion will be forfeited subject to the "use-it-or-lose-it" principle, which constitutes a public appropriation of part of their original water duties. Alternatively, opponents can contend that efficiency-improving irrigators have enlarged their water use illegally by spreading water over land non-appurtenant to their original right. This impairs the water rights of other appropriators contrary to the intent of the prior appropriation doctrine.

Policy-makers in several western states have attempted to resolve the contradiction by adopting two convenient, but unjustifiable, fictions. First, they presume that the unused portion of the water duty after an increase in irrigation efficiency constitutes "conserved" water that can be spread without impairing other water rights. For example, agricultural water conservation statutes in Oregon and Washington define conserved water as the reduction in required diversions before and after an increase in on-farm irrigation efficiency [i.e., 32/3 units in Figure 9(c)] without regard for impacts on consumptive water use and return flows. They further award various portions of the "conserved" water to efficiency-improving irrigators [see, Oregon Revised Statutes §537.455(1) and Revised Code of Washington §90.03.380(1)]. Federal policy-makers also make this presumption. For example, Secretary Norton's "Water 2025" initiative designed to resolve western water-supply crises calls for making irrigation more efficient (Hanson 2003).

Unfortunately, as demonstrated in Figure 9(c), the reduction in the diversion required to maintain traditional levels of consumptive use after an increase in irrigation efficiency is offset by a reduction in the irrigator's return flow. As a result, stream flow below the efficiency-improving irrigator's point of return flow re-

mains unchanged. No new water is created. However, if the law misguidedly allows the efficiency-improving irrigator to spread this water anyway, then streamflow will decrease below the point of return flow in the amount of the increase in consumptive use, and the rights of downstream appropriators and instream-flow uses will be impaired as demonstrated in Figure 9(b).

A second fiction that states have adopted to allow efficiency-improving irrigators to spread water at the expense of other water rights is that irrigation return flow constitutes "waste" water in violation of the beneficial-use requirement. Consider, for example, the case of *Estate of Steed v. New Escalante Irrigation Co.* [846 P.2d 1223 (Utah 1992)]. The New Escalante Irrigation Co. diverted water from the Escalante River in Utah and applied it to crops with an inefficient irrigation technology. Water unconsumed by crops escaped to Alvey Wash where the Steed estate had a vested appropriative right to divert it for irrigation. New Escalante subsequently converted to a more efficient irrigation technology that substantially reduced escape flows to Alvey Wash, and thereby impaired the Steed estate's vested water right. The court refused to protect the Steed estate's vested water right after concluding that it drew water from a previously wasteful irrigation practice. The court failed to realize that escape flows, resulting from the inefficient irrigation practices existing at the time many appropriative rights were granted, are a legitimate means of supplying other water rights. Water is not wasted, it is simply used by another appropriator. As a result, New Escalante was allowed to enlarge its water use contrary to the intent of the prior appropriation doctrine, and in the process impair the Steed estate's water right.

To summarize, the adoption of improved technologies for applying irrigation water to crops brings several benefits to the efficiency-improving irrigator, including increased crop production and lower irrigation costs. Unfortunately, these benefits may come at the expense of other water-right holders and instream uses if efficiency-improving irrigators are allowed to increase their traditional levels of consumptive water use. The result is increased pressure on already over appropriated western water systems. Inconsistency arises as the prior-appropriative principles of beneficial use, use-it-or-lose-it, and the measurement of the water duty in terms of diversionary quantities appear to justify allowing efficiency-improving irrigators to spread water; while principles restricting diversion to appurtenant land and prohibiting enlargement of use appear to ban spreading. The adoption of unjustifiable fictions by federal and state water agencies does not resolve this inconsistency. It is like ignoring a disease as it evolves into an epidemic.

9.3.2 Response to Emerging Water Demands for Instream Flow Uses

The prior appropriation doctrine has not adapted well to changing social demands for water. By definition, instream uses of water do not meet the doctrine's traditional requirement that water be 'diverted to a beneficial use.' Due to this lack of recognition, instream uses were locked out as irrigated agriculture appropriated

the vast bulk of dependable river flows in the west (80-90 percent) in the late nineteenth and twentieth centuries. State appropriation systems continue to restrict the dedication of appropriated water to instream use (Huffman 1983). For example, water rights for instream use generally are established either by states or state-sanctioned water trusts, and are held by the states in trust. They have junior priority to appropriative rights established before them (Hamilton and Huffaker 2003).

As a result, irrigated agriculture maintains prior rights regardless of how little water remains for instream uses, or how much more valuable these uses might be at the margin. The evidence is that the potential gains from marginally shifting water to instream uses may be large. For example, two economic analyses concluded that shifting water to hydropower production would generate benefits ten times greater than lost farm income (Hamilton et al. 1989), and two times greater if the water were shifted primarily to provide flows for migrating fish species (Hamilton and Whittlesey 1992).

Markets have been long recommended as a means of transferring water to more profitable uses within the framework of prior appropriation (Milliman 1959). However, they have not developed substantially for several reasons. One reason is that, similar to the impact of improved irrigation technology, the transfer of appropriative rights can compromise the security of other rights by changing the timing, quantity, and quality of return/escape flows. States protect appropriators from such impairment by imposing moderate to severe limits on water transfers (Gould 1988). For example, Nebraska traditionally has banned the transfer of appropriated water to non-agricultural uses. Wyoming traditionally has severely limited transfers by placing a heavy burden on the transfer proponent to prove lack of injury to other appropriative rights with 'clear and convincing' evidence (Huffaker and Whittlesey 2000).

Another reason that water marketing has not developed more substantially is that it provokes heated political opposition from rural communities fearing that transferring water out of agriculture will have disastrous impacts on regional employment, businesses, and tax bases (see e.g., Hymon 2002). Consequently, although many farmers may be willing sellers, local agribusiness and community interests actively work against marketing policies. For this reason, a voluntary buyout programme, in which the federal government would purchase farm interests in water and/or land for use in the Klamath Basin's National Wildlife Refuges, was dropped although 24 farm families controlling 30,000 acres were offering to participate (ONRC 2001).

9.3.3 Lack of Enforcement of Prior Appropriation Principles

The security of water rights sanctioned under state prior appropriation systems is imperilled by noncompliant water use that state water agencies allow to continue unabated, and state legislatures attempt to legitimise by statute. For example, environmental groups sued the state of Washington to force the state's Department of Ecology to ban noncompliant groundwater withdrawals (i.e., groundwater pumped beyond levels specified in water rights) because of their detrimental impacts on instream flow (Spokane Spokesman Review 1999). In another example, a 1993 survey found that over 500 water users (mostly irrigators) were taking water without a valid right in Whatcom County, Washington. The 1997 Washington Legislature attempted to legitimise these invalid uses by passing a bill that was subsequently vetoed by the Governor (Benson 1998).

The efforts of state water agencies to identify and stop noncompliant use are often plagued by inadequate budgets (Spokane Spokesman Review 1999), and by inconsistent enforcement policies set out by state legislatures and courts. For example, the Idaho Supreme Court held that the state water agency has a mandatory duty to curtail noncompliant water use to protect senior appropriators. Alternatively, a Washington State Court ruled that the state water agency (which ideally has the expertise to untangle complex water issues) is unauthorized to evaluate the priorities of water rights that have not undergone a formal basin-wide adjudication procedure, or to issue regulatory orders to persons violating those rights (Rettkowski 1993). A leading water attorney in the state analysed the impact of this case on the State's prior appropriation system as follows: "Since most of the state's waters remain unadjudicated, the most obvious effect of [Rettkowski v. Department of Ecology] is that for most water users, priority—the keystone of Western water law—is now meaningless…" (Dufford 1994)

More recently, a Washington State Court mediated an agreement ending litigation between the Washington Department of Ecology and Columbia River irrigators that appears to remove the irrigator's rights outside of the normal prior-appropriative framework (Voluntary Settlement Agreement 2002). Irrigators sued to force the state to issue seven water rights. The settlement outlines two ways in which irrigators can be issued rights that the state guarantees will not be interrupted when flows go below instream flow levels set in 1980. Irrigators can either pay $10 per year per acre-foot of uninterrupted water (so that the state can buy replacement water), or install state-of-the-art irrigation devices. Water "conserved" from the increased efficiency would be transferred to the state. The agreement does not consider where replacement water can be purchased for as low as $10 an acre foot in an already over appropriated river basin. It also does not acknowledge the fallacy of equating increased on-farm irrigation efficiency with agricultural water conservation in the return-flow hydrology characterizing the Columbia and Snake River basins [Figure 9(c)]. The settlement effectively grants these irrigators a new species of water right outside the realm of the prior appropriation doctrine. Contrary to the principle of 'first in time first in right,' senior water right holders

with ‘interruptible’ rights would be curtailed by these ‘uninterruptible’ junior rights in water short years.

9.4 A Modern Role for the Prior Appropriation Doctrine

The modern-day erosion of the prior-appropriation doctrine’s past virtues undermines its past status as the pre-eminent water allocation mechanism in the West. Wilkinson (1992) has characterized the doctrine as one of several outmoded western resource laws (‘lords of yesterday’) that have failed to keep pace with societal change, and thus constitute “a government of living by the dead” (p 25). He punctuated his frustration by composing a tongue-in-cheek obituary entitled, “West’s Grand Old Water Doctrine Dies” (Wilkinson 1991). There is, at a minimum, the need to operate with a more flexible version of the prior appropriation doctrine in conjunction with parallel allocation doctrines better equipped to distribute water to a number of meritorious competing public uses.

9.4.1 Increasing the Flexibility of the Prior Appropriation Doctrine

Several ways have been recommended to make the prior appropriation doctrine more responsive to modern water allocation needs while offering some degree of protection for traditional water rights. One recommendation is to restrict water transfers to the quantity of water consumptively used under the right. This can mitigate some, but not all, of the quantity-related impairments to water rights not involved in the transaction (Anderson and Johnson 1986). Moreover, such a quantity restriction is not designed to solve problems related to the timing or quality of return flows (Gould 1988). Due to these limitations, economists have recommended various types of specialized transfers designed to limit the extent and duration of transfer-related impairments. These include ‘trial transfers’ (transfers that can be modified or revoked if actual impairment results), ‘one-time-temporary transfers’ (transfers whose short terms make injuries of short duration), and ‘contingent transfers’ (transfers that occur intermittently and are triggered only by some predetermined contingency).

A second recommendation for increasing the flexibility of the prior appropriation doctrine is to lower the transaction costs of transferring water. For example, the administrative mechanisms supervising transactions can be streamlined by formulating rules to narrow the range of technical issues addressed in each transfer hearing (Gould 1988; Colby 1990), shifting the burden of proof to other appropriators claiming impairment (Gould 1988), and crafting expedited review mechanisms for the specialized water transfers discussed above (Gould 1988).

A third recommendation is for states to remove outright restrictions, and less transparent legal disincentives, on the transfer of water outside of agriculture.

The last recommendation mentioned here is to remove the 'use it or lose it' requirement from prior appropriative rights. The logic behind this traditional restriction is that inappropriate water is wasted. However, this logic no longer holds in modern times when the ecological value of instream flow is recognized. Irrigators have the adverse incentive to continue employing water in a sub-economic use rather than to transfer it to a more valued instream use, since transferred water might be lost to the use-it-or-lose-it requirement (Economist 2001).

9.4.2 Parallel Water Allocation Doctrines

The public trust doctrine is a parallel water allocation doctrine with historical roots deeper than those of prior appropriation. The doctrine is an evolution of common-law principles dating from medieval England that recognizes the government's obligation to manage some types of natural resources in trust for the public benefit (Stevens 1980). For example, in medieval England, public rights protected by the trust were navigation, transportation, and fishing on lands along seashores and rivers. These rights accompanied any grant of the lands by the King into private ownership. In the USA, the US Supreme Court and State courts determine the resources covered under the trust and the range of public activities to be protected. For example, the US Supreme Court has held that navigable freshwater bodies and tidelands are covered by the public trust. Individual states have extended public trust obligations to rural parklands; wetlands associated with navigable water bodies; non-navigable tributaries; and waters usable for fish and wildlife habitat and recreational purposes. Similar to English common law, these public trust obligations accompany the transfer of trust resources into private ownership or use. Consequently, federal and state governments are empowered by the trust to condition appropriative water rights to the extent required to protect public resources and uses protected under the trust. For example, government entities could reject applications for new appropriations that would harm trust values, and continually supervise and regulate existing rights to ensure compatibility.

Federal and state governments also are empowered to condition appropriative water rights by regulatory programs designed to preserve public resources. For example, the Endangered Species Act authorizes lead federal agencies to formulate a recovery plan for listed species, and demands compliance from federal and state agencies (section 7), and private citizens (section 9). The federal government has exercised this power to shut off irrigation water supplied by federal projects, or conveyed by federal ditches, to Washington State's Methow Valley and Oregon's Klamath basin.

9.5 Concluding Remarks

Prior appropriation is a nineteenth century doctrine that functioned best for the economic and technological circumstances of that era. Irrigated agriculture was able to appropriate the vast bulk of water because it constituted the major portion of economic activity, and instream uses were not yet recognized. Water application efficiencies in agriculture were low which meant that a relatively small fraction of diverted water was consumed by crops, and a relatively large fraction returned to the hydrologic system for use by downstream appropriators.

The modern era has witnessed the emergence of instream uses whose contribution to social welfare is rising as irrigated agriculture's historic contribution declines. Competition for water between agricultural and instream ecological and hydropower uses has stressed the allocative abilities of prior appropriation to the crisis point, as illustrated by Oregon's Klamath Basin. Such stress might have been relieved before the crisis point if the prior appropriation doctrine were amenable to water marketing on a wide geographic scale. However, the doctrine's inflexibility in transferring water to meet instream needs has resulted in its occasional subjugation to federal laws (e.g., the Endangered Species Act) designed to protect these uses.

The modern era also has witnessed vast improvement in on-farm irrigation efficiency that has increased agricultural productivity and reduced irrigation costs. However, it also has tended to increase consumptive water use in agriculture, reduce irrigation return flows, and, consequently, further stress over appropriated water supplies. The principles of prior appropriation are not designed to identify or remedy the impairment in downstream water rights deriving from increased irrigation efficiency upstream. As a result, the protection that the doctrine traditionally has offered to appropriative water rights is eroding, and rights holders are looking to state legislatures, agencies, and courts to provide protection in other ways.

To the extent that the prior appropriation doctrine continues to play a modern role in western water allocation, it should be made more flexible in allocating water to socially-desired instream uses, and be operated in conjunction with parallel allocation doctrines better suited to protect these uses. The public ownership of water, the public trust doctrine protecting trust resources and values, and federal environmental statutes provide ample authority for public officials to condition appropriative water rights as required to protect instream uses.

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