

Chapter 1

LAND



Key issues facing Utah's land

- 1.A PROTECTING UTAH'S RANGELANDS FROM ADVERSE IMPACTS OF WILDFIRE**
- 1.B CANAL TRAILS FOR IRRIGATION AND ACTIVE TRANSPORTATION**
- 1.C UNDERSTANDING THE POTENTIAL COSTS OF BUY-AND-DRY**
- 1.D BALANCING HEALTHY ECOSYSTEMS IN UTAH DRILLING AREAS**
- 1.E BIOCHAR OFFERS A LOW-TECH TOOL TO AID IN UTAH'S WASTE WOOD DILEMMA**
- 1.F UTAH'S AGRICULTURAL FUTURE REFLECTED FROM HERITAGE**

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Chapter Summary *by BRIAN STEED*

Over past decades, our relationship with the land has been changing. As Utah has become increasingly urbanized, with demographic trends indicating a sustained move away from rural/agricultural life, our attitudes and opinions about management of Utah's lands have become more diverse.

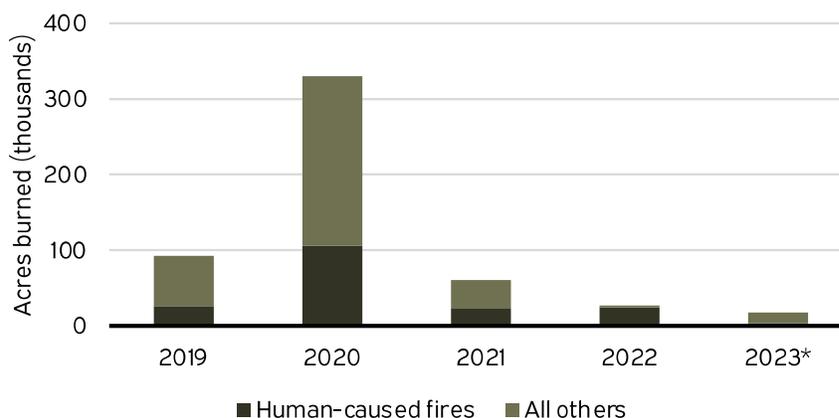
Many in our state treasure landscapes more for their ecological and recreational amenities than for their raw natural resource benefits. Agriculture is still highly valued but is often praised equally as a source of open space, as well as its economic importance. These changes create interesting management challenges.

One example of a land management challenge is our efforts in wildfire mitigation. Over the last five years, we've been largely spared from disaster fires, but it could take significant management of our open spaces to maintain that trend.

Local populations away from the urban centers often feel like they do not have sufficient influence over the decisions made by the state or federal government impacting the landscapes in their regions. Similarly, local economic needs are often much more reliant on actively using the land, rather than recreating on or occasionally visiting it.

As we make land-use decisions, we must understand these differing viewpoints and trade-offs. When it comes to wildfire, extractive industry, and urban community management, among other issues, we can work to create solutions that maximize benefits from the things we value most. In the following sections, we explore some of the recent insights on how we can improve landscape conditions, increase recreational opportunities, and allow continued, yet wiser, resource use across Utah.

Figure 1.1.1 Acres burned by wildfire in Utah (2019–2023)



*Source: National Interagency Coordination Center, Utah Fire Info *2023 provisional numbers*





RANGELAND

by MARK BRUNSON and EUGENE SCHUPP

1.A Protecting Utah's rangelands from adverse impacts of wildfire

TAKEAWAY» Carefully selected fuels-reduction practices can lessen the impact of wildfire on Utah's rangelands.

In Utah's west desert, weedy Eurasian grasses such as cheatgrass and expanding pinyon-juniper woodlands are displacing native sagebrush, bunchgrasses, and wildflowers. As a result, wildfires are much more common, sometimes burning thousands of acres, threatening ranching livelihoods, rural communities, water and air quality, and recreational opportunities.

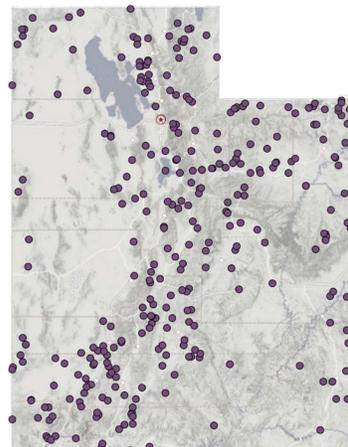
Fires are inevitable in an arid landscape with summer lightning storms and growing recreation use. As part of the Sagebrush Steppe Treatment Evaluation Project (SageSTEP), Utah State University is helping

land managers find tools to protect rangelands and people from wildfire's worst impacts with the fewest unintended negative consequences. Student crews from USU and the U.S. Geological Survey gather data annually from a network of 21 experimental sites across the Great Basin region from Beaver, Millard, and Tooele counties to eastern Oregon and Washington. At each site, experiments were created to understand both positive and negative effects over time of proactive practices such as herbicide spraying, mowing, tree removal, and prescribed burning to reduce the fuels that feed rangeland fires.



NATIVE SAGEBRUSH | RICH COUNTY

Figure 1.A.1 Current terrestrial treatment areas with Utah's Watershed Restoration Initiative



Source: wri.utah.gov

Table 1.A.1 Remedies for pinyon and juniper tree expansion in the Great Basin

In the past 100 years, pinyon and juniper trees have expanded their historic range, partly because wildfires have been suppressed, and partly because there are fewer grasses to carry fire between trees because of grazing. These trees are using more water, out-competing other plants, and changing the ecosystem, leading to some fairly serious consequences. The following table outlines the impacts of three management remedies.

PRESCRIBED FIRE	CUTTING	SHREDDING
Prescribed fire reduces both trees and shrubs. Areas treated with prescribed fire have lower shrub cover than those treated with cutting or shredding even six years after treatment.	Clearcutting uses chainsaws to cut trees taller than half meter, and leaves them where they fall. It can reduce tree cover to less than one percent of what it was before treatment.	During mastication, live trees are shredded with a spiked, rotating drum attached to a tractor. It can be done any time the soil is dry enough to avoid excessive compaction.
Prescribed fire, and mechanical treatments like cutting and shredding, reduce the number of encroached trees. This increases the time that soil water is available to other plants in the spring, which increases grass and shrub growth and cover. Water and available nutrients become available to both desirable native grasses and unwanted weeds like cheatgrass.		
Prescribed fire removes live trees and consumes much of the wood on the ground, allowing later wildfires to be less intense and less severe.	Cutting and shredding are more flexible, more controlled, and less risky than prescribed fire. They reduce canopy fuels and allow easier wildfire suppression, and can be done any time of year, as long as the ground is not too wet.	
Prescribed fire causes short-term increases in runoff and soil erosion. But this should be evaluated in the context of the big picture—avoiding more serious consequences of encroachment and wildfire.	Mechanical treatments like cutting typically double or triple the amount of small down wood that could burn during a wildfire, particularly in older woodland stands.	Shredding produces mulch that can increase water infiltration rates and reduces erosion. Shredding also aids in wildfire suppression by bringing the fire from tree tops to the ground.
Warm and dry sites are not well-suited to prescribed fire, especially if native grasses are missing from the understory	The burnable mulch left after shredding and the downed wood from cutting can increase the risk of high-temperature ground fires, which may damage desirable plants and seeds by causing the fire on the ground to burn hotter and longer.	
Treatment of any kind increases burnable grass fuels, especially in older stands, probably because the removal of woody vegetation results in an increase in soil water during the growing season, which can be captured by grasses and flowering plants like forbs as they grow to re-claim the site.		
To best maintain and increase cover, sites should be treated before the encroaching tree cover approaches 20% (to maintain shrubs) or 45% (to maintain grasses and forbs). These sites will have more surviving native plants at the onset, which will help prevent a cheatgrass invasion later.		

Source: sagestep.org

The emerging results are complex, and the best management for a site depends on the current make-up of the vegetation, elevation, and other factors. By applying study findings to their specific circumstances, land managers can create a landscape more resistant to weed invasion and more resilient after a wildfire. Since 2006, SageSTEP scientists have

informed management strategies used by the U.S. Forest Service and Bureau of Land Management in sagebrush rangelands. Research has also helped to set guidelines for selecting the right treatment at a given site and is used regularly to guide the work of organizations such as Utah's groundbreaking Watershed Restoration Initiative.

RESIDENTIAL LAND

by *PATRICK SINGLETON* and *ALFONSO TORRES-RUA*

1.B Canal trails for irrigation and active transportation

TAKEAWAY» Trails associated with canals can be a win-win solution by promoting healthy transportation and conserving water.

Community planners have increasingly been asked to provide additional active transportation options. Siting trails is often very complicated. Irrigation canals offer unique opportunities for connecting communities with walking and bicycling trails. Canal trails encourage physically-active transportation and outdoor recreation and are especially relevant given the 2023 passage of S.B. 185, a transportation amendments bill that established the Active Transportation Investment Fund and authorized a statewide trail network for walking and bicycling between communities.

Some trails are next to an open channel, and others are above an enclosed canal. Covering a canal conserves water by reducing seepage and evaporation. It also improves water quality and lowers maintenance costs. Although enclosure is expensive, several state and federal funding programs are

available. Some funding sources prioritize projects with recreational trails.

Trails offer many co-benefits for canal operators. They may help with maintenance (trash and weeds), community policing, and documenting/preserving the right-of-way. Of course, there are challenges to overcome, including gaining approval from landowners, limiting legal liability, ensuring canal maintenance can occur, designing safe street crossings, and addressing privacy concerns. Luckily, there are many case studies on how canal trails can be successfully built and operated in Utah.

Utah's nearly two-dozen canal trails come in all shapes and sizes, from the hugely popular Murdock Canal Trail covering 17 miles through Utah County, to the quarter-mile trail along the "Kids Canal" in Vernal.



COVERING A CANAL CONSERVES WATER BY REDUCING SEEPAGE AND EVAPORATION. IT ALSO IMPROVES WATER QUALITY AND LOWERS MAINTENANCE COSTS.

Table 1.B.1 Canal trails in Utah (June 2021)

CANAL TRAIL	TRAIL SPONSOR	CANAL
Smithfield Canal Trail	Smithfield City	Logan, Hyde Park, Smithfield Canal (Cache Highline)
Lundstrom Park and Highline Canal Trails	Logan City	Logan, Hyde Park, Smithfield Canal (Cache Highline)
North Ogden Parkway	North Ogden City	Ogden-Brigham Canal
West Haven Canal Trail	West Haven City	Wilson Canal (South Branch)
Clearfield Canal Trail	Clearfield City	Davis and Weber Canal
200 South Trail	Clearfield/Syracuse	Clearfield Irrigation Company
Clinton Canal Trail	Clinton City	Clinton Creek (Drain)
Onion Parkway Trail	West Bountiful	DSB Canal Drain
Redwood Trail	Salt Lake County	Brighton North Point Canal
Utah & Salt Lake Canal Trail	Salt Lake County	Utah & Salt Lake Canal
Phebe Brown Trail	Draper City	East Jordan Canal
Oquirrh Mountain Trail	South Jordan City	Welby Jacob Canal
Draper - Sandy Canal Trail	Draper/Sandy	Former Draper-Sandy Canal
Canal Trail	Sandy City	East Jordan Canal
Murray Canal Trail	Murray City	Jordan and Salt Lake Canal
Jacob Canal Trail	Saratoga Springs	Welby Jacob Canal (South)
Murdock Canal Trail	Utah County	Murdock Canal
Mapleton Lateral Canal Trail	Mapleton City	Mapleton Lateral Canal
Kids Canal Trail	Vernal City	Ashley Central Canal



AGRICULTURAL LAND

by SHERZOD B. AKHUNDJANOV

1.C Understanding the potential costs of buy-and-dry

TAKEAWAY» Examining the limitations of water markets in adapting to changing water availability can help us understand their potential role in addressing growth and climate variability.

Growing urban populations and shifting climatic patterns drive the need for flexible use of markets to reallocate water in arid regions. In the American West, like many arid regions, irrigated agriculture accounts for up to 80% of water consumption. Water trading between agriculture, urban, and commercial uses offers large potential gains to both buyers and sellers.

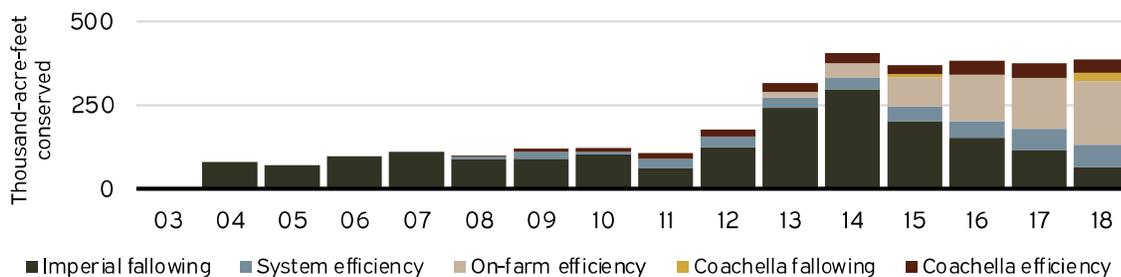
However, local impacts on water-exporting areas are often neglected in economic analyses of water markets. Local opposition to water markets has historically been strong, focusing on potential job losses and limits on future economic development in the originating region. Water transfers have been derisively referred to as “buy-and-dry” due to their perceived fiscal and environmental depletion of the selling regions. These concerns have been expressed as Utah discusses water transfers from agriculture to urban areas or other needs.

Analysis of such water transfers in other areas in the U.S. provide insight to help Utah avoid pitfalls. In

looking at the transfer of agricultural irrigation water from Imperial County to urban uses in San Diego County, California, we see immediate loss of harvested acres, declines in agricultural employment, a widening skilled/unskilled work wage gap, and a significant rise in air pollutants (PM₁₀ and PM_{2.5}) caused by reduced inflows into the Salton Sea—a large terminal saline lake once maintained by return flows from irrigated agriculture. A back-of-the-envelope calculation suggests health costs due to dust are of the same magnitude as the annual revenue of the water sale in some years.

Smoothly operating markets offer significant efficiency advantages over other means of allocation. Our work emphasizes the importance of assessing costs and impacts of environmental and financial externalities associated with market-based resource allocation. Water markets can be designed to maintain ecosystem services and generate gains from trade. Doing so in this case appears to be a more cost-effective approach than a moratorium on transfers.

Figure 1.C.1 Water conservation in the Imperial Irrigation District in California





**AGRICULTURE TO URBAN
WATER TRANSFER RESULTED
IN IMMEDIATE LOSS
OF HARVESTED ACRES,
DECLINES IN AGRICULTURAL
EMPLOYMENT, A WIDENING
SKILLED/UNSKILLED WORK
WAGE GAP, AND A SIGNIFICANT
RISE IN AIR POLLUTANTS.**



Table 1.D.1 Rare plants studied in the Colorado Plateau

- Rabbit Valley gilia
- Horseshoe milkvetch
- Hamilton's milkvetch
- Isely's milkvetch
- Heliotrope milkvetch
- Cisco milkvetch
- Oilshale cryptantha
- Fragrant cryptantha
- Jone's waxdogbane
- Maguire's fleabane
- Flat-top buckwheat
- Uinta Basin waxfruit
- Barneby's pepperwood
- Trotter's alpineparsley
- Despain's pincushion
- Winkler's pincushion
- White River beardtongue
- Flowers' beardtongue
- Gibben's beardtongue
- Uinta Basin beardtongue

1.D Balancing healthy ecosystems in Utah drilling areas

TAKEAWAY» A new strategy offers a way to reduce potential conflict between conservation and development priorities on the Colorado Plateau by helping managers optimize decisions on the placement of infrastructure to minimize impacts on rare plants.

The Colorado Plateau hosts unique and valuable resources—a diverse set of extensive oil and gas deposits and rare plant species. As a high-value resource, deposits have spurred significant investment in the region by extractive industries—including 99,000 oil and gas well pads. This infrastructure can create significant impacts on the biodiversity of the area, especially for the 20% of endemic Colorado Plateau species classified as rare.

A new strategy offers a way to reduce potential conflict between conservation and development priorities by helping managers optimize decisions on the placement of infrastructure to minimize impacts on rare plants. The model uses information about existing plant distributions and spatial optimization data to identify defined locations that conserve sufficient

habitat for rare plants while still accounting for and minimizing disruption to oil and gas development. With such an approach, it is possible to maintain relatively high levels of plant conservation at a minimal cost to the industry. The model identifies 2% of the total area where effective management could protect 30% of the distribution of all 29 rare plant species. By prioritizing and protecting these ecologically important locations, restoration costs could be kept low while protecting a minimum population of genetically unique rare plants, impacting 522 oil and gas well pads of the 99,000 existing sites (less than 1%) on the Colorado Plateau. No solution can completely meet objectives for both plant conservation and energy extraction, but where there is direct conflict, this model can help land managers accommodate a level of balance.

LEFT: HIGH-DENSITY DRILLING AREA | CARBON COUNTY, BELOW: ACTIVE DRILL PAD | CARBON COUNTY



FORESTED LAND

by DARREN MCAVOY

1.E Biochar offers a low-tech tool to aid in Utah's waste wood dilemma

TAKEAWAY» The simple process of biochar production has significant potential toward managing waste wood on Utah lands, benefiting soils, and reducing the amount of carbon added to the atmosphere from wildfire and natural decay.



As society looks to reduce carbon output, one simple practice offers the dual benefit of capturing carbon and providing a tool for forest managers on Utah's landscapes. Biochar production is the relatively simple process of converting waste wood into a charcoal-like product through low-oxygen burning. If downed wood burns or decays in open air, the carbon contained in that material is added to the carbon load of the atmosphere. But through the biochar process, about one third of that carbon can be preserved and stored in soils for centuries—and can immediately benefit soil productivity and water retention.

Biochar materials are around 85% pure carbon, and can be added to soil to increase plant productivity (in most cases) and significantly increase water holding capacity.

The Utah Biomass Resources Group (UBRG) has taught biochar production through workshops and demonstrations in 10 Utah counties and in four surrounding

states over the last decade. The low-tech process of biochar production is possible for anyone who manages Utah's lands—homeowners, farmers, ranchers, or forest managers—and training can help to inform on issues like air quality considerations, permissions, and risks. The entry cost is reasonable, and the process is easy to learn.

UBRG has focused on the on-site production of biochar, and has developed tools like the Big Box biochar kilns. These kilns are purpose-built metal boxes the size of dumpsters that can be used to burn forest waste in a controlled way, and then to completely extinguish the coals with water. While producing biochar is still more expensive than simply burning material in place, its widespread adoption could be a broadly accessible means of working toward a healthier climate and provide another marketable product from forest management.

THIS PROMISING LOW-TECH PRACTICE CAN ACTUALLY REMOVE EXISTING CARBON FROM THE ATMOSPHERE AND STORE IT IN SOILS FOR THE LONG TERM, WHILE ALSO MANAGING FUEL LOADS ON UTAH LANDS.





1.F Utah's agricultural future reflected from heritage

TAKEAWAY» Utah's agricultural legacy, rooted in the diligence of pioneers, continues to thrive through modern sustainability practices, emphasizing the enduring importance of local food production while balancing environmental stewardship and economic stability.

Utah's agricultural legacy traces its roots back to the pioneers who arrived in the Salt Lake Valley in 1847. These early settlers faced countless challenges, but their determination to till the soil, divert water, and cultivate crops laid the foundation for a robust agricultural industry and thriving Utah communities. Today, while society has evolved, the fundamental need for food production remains a constant, and Utahns recognize the significance of local food sources.

Beyond providing local food, Utah's farmers and ranchers play a multifaceted role in the state's landscape. They serve as stewards of the environment, working to preserve wildlife habitats, sequester carbon, and maintain water resources. Their efforts bolster rural communities, offering economic stability and alleviating the pressures of urbanization. Moreover, the agricultural sector instills vital values, emphasizing hard work, responsibility, and civic duty.

In this modern age, sustainability and innovation have become key tenets of Utah's agricultural practices. Farmers leverage cutting-edge technology, including advanced equipment, precision farming tools, and biotechnology, to optimize resource utilization. These innovations enable farmers and ranchers to produce

more food while minimizing environmental impacts, including reducing water and fertilizer use. On the state level, the management of water resources remains a paramount concern. Initiatives such as the Ag Water Optimization grants and efforts to conserve the Great Salt Lake underscore the importance of responsible water management. Additionally, measures are in place to safeguard the agricultural industry, including preserving agricultural lands, promoting local food processing, and reinforcing property rights.

At the national level, broader concerns come into play. These encompass risk management, transparency in beef pricing, and addressing food insecurity. There's a push to modernize the farm bill, enhance transparency in milk pricing, and expand nutrition programs. Trade-related issues, water regulation, and emissions reductions also feature prominently.

Utah's agricultural heritage stands as a testament to adaptability and resilience. While we honor the past, we also need to protect the future of local food production in Utah. With continued support, Utah's farmers and ranchers will continue to sustain local communities and preserve our precious natural resources.

**SUSTAINABILITY AND INNOVATION
HAVE BECOME KEY TENETS OF
UTAH'S AGRICULTURAL PRACTICES.**

UTAH'S LAND

in the news

As we've tracked Utah and national news through 2023, we have compiled some of the key land issues and topics that have appeared in media outlets this year.

01. PUBLIC LANDS CONSERVATION

The proposed BLM Public Lands Rule would put conservation on an equal footing with other land uses on federal public land. Proponents of the rule believe that it will help ensure healthy landscapes, abundant wildlife habitat, clean water, and balanced land-use decision-making. Others oppose the option for leasing land for conservation, which could limit recreation, mining, energy extraction and livestock grazing.

02. CHALLENGES OF A WET WINTER

In addition to water impacts, Utah's historic winter dramatically affected the state's public and private lands. In agriculture, crop planting was delayed and livestock births were endangered. In recreation, campsites and other areas were delayed in opening, but ski resorts had skiable snow well into the summer months. In towns and cities, some homes and neighborhoods were damaged by flooding, and Sugarhouse Park was temporarily turned into a lake.

03. NATIONAL PARK CROWD MANAGEMENT

In an effort to create a better experience for the millions of visitors to Utah's "Mighty 5," a number of management efforts have spread out the visitor experience. Highlights include timed entry at Arches National Park and the pilot permit program for Angel's Landing at Zion National Park. Early results suggest these changes have been well received.

04. ANOTHER YEAR OF REPRIEVE FOR WILDFIRES IN UTAH

Despite unprecedented wildfires elsewhere in the hemisphere, including the Canada fires and the destruction of Maui's Lahaina, Utah's wildfires were mild in impact and even neighboring smoke hazed Utah skies for only a few days this year. At the same time, state agencies are still engaged in programs to reduce fuels for coming years.

05. WILDLIFE AFFECTED BY WATER

Some wildlife were significantly impacted by Utah's wet winter, including mule deer in northern Utah who had a nearly 100% fawn mortality rate. Bird species benefited from increased water to wetlands near the south arm of Great Salt Lake, while white pelicans on Gunnison Island on the north arm saw a higher mortality rate, as Gunnison Island is still connected to the mainland and its predators. Also, 2023 will be remembered as year of grasshoppers.



What's going on in Utah's land, water and air?

We publish a weekly email newsletter, containing a categorized roundup of about 30 stories in local and national media outlets related to Utah's land, water, and air. Subscribe at: usu.edu/ilwa/newsletter.





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