2024 REPORT TO THE GOVERNOR AND LEGISLATURE ON

UTAH'S LAND WATER & AIR

Janet Quinney Lawson
Institute for Land, Water & Air
UtahStateUniversity

SALT FLAT ROAD NORTH OF GREAT SALT LAKE | AARON FORTIN

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Janet Quinney Lawson
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Utah State University and the Janet Quinney Lawson Institute for Land, Water, and Air will focus on convening the right stakeholders to better understand daunting challenges facing Utah. We welcome the input and partnership with local government policymakers, state agencies, industry and community innovators, nonprofits, elected officials, and our colleagues at other institutions of higher education. Together, in a collective approach, Utah can position itself to best address complicated problems.

References in this report are formatted in APA style.

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ELIZABETH CANTWELL

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As Utah's land-grant institution, Utah State University (USU) carries a profound responsibility to serve the people and communities of Utah through research, teaching, and engagement. It is central to our mission to drive innovation, solve critical problems, and strengthen the resilience of our state. At USU, we are proud of our role as a catalyst for positive change, leveraging our diverse expertise across disciplines and colleges to meet Utah's evolving needs.

Through the Janet Quinney Lawson Institute for Land, Water, and Air, USU embodies the ideals of our land-grant mission. The institute draws upon the knowledge and skills of our faculty, researchers, and students from across every academic college—integrating science, technology, and the humanities—to address the complex challenges associated with Utah's natural resources. Whether tackling the future of our water resources, improving air quality, or advancing sustainable land practices, USU is at the forefront of creating solutions for the state.

Our work extends beyond the campus. We are committed to serving the public, building stronger communities, and driving innovation that will benefit generations to come. We form partnerships with state agencies, corporate entities, non-profits, and communities across Utah to ensure that our research is actionable and has a tangible, lasting impact. Through this collective effort, USU not only advances the prosperity and well-being of Utah today but also ensures a vibrant and sustainable future for the state.

As we present this year's report to the Governor and Legislature, I am filled with optimism about the path ahead. USU will continue to be a force for innovation, collaboration, and service. Together, we are creating a more prosperous Utah—one that is built on the pillars of research, education, and community engagement.

BRIAN STEED

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At the Janet Quinney Lawson Institute for Land, Water, and Air, we are focused on supporting Utah's land, water, and air resources for today and for future generations. This year, we have launched a 1,000-day strategy to guide our work and expand our impact across the state. Our five pillars are: (1) Serve as Utah's trusted source for land, water, and air expertise; (2) Expand capacity for research and impact; (3) Build professional development opportunities for students; (4) Facilitate innovation in the business community around land, water, and air issues; and (5) Provide convenings and trusted thought leadership on these critical topics.

We have been privileged to work on key projects this year, including the Great Salt Lake Strike Team, the Colorado River Collaborative, the Bear Lake Needs Assessment, and the Air and Water Innovation Grant Program. These initiatives were successful because of our partnerships with state agencies, corporate collaborators, newsrooms, and non-profits, underscoring the importance of cross-sector collaboration in solving Utah's biggest challenges.

This year, we have also added a new section to the report, compiling key land, water, and air metrics. This data-driven approach provides a broad picture of our state's natural resource challenges, and we anticipate growing this section in future reports as a vital tool for decision-makers.

As we look ahead, our vision is to grow the institute dramatically, deepening our connections and service to the state. Our goal is clear: to create a future where Utah is prosperous, vibrant, and resilient for generations to come. By continuing to engage with all of our partners and by fostering innovation and sustainability, we believe this vision is within reach.

Executive Research Summary

This report serves as a 2024 snapshot of key issues and concerns with Utah's shared resources. It highlights a collection of data that is available to provide context to these issues and identifies areas where more study is needed. Addressing these challenges will enable Utah policymakers to make informed decisions for the future. Under the authorship of 52 researchers and with the support of 47 advisory board members, this report includes:

Chapter 1: Land

1.A Straightforward administrative fixes could better support wetland restoration
Changes to funding cycles and policies, and increased funding, would improve wetland managers' ability to revegetate Utah's wetlands and allow native plant vendors to offer more species.

1.B Measuring Utahns' attitudes toward energy projects
Utahns' attitudes towards different types of energy varied, but wind and solar were most popular.

1.C Grappling with tough consequences of free-roaming horses on western lands
Huge population increases of wild horses on western rangelands have economic impacts on agriculture and wildlife, and highprofile management decisions are becoming increasingly difficult in the face of conflicting social values.

1.D Public lands and urban quality of life
The places people choose to live and work reveal that residents value nearby public lands.

1.E Quantifying the value of recreational fishing in Utah
Fishing is a billion-dollar recreational activity in Utah that managers can maintain into the future by preserving access to waterways in developing areas.

LEFT: DEER CREEK RESERVOIR SUNSET | AARON FORTIN

Executive Research Summary (continued)

Chapter 2: Water

2.A Water-saving success: small changes reap big benefits
Utah State University Extension's Water Check Program provides effective strategies to reduce outdoor water use.

2.B Balancing agricultural water efficiency with healthy groundwater and streamflows
More efficient irrigation techniques can increase groundwater depletion, but efficient irrigation can be balanced with healthy groundwater and streamflows.

2.C Connecting the dots between snowpack, streamflow, and water management
The Logan River Observatory provides critical data and insights on Utah's water resources, empowering state and local leaders to make informed, science-driven decisions for sustainable water management.

2.D Understanding pfas contaminants in municipal biosolids
Forever chemicals are a significant human health and environmental concern in Utah wastewater biosolids.

2.E Utah's snowpack in decline: Bracing for a future with less snow
Utah's snowpack is in steady decline, dropping 16% since tracking began in 1979, with economic and ecosystem consequences on the horizon.

Chapter 3: Air

3.A Uinta Basin ozone improving with increased industry efficiency
The Uinta Basin is on track to meet the EPA's ozone standards, thanks to industry emission reductions, but there is still work to do.

3.B The impacts of drought on Great Salt Lake dust emissions
Policymakers need to remain vigilant on the potential for emissive dust from the exposed playa of Great Salt Lake. Additional monitoring is likely required to provide accurate data for addressing this issue.

3.C Utahns' beliefs and behaviors related to air quality
Air quality health messaging and solutions should address the distinct ways urban and rural Utahns think about and respond to Utah's air quality.

3.D Uneven extreme heat distribution in Salt Lake City
Data from a Heat Watch campaign in July 2023 shows extreme heat can impact the west side of Salt Lake City more than the east side.

3.E Filling an education gap: Utah's statewide Clean Air Marketing Contest
The statewide contest offers thousands of teens essential context about Utah's air quality and empowers them with practical ways to make a difference.

3.F The Wasatch Front is making progress on $PM_{2.5}$ Levels
Despite growth in population, $PM_{2.5}$ levels have generally decreased along the Wasatch Front over the past decade.

Chapter 4: Forests and Rangelands

4.A Utah Forest Restoration Institute: Strengthening forest health
The Utah Forest Restoration Institute at Utah State University will improve wildfire management, train future forest managers, and foster collaboration to enhance forest health statewide.

4.B Tracking Utah's unique wildfire patterns: Managing forests for recovery
Managing forests for conditions that allow smaller fires to burn while leaving big trees alive increases chances for forests to recover from inevitable wildfires.

4.C Woody plant populations are increasing in response to changing climate conditions
Intense precipitation events across the western U.S. are boosting woody plants like juniper and crowding out plants that animals feed on.

4.D From the ground up: Essential Training at USU's T.W. Daniel Experimental Forest
For 75 years, forestry professionals, researchers, and students have relied on Utah State University's School Forest for hands-on training, research, and experience.

4.E From Nepal comes a fiery warning for Utah
A study of a record-setting fire year in Nepal offers clues for predicting seasonal risk, which may help Utah detect and manage future blazes.

4.F Creating islands of nutrition to improve the sustainability of Utah's grazed rangelands
Planting nutritious, low-cost patches of perennial plants on rangelands enhances livestock production and biodiversity while reducing the environmental impacts of grazing.

Chapter 5: Bear Lake

5.A Navigating the future of Bear Lake Valley
Policy makers in Utah and Idaho need to work with Bear Lake Valley stakeholders to protect the "Caribbean of the Rockies."

5.B Bear Lake sovereign lands management and stakeholder communication
More frequent communication across more channels can better align Bear Lake managers and local stakeholders.

5.C Exploring Bear Lake's future through AI
AI models can make projections of Bear Lake's water levels in a future climate using publicly accessible datasets.

5.D Reconnecting fractured streams to restore Bear Lake's native fishes
Restoration work can improve access to spawning habitat and promote cutthroat population recovery and stability.

5.E Eurasian Watermilfoil: The invasive plant threatening Bear Lake
Controlling invasive Eurasian watermilfoil in Bear Lake will require specially designed methods because the lake's unique water chemistry spurs the plants' growth and impedes herbicides.

5.F Detecting and quantifying human-caused nanoparticle pollution in Bear Lake
Human activities at Bear Lake contribute to nanoparticle pollution in the water and on beaches.

BELOW: BRYCE CANYON NATIONAL PARK | AARON FORTIN

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BELOW: GREAT SALT LAKE NORTH ARM | AARON FORTIN

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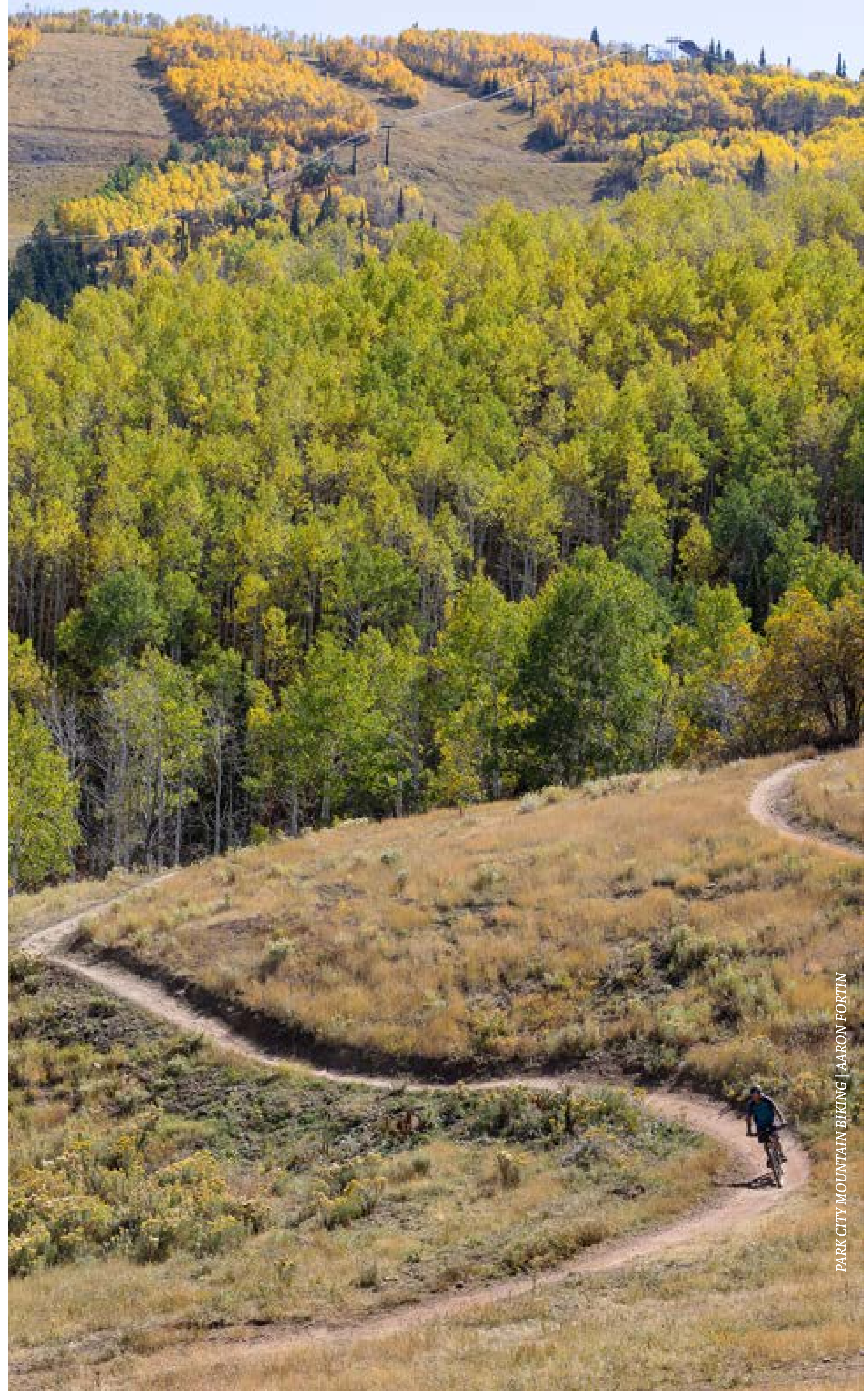

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2024 Land, Water, & Air *in the news*

This year, the Janet Quinney Lawson Institute for Land, Water, and Air worked to share a broader picture of land, water, and air in Utah, which included efforts to track and share news and media. Below are most-viewed stories from each edition of our weekly news round up, "This Week in Land, Water and Air."

January

01/11 A new bill was introduced that would allow Utah to ignore federal orders. (Fox 13)

01/18 Bear River Land Conservancy preserves 1000+ acres of Cache Valley land. (The Utah Statesman)

01/24 PHOTO GALLERY: These invasive birds are responsible for the beautiful murmurations seen in Utah. (St. George News)

01/31 The legal battle between an ultra-exclusive Utah ski area and 5 local residents just reached a stunning resolution. (The Salt Lake Tribune)

February

02/08 Here's what you need to know about Utah's "sovereignty bill". (Deseret News)

02/15 12 million people visited Utah state parks in 2023. These were the most and least popular ones. (KSL.com)

02/22 Utah passes new bill to define personhood amid environmentalist pushbacks. (KSL News)

02/28 Bills on turf and water-wise landscaping have advanced in the Utah legislature (Fox 13)

March

03/06 A curtain falls on the 2024 Utah Legislature. Here's what happened. (Fox 13)

03/13 Politically correct bird names? That doesn't fly with the Utah Legislature. (The Salt Lake Tribune)

03/20 Here's where Utah's 2024 snowpack stands. (The Salt Lake Tribune)

03/28 OPINION: Why citizens, and not the government, should own the wide open spaces in the West. (Deseret News)

April

04/03 See where the federal government wants more Utah solar farms. (The Salt Lake Tribune)

04/10 Climate study reveals alarming trends in heat wave dynamics. (Utah State Today)

04/17 How a small Utah town is embracing its post-coal identity through proactive rural leadership. (KSL News)

04/25 VIDEO: New water treatment plant will improve water heading for Utah Lake. (KSL News)

May

05/01 Battle for Moab: Residents fight against Kane Creek development. (Deseret News)

05/09 Romney and other US lawmakers seek to overturn the EV mandate. (KSL News)

05/15 For years Utahns had to trespass to access this trail. There's a solution in the works, but they don't like it. (The Salt Lake Tribune)

05/22 Utah congressional leaders blast environmental study on Northern Corridor Highway. (The Salt Lake Tribune)

05/30 This invasive tree is bad for almost everybody in southern Utah. (St. George News)

June

06/05 New construction is key to saving water, including the Colorado River. (Deseret News)

06/13 When it comes to climate change, the world may be identifying the wrong enemy. (KSL News)

06/20 The water cycle is 'nothing like the cartoon' we learn in school, so a BYU researcher modernized it. (KUER)

06/26 'Mud glaciers' and sand waves: Unearth trapped sediment's influence on the ever-changing Lake Powell. (St. George News)

July

07/03 Cache County fast-tracks a ski resort's shift toward an exclusive oasis for the rich. (UPR)

07/11 The U.S. Forest Service is abandoning a controversial project in the Uinta Mountains that was the subject of an environmental lawsuit. (Utah News Dispatch)

07/18 Three words are at the center of a debate on the Colorado River. (KUNC)

07/25 A Salt Lake worker accidentally poisoned hundreds of trees downtown. (KSL News)

August

08/02 Environmental officials may have found out what killed 500 fish in a Herriman pond. (KSL News)

08/07 Hilldale man creates a product to rid the world of 'sticker burrs'. (KSL News)

08/14 Salt Lake Valley normally has the worst air quality in Utah, but last year, these two counties did. (The Salt Lake Tribune)

08/22 The federal government owns millions of acres of Utah land. The state is now suing for control of over half of it. (The Salt Lake Tribune)

08/29 The Utah Office of Energy Development announced a funding award to improve air quality in Uintah Basin. (Basin Now)

September

09/05 Drip irrigation grows crops with a lot less water, so why aren't more Utah farmers using it? (Fox 13)

09/12 How a dropped bag of Cheetos can dramatically affect the environment. (Forbes)

09/18 Utah wildlife officials secretly culled 170 elk from LDS Church ranch land. (The Salt Lake Tribune)

09/25 Here is why 43 million acres of agricultural land in US are owned by foreign nations. (KSL News)

October

10/02 Why don't we just fix the Colorado River crisis by piping in water from the East? (KUER)

10/10 Governor Cox announces his plan to double Utah's energy in 10 years. (Fox 13)

10/16 The Utah House Speaker will 'pause' on major new water legislation in Utah. (Fox 13)

10/23 Residents face unique issues in a rural, remote region near Grand Staircase-Escalante. (KSL)

10/30 12 states get behind Utah's lawsuit to take over millions of acres of federally-controlled land (St. George News)

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

We publish a weekly email newsletter, containing a roundup of stories in the media related to Utah's land, water, and air. This year, we shared nearly 2,000 stories, primarily from local media, with additional coverage from national outlets as well. Subscribe to our weekly email news roundup at: **usu.edu/ilwa/newsletter**.

THE NARROWS AT ZION NATIONAL PARK | AARON FORTIN

Chapter 1

LAND

Key issues facing Utah's land

PROFESSOR VALLEY | MICHELLE SMITH

Chapter Introduction

BRIAN STEED

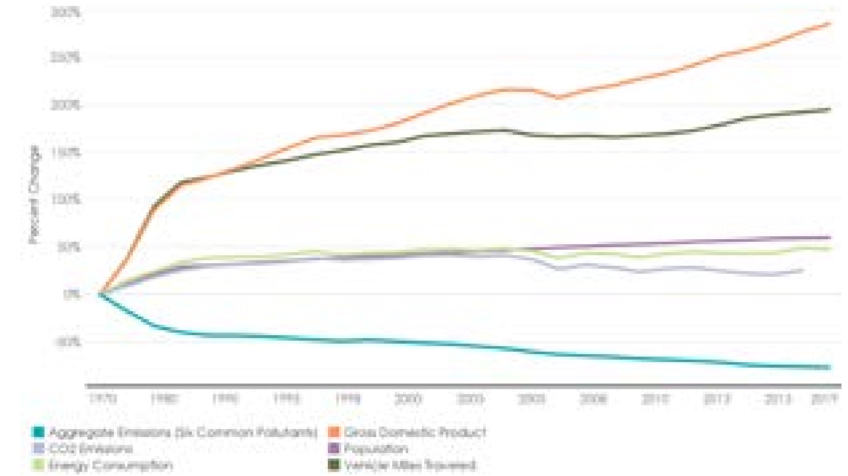
Utahns, like people across the country, seem to want more of everything. When it comes to energy, the U.S. is seeking more oil and gas, along with increased electricity from coal, wind, solar, geothermal, and nuclear sources. This growing demand calls for new power generation, transmission, and storage capacity, as well as investment in energy technologies.

Our growth and energy needs mean we don't just want—but genuinely need—more minerals like copper, uranium, molybdenum, beryllium, vanadium, tellurium, lithium and other critical minerals. Meeting this demand requires new mining and processing operations nationwide. Here in Utah, we urgently need more housing and infrastructure, including transportation systems, which often means more sand and gravel, as well as the conversion of agricultural and other open lands into urban uses.

At the same time, there's a growing desire to protect environmental values: preserving agricultural communities, maintaining open space, expanding access to outdoor recreation, supporting wildlife habitat, and enhancing the quality of nature-based experiences. These goals can seem at odds with our demands for resources, housing, and infrastructure, underscoring the complex challenges we face.

The good news is that we can meet these demands while maintaining the quality of life we expect. Yes, difficult decisions and trade-offs are ahead, but, with thoughtful planning, we can create a brighter future. To succeed, we will need the best science, reliable data, and sound policies. This is no small task, but if the past is prologue, Utahns are up to the challenge.

Figure 1I.1 U.S. Population Growth, Economic Growth, and Energy Consumption (1970 - 2019)



Source: *Environmental Protection Agency*

PROFESSOR VALLEY | MICHELLE SMITH

Straightforward Administrative Fixes Could Better Support Wetland Restoration

KARIN M. KETTENRING & ANNIE L. HENRY

Changes to funding cycles and policies, and increased funding, would improve wetland managers' ability to revegetate Utah's wetlands and allow native plant vendors to offer more species.

Utah communities rely on healthy wetlands to manage droughts and flooding events and to provide essential wildlife habitat. Native vegetation in degraded wetlands often needs to be reseeded or replanted to fully support these ecosystem services, but many native species are hard to source from vendors. A new survey of wetland managers and native plant vendors in the Intermountain West illustrates how some fixes to administrative and funding cycles could aid wetland restoration (Figure 1.A.1).

Challenges managers face include budget limitations, too few employees, conflicts with recreation and cultural resources, and lack of access to diverse native wetland plant species. Vendors report that it is difficult to take risks on new native plant species that managers may seek.

Managers of wetlands would benefit from increased funding and longer funding cycles to hire and retain qualified personnel, and increased awareness of the importance of wetlands. Vendors report that contracts with managers could alleviate hardship from market fluctuations and improve the number of species they can make available. Short funding cycles often prevent managers from planning far enough into the future to give vendors the lead time they need to make new species available for purchase. Funding restrictions often do not allow managers to provide funds until they receive the plant product. Changes to these timelines could help. Financial incentives to produce new or difficult-to-grow species would offset the high costs vendors have to consider when offering new species. The survey results underscore the need for funding entities to prioritize wetland revegetation efforts in an informed way to support production of native wetland seeds and plants.

Figure 1.A.1 Resources needed to improve wetland revegetation

BEAR LAKE BIRD REFUGE | AARON FORTIN

Measuring Utahns' Attitudes Toward Energy Projects

BETSY BRUNNER & STACIA RYDER

Utahns' attitudes towards different types of energy varied, but wind and solar were most popular.

Utah's population is forecasted to reach 4 million residents by 2033, which will significantly increase energy demand. While state policy specifies that "Utah shall have adequate, reliable, affordable, sustainable, and clean energy sources" (Utah State Code 79-6-301), the projects necessary to realize this vision have yet to be sited.

Understanding public attitudes about energy can help government agencies and utility organizations in making better decisions. This knowledge can help identify opportunities to inform voters regarding benefits and risks for energy technology. Such understanding is vital to engage the public, address concerns, increase trust, and facilitate effective energy transitions.

According to the 2023 Utah People and the Environment Poll (Figure 1.B.1), half of the survey's respondents indicated it was important to have access to carbon-free electricity. However, only 39% of respondents were willing to pay more for them, despite Utah energy costs being among the lowest in the nation.

Respondents' support for locating energy projects within 50 miles of their homes varied based on the type of project. Less than 20% supported coal-fired power plants, and 40% neither supported nor opposed natural gas-powered plants. Solar and wind projects garnered support from 73% and 72% of respondents, respectively. Nearly 60% of survey respondents supported geothermal projects, and 47% supported nuclear projects. However, a significant percentage of respondents neither supported nor opposed having geothermal (37%) and nuclear (22%) sites located near their home.

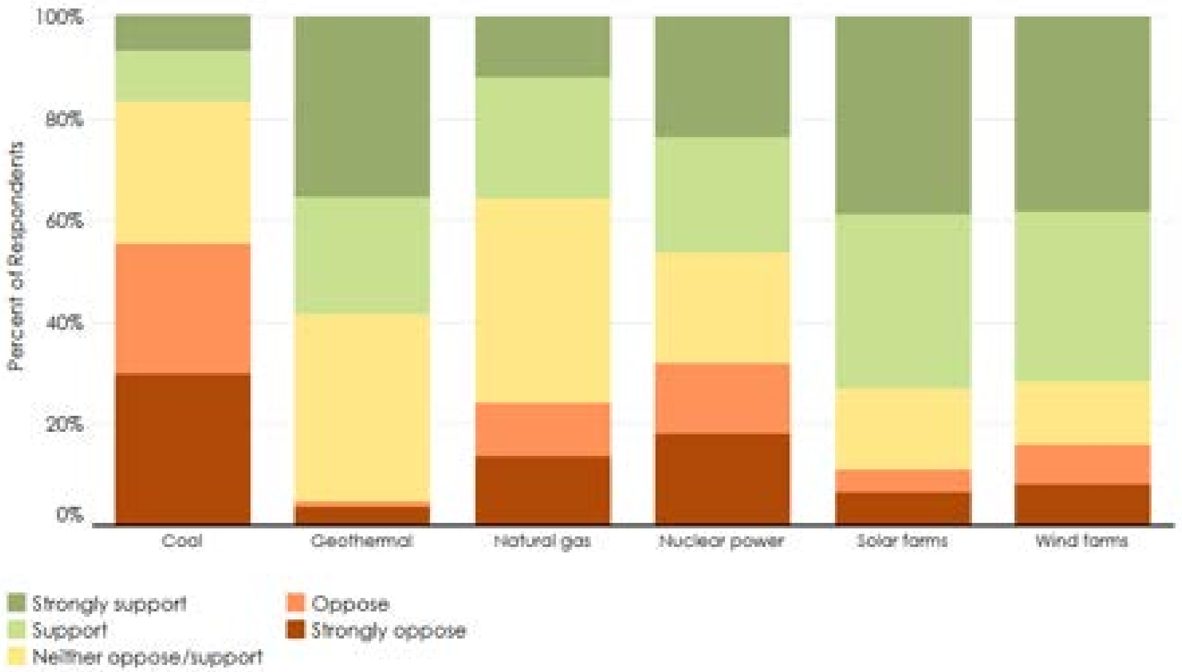
Additional research could help evaluate Utahns' familiarity with these technologies and identify needs for education and outreach. Meaningfully engaging the public in the siting process can also increase public trust and support, which can help facilitate smooth and effective energy transitions.

SOLAR FARM NEAR MONA, UT | AARON FORTIN

WIND TURBINES NEAR MILFORD, UT | AARON FORTIN

Half of the survey's respondents indicated it was important to have access to carbon-free electricity.

Figure 1.B.1 Attitudes toward locating various resource/energy projects within 50 miles of respondents' homes



Grappling with Tough Consequences of Free-Roaming Horses on Western Lands

DAVID STONER, KATHRYN SCHOENECKER, & ERIC THACKER

Huge population increases of wild horses on western rangelands have economic impacts on agriculture and wildlife, and high-profile management decisions are becoming increasingly difficult in the face of conflicting social values.

The wild horse is a romantic and iconic symbol of American heritage and values. Few people are unaffected by the image of these animals galloping across untamed western landscapes. However, growing populations on sensitive arid rangelands have spurred debate about wild horse management, competing land uses, and impacts to rural economies and the environment.

Big game hunting and livestock production, activities that are economically vital in rural Utah, often come in direct conflict with wild horse populations. The sustainability of these activities is closely tied to range conditions. Since 2008, horse populations in the western U.S. have increased by more than 230% (Figure 1.C.1). Given extensive habitat and dietary overlap with livestock and wildlife, this creates high potential for competition.

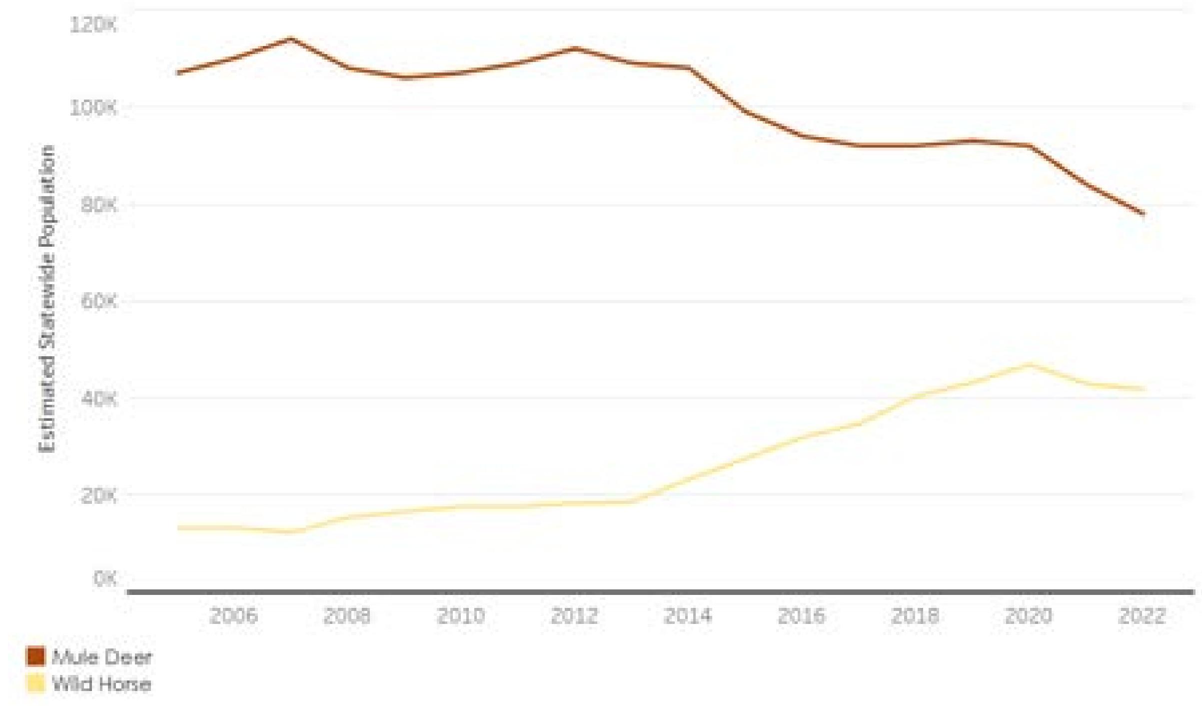
Non-native wild horses have special protections under the law. They are not subject to the same control methods land managers use to regulate livestock grazing or wildlife populations. Utah State University scientists and United States Geological Survey collaborators are conducting research on ways to curtail growth of wild horse populations. They monitor rangelands using NASA satellite imagery to predict grazing capacity, wildlife population trends, and health of wild horses. Research shows that, unlike native animals, the body condition of horses does not fluctuate with range conditions, indicating resilience to drought and harsh winters. Other projects include development of long-lasting forms of horse contraception and quantifying the impacts of natural mortality from predation and other causes. These efforts will assist state and federal land managers with efforts to navigate this growing problem.

Currently the only widely effective means of controlling horse populations is to physically remove the animals from the range, but this method has been challenged in court as inhumane. Quantifying the impacts horses have on sensitive habitats, grazing capacity, and competition with valued wildlife will be increasingly important as public opinion and changing demographics continue to influence management decisions.

WILD HORSE IN SOUTHERN UTAH | UTAH STATE UNIVERSITY

WILD HORSE ON UTAH RANGELANDS | UTAH STATE UNIVERSITY

Figure 1.C.1 Population trends of mule deer and wild (feral) horses in Nevada



Public Lands and Urban Quality of Life

SHERZOD B. AKHUNDJANOV & PAUL JAKUS

The places people choose to live and work reveal that residents value nearby public lands.

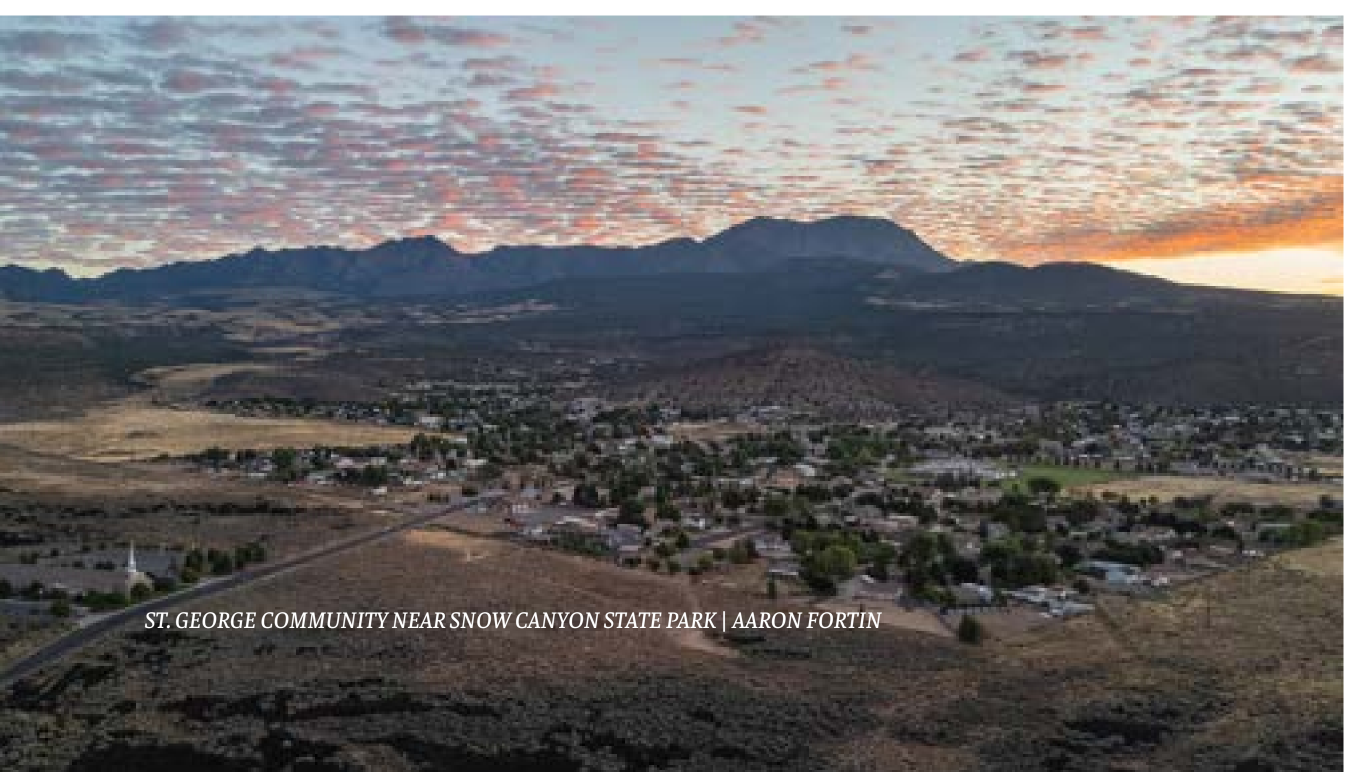
People prefer to live in places they like. Some people want to live in warmer climates while others prefer cooler places. Some prefer to live near an ocean or beach while others prefer mountains. And others place a high value on arts and entertainment offered in dense urban regions.

Where people choose to work and live reveals the value of those amenities. Past research shows people will accept a lower wage and pay higher housing costs to live someplace with desirable amenities. Conversely, in areas with few desirable amenities, people will require higher wages and lower housing costs to live there.

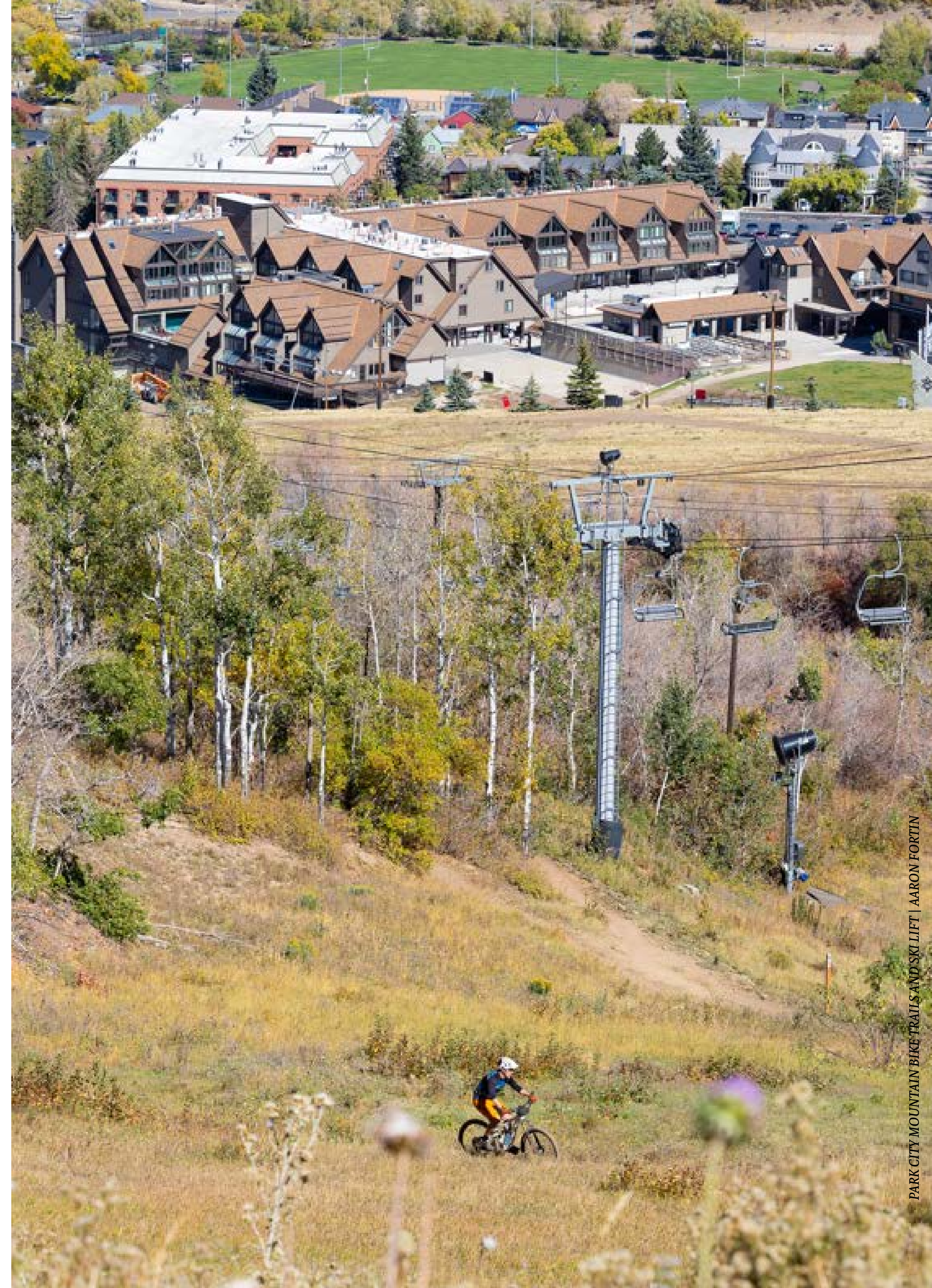
Utah State University researchers examined differences in wages and housing costs across 172 combined statistical areas (urban areas) in the United States. After accounting for worker skills and housing characteristics, a quality of life index was calculated for each urban area. Similar to previous studies, higher quality of life regions were associated with proximity to beaches, warmer climates, and vibrant arts and entertainment sectors.

The researchers also found that nearby public lands are a key factor in urban quality of life. This research significantly expands the literature's typical focus on national parks and wilderness areas to include more "generic" public lands not subject to special protections. These are important because many popular public land activities, such as motorized recreation and mountain biking, are prohibited or highly restricted in protected areas.

This study identifies a recruitment advantage for Utah industries because many potential workers are willing to accept lower wages to live near high-quality recreation opportunities offered by nearby public lands. This advantage, however, may be offset by higher housing costs.



ST. GEORGE COMMUNITY NEAR SNOW CANYON STATE PARK | AARON FORTIN



PARK CITY MOUNTAIN BIKE TRAILS AND SKI LIFT | AARON FORTIN

Utah's recreational fisheries produce $1.28 billion in economic value to residents and out-of-state visitors.

FISHING AT KERMSUH LAKE, HIGH UINTA MTNS. | AARON FORTIN

Quantifying the Value of Recreational Fishing in Utah

JORDAN SMITH

Fishing is a billion-dollar recreational activity in Utah that managers can maintain into the future by preserving access to waterways in developing areas.

Hundreds of thousands of Utahns visit the state's streams, rivers, lakes, and reservoirs to fish each year. While each fishing license costs Utahns anywhere between $5 and $40, the social and personal value the state's residents get from fishing is considerably greater. First-time anglers earn the chance of having a novel outdoor experience, while seasoned anglers find the opportunity to hone skills, spend time outside, and test equipment. Families and friends get the chance to be outside together, creating memories that may last a lifetime.

These social and interpersonal values are often very difficult to quantify, but with the right methods and resources, it is possible to better understand how the experience of fishing is valued in the state. Researchers from Utah State University's Institute of Outdoor Recreation and Tourism used data from nearly 3,000 fishing trips, as well as geospatial data characterizing fishing opportunities, to estimate the value of recreational fishing in Utah—worth an estimated $1.28 billion to Utahns and out-of-state visitors.[1E] But these valuable opportunities are at risk. Population growth, which is often associated with urban sprawl and a loss of access to fishing opportunities, is expected to lead to a loss of over $250 million by mid-century (Figure 1.E.1). Similarly, increases in air temperatures are making mid-summer trips less preferable, leading to a loss of another $200 million by 2050. Recognizing these shifts, managers can begin to anticipate likely impacts on both economic returns and well-being derived from fishing. Fisheries and land managers can make strategic policy decisions, such as preserving access to fishing opportunities in developing areas of the state, to mitigate these losses. Proactive management will support the sustainability of fishing experiences in Utah, fish habitat, and the fish themselves.

Figure 1.E.1 Effects of population growth and temperature increases on the value of recreational fishing in Utah

Total use value of Utah's fishing opportunities	$1,283,548,814
Expected loss due to projected population growth by 2050	$257,888,545
Expected loss due to projected 1 degree C increase in mean daily maximum temperatures by 2050	$197,720,100

Utah's **LAND** *in the news*

As we've tracked Utah and national news through 2024, we have compiled some of the key land issues and topics that have appeared in media outlets this year.

1. FEDERAL LAND CHALLENGES

Utah is challenging federal control of millions of acres of public lands in a lawsuit seeking state ownership, arguing that local management would better serve state interests. Meanwhile, the Bears Ears National Monument Resource Management Plan is finalized, granting additional restrictions based on input from local tribes and others. Both issues highlight the evolving landscape of public land management.

2. WILDFIRE IN THE WEST

Utah faced significant wildfire challenges in 2024, including the Yellow Lake fire, which scorched over 33,000 of acres. Western states have struggled with resource constraints, as several have exhausted their wildfire response budgets early in the season. The increasing intensity of fires underscores the ongoing difficulties in managing wildfire risks across the region.

3. MINERAL EXTRACTION IN CENTRAL AND SOUTHERN UTAH

In 2024, uranium mining in southern Utah saw renewed interest due to rising global demand for nuclear energy. At the same time, lithium exploration along the Green River gained momentum, driven by the growing electric vehicle market. These developments are shaping discussions around resource extraction and its future in Utah's energy landscape.

4. HOUSING DEVELOPMENT'S IMPACTS ON LAND MANAGEMENT

Utah's growing demand for housing in 2024 has intensified land management challenges, exemplified by rapid development in Washington County. Urban expansion competes with agricultural, recreational, and conservation priorities, while water scarcity complicates planning. Rising housing costs and limited availability are driving new discussions about resource allocation and long-term land use strategies in the state.

5. NEW EFFORTS IN EFFICIENT LANDSCAPING

In 2024, Utah passed legislation encouraging cities to adopt water-saving measures, including restrictions on turf in new developments, as part of broader municipal water conservation efforts. Recent research on drought-resistant bermuda grass has shown promise for reducing water use in landscaping, offering a potential solution as the state continues to address its ongoing water conservation challenges.

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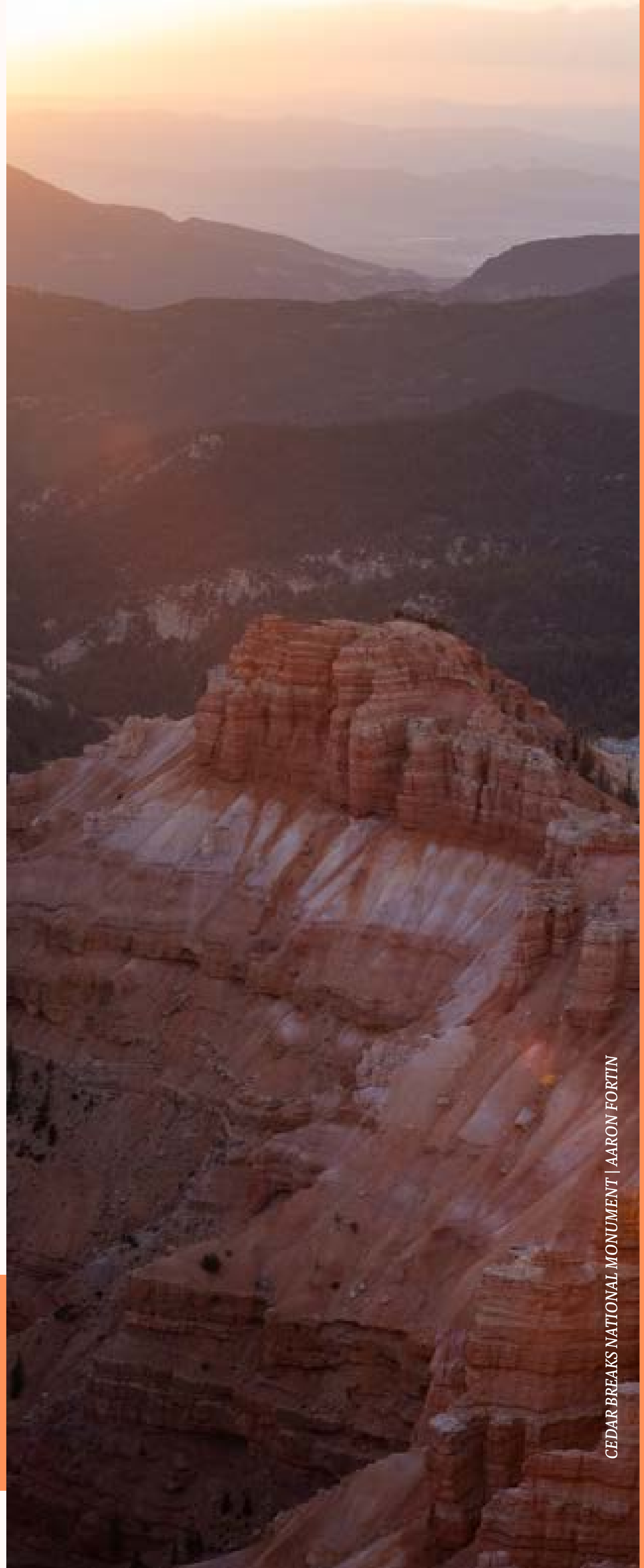


CEDAR BREAKS NATIONAL MONUMENT | AARON FORTIN

CHAPTER 1 REFERENCES

1.I Introduction Environmental Protection Agency. (2020). Our Nation's Air: EPA Celebrates 50 Years! EPA.gov. https://gispub.epa.gov/air/trendsreport/2020/#home

1.A Henry, A.L., R. Robinson, K. Sinnott, M. Brunson, A. Ernst, and K.M. Kettenring. (2024). Got plants? Availability of and challenges to production of native plants for wetland restoration. *Restoration Ecology* e14120. http://doi.org/10.1111/rec.14120

Henry, A.L., R. Robinson, K. Sinnott, E. Tarsa, M. Brunson, and K.M. Kettenring. (2024). Lay of the (wet)land: Manager practices and challenges in wetland revegetation. *Restoration Ecology 32(5)* e14167. https://doi.org/10.1111/rec.14167

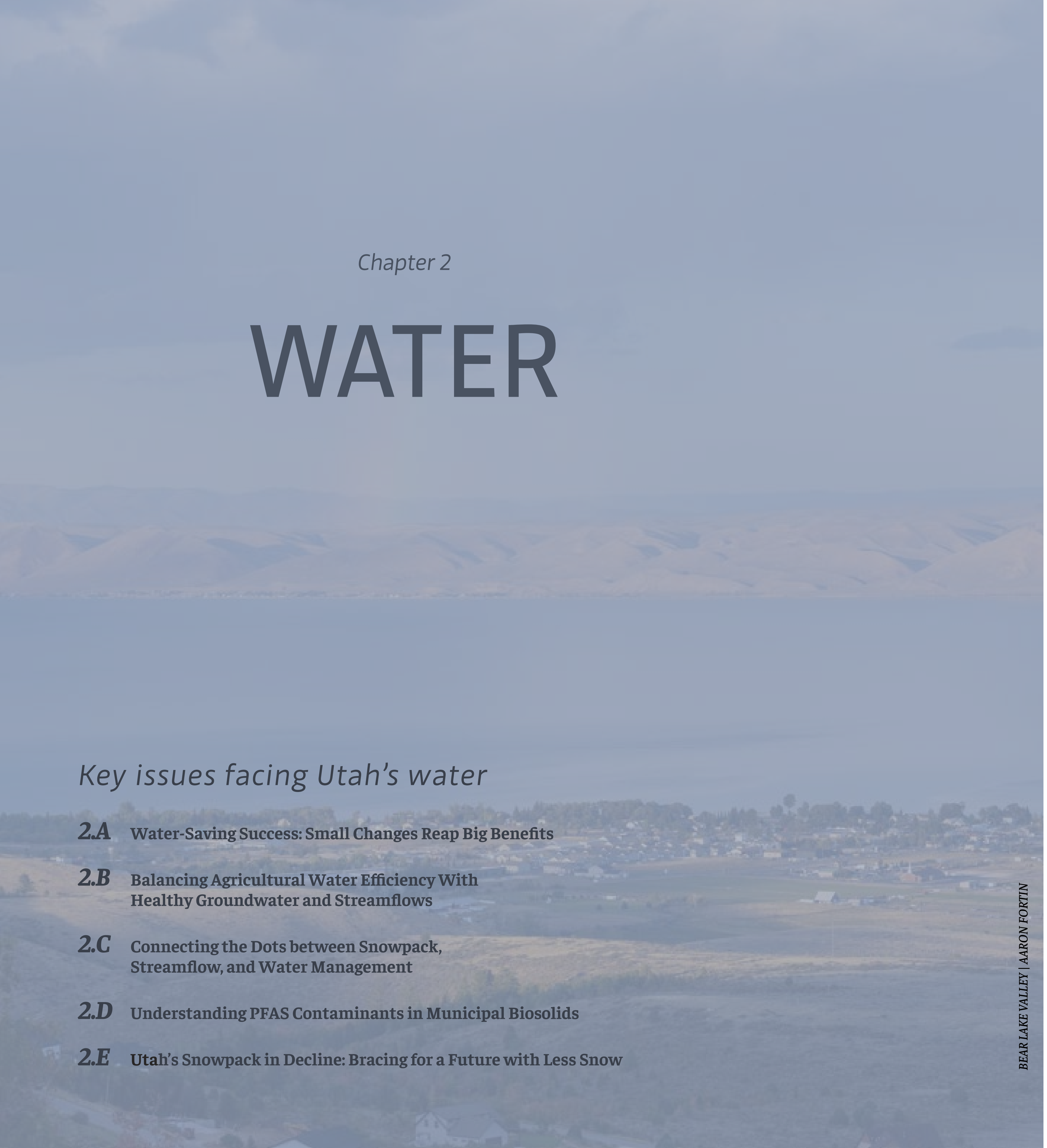
1.B Community and Natural Resources Institute. (2023). *The Utah People and Environment Poll (UPEP)*. Utah State University College of Humanities and Social Sciences Sociology Department. https://chass.usu.edu/sociology/canri/upep

1.C Stoner, D.C., M.T. Anderson, C.A. Schroeder, C.A. Bleke, and E.T. Thacker. (2021). Distribution of competition potential between native ungulates and free-roaming equids on western rangelands. *Journal of Wildlife Management 85(6)*: 1062-1073.

Stoner, D.C., Thacker, E. Greenhalgh L., and Nelson, M.. (2023). *You can lead a horse to water: Mapping seasonal water resources to predict wild horse movements and reduce conflict on Utah Rangelands.* [USU Extension Fact Sheet]. https://digitalcommons.usu.edu/extension_curall/2382/

1.D Akhundjanov, S.B., and Jakus, P.M. (2024). *Public Lands and Urban Quality of Life.* [Working paper]. Utah State University

1.E Smith, J. W., and Lamborn, C. C. (2024). The influence of population growth and weather on the value of recreational angling trips within Utah (USA). *Fisheries Research, 274*, 106976. https://doi.org/10.1016/j.fishres.2024.106976



BEAR LAKE VALLEY | AARON FORTIN

Chapter 2

WATER

Key issues facing Utah's water

2.A Water-Saving Success: Small Changes Reap Big Benefits

2.B Balancing Agricultural Water Efficiency With Healthy Groundwater and Streamflows

2.C Connecting the Dots between Snowpack, Streamflow, and Water Management

2.D Understanding PFAS Contaminants in Municipal Biosolids

2.E Utah's Snowpack in Decline: Bracing for a Future with Less Snow

Chapter Introduction

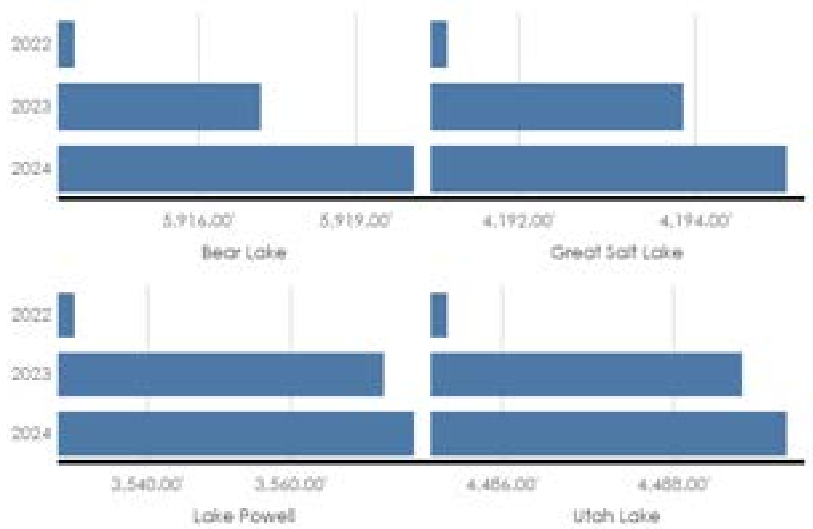
BRIAN STEED

The last two water years have been historic. After enduring some of the most severe droughts in recent history, two consecutive years of above-average precipitation have provided welcome relief to our strained water systems. Reservoirs have been the biggest winners, as water managers have been able to refill our storage systems levels that had dropped frighteningly low. Waterbodies like Bear Lake and Utah Lake, both natural lakes managed as storage reservoirs, have similarly experienced amazing recoveries, with Utah Lake spilling hundreds of thousands of acre feet of water down to the Great Salt Lake.

The South Arm of the Great Salt Lake reached a seven-year high of 4,195.1 feet above sea level this year—a significant improvement from the historical low of 4,188.5 feet in 2022. Unlike the previous year, the North Arm of the lake also saw a similar rise, peaking at above 4,192 feet above sea level and nearly equalizing with the level of the South Arm by the end of the water year. Equally important, salinity levels in the South Arm dropped from an unhealthy 180 grams per liter to a much healthier 120 grams per liter. This reduction in salinity has greatly benefited the lake's brine shrimp and brine fly populations, which have returned in abundance.

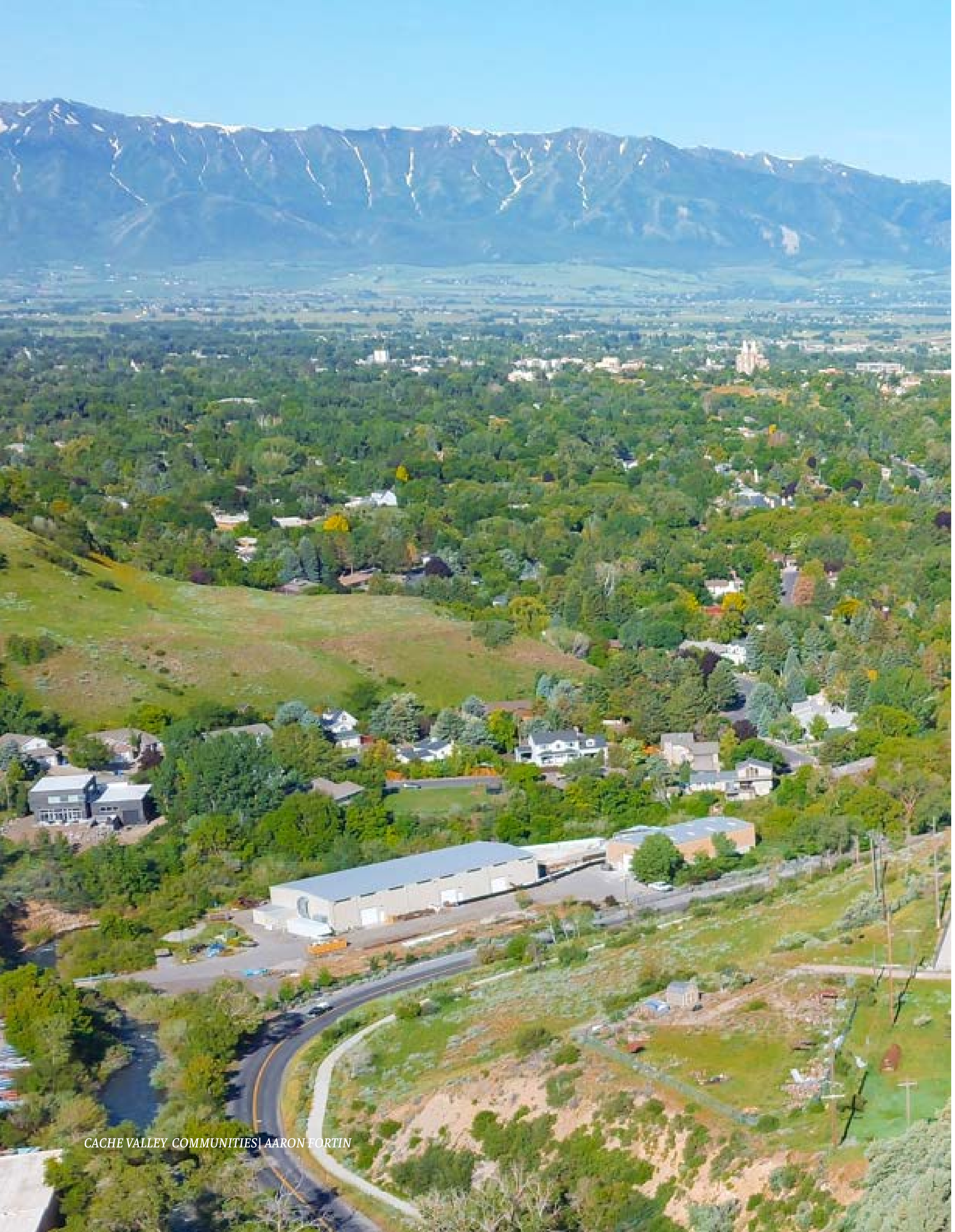
All this good news, however, came with a bit of a warning this year. The summer and fall of 2024 were unusually hot and dry, leading to increased water usage and evaporation on the Great Salt Lake. This contrast serves as a reminder of the importance of staying committed to conservation efforts. Reducing water use is essential—not only to support future growth but to preserve our vital natural systems.

Figure 2.I.1 Water levels for Utah's major lakes (2022-2024)



Source: *Utah Division of Water Resources, Utah Lake Water Levels, Lake Powell Water Database, and Great Salt Lake Elevation*

BEAR LAKE VALLEY | AARON FORTIN



CACHE VALLEY COMMUNITIES| AARON FORTIN

Water-Saving Success: Small Changes Reap Big Benefits

DAVID ROSENBERG & KELLY KOPP

Utah State University Extension's Water Check Program provides effective strategies to reduce outdoor water use.

Utah State University Extension's Water Check Program offers Utah residents and landscape managers onsite evaluations of their irrigation system efficiency and provides customized sprinkler irrigation schedules that conserve water while maintaining plant health. Recommended irrigation repairs and improvements are also provided to participants. Researchers recently evaluated the program's effectiveness for reducing outdoor water use, which accounts for the greatest amount of residential use and offers the largest opportunity for conservation.

Researchers used five-second water use data collected with Flume™ Smart Water Home Monitors at participating residences before and after a water check evaluation to answer four questions.

- How much water did households save?
- Which water check recommendations did participants implement?
- Why did participants implement some recommendations and not others?
- What opportunities exist to further reduce landscape water use?

The program participants saw an average of 20-30% reduction in water use.

The 59 participating households implemented a variety of water-saving techniques, such as reducing water application to match the needs of their landscape plants, reducing the duration and number of irrigation events, and increasing the period between irrigation events. An evaluation of water savings during the month following each Water Check showed that participants reduced water use by 626,000 gallons (a 20-30% reduction, on average). These findings were similar across two participating cities: Logan and Hyde Park, Utah.

Based on the study's results, several actions were recommended to improve the Water Check Program, including assessing drip irrigation zones, sharing examples of water-wise landscapes, providing contact information for landscape contractors, and connecting participants to city water conservation staff.

RIGHT: FLUME™ SMART WATER HOME MONITOR

Balancing Agricultural Water Efficiency With Healthy Groundwater and Streamflows

CHRISTINA MORRISETT, SARAH NULL, & ROBERT VAN KIRK

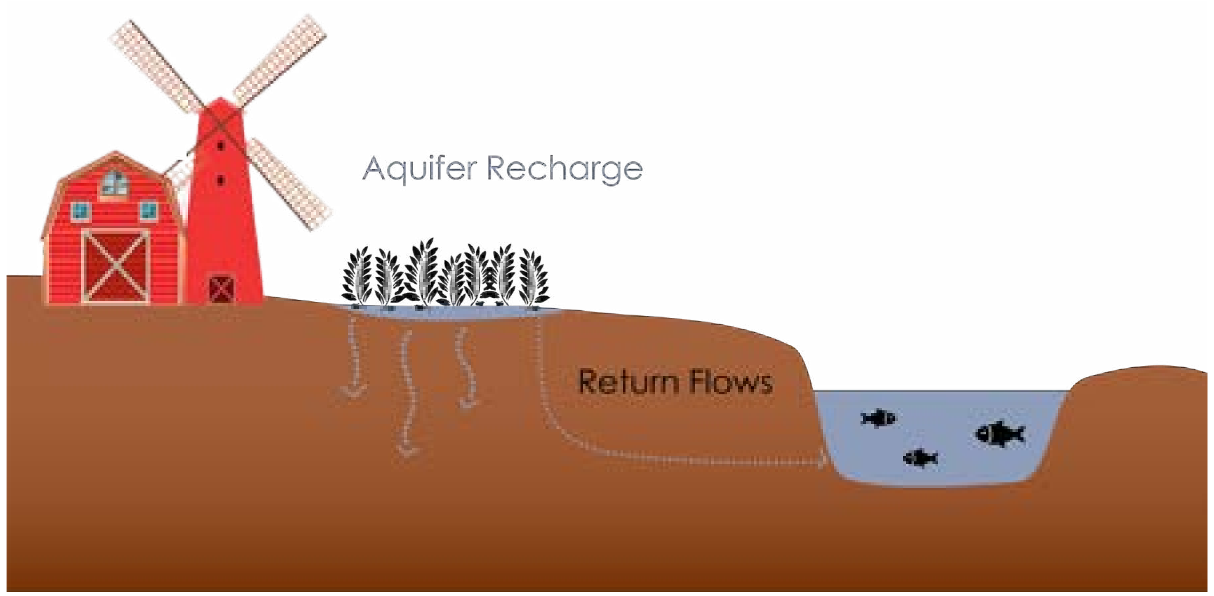
More efficient irrigation techniques can increase groundwater depletion, but efficient irrigation can be balanced with healthy groundwater and streamflows.

In Utah's agricultural systems, some of the water delivered through earthen canals or applied via flood irrigation seeps into the ground. In recent decades farmers have been encouraged to replace these traditional techniques with lined canals and center-pivot sprinklers to conserve water—but this practice can have unintended consequences for both water users and aquatic life. Water that seeps into the ground through less-efficient irrigation systems increases the amount of water stored in underground aquifers and flows back to the river via underground pathways. These "return flows" contribute water to the river system during seasons when river flow is low (Figure 2.B.1). Return flows increase the water available for human use and provide a source for cool water needed by coldwater trout.

In Henry's Fork of the Snake River, located in Idaho, traditional water conveyance and flood irrigation techniques have contributed large quantities of return flow to the river for over a century. Most farmers transitioned from flood to sprinkler irrigation between 1978–2000. The large-scale change in irrigation practices decreased annual streamflow diversions by 250,000 acre-ft (23%), but also decreased annual groundwater return flow by 240,000 acre-feet. In other words, more efficient irrigation techniques contributed to more water being depleted—or consumed—in the basin, rather than conserving water for other uses.

Farmers in the Teton River Basin have begun using flood irrigation early in the growing season when spring runoff is more abundant and are preserving sprinkler irrigation for use later in the year when surface water is less available. This dual irrigation practice will help agricultural growers recharge groundwater and aquifers and conserve water.

Figure 2.B.1 Water that seeps into the ground can get stored in underground aquifers and flow back to the river via underground pathways



Traditional water conveyance and flood irrigation techniques have contributed large quantities of return flow to the river for over a century.

BELOW: NORTHERN UTAH FLOOD IRRIGATION | AARON FORTIN

Connecting the Dots between Snowpack, Streamflow, and Water Management

BETHANY NEILSON & JEFFERY S. HORSBURGH

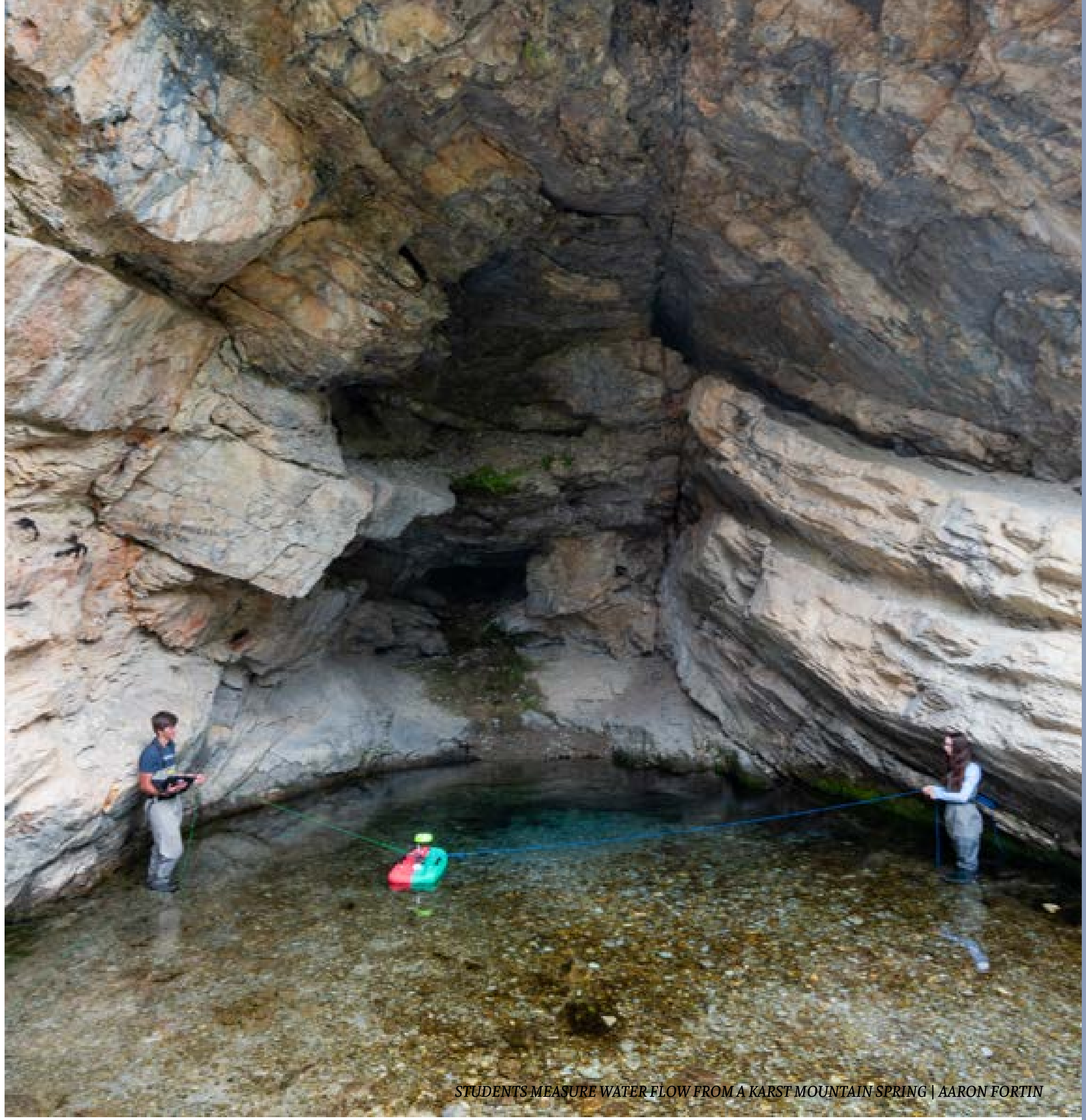
The Logan River Observatory provides critical data and insights on Utah's water resources, empowering state and local leaders to make informed, science-driven decisions for sustainable water management.

The Logan River Observatory plays a critical role in advancing Utah's understanding of water availability by studying the connections between snowpack, streamflow, and groundwater. As Utah faces growing challenges in managing its water resources, the observatory supplies essential, long-term hydrologic data to inform water management decisions statewide. Founded to support Utah-specific hydrologic research, the observatory also serves as a hands-on educational facility, training future engineers and scientists in water stewardship.

In collaboration with the National Science Foundation, the observatory has developed robust watershed modeling tools that use data from mountainous areas to predict how warming temperatures and shifting snow patterns impact snowmelt-driven streamflow—insights crucial for managing water supplies for Utah's population and the Great Salt Lake.

The observatory's partnerships with state and local stakeholders, including the Utah Division of Water Resources, Division of Water Rights, Logan City, and Cache Water District, amplify its impact. Together, they enhance water data management, improve streamflow monitoring, and develop strategies to ensure conserved water reaches its intended destinations through Utah's managed river systems. By connecting scientific research with practical applications, the observatory's work is essential for building Utah's water resilience, helping the state prepare for future water needs with informed management practices.

LEFT: USU HYRDOLOGY RESEARCH ON THE LOGAN RIVER | AARON FORTIN



STUDENTS MEASURE WATER FLOW FROM A KARST MOUNTAIN SPRING | AARON FORTIN

Robust modeling tools are being developed to predict the impact of warming temperatures and changing snow accumulation on streamflow.

Understanding PFAS Contaminants in Municipal Biosolids

RYAN DUPONT

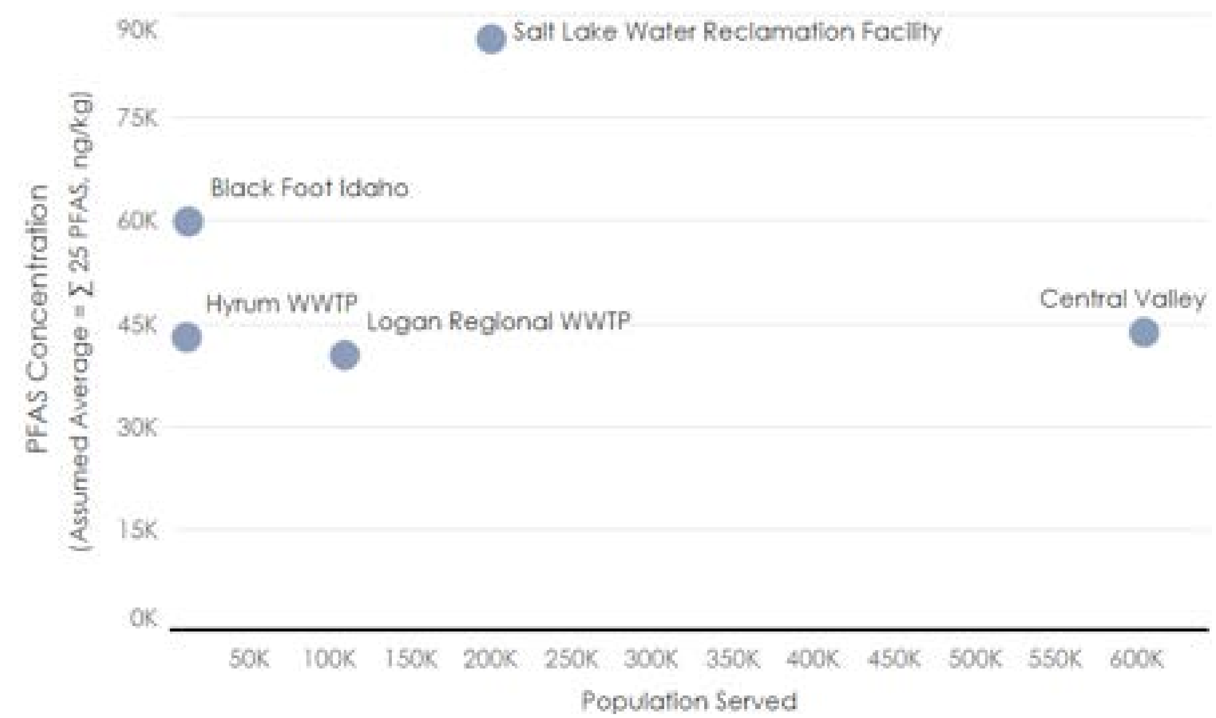
Forever chemicals are a significant human health and environmental concern in Utah wastewater biosolids.

Polyfluorinated alkyl substances (PFAS) compounds are ubiquitous in our environment and have been associated with adverse effects on human health. They are a significant source of pollution in ecosystems and are often inadvertently released via land application in agriculture, mining reclamation sites, forest soils, or lawns and gardens. Biosolids, or sewage sludge, are a byproduct of wastewater treatment plants. Biosolids are considered a valuable resource because they can improve soil's water-holding capacity, organic content, and nutrient value. They do, however, contain a wide range of organic and inorganic compounds, including PFAS, that are not removed during conventional wastewater treatment.

A Utah State University study surveyed biosolids generated from a wide range of municipal wastewater treatment plants in northern Utah and central Idaho that served populations ranging from 10,000 to over 600,000 people (Figure 2.D.1). Research revealed that PFAS concentrations are not related to community size nor residential-commercial-industrial make-up. Communities will likely be facing increasingly stringent PFAS biosolids regulations in the future because of the health and environmental risks associated with these substances. Whether biosolids produced by wastewater treatment plants can be beneficially utilized by communities with such regulations in place will depend on how well PFAS can be removed.

At Utah State University's Utah Water Research Laboratory, studies are underway to evaluate whether composting biosolids at a high temperature with and without a biochar additive will reduce the concentration and/or availability of these elevated levels of PFAS. Developing successful techniques to create safe biosolids will allow users to reap the benefits of this soil amendment without future concerns for human health and environmental harm.

Figure 2.D.1 PFAS concentrations in local municipal biosolids as a function of community size



Research revealed that PFAS concentrations are not related to community size nor residential-commercial-industrial make-up.

Utah's Snowpack in Decline: Bracing for a Future with Less Snow

SCOTT HOTALING

Utah's snowpack is in steady decline, dropping 16% since tracking began in 1979, with economic and ecosystem consequences on the horizon.

In many ways, snow defines Utah. Winter snowpack offers culturally and economically important opportunities for recreation and tourism, and acts as a giant natural reservoir for the state, feeding streams and rivers, irrigating fields and filling reservoirs as it melts. Utah's snowpack, however, is in decline. Since 1979, when the first SNOw TELemetry (SNOTEL) sites were installed in the state, peak snowpack has decreased by 16%. Although the exceptional winter of 2022-23 offered a reprieve, the trend is clear: an increasing portion of the state's precipitation is falling as rain instead of snow. These conditions will likely continue into the future.

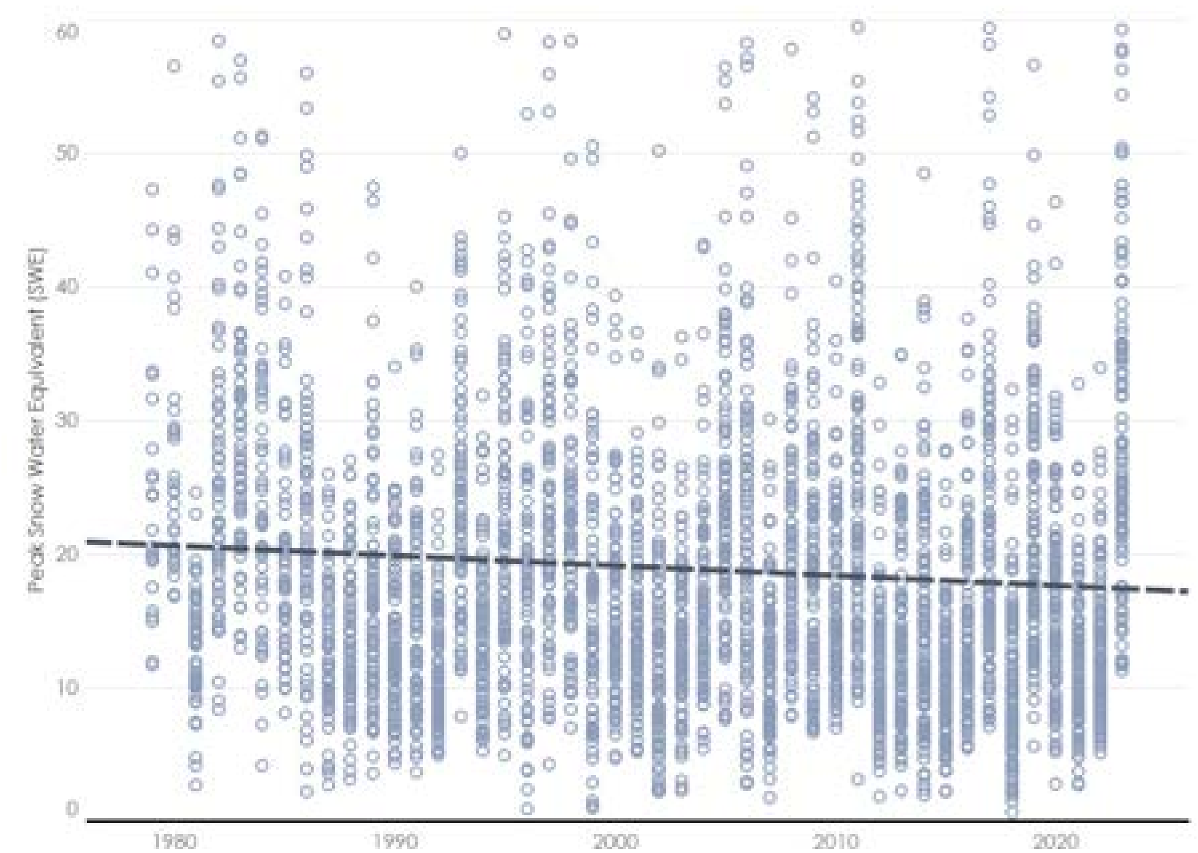
It is critical that Utahns prepare for a future with less snow, longer and drier summers, and higher temperatures in all seasons. Diminishing snowpack will shorten the season for skiing and other forms of winter tourism and recreation, which could lead to lost revenue. More importantly, less snow in the longer term means less water available for multiple uses, including drinking water and agriculture. Rain is harder to capture than snow, and it's impossible with our current infrastructure to store anywhere near the volume of water that currently is naturally stored in early spring snowpack. So even if Utah continues to receive the same amount of precipitation under a warming climate, or even more precipitation as some models suggest (Figure 2.E.1), we'll still grapple with water shortages and droughts, threatening communities' health and safety.

Less water will also be harmful and disruptive to ecosystems, fish, and wildlife, and could threaten biodiversity. For example, the state fish—the Bonneville cutthroat trout—relies on cold, reliable streamflow to survive. Less snow will impact this species. There is also potential for the tree line to shift, as subalpine fir and other high-altitude trees adapt to growing at higher elevations. A higher tree line would decrease the extent of alpine tundra ecosystems, which could threaten some tree and wildlife species.

LEFT: EARLY SPRING AT CUTLER RESERVOIR | AARON FORTIN

SNOWPACK IN THE BEAR RIVER MOUNTAIN RANGE | AARON FORTIN

Figure 2.E.1 The long-term trend in peak annual snowpack in Utah



Utah's **WATER** *in the news*

As we've tracked Utah and national news through 2024, we have compiled some of the key water issues and topics that have appeared in media outlets this year.

1. COLORADO RIVER ALLOCATION NEGOTIATIONS

In 2024, negotiations over the Colorado River's future continued as states, including Utah, prepared for key agreements set to expire in 2026. The Colorado River Collaborative has brought heightened media attention to these discussions, emphasizing the need for sustainable solutions. Utah is closely monitoring developments as water from the river remains critical to the state's agricultural, urban, and industrial needs.

2. GREAT SALT LAKE WATER ELEVATION

In 2024, the Great Salt Lake reached a high point of 4,195.1 feet in the spring, thanks to increased snowmelt and rainfall. However, by fall, its elevation had dropped to 4,188.5 feet due to hot, dry conditions and continued water diversions. These fluctuations remain a critical concern for Utah's ecosystem and water management strategies.

3. ANOTHER WET WINTER

Utah experienced its second consecutive wetter-than-normal winter in 2024, with record snowpack and heavy precipitation helping to maintain reservoirs and boost the Great Salt Lake's elevation. However, a hot and dry summer and fall quickly reversed some of these gains, with higher temperatures accelerating snowmelt and increasing water demand across the state.

4. WATER CONSERVATION EFFORTS

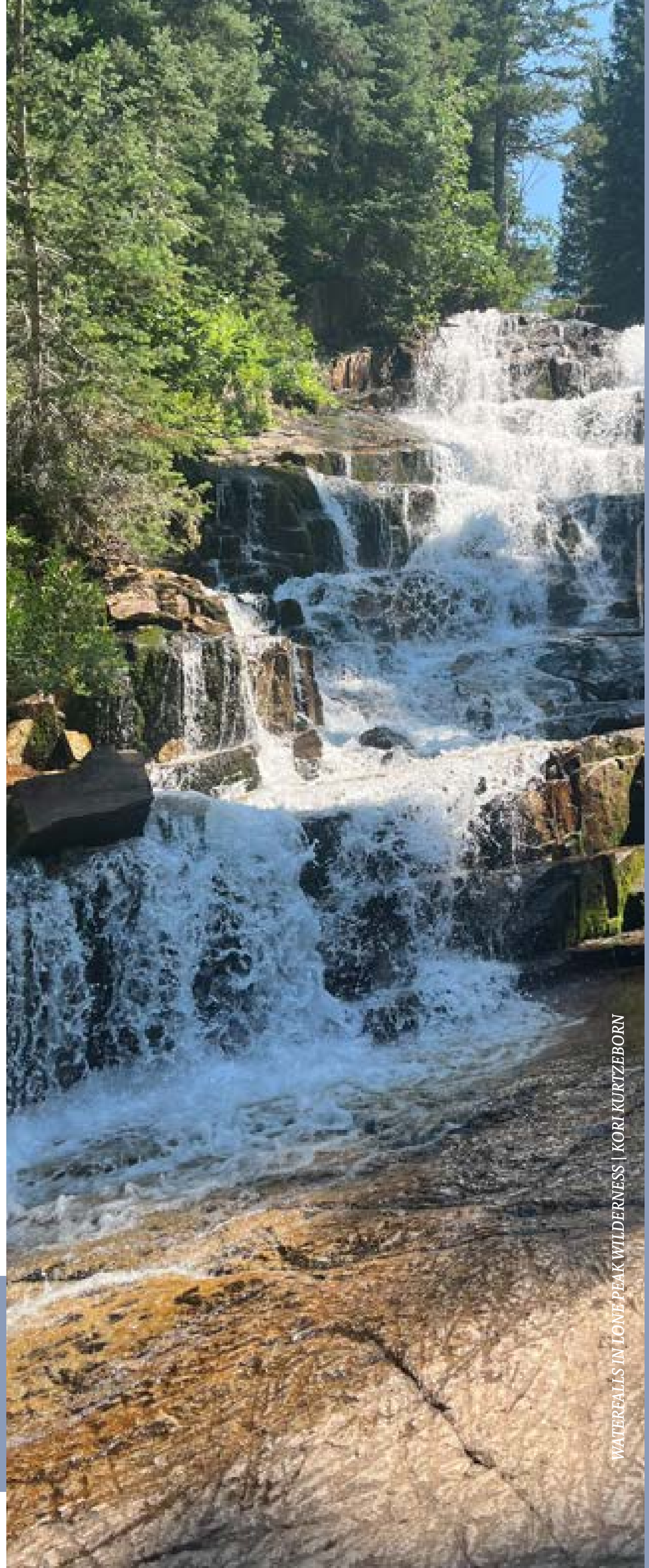
In 2024, Utah intensified its water conservation efforts, particularly in optimizing agricultural irrigation. Farmers adopted advanced technologies like drip irrigation and soil moisture sensors to reduce water use. Further work is needed to quantify the total water savings. These initiatives are part of broader efforts to improve water efficiency amid ongoing drought conditions.

5. DAM SAFETY CONCERNS

In 2024, dam safety became a growing concern in Utah, particularly at Panguitch Dam, where structural issues prompted increased monitoring and maintenance. Heavy runoff from consecutive wet winters heightened worries about potential overflows and the dam's capacity to manage high water levels. Repairs and upgrades are being planned to address these vulnerabilities.

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

We publish a weekly email newsletter, containing a roundup of stories in the media related to Utah's land, water, and air. This year, we shared nearly 2,000 stories, primarily from local media, with additional coverage from national outlets as well. Subscribe to our weekly email news roundup at: **usu.edu/ilwa/newsletter**.



WATERFALLS IN LONE PEAK WILDERNESS | KORI KURTZEBORN

CHAPTER 2 REFERENCES

2.1 Utah Division of State Parks. (2024). Bear Lake State Park - Current Conditions. Utah Department of Natural Resources. https://stateparks.utah.gov/parks/bear-lake/current-conditions/

Lake Powell Water Database. (2024). Water Summary. [Data set}. Water-Data.com https://lakepowell.water-data.com/

Utah Lake Authority. (2024). Water Levels. https://utahlake.gov/water-levels/

Utah Division of Water Resources. (2024). Great Salt Lake Elevation. Utah Department of Natural Resources. https://water.utah.gov/great-salt-lake-elevation/

2.A Aveek, M., Rosenberg, D.E., Bastidas, C., Horsburgh, J.S., Lane, B.A., Kopp, K., Mayer, P., and Fazio, J. (2023, July 6). Increasing the Impact of Utah State University's Extension Water Check Program With 5-Second Metering. Digital Commons. https://digitalcommons.usu.edu/water_rep/681/

2.B Morrisett, C. N., Van Kirk, R. W., Bernier, L. O., Holt, A. L., Perel, C. B., & Null, S. E. (2023). The irrigation efficiency trap: rational farm-scale decisions can lead to poor hydrologic outcomes at the basin scale. Frontiers in Environmental Science, 11, 1188139. doi.org/10.3389/fenvs.2023.1188139

O'Connell, J. (2019, December 3). Teton Basin launches aquifer recharge pilot. Intermountain Farm and Ranch. https://www.postregister.com/farmandranch/eastern_idaho/teton-basin-launches-aquifer-recharge-pilot/article_ba40be3e-a4d2-5c12-8584-849e7a260036.html

2.D Environment Canada. (2024). Objective for Canadian drinking water quality- per- and polyfluoroalkyl substances. https://www.canada.ca/en/health-canada/services/publications/healthy-living/objective-drinking-water-quality-per-polyfluoroalkyl-substances.html

European Union. (2023). Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006. Official Journal of the European Union, L 119, 103-157. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R0915

Chapter 3

AIR

Key issues facing Utah's air

YELLOW LAKE WILDFIRE SMOKE IN OAKLEY, UT | AARON FORTIN

Chapter Introduction

BRIAN STEED

Air quality remains a top concern in Utah. High-pressure events naturally trap air in Northern Utah's valleys, holding pollutants in the state's most populated areas. Wildfire and summer ozone have emerged as additional threats to our air quality.

In the Uinta Basin, winter ozone, linked to oil and gas production, has been the main issue. The good news is that both urban and rural Utah have made substantial progress in air quality. $PM_{2.5}$ (particulate matter under 2.5 microns) levels have improved, with fewer bad air days, thanks to policy adaptations, new technology, and better public awareness— a reason to celebrate.

That being said, there are emerging concerns about less-measured pollutants. While monitoring of $PM_{2.5}$ and summer ozone has increased, the state has under monitored PM_{10} (particulate matter or dust under 10 microns). Blowing dust from the drying Great Salt Lake seems to be more common along the Wasatch Front, and halogens, ammonia, and other airborne pollutants may be cause for greater vigilance. The solution to these newer concerns is a more robust monitoring network. Although the state has invested in new equipment, further efforts are needed to understand and respond to air quality concerns.

Figure 3.I.1 Air quality monitoring sites near Great Salt Lake

Source: *Utah Division of Air Quality*

YELLOW LAKE WILDFIRE SMOKE IN OAKLEY, UT | AARON FORTIN

Uinta Basin Ozone Improving with Increased Industry Efficiency

SETH LYMAN

The Uinta Basin is on track to meet the EPA's ozone standards, thanks to industry emission reductions, but there is still work to do.

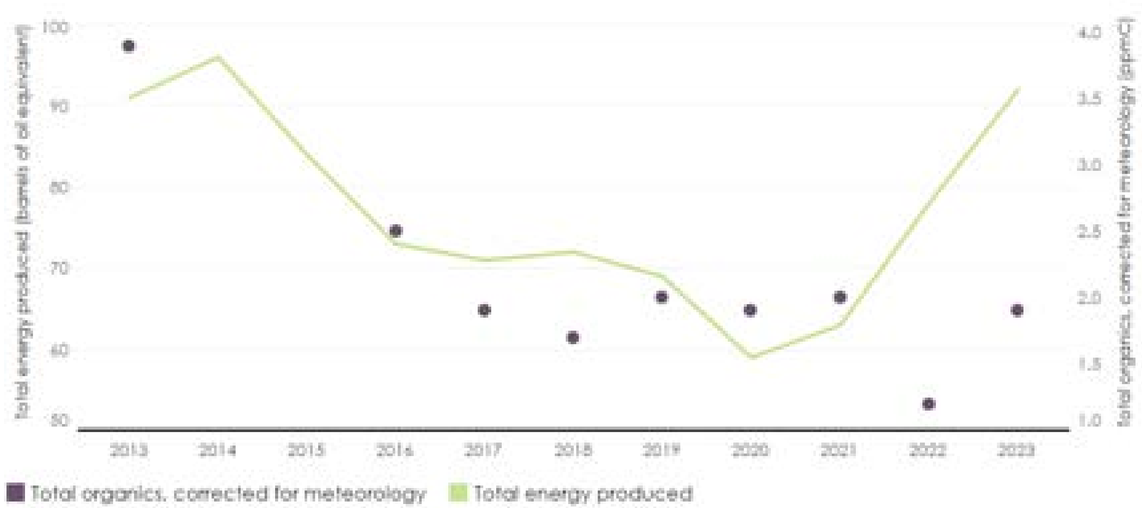
During winters with strong temperature inversions and snow cover, Uinta Basin ozone levels exceed Environmental Protection Agency standards. The largest source of ozone-forming pollution is the local oil and gas industry, a key driver of the local economy. High ozone threatens public health, and regulations targeting the oil and gas industry have the potential to harm economic development.

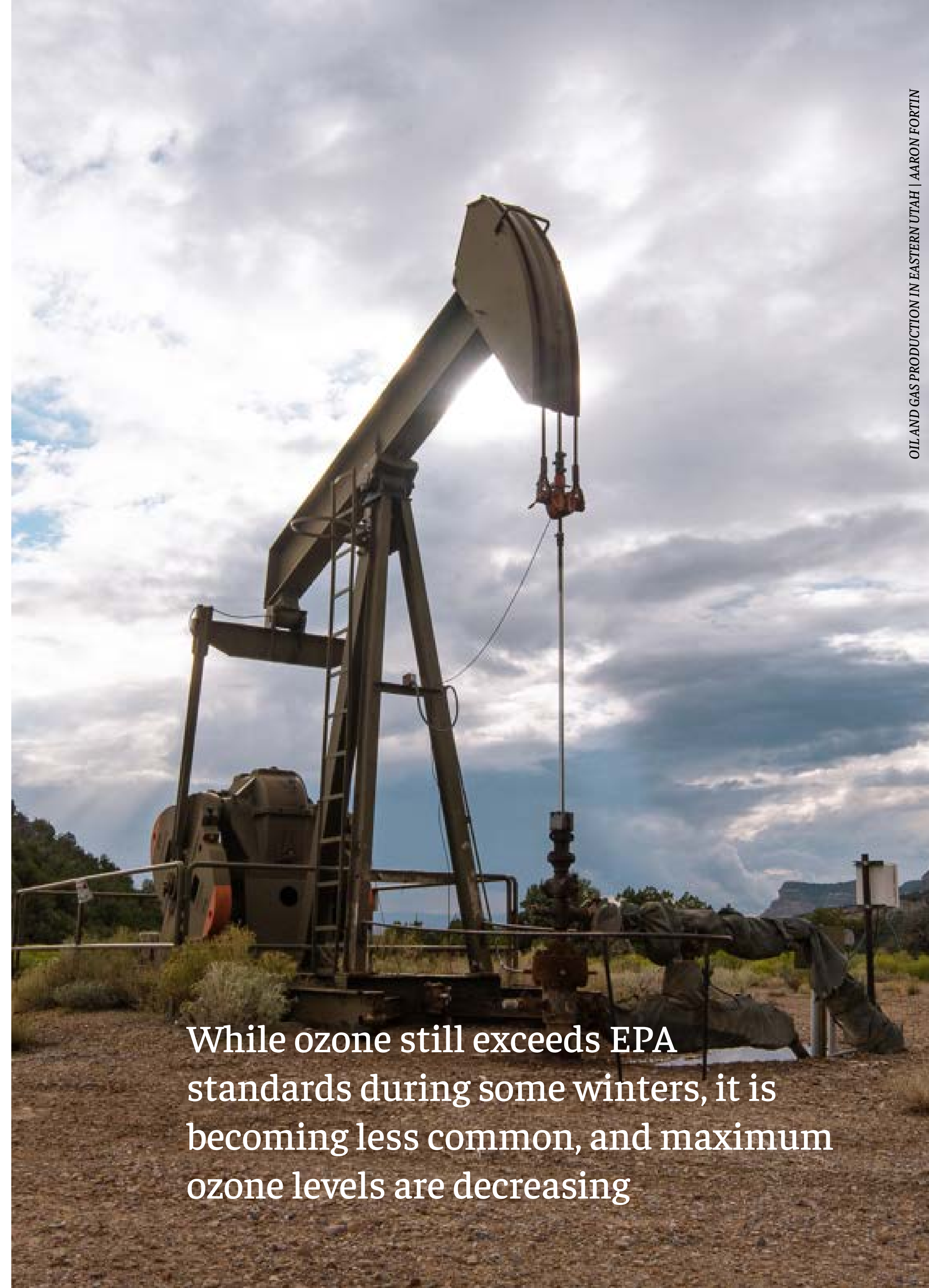
Since the issue was first discovered in 2009, regulatory changes and voluntary action by the oil and gas industry have led to decreases in ozone and related pollutants. While ozone still exceeds Environmental Protection Agency standards during some winters (most recently in January and February 2023), it is becoming less common, and maximum ozone levels are decreasing.

Energy production in the Uinta Basin rose until 2014 and then declined through 2020. But in 2021, persistent high energy prices led to a surge in production, as shown in the figure. Even as oil and gas activity has increased, however, pollution levels have remained flat when corrected for meteorological conditions. This indicates that improvements in new oil and gas infrastructure results in less pollution emissions than older infrastructure.

Because of this progress, this year the Environmental Protection Agency has begun the process to classify the Uinta Basin ozone levels as attaining air quality standards. More work is needed because high ozone still occurs during years like 2023, when there were many strong inversions and the basin experienced deep snow cover. The good news is that cooperative efforts by many partners are addressing this long-standing problem.

Figure 3.A.1 Total energy produced compared to total pollution (2013-2023)





OIL AND GAS PRODUCTION IN EASTERN UTAH | AARON FORTIN

GREAT SALT LAKE DUST NEAR FARMINGTON BAY | MOLLY BLAKOWSKI

The Impacts of Drought on Great Salt Lake Dust Emissions

MOLLY BLAKOWSKI & JANICE BRAHNEY

Policymakers need to remain vigilant on the potential for emissive dust from the exposed playa of Great Salt Lake. Additional monitoring is likely required to provide accurate data for addressing this issue.

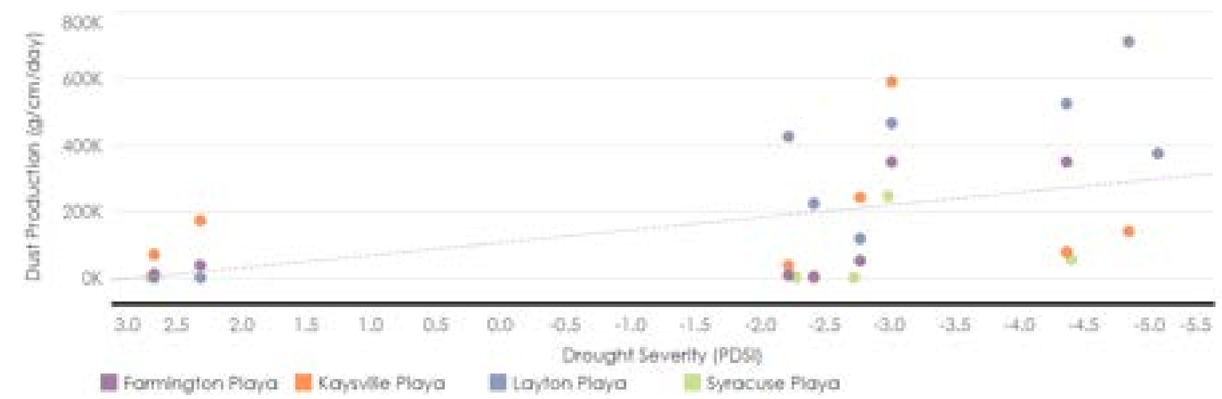
Great Salt Lake has fallen to unprecedented low levels, exposing hundreds of square miles of dry lakebed to the atmosphere. Recent studies have traced metal-laden dust from the lakebed across the Wasatch Front, raising considerable concerns for public health.

Between 2019 and 2021, Utah State University researchers have maintained a network of wind erosion samplers on the dry lakebed of Great Salt Lake. The amount of dust produced varied greatly by site, with most exhibiting the highest rates of wind erosion in 2021 (Figure 3.B.1). The research team found a significant association between dust production and drought conditions, which worsened between 2019 and 2021. Droughts reduce soil moisture and make soil surfaces more susceptible to emitting fine dust when bombarded by large, bouncing particles during high wind events. At the site with the highest rates of dust production, the research team found that particle size became more fine over time in response to the weathering of protective surface crusts in the surrounding area.

Paired with drought conditions, a gradual breakdown of surface crusts may lead to more frequent, low-intensity dust events of fine lakebed sediments by relatively low wind speeds. While particles of any size can impact human and ecosystem health, finer particles require less wind energy to travel farther from the lakebed, such as to the Wasatch Mountains, where they may speed snowmelt by laying down a layer of dark material on the white snow, increasing the absorption of the heat from the sun.

In addition to this project, researchers are also investigating different pathways through which populations may be exposed to harmful metals in Great Salt Lake dust, as well as evaluating the sources of metal pollution that have accumulated in lakebed sediments over time.

Figure 3.B.1 Rates of dust production from four wind erosion monitoring sites across the dry lakebed plotted against drought severity



Utahns’ Beliefs and Behaviors Related to Air Quality

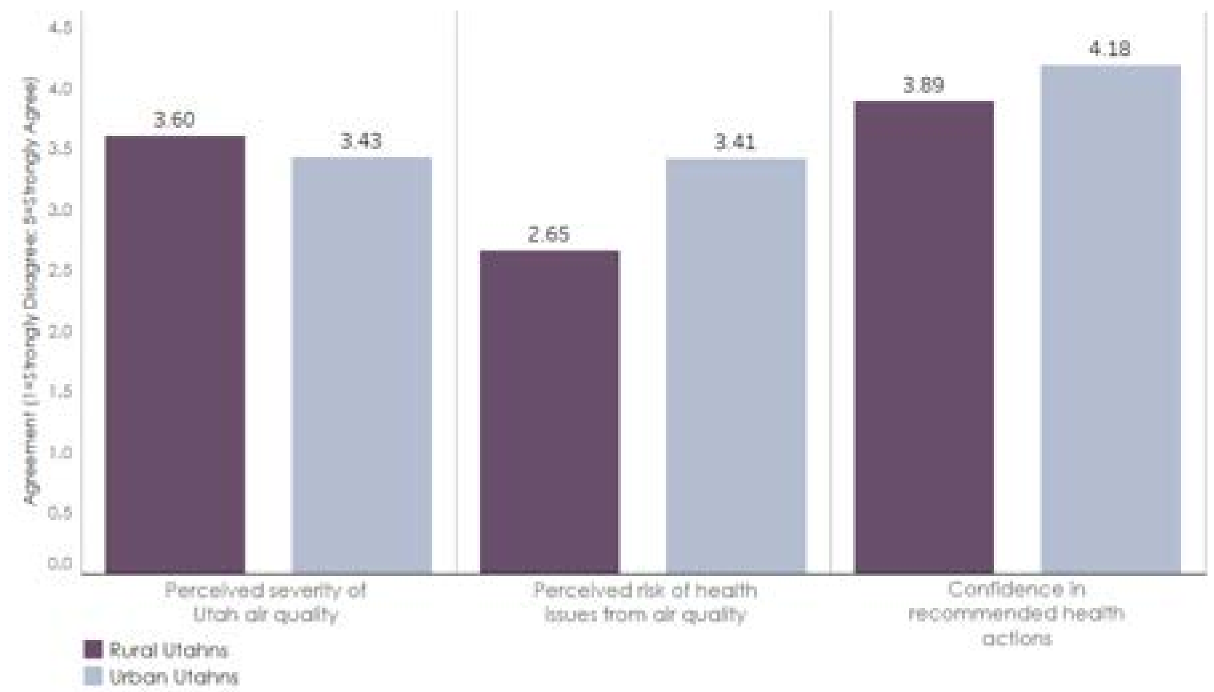
SYDNEY O’SHAY & MEHMET SOYER

Air quality health messaging and solutions should address the distinct ways urban and rural Utahns think about and respond to Utah’s air quality.

Air quality is one of the top environmental concerns for Utahns today.[3.C] Health risks associated with air pollution can range from mild physiological impacts to death from cardiovascular and respiratory disease.[3.C]

Attitudes and behavior regarding air pollution and associated health risks vary among Utahns. According to findings from the 2023 Utah People and the Environment Poll (Figure 3.C.1), people living in urban areas view air pollution as a greater health risk compared to those in rural areas. Urban areas experience air pollution differently than in rural parts of the state. As a result, urban Utahns are more likely to protect themselves by using an air purifier or avoiding strenuous outdoor activities on poor air quality days. On the other hand, because rural Utahns don’t experience air pollution as a persistent risk, they are less likely to take action during poor air quality events unless the air pollution is severe enough, such as with wildfire events.

Figure 3.C.1 Rural and urban Utahns’ perceptions of severity, health risk, and recommeded health actions related to poor air quality



These findings can be used to improve air pollution messaging techniques of policy makers, health practitioners, and communicators. Proposed solutions to air quality issues will be more effective if they’re crafted in ways that target urban and rural Utahns’ specific needs. Messaging and solutions should avoid instilling fear while also helping Utahns recognize the risks air pollution poses, encourage confidence in combating pollution while planning ahead for bad air days, and provide resources that enable Utahns to act, such as affordable public transportation or e-bike and air purifier rebate programs.

WILDFIRE SMOKE OVER SALT LAKE CITY | AARON FORTIN

Uneven Extreme Heat Distribution in Salt Lake City

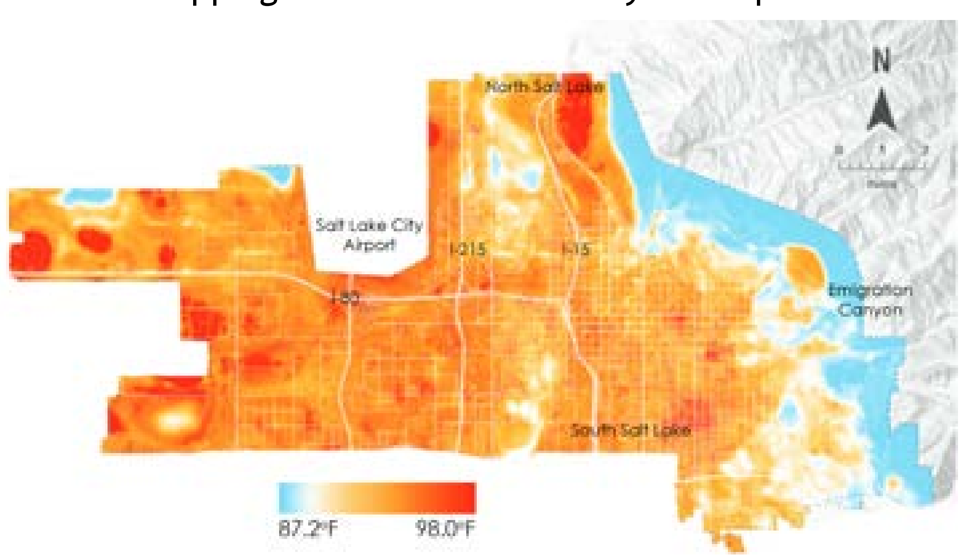
WEI ZHANG

Data from a Heat Watch campaign in July 2023 shows extreme heat can impact the west side of Salt Lake City more than the east side.

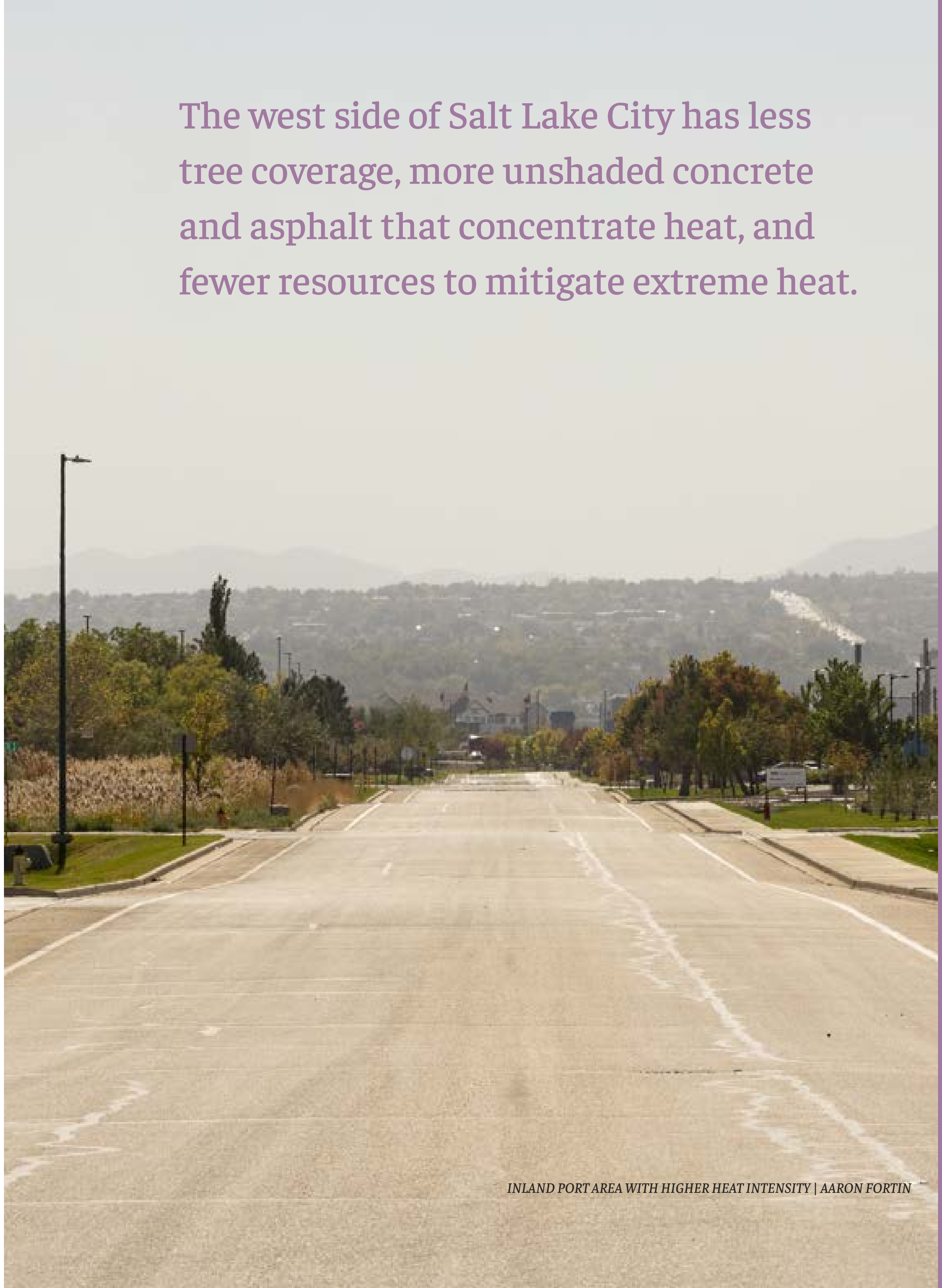
Extreme heat is one of the deadliest natural disasters, and its impacts are not evenly distributed across places and communities. People living in underserved communities are typically hit the hardest by the effects of extreme heat. Historically, data on extreme heat events has lacked sufficiently detailed geographic coverage. With support from the National Oceanic and Atmospheric Administration's National Integrated Heat Health Information System, a team led by Utah State University scientists accomplished a Heat Watch campaign in Salt Lake City in July 2023. The detailed heat mapping results—based on 58,707 temperature measurements over an area of 72.6 square miles—show that the west side of Salt Lake City suffers more extreme heat than the east side (Figure 3.D.1). Among the reasons for this difference are that the west side of the city has less tree coverage, more unshaded concrete and asphalt that concentrate heat, and fewer resources to mitigate extreme heat. This campaign lays the groundwork for future adaptation efforts amidst escalating extreme heat risks. By employing community engagement and sensor innovations, a high-resolution heat description has been developed for the region, fostering local partnerships to address the inequitable risks associated with extreme heat.

Utah State University's co-leadership in the Center for Collaborative Heat Monitoring, funded by the National Oceanic and Atmospheric Administration, empowers communities through science-based observations and data collection on local heat impacts. Utah's proactive stance exemplifies its crucial role in tackling nationwide extreme heat challenges.

Figure 3.D.1 Heat mapping results for Salt Lake City for 3-4 pm in summer 2023



The west side of Salt Lake City has less tree coverage, more unshaded concrete and asphalt that concentrate heat, and fewer resources to mitigate extreme heat.



INLAND PORT AREA WITH HIGHER HEAT INTENSITY | AARON FORTIN

Filling an Education Gap: Utah's Statewide Clean Air Marketing Contest

EDWIN STAFFORD & ROSLYNN MCCANN

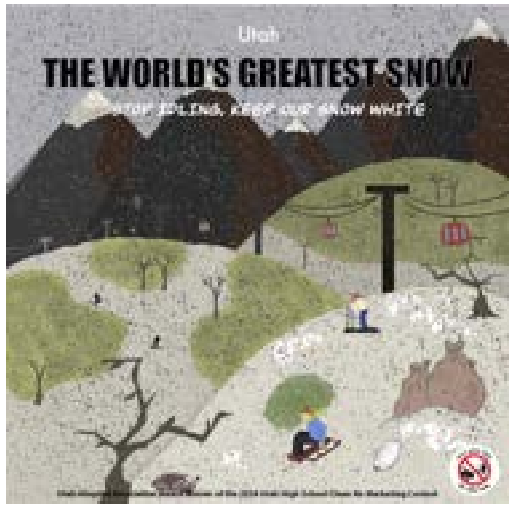
The statewide contest offers thousands of teens essential context about Utah's air quality and empowers them with practical ways to make a difference.

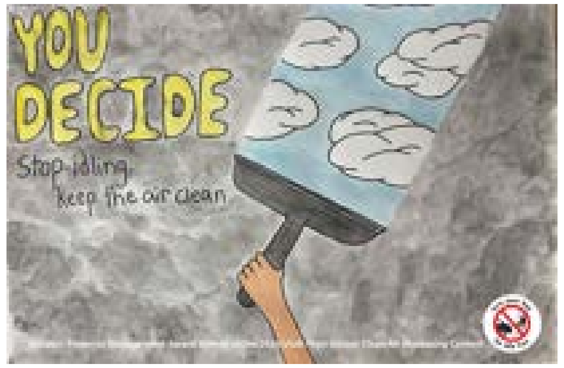
Now celebrating its ten year anniversary, the Utah High School Clean Air Marketing Contest has engaged over 6,500 teens on the topic of air pollution in Utah, teaching responsible transportation strategies and helping them understand how to preserve air quality in their own communities. The contest message focuses on practical strategies: limiting idling, carpooling, taking the bus, trip-chaining, biking, and avoiding the drive-thru. Combining environmental science, art, and savvy marketing, teens are given the opportunity to create public service announcements to promote clean air actions that appeal to their high school peers and to Utah citizens.

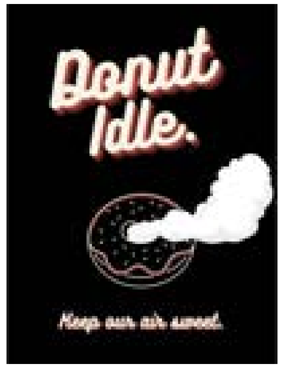
Contest entries are often funny, edgy, and provocative—reflecting teen culture. Participants win cash and gift cards donated by Utah businesses, foundations, and citizens. This year over a thousand teens across the state participated, from Whitehorse High School on the Navajo Nation in the south to Preston High School in Idaho (which shares northern Utah's airshed in Cache Valley).

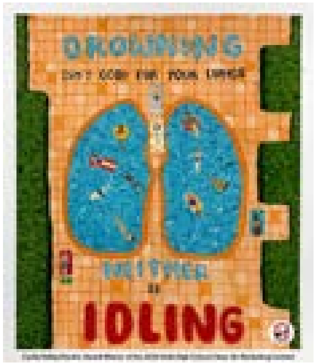
Surveys conducted after the contest show that teens have a greater willingness and commitment to act in ways that will preserve air quality, such as shutting off their engines and sharing rides. Teens report persuading their parents to do the same in what is called "the inconvenient youth" effect. Parents also generally welcome such interactions. This research has shown a gap in Utah school curricula on air quality and pollution, even though it is a high-profile and high-impact issue affecting everyone in the state. Most participants reported that the contest offered the only formal clean air education they recall receiving.

Figure 3.E.1 Selected winners from the 2024 contest

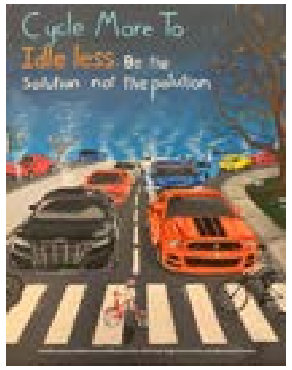


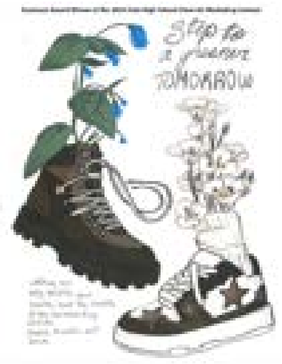


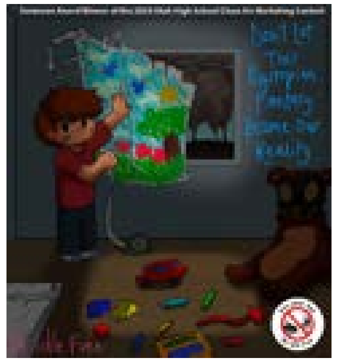


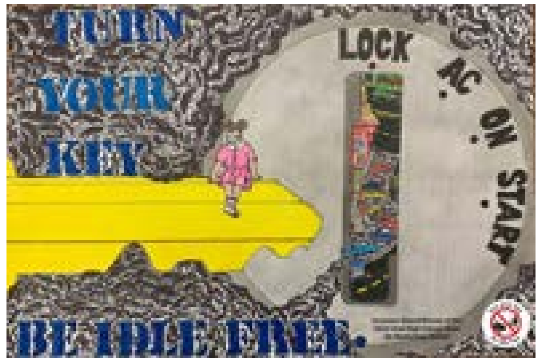


The contest message focuses on practical strategies: limiting idling, carpooling, taking the bus, trip-chaining, biking, and avoiding the drive-thru.









The Wasatch Front is making progress on $PM_{2.5}$ levels

RANDY MARTIN

Despite growth in population, $PM_{2.5}$ levels have generally decreased along the Wasatch Front over the past decade.

Small particulate matter (PM) measuring 2.5 microns or less across the Wasatch Front is monitored at several locations in order to assess air quality. As is widely known, airborne particulate matter is a large concern because of how Utah's air is impacted by weather patterns, population growth, wildfire smoke, pollution from various industries and transportation, and topography all intersect to create challenges to Utah's air quality. Higher levels of $PM_{2.5}$ affect human health but also affect how the state is perceived by visitors and recreators from outside the state.

$PM_{2.5}$ is one of the measurements that the Environmental Protection Agency uses to determine whether Utah is attaining healthy levels of cleaner air. During the past decade, legislation, management and policy, air quality monitoring, and upgrades to industries that have historically contributed to air pollution have been working together to improve Utah's air. One of the interesting observations of $PM_{2.5}$ levels over the last decade is that while population has grown along the Wasatch Front, overall $PM_{2.5}$ levels have declined. This shows that such collaboration has produced some positive results; however, as shown in Figure 3.F.1, it must be noted that northern Utah's airsheds are only a bad (i.e. stagnant) winter away from excessive violations (see 2021 and 2023).

This past wildfire season was one of Utah's busiest in years in terms of human-caused wildfires (Figure 3.F.2). There are some interesting correlations between days when $PM_{2.5}$ levels were higher and times when the air was filled with trapped smoke due to weather patterns. This was particularly true for events in mid-July and early August (Figure 3.F.3). Some of that smoke came from Utah's fires, but some was also attributed to wildfires burning in other states. While Utahns must continue to work together to improve our state's contributions to air pollution and manage the size of Utah wildfires, we are still sometimes subject to outside influences on our air quality.

Additionally, on Feb. 24, 2024, the U.S. EPA announced a revision to the annually averaged $PM_{2.5}$ standard, lowering from 12 µg/m³ to a 9 µg/m³. As shown in the Figure 3.F.4, over the past 3-year averaging period, several monitoring locations showed year-to-year violations of the new standard, but only the Near Road location in the central Salt Lake City valley showed consistent and regulatory-enforceable exceedance of the 3-year average relative to the new annual standard.

Figure 3.F.1 Chronological Northern Utah 24-hr 98th percentile $PM_{2.5}$

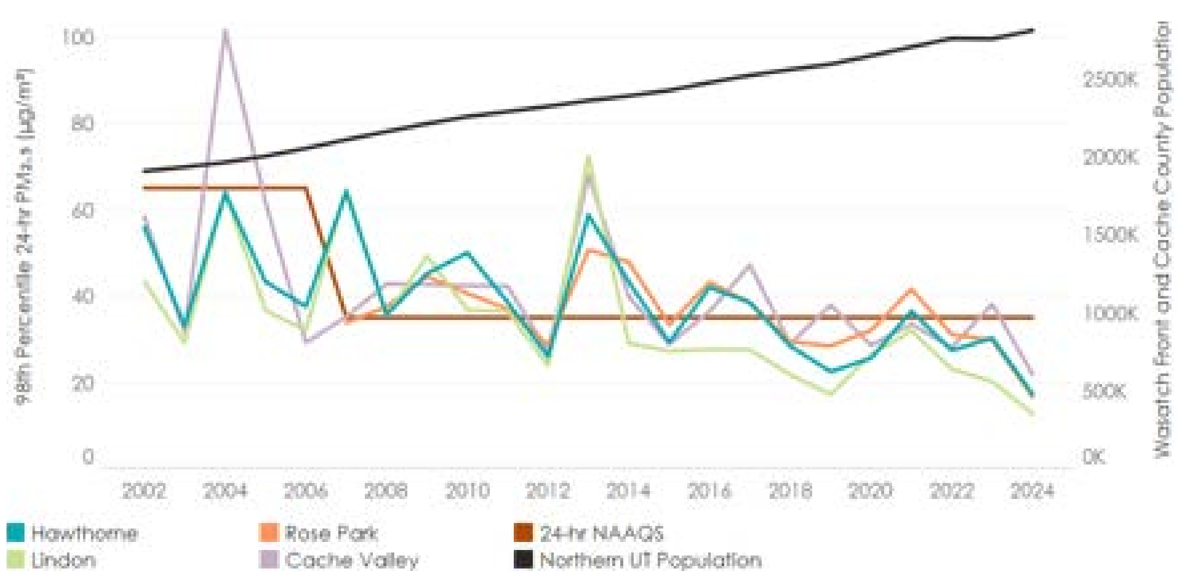


Figure 3.F.2 Summer 2024 newsworthy hazy smoke days

July 15-17	August 2-3
July 23-24	August 6-10
July 28-31	August 28-30

Figure 3.F.3 $PM_{2.5}$ levels through Summer 2024

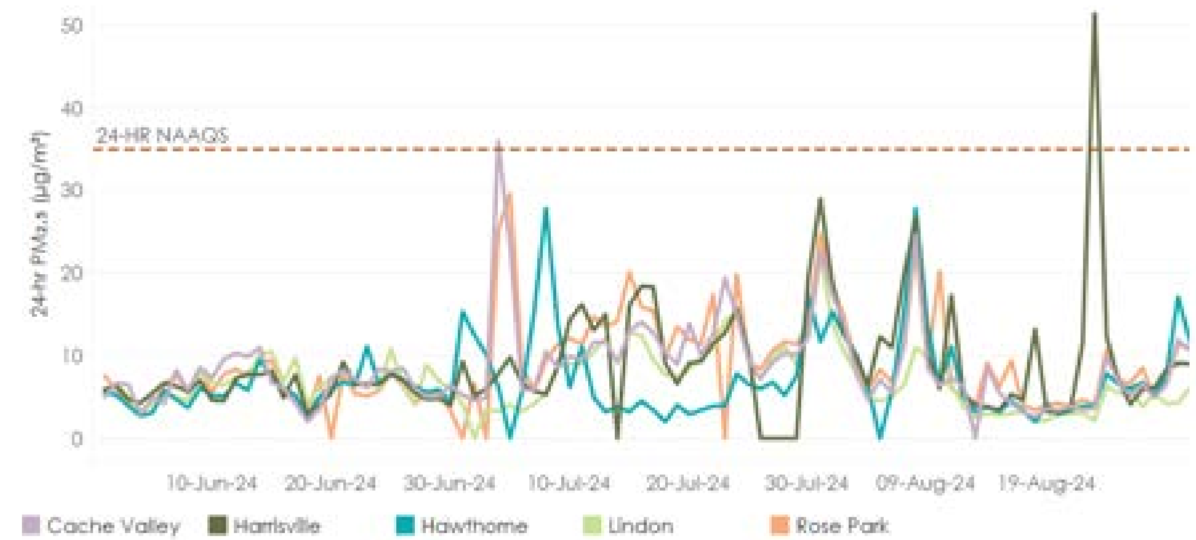


Figure 3.F.4 Three-year average $PM_{2.5}$ by monitoring station

	2021	2022	2023	Average
Smithfield (SM)	9.26	7.52	7.55	8.1
Harriville (HV)	8.10	6.60	5.85	6.9
Bountiful (BV)	9.42	7.18	7.26	8.0
Rose Park (RP)	9.43	8.55	6.69	8.2
Hawthorn (HW)	8.43	7.31	7.85	7.9
Near Road - SLC (NR)	11.4	9.88	9.45	10.1
Lindon (LN)	8.20	7.23	6.69	7.4

Utah's **AIR** *in the news*

As we've tracked Utah and national news through 2024, we have compiled some of the key air issues and topics that have appeared in media outlets this year.

1. PAUSE ON EPA OZONE RULE

In 2024, the U.S. Supreme Court halted the EPA's Good Neighbor rule, which sought to curb interstate ozone pollution. This decision temporarily blocks the rule's implementation, affecting how Utah and other states manage cross-border air quality impacts. The ruling has created uncertainty around future air pollution regulations and compliance measures in Utah.

2. AIR QUALITY IMPACTS ON UTAH'S ECONOMY

Air pollution is increasingly impacting Utah's economy, affecting industries like tourism and raising concerns for the 2034 Olympic Winter Games. Poor air quality can deter visitors and disrupt outdoor events, which are key economic drivers. A Utah Foundation study showed support for environmental protection, but enthusiasm wanes if solutions increase costs, highlighting the challenge of balancing clean air with economic interests.

3. WEST SIDE AIR QUALITY

Recent news coverage in 2024 highlighted how air pollution disproportionately affects residents on the west side of Salt Lake Valley. Proximity to industrial sites, highways, and prevailing wind patterns has led to higher pollution levels in these communities. Concerns about long-term health impacts have sparked calls for targeted air quality improvements in the area.

4. SUMMERTIME OZONE

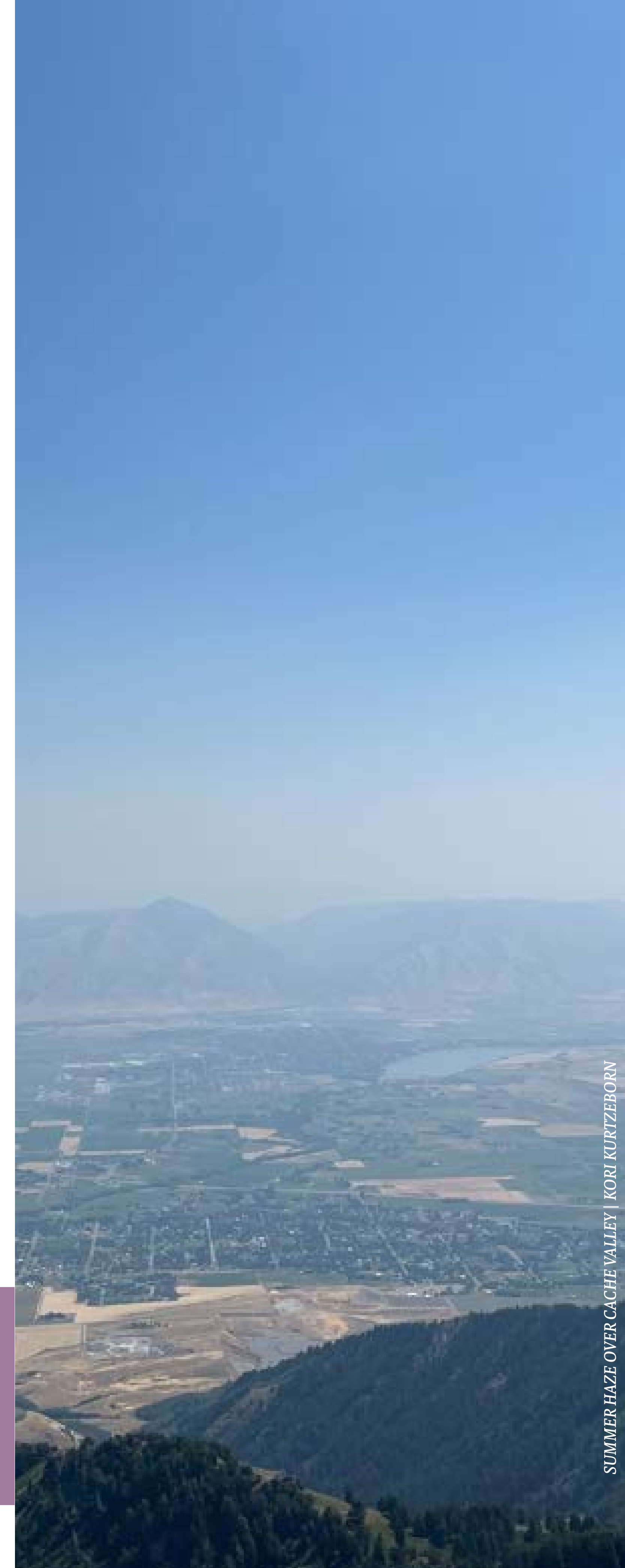
In 2024, elevated summertime ozone levels continued to raise health concerns in Utah, especially along the Wasatch Front. High temperatures and vehicle emissions contributed to frequent ozone spikes, affecting air quality and posing respiratory risks. State agencies have urged residents to reduce emissions during ozone action days to help mitigate these seasonal air quality challenges.

5. SUPPORT FOR AIR QUALITY EFFORTS

UCAIR, Utah's nonprofit focused on improving the state's air quality through education and partnerships, appointed Lindsie Smith as its new executive director. The organization also honored Utah State University's Dr. Randy Martin as Person of the Year for his significant contributions to air quality research, particularly in reducing harmful pollutants such as $PM_{2.5}$ across the state.

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

We publish a weekly email newsletter, containing a roundup of stories in the media related to Utah's land, water, and air. This year, we shared nearly 2,000 stories, primarily from local media, with additional coverage from national outlets as well. Subscribe to our weekly email news roundup at: **usu.edu/ilwa/newsletter**.



SUMMER HAZE OVER CACHE VALLEY | KORI KURTZEBORN

CHAPTER 3 REFERENCES

3.I Utah Division of Air Quality. (2024). *Utah Air Monitoring Program.* [Data set]. Utah Department of Environmental Quality. https://air.utah.gov/dataarchive/archall.htm

3.B Carling, G.T., Fernandez, D.P., Rey, K.A., Hale, C.A., Goodman, M.M. and Nelson, S.T. (2020). Using strontium isotopes to trace dust from a drying Great Salt Lake to adjacent urban areas and mountain snowpack. *Environmental Research Letters, 15(11).* 114035.

Lang, O.I., Mallia, D. and Skiles, S.M. (2023). The shrinking Great Salt Lake contributes to record high dust-on-snow deposition in the Wasatch Mountains during the 2022 snowmelt season. *Environmental Research Letters, 18(6).* 064045.

Putman, A.L., Jones, D.K., Blakowski, M.A., DiViesti, D., Hynek, S.A., Fernandez, D.P. and Mendoza, D. (2022). Industrial particulate pollution and historical land use contribute metals of concern to dust deposited in neighborhoods along the Wasatch Front, UT, USA. *GeoHealth, 6(11).* e2022GH000671.

3.C Community and Natural Resources Institute. (2023). *The Utah People and Environment Poll (UPEP).* Utah State University College of Humanities and Social Sciences Sociology Department. https://chass.usu.edu/sociology/canri/upep

3.D CAPA Strategies and NOAA NIHHIS. (2023, August 7). *Heat Watch Salt Lake City.* Open Science Framework. Retrieved June 2023. https://osf.io/vhkga

3.F Environmental Protection Agency. (2024). *Final Rule to Strengthen the National Air Quality Health Standard for Particulate Matter.* [Fact Sheet]. United States Environmental Protection Agency. https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-overview.pdf

Utah Department of Environmental Quality. (2024). *Utah Air Monitoring Program Data Archive, Particulate Matter PM2.5 Monthly Reports.* [Data set]. UDAQ. https://air.utah.gov/dataarchive/archpm25.htm

Dunphy, K. (2024, July 15). With six large fires burning in Utah, conditions could worsen with upcoming forecast. *Utah News Dispatch.* https://utahnewsdispatch.com/2024/07/15/utah-fire-conditions-could-worsen-with-weather/

Duphney, K. (2024, August 2.) Despite some rain on Utah's horizon, the rest of summer looks hot, dry and fire-prone. *Utah News Dispatch.* https://utahnewsdispatch.com/2024/08/02/utah-summer-forecast-despite-some-rain-hot-dry-fire-risk/#:~:text=That%20goes%20for%20the%20northwestern,wildfires%20develop%2C%E2%80%9D%20said%20Cunningham.

Gephardt Daily Staff. (2024, August 29). Idaho's wildfire smoke coming to Utah. *Gephardt Daily.* https://gephardtdaily.com/local/idahos-wildfire-smoke-coming-to-utah/

Jeremias, S. (2024, July 15). Wildfire smoke could stick around in Salt Lake Valley. *The Salt Lake Tribune.* https://www.sltrib.com/news/environment/2024/07/15/get-ready-wildfire-smoke-salt-lake/

O'Donoghue, A.J. (2024, July 23). Air quality sinking, temperatures rising making for a blistering Pioneer Day. *Deseret News*. https://www.deseret.com/utah/2024/07/23/wildfire-heat-utah-temperatures-weather/#:~:text=Church%20says%20residents%20can%20expect,Utah%20and%20around%20the%20West.&text=The%20Utah%20Division%20of%20Air,world%20news%20that%20you%20value.

Small, A. (2024, August 28). More wildfire smoke headed to the Wasatch Front. *KSL Newsradio.* https://kslnewsradio.com/2130783/more-wildfire-smoke-headed-to-the-wasatch-front/

Williams, C. (2024, August 7.) Wildfire smoke returns to Utah. Here's where it's coming from. KSL News. https://www.ksl.com/article/51093274/wildfire-smoke-returns-to-utah-heres-where-its-coming-from#:~:text=15,Park%20Fire%20in%20northern%20California.

Chapter 4

FORESTS AND RANGELANDS

Key issues facing Utah's forests and rangelands

FOREST AT CEDAR BREAKS NATIONAL MONUMENT | AARON FORTIN

Chapter Introduction

BRIAN STEED

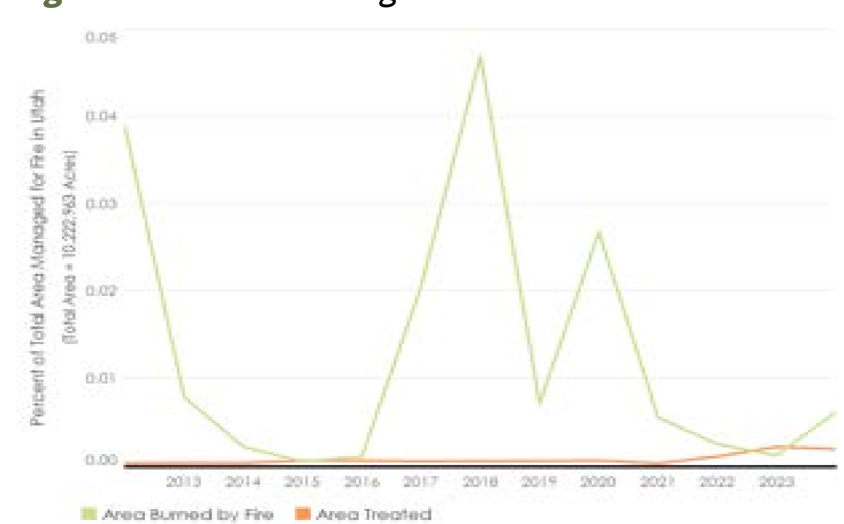
Federal and state governments control almost 70 percent of Utah's lands, with much of it forested. These lands provide critical watershed protections, outdoor recreation, wildlife habitat, grazing opportunities, forest products, and a variety of other essential benefits to the state.

Forest lands have also been a source of real controversy. Management practices on these landscapes have shifted throughout Utah's history. Early policies prioritized human use, favoring fire suppression to protect watersheds and preserve grazing and timber resources. Later, management adjusted to a more preservationist approach, moving away from forest products and toward the protection of wildlife habitat, aesthetic beauty, and recreational opportunities, while still focusing heavily on fire suppression. These policy preferences led to forests with heavy fuel buildup, dense monocultures, and trees less resistant to disease and pests.

Active forest management offers a chance to create healthier and more resilient forests. This approach relies on the best science and data available. Controlled burns can mimic natural fire cycles and help to restore forest health. Similarly, mechanical treatments reducing tree density and fine fuels can improve forest conditions. Innovative approaches can create new opportunities for forest product entrepreneurs.

At the same time, active forest management requires a new generation of trained forest experts and workers. The State of Utah has invested millions into active management to date, and Utah State University's new Forest Restoration Institute will provide research and training to bolster these efforts and create the next generation of future forest stewards.

Figure 4.I.1 Forest Management Practices and Wildfires



Source: *Utah Division of Forestry, Fire, and State Lands*

FOREST AT CEDAR BREAKS NATIONAL MONUMENT | AARON FORTIN

ASPEN MIRROR LAKE | AARON FORTI

Utah Forest Restoration Institute: Strengthening Forest Health

LINDA NAGEL, DEAN OF THE S.J. & JESSIE E. QUINNEY COLLEGE OF NATURAL RESOURCES

The Utah Forest Restoration Institute at Utah State University will improve wildfire management, train future forest managers, and foster collaboration to enhance forest health statewide.

The newly established Utah Forest Restoration Institute at Utah State University aims to transform forest management across the state. With Utah's forests increasingly impacted by wildfire and other natural disturbances, the Utah Forest Restoration Institute will provide critical support for managing fire risks, improving resilience, and restoring forest health. The Utah Forest Restoration Institute will offer cutting-edge training for the next generation of Utah forest managers and help bridge the gap between researchers and land managers by facilitating collaboration. By hosting workshops, conferences, and outreach efforts, the Utah Forest Restoration Institute will create a community of practice around adaptive forest management, ensuring that both public and private land managers have access to the latest scientific knowledge and best practices.

Thanks to new ongoing funding from the Utah Legislature, the Utah Forest Restoration Institute will also integrate Utah into a broader regional effort, joining similar institutes in neighboring states as part of the Southwest Ecological Restoration Institutes. This collaboration will leverage federal resources and provide Utah with unique opportunities to address its specific forest health challenges. Ultimately, the Utah Forest Restoration Institute will play a vital role in protecting Utah's forests, reducing wildfire risks, and fostering a greater public understanding of active forest management.

Figure 4.A.1 The Utah Forest Restoration Institute's key objectives

Tracking Utah's Unique Wildfire Patterns: Managing Forests for Recovery

JAMES A. LUTZ & JOSEPH D. BIRCH

Managing forests for conditions that allow smaller fires to burn while leaving big trees alive increases chances for forests to recover from inevitable wildfires.

Fire is an integral part of Utah's landscapes, but it also poses great risks to people, structures, forests, rangelands, and agriculture. Unchecked wildfires decrease air quality, water quality, and the effectiveness of reservoirs as they fill with fire-produced erosion.

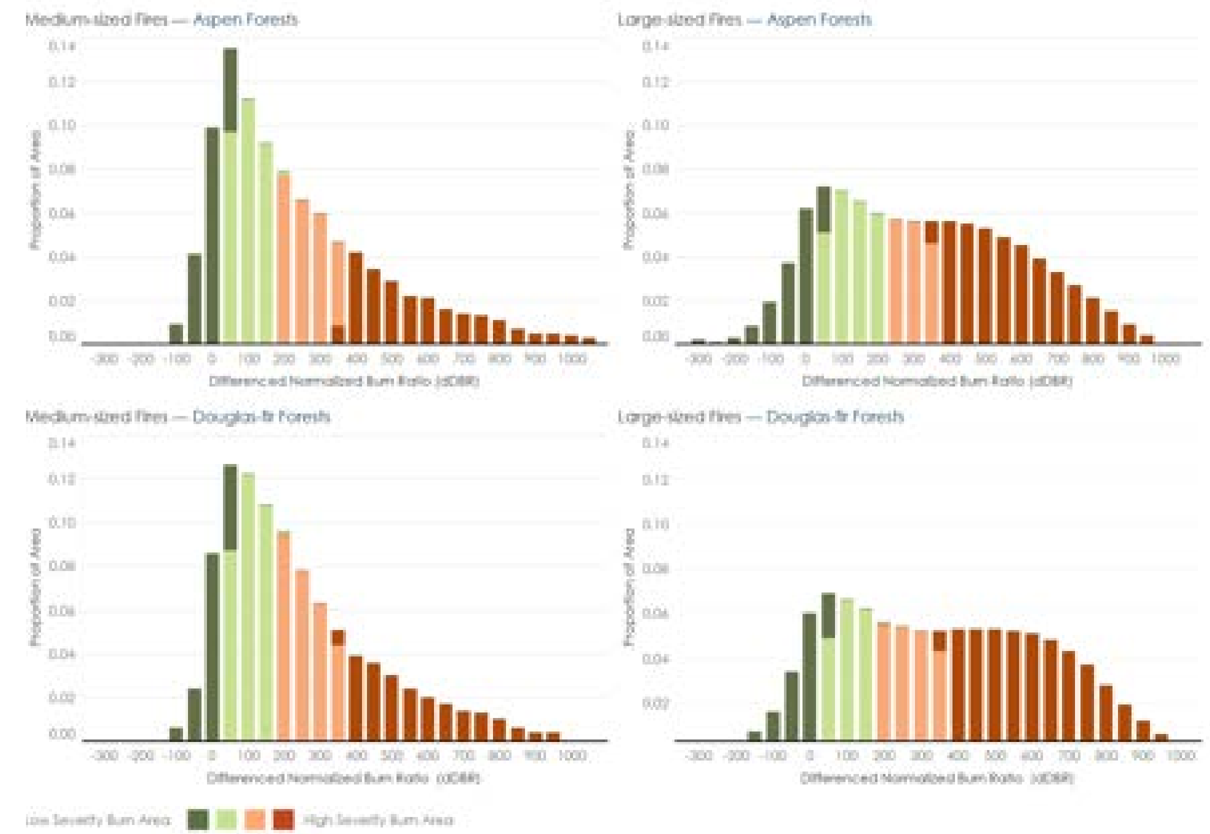
Researchers have learned over the last century that we can't keep fires from starting or burning, but we can create the best conditions possible to assist forests for post-fire recovery. Research is emerging to show that best practice includes managing forests in a way to increase chances that a fire will burn but leave some trees alive, especially large trees. Large, living trees provide the structure of the future forest, contribute seeds for regrowth, help reduce erosion, and keep winter snow on the ground longer. Forests that are less dense (because of previous fire or mechanical thinning) can also be more resistant to drought and insect attack.

There is increasing focus on large fires in Utah because of the damage that they cause and the resources needed to control them. Smaller fires (between 100–1,000 acres) do much less damage, and can consume surface fuels and decrease tree density without killing all trees. Although fire behavior is complex, in some forest types (such as aspen and Douglas-fir), smaller fires burn less severely while large fires are more intense (Figure 4.B.1).

Researchers from Utah State University mapped and analyzed all fires larger than 100 acres in Utah from 1984–2022 and indexed them by vegetation type, year, and size class to serve as a baseline for examining future changes. This baseline data will be a valuable tool to understand wildfire trends and consequences as we continue to manage wildfire and aid forests in recovery.

Research is emerging to show that best practice includes managing forests in a way to increase chances that a fire will burn but leave some trees alive, especially large trees.

Figure 4.B.1 Fire severity distributions for large fires (>1,000 acres) and medium-sized fires (100–1,000 acres) in aspen and Douglas-fir forests in Utah from (1984 to 2022)



YELLOW LAKE FIRE SMOKE NEAR MIRROR LAKE HIGHWAY | AARON FORTIN

Woody Plant Populations are Increasing in Response to Changing Climate Conditions

ANDREW KULMATISKI

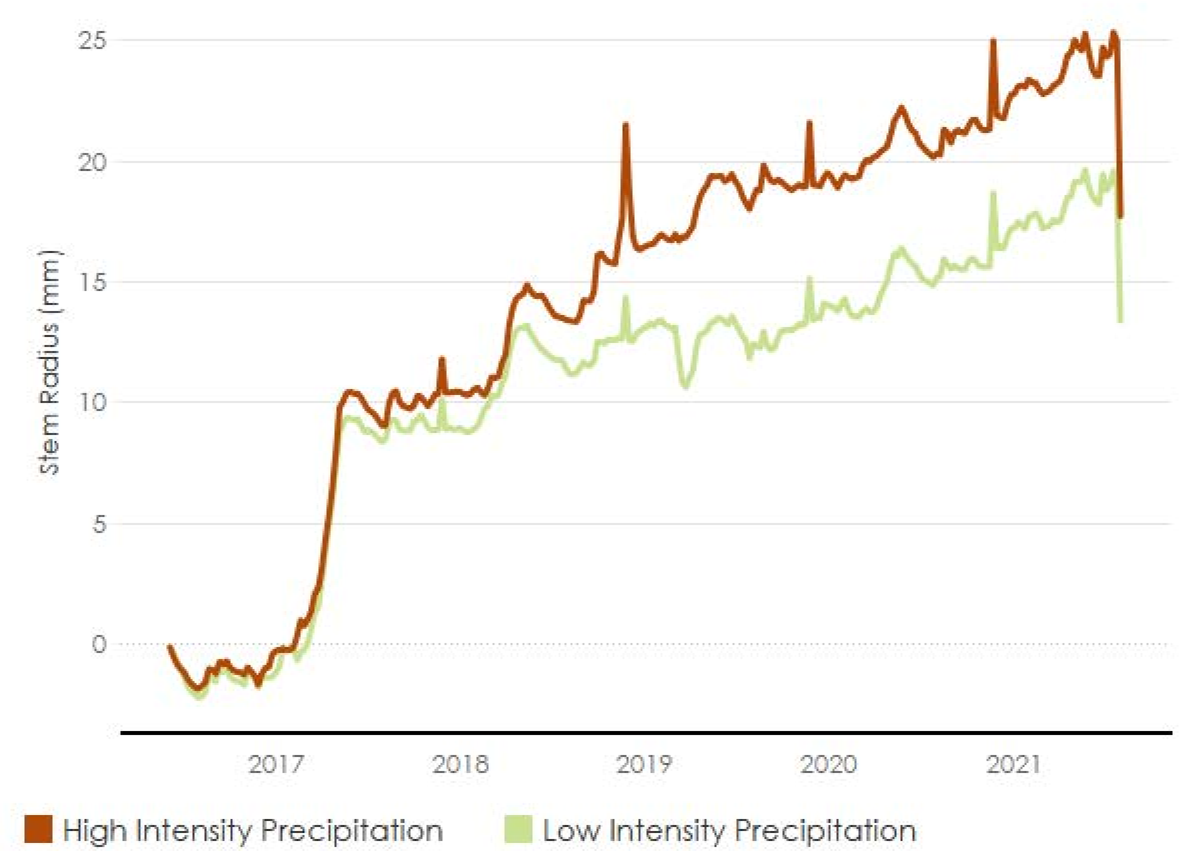
Intense precipitation events across the western U.S. are boosting woody plants like juniper and crowding out plants that animals feed on.

Woody plants have become more abundant around the world over the past 50 years. In the western U.S. this "woody plant encroachment" has resulted in doubling woody cover that has induced $5 billion in lost forage production for animals and rangeland management costs. Utah State University researchers are examining why this is happening, how woody growth is likely to change in the future, and how control strategies for woody plants are likely to affect forage production.

Larger precipitation events caused by a warmer climate change the way that water moves through plant canopies, soils, and into roots (Figure 4.C.1). Plants like sagebrush respond positively to larger precipitation events, which "push" water into deeper soils where woody plant roots are better able to access it, giving them an ecological edge and increasing their growth. Small changes in root activity and distributions make a big difference on landscape scales, and these changes in precipitation patterns are contributing to increased woody plant growth around the world.

There are a few factors that make this topic especially complex to study: it is very difficult to measure water uptake by different species in the field, and responses in different environments, even within Utah, vary greatly. Researchers are exploring this process in more arid conditions in southern Utah by using hydrological tracers to measure water uptake by different species (e.g., juniper, pinyon pine, big galleta grass, prickly pear cactus, Indian ricegrass, etc.). These profiles can then be used to predict water uptake by different species on the landscape and aid their response to climate change. This data will help predict whether woody plant encroachment is likely to increase or decrease over time. It will also contribute to better understanding how shrub control will affect forage grass productivity.

Figure 4.C.1 Sagebrush stem growth where plants were either watered with "many small" (i.e., low intesity) or "few large" (i.e., high intensity) precipitation events



USU'S T.W. DANIEL EXPERIMENTAL FOREST | AARON FORTIN

Multiple, ongoing research projects document forest change over time, and demonstration management trials showcase how to successfully manage Utah's forest for adaptation to climate, fire, and changing conditions of the future.

From the Ground Up: Essential Training at USU's T.W. Daniel Experimental Forest

JUSTIN DEROSE

For 75 years, forestry professionals, researchers, and students have relied on Utah State University's School Forest for hands-on training, research, and experience.

For the better part of a century, students, researchers, and professionals have visited the T.W. Daniel Experimental Forest to learn essential skills for monitoring and managing Utah forests, range, and wildlife. The forest was purchased by Utah State University in 1936 and commenced with forestry camps in 1947. The so-called School Forest has been woven into the tapestry of natural resources training and professional learning in northern Utah for 75 years. Located less than an hour from the Logan campus in the Bear River range, activities on the School Forest are administered through a long-standing cooperative agreement with the Uinta-Wasatch-Cache National Forest, Logan Ranger District.

In 1947, Utah State University faculty member Theodore W. "Doc" Daniel, initiated a cone monitoring project that launched long-term research activity on the forest. Since then, hundreds of projects, publications, theses, demonstrations, and dissertations have resulted from the work conducted on this important piece of wildland.

Long-term monitoring plots on the forest represent data collection efforts spanning decades, something only possible through stable, continued commitment and a successful transfer of knowledge through leadership of the historic resource. Dr. Justin DeRose, a Utah State University associate professor who is currently the liaison for the School Forest, manages projects that measure forest growth response to silvicultural treatments and monitor changing conditions over the long term.

Multiple, ongoing research projects document forest change over time, and demonstration management trials showcase how to successfully manage Utah's forest for adaptation to climate, fire, and changing conditions of the future. The unique opportunity to bring students to the site to experience hands-on and locally based research and demonstration projects arms them with tools and experience necessary to understand evolving issues forests will inevitably face in a complex environmental future.

BELOW: USU STUDENTS STUDY FOREST MANAGEMENT | UTAH STATE UNIVERSITY

From Nepal Comes a Fiery Warning for Utah

BINOD POKHAREL, MATTHEW LAPLANTE, & SIMON WANG

A study of a record-setting fire year in Nepal offers clues for predicting seasonal risk, which may help Utah detect and manage future blazes.

In the spring of 2021, Nepal was engulfed in a wildfire season of unprecedented ferocity, with flames consuming one of the world's most awe-inspiring landscapes at a rate 10 times the annual average.

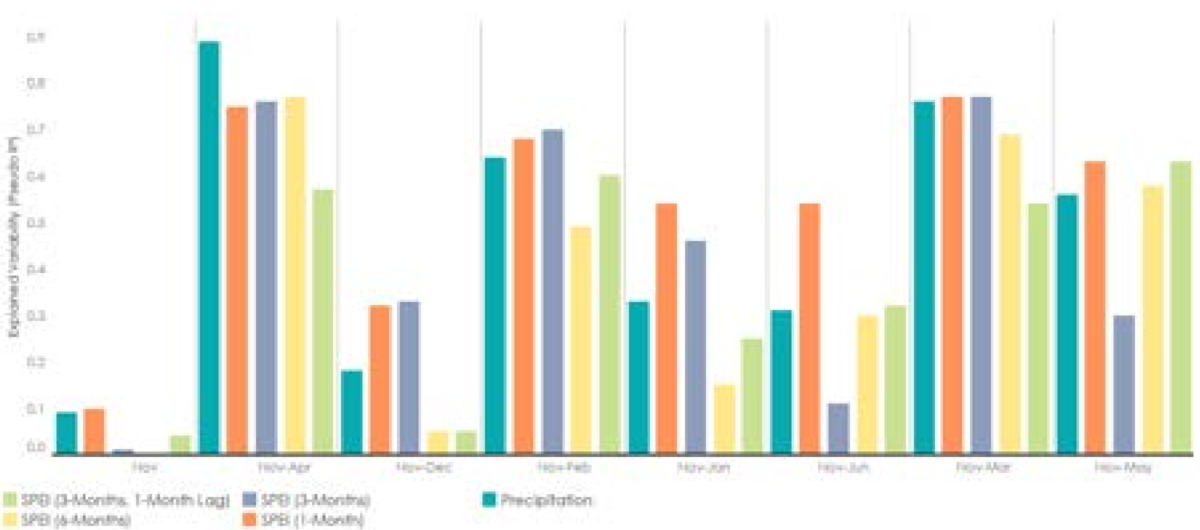
The blazes may offer a searing glimpse into the future for fire-prone regions around the globe—including in Utah, where the delicate dance between wet and dry years can easily be set off-balance.

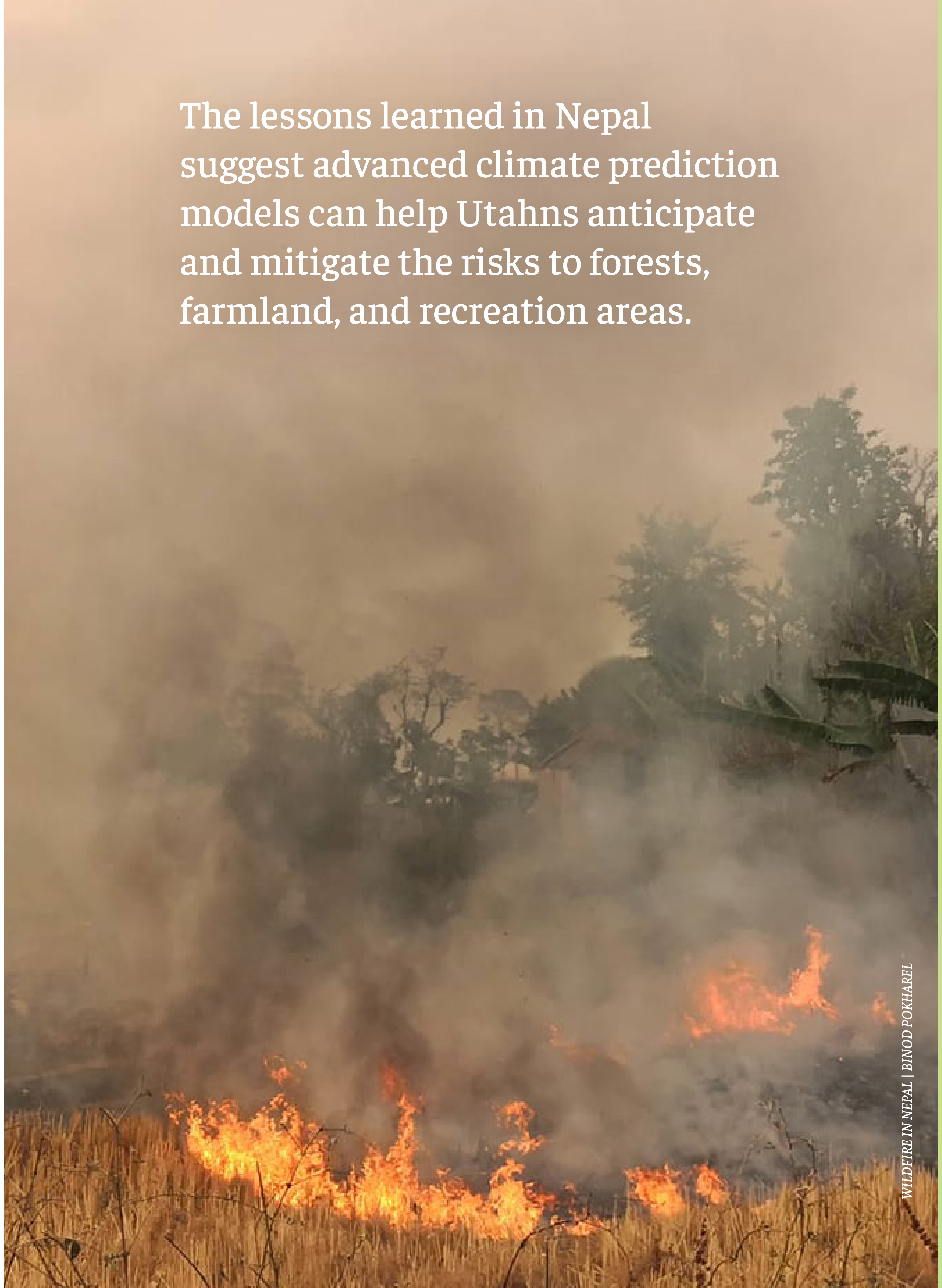
The research highlights the risks of amplified climate variability. Abnormally wet years, while a temporary reprieve from drought, can also strengthen the growth of vegetation which, in hotter and drier times, become the kindling for infernos (Figure 4.E.1).

Utah is no stranger to this cycle. From 2010 to 2017, the state averaged about 18,000 wildfire acres per year as vegetation aggregated, waiting for lightning to strike or a campfire to be poorly tended. That happened in 2018, when more than 181,000 acres burned—and the high-fire years continued for several summers thereafter before returning to normal levels once again.

The lessons learned in Nepal suggest advanced climate prediction models can help Utahns anticipate and mitigate the risks to forests, farmland, and recreation areas—and also help prepare the state for the far-reaching impacts of smoke on public health. By closely monitoring ocean temperatures, watching the skies for patterns of precipitation, keeping tabs on mountain snowpacks, and scrutinizing the ebbs and flow of groundwater, Utah can build interannual resilience against the recurring threat of wildfires, charting a course towards detectable and manageable risks.

Figure 4.E.1 The relationship between 2002–2020 monthly precipitation deficits and subsequent active fire points in Nepal




The lessons learned in Nepal suggest advanced climate prediction models can help Utahns anticipate and mitigate the risks to forests, farmland, and recreation areas.

WILDFIRE IN NEPAL | BINOD POKHAREL

Creating Islands of Nutrition to Improve the Sustainability of Utah's Grazed Rangelands

JUAN VILLALBA

Planting nutritious, low-cost patches of perennial plants on rangelands enhances livestock production and biodiversity while reducing the environmental impacts of grazing.

The Utah State University "Smart Foodscapes" project is finding ways to make range meat production more environmentally sustainable. This major research project is focused on increasing grazing animals' health and productivity, boosting ecological diversity on Utah's rangelands, and reducing the environmental impacts of grazing in the state. It explores effective ways to include diverse deep-rooted perennial legumes and high-nutrient herbs in resource patches across grass-dominated rangelands (Figure 4.F.1). These islands of ecological and nutritional diversity are added to grazing landscapes as a low-cost and sustainable supplement for beef cattle diets.

Carefully selected plants are strategically seeded in patches and tested for their support toward beef cattle performance; habitat for pollinators, mammals, and birds; environmental impact; and economic viability. Researchers are screening a wide selection of native and introduced plants for their ability to grow and persist in natural conditions. They also evaluate their chemical properties and measure the plants' nutritional benefits. Results are disseminated through existing grazing schools. Surveys given to practitioners help researchers monitor how the results are adopted. A multi-institutional team of researchers and teachers have developed materials for the classroom that integrate related garden-based learning into science, technology, engineering, arts, and mathematics curricula. This transdisciplinary project is contributing to more sustainable beef production while engaging and educating current and future land stewards.

Figure 4.F.1 Phytochemical and nutritional richness (black arrow) increases with the taxonomic diversity provided by focal resource patches or "islands" with a broad array of legumes and herbs growing in a monotonous landscape


COWS GRAZE NEAR TONY GROVE, UT | AARON FORTIN


NORTHERN UTAH RANGELAND | AARON FORTIN


CEDAR BREAKS NATIONAL MONUMENT | AARON FORTIN

CHAPTER 4 REFERENCES

4.1 Utah Division of Forestry, Fire, and State Lands. (2020). Utah Forest Action PLan. *Utah Department of Natural Resources.* https://ffsl.utah.gov/wp-content/uploads/FAP-2020-Final-12-30-2020-03.pdf

4.B Birch, J. D., and Lutz, J.A. (2023). Fire regimes of Utah: the past as prologue. *Fire, 6(11),* 423. https://doi.org/10.3390/fire6110423

Furniss, T. J., Das, A. J., van Mantgem, P. J., Stephenson, N.L., and Lutz, J.A. (2022). Crowding, climate, and the case for social distancing among trees. *Ecological Applications, 32(2),* e2507. https://doi.org/10.1002/eap.2507

Teich, M., Becker, K. M. L. , Raleigh, M. S. , and Lutz, J. A. (2022). Large-diameter trees affect snow duration in post-fire old-growth forests. *Ecohydrology, 15(3),* e2414. https://doi.org/10.1002/eco.2414

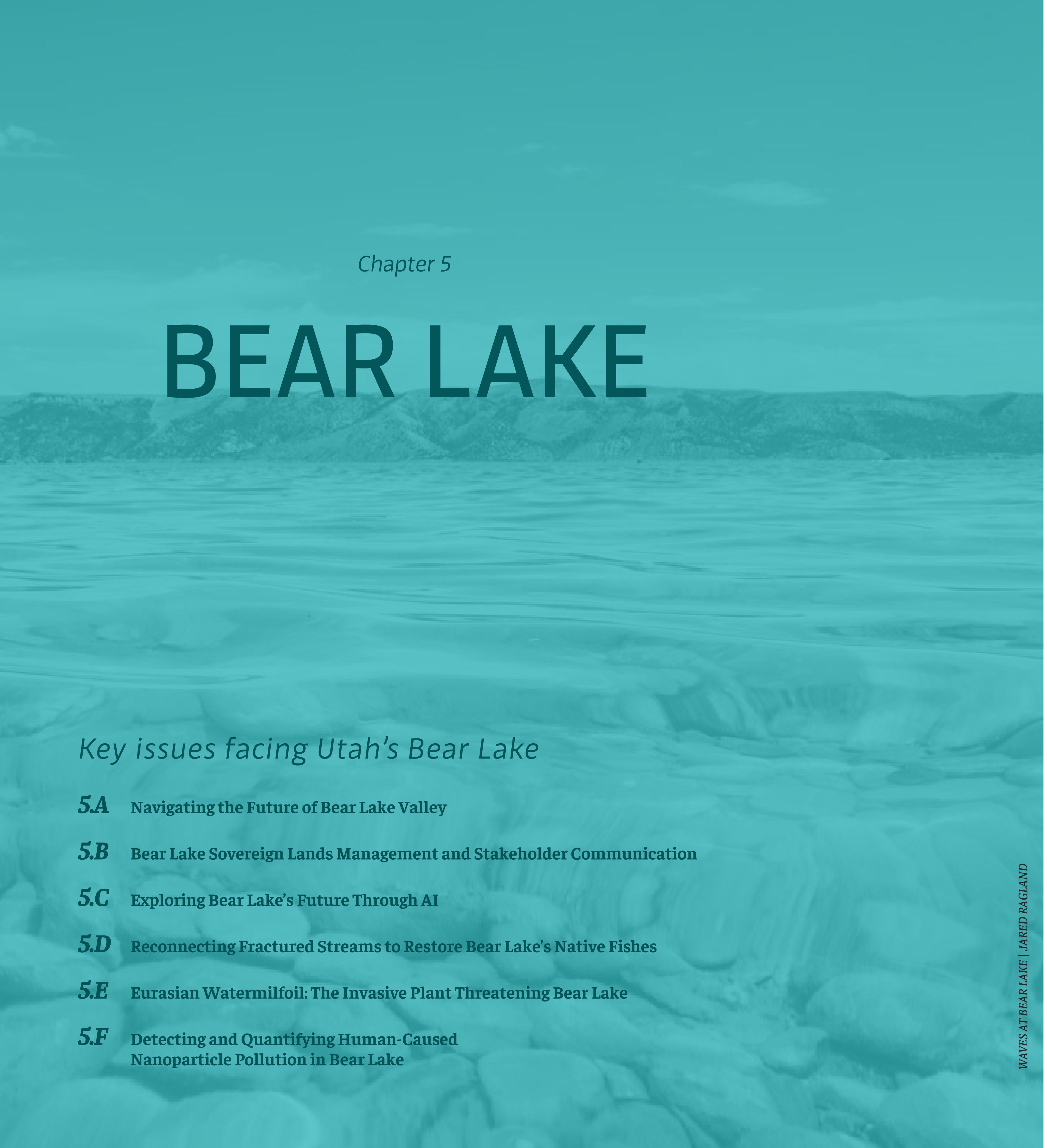
4.C Holdrege, M.C., Beard, K.H., Kulmatiski, A. (2021). Woody plant growth increases with precipitation intensity in a cold semiarid system. *Ecology, 102(1).*

4.D Quinney College of Natural Resources. (2024). *T.W. Daniel Experimental Forest.* Utah State University. https://qcnr.usu.edu/twdef/

4.F Villalba, J.J., Beauchemin, K.A., Gregorini, P., and MacAdam, J.W. (2019). Pasture chemoscapes and their ecological services. *Translational Animal Science, 3(2),* txz003. https://doi.org/10.1093/tas/txz003

Distel, R.A., Arroquy, J.I., Lagrange, S., Villalba, J.J. (2020). Designing diverse agricultural pastures for improving ruminant production systems. *Frontiers in Sustainable Food Systems, 4,* 215. https://doi.org/10.3389/fsufs.2020.596869

Villalba, J.J., Ramsey, R.D., Athanasiadou, S. (2024). Review: Herbivory and the power of phytochemical diversity on animal health. *Animal, 8/6,* 101287. https://doi.org/10.1016/j.animal.2024.101287



Chapter 5

BEAR LAKE

Key issues facing Utah's Bear Lake

WAVES AT BEAR LAKE | JARED RAGLAND

Chapter Introduction

ANNA McENTIRE

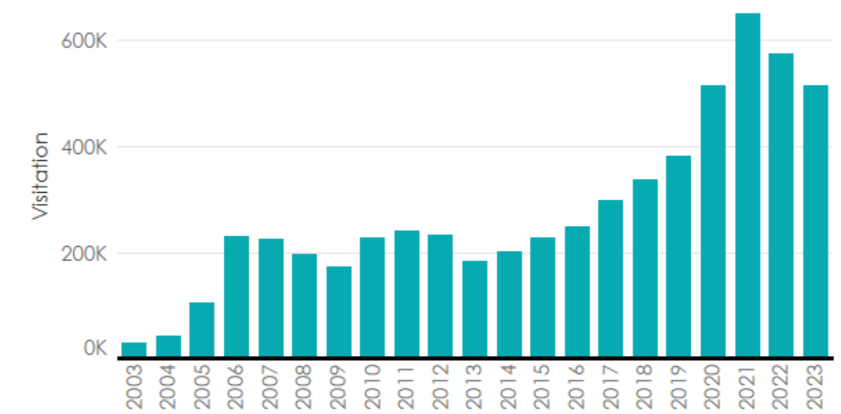
The stunning blue waters of Bear Lake have made it a rapidly growing destination for recreation. With that increase in visitation comes new challenges in managing water, plant life, wildlife, safety, transportation, and more. More than ever, we need to double down on evidence-based stewardship for the lake and its surroundings. That's why Utah State University, in partnership with the Utah Division of Forestry, Fire, and State Lands, launched a Bear Lake Needs Assessment, building off the state's recently completed comprehensive management plan for the lake.

This project has brought together faculty and student researchers from across disciplines, creating a vibrant community of practice and unique comradery. By mobilizing a diverse cohort of experts, we're not only building capacity within our academic community but also addressing urgent issues in a way that maximizes our collective strengths. The energy generated from working together on such a focused challenge has led to new ideas and innovative solutions.

At the heart of this effort is collaboration with the people who know Bear Lake best—state and local leaders, dedicated non-profits like Bear Lake Watch, and the surrounding community. These partnerships are allowing us to remain nimble and responsive to the lake's needs, whether it's addressing invasive species, residents' concerns, or the growing presence of microplastics.

In the following sections, we'll highlight a few key projects that are part of this larger effort, demonstrating how we can protect Bear Lake's future by balancing the needs of people with responsible environmental stewardship.

Figure 5.1.1 Bear Lake State Park visitation numbers (2003-2024)



Bear Lake State Park, Utah is just one destination for visitors to Bear Lake Valley, which has seen similar magnitudes of tourism increase all around the lake and surrounding areas.

Source: *Utah Division of State Parks*

WAVES AT BEAR LAKE | JARED RAGLAND

Navigating the Future of Bear Lake Valley

TODD JOHNSON & JAKE POWELL

Policy makers in Utah and Idaho need to work with Bear Lake Valley stakeholders to protect the "Caribbean of the Rockies."

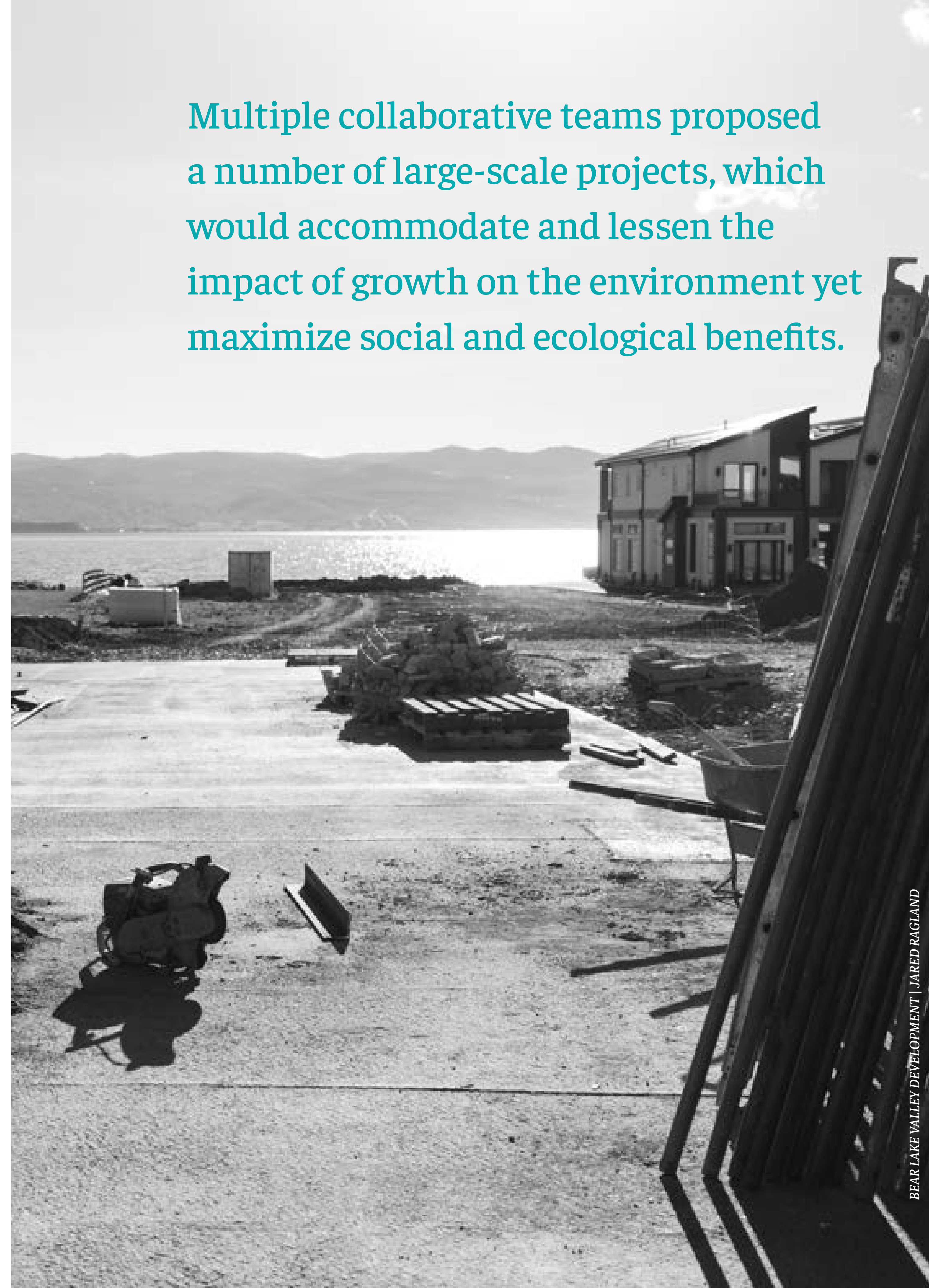
The Bear Lake Valley straddles two different states and two counties. It is home to several municipalities, lands managed by both federal and state agencies, and Bear Lake. This once-tranquil valley is experiencing complex challenges faced by many other western gateway communities: explosive growth, dated infrastructure, lack of workforce housing, traffic congestion, and spiking seasonal visitation, all straining the community's social fabric. The presence of additional developments could significantly impact the preservation of the valley's small-town aspects. The greater peril is the potential loss of water quality and the impact of growth on the lake's natural systems, which will ultimately affect the livelihood of people who make the Bear Lake Valley their home.

Utah State University's Landscape Architecture and Environmental Planning's charrette program spent two semesters focusing on protecting the health of Bear Lake by identifying sensitive ecological areas, designing infrastructure, and shaping the distribution of land use (Figure 5.A.1). Multiple collaborative teams proposed a number of large-scale projects, which would accommodate and lessen the impact of growth on the environment yet maximize social and ecological benefits.

At the end of the charette, one fact was clear: unless the valley's leaders and policy makers unite across jurisdictional boundaries to create a community vision, the ecological and community assets that make Bear Lake Valley special will be compromised.

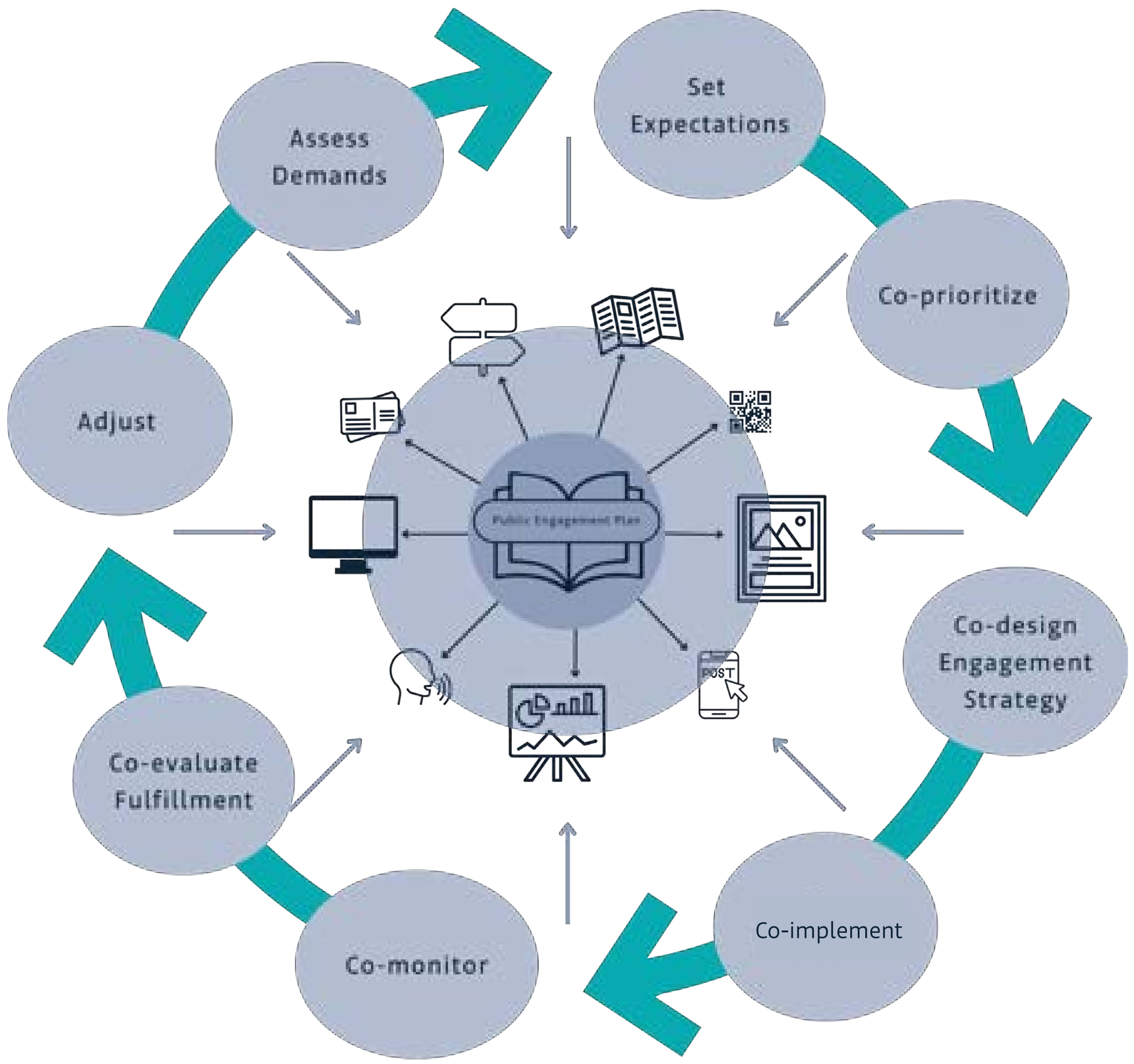
Figure 5.A.1 A current community structure diagram of Garden City, Bear Lake's primary gateway community

Multiple collaborative teams proposed a number of large-scale projects, which would accommodate and lessen the impact of growth on the environment yet maximize social and ecological benefits.



BEAR LAKE VALLEY DEVELOPMENT | JARED RAGLAND

Figure 5.B.1 Adaptive management and public engagement plan



Bear Lake Sovereign Lands Management and Stakeholder Communication

WESLEY MATHIS

More frequent communication across more channels can better align Bear Lake managers and local stakeholders.

Bear Lake management strategies and processes are guided by a comprehensive management plan, created by Utah's Division of Forestry, Fire, and State Lands. The goal of the plan, recently updated in 2022, is to set objectives for balancing the lake's many competing values, including ecological health, recreation, navigation, beauty, and economic benefits. Events such as low water levels in Great Salt Lake and increased outdoor recreation following the COVID pandemic added urgency and importance to implementing the updated plan more effectively.

USU researchers interviewed practitioners and stakeholders to understand how they viewed the plan's regulations and their expectation about how the lake should be managed. Large gaps exist in some of those groups' perceptions. Stakeholder groups have varying objectives, motives, and perspectives that change over time, and state land managers reevaluate and reprioritize management concerns based on their interpretations of Bear Lake's needs.

Opportunities exist to better align these groups' differing perceptions and expectations, through expanding communication on lake management beyond the comprehensive management plan. Because requirements for the state's role on Bear Lake—and how the public perceives that role—changes over time, state land managers can engage with the public more frequently using different communication touchpoints. Forestry, Fire, and State Lands can host regular meetings in which land managers and community partners co-prioritize concerns together. Other touchpoints include a website geared toward visitors and property owners, short videos about regulations or permitting, or interactive flyers to educate tourists. These interactions will help the state achieve management outcomes and tailor their communication to a wider audience.

BELOW: COMMUNITY ON THE SHORES OF BEAR LAKE | JARED RAGLAND

Exploring Bear Lake's future through AI

BRENNAN BEAN, BEN SHAW, SCOUT JARMAN, KEVIN R. MOON, & WEI ZHANG

AI models can make projections of Bear Lake's water levels in a future climate using publicly accessible datasets.

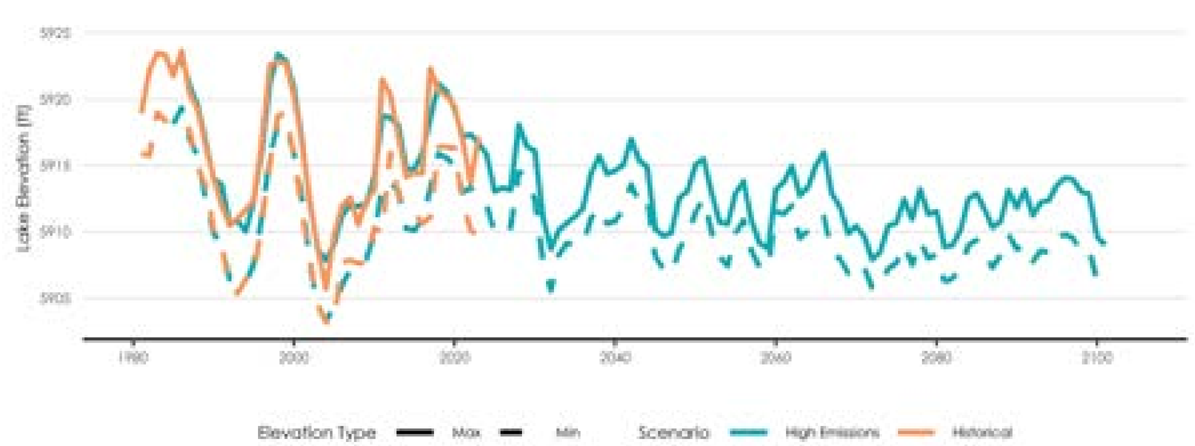
Water levels in Utah lakes and reservoirs are affected by complex cycles and interactions between weather and land use. While traditional computer models can explain some of these complexities, implementing scenarios for decades-long forecasts of future climate conditions can be challenging and time consuming. One promising alternative is a process called machine learning emulation. This technique uses advanced data-driven models such as artificial intelligence to predict different variables within a complex environmental process by training the artificial intelligence using past data. These emulators can then make predictions in a fraction of the time compared to more traditional computer models.

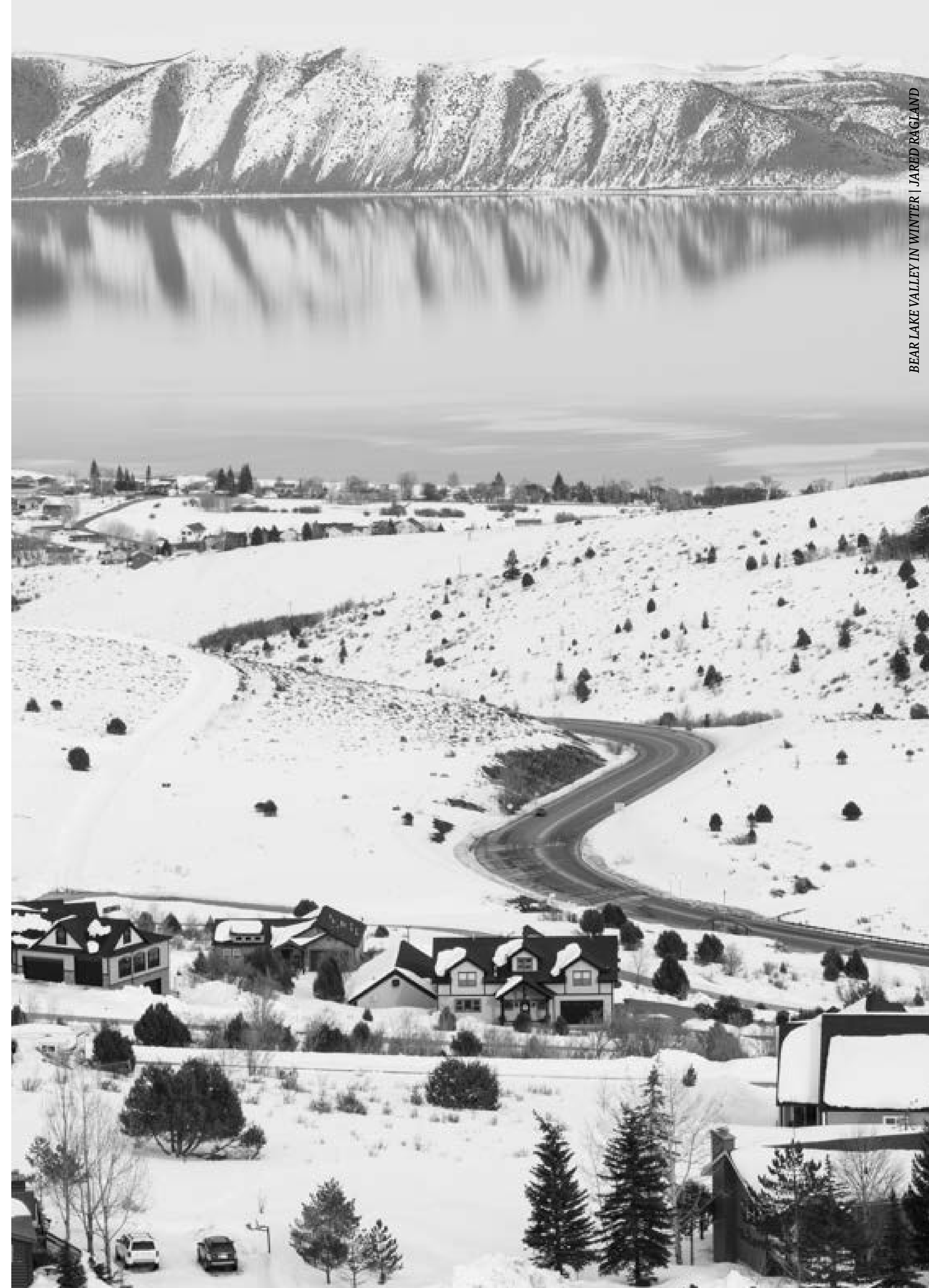
Machine learning emulation was used to predict Bear Lake's annual maximum and minimum water levels through the end of the century under different future climate scenarios. First, researchers "taught" the model using climate measurements from the last 40 years. Then, they used the models to project possible climate outcomes. The emulation results are available in a publicly accessible data dashboard.

Climate models that only accounted for annual snowpack in their analysis predicted lower average lake elevations in the future, as observed in (Figure 5.C.1). Conversely, models that used total precipitation (i.e., rain and snow combined) predicted higher average lake levels. Further research is needed to understand how lake levels might be affected by more rain and less snow.

The public can access these data models and become a "citizen climate data analyst." Allowing people to see what happens when temperatures become warmer, snowpack diminishes, and more rain and evaporation occurs helps them better understand the complexity of the Bear Lake watershed.

Figure 5.C.1 Historical and future emulations of the annual maximum and minimum water level of Bear Lake using a high emissions global climate model simulation





BEAR LAKE VALLEY IN WINTER | JARED RAGLAND

Reconnecting Fractured Streams to Restore Bear Lake's Native Fishes

TIMOTHY WALSWORTH, PHAEDRA BUDY, JAMES DERITO, & TYLER COLEMAN

Restoration work can improve access to spawning habitat and promote cutthroat population recovery and stability.

Bonneville cutthroat trout, Utah's state fish, live and move among diverse habitats to complete their life cycle. Bear Lake is home to one of only a few remaining lake-dwelling populations of the species. However, a century of land-use change, water development, and interactions with non-native fishes has created major declines in the population. Cutthroat trout must migrate into tributary streams to spawn and rear each spring. Diversion dams, culverts, and increased drought have fractured streams and limited the population's access to tributary spawning habitats, curbing their reproductive success.

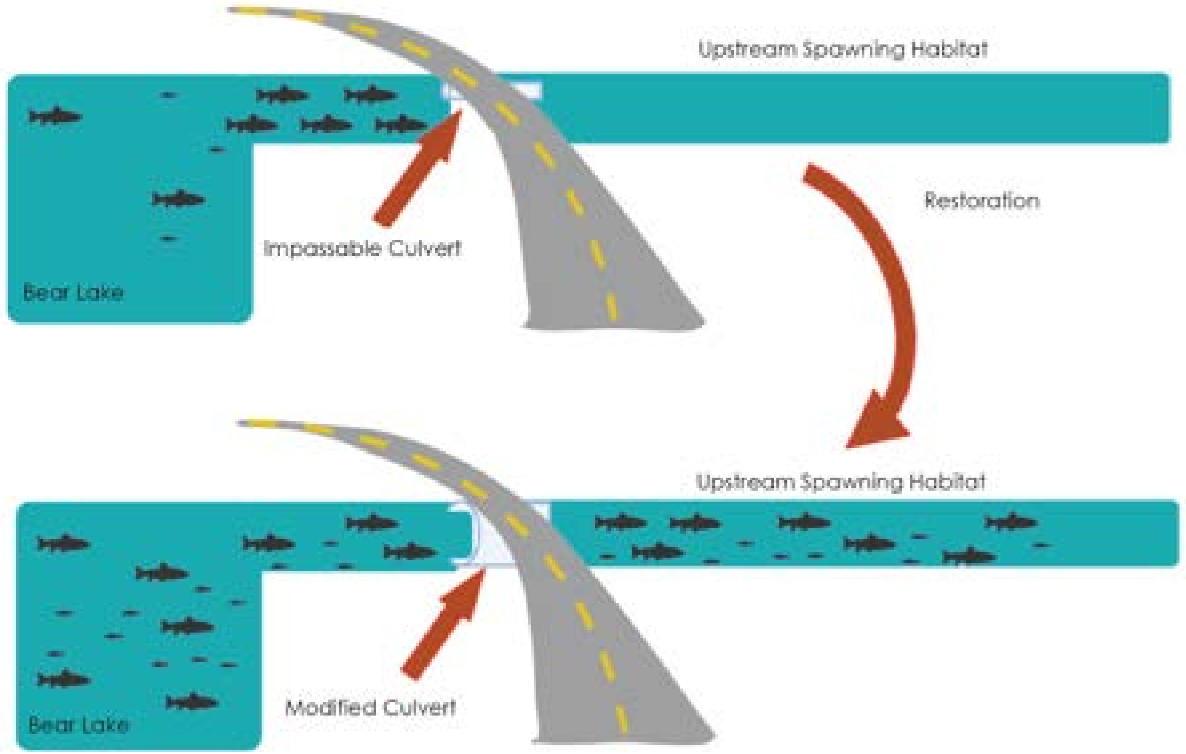
Over the last 25 years, projects aimed at reconnecting small streams to the lake by improving culverts and dams have helped fish reach their spawning areas (Figure 5.D.1). These changes have led to a significant increase in the population of wild Bonneville cutthroat trout, making recreational harvest of wild cutthroat trout possible again. It's important for managers to keep finding and fixing barriers that block these trout from accessing stream habitats to ensure their population remains strong and stable.

For instance, in the fall of 2025, a culvert on North Eden Creek (on the east shore of Bear Lake) will be improved to let cutthroat trout swim upstream to spawn. Researchers at Utah State University are working with Trout Unlimited and the Utah Division of Wildlife Resources to study how this project will impact the number and size of trout living and spawning upstream. They're also designing a long-term plan to monitor the success of this restoration effort.

LEFT: TYLER COLEMAN CATCHES A TROUT | JARED RAGLAND

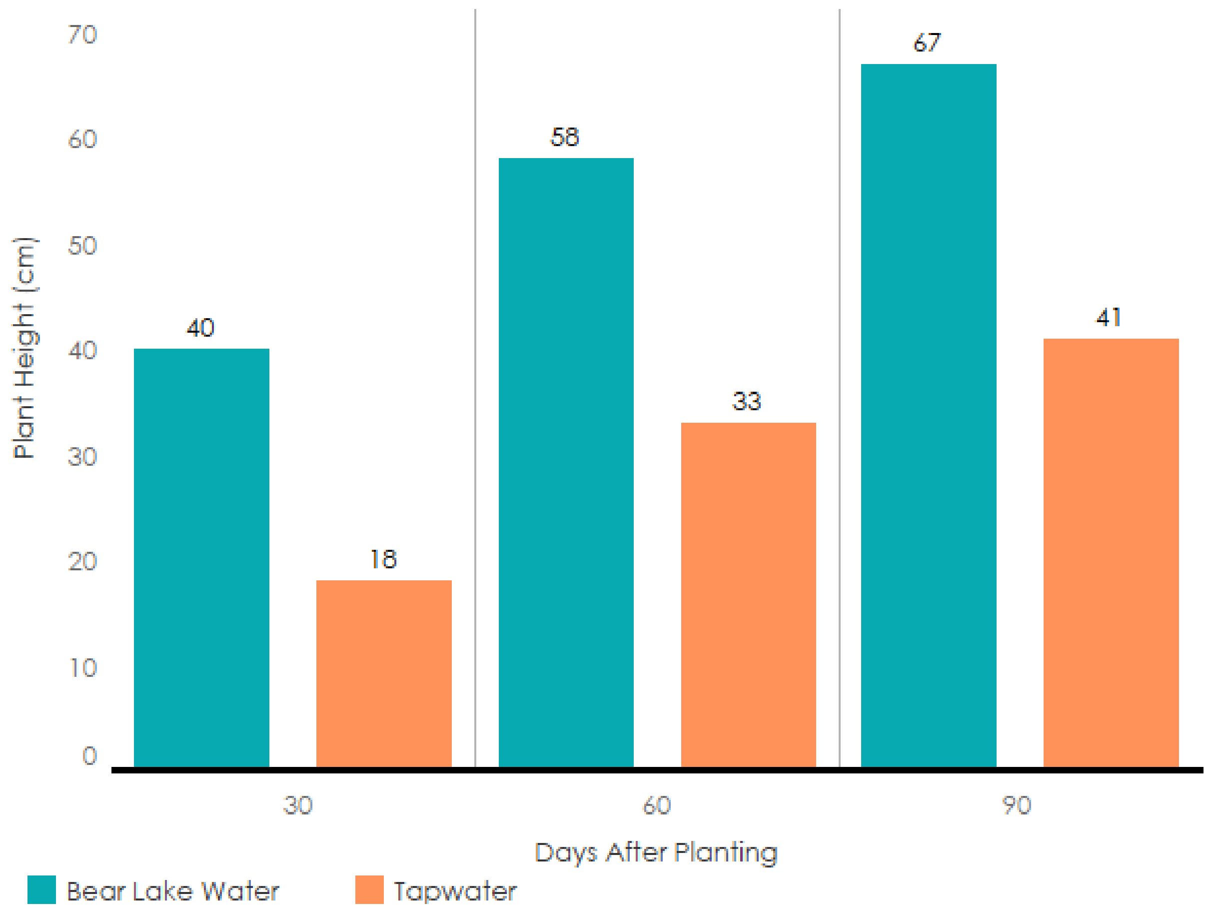
USU STUDENTS STUDY BONNEVILLE CUTTHROAT TROUT | JARED RAGLAND

Figure 5.D.1 Predicted effect of reconnecting tributary habitats to Bear Lake, allowing adult cutthroat trout to access upstream spawning habitats



ABOVE: DR. ORTIZ AND USU STUDENTS STUDY EURASIAN WATERMILFOIL | JARED RAGLAND

Figure 5.E.1 Average plant height of Eurasian watermilfoil growth in Bear Lake water and tap water at 30, 60, and 90 days after planting



Eurasian Watermilfoil: The Invasive Plant Threatening Bear Lake

OLANREWAJU ADEYEMI & MIRELLA ORTIZ

Controlling invasive Eurasian watermilfoil in Bear Lake will require specially designed methods because the lake's unique water chemistry spurs the plants' growth and impedes herbicides.

Eurasian watermilfoil is an invasive aquatic plant that disrupts natural ecosystems and degrades water quality. It forms dense canopies that adversely affect fish populations, water temperature, and oxygen levels. Additionally, Eurasian watermilfoil hinders recreational activities such as boating, fishing, and swimming, lowers property values, and promotes the spread of disease vectors.

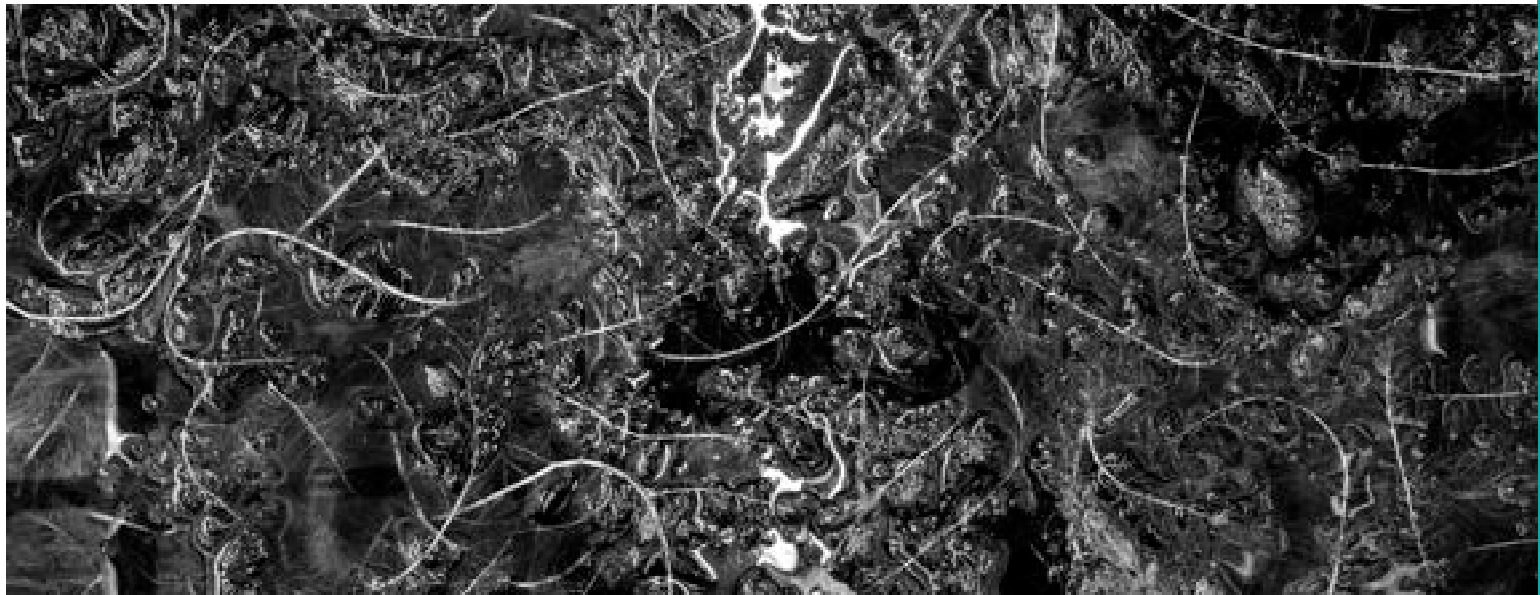
To support management decisions for Bear Lake, USU weed scientists investigated the behavior and effectiveness of commonly used herbicides to control Eurasian watermilfoil, along with the influence of Bear Lake's unique water chemistry on Eurasian watermilfoil growth.

Eurasian watermilfoil plants were grown in the Utah State University Research Greenhouse using either Bear Lake water or tap water and monitored over three months. Researchers also assessed herbicides' degradation and how effective they were in controlling Eurasian watermilfoil in Bear Lake water.

Results demonstrated Eurasian watermilfoil's significant adaptability and potential for rapid colonization in Bear Lake water. The invasive plant grew vigorously in Bear Lake water, with significant increases in plant height (Figure 5.E.1), the number of shoots per plant, and both aboveground and belowground biomass compared to plants grown in tap water.

Herbicides degraded in Bear Lake water much as they did in tap water, indicating that the unique chemistry of Bear Lake water does not impact herbicide behavior. However, due to the vigorous plant growth in Bear Lake water, a 24-hour exposure to 2,4-D herbicide only achieved 64% control in Bear Lake water, compared to 92% in tap water. This greatly reduced effectiveness highlights the need for tailored management strategies to address Eurasian watermilfoil infestation in Bear Lake.

BELOW: EURASIAN WATERMILFOIL | JARED RAGLAND



Detecting and Quantifying Human-Caused Nanoparticle Pollution in Bear Lake

YIMING SU & JUNJIE TANG

Human activities at Bear Lake contribute to nanoparticle pollution in the water and on beaches.

Manufactured nanomaterials and naturally derived microplastics are particles that come from sources such as coatings, paint, plastic bags and food containers, water bottles, sunscreen, rubber tires, and plastic toys. These materials have been widely found in natural water bodies, posing a potentially significant threat to ecosystem and human health.

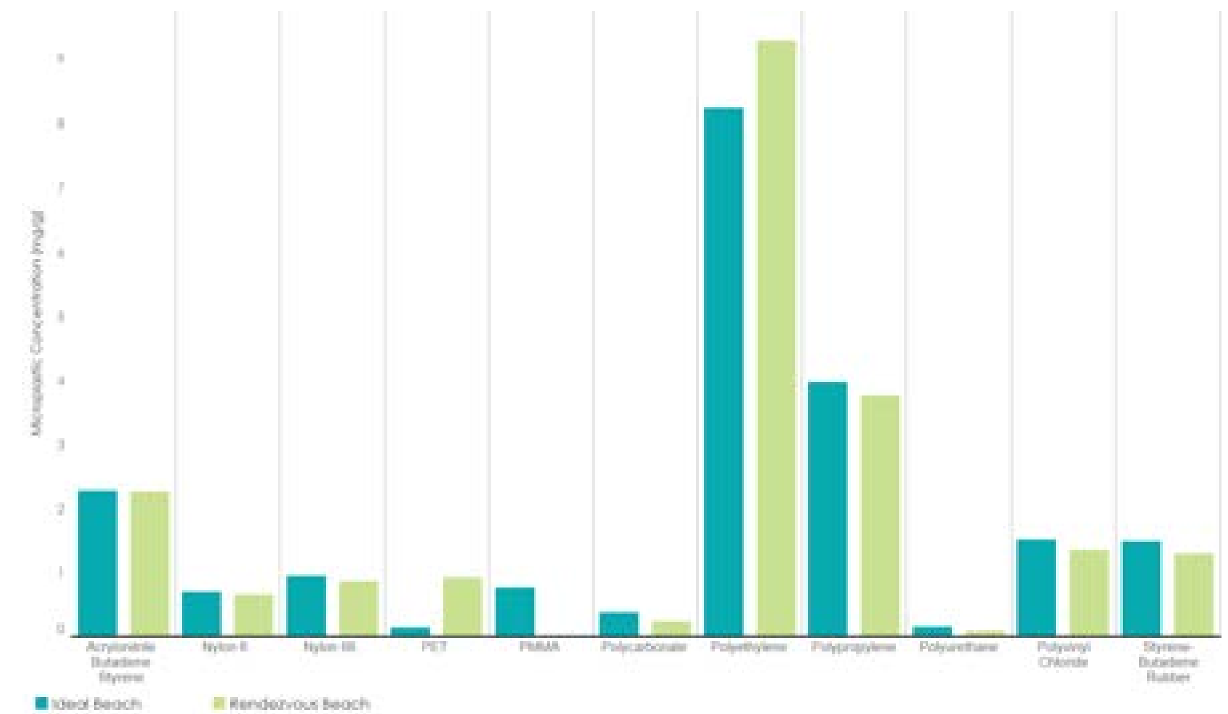
Researchers from the Utah Water Research Laboratory sampled lake water and beach sediment around Bear Lake to measure nanoparticle pollution. Zinc oxide and copper oxide particles were detected near major beaches, with the highest concentration recorded at Bear Lake State Park near the Marina and watercraft rental locations. These nanoparticles are likely from antifouling boat paints used to prevent corrosion. Samples from different beaches showed significant polyethylene contamination. Sage Springs Group Camp, Bear Lake State Park's Rendezvous Beach, and Ideal Beach Resort had the highest concentrations, with one sample containing up to 10 billion plastic particles in one gram of dry lakeshore sediment. During the summer, when tourism generally increases, samples from the popular beaches—Rendezvous Beach and Ideal Beach—had higher concentrations of nanoparticles from sunscreen, but a large portion of these particles aggregate and sink down in the sediment over time.

The study found that (1) human activity did cause nanoparticle concentrations to increase over the summer; (2) more tourism caused greater contamination; (3) boats and personal care products seem to be the major contributors to nanoparticles in the lake; and (4) microplastic contamination on beaches is significant. To maintain good water quality at Bear Lake, researchers recommend that watercraft owners limit use of antifouling paints and coatings and that beaches further develop their plastic waste management plan.

BELOW: DR. YIMING SU AND JUNJIE TANG SAMPLE WATER | JARED RAGLAND

TAKING SAMPLES OF BEAR LAKE WATER | JARED RAGLAND

Figure 5.F.1 Bear Lake plastic concentration sampled at Ideal Beach and Rendezvous Beach in 2024



BEAR LAKE *Research Summary*

Additional Utah State University projects were funded by the Bear Lake research program. These projects are adding to our understanding of the lake, its ecosystem, and the surrounding community. Full reports will be released with the Bear Lake Needs Assessment in early 2025.

Bear Lake Needs Assessment Documentation and Visualization Project

JARED RAGLAND

Photos for this chapter were provided by Utah State University photography students, who worked to document the challenges facing Bear Lake. This initiative combines scientific research and visual storytelling to highlight issues related to Bear Lake's natural resources, land use, and human impact. Ragland and his students conducted over 20 field visits, collaborating with local stakeholders and Utah State University researchers. Their work, reflecting Bear Lake's agriculture, infrastructure, recreation, and ecology, will be shared and archived, creating a valuable resource of several hundred images for research and communication efforts.

Assessing Bear Lake Environmental Concerns of Scientists, Residents, & Community Organizations

BETSY BRUNNER, JESSICA SCHAD AND STACIA RYDER

Utah State University faculty and student researchers interviewed 28 Bear Lake area residents about wellbeing and future concerns. Participants valued their community's close-knit nature, outdoor recreation, and environmental connections. Key concerns included rising housing costs, traffic, and ecological impacts from tourism and development.

Irrigation Practices Impact Bear Lake Water Quality

SENA BILDIM, BURDETTE BARKER, MATT YOST, AND REGANNE BRIGGS

Irrigation practices in the Bear Lake Valley, essential for agriculture, contribute to nutrient loading in local water bodies. Runoff from irrigated lands raises mineral content in nearby waters, which could potentially impact the growth of native and invasive plants, affect wildlife, and influence the ecosystem's health.

Bear Lake's History Informs the Region's Future

LAWRENCE CULVER

Historical records are valuable for understanding Bear Lake's past and guiding future management decisions. Utah State University students made Bear Lake's historical resource records more accessible and organized. By providing insights into past management and development, these records can support informed decision-making for the lake's sustainable future.

Temperatures Affect Bear Lake Watershed's Peak Runoff and Snowpack

WEI ZHANG AND GRACE AFFRAM

Warming temperatures in the Bear Lake watershed will lead to shifts from snow to rain, resulting in reduced peak runoff. Accurately assessing the watershed's water budget is challenging, especially with climate-driven changes. The balance of precipitation and runoff impacts the region's water availability and ecosystem health.

Aquatic Exploration with Autonomous Underwater Vehicles at Bear Lake

MARIO HARPER

Student and faculty utilized the advanced Blue ROV 2 autonomous submarine robotic system to study Bear Lake's underwater environment. This project provided a holistic view of the lake's conditions, offering insights for future conservation and management efforts.

SUBMARINE ENTERING THE LAKE | JARED RAGLAND

BEAR LAKE STATE PARK MARINA | JARED RAGLAND

CHAPTER 5 REFERENCES

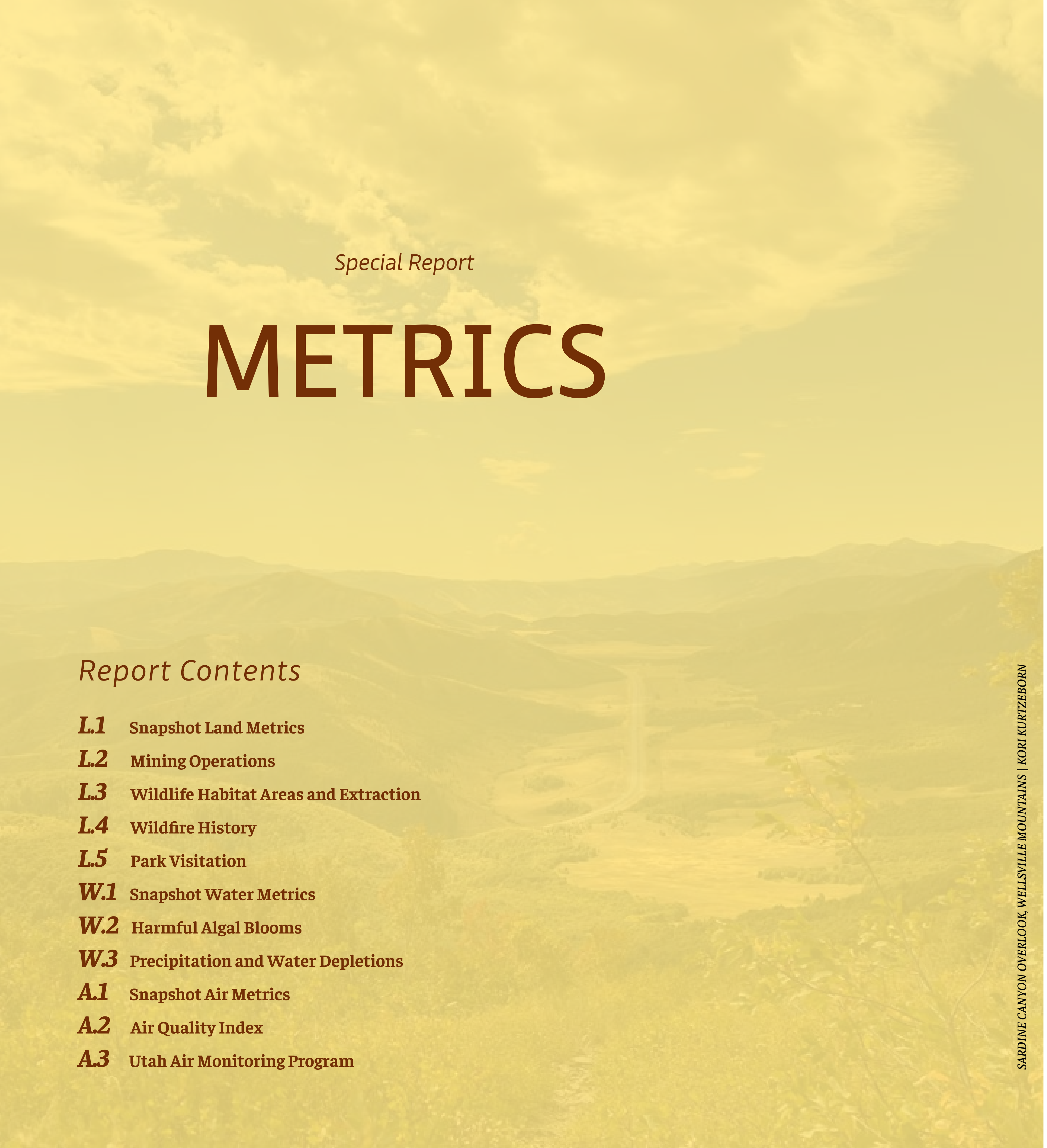
5.I Chapter Introduction Utah Division of State Parks. (2024). *Park Visitation Data.* [Data set]. Utah Department of Natural Resources. https://stateparks.utah.gov/resources/park-visitation-data/

5.C Shaw, B., Jarman, S., Bean, B., Moon, K.R., Zhang, W. (2024). *Interactive Modeling of Bear Lake Elevations in a Future Climate.* Janet Quinney Lawson Institute for Land, Water, and Air, Utah State University. https://www.usu.edu/ilwa/files/grant-winners/bean.pdf

5.D Kershner, J.L., (1995). *Conservation Assessment for Inland Cutthroat Trout.* General Technical Report RM-GTR-256. Department of Agriculture, Forest Service, Fort Collins, Colorado. https://doi.org/10.2737/RM-GTR-256

Heller, M.R., Dillon, J.C., Tolentino, S.A., Watkins, C.J. and Quist, M.C. (2022). Population Dynamics and Harvest Management of the Bonneville Cutthroat Trout Fishery in Bear Lake, Idaho–Utah. *North American Journal of Fisheries Management, 42(3).* 701-712. https://doi.org/10.1002/nafm.10769

Glassic, H.C. and Gaeta, J.W. (2020). The influence of multiyear drought and associated reduction in tributary connectivity on an adfluvial fish species. *Ecology of freshwater fish, 29(4),* 588-601. https://doi.org/10.1111/eff.12535



Special Report

METRICS

Report Contents

SARDINE CANYON OVERLOOK, WELLSVILLE MOUNTAINS | KORI KURTZEBORN

Report Summary

by BRIAN STEED

Since the founding of the Institute in 2021, the annual *Report to the Governor and Legislature* has been our flagship project. The report synthesizes research efforts and highlights the beauty of Utah's diverse landscapes and ecology. Our purpose is to provide unique information on a host of land, water, air, and special topics.

In approaching our report this year, we found an additional purpose: providing a curated report of land, water, and air metrics. This special report compiles numerous public datasets detailing topics from mining extractions to harmful algae blooms and relates them to various geographic and political boundaries. It is our intention to update with current data from the same sources in subsequent reports, continuing to refine communication and collect additional sources.

Often the biggest challenge in approaching an issue is understanding the data around it. Finding, synthesizing, and communicating these metrics is challenging and time consuming. We hope to increase data visibility and provide tools for understanding each of these metrics. The metrics detailed in the following sections are publicly available, provided and managed by several state and federal agencies including: Utah Department of Natural Resources, Utah Department of Environmental Quality, Utah Department of Agriculture and Food, Bureau of Land Management, and Environmental Protection Agency. Thank you to the researchers, managers, and staff who work to provide this data.

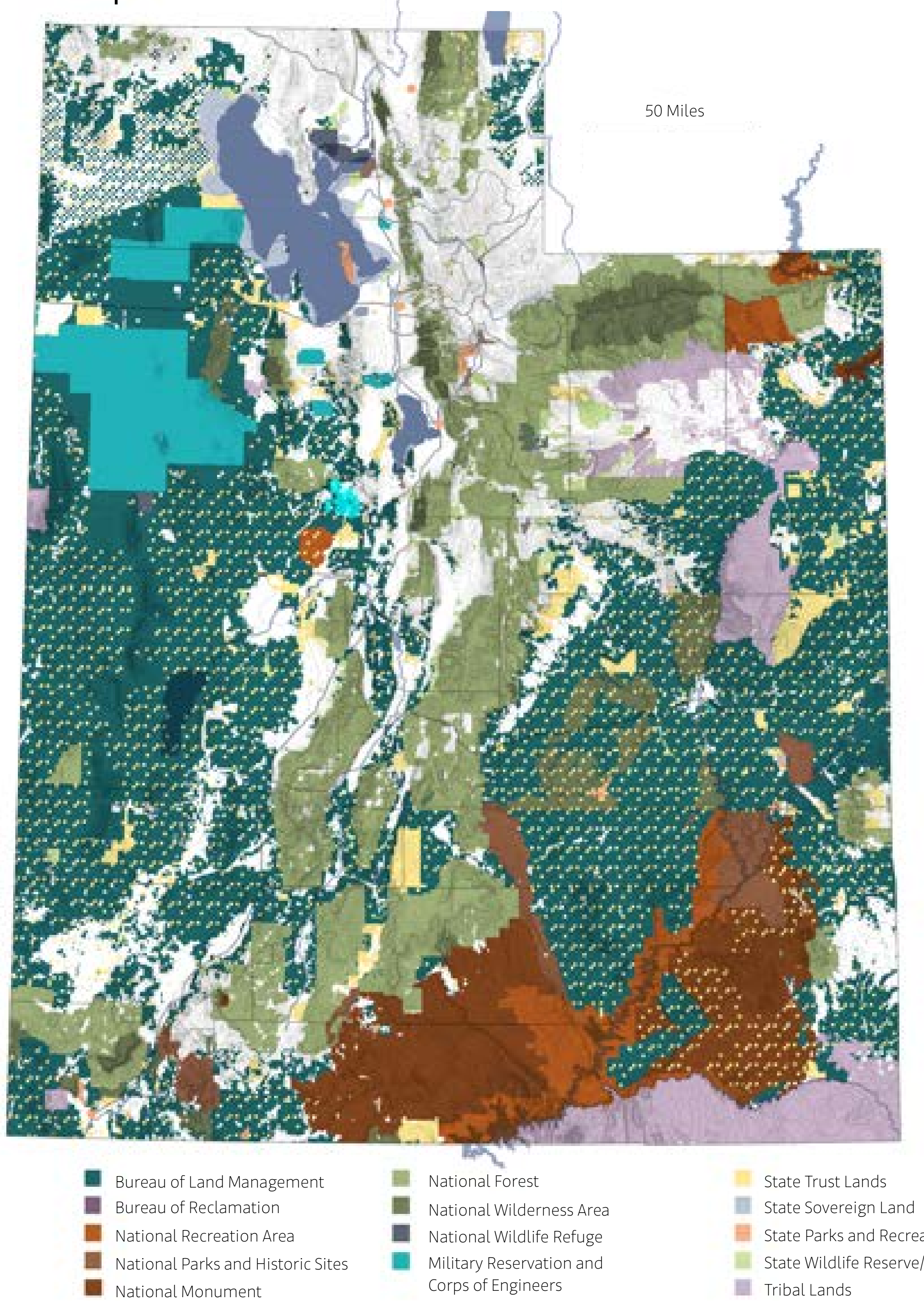
Data Analytics Team

KORI KURTZEBORN, MAKENNA ROBERTS, and AVERY CHILD

SARDINE CANYON OVERLOOK, WELLSVILLE MOUNTAINS | KORI KURTZEBORN

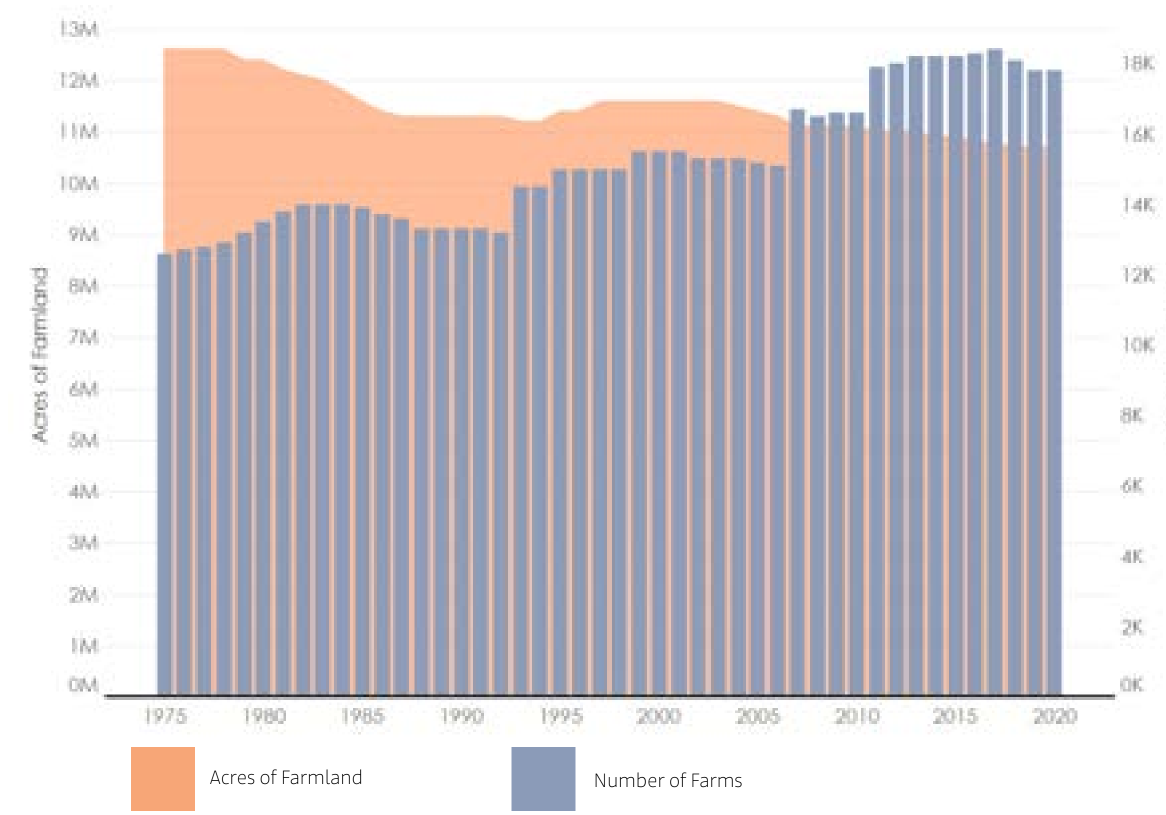
Utah's LAND *metrics*

L.1.1 Utah's public land owners



Created using land ownership data cooperatively maintained by the Bureau of Land Management and the Utah Trust Lands Administration, this map details public landowners across Utah. Private land is not colored on this map.

L.1.2 Number of operating farms and farmed acres



Created using data from the Utah Department of Agriculture and Food annual summary, this chart compares the number of farmed acres to the number of operating farms. This chart shows that while the number of operating farms continues to increase, agricultural land decreases.

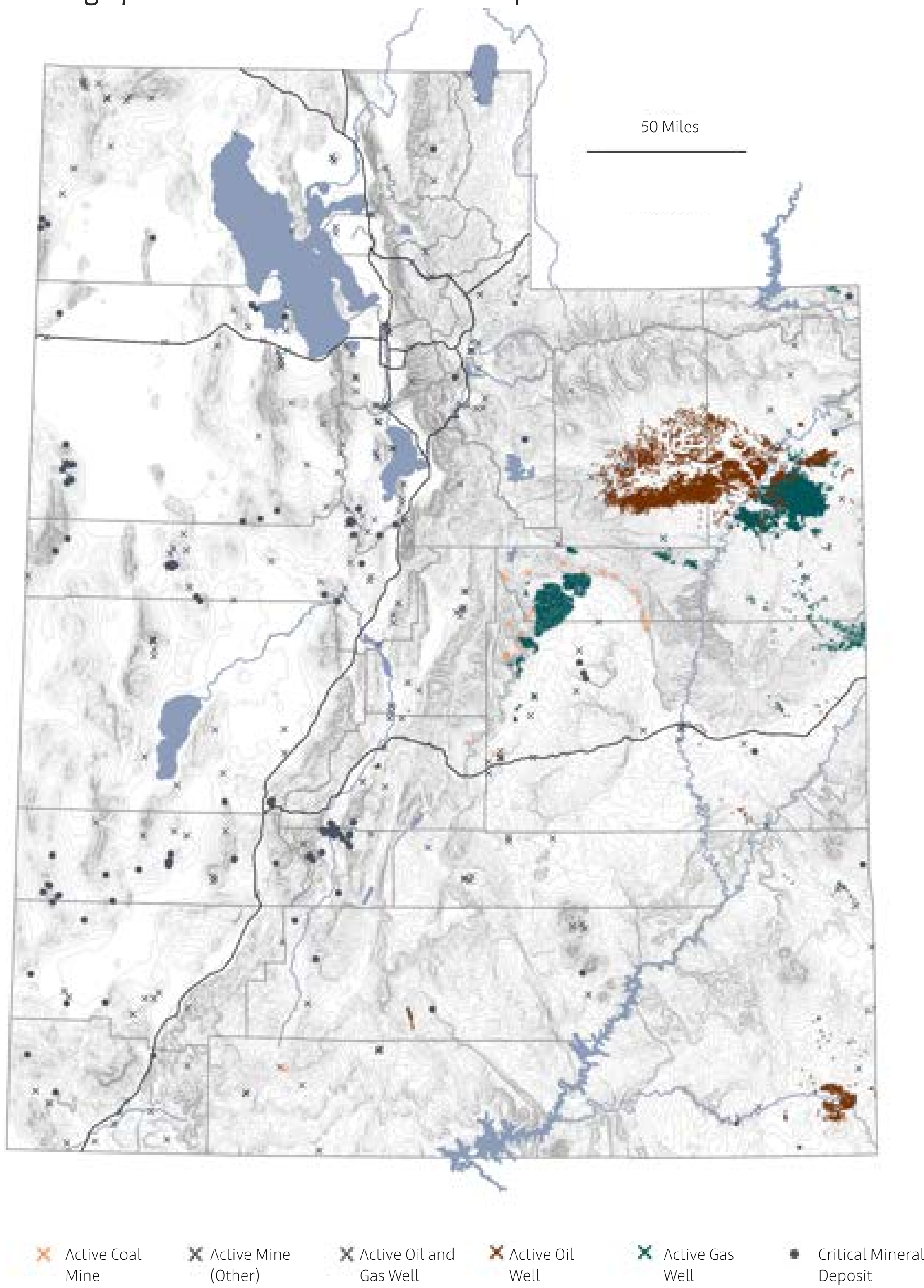
The public lands of Utah are owned and managed by several federal and state agencies. Federal public lands are owned and managed by the Bureau of Land Management, National Forest Service, National Parks Service, military institutions, etc. State public lands are managed by Utah Division of Forestry Fire and State Lands, the Utah Division of State Parks , the Utah Trust Lands Administration, and other relevant state agencies. The Utah Trust Lands Administration manages a patchwork of parcels granted to the state by the federal government at statehood with the purpose of generating revenue for public institutions, primarily schools. These lands are carefully considered for various development, extraction, renewable energy, and other projects for the best benefit to public institutions and sustainability. Different from other public lands, these areas are generally not open access and are only occasionally developed for recreational use.

Utah has a statewide legacy of productive agriculture. Examining the way we develop or maintain farmed lands, and considering who manages them is important to understanding the future of this legacy. In recent years we observe a trend of lost farmland as the number of acres held in agriculture decreases. Interestingly, this coincides with an increase in the total number of farms operating. These seemingly contrary trends indicate an increase in the number of small-scale farm operations around the state.

The following metric section highlights a variety of spatial and numeric measures of Utah's landscape. It details wildfire history, wildlife extraction, mining activities, and statewide park recreation increases.

Critical Minerals and Active Mines

L.2.1 Mining operations and critical mineral deposits



Created by compiling data from the Utah Division of Oil, Gas, and Mining and Utah Geospatial Resource Center, this map highlights active natural gas, oil, and coal operations throughout the state, as well as several critical mineral deposits. Critical minerals, defined in The Energy Act of 2020, are critical to economic or national security and may be vulnerable to supply chain disruption.

Coal Production

Sourced from the Utah Mining 2022 report (Circular 136), published by the Utah Geological Survey. This dataset details historic coal production by mine. Coal production is measured in **short tons**.

L.2.2 Coal production by mine (short tons)

Mine	County	2016	2017	2018	2019	2020	2021	2022	2023
Dugout Canyon	Carbon	650	626	557	430	-	-	-	-
Skyline #3	Carbon/ Sanpete/ Emery	4,767	4,389	3,614	3,896	3,713	3,530	2,521	3,500
SUFCO	Sevier	5,375	5,947	4,842	4,374	4,601	3,425	3,882	3,300
Fossil Rock (Trail Mtn.)	Emery	-	-	-	-	-	-	-	100
Emery	Emery	-	135	442	694	474	1,171	1,063	1,300
Gentry #3	Emery	170	205	102	562	660	511	600	750
Gentry #4	Emery	724	754	893	488	11	-	-	-
Lila Canyon	Emery	1,587	1,638	2,816	3,664	3,296	3,471	2,299	500
Coal Hollow	Kane	671	724	488	240	569	434	354	350
Burton #1	Kane	34	-	-	-	-	-	-	-
Total	**Statewide**	**13,978**	**14,418**	**13,754**	**14,348**	**13,324**	**12,542**	**10,719**	**9,800**

Oil Production

Oil and natural gas production data is provided by the Utah Division of Oil, Gas, and Mining. The dataset includes detailed information on oil and natural gas production by county, field, and operator. Shown here is historic oil production summed by county. Oil production is measured in **barrels (BBL)**.

L.2.3 Oil production aggregated by county (barrels)

County	2019	2020	2021	2022	2023
Carbon	43,181	34,890	28,003	28,234	25,920
Daggett	533	1,306	1,127	1,498	1,123
Duchesne	20,034,684	16,497,440	20,353,519	29,065,414	38,544,883
Emery	18	0	0	0	0
Garfield	125,868	110,211	116,775	117,869	109,339
Grand	218,571	146,093	141,384	118,899	109,493
Rich	0	0	34	0	466
San Juan	2,923,214	2,546,169	2,427,331	2,342,787	2,715,931
Sanpete	71,819	71,276	64,345	59,853	57,561
Sevier	1,330,640	1,103,994	960,444	1,126,316	1,116,612
Summit	165,682	157,335	156,364	143,077	152,386
Uintah	10,895,503	9,368,558	10,628,668	11,489,677	12,608,795
Unreported	1,123,387	963,624	893,478	920,932	1,007,655
Statewide Total	**36,933,100**	**31,000,896**	**35,771,472**	**45,414,556**	**56,450,164**

Natural Gas Production

Oil and natural gas production data is provided by the Utah Division of Oil, Gas, and Mining. The dataset includes detailed information on oil and natural gas production by county, field, and operator. Shown here is historic natural gas production, summed by county. Natural gas production is measured in **cubic ft**.

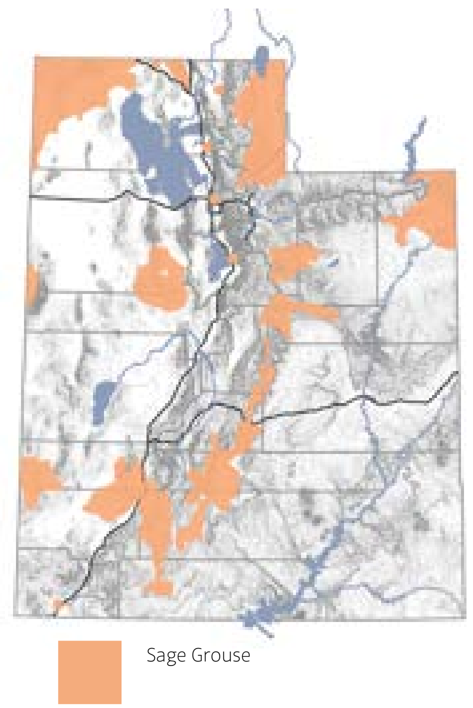
L.2.4 Natural gas production aggregated by county (cubic feet)

County	2019	2020	2021	2022	2023
Carbon	38,344,267	35,247,645	33,087,386	30,964,336	29,960,523
Daggett	981,362	851,446	733,777	794,204	748,794
Duchesne	43,123,342	39,804,599	45,287,760	55,608,011	62,308,224
Emery	6,363,961	5,949,925	5,611,293	5,379,334	5,114,518
Garfield	9,125	9,151	9,129	9,103	9,113
Grand	2,559,605	2,327,458	2,604,236	2,776,170	2,391,346
San Juan	8,473,564	7,114,447	7,059,639	6,259,206	7,991,906
Sanpete	666,573	634,255	580,237	533,187	514,481
Summit	1,807,140	868,890	1,103,811	1,224,218	1,145,318
Uintah	165,764,581	145,182,399	139,453,806	152,895,889	175,716,245
Unreported	4,884,379	4,570,118	4,518,390	4,109,853	3,486,524
Statewide Total	**272,977,899**	**242,560,333**	**240,049,464**	**260,553,511**	**289,386,992**

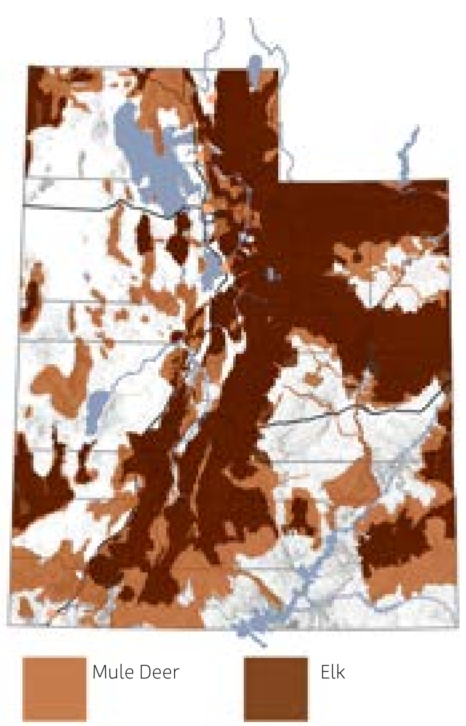
Habitat Areas of Relevant Species

L.3.1 Bighorn Sheep

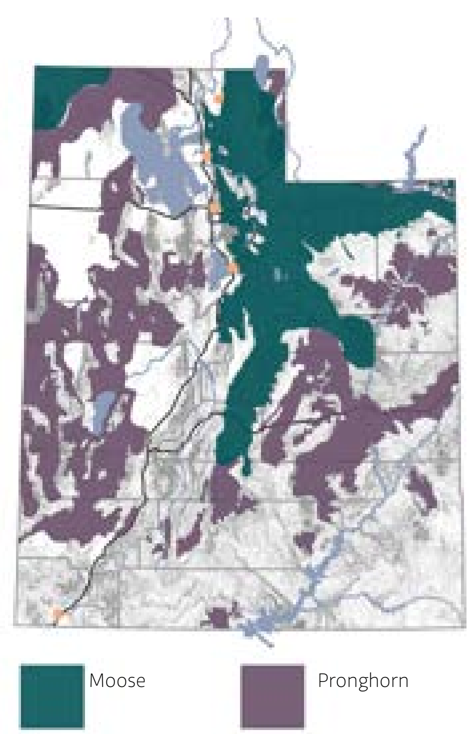
L.3.2 Sage Grouse



L.3.3 Elk and Deer



L.3.4 Moose and Pronghorn



Big Game Harvest

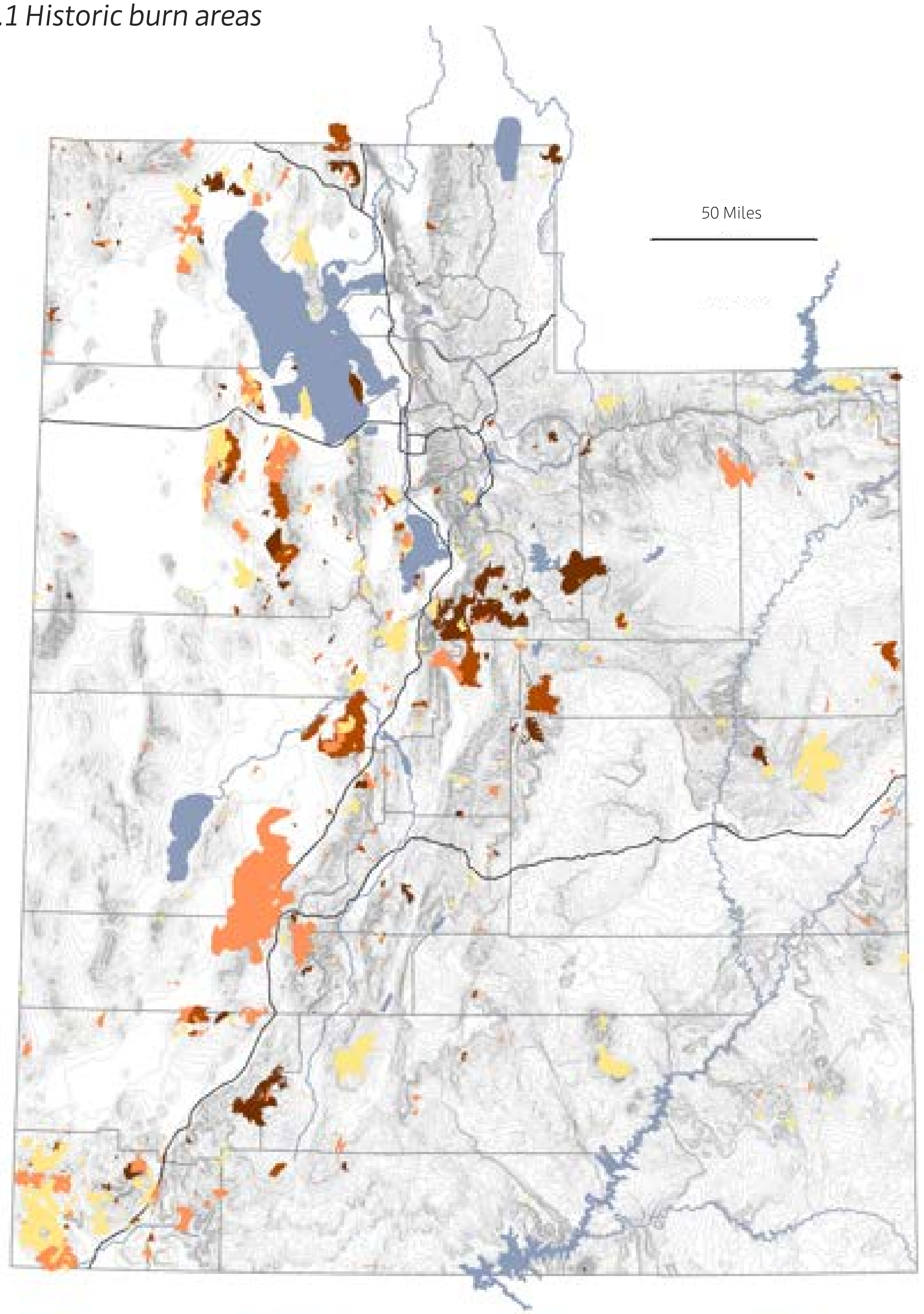
A compilation of annual permit and harvest data from select species monitored by Utah Division of Wildlife Resources. The total number of successful harvests for each hunt area are summed statewide. Maps highlighting habitat areas for these and other relevant species are provided for reference. Data supporting these maps comes from the Utah Division of Wildlife Resources.

L.3.5 Statewide harvest by species

Permit Type & Species	2015	2016	2017	2018	2019	2020	2021	2022	2023
General Harvest Buck Deer	29,553	31,315	26,907	28,908	21,348	20,340	21,947	23,286	17,031
Limited Entry Buck Deer	2,441	2,597	2,619	2,622	2,413	2,496	2,413	2,396	2,143
Antlerless Deer	359	492	938	1,209	1,201	604	444	356	180
Total Deer	**32,353**	**34,404**	**30,464**	**32,739**	**24,962**	**23,440**	**24,804**	**26,038**	**19,354**
Limited Entry Bull Elk	2,786	2,658	2,706	2,629	2,581	2,665	2,719	2,916	2,722
Antlerless Elk	6,926	7,639	4,166	5,616	4,912	4,264	4,875	5,304	4,277
Total Elk	**9,712**	**10,297**	**6,872**	**8,245**	**7,493**	**6,929**	**7,594**	**8,220**	**6,999**
Once In a Lifetime Bull Moose	137	133	137	163	159	167	176	173	162
Anterless Moose	0	15	18	24	34	28	13	15	8
Total Moose	**137**	**148**	**155**	**187**	**193**	**195**	**189**	**188**	**170**
Limited Entry Buck Pronghorn	775	737	845	888	983	1,085	1,112	1,205	1,232
Anterless Pronghorn	501	481	592	593	527	463	271	220	148
Total Pronghorn	**1,276**	**1,218**	**1,437**	**1,481**	**1,510**	**1,548**	**1,383**	**1,425**	**1,380**
Desert Bighorn Sheep	45	41	60	57	75	83	75	76	76
Rocky Mountain Bighorn Sheep	40	41	38	44	58	71	68	62	62
Once in a Lifetime Bison	67	59	96	214	183	100	114	144	123
Mountain Goat	112	103	100	115	114	117	110	96	85

Historic Wildfires

L.4.1 Historic burn areas



2000-2005 2006-2010 2010-2015 2016-2018

This map highlights data from the Monitoring Trends in Burn Severity interagency project. These datasets capture footprints of historic burn areas and keep point data of present and historic fires. Highlighted here are historic burn areas colorized by year.

Wildfire Response History

This dataset from the Geospatial Multi-Agency Coordination Group (GEOMAC) contains historic wildfire perimeter and area information. Including comprehensive geospatial information on wildfire incidents across Utah, this dataset contains key attributes such as the location, size, and extent of each fire. Using a spatial join, wildfires from this dataset are assigned to the county containing a majority of the burn area. Fire size and responding agencies are included below as data is summed by county.

L.4.2 Statewide wildfire history

		Responding Agency (Number of Fires Attended)			
Year	Acres Burned	Bureau of Land Management	United States Forest Service	Division of Forestry, Fire, and State Lands	Other State Agency
2000	195,036	32	0	0	59
2001	88,489	0	0	0	65
2002	240,786	0	0	0	59
2003	102,505	51	12	0	1
2004	92,393	57	5	0	1
2005	226,754	91	11	0	14
2006	325,413	160	8	0	19
2007	593,052	91	5	0	19
2008	17,700	42	4	0	5
2009	102,664	37	12	0	0
2010	58,853	21	11	0	3
2011	48,866	65	7	0	2
2012	414,910	90	10	0	20
2013	78,518	14	11	0	4
2014	15,618	8	8	0	1
2015	5,542	9	5	0	6
2016	90,216	14	29	9	1
2017	184,091	26	9	13	1
2018	343,588	36	17	18	8

National and State Park Visitation

The National Park Service tracks visitor numbers for national parks, while the Utah Department of Natural Resources monitors visitation at state parks. These datasets provide annual visitor statistics, spanning from the start of reporting for each selected park up to the most recent calendar year. Each park also has an issued set of counting procedures to record the number of visitors in the park. These methods can range from traffic counters, door counters, or are done manually.

L.5.1 National park visitation

Year	Arches	Bryce Canyon	Canyonlands	Capitol Reef	Zion
2003	757,781	903,760	386,986	535,441	2,458,792
2004	733,131	987,253	371,706	549,708	2,677,342
2005	781,670	1,017,681	393,381	550,255	2,586,665
2006	833,049	890,676	392,537	511,511	2,567,350
2007	860,181	1,012,563	417,560	554,907	2,657,281
2008	928,795	1,043,321	436,715	604,811	2,690,154
2009	996,312	1,216,377	436,241	617,208	2,735,402
2010	1,014,405	1,285,492	435,908	662,661	2,665,972
2011	1,040,758	1,296,000	473,773	668,834	2,825,505
2012	1,070,577	1,385,352	452,952	673,345	2,973,607
2013	1,082,866	1,311,875	462,242	663,670	2,807,387
2014	1,284,767	1,435,741	542,431	786,514	3,189,696
2015	1,399,247	1,745,804	634,607	941,029	3,648,846
2016	1,585,718	2,365,110	776,218	1,064,904	4,295,127
2017	1,539,028	2,571,684	742,271	1,150,165	4,504,812
2018	1,663,557	2,679,478	739,449	1,227,627	4,320,033
2019	1,659,702	2,594,904	733,996	1,226,519	4,488,268
2020	1,238,083	1,464,655	493,914	981,038	3,591,254
2021	1,806,865	2,104,600	911,594	1,405,353	5,039,835
2022	1,460,652	2,354,660	779,147	1,227,608	4,692,417
2023	1,482,045	2,461,269	800,322	1,268,861	4,623,238

L.5.2 State park visitation

Year	Anasazi Indian Village State Park	Antelope Island State Park	Bear Lake State Park	Camp Floyd - Stage Coach Inn State Park	Coral Pink Sand Dunes State Park
2003	33,145	268,732	32,230	12,348	128,675
2004	34,076	255,155	45,228	12,293	122,832
2005	32,959	272,381	105,849	15,422	65,270
2006	27,614	250,886	232,825	15,850	66,468
2007	26,958	281,266	225,985	15,018	69,509
2008	24,309	256,901	198,141	16,331	62,741
2009	24,883	273,510	175,049	16,213	58,943
2010	21,850	285,390	229,669	16,656	56,939
2011	20,605	282,145	242,749	16,703	52,676
2012	20,119	292,662	234,095	16,609	58,734
2013	19,166	307,239	185,113	13,527	64,430
2014	19,836	328,139	213,346	13,472	73,156
2015	19,253	394,748	245,780	15,446	78,737
2016	21,221	409,246	281,717	13,657	92,010
2017	18,771	475,371	321,277	14,360	130,016
2018	19,751	499,469	364,199	13,774	117,922
2019	19,477	528,865	458,344	16,933	128,558
2020	14,236	815,445	638,798	6,278	177,655
2021	21,640	1,074,569	603,297	8,605	252,623
2022	17,301	885,078	539,173	18,303	229,527
2023	19,949	936,147	569,905	12,238	229,005

L.5.3 State park visitation continued

Year	Dead Horse Point State Park	Deer Creek State Park	East Canyon State Park	Echo State Park	Edge Of The Cedars State Park
2003	161,774	176,975	71,101	-	19,309
2004	145,800	202,740	56,641	-	41,315
2005	137,265	209,149	55,904	-	10,446
2006	169,206	355,003	95,543	-	17,420
2007	172,176	326,038	98,010	-	17,555
2008	184,560	260,299	79,731	-	13,516

National and State Park Visitation

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L.5.3 State park visitation continued

Year	Dead Horse Point State Park	Deer Creek State Park	East Canyon State Park	Echo State Park	Edge Of The Cedars State Park
2009	179,157	295,993	99,663	-	11,981
2010	169,595	359,365	83,967	-	12,416
2011	182,419	305,748	100,250	-	14,286
2012	200,620	360,565	82,731	-	10,881
2013	266,263	225,873	64,410	-	9,656
2014	351,743	218,886	95,166	-	8,950
2015	398,094	255,946	92,571	-	10,858
2016	416,180	334,357	92,120	-	10,121
2017	704,841	400,383	120,307	5,777	12,489
2018	880,678	422,119	142,452	6,451	12,212
2019	978,380	433,855	159,881	55,488	12,735
2020	792,099	707,836	252,273	77,726	5,196
2021	1,265,223	688,619	190,084	44,512	12,402
2022	1,069,571	587,052	205,561	25,255	13,776
2023	1,080,536	702,506	232,674	133,437	13,616

L.5.4 State park visitation continued

Year	Escalante Petrified Forest State Park	Fremont Indian State Park	Goblin Valley State Park	Goosenecks State Park	Great Salt Lake Marina State Park
2003	36,105	71,465	67,913	57,098	139,254
2004	82,584	58,190	46,065	87,170	38,196
2005	37,455	66,235	56,597	58,910	57,966
2006	40,451	64,116	30,081	40,761	138,763
2007	39,554	72,184	39,529	50,340	250,478
2008	42,978	74,919	63,343	58,096	214,127
2009	39,599	82,486	52,771	66,722	213,289
2010	40,229	78,055	46,270	65,545	249,085

L.5.4 State park visitation continued

Year	Escalante Petrified Forest State Park	Fremont Indian State Park	Goblin Valley State Park	Goosenecks State Park	Great Salt Lake Marina State Park
2011	57,934	101,993	61,435	63,778	254,317
2012	51,774	113,892	80,628	69,670	272,842
2013	53,315	70,960	94,222	28,891	136,530
2014	46,521	13,092	108,914	-	177,380
2015	48,678	16,621	158,404	45,351	423,012
2016	53,512	19,488	220,738	61,941	110,845
2017	61,477	25,000	251,004	66,523	112,154
2018	63,471	25,037	279,555	63,445	77,390
2019	66,730	32,490	305,325	66,313	94,687
2020	57,669	45,317	309,039	25,256	118,119
2021	86,049	52,423	453,937	49,385	149,194
2022	73,969	48,540	408,343	55,660	136,170
2023	90,821	51,605	398,962	56,367	169,377

L.5.5 State park visitation continued

Year	Green River State Park	Gunlock State Park	Huntington State Park	Hyrum State Park	Frontier State Park
2003	83,951	82,665	41,270	74,411	16,549
2004	-	37,835	61,947	17,139	166,457
2005	20,937	-	54,833	62,712	13,176
2006	22,857	60,891	47,848	67,980	18,498
2007	20,217	45,222	19,043	82,480	15,853
2008	21,142	51,915	37,197	70,705	16,904
2009	25,190	41,225	59,459	62,961	16,881
2010	23,282	60,189	60,035	131,973	16,272
2011	23,571	55,912	67,418	89,885	17,617
2012	23,740	55,574	71,757	124,958	20,127
2013	35,482	36,474	38,048	83,526	12,826
2014	47,326	13,684	32,276	50,827	18,546
2015	52,189	14,621	29,660	73,225	8,435
2016	56,988	14,142	31,435	76,239	10,126
2017	68,039	24,022	35,911	90,280	11,778
2018	74,498	40,126	38,157	89,305	12,302

National and State Park Visitation

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L.5.5 State park visitation continued

Year	Green River State Park	Gunlock State Park	Huntington State Park	Hyrum State Park	Frontier State Park
2019	82,335	71,052	36,803	109,971	12,385
2020	84,413	114,923	63,789	146,846	8,277
2021	120,653	73,335	55,579	139,555	14,669
2022	106,154	61,021	43,233	146,212	15,039
2023	90,002	269,603	42,124	152,788	15,287

L.5.6 State park visitation continued

Year	Jordanelle State Park	Jordan River OHV State Park	Kodachrome Basin State Park	Lost Creek State Park	Millsite State Park
2003	112,169	-	57,689	-	17,130
2004	59,463	-	21,856	-	-
2005	182,895	-	49,700	-	28,044
2006	198,592	-	49,804	-	20,353
2007	310,348	-	52,523	-	34,923
2008	296,781	-	52,712	-	32,383
2009	290,326	17,477	50,939	-	34,266
2010	265,208	15,364	52,654	-	34,782
2011	257,675	11,921	49,806	-	40,487
2012	323,689	18,347	48,407	-	40,959
2013	261,528	13,968	66,858	-	20,615
2014	275,225	91,710	73,002	-	19,960
2015	380,995	10,015	102,840	-	13,030
2016	485,292	13,046	110,517	-	30,902
2017	576,536	19,366	118,790	-	14,078
2018	624,103	59,796	130,860	-	11,065
2019	652,705	55,123	132,202	-	13,348

L.5.6 State park visitation continued

Year	Jordanelle State Park	Jordan River OHV State Park	Kodachrome Basin State Park	Lost Creek State Park	Millsite State Park
2020	977,252	69,293	150,144	10,520	62,708
2021	821,719	86,873	199,555	11,599	44,914
2022	712,633	101,398	160,956	93	18,558
2023	829,944	113,729	152,777	13,381	23,828

L.5.7 State park visitation continued

Year	Otter Creek State Park	Palisade State Park	Piute State Park	Point of the Mountain Sky Park	Quail Creek State Park
2003	47,346	125,624	9,647	-	514,718
2004	151,111	8,502	164,945	-	27,550
2005	43,689	125,017	21,990	-	165,702
2006	65,267	211,646	29,609	-	108,482
2007	70,973	233,739	47,918	-	112,534
2008	83,042	290,682	26,230	-	95,239
2009	72,722	313,501	29,249	-	97,110
2010	57,786	141,458	18,294	-	101,967
2011	57,942	167,869	17,531	-	72,366
2012	51,875	195,596	16,739	-	64,980
2013	36,654	135,271	7,983	-	58,555
2014	25,838	100,059	2,143	-	72,110
2015	29,903	110,946	1,636	-	78,854
2016	36,708	123,063	1,184	-	88,054
2017	37,363	140,950	1,084	-	107,622
2018	31,257	151,383	793	-	141,879
2019	38,222	173,421	1,408	-	169,137
2020	137,867	105,477	4,481	159,376	168,067
2021	112,705	96,229	9,167	186,592	206,807
2022	43,833	184,404	535	5,234	283,321
2023	47,820	257,874	1,322	3,827	336,676

National and State Park Visitation

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L.5.8 State park visitation continued

Year	Red Fleet State Park	Rockport State Park	Sand Hollow State Park	Scofield State Park	Snow Canyon State Park
2003	33,162	159,570	135,749	106,942	277,285
2004	184,504	352,949	103,336	287,132	106,366
2005	23,959	172,783	172,179	78,276	206,606
2006	30,818	117,683	186,685	102,276	255,643
2007	38,274	127,832	203,753	126,895	385,963
2008	39,210	135,937	175,587	108,975	299,233
2009	37,222	137,697	185,141	79,862	308,126
2010	28,617	132,415	193,633	75,584	321,752
2011	31,822	146,314	183,691	45,160	344,915
2012	45,142	157,575	217,367	39,779	353,870
2013	28,647	105,717	225,849	36,561	292,332
2014	24,979	104,683	320,150	24,889	220,643
2015	28,096	110,458	386,340	19,789	261,043
2016	27,632	130,282	498,644	20,968	291,573
2017	37,032	146,928	575,184	22,952	318,294
2018	49,580	130,020	763,564	22,167	391,444
2019	56,331	153,244	864,751	28,249	509,348
2020	186,888	864,853	580,051	298,635	418,421
2021	122,726	759,199	870,299	532,605	381,620
2022	36,344	190,419	1,089,087	35,482	735,329
2023	14,008	206,574	1,415,554	45,497	954,572

L.5.9 State park visitation continued

Year	Fred Hayes State Park at Starvation	Steinaker State Park	Territorial Statehouse State Park	Utah Field House of Natural History State Park	Utah Lake State Park
2003	110,301	35,400	30,091	52,150	83,076
2004	27,612	38,109	78,133	166,211	843,772

L.5.9 State park visitation continued

Year	Fred Hayes State Park at Starvation	Steinaker State Park	Territorial Statehouse State Park	Utah Field House of Natural History State Park	Utah Lake State Park
2005	51,957	35,136	34,894	60,179	252,565
2006	54,398	45,615	46,794	52,027	265,271
2007	61,351	57,621	50,169	47,070	270,836
2008	56,294	70,312	53,493	42,409	284,740
2009	64,609	73,378	20,562	36,464	336,952
2010	61,539	81,517	8,817	40,356	278,664
2011	70,044	91,434	22,564	44,290	285,359
2012	89,697	43,522	29,079	44,786	280,422
2013	79,967	27,732	14,785	48,680	234,032
2014	83,729	25,024	5,264	45,206	150,899
2015	96,972	36,893	7,751	60,324	140,546
2016	109,588	40,684	7,776	54,821	117,029
2017	119,830	39,365	9,023	53,700	143,802
2018	116,148	26,577	5,697	56,448	89,622
2019	112,753	16,686	10,117	57,381	150,475
2020	90,482	24,517	31,307	155,516	410,395
2021	109,355	22,280	45,365	183,179	255,170
2022	139,477	52,933	6,615	61,657	215,687
2023	153,538	79,299	9,520	60,704	342,885

L.5.10 State park visitation continued

Year	UtahRaptor State Park	Wasatch Mountain State Park	Willard Bay State Park	Yuba State Park
2003	-	799,617	206,968	66,660
2004	-	138,868	92,149	-
2005	-	915,963	297,038	138,233
2006	-	412,283	325,933	122,964
2007	-	279,176	192,224	180,045
2008	-	298,195	171,589	180,059
2009	-	341,881	304,441	194,947
2010	-	359,871	340,645	225,213
2011	-	357,696	337,072	140,965

National and State Park Visitation

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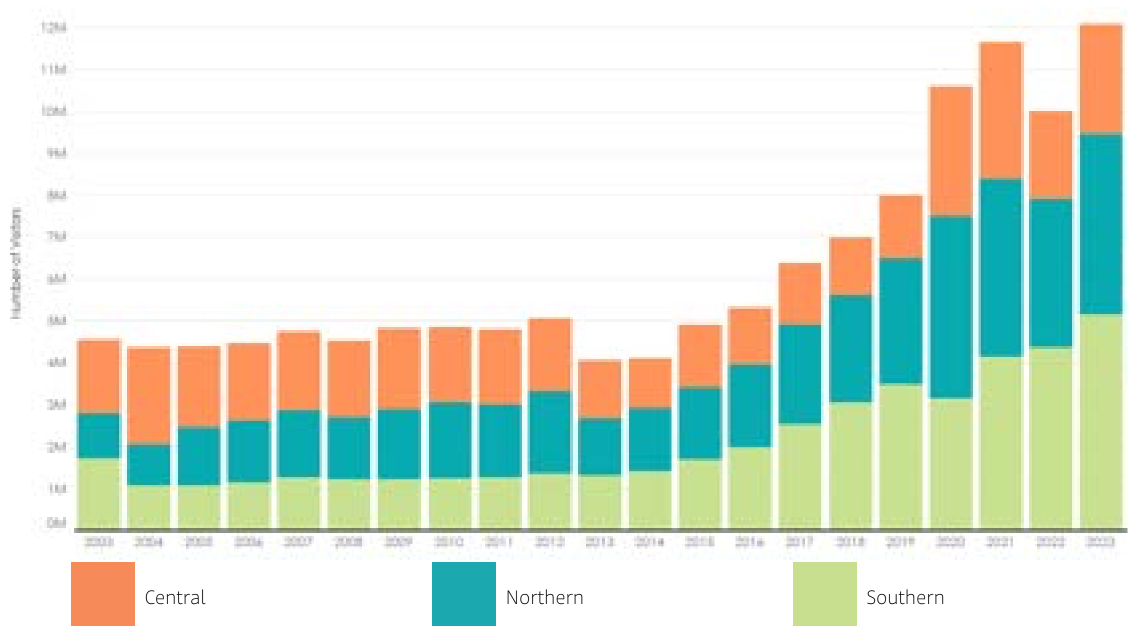
L.5.10 State park visitation continued

Year	UtahRaptor State Park	Wasatch Mountain State Park	Willard Bay State Park	Yuba State Park
2012	-	256,887	348,534	237,708
2013	-	358,095	144,008	112,217
2014	-	280,030	227,315	99,237
2015	-	284,865	260,798	102,902
2016	-	340,697	366,251	100,514
2017	-	353,400	482,391	109,231
2018	-	353,727	503,808	92,830
2019	-	360,274	645,381	124,471
2020	508,761	271,566	372,526	77,218
2021	370,997	440,934	352,145	58,710
2022	2,486	574,185	540,910	120,829
2023	17,571	678,082	880,331	152,987

L.5.9 State park visitation history by region

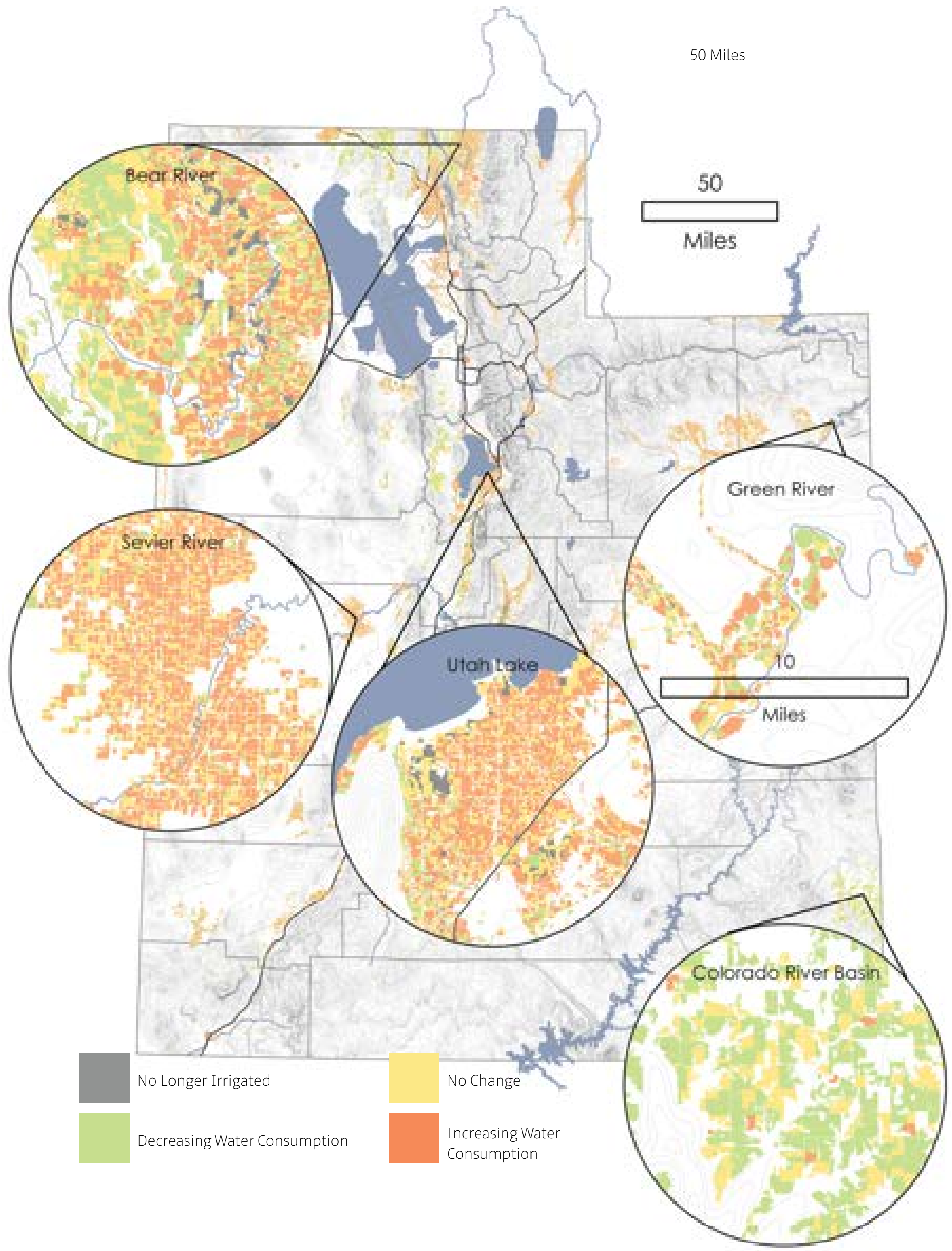


This chart was made using the state park visitation data from the Department of Natural Resources, covering the years 2003 to 2024. It displays the total number of park visits each year, with the data categorized and color-coded by region: northern, central, and southern Utah.

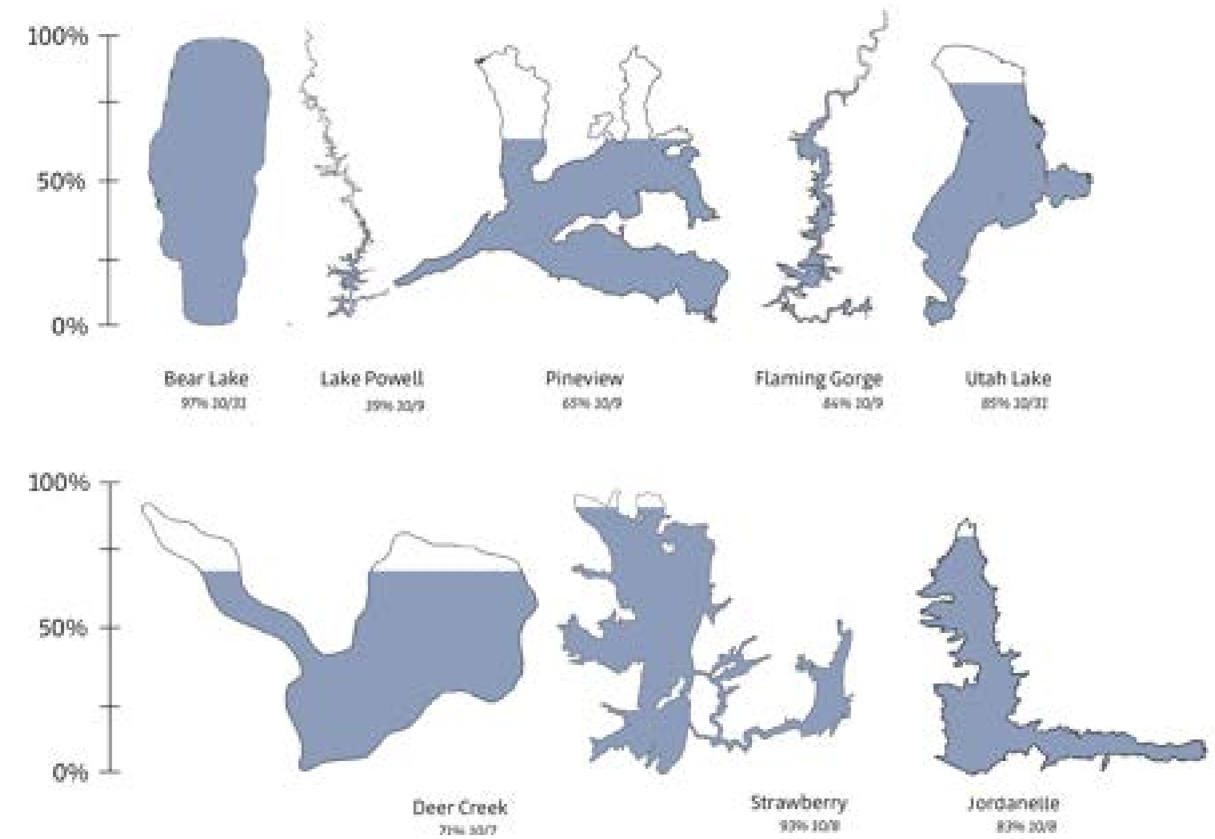
CANYONLANDS NATIONAL PARK WHITE RIM OVERLOOK | AARON FORTIN

Utah's WATER *metrics*

W.1.1 Irrigation system changes from 2018-2023



W.1.2 Waterbody fill level at end of 2024 water year



Above: Made using reported reservoir storage information and lake elevation levels from the month of October, marking the end of the 2024 water year. This bar chart compares the elevation of several waterbodies. Footprints are colored to show the percentage of total capacity filled around peak season. The spatial size and total water volume is not represented here, rather the amount of water within each body with a normalized capacity.

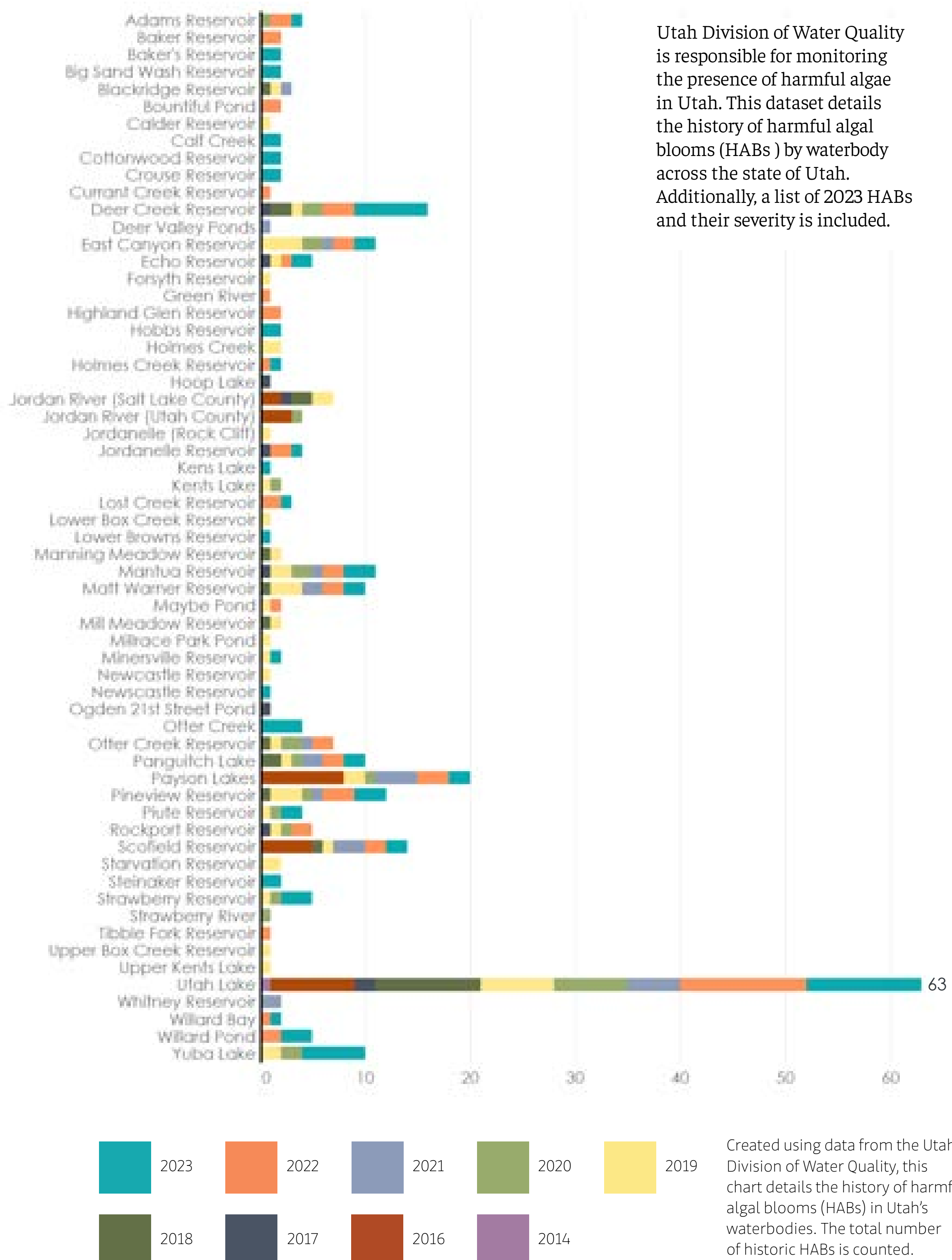
Left: Made by comparing irrigation methods reported in 2018 and 2023, this map draws generalizations about changes in water consumption, or water lost to the natural system. System changes were grouped into three general categories using the Irrigation Conversion Water Savings Destination Calculator produced by Utah State University Extension: decreasing, increasing, and unchanging water consumption. Generally, non-irrigated lands are considered the least consumptive, followed by land irrigated using a drip system, then surface system irrigation, and sprinkler irrigation systems are considered the most consumptive.

Water conservation efforts have brought a host of policy and scientific attention to infrastructure efficiency. Across the state farmers are shifting irrigation methods to better align with known best practices, capitalize on incentives, and update aging infrastructure. Some of these changes are demonstrated in the map to the left.

The state of Utah has been in an off-and-on state of drought for the past several years. As weather patterns change, and we continue to exist in this natural drought cycle, it's important to monitor and budget our water availability, storage, and use. The chart above highlights reservoir storage at the end of the water year for a few key reservoirs. High-storage volume is indicative of the past few years of good water. The following statewide water budget information provides further information about where we receive and use our water. This information is critical to understanding the complex natural systems that dictate our water and informing the political systems that govern it.

Historic Harmful Algal Blooms

W.2.1 Number of blooms per waterbody



Utah Division of Water Quality is responsible for monitoring the presence of harmful algae in Utah. This dataset details the history of harmful algal blooms (HABs) by waterbody across the state of Utah. Additionally, a list of 2023 HABs and their severity is included.

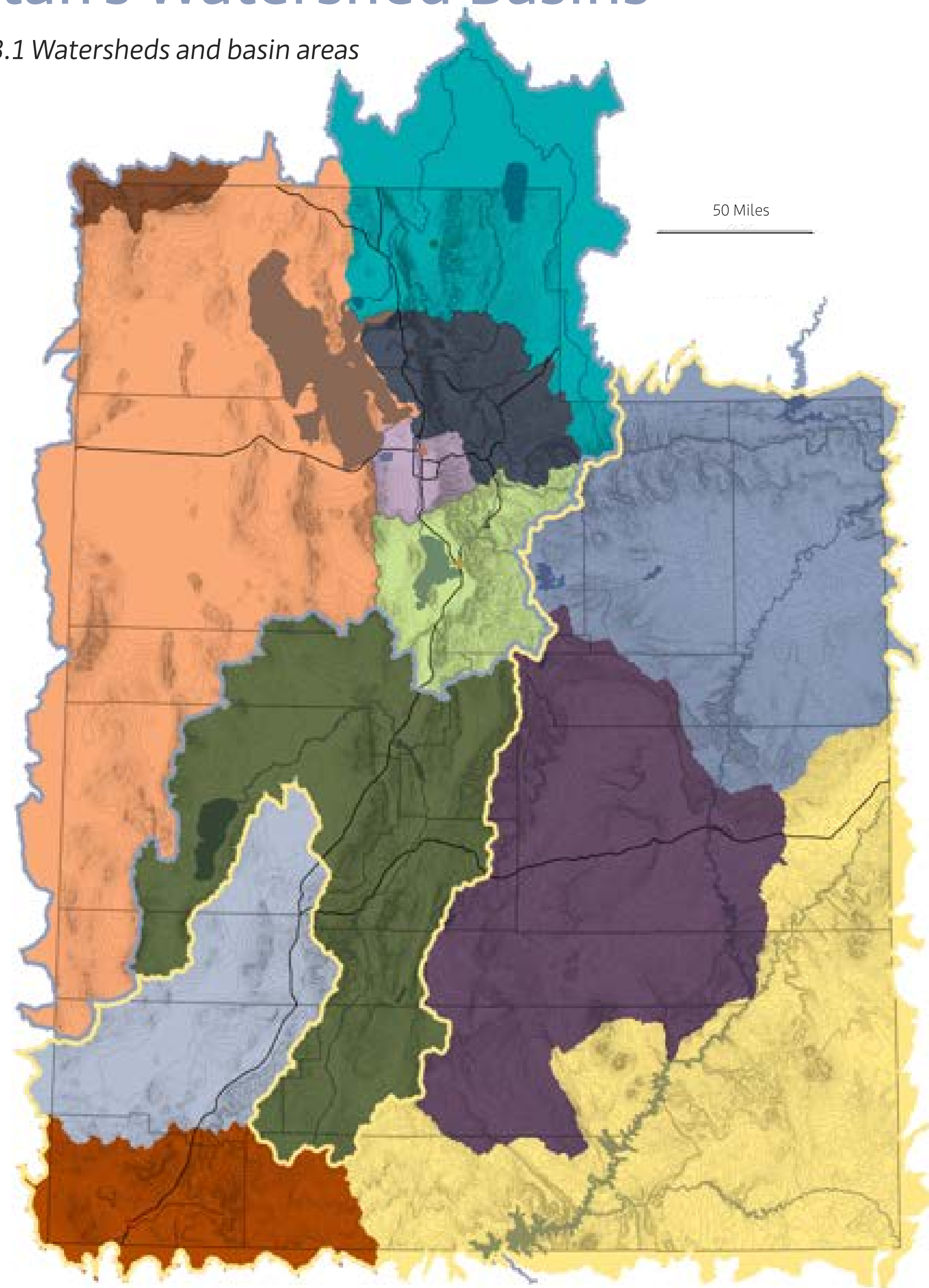
Created using data from the Utah Division of Water Quality, this chart details the history of harmful algal blooms (HABs) in Utah's waterbodies. The total number of historic HABs is counted. Each bar is colorized by year.

W.2.2 2023 Bloom locations, duration in days, and severity

Waterbody	Length	Advisory Type
Adams Reservoir	80	Warning
Baker's Reservoir	1	Health Watch
Baker's Reservoir	Current (11/1)	Warning
Big Sand Wash Reservoir	11	Health Watch
Big Sand Wash Reservoir	28	Warning
Calf Creek	98	Health Watch
Calf Creek	63	Warning
Cottonwood Reservoir	11	Health Watch
Cottonwood Reservoir	28	Warning
Crouse Reservoir	1	Health Watch
Crouse Reservoir	102	Warning
Deer Creek Reservoir: Charleston	15	Health Watch
Deer Creek Reservoir: Charleston	11	Warning
Deer Creek Reservoir: Charleston	21	Danger
Deer Creek Reservoir: Charleston	66	Warning
Deer Creek Reservoir	84	Health Watch
Deer Creek Reservoir	60	Warning
Deer Creek Reservoir	38	Warning
East Canyon Reservoir	6	Health Watch
East Canyon Reservoir	35	Warning
Echo Reservoir	7	Health Watch
Echo Reservoir	32	Warning
Hobbs Reservoir	2	Health Watch
Hobbs Reservoir	64	Warning
Holmes Creek Reservoir	66	Warning
Jordanelle Reservoir	39	Health Watch
Kens Lake	23	Health Watch
Lost Creek Reservoir	35	Warning
Lower Browns Reservoir	20	Health Watch
Mantua Reservoir	17	Health Watch
Mantua Reservoir	69	Warning
Mantua Reservoir	12	Health Watch
Matt Warner Reservoir	1	Health Watch
Matt Warner Reservoir	102	Warning
Minersville Reservoir	43	Health Watch
Newscastle Reservoir	56	Health Watch
Otter Creek: State Park	42	Warning
Otter Creek	41	Warning
Otter Creek	42	Health Watch
Otter Creek	61	Warning
Panguitch Lake	6	Health Watch
Panguitch Lake	112	Warning
Payson Lakes: McClellan Lake	59	Health Watch
Payson Lakes: McClellan Lake	105	Warning
Pineview Reservoir	3	Health Watch
Pineview Reservoir	29	Warning
Pineview Reservoir	12	Health Watch
Piute Reservoir	7	Health Watch
Piute Reservoir	32	Warning
Scofield Reservoir	1	Health Watch
Scofield Reservoir	104	Warning
Steinaker Reservoir	28	Health Watch
Steinaker Reservoir	70	Warning
Strawberry Reservoir: Jake's Bay	40	Warning
Strawberry Reservoir	33	Health Watch
Strawberry Reservoir: Renegade Point	29	Warning
Utah Lake: Provo Bay	4	Health Watch
Utah Lake: Provo Bay	43	Warning
Utah Lake: Lincoln Beach	47	Warning
Utah Lake: Lindon Marina	4	Health Watch
Utah Lake: Lindon Marina	15	Warning
Utah Lake: American Fork	4	Health Watch
Utah Lake: American Fork	15	Warning
Utah Lake	5	Health Watch
Utah Lake	111	Warning
Utah Lake: Saratoga Springs	68	Health Watch
Utah Lake: State Park	68	Health Watch
Willard Bay	4	Health Watch
Willard Pond	15	Health Watch
Willard Pond	6	Health Watch
Willard Pond	55	Warning
Yuba Lake	2	Health Watch
Yuba Lake	13	Warning
Yuba Lake	9	Danger
Yuba Lake	32	Warning
Yuba Lake	27	Danger
Yuba Lake	32	Warning

Utah's Watershed Basins

W.3.1 Watersheds and basin areas



Delineating watersheds used to inform Utah's water budget model; this map is provided as reference to inform the following tables. Water budget data correlates with watershed boundaries.

Precipitation and Depletions by Basin Area

The Utah Department of Natural Resources Water Budget Model gathers data from agricultural, municipal and industrial, wetland, reservoir, climate, and water supply inputs and calculates the major inputs and outputs for each sub-basin by year. Tables are broken down by basin area and contain annual precipitation, and categorical depletions for the years 2010-2022. Precipitation measures the amount of rain and snowfall within the region. Depletions in each category measure the amount of water drawn lost from the system due to consumptive use. Water is measured in **acre-ft.**

W.3.2 Cedar/Beaver basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	6,670,852.86	220,632.89	23,404.86	-
2011	4,500,150.53	207,678.49	23,573.60	-
2012	4,029,005.16	225,812.54	23,581.38	-
2013	4,179,570.40	218,748.06	23,589.30	-
2014	4,204,188.00	210,648.13	23,597.38	-
2015	4,632,036.90	206,705.05	22,441.53	-
2016	4,159,315.02	224,824.57	63,260.49	-
2017	4,397,591.12	209,617.88	49,840.76	-
2018	4,194,275.90	193,831.53	64,566.95	-
2019	5,542,285.65	231,775.19	45,224.47	-
2020	2,112,928.96	225,397.98	46,306.47	-
2021	5,304,898.33	198,510.65	48,135.40	-
2022	4,137,055.35	210,337.83	48,638.99	-

W.3.1 Watersheds and basin areas key

- Bear River
- Weber River
- Columbia River
- West Desert
- Sevier River
- Uintah
- Utah Lake
- Jordan River
- West Colorado River
- Southeast Colorado River
- Kanab Creek/Virgin River
- Cedar/Beaver
- Great Salt Lake Watershed
- Colorado River Watershed

Precipitation and Depletions by Basin Area

The Utah Department of Natural Resources Water Budget Model gathers data from agricultural, municipal and industrial, wetland, reservoir, climate, and water supply inputs and calculates the major inputs and outputs for each sub-basin by year. Tables are broken down by basin area and contain annual precipitation, and categorical depletions for the years 2010-2022. Precipitation measures the amount of rain and snowfall within the region. Depletions in each category measure the amount of water drawn lost from the system due to consumptive use. Water is measured in **acre-ft.**

W.3.3 Kanab Creek/Virgin River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	5,608,051.14	44,985.71	17,603.18	-
2011	2,814,075.56	42,859.03	17,698.87	-
2012	3,149,683.43	46,080.24	17,707.22	-
2013	3,225,423.25	43,185.07	17,716.24	-
2014	2,970,246.95	38,355.44	17,725.99	-
2015	3,882,318.82	37,770.57	18,086.82	-
2016	3,919,746.11	38,264.03	19,549.84	-
2017	3,051,904.22	33,751.75	19,666.93	-
2018	3,268,835.58	37,617.55	20,642.55	-
2019	5,253,698.80	34,116.07	18,539.70	-
2020	1,793,734.77	37,696.23	19,668.48	-
2021	4,088,234.49	36,840.52	19,836.14	-
2022	3,116,298.10	31,962.03	20,433.64	-

W.3.4 West Colorado River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	9,942,720.11	178,954.77	40,064.98	-
2011	7,840,817.62	196,410.74	40,403.95	-
2012	6,378,647.87	173,173.03	40,405.96	-
2013	9,299,734.80	173,223.78	40,407.98	-
2014	7,455,383.82	196,690.65	40,410.02	-
2015	10,040,399.39	184,209.20	38,799.10	-
2016	8,223,825.76	182,721.97	29,960.48	-
2017	6,788,958.48	195,560.58	32,021.52	-
2018	6,524,514.94	169,225.15	30,355.69	-
2019	9,597,519.56	195,297.13	32,803.74	-
2020	4,074,818.17	191,202.90	29,070.86	-
2021	9,141,652.46	144,444.64	34,414.72	-
2022	6,618,809.34	184,012.93	31,308.70	-

W.3.5 Southeast Colorado River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	11,688,185.99	34,926.09	4,544.39	-
2011	7,787,316.35	30,741.67	4,968.82	-
2012	6,451,450.89	34,556.39	5,017.39	-
2013	10,361,524.79	26,909.22	4,990.65	-
2014	7,502,902.90	25,365.35	4,991.14	-
2015	13,794,074.75	27,860.72	4,445.80	-
2016	9,364,980.43	30,966.30	4,257.18	-
2017	7,453,219.90	30,707.79	3,863.86	-
2018	7,212,611.03	27,585.75	3,442.20	-
2019	11,291,343.51	35,763.41	3,779.34	-
2020	4,800,896.45	29,628.25	3,419.05	-
2021	9,457,485.01	23,297.71	3,402.95	-
2022	8,488,298.79	22,880.94	3,114.90	-

Precipitation and Depletions by Basin Area

The Utah Department of Natural Resources Water Budget Model gathers data from agricultural, municipal and industrial, wetland, reservoir, climate, and water supply inputs and calculates the major inputs and outputs for each sub-basin by year. Tables are broken down by basin area and contain annual precipitation, and categorical depletions for the years 2010-2022. Precipitation measures the amount of rain and snowfall within the region. Depletions in each category measure the amount of water drawn lost from the system due to consumptive use. Water is measured in **acre-ft.**

W.3.6 Uinta basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	11,845,343.79	422,585.45	9,223.81	-
2011	11,345,429.70	447,350.04	9,499.77	-
2012	7,315,686.45	386,580.81	9,508.77	-
2013	9,781,317.83	408,634.35	9,517.97	-
2014	10,101,707.79	389,541.75	9,106.22	-
2015	11,028,626.74	444,333.58	8,296.63	-
2016	11,492,630.97	427,974.51	28,716.90	-
2017	9,820,698.37	480,840.71	24,615.98	-
2018	7,846,571.19	399,533.01	29,927.26	-
2019	12,248,240.00	461,286.12	11,072.96	-
2020	6,097,238.84	448,491.16	12,876.77	-
2021	11,771,512.84	371,768.62	12,140.09	-
2022	9,730,635.50	428,308.19	14,704.22	-

W.3.7 Bear River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	9,526,605.00	824,984.68	32,444.89	-
2011	9,508,094.32	800,772.22	32,715.65	-
2012	6,975,978.35	912,165.95	32,725.56	-
2013	6,301,025.56	839,333.41	32,735.60	-
2014	10,294,662.52	799,126.37	32,745.78	-
2015	8,051,354.78	744,953.60	27,285.92	-
2016	10,145,513.29	809,932.69	27,793.70	-
2017	11,196,162.02	891,685.32	29,263.40	-
2018	6,843,050.71	995,984.98	32,092.28	-
2019	10,217,422.26	839,046.90	30,195.29	-
2020	6,764,716.26	952,054.77	35,166.58	-
2021	8,436,673.41	986,085.06	33,441.20	-
2022	7,681,217.49	950,223.65	31,573.66	-

W.3.8 West Desert basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	14,031,140.22	152,034.08	8,306.12	83,831.67
2011	12,690,796.29	151,548.32	8,473.85	107,111.41
2012	10,765,479.58	191,953.68	8,483.49	104,775.32
2013	10,805,614.75	197,329.33	8,496.61	119,060.06
2014	13,017,388.84	179,912.56	8,508.97	75,594.94
2015	13,367,911.02	182,284.37	6,740.58	116,508.87
2016	13,390,987.60	204,637.78	6,805.69	80,208.66
2017	12,483,297.48	150,288.69	7,190.71	62,705.88
2018	10,406,940.86	133,373.70	8,408.48	84,747.64
2019	17,229,204.20	159,322.42	7,302.74	65,670.49
2020	6,482,933.35	165,742.98	7,179.12	85,986.55
2021	12,101,354.76	146,732.08	6,365.62	65,373.34
2022	10,414,754.01	135,867.17	6,673.75	120,955.74

Precipitation and Depletions by Basin Area

The Utah Department of Natural Resources Water Budget Model gathers data from agricultural, municipal and industrial, wetland, reservoir, climate, and water supply inputs and calculates the major inputs and outputs for each sub-basin by year. Tables are broken down by basin area and contain annual precipitation, and categorical depletions for the years 2010-2022. Precipitation measures the amount of rain and snowfall within the region. Depletions in each category measure the amount of water drawn lost from the system due to consumptive use. Water is measured in **acre-ft.**

W.3.9 Sevier River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	11,363,629.61	560,334.66	35,292.27	-
2011	9,371,904.52	513,046.44	36,125.29	-
2012	7,639,750.19	613,360.90	36,137.63	-
2013	8,317,781.03	557,828.74	36,150.11	-
2014	8,411,597.07	547,187.45	36,162.74	-
2015	8,265,413.35	545,613.22	37,655.40	-
2016	7,662,917.71	590,835.28	26,708.00	-
2017	7,856,806.80	523,352.52	28,684.17	-
2018	7,409,199.83	519,710.38	28,331.67	-
2019	10,266,087.92	517,144.97	26,174.19	-
2020	4,112,432.22	573,602.37	26,378.80	-
2021	9,621,313.58	516,487.91	25,239.85	-
2022	7,137,013.33	511,647.96	24,523.41	-

W.3.10 Columbia River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	732,607.38	11,161.37	2.10	-
2011	600,845.71	12,260.03	4.34	-
2012	578,930.57	16,194.42	4.36	-
2013	493,361.65	19,671.70	4.37	-
2014	828,088.89	17,182.10	4.38	-
2015	669,716.26	18,647.00	3.55	-
2016	800,071.46	21,514.23	3.56	-
2017	910,645.63	11,002.74	3.57	-
2018	666,867.97	9,582.26	3.58	-
2019	1,032,385.84	10,202.60	0.51	-
2020	630,151.51	10,944.67	0.37	-
2021	696,837.26	10,911.90	0.29	-
2022	678,902.91	8,689.45	0.28	-

W.3.11 Utah Lake basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	4,252,792.78	222,273.29	63,564.06	-
2011	3,713,625.41	196,510.85	64,129.43	-
2012	2,969,833.72	259,789.69	64,192.33	-
2013	2,816,034.03	227,097.87	64,261.39	-
2014	3,662,927.43	198,520.55	64,337.25	-
2015	2,951,061.53	218,346.63	62,310.91	-
2016	3,237,628.19	236,498.16	66,532.91	-
2017	3,872,002.75	177,630.74	74,651.53	-
2018	3,307,059.33	249,783.44	68,333.87	-
2019	4,610,443.10	186,160.13	75,705.15	-
2020	1,915,329.30	245,930.12	83,812.16	-
2021	3,819,275.24	244,068.56	77,350.49	-
2022	3,163,330.07	208,122.00	82,604.46	-

Precipitation and Depletions by Basin Area

The Utah Department of Natural Resources Water Budget Model gathers data from agricultural, municipal and industrial, wetland, reservoir, climate, and water supply inputs and calculates the major inputs and outputs for each sub-basin by year. Tables are broken down by basin area and contain annual precipitation, and categorical depletions for the years 2010-2022. Precipitation measures the amount of rain and snowfall within the region. Depletions in each category measure the amount of water drawn lost from the system due to consumptive use. Water is measured in **acre-ft.**

W.3.12 Jordan River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	1,124,306.86	17,319.86	197,554.04	-
2011	1,150,283.31	14,700.50	197,535.95	-
2012	820,241.64	21,950.81	197,535.95	-
2013	819,334.01	19,681.59	197,535.96	-
2014	989,594.32	12,863.09	197,535.96	-
2015	953,486.83	14,641.63	190,259.43	-
2016	965,041.94	15,186.45	184,777.67	-
2017	1,087,204.01	10,715.55	187,728.68	-
2018	921,482.28	15,022.38	186,996.16	-
2019	1,453,964.87	10,010.10	158,430.56	-
2020	644,005.40	15,683.25	152,237.64	-
2021	1,074,799.49	14,496.93	137,786.76	-
2022	925,623.70	12,606.21	136,299.21	-

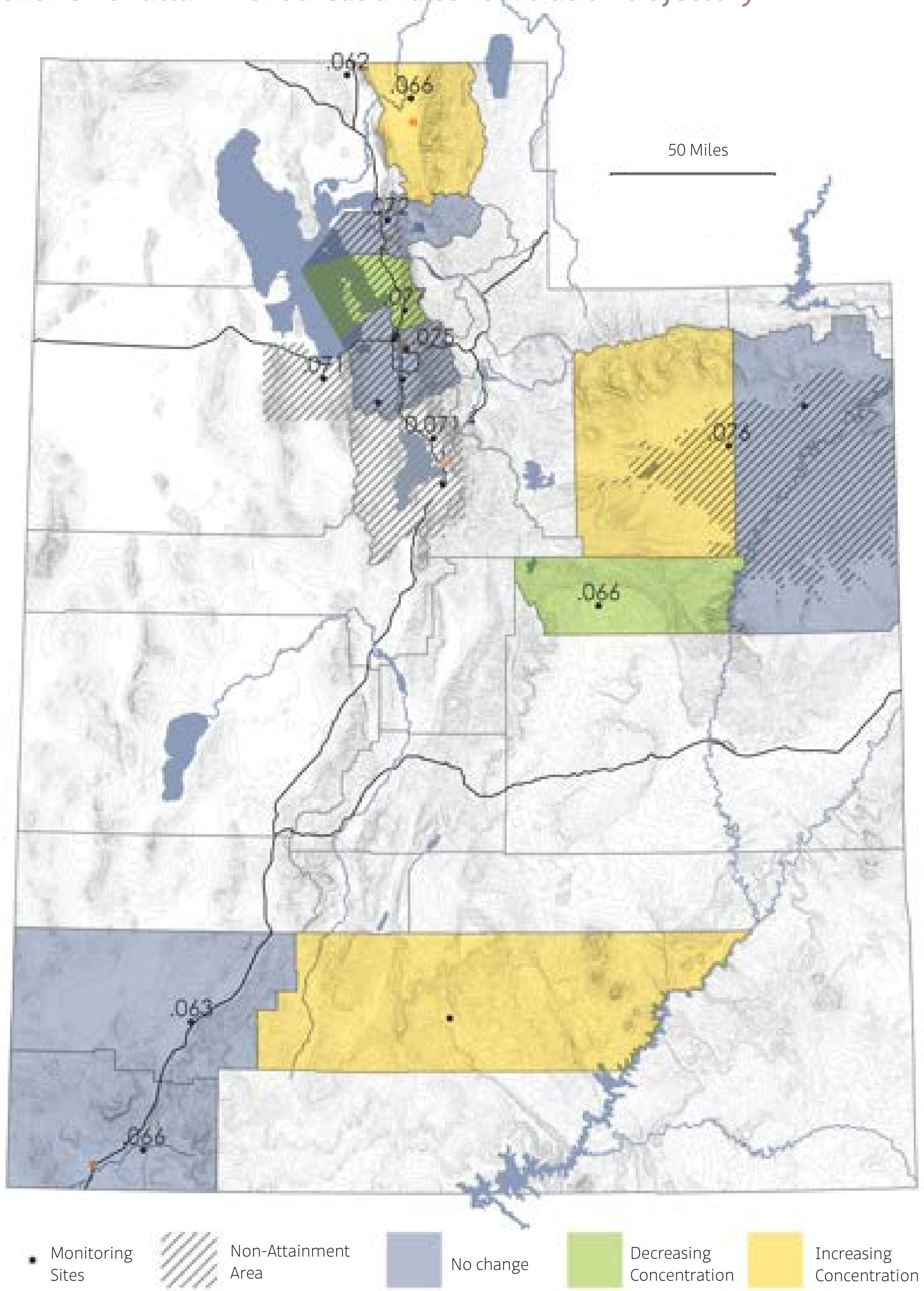
W.3.13 Weber River basin

Year	Precipitation	Agricultural Depletions	Municipal and Industrial Depletions	Mineral Depletions
2010	3,894,741.32	159,044.14	67,856.94	136,284.08
2011	3,896,362.46	141,173.83	68,024.13	98,408.18
2012	2,792,724.48	203,329.78	68,029.31	141,477.95
2013	2,561,133.22	184,789.51	68,034.57	128,187.38
2014	3,560,415.05	147,477.37	68,039.92	139,938.04
2015	3,112,197.46	142,852.37	62,657.30	108,832.87
2016	3,625,607.03	154,594.99	66,325.93	71,332.78
2017	4,148,921.14	147,281.37	65,210.91	122,853.63
2018	2,724,973.18	180,718.49	68,459.95	119,410.46
2019	4,213,144.56	131,142.33	61,212.21	92,291.31
2020	2,245,854.70	182,278.40	80,552.15	119,973.71
2021	3,446,322.73	183,980.40	67,300.43	104,015.03
2022	3,245,873.22	158,400.92	63,707.61	74,092.70

RUTH LAKE, HIGH UINTAS WILDERNESS | KORI KURTZEBORN

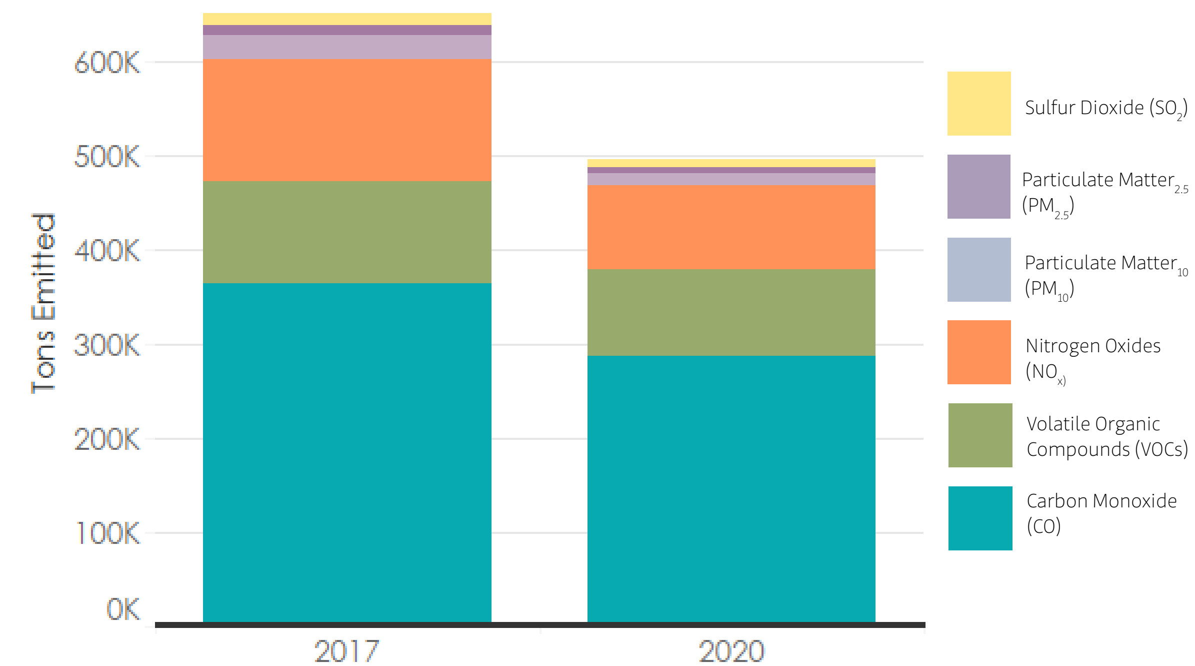
Utah's AIR *metrics*

A.1.1 Ozone nonattainment areas and concentration trajectory



This map highlights air quality monitoring sites across Utah, labeling key sites with ozone (O_3) design values. Design values compare a regional average with national standards to determine attainment. Regional ozone non-attainment areas are also highlighted as reported in the Utah Division of Air Quality (UDAQ) Marginalized Ozone Inventory (2020). Ozone trajectory was calculated using the difference between fourth-highest ozone days in 2020 and 2022. The resulting value is used to colorize the relevant county.

A.1.2 Statewide emissions



Every third year, the Division of Air Quality releases an extended emissions report detailing what has been released into the atmosphere. This chart indicates pollutants released and does not account for the concentration of those pollutants in the atmosphere. This chart sums emissions by pollutant, excluding emissions from biogenic sources and wildfires, from the last two triannual reports. Changes in monitoring strategies make comparisons between historic reports challenging.

The Environmental Protection Agency uses regional design values in comparison with set regulatory values to determine air quality attainment for each pollutant. Design values are calculated using an average of various relevant measures over three years. Information about the measure used to calculate design values and relevant regulatory values can be found in the following table sections. Ozone (O_3) design values are determined by calculating using the fourth-highest annual concentration averaged over three years. A design value over the set regulatory value of 0.07 parts per million (ppm) is considered a violation and will cause the area to be moved into nonattainment. Ozone forms in the atmosphere when nitrogen oxides and volatile organic compounds react with sunlight. These and a variety of other chemicals are counted as pollutants within our atmosphere. The chart above details emissions for all currently measured pollutants.

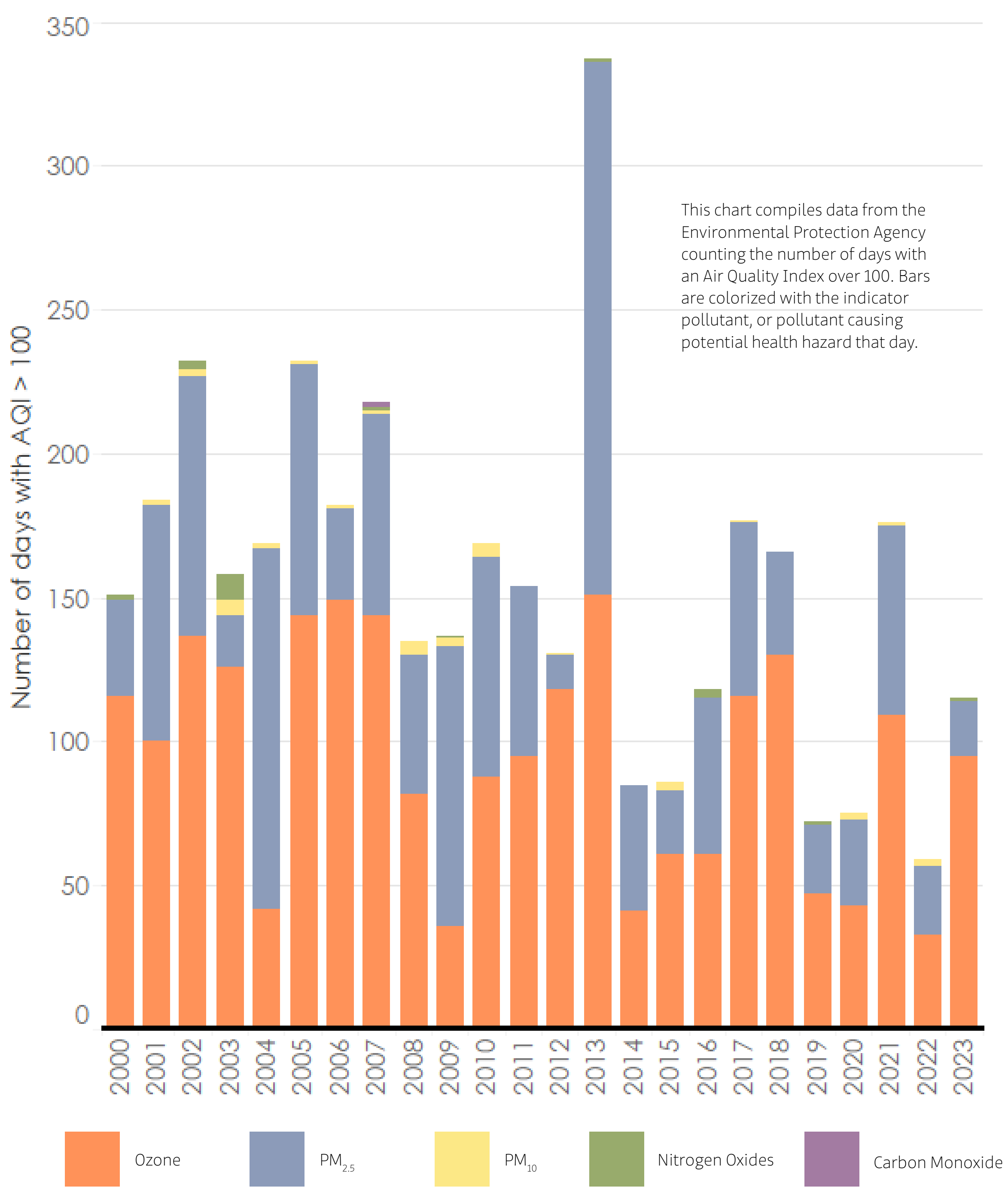
The Environmental Protection Agency measures a variety of atmospheric pollutants, some have impacts on human health. Nitrogen oxides (NO_x) and volatile organic compounds (VOCs) are responsible for forming ozone (O_3) a powerful greenhouse gas. Ozone (O_3) and particulate matter ($PM_{10,2.5}$) or pollution from smoke and other small particles have the most direct impact on human health causing a host of respiratory issues. Carbon monoxide (CO) frequently coming from auto emissions is another greenhouse gas with some human health impact in large quantities.

There are currently 20 air quality monitoring sites in Utah covering 13 counties. Historic measures contributing to regional design values and relevant regulatory values are summarized alongside air quality index reports in the following sections.

AIR QUALITY INDEX (AQI)

The Air Quality Index is a national tool from the Environmental Protection Agency used to communicate outdoor air quality as it relates to human health. Calculated using the average pollutant concentration over 24 hours compared with federal standards, when Air Quality Index values surpass 100, it is generally considered unsafe for sensitive groups. Measuring the number of "bad air days" exceeding an Air Quality Index of 100 is a common strategy for understanding the air quality of an area. Shown here are the number of "bar air days" in each county monitored.

A.2.1 Days of AQI>100 by indicator pollutant



A.2.2 County history of AQI>100 days

Year	Box Eder	Cache	Carbon	Davis	Duchesne	Garfield	Iron	Salt Lake	San Juan	Tooele	Uintah	Utah	Washington
2000	1	12	-	27	-	-	-	52	11	-	-	27	-
2001	24	16	-	22	-	-	-	54	1	2	-	41	-
2002	34	15	-	31	-	-	-	66	7	5	-	39	-
2003	16	10	-	17	-	-	-	39	8	1	-	30	-
2004	7	39	-	9	-	-	-	55	6	0	-	28	12
2005	20	38	-	31	-	-	-	60	4	12	-	22	21
2006	16	9	-	16	-	-	-	54	2	12	-	34	7
2007	19	18	-	19	-	-	-	63	6	12	-	36	4
2008	12	15	-	17	-	-	-	33	4	5	-	23	7
2009	5	28	-	15	-	-	-	37	2	10	2	22	3
2010	11	20	-	10	-	-	-	23	2	10	47	14	8
2011	8	10	1	4	23	-	-	30	3	7	32	9	5
2012	14	7	12	0	9	2	-	17	5	7	16	12	12
2013	22	44	13	11	44	2	-	5	0	15	64	41	2
2014	6	13	0	11	2	0	-	22	0	1	8	12	1
2015	5	4	2	7	3	2	-	27	1	4	2	13	3
2016	4	8	0	14	8	0	-	27	0	7	11	19	0
2017	11	17	0	28	9	2	-	44	0	17	11	14	1
2018	9	7	5	13	11	2	-	41	7	10	11	32	1
2019	2	14	1	6	11	0	-	16	0	2	17	1	0
2020	3	9	12	14	5	0	-	20	2	5	3	5	3
2021	4	10	0	26	8	2	4	47	2	16	8	17	3
2022	0	7	0	10	4	0	0	22	0	6	0	5	0
2023	0	8	0	13	34	0	1	16	0	0	9	0	0

Utah Air Monitoring Program

Made using data from the Utah Air Monitoring Program data archive, these tables report relevant pollutant measures as well as design values from each monitoring site. **Design values (DV)** are used by the Environmental Protection Agency to designate non-attainment areas and track progress towards the National Ambient Air Quality Standards. Calculated using a three-year average of various pollutant measures, these design values are compared with national regulatory values to determine attainment. These averages are used in comparison with Environmental Protection Agency regulatory values reported in table A.3.1 to determine attainment. Tables are labeled by name and monitoring site ID.

A.3.1 Pollutant measures, units, and regulatory values

Pollutant	Measure	Timescale	Units	Regulatory Value (RV)
Ozone	Fourth max	8hr	parts per million	**0.07**
$PM_{2.5}$	98th percentile	24hr Max	micrograms per cubic meter	**35**
PM_{10}	Second max	24hr	micrograms per cubic meter	**150**
CO	First max	8hr	parts per million	**9**
SO_2	98th percentile	1hr Max	parts per billion	**75**
NO_x	98th percentile	1hr Max	parts per billion	**100**

Regulatory values are set standards from the Environmental Protection Agency used to determine attainment. This table provides pollutant regulatory values for reference. The relevant annual measure used to calculate design value as well as the timescale and unit of measurement are shown as well.

A.3.2 Portage (Box Elder) - 49-003-7001

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.063	0.069	0.059	0.066	0.071	0.049	0.057	**0.062**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	14	15	11	10	18	8.6	**12.767**

A.3.3 Smithfield - 49-005-0007

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.063	0.069	0.062	0.068	0.068	0.063	0.067	**0.066**
$PM_{2.5}$	39.3	27.9	44	29.4	37.2	28.1	38	**34.843**
PM_{10}	80	67	66	260	135	-	-	**121.6**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	37	30	33.1	30.9	31.3	33.3	37.3	**33.271**

A.3.4 Price - 49-007-1003

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.066	0.073	0.068	0.067	0.071	0.06	0.059	**0.066**
$PM_{2.5}$	-	-	-	-	-	13.2	7.3	**10.25**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO2	-	-	-	-	-	-	-	**-**
NO_x	22	14	16	18	16.9	15.6	16.7	**17.029**

A.3.5 Bountiful Viewmont - 49-011-0004

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.078	0.08	0.073	0.08	0.082	0.075	0.073	**0.077**
$PM_{2.5}$	36	25.7	22.5	34	35.8	25.4	25.7	**29.3**
PM_{10}	48	48	29	42	77	53	60	**51**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	46	45	46	44.1	46.7	49.7	50.7	**46.886**

A.3.6 Roosevelt - 49-013-0002

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.078	0.071	0.087	0.063	0.072	0.066	0.093	**0.076**
$PM_{2.5}$	28.2	23.9	22.3	23.2	26.9	21.4	33.7	**25.657**
PM_{10}	-	-	-	-	21	103	67	**63.667**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	26.3	22.8	27	26.8	26.1	40.3	51	**31.471**

A.3.7 Myton (Duchesne) - 49-013-7011

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.081	0.065	0.079	0.064	0.069	0.066	0.094	**0.074**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	28.1	14.4	18.5	18.2	24.4	18.9	31.6	**22.014**

Utah Air Monitoring Program

Made using data from the Utah Air Monitoring Program data archive, these tables report relevant pollutant measures as well as design values from each monitoring site. **Design values (DV)** are used by the Environmental Protection Agency to designate non-attainment areas and track progress towards the National Ambient Air Quality Standards. Calculated using a three year average of various pollutant measures, these design values are compared with national regulatory values to determine attainment. These averages are used in comparison with Environmental Protection Agency regulatory values reported in table A.3.1 to determine attainment. Tables are labeled by name and monitoring site ID.

A.3.8 Moab - 49-019-0007

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	-	-	-	-	-	0.062	**0.062**
$PM_{2.5}$	-	-	-	-	-	-	13.2	**13.2**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	-	-	-	-	-	23.4	**23.4**

A.3.9 Enoch - 49-021-0005

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	0.067	0.06	0.061	0.065	0.061	0.061	**0.063**
$PM_{2.5}$	-	13.7	11.3	16.5	20.9	12.4	9.9	**14.117**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	29	46.3	40.2	35.2	38.4	60.8	**41.65**

A.3.10 Copperview - 49-035-2005

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	0.079	0.067	0.075	0.086	0.074	0.073	**0.076**
$PM_{2.5}$	-	31.6	28.7	31.2	44.4	28.9	29.1	**32.317**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	1	1	1.4	1.1	1	1	**1.083**
SO_2	-	3	5	2.2	2.7	3	3.1	**3.167**
NO_x	-	46	51.7	50.8	45.3	47.8	48.3	**48.317**

A.3.11 Hawthorne - 49-035-3006

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.081	0.074	0.073	0.075	0.081	0.072	0.072	**0.075**
$PM_{2.5}$	35.7	26.2	26.4	27	36.9	27.4	30.3	**29.986**
PM_{10}	77	103	67	77	93	112	71	**85.714**
CO	1.7	1.6	1.2	1.2	1.1	1.1	0.8	**1.243**
SO_2	3.3	3.7	4.2	3.5	3.8	3.3	3.4	**3.6**
NO_x	51	49	55.4	52.6	46.6	44.9	45.4	**49.271**

A.3.12 Rose Park - 49-035-3010

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	0.08	0.071	0.08	0.079	0.075	0.07	**0.076**
$PM_{2.5}$	38.5	29.4	21.7	32	39.5	31.4	29.8	**31.757**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	2.9	1.3	1.4	1.3	1.1	1.2	**1.533**
SO_2	-	5	6.6	4.8	6.5	5.2	4.9	**5.5**
NO_x	-	47	46.8	50.4	48.6	49.8	49.4	**48.667**

A.3.13 Herriman - 49-035-3013

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.078	0.078	0.07	0.073	0.087	0.071	0.068	**0.075**
$PM_{2.5}$	28.2	29	18.8	24.9	36.9	25.8	21.5	**26.443**
PM_{10}	87	88	64	106	91	152	78	**95.143**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	43	39	40.1	30.3	31.9	37.4	35.4	**36.729**

A.3.14 Lake Park - 49-035-3014

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	-	-	0.062	0.082	0.072	0.072	**0.072**
$PM_{2.5}$	-	-	-	-	-	29.6	26.5	**28.05**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	-	-	47.3	39	41.6	45.4	**43.325**

Utah Air Monitoring Program

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A.3.15 Utah Technical Center - 49-035-3015

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	-	0.036	0.07	0.082	0.076	0.062	**0.065**
$PM_{2.5}$	-	-	18.8	30	41	34.4	29.8	**30.8**
PM_{10}	-	-	62	112	103	146	73	**99.2**
CO	-	-	1.5	1.3	1.5	1.3	1.6	**1.44**
SO_2	-	-	4.3	3.5	4.7	4.1	5.4	**4.4**
NO_x	-	-	47.5	48.3	51.4	53.4	52.1	**50.54**

A.3.16 Inland Port (Salt Lake City) - 49-035-3016

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	-	-	-	0.084	0.075	0.073	**0.077**
$PM_{2.5}$	-	-	-	-	42.6	29.9	24.8	**32.433**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	-	-	-	40.5	42.9	40.9	**41.433**

A.3.17 Near Road (Murray) - 49-035-4002

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	-	0.064	0.072	0.083	0.072	0.076	**0.073**
$PM_{2.5}$	-	-	31	32.5	42.4	32	30.7	**33.72**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	1.3	0.9	1.2	1.2	1.2	**1.16**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	-	53.1	48	47.1	52.7	56.7	**51.52**

A.3.18 Canyonlands National Park - 49-037-0101

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.064	0.068	0.064	0.066	0.069	0.063	0.063	**0.065**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	-	-	-	-	-	-	**-**

A.3.19 Erda - 49-045-0004

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.077	0.074	0.065	0.07	0.075	0.07	0.068	**0.071**
$PM_{2.5}$	28.8	30.6	22.7	25.5	35.5	28.2	21.1	**27.486**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	24	25	24.4	20.5	18.1	21.7	19.3	**21.857**

A.3.20 Dinosaur National Monument - 49-047-1002

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.074	0.067	0.07	0.063	0.068	0.063	0.098	**0.072**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	-	-	-	-	-	-	**-**

A.3.21 Vernal - 49-047-1004

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.068	0.069	0.065	0.063	0.068	0.063	0.078	**0.068**
$PM_{2.5}$	20.6	19.1	16.1	22.3	7.3	16.5	25.1	**18.143**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	32	21	27.7	34.1	26.2	29.8	37.6	**29.771**

Utah Air Monitoring Program

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A.3.22 Redwash (Uintah) - 49-047-2002

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.076	0.068	0.074	0.066	0.071	0.062	0.081	**0.071**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO2	-	-	-	-	-	-	-	**-**
NO_x	13.6	13.3	17.3	13.3	13.5	13.6	23.3	**15.414**

A.3.23 Ouray (Uintah) - 49-047-2003

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.103	0.067	0.098	0.065	0.072	0.064	0.091	**0.08**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	15.6	11.6	16	14.4	10.3	12.9	20.8	**14.514**

A.3.24 Whiterocks (Uintah) - 49-047-7022

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.066	0.069	0.067	0.065	0.068	0.062	0.088	**0.069**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	13.8	20.5	8.3	7.6	7.3	5.8	11.4	**10.671**

A.3.25 Lindon - 49-049-4001

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	-	0.079	0.062	0.068	0.077	0.074	0.066	**0.071**
$PM_{2.5}$	27.6	21.6	17.2	26.2	35.9	23.1	20.2	**24.543**
PM_{10}	82	85	53	90	100	82	61	**79**
CO	-	0.5	1.1	0.9	1.3	0.8	1	**0.933**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	41	40.8	43.1	42.2	40.7	38.6	**41.067**

A.3.26 Spanish Fork - 49-049-5010

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.072	0.073	0.066	0.07	0.076	0.066	0.065	**0.07**
$PM_{2.5}$	27.6	50.7	16.1	25.4	27.8	24.9	20.6	**27.586**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	39	41.9	38.5	34.6	38.2	37	**38.2**

A.3.27 Hurricane - 49-053-0007

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.067	0.069	0.064	0.065	0.067	0.064	0.063	**0.066**
$PM_{2.5}$	13.5	17.9	10.9	16.6	18.5	13.1	9.4	**14.271**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	26	27	25.8	30	24.9	29.8	28.5	**27.429**

A.3.28 Zion National Park - 49-053-0130

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.067	0.069	0.063	0.067	0.067	0.064	0.064	**0.066**
$PM_{2.5}$	-	-	-	-	-	-	-	**-**
PM_{10}	-	-	-	-	-	-	-	**-**
CO	-	-	-	-	-	-	-	**-**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	-	-	-	-	-	-	**-**

Utah Air Monitoring Program

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A.3.29 Harrisville - 49-057-1003

Pollutant	2017	2018	2019	2020	2021	2022	2023	DV
Ozone	0.073	0.077	0.063	0.074	0.077	0.071	0.07	**0.072**
$PM_{2.5}$	-	-	26.8	25.6	32.4	27.1	19.6	**26.3**
PM_{10}	-	-	44	77	86	126	69	**80.4**
CO	-	-	0.5	0.6	1	0.8	0.8	**0.74**
SO_2	-	-	-	-	-	-	-	**-**
NO_x	-	37	44.4	47	41.7	41.2	44.1	**42.567**

BEAR RIVER MOUNTAIN RANGE FROM NAOMI PEAK | KORI KURTZEBORN

VIEW FROM KINGS PEAK, HIGH UINTAS WILDERNESS | KORI KURTZEBORN

APPROACHING PHEIFFERHORN PEAK AT SUNRISE | KORI KURTZEBORN

METRICS CHAPTER REFERENCES

L1 LAND OWNERSHIP

Utah Geospatial Resource Center. (2024). *Utah Land Ownership*. (Land ownership and Number of farms). [Data set]. UGRC. https://gis.utah.gov/products/sgid/cadastre/land-ownership/

L2 CRITICAL MINERALS AND ACTIVE MINES

Utah Automated Geographic Reference Center. (2024). *Utah Minerals.* [Data set]. Utah SGID. https://opendata.gis.utah.gov/datasets/utah-minerals/explore

Esri USGS. (2024). *Minerals Permits View Layer – VwMineralsPermitsSurvey 123.* [Data set]. ArcGIS REST Services Directory. https://services.arcgis.com/ZzrwjTRez6FJiOq4/arcgis/rest/services/Minerals_Permits_View_Layer/FeatureServer

Utah Geospatial Resource Center. (2024). *Utah Oil Gas Wells.* [Data set]. UGRC. https://gis.utah.gov/products/sgid/energy/oil-gas-wells/

Utah Automated Geographic Reference Center. (2024). *Utah Coal Mines UGS*. [Data set]. Utah SGID. https://opendata.gis.utah.gov/datasets/utah-coal-mines-ugs/explore?location=38.549706%2C-111.401310%2C-1.00

Utah Geological Survey. (2023, September 7). *Utah Geological Survey Releases 2022 Mining Report*. [Press release]. https://geology.utah.gov/press-release-utah-geological-survey-releases-2022-mining-report/

Utah Division of Oil, Gas and Mining. (2024). *Statistics*. [Data set]. Utah Department of Natural Resources. https://ogm.utah.gov/statistics/

L3 WILDLIFE

Esri USGS. (2024). *Utah Bighorn Sheep Habitat.* [Data set]. ArcGIS REST Services Directory. https://services.arcgis.com/ZzrwjTRez6FJiOq4/arcgis/rest/services/Utah_Desert_Bighorn_Sheep_Habitat/FeatureServer

Esri USGS. (2024). *Utah Rocky Mountain Bighorn Sheep Habitat*. [Data set]. Utah Division of Wildlife Resources. https://dwr-data-utahdnr.hub.arcgis.com/datasets/82b1e7ce1ec74920bcd40cd7e729c9b3_0/explore?location=40.784358%2C-108.245158%2C5.83

Esri USGS. (2024). *SAGR Habitat 2012.* [Data set]. ArcGIS REST Services Directory. https://services.arcgis.com/ZzrwjTRez6FJiOq4/arcgis/rest/services/SAGR_Habitat_2012/FeatureServer

Esri USGS. (2024). *Utah Moose Habitat.* [Data set]. ArcGIS REST Services Directory. https://services.arcgis.com/ZzrwjTRez6FJiOq4/arcgis/rest/services/Utah_Moose_Habitat/FeatureServer

Esri USGS. (2024). *Utah Mule Deer Habitat*. [Data set]. ArcGIS REST Services Directory. https://services.arcgis.com/ZzrwjTRez6FJiOq4/arcgis/rest/services/Utah_Mule_Deer_Habitat/FeatureServer

Utah Division of Wildlife Resources. (2024). *Big game harvest and survey data.* (2023 Harvest Data, 2022 Harvest Data, 2021 Harvest Data, 2020 Harvest Data, 2019 Harvest Data, 2018 Harvest Data, 2017 Harvest Data, 2016 Harvest Data, 2015 Harvest Data). Utah Department of Natural Resources. https://wildlife.utah.gov/hunting/main-hunting-page/big-game/big-game-harvest-data.html

L4 WILDFIRES

MTBS. (2024). *Direct Download*. [Data set] MTBS.gov. https://www.mtbs.gov/direct-download

L5 PARK VISITATION

National Park Service. (2024). *National Park Service Visitor Use Statistics – Park Reports.* [Data set]. U.S. Department of the Interior. https://irma.nps.gov/Stats/Reports/Park

Utah Division of State Parks. (2024). *Park Visitation Data*. [Data set]. Utah Department of Natural Resources. https://stateparks.utah.gov/resources/park-visitation-data/

W1 WATER

Utah Geospatial Resource Center. (2024). *Utah Water Related Land Use*. (2018 and 2023). [Data set]. UGRC. https://gis.utah.gov/products/sgid/planning/water-related-land-use/

Utah Division of Water Resources. (2024). *Reservoir Conditions.* [Data set]. Utah Department of Natural Resources. https://water.utah.gov/reservoirlevels/

W2 HARMFUL ALGAL BLOOMS

Utah Division of Water Quality. (2023, November 17). *Historic Utah Division of Water Quality Harmful Algal Bloom Advisories*. Utah Division of Environmental Quality.

W3 WATERSHED BASINS

Utah Division of Water Resources. (2022). *Water Budget Data*. [Data set]. Utah Department of Natural Resources. https://dwre-utahdnr.opendata.arcgis.com/pages/water-budget-data

Esri. (2024). *Water Related Land Use Dashboard*. [Data set]. Utah Department of Natural Resources. https://dwre-utahdnr.opendata.arcgis.com/pages/wrlu-apps

A1 AIR

Utah Division of Air Quality. (2020, June). *Marginal Ozone Inventory Uinta Basin, UT*. [Report]. Utah Department of Environmental Quality. https://www.utah.gov/pmn/files/609997.pdf

A2 AQI MODERATE TO BAD AIR DAYS

US Environmental Protection Agency. (2024). *Air Quality Index Daily Values Report.* (# Days Unhealthy, # Days Very Unhealthy, # Days Hazardous). [Data set]. AirNow. https://www.epa.gov/outdoor-air-quality-data/air-quality-index-daily-values-report

A3 AIR MONITORING PROGRAM

Utah Deivion of Air Quality. (2024). *Utah Air Monitoring Program.* [Data set]. Utah Department of Environmental Quality. https://air.utah.gov/dataarchive/archo3.htm

Utah Division of Air Quality. (2024). *Statewide Emissions Inventories*. (Triennial Statewide Emission Inventories). [Data set]. Utah Department of Environmental Quality. https://deq.utah.gov/air-quality/statewide-emissions-inventories

Utah Division of Air Quality. (2024). *Utah Air Monitoring Program.* (All Criteria Pollutant Yearly Quicklook Summary Reports). [Data set]. Utah Department of Environmental Quality. https://air.utah.gov/dataarchive/archall.htm

Land, Water, and Air Bills Passed During the 2024 Utah Legislative Session

Agriculture & Livestock

H.B. 291 | Department of Agriculture and Food Amendments
R.P. Shipp
This bill is the annual clean-up bill on technicalities in the Department of Agriculture and Food.

H.B. 297 | Utah Bee Inspection Act Amendments
R.P. Shipp
This bill restricts the ability of local governments to regulate beekeeping on private property.

H.B. 363 | Livestock Grazing Amendments
C. Albrecht
This bill recognizes grazing allotment as an existing right in range management.

H.B. 526 | Small Egg Producers Amendments
R.P. Shipp
This bill allows small producers to sell eggs on a wholesale basis.

Air

H.B. 104 | Property Owner Association Amendments
N. Thurston
This bill limits a homeowners' association's authority to prohibit an owner from making modifications for radon mitigation.

H.B. 220 | Emissions Reduction Amendments
Stoddard
This bill requires the Division of Air Quality to conduct an inventory related to certain emissions; complete an emissions reduction plan for certain emissions; recommend state standards limiting halogen emissions; publish the inventory, plan, and recommendations on the division's website; and report on the inventory, plan, and recommendations.

H.B. 319 | Uintah Basin Air Quality Research Project Amendments
Chew
This bill repeals the sunset date for the Uintah Basin Air Quality Research Project.

H.B. 373 | Environmental Quality Amendments
C. Snider
This bill repeals the Air Quality Policy Advisory Board and creates an informal working group on environmental issues. It also adds a representative from the mining industry to the group.

H.B. 452 | Carbon Capture Amendements
S. Chew
This bill combines two existing funds into the Carbon Dioxide Storage Fund.

S.C.R. 2 | Concurrent Resolution Regarding the Environmental Impact of Vehicle Idling
Fillmore
This resolution provides data on fuel expended idling compared with restarting an engine; encourages Utahns to turn off their engines, especially in areas where sensitive populations congregate; and encourages certain businesses, organizations, and entities to place signs educating drivers on the fuel savings of restarting an engine instead of idling.

Energy

H.B. 048 | Utah Energy Act Amendments
C. Jack
This bill requests the Office of Energy Development to project the supply and demand of energy so the state can make proper decisions on where to spend research dollars.

H.B. 116 | Commercial Property Assessed Clean Energy Act Amendments
C. Watkins
This bill amends the Commercial Property Assessed Clean Energy Act so commercial energy systems can use a public utility's power grids if they are producing biofuel.

H.B. 117 | Wind Energy Facility Siting Modifications
J. Burton
This bill requires the owner of a wind energy facility to undergo a clearing process with the U.S. Department of Defense before construction.

H.B. 124 | Energy Infrastructure Amendments
C. Albrecht
This bill provides a tax credit for certain emissions reduction projects and adds to the definition of high-cost infrastructure.

H.B. 191 | Electrical Energy Amendments
C. Jack
This bill ensures that before a power plant is demolished, the Public Service Commission must review the proposal and ensure that there is equal capacity available to replace the power plant that will be demolished.

H.B. 241 | Clean Energy Amendments
C. Albrecht
This bill changes code to add new types of energy to the definition of clean energy and makes other technical changes.

H.B. 317 | Energy Storage Amendments
C.R. Musselman
This bill requires the Office of Energy Development to conduct a study analyzing Utah's energy fuel infrastructure and supply chain.

H.B. 374 | State Energy Policy Amendments
C. Jack
This bill modifies the state energy policy to make it more efficient and requires the Office of Energy Development to compile an annual report.

H.B. 410 | Utah San Rafael State Energy Lab
C. Watkins
This bill establishes the Utah San Rafael State Energy Lab and creates the Utah San Rafael Energy Lab Board.

S.B. 161 | Energy Security Amendments
D.R. Owens
This bill is part of a larger effort by legislators to change the governance of the IPA power plants and determine how the plant may valued, decommissioned, and sold.

S.B. 224 | Energy Independence Amendments
S. Sandall
This bill modifies provisions related to planning and cost recovery for certain energy resource decisions and allows a large-scale electric utility to establish a Utah fire fund.

Fire

H.B. 437 | Fire Amendments
C. Snider
This bill allows Wildland Fire Suppression Fund to be used for pre fire treatment and post fire restoration instead of only fire suppression.

H.B. 567 | Fire Regulation Amendments
W. Brooks
This bill allows rural Utah to burn natural horticultural or agricultural clipping and pruning waste outdoors from November to March.

S.B. 119 | Fire and Rescue Training Amendments
W. Harper
This bill adds aircraft rescue firefighting training to the fire prevention, education, and training program.

Land

H.B. 57 | Snake Valley Aquifer Advisory Council Amendments
W. Brooks
This bill repeals the Snake Valley Aquifer Advisory Council.

H.B. 159 | Bears Ears Visitor Center Advisory Committee Repeal Amendments
D. Owens
This bill enacts a sunset date for the Bears Ears Visitor Center Advisory Committee.

H.B. 262 | School and Institutional Trust Lands Amendments
C. Snider
This bill provides School and Institutional Trust Lands Administration an opportunity to sell land to the Department of Natural Resources.

H.B. 302 | Paleontological Landmark Amendments
J. Elison
This bill clarifies a process to designate paleontological landmarks through administrative action or through legislative Concurrent Resolution.

H.B. 496 | Public Land Use Amendments
C. Albrecht
This bill prohibits natural asset companies from owning or leasing state public lands.

H.C.R. 8 | Concurrent Resolution Creating the Butch Cassidy State Monument
C. Albrecht
This bill creates the Butch Cassidy State Monument of Butch Cassidy's childhood home in Garfield County.

H.J.R 26 | Joint Resolution Rejecting Exchange of School and Institutional Trust Lands
C. Snider
This bill rejects a proposed exchange of trust lands in and around Bears Ears National Monument for United States government lands.

S.C.R. 6 | Concurrent Resolution Creating the Golden Spike State Monument
S. Sandall
This bill creates the Golden Spike State Monument.

S.B. 198 | Point of the Mountain State Land Authority Amendments
J. Stevenson
This bill modifies the definition of Point of the Mountain state land for purposes of the Point of the Mountain State Land Authority Act.

Management

H.B. 5 | Natural Resources, Agriculture, and Environmental Quality Base Budget
S. Barlow
This bill finalized the 2024 legislative budget for Utah's natural resources.

H.B. 74 | Utility Relocation Cost Sharing Amendments
K. Christofferson
This bill amends provisions related to allocation costs to relocate utility infrastructure within state highways and certain public transit rights of way.

H.B. 76 | State Resource Management Plan Amendments
K. Stratton
This bill updates the State Resources Management Plan and makes some technical changes.

H.B. 522 | Veterinarian Education Loan Repayment Program Amendments
C. Albrecht
This bill amends the Veterinarian Education Loan Repayment Program to modify payments on the annual loan balance.

S.B. 36 | Heber Valley Historic Railroad Authority Sunset Amendments
W. Harper
This bill extends the sunset for Heber Valley Historic Railroad Authority.

S.B. 57 | Utah Constitutional Sovereignty Act
S. Sandall
This bill creates a process for the legislature and governor to pass a resolution stating the state of Utah does not have to comply with a federal directive that appears to violate state sovereignty.

S.B. 135 | Advanced Air Mobility and Aeronautics Amendments
W. Harper
This bill amends a provision related to aeronautics and air mobility systems.

Mining

H.B. 54 | Coal Miner Certification Panel Amendments
C. Albrecht
This bill extends the sunset on the Coal Miner Certification Panel for ten years.

H.B. 353 | Mining Operations Amendments
B. Bolinder
This bill addresses regulations of mining operations to provide clarity and technical changes.

H.B. 433 | Brine Amendments
B. Bolinder
This bill requires the Division of Oil, Gas, and Mining to study brine mining and present it to the Natural Resource Interim Committee.

H.B. 502 | Critical Infrastructure and Mining
C. Snider
This bill designates a study to be done by the Division of Oil, Gas, and Mining on how much sand and gravel (aggregate) the state needs, where it is, and examine the infrastructure for Utah mining operations.

S.B. 145 | Utility Easement Amendments
D. McCay
This bill requires utility operators to create a statewide association to manage requests to mark utility facilities before excavation.

Outdoor Recreation

H.B. 23 | Division of Outdoor Recreation Advisory Council Sunset Extension
W. Brooks
This bill extends the sunset on the advisory council until 2029.

H.B. 90 | Outdoor Recreation Infrastructure Amendments
J. Stenquist
This bill adds avalanche forecasting infrastructure to be allowed in the Outdoor Recreation Infrastructure restricted account.

H.B. 360 | Outdoor Recreation Amendments
D. Owens
This bill creates a position and program in the Department of Natural Resources to identify and promote projects in outdoor recreation.

S.B. 108 | Veteran Access to State Parks
K. Kwan
This bill creates a pilot program allowing for any resident veteran of Utah to have access to state parks with a free pass.

Water

H.B. 11 | Water Efficient Landscaping Requirements
D. Owens
This bill limits use of nonfunctional turf on new government buildings (municipal and state).

H.B. 42 | Water Rights Publication Amendments
J. Briscoe
This bill allows the state engineer to document water rights notices electronically.

H.B. 61 | Water Measuring and Accounting Amendments
C. Albrecht
This bill gives the state engineer accurate real-time measurements of water flow through telemetry.

H.B. 62 | Utah Water Ways Amendments
D. Owens
This bill outlines coordination on water curriculum between Utah Water Ways and the public education system.

H.B. 206 | Columbia Interstate Compact Amendments
T. Peterson
This bill repeals the state's ratification of the Columbia Interstate Compact.

H.B. 275 | Water Amendments
C. Snider
This bill cleans up technicalities relating to grant money for water metering, rules allowed by HOAs on turf installation and waterwise landscaping, and water use data collected by the Division of Water Rights.

H.B. 280 | Water Related Changes
C. Snider
This bill coordinates water planning efforts in the state, creates the Water Infrastructure Fund, and enacts a planning process and decision-making body to distribute the fund.

H.B. 295 | Produced Water Amendments
S. Lund
This bill authorizes water produced from oil gas and mining to be reused.

H.B. 453 | Great Salt Lake Revisions
C. Snider
This bill will pull users from below the water line into a water distribution management plan and adds incentives for Great Salt Lake mining companies to use less water.

S.B. 17 | Safe Drinking Water Act Sunset Extension
S. Sandall
This bill extends the Safe Drinking Water Act to 2029.

S.B. 18 | Water Modifications
S. Sandall
This bill expands the definition of saved water to any water the state engineer can identify as saved whether participating in the ag water optimization program or not.

S.B. 39 | Water Shareholder Amendments
S. Sandall
This bill lengthens the acceptable time for a water company's response to a shareholder's proposed change application.

S.B. 77 | Water Rights Restricted Account Amendments
S. Sandall
This bill allows the state engineer additional flexibility over the Water Rights Restricted Account as more measuring tools are being implemented throughout the state.

S.B. 125 | Secondary Water Amendments
D. Hinkins
This bill includes water districts with more hookups in the exemption for secondary metering.

S.B. 211 | Generational Water Infrastructure Amendments
J. Stuart Adams
This bill creates a Water Commission that reports every year to the legislature and designates a new state water agent to negotiate water imports from other states.

S.B. 242 | Utah Lake Modifications
M. McKell
This bill repeals the Utah Lake Restoration Act and provisions related to the Utah Lake Diking Project.

S.B. 270 | Utah Lake and Great Salt Lake Study Amendments
C. Bramble
This bill requires the Division of Forestry, Fire, and State Lands to conduct a study on Utah Lake to determine if managing Utah Lake differently would have positive benefits on Great Salt Lake.

Wildlife and Hunting

H.B. 222 | Wildlife Hunting Amendments
S. Gricius
This bill simplifies the clothing requirement for hunting to one orange item on the exterior of a person's upper body.

H.B. 375 | Domesticated Elk Amendments
K. Stratton
This bill allows the state to bring in domesticated elk from Canada for breeding after they have been dewormed.

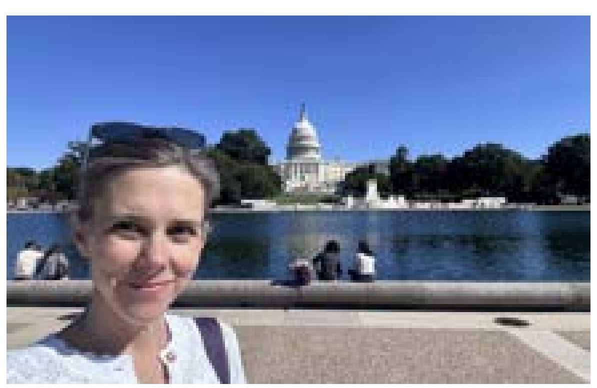
H.B. 382 | Wildlife Amendments
C. Snider
The annual clean-up bill for the Division of Wildlife with small technical changes.

H.C.R. 13 | Concurrent Resolution Related to the Division of Wildlife Resources
C. Albrecht
This concurrent resolution encourages the Division of Wildlife Resources to capture and return wolves to Colorado.

S.B. 20 | Agricultural and Wildlife Damage Prevention Board Amendments
S. Sandall
This bill extends the sunset of the board from 2024 to 2034.


VIEW FROM HIGHWAY 12 IN SOUTHERN UTAH | AARON FORTIN

Janet Quinney Lawson Institute for Land, Water, and Air in 2024



TOP LEFT: Governor Cox speaks at the Northern Utah Water Users/Spring Runoff Conference in Logan, Utah. **TOP RIGHT:** Brian Steed and Anna McEntire host a panel at the NUWU/Spring Runoff Conference. **MIDDLE LEFT:** Institute adminstrators attend a salon held by Ellen Rossi of the Lawson Foundation. **MIDDLE RIGHT:** Members of the Institute take a tour of Great Salt Lake wetlands with Ben Stireman, Deputy Director of the Division of Forestry, Fire, and State Lands. **BOTTOM LEFT:** Stephanie Frohman, Associate Director, traveled to Washington D.C. for a conference with the Consortium of Public University Service Organizations, of which the Institute is now a member. **BOTTOM RIGHT:** Under the guidance of Managing Director Anna McEntire, the Institute formed a statewide Colorado River media collaborative with several news outlets in the state to help communicate Utah's issues within this important water basin.

The Institute for Land, Water, and Air has advanced in its mission of guiding land, water, and air policy in Utah by connecting policymakers with high-quality research. In our second year of staffed operation, we've grown our team, brought in new partners, and contributed to several important research projects.

Establishing Trust

Establishing trusted relationships with Utah decision makers is the first step in bringing new research insights into policy discussions. Our executive team serves on more than 30 boards and commissions with public, private and nonprofit partners. We've provided consistent service to the state through Brian Steed's appointment as Great Salt Lake Commissioner and our ongoing engagement with both the legislative and executive branches. We've trained policy makers at the federal level on Western water issues through the U.S. Senate Colorado River Caucus and the U.S. Department of the Interior.

Generating High-Quality Research

We've been proud to partner on research projects with four state agencies, and to begin to welcome external collaboration in our *Report to the Governor and Legislature on Utah's Land, Water and Air.* We are actively connecting key researchers to critical state priorities in land, water and air. Efforts this year included the Great Salt Lake Strike Team, the Logan River Observatory, and the Bear Lake Needs Assessment.

Sharing Thought Leadership

We strive to convene experts and share insights that drive collaboration. Over the past two years, we've been invited to present at more than 500 events in Utah, nationally and even abroad. We will soon publish our 100th issue of *This Week in Utah's Land, Water and Air*, providing weekly, unbiased insights into land, water and air news. Through the Colorado River Collaborative, we've supported training for Utah newsrooms to expand coverage of Colorado River issues, and we're gearing up to host a National Conference on Colorado River Studies in Utah in October 2025.

Expanding Community Partnerships

Utah's business community is a critical part of Utah's land, water and air trajectory. To learn more about their priorities, we hosted two corporate idea exchanges with executives from leading Utah employers. We created a Community Partners program as a pathway to support our work and brought in several new investments.

We are gathering momentum and welcome new prospective partners to join us.

Partners in the Community

ABOVE: JANET QUINNEY LAWSON, 2009 LIFE-SIZE BRONZE, ON CAMPUS AT UTAH STATE UNIVERSITY

In 2021, the Janet Quinney Lawson Foundation provided the lead gift of $7 million to fund the Janet Quinney Lawson Institute for Land, Water, and Air. An avid outdoorswoman characterized by friends and family as a champion of environmental education and conservation, Janet Quinney Lawson was a steadfast supporter of Utah State University. She championed projects throughout her life to help others connect with the beauty of Utah.

We are grateful to the following community partners for their support of the Janet Quinney Lawson Institute for Land, Water, and Air.

The Janet Quinney Lawson Foundation

Summit Partners

Judi Houston Rangesan and Rangesan Narayanan
Rio Tinto Kennecott
State of Utah
Utah State University

Peak Partners

Big West Oil

Cirque Partners

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Meadow Partners

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LONE PINION PINE AT BRYCE CANYON NATIONAL PARK | AARON FORTIN

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