Water Rights for Wetlands in the Bear River Delta

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Distribution and Value of Utah Wetlands

Utah is best known for its stark rock formations, desert canyons, and arid climate. Utah's wetlands are uncommon oases in a desert land. **Wetlands** are ecosystems where flooding or soil saturation occurs during part of the growing season, leading to the development of **hydric soils** and the dominance of **hydrophytic plants**. Wetlands support a suite of organisms that are adapted to living in wet conditions, such as waterbirds, fish, amphibians, and **aquatic macroinvertebrates**. Wetland habitats are a vital resource for Utah's wildlife.

In Utah, as in much of the United States, wetlands are threatened by factors such as urban development, drought, and the increasing water demands of a growing population. Thirty percent of Utah's wetlands were lost to development and other uses prior to 1980 [1]. About 85% of Utah's remaining wetlands are located around Great Salt Lake (see map, p. 3) [2]. The Wasatch Front, east of Great Salt Lake, is the most populous region of the state, and wetlands will continue to be threatened by regional water development and urban sprawl.

Wetland loss in the United States

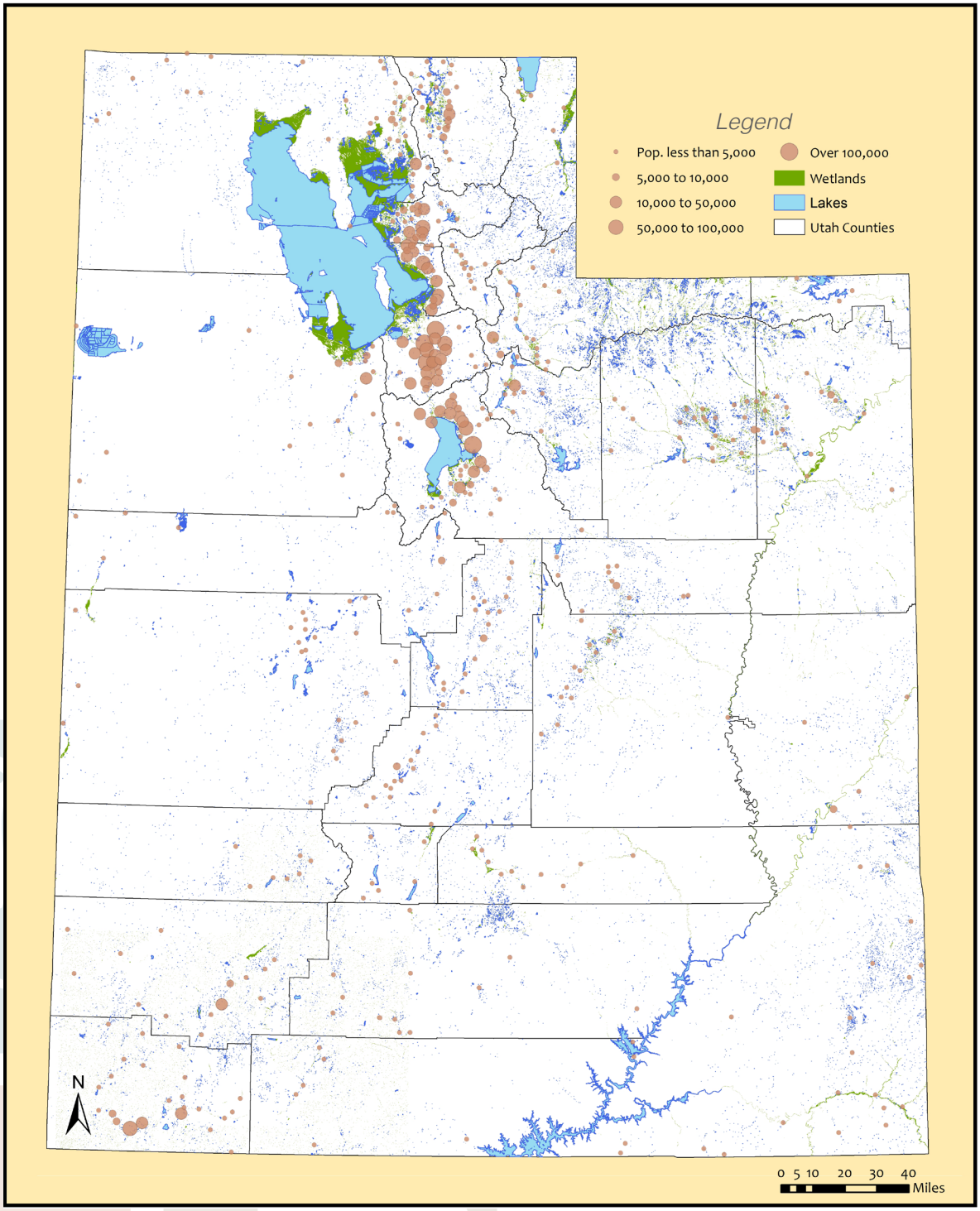
By 1980, we had lost over half of all wetlands in the country. [1]

Emergent wetland along the Wasatch Front.

Wetlands have great value to society. Some of the benefits wetlands provide to humans are hard to quantify, such as providing habitat for plants and wildlife, reducing the impact of floods and storms, improving **water quality**, and recharging groundwater systems. Other wetland services are easier to measure: hunting, fish production, and timber harvesting provide direct economic benefits. People also enjoy the aesthetic quality of wetlands and their associated wildlife.

Great Salt Lake wetlands are best known for their value to waterfowl and shorebirds. Each year, millions of ducks use Great Salt Lake and its wetlands on their migratory journey [2]. They are joined by tens of thousands of swans and geese and hundreds of thousands of shorebirds. Hunters, birdwatchers, photographers, and other wildlife enthusiasts value the robust bird communities and the opportunities they provide.

Distribution of Utah Wetlands and Cities



Distribution of Utah wetlands and human population areas. Wetland data based on National Wetlands Inventory Data published Mar. 2014 [3, 4]. Map by M. Frank.

Why Wetlands Need Water

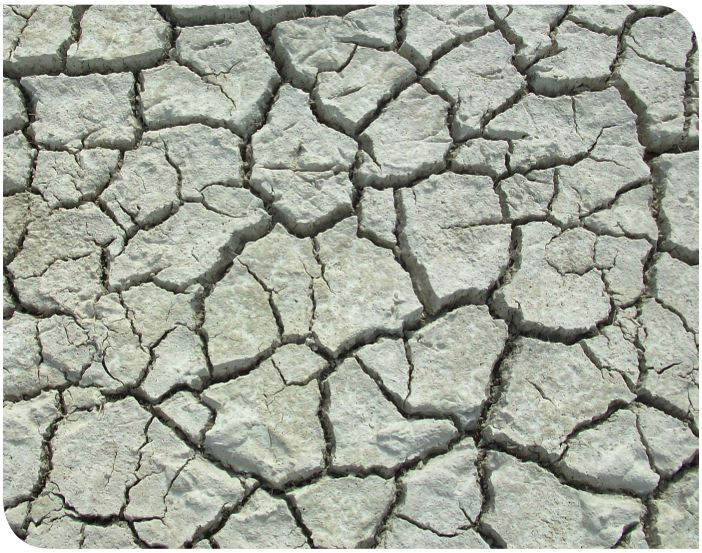
Within a wetland, variations in water depth and corresponding plant communities create microhabitats for a diverse assemblage of species. Birds, plants, and other species that live in wetlands are specially adapted to thrive in flooded environments. For instance, some wetland plants produce floating seeds that can travel on the water until they reach a suitable place to germinate [1]. Waterbirds such as grebes spend nearly all of their time in water, including using wetland vegetation to build floating nests. Herons wade through the shallows to search for fish. Even the tiniest wetland organisms such as microbes have adapted to the unique saturated conditions of wetlands.

Western grebe at Bear River Migratory Bird Refuge.

Wetlands Without Water

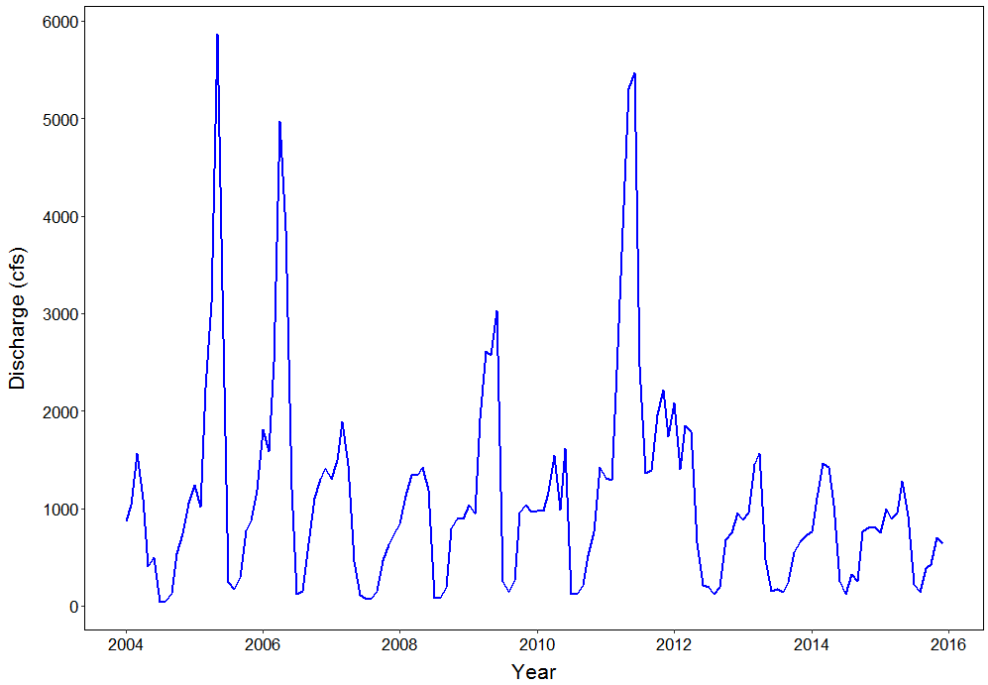
Unfortunately, life-giving water is not a certainty in Utah wetlands. Water may be diverted upstream of wetlands for use in agriculture, industry, power generation, or municipalities. In years of drought, upstream diversions can greatly reduce the amount of water flowing into Great Salt Lake wetlands.

Plants, fish, birds, mollusks, insects, and aquatic macroinvertebrates that usually live in wetlands are negatively affected when water is scarce. Even if

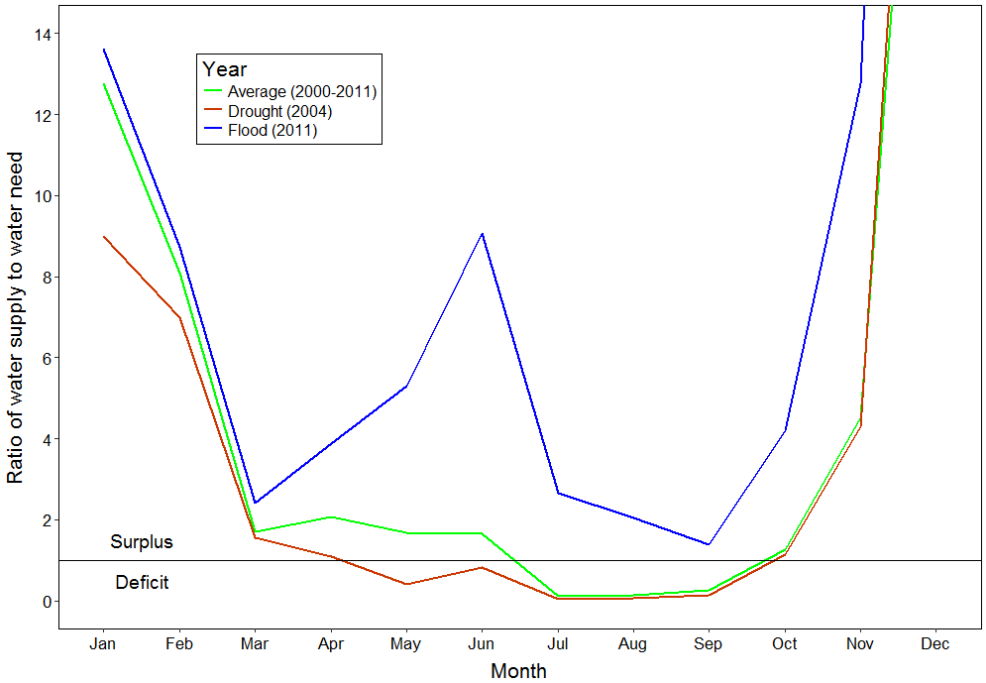


a wetland is not totally dry, a reduction in flow or sharp decrease in water levels can disrupt insect emergence and decrease the seedling survival of wetland plants [5]. Invasive species may colonize more successfully in a wetland that does not receive sufficient water [6]. In emergent wetlands of the Bear River Delta, areas that are dry (with the water table 30 cm or more below the soil surface) for a longer period of time have significantly higher non-native plant cover [7].

In the 1920s, so much water had been diverted from Bear River that the Bear River Delta shrank to less than 7% of its original acreage [9]. Only tiny pools of water remained for ducks and other birds to use. The lack of water and the crowded conditions were a recipe for disaster. An outbreak of avian botulism spread rapidly and killed hundreds of thousands of birds. This devastating event demonstrated the consequences of leaving wetlands without sufficient water and spurred action to create Bear River Migratory Bird Refuge [10].



Average monthly discharge from the Bear River. Flow from the Bear River varies seasonally and from year-to-year. Data obtained from the USGS flow gauge near Corinne, UT [4]. Graph by R. Downard.



During an average summer, managers expect approximately 75% of the refuge to go dry [8]. Graph adapted from [8] by R. Downard.

Impacts of European Settlement on the Great Salt Lake Watershed

Settlement and agriculture in an arid land

As Mormon settlers arrived in Utah in the mid-1800s, they established agricultural communities. Irrigating the desert required **diversion** of water. Most people settled where water and relatively flat land were readily available [11]. Settlements originally concentrated along the Wasatch Front, which is still the most densely populated area of the state [12, 13]. As the population grew, so did water infrastructure that allowed lands to be irrigated farther from water sources [13, 14].

Sharing a resource... and making a profit

Because water is scarce in the western U.S., laws were needed to regulate who got to use water and how much they could use. Following the example of mining claims, western states developed a **prior appropriation doctrine** for **water rights**. This is a "first in time, first in right" model where older rights have **priority** over recent ones.

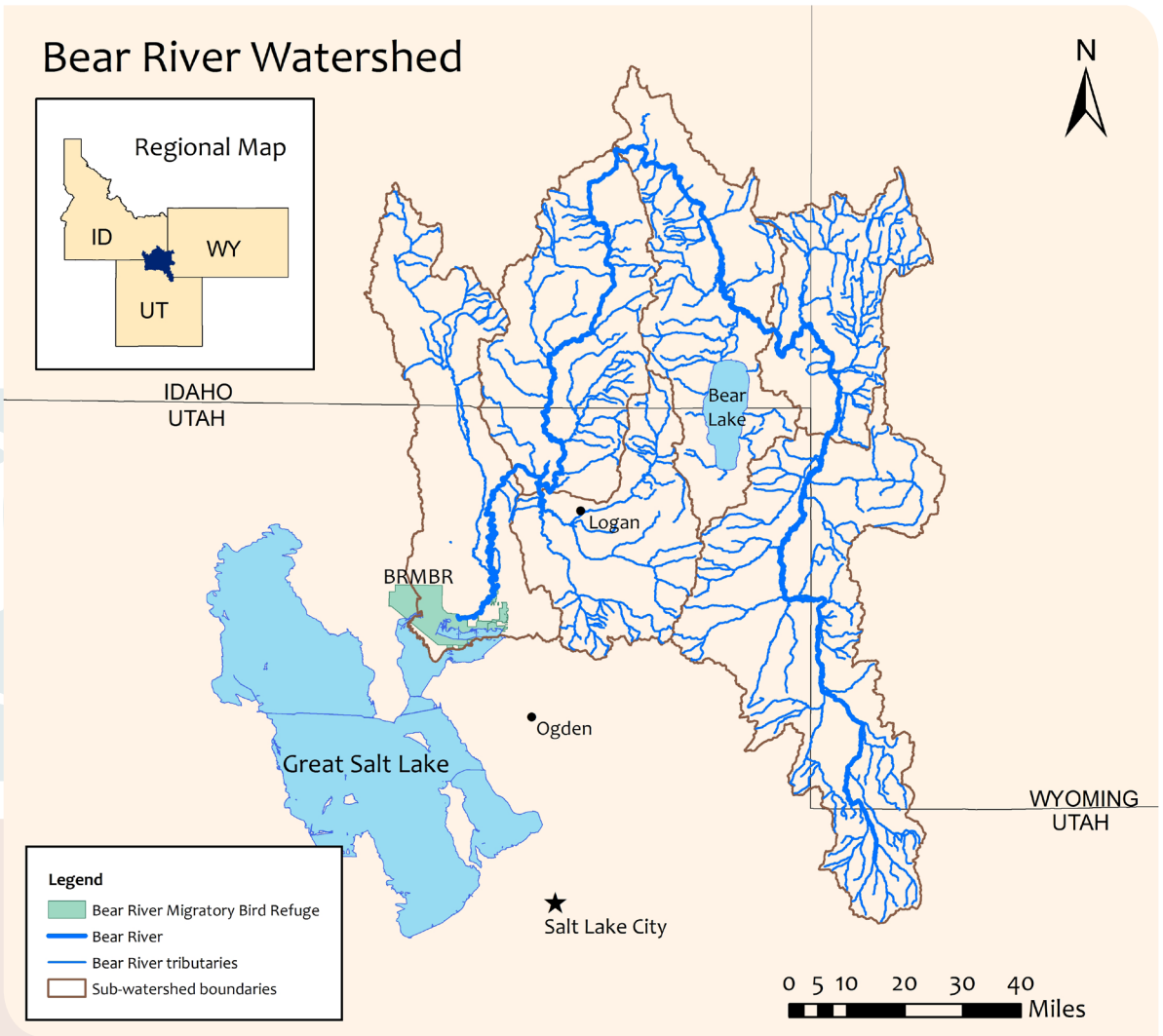
Before Utah became a state, the Mormon Church oversaw administration of all water rights [14, 15]. The church's goal was "making the desert bloom" with agriculture, so the church gave precedence to **irrigation** needs rather than mining uses, which often held the primary water rights claims in the West [15]. However, as in other western states, the **beneficial use** of water in Utah generally included economic-benefit uses. Irrigation water rights allowed crops to be grown to feed families and to make a profit. Non-economic uses of water, such as wetlands, were not originally considered to be beneficial uses (see sidebar). Utah's water rights were quickly divvied up for agriculture. The Utah legislature agreed to acknowledge the water rights previously allocated by the Mormon Church in 1897, one year after Utah became a state [14, 15].

But, what about wetlands?

Although water for wetlands can now be secured through wildlife water rights (see "Beneficial Use" sidebar, p.7), having sufficient water for wetlands was not historically a concern. Many settlers thought there was enough water to irrigate the entire western U.S. Major John Wesley Powell was one of the few people to recognize water scarcity and advocate careful water planning [16, 17, 18]. Most rivers in Utah were fully **appropriated** before society became concerned with environmental uses. Wetlands today are disadvantaged by their junior standing in water rights allocations [19].

Bear River Migratory Bird Refuge

The Bear River Migratory Bird Refuge (hereafter, the Refuge) is a large wetland complex managed by the U.S. Fish and Wildlife Service and located where the Bear River enters the northeast arm of Great Salt Lake. The Refuge was established in 1928 in an attempt to reverse the devastating effects of large (primarily agricultural) diversions that were depleting the Bear River Delta's vast wetlands. Managers created a network of dikes and canals that impound water from the Bear River [20]. This infrastructure allows the Refuge to hold on to plentiful water during spring snowmelt and then slowly draw down water during the dry summer months [8]. The impoundments create a complex of wetland units that can be managed at different water levels appropriate for a wide array of wetland plant communities [8]. In addition to building this infrastructure, Refuge managers have secured water rights to ensure legal protection for water to reach the Refuge [21].



Map of the Bear River Watershed showing the location of the Refuge [3, 22, 23, 24, 25]. Map by M. Frank.

What is a water right?

Water is a vital and much-contested resource requiring a policy and legal framework to ensure its fair distribution [26]. But the rules are not the same in all states. In the eastern United States, where water is relatively plentiful, water is regulated in a legal system based on the **riparian doctrine** that allows landowners next to waterways reasonable shared use of water for recognized purposes [27]. When there is a limited supply of water, users' rights generally are proportionally reduced. In this system, a right to use water is **appurtenant** to land ownership [27]. In contrast, most western states follow the prior appropriation doctrine, which gives priority access to water rights holders who first diverted water and continued to put the water to beneficial use. This prioritization system suits the West where water is scarce and well-defined rules are needed for how to distribute water during times of shortage. In this system, water is not tied to land adjacent to waterways, but can be diverted to the location(s) of beneficial use as specified in a water right [27]. The following pages provide an example of implementing the prior appropriation doctrine with water rights issued for Bear River Migratory Bird Refuge and neighboring water users.

A water right allows the owner to divert a specified quantity of water in a certain location for a specific purpose at a certain time under a determined priority.

Priority

If water supply is inadequate, water right priority determines which users have first access to the limited water. In Utah, priority of water use is determined by the date water was put to beneficial use (prior to 1903) or the date a water right application was filed (after 1903) [27, 28]. A water user with an older water right is senior to a junior user with a more recent water right. When there is not enough water for everyone, junior water rights holders are legally obligated to stop using water so that senior water rights may be satisfied, regardless of where the users are located on the stream. Thus, an upstream junior user may have to watch water pass by without diverting any so that a downstream senior user can access their full water right.

The Refuge's primary water right, 29-1014, has a priority of 1928 [21]. A duck club upstream of the Refuge has a water right with a 1971 priority date, making it a junior user to BRMBR. During a drought, the duck club may be required to cede water to the Refuge. One irrigation user further upstream has a priority of 1920, making it a senior water user to the Refuge and the duck club (see map on next page). During a severe drought, all senior users have priority on the limited water in the Bear River, while the Refuge and various duck clubs may only have "paper water" at that time.

"Wet water" vs. "paper water"

Priority date, location in the watershed, climate, and infrastructure can make the difference between having a water right (paper water) and actually having water (wet water).

Purpose and Time

The purpose of a water right dictates the specific activity for which water can be used [27]. In Utah, the purpose falls into one of seven categories of beneficial use. The type of beneficial use has important implications for the timing, duration, and quantity of water use. For instance, culinary and stock water can be used year-round because people and animals always need water. In contrast, irrigation water rights only permit water to be used during a specified growing season. The timing and duration of other beneficial uses are typically application-specific and may be subject to negotiation.

Beneficial Use

There are seven broad categories of beneficial use in Utah: domestic, municipal, agriculture, industry, recreation, wildlife, and in-stream. Within these seven categories, beneficial uses are further classified by specific use. For example, within agriculture there are stock water and irrigation uses. Each specific use is subject to different quantity, timing, and duration criteria.

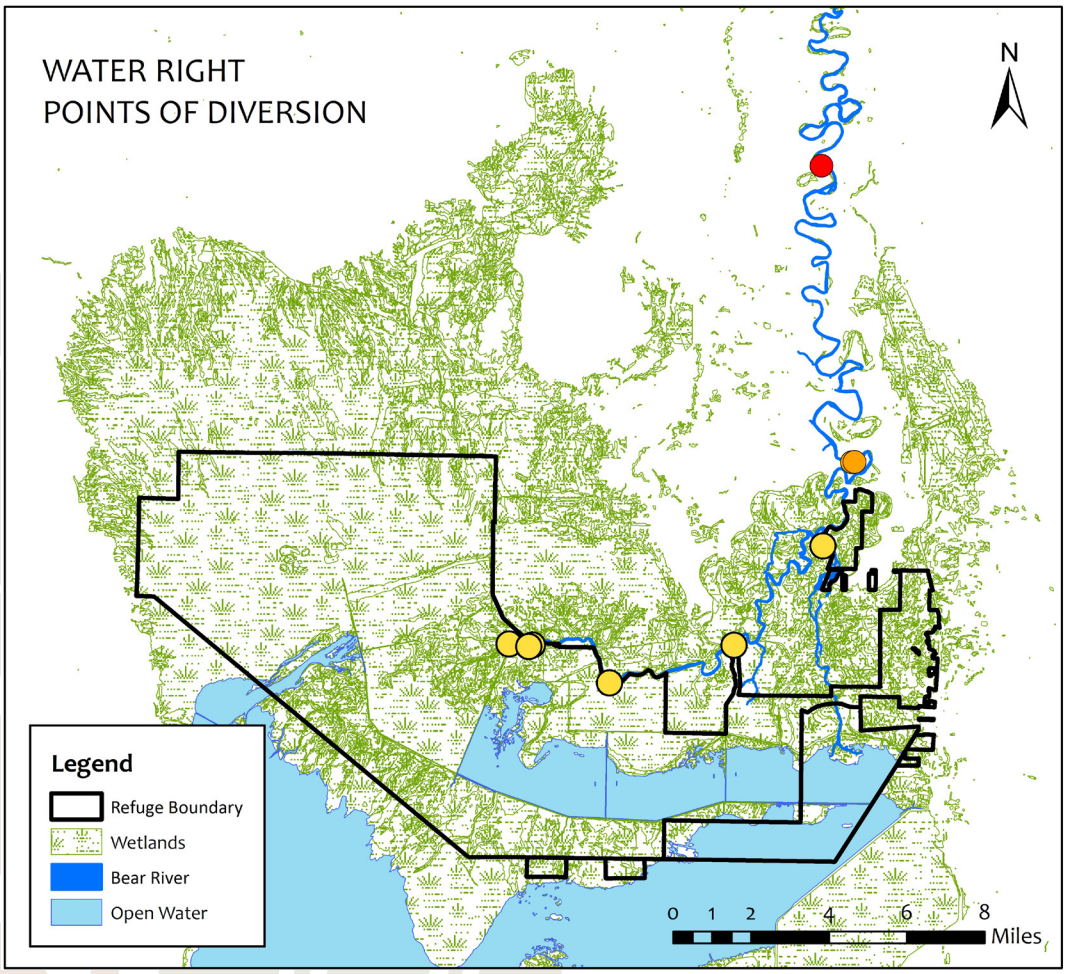
The Refuge's main water right specifies a wildlife propagation use for maintaining waterfowl habitat. Many of the Refuge's neighbors, including other wetland management areas such as duck clubs, have irrigation uses. The Refuge's wildlife propagation use allows the Refuge to divert more water from the river for a longer period of the year than agricultural irrigation use [21]. The Refuge carefully monitors water use and keeps detailed records on when water is most available and most needed [21].

Water is available year-round to the Refuge in specified monthly amounts [21]. In contrast, irrigation rights upstream of the Refuge can only withdraw water from April 1 to October 31. As a result, the Refuge often has the most water available outside the irrigation season.

Location

Location specifies the **point(s) of diversion** and place(s) of use for a water right [27]. A point of diversion is the location from which water specified in a water right may be sourced. There are different types of points of diversion. Surface diversions (e.g., from rivers, canals, and agricultural **return** flow) are the most common [27]. Place of use stipulates on which property water may be used.

The Refuge's primary water right has points of diversion along the lower part of the Bear River [21]. This water can then be used within the impounded wetlands of the Refuge, and can be diverted within the Refuge, according to management needs. While the Refuge has some flexibility in how to distribute its water, not all the nearby wetlands can benefit. The Refuge's place of use ends at its southernmost dike, so the wetlands beyond that point are not included in calculations of water need and have no legally protected water source [21].



Map of example water right diversion points for an irrigator (red), a duck club (orange), and the Refuge (yellow) [3, 29]. Map by M. Frank.

Quantity

The quantity of water diverted is also determined by beneficial use. Culinary use is usually unlimited because it is very difficult to specify universal guidelines on a household-by-household basis. Stock water is much simpler: each head of livestock is given a particular amount of water. Determining quantities needed for irrigation is a bit more complex. In Utah, crop demands for water are generally determined using estimates of the amount of water needed to grow alfalfa within each water-use region of the state. The demand of water for alfalfa has been used to set the **duty of water** and is often measured in **acre-feet** that can be applied to an acre of crops during the year (acre feet/acre/yr) [13]. Regional factors such as climate and elevation are then taken into consideration to define place-specific duties. Plant transpiration (water loss) is higher in hot and dry climates, so in these regions it takes more water to grow alfalfa. For most other beneficial uses, quantities are application-specific.

The Refuge's primary water right is allowed 425,771 acre-feet/year [21]. The timing and duration of the water right allow the Refuge to use water year round. The Refuge concentrates most of its water diversion during the spring and early summer, but also diverts over 100,000 acre-feet outside of the growing season, allowing the Refuge to utilize water when it is not needed for agricultural irrigation.

The duty of water for irrigators in northern Utah is generally 4 acre feet/acre [13]. The example water right directly upstream of the Refuge irrigates 90 acres, so a total of 360 acre-feet of water can be diverted by that user during irrigation season. Although the Refuge's right stipulates a higher duty of water, the Refuge does not always receive its full allocation of water due to its priority and location.

Protecting Wetlands at Bear River Migratory Bird Refuge

Challenges and Opportunities

A significant water management challenge along the Bear River is satisfying as many water rights as possible in the complex array of temporal priorities and geographic locations. Landowners who manage for wetlands must use their varied water rights as best they can to help maintain healthy wetland habitat. Bear River Migratory Bird Refuge has used Utah's water policy framework to try to ensure that the maximum amount of water reaches the Refuge at the end of Bear River. Since its establishment in 1928, the Refuge has acquired a portfolio of 28 water rights as the primary means of securing access to water for its wetlands [21]. However, particularly during drought years, these rights are not enough to meet the Refuge's water needs and many parts of the Refuge go dry. The situation for Great Salt Lake is even more challenging, as the lake does not have any water rights provisions. Bear River water will only reach Great Salt Lake when excess flow passes or leaves the Refuge.

Despite their junior water rights position, Refuge managers have used many strategies to safeguard water for their wetlands and meet the challenge of a variable water supply. One direct strategy is to acquire a more diverse water rights portfolio, which can be accomplished by purchasing water rights with nearby lands, buying shares in canal companies, and negotiating agreements for shared use of senior water rights [21]. Purchasing more senior water rights could potentially be very effective for the Refuge, but these rights can be very expensive. Another approach Refuge managers use to secure water is by filing diligence claims. A diligence claim is a legal way to prove that the wetlands were using water historically, and therefore have a right to use water in the future [21]. Refuge managers also participate in Bear River water right allocation meetings and often protest new water right applications that would negatively impact their ability to use their own water rights [21].

Refuge managers recognize that their access to water is determined by what happens upstream and have thus participated in many efforts to coordinate water management throughout the Bear River watershed, such as participating in the Lower Bear River water users group and coordinating with water users in Box Elder County [30]. Refuge managers have also partnered with powerful water users in the region, particularly irrigators, to try to ensure a more reliable water supply.

While early wetland losses in the Bear River watershed were linked to agricultural water diversions, the remaining wetlands are now highly dependent on agricultural return flow, which is the non-consumptive water that runs off agricultural areas [30]. During the late summer – a crucial wetland growing season as well as the period of highest irrigation need – most of the water in Bear River is return flow. Irrigators who recognize the importance of water to the maintenance of wildlife habitat try to accommodate the needs of the Refuge, so these relationships allow the Refuge to be flexible in their own water use [30].

Refuge managers are joining irrigators in addressing current and upcoming regional water supply challenges such as the conversion of agricultural

land to residential development, which can vastly reduce return flow [30]. Another serious threat to the Refuge and nearby wetlands is Utah's high per-capita water use and projected population growth. Proposed projects to solve these issues by creating upstream water storage and diverting Bear River water outside the watershed would greatly reduce the water available to important wetland habitats. Refuge managers are currently leading efforts to create a Bear River Conservation Area that would protect habitat along the whole river, secure voluntary agricultural land conservation easements (and their associated water rights) to protect return flows, and prevent water rights transfers that would remove water from the watershed [8, 30].

Final Remarks

In Utah, water for wetlands is not guaranteed. Wetland managers must understand and utilize complex water laws and regulations to sustain wetlands. In an environment where water is scarce, the rules about how, when, and where water is used have enormous implications for the survival of our wetlands. Utah's prior appropriation system for water allocation was adopted long before the needs of the environment were considered. Benefits of wetlands are now better understood and more valued, so managers must work within the legal system of water rights to make sure wetlands remain wet. Working within a system of water rights to protect wetlands has many challenges, particularly because most of the water was appropriated to meet economic needs, and thus given priority, before environmental needs were considered. Current predictions indicate that water supply constraints will increase in the future, due to factors such as climate change and increasing water demands to meet a growing human population and expanding economy. Given these challenges, it will become even more imperative for wetland managers to understand and utilize water law, cooperate with other water rights owners, and improve relationships among all water users to maintain wetland health and sustainability.

Glossary of Terms*

Acre-Foot (AF)
Unit commonly used to measure volume of water; equal to 43,560 cubic feet, or 325,851 gallons (will cover 1 acre 1 foot deep).

Appropriate
To initiate a water right by requesting and receiving permission to beneficially use public waters.

Appurtenant
Belonging to.

Aquatic macroinvertebrates
Invertebrates that live in the water and are big enough to be seen without a microscope, e.g., the larvae of dragonflies and midges.

Beneficial Use
Use of water for one or more of the recognized purposes including but not limited to domestic, municipal, irrigation, hydropower generation, industrial, commercial, recreation, fish propagation, and stockwatering; it is the basis, measure, and limit of a water right.

Diligence Claim
A claim to the use of surface water where the use was initiated prior to 1903.

Diversion
Removal of water from its natural source; turning aside or alteration of the natural course of a flow of water, normally considered physically to leave the natural channel.

Duty of Water
Quantity of water, determined by the State Engineer, required to satisfy the irrigation water requirements in a given area; based on the irrigation requirements of alfalfa.

Hydric Soils
Soils formed in very low-oxygen (anaerobic) conditions due to seasonal or permanent saturation with water.

Hydrophytic Plants
Plants that have special adaptations to living in water or in saturated soil.

Irrigation
The controlled application of water to land to supplement that supplied by nature.

Point of Diversion
Point specified in a water right from which water is diverted from a source.

Prior Appropriation Doctrine
Legal system for allocating water, used in most western states. "First in time is first in right" means that the first person to take a quantity of water and put it to beneficial use has a higher priority than a subsequent user.

Priority
Concept that the person first using water has a better right to it than those commencing use later.

Return Flow
Part of a diverted flow that is not consumptively used and returns to its original source or another body of water.

Riparian Doctrine
Legal system for allocating water in the eastern United States where ownership of land along a stream, river or lake is an absolute prerequisite to a right to use water from that source. Each landowner has an equal right to make reasonable use of the water.

Storage
Water artificially impounded in surface or underground reservoirs for future use; water naturally detained in a drainage basin.

Water Quality
Term used to describe the chemical, physical, and biological characteristics of water in respect to its suitability for a particular purpose.

Water Right
The right to use water diverted at a specific location on a water source, and putting it to recognized beneficial uses at set locations.

Wetlands
Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support the development of hydric soils and the growth of hydrophytic plants.

**All terms from "Glossary of Water Words," Utah Division of Water Rights. Available from: http://www.waterrights.utah.gov/wrinfo/glossary.asp*

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