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*7 WORKING RIVERS AND WORKING LANDSCAPES: USING SHORT-TERM WATER USE AGREEMENTS TO CONSERVE ARIZONA'S RIPARIAN AND AGRICULTURAL HERITAGE

INTRODUCTION

Desert water--our streams and rivers, springs, ponds and pools--allows both human and natural communities to survive in the arid Southwest. The working landscapes--farms and ranches--that span our watersheds are part of an intricate system of natural and man-made elements that support and protect rural communities, biodiversity, cultural resources, and sweeping western vistas. Traditionally, river systems and watersheds were maintained by a balance between natural processes and human uses: fire, flood, and grazing herbivores. These influences provided a mosaic of "disturbances" that allowed diverse biota to thrive in riparian habitats.[1] The combined stressors of drought, climate change, and economic growth have upset this balance. Many water conservation and restoration projects are being undertaken in Arizona with varying degrees of success. Few of these projects take into account the importance of the symbiotic relationship between human and natural use of water systems and riparian and river health. By incentivizing partnerships that address the needs of this symbiotic relationship, the State of Arizona may be able to reach a condition of lasting water and landscape resilience.

Arizona's water management regime provides few incentives for landowners to proactively conserve and manage their water in a manner that balances natural resources with human use. Most water conservation mechanisms available require a choice between agricultural water use and environmental flows. But ranchers, farmers, and rural landowners ***8** have put water to a beneficial use for generations and have stewarded our vast working landscapes and watersheds. Working landscapes can act as a modern continuation of historic disturbance: "occasional trampling by livestock, or periodic disturbance of bank and stream channels by livestock, may mimic natural forms of disturbance that recreate early successional stages favorable for population expansion."[2] Active management can be utilized to mimic the most beneficial aspects of historic use.[3] This can be accomplished through incentivized partnerships such as short-term water and groundwater use agreements with agricultural landowners to protect native fish populations, surface flows, and riparian habitat.

Short-term water use agreements are private contractual agreements in which a water user agrees not to pump or divert water for a period of time. Depending upon the needs of the particular hydrologic and ecologic system that is targeted for conservation, an appropriate surface water or groundwater use agreement may be implemented for a term of months or for a period of less than five years, so to not risk forfeiture of a surface water right.[4] Short-term agreements can be tailored to mimic seasonal flood flows or provide water to help reestablish riparian vegetation. The water right or claim does not change hands; rather, its use is temporarily contractually dedicated to a conservation purpose, allowing the continuation of agricultural or other water uses.

I. WORKING LANDSCAPES: A HISTORY OF AGRICULTURAL USE

Farming and ranching have been prevalent in Arizona since long before statehood. "Livestock were introduced to southern Arizona before 1700 [,]"[5] and farming and irrigated agriculture have been in place since at least 1200 B.C.[6] These uses have impacted riparian habitats in a variety of ways. Overgrazing and drought, especially at the end of the nineteenth century, coincided with widespread range degradation and arroyo widening.[7] Grazing in riparian corridors can degrade watersheds and lead to "increased runoff and sediment yields to riverine systems; direct consumption of seedlings of native woody species; and trampling and damage of established individuals on floodplains."[8]

***9** Historically, livestock grazed on vast expanses of grass, and they "received the majority of their nutrition from field grass with very little supplementation from grains."[9] But as agricultural subsidies, dating back to the "Green Revolution" of the late 1960s and 1970s, reduced the price of corn, "many cattle ranchers have replaced open-range grazing with corn production and feed their animals a mostly corn-based diet in confined feedlots."[10] This concentration of confined livestock--and thus livestock waste--onto smaller parcels has unsurprisingly created significant water pollution impacts.[11] Nevertheless, many grass-fed livestock operations have survived in southern Arizona where livestock are grazed in a more traditional fashion on the open range without the need for supplemental corn or grain. Such operations "have among the lowest carbon footprints, sustain the highest biodiversity, and maintain the widest range of ecological services of any food production systems on this planet."[12]

The "Green Revolution" increased America's focus on industrialized agriculture with the development of high-yield crops that could be harvested year round through selective breeding and hybridization.[13] A 1972 U.S. agricultural policy promoted by Earl Butz, President Richard Nixon's second Secretary of Agriculture, urged farmers to "plant from fencerow to fencerow."[14] Butz's policy highlights the government's commitment to the "Green Revolution." Newly resilient commodity crops were thus planted on marginally productive soils, "which inherently lead[s] to high levels of soil erosion."[15]

Domestic livestock and grazing cattle have been present along the U.S.-Mexico border region since perhaps as early as 1790-1830.[16] Some long-term changes on grazing lands are clear and "[t]here is no disputing the historic contribution of overgrazing to arroyo ***10** formation, soil erosion, and vegetation change."[17] While "heavy, uncontrolled grazing can have detrimental effects by removing too much vegetation, changing species composition, excessively compacting the soil, and causing increased soil erosion," well-managed grazing generally has a positive or neutral impact on rangelands.[18] Increases in riparian vegetation over time have similarly been observed "irrespective of the presence of grazing animals."[19]

The benefits to riparian systems of agricultural use, grazing in particular, have been largely ignored or misunderstood.[20] Recently, however, the many and diverse values of agricultural landscapes have started to gain the acceptance of the general public and academics alike.[21] In appropriate locations, grass-fed cattle grazing can help repair degraded landscapes and sustain diverse ecosystems.[22] Agriculture and grazing allows for significant increases in soil infiltration and groundwater recharge by increasing the quantities of carbon and organic matter in the soil.[23] Carbon sequestration is beneficial to groundwater recharge--"the more carbon and organic matter you have retained in soils, the better your moisture-holding capacity will be."[24] Groundwater recharge and underground storage are already priorities in Arizona.[25] An increase in the land's natural capacity to store water would be a welcome addition to the many recharge projects that have been and continue to be constructed across the state. The benefits of responsible ranching and agriculture to surrounding communities and ecological values are substantial:

> ***11** Ecologically, ranching as a land use is compatible with the natural heritage of the West. It keeps lands open and stewarded, keeps human densities low, and safeguards private lands from fragmentation. Economically, ranching provides home-grown food, pays its own way, and supports a fiscally responsible economy. Culturally, ranching covers a time frame dating back over 400 years, one of the oldest land uses that Euro-Americans have given the New World.[26]

While irresponsible ranching and agriculture can cause ecological damage, carefully planned and managed ranching and agriculture can produce substantial benefits that can be utilized to promote watershed and riparian health.

II. RANCHING AND RIPARIAN SYSTEMS

Management of livestock grazing on public lands takes watershed and riparian health into consideration.[27] While the fencing and exclusion of livestock from desert watercourses has been a common management strategy, these systems have historically been sustained by a delicate balance of disturbances. Livestock grazing or its historic equivalents--fire, flood, grazing herbivores, Native American use, and beavers--help manage the growth of some seedling trees and grasses. If undisturbed, this overabundance of vegetation of similar size and age can choke and straighten channels and destroy the open-water habitat required for native species.[28] A large community of trees and grasses of a similar age and size heavily shades streams and "greatly reduces the availability of algae for herbivores" and native fish.[29] The historic disturbance regime has created a balanced system of channel maintenance and geometry. Managed grazing can mimic historic conditions and return desert springs and river systems to an appropriate function in a new setting:[30] "the normal ecological structure and function of desert springs depends on continual, high levels of physical disturbance by large mammals."[31]

In the right circumstances, the adaptive management and experience provided by ranchers and farmers may provide particular benefits to river systems and desert springs.[32] The fencing of springs and removal of livestock from riparian areas have been shown to reduce fish habitat and the diversity of riparian vegetation.[33] Studies at both Ash Meadows in ***12** Nevada and Dalhousie Springs in Australia have shown that management activities, such as the exclusion of livestock and removal of exotic species from desert springs and surrounding habitats, have failed to adequately address declines in aquatic habitat and native fish populations. Traditional livestock fencing is intended to protect desert riparian systems when, in fact, it can have the opposite effect. Three small springs--Devils Hole, School Spring, and Mexican Spring--were fenced in the 1960s and early 1970s in the Ash Meadows area. Fencing caused steep declines in aquatic habitat for two of the three springs:

> School and Mexican Springs, however, were rapidly overgrown. Within a few weeks after the fencing of Mexican Spring, growth of *Scirpus* and other vegetation, and the resulting transpiration,[34] caused complete drying of surface water and the extinction of pupfish. School Spring, which was somewhat larger, also became densely overgrown. The population of pupfish was maintained, however, first by periodic manual removal of vegetation, and subsequently by extensive habitat modification, including installation of concrete pools.[35]

Results in Dalhousie Springs, South Australia, have been similar. In 1985, the area around Dalhousie Springs was purchased by the South Australia government for the creation of Witjira National Park. The park was fenced and livestock removed. When the springs were surveyed in 2003, eighteen aquatic species had become extinct. The survey report provides that "we attribute nearly all of these extinctions to the direct and indirect effects of the changes in vegetation due to exclusion of livestock."[36]

III. LIMITED MARKET FOR WATER RIGHTS

The open space and cultural values of agricultural lands can be protected while preserving and enhancing instream flows and riparian habitat by incentivizing water use agreements and best management practices. Environmental water markets can be established by directing incentives to willing landowners to encourage environmental water use transactions. Large-scale water markets in Arizona and most western states have been slow to develop. Water is unlike more traditional property rights and does not lend itself to streamlined transactions.[37] A market requires reasonably secure property rights to function properly.[38] Water rights tend to be less secure than other property rights for a variety of reasons.[39] Water is physically difficult to pin down; it moves and is not easily transportable. ***13** Myriad externalities must be taken into consideration in order to transfer water. Surface water and groundwater are regulated separately but are hydrologically connected. It is difficult, if not impossible, to transfer one without impacting the other. Water transactions are regulated in order to avoid harm to third parties who rely on return flows from water that is appropriated but not consumed.[40] While this principle of "no injury to juniors" is clearly necessary, it makes free market trading of water more complex. Water rights within the boundaries of the ongoing adjudications are also legally uncertain until their relative quantity and priority are finally resolved by the courts.[41] These high levels of risk are amplified by the sometimes extraordinary costs of conveyance mechanisms to physically transport acquired water.[42]

Despite these many impediments, water markets are slowly emerging across the West.[43] The most common transactions are from agricultural water use to urban water use.[44] As cities grow and agricultural uses decline in many areas, this trend is not surprising. Urban growth needs an accompanying water supply, but there is also significant value in keeping land in agricultural production.[45] Short-term environmental water transactions can provide flows and aquifer maintenance without sacrificing Arizona's agricultural heritage and the habitat, groundwater recharge capacity, food security, economic benefits,[46]

and open space values it provides.[47]

***14** Arizona has attempted to address the balance between these seemingly competing water interests to protect riparian areas. In 1991, Governor Rose Mofford signed Executive Order No. 91-6 that decreed the protection of riparian areas to be in the public interest.[48] Now, the policy of the State of Arizona is "[t]o actively encourage and develop management practices that will result in maintenance of existing riparian areas and restoration of degraded riparian areas."[49] The executive order focused on the "preservation, maintenance, and restoration of instream flows" and mitigation of future losses.[50] Despite these lofty goals, Arizona's water law contains a variety of impediments that discourage water conservation and water markets. Even with advances made in conservation practices for riparian protection and instream flow maintenance in Arizona, a lasting balance between competing water interests has yet to be achieved. Short-term water leasing is a valuable tool that can support agricultural economies and associated open space while providing incentives and a mechanism for landowners to protect instream flows.

IV. ARIZONA WATER LAW DEVELOPMENT: IMPEDIMENTS TO BALANCED MANAGEMENT

The water law of Arizona developed, in large part, as a means to encourage mining in the arid West.[51] The doctrine of prior appropriation, which granted the highest priority rights on a river to the landowner who first puts the water to a beneficial use, was preferred because it "provided secure title to mining and irrigation entrepreneurs desiring water for their industries."[52] Historian Gordon Bakken summarized the impetus for the creation of the prior appropriation doctrine: "[p]ioneer legislators and judges in the Rocky Mountain States created the law of prior appropriation to deal with this problem of aridity."[53] For all its perceived value and potential to reward risk-takers for their investments in the development in the West, the system struggles to equitably manage such a scarce resource in arid Arizona.

***15** Surface water and groundwater are physically and hydrologically connected by interactions between streams and underground aquifers.[54] Groundwater discharge supports surface water flows, and surface water recharges aquifers. As groundwater levels decline, streams may be dewatered and associated riparian vegetation will die off. At common law, groundwater "is not appropriable and may be pumped by the overlying landowner, subject to the doctrine of reasonable use."[55] The doctrine of reasonable use is quite broad. Groundwater may be pumped for those purposes "incident to the beneficial enjoyment of the land from which they are obtained."[56]

Arizona law largely ignores the interconnection between surface water and groundwater; under the law, surface water and groundwater are distinct and are regulated under different legal doctrines.[57] The law's failure to recognize this connection has led to significant declines in major river systems across the West.[58] Groundwater pumping may draw down nearby rivers and impact riparian vegetation. The proliferation of small, private wells continues to have detrimental impacts on ecological values across the West.[59] While groundwater use within Active Management Areas ("AMAs") is limited to the water used between 1975 and 1980, new small non-irrigation wells with a pump capacity of less than thirty-five gallons-per-minute can be drilled and are exempt from most of the Ground Water Management Act's ("GMA") limitations and restrictions on groundwater use within AMAs.[60] New low-capacity wells can be drilled inside and outside AMAs and are generally unregulated across the state.[61]

Arizona law has begun to take note of the impacts groundwater pumping near rivers can have on surface water flows.[62] For the purposes of the ongoing general adjudications of water rights, the hydrologic connection between surface water and groundwater is being taken into consideration with respect to groundwater pumped from especially close to a river. *Subflow*--legally defined as the "saturated floodplain Holocene alluvium"--is water that exists at the interface of groundwater and surface water. Within the context of the ongoing General Adjudication of Water Rights, initiated in 1974 to determine "the extent ***16** and priority of the rights of all persons to use water in any river system and source,"[63] subflow is legally presumed to be surface water subject to this adjudication.[64] Users of subflow from wells located within the saturated Holocene alluvium are thus subject to the prior appropriation system and cannot diminish the water supply available to earlier established surface water rights in the same river system.[65] While this is a positive first step in linking physical reality with legal regulation, the subflow analysis only applies in very limited circumstances and does not fully match with the broader linkages between groundwater and surface water.

Despite this legal disconnect between groundwater and surface water, Arizona has been progressive and forward-thinking in many aspects of its water management. Instream flow maintenance for "wildlife, including fish"[66] was recognized in 1941.[67]

Instream flow for recreation was recognized as a beneficial use in 1962.[68] The Arizona Groundwater Management Act ("GMA") was adopted in 1980 to "conserve, protect and allocate the use of groundwater resources of the state and to provide a framework for the comprehensive management and regulation of the withdrawal, transportation, use, conservation and conveyance of rights to use the groundwater in [Arizona]."[69] One of the major goals of the GMA is to protect Arizona's aquifers from groundwater overdraft in areas where groundwater pumping exceeds artificial and natural recharge.[70]

A. Water as a Public Trust: Enforcement of Competing Water Interests

The prior appropriation system is generally blind to the competing public values of different beneficial uses. Surface water in Arizona is held in trust for the state and "belong[s] to the public,"[71] but almost any reasonable use will be considered equally "beneficial" to appropriate surface water.[72] Though watershed health, environmental stability, and food security clearly provide public benefits--commonly referred to as "ecosystem services"[73]-- ***17** difficult decisions about the hierarchy of public values are rarely, if ever, made at the agency level.

The Arizona Department of Water Resources ("ADWR") and its predecessors were granted broad statutory authority to administer the Arizona Water Code.[74] The ADWR acts generally as a permitting and planning agency, but it was arguably granted greater power in both the enforcement of existing rights-- by refusing to issue new permits that infringe upon those rights--and the protection of the public interest than it currently exercises.[75] The legislature similarly granted the ADWR broad police powers to administer, manage, and enforce water rights in Arizona.[76] The Arizona Supreme Court recently the legislature's authority to balance and manage correlative water uses in the interests of the general welfare: "[t]he legislature is free to choose between competing uses of groundwater and to modify such rights in the public interest as an exercise of its police power."[77] Thus, lacking a specific legislative grant of power, which has not been forthcoming, such decisions might not currently be within the purview of the ADWR.

Currently, water users and interested parties have only minimal ability to manage and balance competing water uses themselves because private civil actions within the Gila River and Little Colorado Watersheds are precluded by the ongoing general water rights adjudications.[78] In this authority and enforcement vacuum, a private market-based approach may be effective in protecting and restoring Arizona's rivers and watersheds. This approach may provide significant benefits to Arizona's delicate desert riparian corridors without sacrificing the stewardship, food security, and economic base provided by an interconnected system of vast working landscapes. In fact, agricultural use, when appropriately managed, may be beneficial and necessary to the survival of and restoration of desert streams and spring systems.[79] A brief overview of some of the existing water conservation tools available in Arizona shows the need for a new way to more appropriately manage and allocate Arizona's water as a public trust.

***18 V. TRADITIONAL WATER CONSERVATION MECHANISMS**

The protection of surface flows in Arizona has most commonly been achieved through new appropriations of water for instream flows.[80] While potentially beneficial on small, tributary streams, most large rivers are fully--if not over--appropriated.[81] Establishing a new water right with a priority date of 2010 or later might preserve an existing flow regime, but all earlier established rights would have to be satisfied before any water claimed would be protected under the new instream flow permit. A new appropriation for instream flow would be vulnerable within the pending adjudications. In order to create an instream flow surface water right with an earlier priority date, applicants today can apply to sever and transfer historic surface water rights to instream flow.[82] Water rights can be severed from the land to which they are appurtenant and transferred "to the state or its political subdivisions for use for recreation and wildlife purposes, including fish, without losing priority theretofore established ...."[83] Due to the lengthy administrative review process and lack of precedent regarding quantity transferred and legal viability of transferred rights, the applicability and effectiveness of severing and transferring water rights remains unclear. Arizona has recognized the benefit of instream uses of water for years, but its "instream flow laws are progressive for appropriations but fairly restrictive for existing uses, which promotes preservation but limits restoration, responsiveness, and options for use."[84] In essence, it is comparatively easy to make a new appropriation for instream flow with a late priority date. But the process by which an existing, high priority, right can be severed and transferred to instream flow is still being defined. Questions about the appropriate process, quantification, and timeframe reduce the practical viability of a "sever and transfer" application and thus reduce current incentives to use this conservation tool.

Groundwater regulations present a different set of conservation challenges. Groundwater conservation is addressed tangentially by the GMA. The GMA was focused on conserving Arizona's groundwater resources for the people of the State who are "dependant in whole or in part upon groundwater basins for their water supply ...."[85] The GMA was adopted to address extensive groundwater mining that had begun to cause significant ***19** subsidence[86] and was threatening Arizona's long-term water supply. It contained many aggressive goals, one of which was for three of the four initial AMAs to reach "safe yield," a balancing of groundwater withdrawals with recharge,[87] by 2025.[88] It seems increasingly unlikely that the state will meet this goal by 2025.[89] While groundwater mining has slowed significantly in many areas, some of Arizona's most critical riparian zones continue to be affected by dropping water tables.[90]

For all its successes, the existing water management regime in Arizona provides few incentives for landowners to independently conserve their water. Water conservation for instream flows and riparian protection can be achieved through market-based agreements that balance the water needs of landowners with the environment. Ranchers and farmers have put water to beneficial uses for generations and are the stewards of our vast working landscapes and watersheds. By incentivizing partnerships with willing landowners, Arizona's rural water resources can be balanced between communities, conservation, and rural agriculture, and rural agriculture can be maintained as security against sprawl and further groundwater mining.

VI. SHORT TERM WATER LEASING: WORKING LANDSCAPES IN BALANCE WITH WORKING RIVERS

In the absence of reliable mechanisms for water conservation on a grand scale, short-term water use agreements with willing landowners can support hydrologic balance and resiliency. Water use agreements avoid the inherent administrative and legislative delays of most existing water conservation mechanisms. Water use agreements are private contractual agreements wherein water users agree to modify their water use for a specified period of time. Environmental water use agreements can be tailored to compensate water ***20** users for their dedication of all or a portion of a water right to an environmental purpose-- such as instream flow--on a monthly, seasonal, or annual basis. So long as the agreement runs for less than the statutory five-year forfeiture period, surface water users should not run the risk of forfeiting their water right for non-use.[91] Short-term environmental water use agreements may also take the form of groundwater forbearance agreements. In such an agreement, a landowner would be compensated to pump less water for a period of time in order to allow groundwater levels to rise either to provide surface base flows in nearby rivers or to support riparian vegetation. A short-term contractual water management program can function within the ever-growing water market systems that have begun to take shape in Arizona while directing water towards the protection of agricultural economies and wildlife habitat.

Short-term or split-season agreement programs have emerged in recent years as an increasingly viable option to protect streamflows and riparian habitat. In 2000, the Oregon Water Trust (now the Freshwater Trust) entered into a short-term, annual agreement with the owners of the Austin Ranch, Pat and Hedy Voigt, along the Middle Fork John Day River.[92] The owners were compensated for shortening their irrigation season each year and allowing the water to remain in the stream. After five years, a concurrent habitat monitoring program established to "evaluate the biological effectiveness" of this water use agreement found clear habitat benefits.[93] The split-season water use agreement has since been made permanent through a voluntary agreement--the ranchers shorten their irrigation season by 40% in exchange for compensation from the Bonneville Power Administration through the Columbia Basin Water Transactions Program and the United States Bureau of Reclamation. The ranchers have maintained their cattle operation, and their split season agreement benefits a seventy-mile reach of the Middle Fork John Day River, supporting salmon, steelhead, and bull trout.[94] The ranchers seem pleased with the results: "[w]e'll still be able to run close to the same number of cattle and irrigate, yet we're putting a significant amount of water back instream during critical flow times."[95]

Similar programs are being proposed across the West. Agricultural lands have over time become valuable habitats and, in some locations, irrigated agriculture has created critical wetlands.[96] These agricultural lands and "wetlands have become productive habitats that ***21** support species, particularly migrating waterfowl and shorebirds, and provide valuable recreational opportunities."[97] In order to retain the habitats provided by agricultural lands while also increasing instream flows, academics in Wyoming have suggested a short-term water use agreement program to use existing irrigation rights to balance the water needs of these two uses.[98] The Laramie Basin in southeastern Wyoming, a subbasin of the Platte River, is dominated by beef cattle production. While permanent water transfer proposals "are often met with resistance from the agricultural community,"[99] short-term use agreements may be more palatable for agricultural landowners. Landowners will be able to retain the productive use of their lands while voluntarily "contributing water during two or three nonconsecutive

irrigation seasons over a 10-year contract period."[100] In return, landowners will be offered financial incentives that may be used to increase the efficiency of their water use or delivery system, if necessary.[101]

The general principles put into practice in Oregon, which are also proposed in Wyoming, could be applied in Arizona with some modifications. The formalization of the split season use agreement into a perpetual instream flow agreement similar to the Austin Ranch in Oregon would be difficult to achieve in Arizona until more clarity emerges from Arizona's administrative review process for severing and transferring nonconsumptive water rights. One of the major incentives that can be offered to landowners to participate in instream flow agreements is also absent in Arizona. Surface water saved through increased efficiency projects in Arizona may be subject to forfeiture if it is not applied to its previously designated beneficial use (generally irrigation, domestic, or stock watering) at least once every five years.[102] Put simply, surface water saved through increased efficiency in Arizona cannot be permanently put to other uses with its existing priority date--it may be at risk of forfeiture. Some states expressly exempt conserved water from forfeiture to encourage increased efficiency.[103] Others, like Oregon,[104] Washington,[105] Montana,[106] and New Mexico[107] have adopted programs that allow conserved water to be transferred or applied ***22** instream to encourage efficiency and conservation.[108] Arizona does not exempt conserved water from forfeiture. Nor has it created an efficiency incentive program. Short-term use agreements that require beneficial use at least once every five years remain a viable tool as they avoid the forfeiture problems that could arise with a long-term transfer. Water also remains concurrently available for agriculture, thus protecting the economic bases of many rural communities.

Rotating short-term water use agreements in critical locations can prevent the loss of agricultural livelihoods and the myriad benefits they provide while meeting the particular ecological needs of a system or region. Such agreements can be completed outside the administrative system so long as third-party rights are respected. Agreements can be individually tailored to the needs of the landowner and the ecological system and can be responsive to droughts and floods. The perpetuation of agricultural use provides food security and preserves many of the last remnants of Arizona's iconic cottonwood-willow riparian forests. By working with willing landowners to achieve conservation results outside of the existing legal and administrative systems, Arizona's water can be managed to secure a more balanced and resilient future. To meet its conservation goals,[109] Arizona need not make the traditional zero-sum choice between agriculture and the environment. Through short-term water use agreements with willing landowners, Arizona can preserve the respective benefits of both[110] through the perpetuation of a balanced system of healthy, working rivers--rivers that provide for both human and environmental needs--flowing beside working landscapes.

CONCLUSION

There are limited options to restore and conserve instream flows, riparian corridors, and effective floodplains in Arizona. Questions remain about the current practical value of surface water conservation tools such as the "sever and transfer" of high priority water rights. Also, groundwater regulations provide only tangential conservation mechanisms to address the groundwater-dependent rivers, springs, and riparian systems in Arizona. On the other hand, flexible short-term water use agreements offer a new set of tools to work directly with willing landowners. Agricultural lands provide food, fiber, economic livelihoods, biodiversity, and safeguards against further sprawl. As these various benefits become increasingly evident, the value of short-term water use agreements increases as a means to retain agricultural landscapes while preserving and restoring riparian habitat and instream flows. A wider array of practical approaches may be viable when more clarity emerges in the ***23** existing surface water and groundwater conservation processes. Until that time, short-term water use agreements and forbearance agreements provide market-based opportunities that can be tailored to fit the particular needs of ecosystems and landowners. Policies that encourage and streamline short-term contractual water management programs should be promoted to meet the needs of agriculture and the environment. The balance between human and environmental water uses is fundamental if Arizona is to continue to flourish in the desert Southwest.

Footnotes

a1 Aaron Citron is Project Manager for the Desert Rivers and Riparian Heritage Initiative with the Arizona Land and Water Trust. The Arizona Land and Water Trust recently published a handbook on water conservation mechanisms entitled *Benefiting Landowners and Desert Rivers: A Water Rights Handbook for Conservation Agreements in Arizona*. The author would like to thank Jeff Simms, George Ruyle, Diana Freshwater, and Liz Petterson for their assistance.

[1] Astrid Kodric-Brown & James H. Brown, *Native Fishes, Exotic Mammals, and the Conservation of Desert Springs*, FRONTIERS ECOLOGY & ENV'T 549, 552 (2007); interview with Jeff Simms, Bureau of Land Mgmt., in Tucson, Ariz. (Mar. 18, 2010).

[2] GITA BODNER & KAREN SIMMS, STATE OF THE LAS CIENEGAS NATIONAL CONSERVATION AREA: PART 3. CONDITION AND TREND OF RIPARIAN SPECIES, VEGETATION AND CHANNEL GEOMORPHOLOGY 2, 34 (2008), *available at* http:// azconservation.org/dl/TNCAZ_LasCienegas_Riparian_Status_and_Trends.pdf.

[3] Kodric-Brown & Brown, *supra* note 1, at 552.

[4] ARIZ. REV. STAT. ANN. § 45-141(C) (2010).

[5] ROBERT H. WEBB, STANLEY A. LEAKE & RAYMOND M. TURNER, THE RIBBON OF GREEN: CHANGE IN RIPARIAN VEGETATION IN THE SOUTHWESTERN UNITED STATES 407 (2007).

[6] Heather Pringle, *Early Irrigators*, ARCHAEOLOGY, Jan.-Feb. 2010, at 22, 22, *available at* http://www.archaeology.org/1001/topten/arizona.html.

[7] WEBB, LEAKE & TURNER, *supra* note 5.

[8] *Id.*

[9] Mary Jane Angelo, *Corn, Carbon, and Conservation: Rethinking U.S. Agricultural Policy in a Changing Global Environment*, 17 GEO. MASON L. REV. 593, 606 (2010).

[10] *Id.* at 607.

[11] William S. Eubanks II, *A Rotten System: Subsidizing Environmental Degradation and Poor Public Health with our Nation's Tax Dollars*, 28 STAN. ENVTL. L.J. 213, 260 (2009) ("Many of the larger [concentrated animal feeding operations] have thousands of animals in very small quarters, which creates a large concentration of excrement. Due to poor sanitation and the lack of reinforced waste lagoons, large volumes of waste often spill into the local rivers during rainstorms, creating a public health emergency.").

[12] Gary Nabhan, Duncan Blair & Dennis Moroney, *Ranching to Produce Tacos Sin Carbon: The Low Carbon Footprint of Grass-Fed Beef and Sheep Production in the Semi-Arid West*, QUIVIRA COALITION J., Feb. 2010, at 28, 29.

[13] INT'L FOOD POLICY RESEARCH INST., GREEN REVOLUTION: CURSE OR BLESSING 2 (2002), *available at* http://www.ifpri.org/pubs/ib/ib11.pdf; Eubanks II, *supra* note 11, at 251-52.

[14] Eubanks II, *supra* note 11, at 224.

[15] *Id.* at 261.

[16] Charles G. Curtin, Nathan F. Sayre & Benjamin D. Lane, *Transformations of the Chihuahuan Borderlands: Grazing, Fragmentation, and Biodiversity Conservation in Desert Grasslands*, 5 ENVTL. SCI. & POL'Y 55, 57 (2002). While more recent scholars dispute this claimed date, livestock grazing has at least been prevalent in the border region since the Gadsden Purchase. *See id.*

[17] *Id.* at 59; *see also* JAMES RODNEY HASTINGS & RAYMOND M. TURNER, THE CHANGING MILE: AN ECOLOGICAL STUDY OF VEGETATION CHANGE WITH TIME IN THE LOWER MILE OF AN ARID AND SEMIARID REGION, 43-45 (1965).

[18] Marc Stimpert, *Counterpoint: Opportunities Lost and Opportunities Gained: Separating Truth from Myth in the Western Ranching Debate*, 36 ENVTL. L. 481, 518-19 (2006) ("Although treading by livestock can have undesirable effects such as soil compaction, it can also have desirable effects. Treading incorporates standing dead material into the soil surface, increasing mineral cycling. It can reduce large accumulations of mulch and litter by incorporating these materials into the soil. Moderate treading by livestock appears to favor emergence and survival of perennial grass seedlings while heavy treading can favor forbs and shrubs. Like so many things, a small to moderate level of hoof action can be beneficial while heavy amounts are destructive.").

[19] WEBB, LEAKE & TURNER, *supra* note 5, at 407-08 ("[T]he mere presence of grazing animals in a riverine setting does not portend declines or collapse of woody riparian vegetation.").

[20] *See generally* DEBRA L. DONAHUE, THE WESTERN RANGE REVISITED: REMOVING LIVESTOCK FROM PUBLIC LANDS TO CONSERVE NATIVE BIODIVERSITY (1999).

[21] *See* WEBB, LEAKE & TURNER, *supra* note 5, at 221 ("Many researchers have noted that [the San Pedro River], once swampy, now sustains a verdant forest. If cattle grazing caused arroyos to downcut, then it created this forest growth and establishment of most of these woody trees required dewatering of the upper few feet of a once saturated alluvial aquifer and disturbance.").

[22] Lisa Abend, *Save the Planet: Eat More Beef*, TIME, Jan. 25, 2010, at 50, 53.

[23] Ronald F. Follett & Debbie A. Reed, *Soil Carbon Sequestration in Grazing Lands: Societal Benefits and Policy Implications*, 63 RANGELAND ECOLOGY & MGMT. 4, 5 (2010); Nabhan, Blair & Moroney, *supra* note 12, at 31.

[24] Nabhan, Blair & Moroney, *supra* note 12, at 31 (noting that well-managed crops or livestock "can make a 200-fold difference in the moisture-holding capacity of the land").

[25] ARIZ. REV. STAT. ANN. § 45-801.01 (2010).

[26] Richard L. Knight, *Ranchers as a Keystone Species in a West That Works*, RANGELANDS, Oct. 2007, at 4, 4.

[27] Joseph M. Feller, *Recent Developments in the Law Affecting Livestock Grazing on Western Riparian Areas*, 18 WETLANDS 646, 647 (1998).

[28] Kodric-Brown & Brown, *supra* note 1, at 552.

[29] Theodore A. Kennedy, Jacques C. Finlay & Sarah E. Hobbie, *Eradication of Invasive Tamarix Ramosissima Along a Desert Stream Increases Native Fish Density*, 15 ECOLOGICAL APPLICATIONS 2072, 2072 (2005); interview with Jeff Simms, *supra* note 1.

[30] Interview with Jeff Simms, *supra* note 1.

[31] Kodric-Brown & Brown, *supra* note 1, at 552 ("[S]prings historically experienced such disturbance, originally from native megafauna, then from aboriginal humans, and most recently from livestock.").

[32] Interview with Jeff Simms, *supra* note 1.

[33] Kodric-Brown & Brown, *supra* note 1, at 549.

[34] Merriam-Webster OnLine, Transpiration, http://www.merriam-webster.com/dictionary/transpiration (last visited Aug. 6, 2010) ("[T]he act or process or an instance of transpiring; *especially*: the passage of watery vapor from a living body (as of a plant) through a membrane or pores.").

[35] Kodric-Brown & Brown, *supra* note 1, at 550.

[36] *Id.*

[37] Joseph L. Sax, *Understanding Transfers: Community Rights and the Privatization of Water*, 1 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 13, 13 (1994).

[38] Jedidiah Brewer, Robert Glennon, Alan Ker & Gary Libecap, *2006 Presidential Address Water Markets in the West: Prices, Trading, and Contractual Forms*, 46 ECON. INQUIRY 91, 94 (2008) (discussing the complexities of water markets).

[39] *Id.* at 110.

[40] *See* Se. Colo. Water Conservancy Dist. v. Fort Lyon Canal Co., 720 P.2d 133, 145-46 (Colo. 1986); W.S. Ranch Co. v. Kaiser Steel Corp., 439 P.2d 714, 718 (N.M. 1968); JOSEPH L. SAX, BARTON H. THOMPSON, JR., JOHN D. LESHY & ROBERT H. ABRAMS, LEGAL CONTROL OF WATER RESOURCES 270-76 (4th ed. 2006).

[41] ARIZ. REV. STAT. ANN. §§ 45-251 to 45-264 (2010).

[42] Brewer, Glennon, Ker & Libecap, *supra* note 38, at 94.

[43] *See generally* Jedidiah Brewer, Robert Glennon, Alan Ker & Gary D. Libecap, *Transferring Water in the American West: 1987-2005*, 40 U. MICH. J.L. REFORM 1021 (2007) (discussing water markets in the West).

[44] *Id.* at 1038.

[45] Gary Paul Nabhan & Ken Meter, *In Praise, and in Appraisal of, the Working Landscapes of the West*, QUIVIRA COALITION J., Oct. 2006, at 11, 11; Richard Manning, *We Need and Owe Rural People*, PRAIRIE WRITERS, Oct. 23, 2006, http://www.landinstitute.org/vnews/display.v/ART/2006/10/23/453e7186c461f ("Intact wetlands filter water and control floods. Native grasslands and forests stop erosion and pull globe-warming carbon dioxide from the atmosphere.").

[46] *See* Julia Freedgood, *Cost of Community Services Studies: Making the Case for Conservation*, American Farmland Trust (2002). *See generally* Taylor H. Ricketts, Gretchen C. Daily, Paul R. Ehrlich & Charles D. Michener, *Economic Value of Tropical Forest to Coffee Production*, 101 PROC. NAT'L ACAD. SCI. 12579 (2004), *available at* http://www.pnas.org/content/101/34/12579.full.pdf; Wei Zhang, Taylor H. Ricketts, Claire Kremen & Scott M. Swinton, *Ecosystem Services and Dis-services to Agriculture*, 64 ECOLOGICAL ECON. 253 (2007).

[47] *See* Dannele E. Peck, Donald M. McLeod, John P. Hewlett & James R. Lovvorn, *Irrigation-Dependent Wetlands Versus Instream*

Flow Enhancement: Economics of Water Transfers from Agriculture to Wildlife Uses, 34 ENVTL. MGMT. 842, 852 (2005).

[48] Ariz. Exec. Order No. 91-6, 91 Ariz. Admin. Reg. 58, 59 (Feb. 14, 1991), *available at* http://www.adwr.state.az.us/Adjudications/documents/SPRNCADisclosureStatements/ASARCO3rdSupplementalDisclosure/Document%20No.%2002.pdf.

[49] *Id.*

[50] *Id.*

[51] John D. Leshy, *The Prior Appropriation Doctrine of Water Law in the West: An Emperor with Few Clothes*, J.W., July 1990, at 5, 6-7.

[52] Peter L. Reich, *The "Hispanic" Roots of Prior Appropriation in Arizona*, 27 ARIZ. ST. L.J. 649, 650 (1995); *see also* Bear Mountain & Auburn Water & Mining Co. v. N.Y. Mining Co., 8 Cal. 327, 334 (1857) (stating that California had adopted the doctrine of prior appropriation "to distribute the bounty of the government among the greatest number of persons, so as to most rapidly develop the hidden resources of this region ..."); Fitzgerald v. Urton, 5 Cal. 308, 309 (1855) ("The legislature of our State in the wise exercise of its discretion has seen proper to foster and protect the mining interests as paramount to all others.").

[53] Gordon Morris Bakken, *The Influence of the West on the Developments of Law*, J.W., Jan. 1985, at 66, 67.

[54] *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, 9 P.3d 1069, 1073 (Ariz. 2000) ("The boundary between surface water and groundwater is not at all clear. Most surface streams not only flow above the ground but also have 'subflow.'").

[55] Davis v. Agua Sierra Res., L.L.C., 203 P.3d 506, 508 (Ariz. 2009).

[56] Bristor v. Cheatham, 255 P.2d 173, 178 (Ariz. 1953).

[57] *Id.*

[58] *See* ROBERT GLENNON, WATER FOLLIES: GROUNDWATER PUMPING AND THE FATE OF AMERICA'S FRESH WATERS 206-07 (2002).

[59] Cally Carswell, *Death by a Thousand Wells: Unregulated Wells Strain Short Water Supplies in Washington's Yakima Basin and Throughout the West*, HIGH COUNTRY NEWS, Oct. 26, 2009, at 8, *available at* http://www.hcn.org/issues/41.18/death-by-a-thousand-wells.

[60] ARIZ. REV. STAT. ANN. § 45-454 (2010).

[61] *Id.*

[62] *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, 9 P.3d 1069, 1073 (Ariz. 2000).

[63] ARIZ. REV. STAT. ANN. § 45-251(2).

[64] *Gila River Sys.*, 9 P.3d at 1073-74.

[65] *Id.*

[66] ARIZ. REV. STAT. ANN. § 45-141(A).

[67] 1941 Ariz. Sess. Laws 179; McClellan v. Jantzen, 547 P.2d 494, 496 (Ariz. Ct. App. 1976).

[68] 1962 Ariz. Sess. Laws 265-66; *McClellan*, 547 P.2d at 496.

[69] ARIZ. REV. STAT. ANN. § 45-401(B).

[70] *Id.* § 45-401.

[71] *Id.* § 45-141(A).

[72] *Id.* § 45-151(A) (stating that beneficial uses include "domestic, municipal, irrigation, stock watering, water power, recreation, wildlife, including fish, nonrecoverable water storage pursuant to section 45-833.01 or mining uses, *for his personal use*, or for delivery to consumers" (emphasis added)); *cf.* Tulare Irrigation Dist. v. Lindsay-Strathmore Irrigation Dist., 45 P.2d 972, 1007 (Cal. 1935) (holding that water used solely to drown gophers was "not devoted to a beneficial use[,]" so the use did not confer rights against subsequent appropriators).

[73] *See generally* 1 ECOSYSTEMS AND HUMAN WELL-BEING (Rashid Hassan, Robert Scholes & Neville Ash eds., 2005).

[74] ARIZ. REV. STAT. ANN. § 45-103(B) ("The director has general control and supervision of surface water, its appropriation and distribution, and of groundwater to the extent provided by this title ....").

[75] Joseph M. Feller, *The Adjudication That Ate Arizona Water Law*, 49 ARIZ. L. REV. 405, 426-28 (2007).

[76] Davis v. Agua Sierra Res., L.L.C., 203 P.3d 506, 510 (Ariz. 2009); Town of Chino Valley v. City of Prescott, 639 P.2d 1324, 1329-30 (Ariz. 1981); Sw. Eng'g Co. v. Ernst, 291 P.2d 764, 768-69 (Ariz. 1955).

[77] *Davis*, 203 P.3d at 510.

[78] Gabel v. Tatum, 707 P.2d 325, 327 (Ariz. Ct. App. 1985).

[79] BODNER & SIMMS, *supra* note 2, at 34. *See* Maria E. Fernandez-Gimenez, Sonya Le Febre, Alex Conley & Amy Tendick, *Collaborative Stewardship of Arizona's Rangelands*, RANGELANDS, Dec. 2004, at 24, 30. *See generally* Kodric-Brown & Brown, *supra* note 1.

[80] ARIZ. REV. STAT. ANN. § 45-151 (2010); Phelps Dodge Corp. v. Ariz. Dep't of Water Res., 118 P.3d 1110, 1113 (Ariz. App. 2005).

[81] *See* SAX ET AL., *supra* note 40, at 246-56 (noting that because the ADWR acts as a permitting agency and water rights may be acquired in particularly wet years, a distinction is frequently made between "wet water" for which a physical supply actually exists,

and "paper water," permitted rights to water beyond the actual capacity of the river system); Donald J. Pisani, *Enterprise and Equity: A Critique of Western Water Law in the Nineteenth Century*, 18 W. HIST. Q., 15, 25 (1987) ("Moreover, 'paper claims' could be maintained for years through minimal work on ditches. This was one reason the Salt River in Arizona had been appropriated 25 times over by 1900 and the San Joaquin River 172 times over.").

82 ARIZ. REV. STAT. ANN. § 45-172(A).

83 *Id.*

84 Adam Schempp, *Western Water in the 21st Century: Policies and Programs That Stretch Supplies in a Prior Appropriation World*, 40 ENVTL. L. REP. NEWS & ANALYSIS 10394, 10402 (2010).

85 ARIZ. REV. STAT. ANN. § 45-101(A).

86 ARIZONA LAND SUBSIDENCE GROUP, LAND SUBSIDENCE AND EARTH FISSURES IN ARIZONA: RESEARCH AND INFORMATIONAL NEEDS FOR EFFECTIVE RISK MANAGEMENT 2 (2007), *available at* http://www.azgs.state.az.us/Resources/CR-07-C_Dec07.pdf ("Land subsidence and earth fissure formation in Arizona are the result of substantial groundwater withdrawal from aquifers in sedimentary basins. Subsidence frequently results in bowl-shaped depressions, with loss of elevation greatest in the center and decreasing towards the perimeter.").

87 ARIZ. REV. STAT. ANN. § 45-561(12).

88 ARIZ. REV. STAT. ANN. §§ 45-561(12), 45-562.

89 Tony Davis, *Cuts Put AZ Water Goals in Jeopardy: Key Agency Slashed as State Faces 2025 Deadline on Overpumping*, ARIZ. DAILY STAR, May 12, 2010, at A1 ("Department Director Herb Guenther, however, said the state won't meet the 2025 deadline with or without staff cuts because it lacks money to buy out water rights owned by farms."). *See also* Rita Pearson Maguire, *Patching the Holes in the Bucket: Safe Yield and the Future of Water Management in Arizona*, 49 ARIZ. L. REV. 361, 365-67 (2007).

90 Conrad Moore, *Declining San Pedro River: It's Not the Mesquite*, TROGON NEWS, March 2010, at 1 ("The only explanation for the nearly equal percentage loss of stream flow in late spring and winter is the expansion of the Sierra Vista groundwater depression cone from 5 square miles in 1968 to over 35 square miles in 2001 (AZ Department of Water Resources, 2005) as a result of increased groundwater pumping for residential and commercial use in the Sierra Vista area."); Conrad Moore, *The Impending Death of Southeastern Arizona's San Pedro River*, 24 F. ASS'N ARID LANDS STUD. 9 (2008).

91 ARIZ. REV. STAT. ANN. § 45-141(C); Phelps Dodge Corp. v. Ariz. Dep't of Water Res., 118 P.3d 1110, 1115 (Ariz. App. 2005) ("So long as utilization [of the legal water right] continues, the right remains secure." (quoting *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, 35 P.3d 68, 71 (Ariz. 2001)).

92 TROUT UNLIMITED, WYOMING WATER, WYOMING SOLUTIONS: PARTNERING FOR STREAMFLOW RESTORATION 5 (2006), *available at* http://www.tu.org/atf/cf/%7BED0023C4-EA23-4396-9371-8509DC5B4953%7D/WYWaterWYSolutions.pdf; *Finding Balance in the Basin: Annual Report Summary*, 2006 COLUM. BASIN WATER TRANSACTIONS PROGRAM 5.

93 *Finding Balance in the Basin: Annual Report Summary, supra* note 92, at 5.

94 *Id.*

[95] *Id.* at 7.

[96] *See generally* Dannele E. Peck, Donald M. McLeod, James R. Lovvorn & John P. Hewlett, Opportunity Costs of Water Leasing: Irrigation, Instream Flow, and Wetland Considerations in the Laramie Basin, Wyoming (July 13-16, 2003) (unpublished paper), http:// ageconsearch.umn.edu/bitstream/36034/1/sp03pe01.pdf.

[97] *Id.* at 1.

[98] *Id.*; Peck et al., *supra* note 47, at 848.

[99] Peck et al., *supra* note 47, at 846; Peck et al., *supra* note 96, at 4. *See also* K.A. Miller, *Managing Supply Variability: The Use of Water Banks in the Western United States, in* DROUGHTS: A GLOBAL ASSESSMENT 70, 70-86 (2000).

[100] Peck et al., *supra* note 47, at 847.

[101] *Id.*

[102] ARIZ. REV. STAT. ANN. § 45-141(C) (2010).

[103] *See* NEV. REV. STAT. § 533.060(2) (2010) (expressly rejecting the doctrine of forfeiture for nonuse); Schempp, *supra* note 84, at 10396.

[104] OR. REV. STAT. § 537.490(1) (2010); BRUCE AYLWARD, RESTORING WATER CONSERVATION SAVINGS TO OREGON RIVERS: A REVIEW OF OREGON'S CONSERVED WATER STATUTE 29 (2008).

[105] WASH. REV. CODE § 90.03.380(1) (2010).

[106] MONT. CODE ANN. § 85-2-419 (2010).

[107] N.M. STAT. ANN. § 72-5-18(c) (West 2010).

[108] *See* Schempp, *supra* note 84, at 10409-11.

[109] Ariz. Exec. Order No. 91-6, 91 Ariz. Admin. Reg. 58, 59 (Feb. 14, 1991), *available at* http:// www.adwr.state.az.us/Adjudications/documents/SPRNCADisclosureStatements/ASARCO3rdSupplementalDisclosure/ Document%20No.%2002.pdf.

[110] *See* Nabhan, Blair & Moroney, *supra* note 12 at 31; Tim LaSalle, *In Defense of the Cow: How Eating Meat Could Help Slow Climate Change*, TREEHUGGER, July 9, 2009, http://www.treehugger.com/files/2009/07/in-defense-of-the-cow-eating-meat-could-slow-climatechange.php; *cf.* Angelo, *supra* note 9, at 600 ("[C]urrent agricultural practices are significant contributors to greenhouse gas emissions believed to be linked to climate change.").

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