

UTAH LAND MANAGEMENT EVALUATION AND ASSESSMENT NETWORK

2020 Needs Assessment



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TABLE OF CONTENTS

Executive Summary	4
Introduction	6
What is the Utah Land Management Evaluation and Assessment Network? ...	6
Methods	7
Problem Definition and Stakeholder Representation	8
Scoping	8
Outcomes	8
Results	9
Respondent Characteristics	9
Fire Prevention and Suppression	10
Information Needs	11
Funding Needs	12
Research Needs	13
Grazing Decisions	14
Information Needs	14
Funding Needs	16
Research Needs	17
Fisheries Management Decisions	18
Information Needs	18
Funding Needs	19
Research Needs	19
Wildlife Management Decisions	21
Information Needs	22
Funding Needs	22
Research Needs	24
Program Participation, Satisfaction, and Contribution to Sustainable Land Management in Utah	24
Synthesis and Recommendations	27
Common Information Need	27
Common Funding Need	28
Common Research Need	29
Conclusion	30

EXECUTIVE SUMMARY

It can be difficult to make and implement land management decisions that are informed by the best available science, satisfy different stakeholders, and are compliant with established policies and regulations. Local, state, and federal entities with the capacity to influence land management decisions, can benefit from an understanding of the shared needs of landowners and managers. This needs assessment reports on the shared information, funding, and research needs expressed by land managers and owners throughout Utah who make decisions about: (1) fire prevention and suppression; (2) livestock grazing; (3) fisheries; or (4) wildlife. The report provides a high-level assessment of where federal and state agencies, non-profit organizations, and private landowners can invest their time and resources to produce mutually beneficial outcomes.

Data were acquired through an online survey distributed to participants who have worked with, or members of, the following programs and organizations:

- Cooperative Wildlife Management Units Program;
- UDAF Grazing Improvement Program;
- Utah Association of Conservation Districts;
- Utah Cattlemen's Association;
- Utah Division of Forestry, Fire and State Lands;
- Utah Farm Bureau;
- Utah Section of the Society for Range Management;
- Utah Woolgrower's Association; and
- Watershed Restoration Initiative.

Although there was a broad spectrum of responses, commonalities could be found in expressed need for:

1. authoritative best practices related to land management decisions;
2. multi-year funding or support for existing programs that lessen administrative burdens; and
3. research that can provide a better understanding of the interactions between grazing and rangeland conditions on other ecosystem processes.

Common Information Need: Authoritative Best Practices

The compilation, review, and distribution of best practices was identified as necessary for landowners and managers who make decisions regarding wildfire prevention and suppression, livestock grazing, and the management of fish populations.

The common desire for information on authoritative best practices amongst Utah's land managers is an opportunity for the federal and state agencies, as well as university and non-profit partners, to collectively support the development of information that could be widely useful and contribute to more informed land management decisions within the state.

Recommended Action: Federal and state agencies, as well as university and non-profit organizations, should partner to develop and distribute authoritative best practices.

Common Funding Need: Multi-year Funding to Lessen Administrative Burdens

Multi-year funding to reduce the administrative burdens of already overtaxed local, state, and federal employees was a common need expressed across three of the four types of resource management decisions we asked about.

The creation of new or increased funding is not likely, given federal and state budgetary appropriations for natural resource management and conservation efforts have been flagging. Federal and state agencies, as well as non-profit organizations and large private landowners, could benefit from utilizing existing (or developing new) partnership-based initiatives that pool financial resources and use them to implement high-priority projects collectively determined by contributing organizations and agencies.

Recommended Action: Engage in partnership-based programs to reduce the administrative burdens of developing and implementing conservation projects.

Common Research Need: A Better Understanding of the Interactions Between Grazing and Rangeland Conditions on Other Ecosystem Processes

Across three of the four types of land management decisions we asked about, landowners and managers expressed a need for research that could provide a better understanding of interactions between grazing and rangeland conditions and other ecosystem processes.

Federal and state natural resource management agencies could prioritize research that integrates social and ecological data to bring together range scientists with biologists and ecologists to investigate the central role that livestock grazing plays on the health of Utah's ecosystems.

Recommended Action: Fund interdisciplinary research that can produce a better understanding of how grazing affects environmental processes and overall ecosystem health.

The future work of the ULMEAN can focus on facilitating discussions on how all Utah land managers might collaboratively work toward the common needs identified here. Doing so will increase the ability of public and private lands to generate benefits across multiple land uses, ultimately leading to a more sustainable use of the state's natural resources.



INTRODUCTION

Finding common ground for land management decisions can be difficult in Utah. Over three-quarters of Utah's land is regulated by various federal and state agencies, each with specific mandates, policies, decision-making practices, and funding resources. Add to the mix thousands of active private landowners, each of whom holds individual and diverse beliefs about how lands should be managed. With so many factors involved in the oversight of Utah's unique landscapes, it can be a challenge to identify common needs across all groups. The purpose of this assessment is to find that shared ground.

Needs assessments are a systematic method to determine, for a defined group of stakeholders, the discrepancies between current conditions/processes and a desired state, and to address remedies. I made an effort to be as inclusive as possible when reaching out to the wide diversity of landowners and managers in the state. I did this by sourcing contact lists of well-established programs and organizations that coordinate, fund, or support land management within the state. The programs and organizations that I worked with to collect data are shown in Table 1.

Program or Organization
Cooperative Wildlife Management Units Program
UDAF Grazing Improvement Program
Utah Association of Conservation Districts
Utah Cattlemen's Association
Utah Division of Forestry, Fire and State Lands
Utah Farm Bureau
Utah Section of the Society for Range Management
Utah Woolgrower's Association
Watershed Restoration Initiative

This list of programs and organizations is obviously not exhaustive of all programs and organizations that coordinate, fund, or support land management within the state. But those represented are diverse in size, scope, and purpose. The listed programs and organizations also expressed an interest in participating in the study and in being involved in the broader Utah Land Management Evaluation and Assessment Network.

What is the Utah Land Management Evaluation and Assessment Network (ULMEAN)

ULMEAN is an inclusive network of private and public land managers who actively manage land within Utah. Members in the network provide input on the most important information, funding, and research needs related to land management within the state. These needs are then used to inform future funding decisions by a variety of agencies and organizations throughout Utah.

ULMEAN currently focuses on four topical areas:

1. Fire Prevention and Suppression;
2. Livestock Grazing;
3. Fisheries; and
4. Wildlife Management.

These topical areas are not inclusive of all the types of land management decisions within the state. They do however represent a core set of interrelated decisions which often have mutual ecological and management influence. Landowners and managers are often asked to prioritize one outcome at the expense of another when making land use decisions. By focusing on these four types of decisions, **our goal was to identify common information, funding and research needs that, if met, would benefit multiple land uses.**

METHODS

Needs assessments can be either extensive or intensive. In an extensive approach, an analyst evaluates data across a large number of cases to determine generalizable needs. Intensive strategies, on the other hand, work to identify critical needs from an in-depth examination of a small number of cases. This needs assessment is extensive; intended for application to a variety of different scenarios for landowners, organizations, and agencies who manage public lands and wildlife within Utah. Following best practice guidelines for needs assessment development, the ULMEAN needs assessment employed three processes:

1. **Problem Definition and Stakeholder Representation:** Identifying individuals, programs, and agencies who have an interest in, and influence over, the outcome of land management decisions in Utah;
2. **Scoping:** Providing identified stakeholders with a mechanism to identify differences between current decision-making processes and outcomes related to land management in Utah and desirable future processes and outcomes; and
3. **Outcomes:** Identifying common needs that, if met, would enable individuals who manage for multiple land uses to make more informed management decisions.



Problem Definition and Stakeholder Representation

In the fall of 2019, I met with leadership from a variety of programs and organizations who coordinate, fund, or support land management within Utah. Initial contacts were identified through previous professional experience. The programs and organizations listed in Table 1 agreed to participate in the assessment. Specifically, they agreed to share a link to an online survey (described below) with program participants or organization members.

Scoping

Survey Instrument

I developed an online needs assessment survey that asked landowners and managers to identify specific information, funding, and research that would allow them to make more informed management decisions. The survey first asked potential respondents to indicate what type of land management decisions they currently make. Four, non-exclusive, options were provided:

- Decisions regarding fire prevention and suppression;
- Decisions regarding the grazing of livestock;
- Decisions regarding the management of fish; and
- Decisions regarding the management of wildlife.

For each type of decision, landowners and managers were asked:

- How long they have been making that type of decision;
- The number of acres their decisions affect;
- The information sources they use to make that type of decision;
- What information they would like to have access to so they could make more informed decisions;
- What funding resources would enable them to make more informed decisions; and
- What research would help them make more informed decisions.

The questions about information sources used were specific to each type of decision. Response options were generated based upon consultation with a panel of topical experts. The questions about information, funding, and research needs were open-ended. Respondents were given a multi-line text box which they could use to describe their needs.

Data Collection

I provided each participating program and organization a template email, containing a link to the online survey instrument, for distribution to their program participants and/or members. I offered potential respondents a chance to win one of six \$50 VISA gift cards if they completed the survey. The leadership within each program and organization distributed the initial solicitation email in late February 2020; a second solicitation email was also sent in mid-March 2020.

Outcomes

All quantitative data were analyzed with basic descriptive statistics. Responses to open-ended questions were read and then inductively sorted into general categories based on their content. Responses and their ascribed categories were reviewed by two analysts to ensure the data were accurately represented.



RESULTS

Respondent Characteristics

I received 145 unique responses from land managers across Utah (Figure 1). Responses came primarily from state land management agencies (32.2%), private landowners (30.8%), and federal land management agencies (22.4%). I also received responses from individuals employed by nonprofit organizations (4.9%), private consultants (4.9%), and county governments (2.1%).

I asked respondents to indicate what type of land management decisions they make, providing four non-exclusive options:

- Decisions regarding wildfire prevention and suppression;
- Decisions regarding grazing livestock;
- Decisions regarding the management of fish populations; and
- Decisions regarding the management of wildlife populations.

The types of land management decisions made by respondents was roughly split across the four categories (Figure 1). Approximately one third of all respondents ($n = 101$, 32.0%) indicated making decisions about grazing. Slightly more than one quarter indicated making decisions about wildfire prevention and/or suppression ($n = 89$, 28.2%) or the management

of wildlife populations ($n = 86$, 27.2%). A total of 40 respondents (12.7%) indicated making decisions about the management of fish populations.

The socioeconomic characteristics of respondents are reported in Table 2. Respondents ranged in age from 29 to 82, with the mean age at 51 ($SD = 12.7$). Respondents were predominantly male (84.9%). The majority of respondents were well-educated, with 80.9% having at least a four-year college degree.

Characteristic	Percent
Age ($n = 65$)	
25 - 44	41.5
45 - 64	46.2
65+	12.3
Gender ($n = 66$)	
Female	12.12
Male	84.85
Prefer not to answer	3.03
Education ($n = 68$)	
High school diploma or equivalent	4.41
Technical/vocational school	2.94
Some college (did not obtain a degree)	11.76
College graduate (4-years)	38.24
Graduate or professional degree	42.65

Number of Respondents by Organization Type

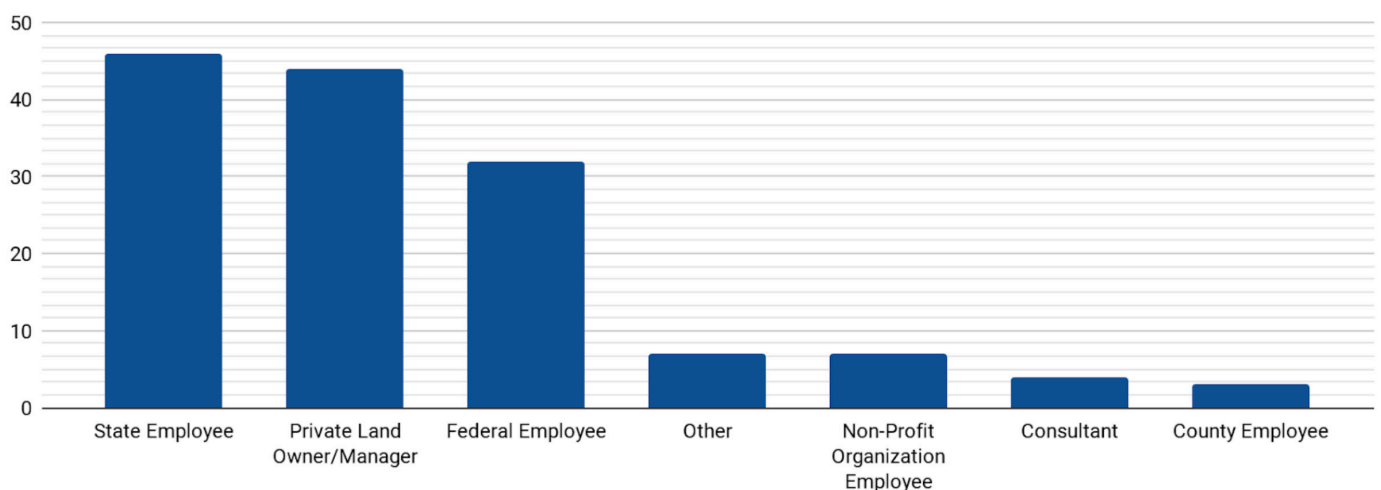


Figure 1. Number of responses by organization type.

Number of Respondents Making Each Type of Land Management Decision

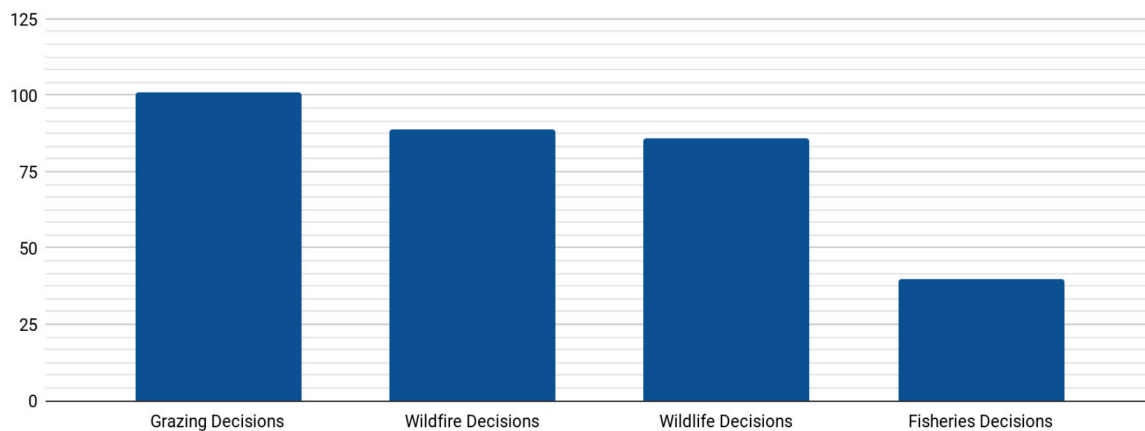


Figure 2. Type of land management decisions made by survey respondents.

Fire Prevention and Suppression

A total of 89 respondents indicated they make decisions about wildfire prevention and suppression (Table 3). On average, these respondents indicated they had been making these types of land management decisions for just over 17 years ($M = 17.1, SD = 13.1$).

Respondents indicated that they are responsible for making wildfire decisions on areas that range from just 50 acres to 13 million acres; however, over half (56.0%) of respondents who make decisions regarding wildfire do so for less than 100,000 acres.

Federal agencies are the most common source of information used to make wildfire prevention and suppression decisions, with nearly a quarter of respondents (21.6%) using this type of information. The specific types of information used by respondents from federal agencies varied, however many respondents indicated they used technical references from federal agencies. Data on fuel loading, threat assessment, and timber stand health were specifically mentioned as information provided by federal agencies to make fire prevention and suppression decisions. Respondents also mentioned using models of fire spread and debris flow potential provided by federal agencies.

Nearly one-fifth (17.1%) of respondents who make wildfire prevention and suppression decisions use information provided by the Utah Division of Forestry, Fire, and State Lands (UDFFSL). Explicitly mentioned information sources provided by UDFFSL included the Utah Wildfire Risk Assessment Portal, Forest Stewardship and Legacy Plans, and fire risk maps.

University programs were used by 16.6% of land managers who said they make wildfire prevention and suppression decisions. Specific types of information used include articles and information on best management practices for preventing wildfire. Respondents pointed out specific examples such as “best-management practices for prevention (i.e., seed sources for resistant and resilient communities).” Symposia hosted by university programs were also mentioned. The Restoring the West conference, an annual conference hosted by the S.J. and Jessie E. Quinney College of Natural Resources at Utah State University was explicitly mentioned by several respondents.

A substantial number of respondents indicated they used an information source other than the ones I included in the set of response options. These respondents went on to indicate that these “other” sources of information included their personal connections they have with other land managers and their own personal experience. “In person/informal contacts,” “experience with previous fires,” and “private landowners” were cited.

Table 3. Characteristics of Respondents' Decisions Regarding Wildfire Prevention and Suppression	
Characteristic	Percent
Years making decisions regarding fire prevention and suppression (n = 53)	
>10	30.2
10 - 19	39.6
20 - 29	11.3
30 - 39	9.4
40+	9.4
Acres that fire prevention and suppression affect (n = 50)	
< 100 thousand	56.0
100 - 500 thousand	26.0
500 thousand - 1 million	8.0
1 - 5 million	6.0
> 5 million	4.0
Information sources used to make wildfire prevention and suppression decisions (n = 47)	
Federal Agencies	21.6
UDFFSL	17.1
University Programs	16.6
Other (not specified)	9.4
Peer-reviewed Articles	8.3
Non-profit Organizations	7.2
Utah Division of Wildlife Resources	5.5
Private Forester or Consultant	5.5
Fire Science Exchange Network	3.3
Utah Department of Agriculture and Food	1.1
Natural Resource Conservation Service	1.1
SITLA	1.1
Utah Department of Natural Resources	1.1
Governor's Office	0.6
US Air Force	0.6

Less frequently used information sources included peer-reviewed journal articles, nonprofit organizations, the Utah Division of Wildlife Resources, and the Fire Science Exchange Network.

Information Needs

Respondents were asked what kinds of information would help them make better and more informed decisions regarding wildfire prevention and suppression. From their responses to this open-ended question, I identified four general types of information

needs. These are: a central clearinghouse for wildfire prevention and suppression data and information; real-time and spatially-explicit weather and resource condition data; a catalog of best practices and case studies related to fire prevention and suppression; and more information on options for prescribed fires.

Central Clearinghouse for Wildfire Prevention and Suppression Information. Respondents noted that while there is a lot of data and information available to provide them with guidance on their decisions regarding wildfire prevention and suppression, data

and information are not readily accessible in a central location. For example, one respondent noted:

A library by subject, accessed online would be the most helpful. Often, it is not that the information does not exist, it is finding the information in a timely manner.

With requests for “more web-based information that is specific to the ecoregion” and “continued info over the Internet,” respondents reiterated that such information needed to be provided online. Respondents also expressed a desire for this information to be accessible to private landowners. For example, one respondent noted “I don’t know of a site for guidance for larger property owners.”

Real-time and Spatially-explicit Weather and Resource Condition Data. Even if a landowner or land manager believed they have all the data and information needed to make wildfire prevention and suppression decisions, they often expressed a need for real-time data on local conditions. For example, one respondent noted:

As a Professional Farm/Ranch Manager, I gather the data based on types of crops, type of year and staffing available for fire suppression. I pretty well have all the information I need to make a decision. Real time weather and fire conditions in specific areas of the farms I manage would be helpful.

Another respondent noted, “more site specific information is needed” and another noted “up to date weather and restriction information would be useful.”

Best Practices and Case Studies. Respondents noted that information on best practices for fire prevention and suppression are needed. Some respondents simply noted the need for “best practices” or “better access to case studies,” while others noted specific information needs. Examples of specific needs for best practices or compiled case studies included, “Best methods for phragmites and tamarisk control and follow-up information on restoration efforts,” and “best practices for the control of cheatgrass and other invasive weeds from livestock grazing in spring time and prior to flowering and seed set.” Relatedly, several landowners and land managers also expressed a need

for information on the effectiveness of restoration and monitoring efforts with statements such as “recovery data post fire isn’t easy to find.”

Options for Prescribed Fire. A handful of respondents explicitly noted the need for more information on their options for prescribed fire. For example, one respondent noted “I need information on the effects of fire, prescribed fire specifically, and the different seasonal effects of fire for each season.” Another noted, “It would be really useful to have information on fuel load management options and access to resources for prescribed burn options.” None of the respondents mentioned the relatively new Utah Prescribed Fire Council which has yet to establish a widespread presence amongst land managers and landowners.

Funding Needs

I also asked respondents what their funding needs were. Given their responses, I identified three broad funding needs: Funding for pre-suppression efforts; multi-year funding that lessens administrative burdens; and more funding for existing programs.

Funding for Pre-suppression Efforts. In their open-ended responses to the question soliciting information on the types of funding support that would allow them to make more informed fire prevention and suppression decisions, several respondents noted the high costs of fire suppression and a desire for more funding to support pre-suppression efforts. One respondent highlighted this, noting:

Suppression is really expensive. It’ll stay that way - get worse, probably - until nature or people reduce and re-arrange fuel beds into whatever equilibrium state future climate & weather conditions dictate. I feel like we need to hurry up and get as much pre-suppression fuels work done as possible, before nature just burns it up and does the job for us. That would be ugly.

Others simply noted the need for more funding for “fire prevention and natural barriers” or “more federal specific prescribed fire funding.”

Multi-year Funding that Lessens Administrative Burdens.

Several respondents noted that multi-year funding or assistance to ease administrative burdens would help them make more informed decisions. One respondent noted, “Having a funding source that could span multiple seasons would allow us to better undertake large multi-phase landscape scale projects.” Another respondent noted “We have the desire, equipment and time to reduce fuel loads and do post fire management but navigating through the hurdles to get to a management action is very difficult.”

Several respondents had specific ideas for how administrative burdens could be alleviated. One suggested “funding for seasonal technicians to collect data to expedite the NEPA process and allow efficient project design for prevention projects. Additionally, seasonal technician funding would help with project layout and administration.” Another suggested,

...the development of a memorandum of understanding agreement between all of Utah related to pre-suppression projects. These exist for fire suppression efforts but not for project level participation efforts. This would expand the scale and scope of the good neighbor authority. This would allow for the smaller player to contribute to the larger efforts both financially and practically.

More Funding for Existing Programs. Numerous respondents reported the need for more financial support to the existing programs involved in wildfire prevention and suppression. I did observe a tendency

amongst respondents to indicate more funding from the state, as opposed to federal agencies, would be helpful. For example, one respondent noted, “we need more availability of state funding. We rely too much on federal funding, which is decreasing over the years” while another noted a need for “continuance of programs like the Watershed Restoration Initiative.” While respondents did tend to mention the need for more state funding, several noted the need for more federal funding, particularly inter-agency funding. For example, one respondent noted “We need more state or federal grant dollars, particularly inter-agency based funds such as the Joint Chiefs funds.”

Aside from these three broad categories of funding needs, there were a handful of specific needs identified by respondents. These included: funds to support cost-share requirements; rapid response funding; funding for suppression equipment; funding for invasive weed control; and funding for access to scientific journals.

Research Needs

There were two dominant research needs expressed by respondents: Research on the effects of different vegetation treatments and social science research on how best to communicate/collaborate with the public.

Vegetation Treatment Effects. By and large, the most common research need identified was for work on the effects of various vegetation treatments; this includes pre- and post-fire treatments. Several respondents



noted an explicit need to study the effects of the removal of pinyon-juniper trees on wildlife habitat, rangeland health, and fuel loads. For example, one respondent succinctly noted, “We need more research on how PJ removal affects ecosystems.” Most other respondents expressed a general need for more research on the effectiveness of different vegetation treatments. One respondent noted a need for “more information into post-seeding success” while another noted a need for research on “seed application rates relating to success and or competition.”

Social Science Research on Communication/ Collaboration. Aside from the relatively large number of landowners and land managers who expressed a need for more research on the effects of different vegetation treatments, several noted a need for more social science research on how best to communicate with the public and how best to collaborate across agency and jurisdictional boundaries. One respondent noted, “We need more research on how to engage the public and help increase understanding about good and bad fire.” Another respondent observed:

I think a lot of research has already been done. The issue now is getting this information out to the public so they understand what land management activities help prevent catastrophic wildfire. In other words, help the public understand why we do certain treatments to prevent wildfire.

Grazing Decisions

Just over 100 respondents ($n = 101$) indicated that they make livestock grazing decisions (Table 4). On average, these individuals reported making these types of decisions for over 18 years ($M = 18.6$, $SD = 13.9$). These individuals are responsible for livestock grazing decisions on anywhere from 200 acres to 2 million acres of land; the average was 243,000 acres.

Federal agencies were the most commonly cited source of information used when making decisions about livestock grazing; over a quarter (25.5%) of respondents who reported making livestock grazing decisions use information from a federal agency. The Natural Resource

Conservation Service’s soils database as well as their Ecological Site Descriptions and Grazing Land Plant Inventories were commonly cited examples of the types of information used from a federal agency. Similarly, numerous respondents indicated using the Bureau of Land Management’s Grazing Reporting Database. The USDA Forest Service’s Annual Operating Instructions were also cited as a frequent information source used by respondents.

University programs were used by over one-fifth (21.7%) of respondents who indicated making livestock grazing decisions. Utah State University Extension’s Range Specialists were the most commonly cited information source. Respondents reference the products of the USU Rangeland Extension program specifically, noting their research publications, fact sheets, and workshops. Several other universities were mentioned, although respondents did not say which specific programs they were getting their information from; these universities included Brigham Young University, the University of Arizona, and the University of Nevada-Reno.

State agencies were used as an information source by nearly 15% of all respondents who indicated making livestock grazing decisions. The Utah Department of Agriculture and Food Grazing Improvement Program (GIP) was the sole state-level information provider mentioned by respondents. Specific information from the GIP program referenced by respondents included vegetation, monitoring, and GIS data.

Just over 10% of respondents who indicated making livestock grazing decisions reported using peer-reviewed journal articles to inform their decision-making. The Society for Range Management and their publication, *Rangelands*, were frequently mentioned.

Information Needs

The information needs of landowners and managers specific to livestock grazing centered around four broad types of information: resources on how their grazing decisions could improve rangeland health; more geographically-specific ecological and economic

Table 4. Characteristics of Respondents' Decisions Regarding Livestock Grazing	
Characteristic	Percent
Years making decisions regarding livestock grazing (n = 57)	
>10	28.1
10 - 19	28.1
20 - 29	19.3
30 - 39	12.3
40+	12.3
Acres that livestock grazing affect (n = 52)	
< 100 thousand	61.54
100 - 500 thousand	17.31
500 thousand - 1 million	13.46
> 1 million	7.69
Information sources used to make livestock grazing decisions (n = 47)	
Federal Agencies	25.5
University Program	21.7
State Agencies	14.7
Other (not specified)	14.0
Peer-reviewed Articles	10.2
Private Landowners/Ranchers	5.1
Utah Division of Wildlife Resources	1.9
Utah Department of Agriculture and Food	1.9
Natural Resource Conservation Service	1.3
Governor's Office	0.6
SITLA	0.6
Grazing Improvement Program	0.6
Non-profit Organizations	0.6
Consultants/Contractors	0.6
Online News	0.6

data; compiled information on best practices; and the need for grazing-specific information to be compiled, updated, and made available through a central online repository.

How To Use Grazing Decisions to Improve Rangeland Health. A large proportion of respondents indicated that having information on the long-term ecological consequences of grazing would help them make more informed decisions. Respondents specifically expressed a desire to have information on how to

make grazing decisions to improve the quality of rangeland conditions. For example, one respondent noted “I would also like to know how I can manage grazing to improve soil, water and nutrient uptake.” Similar sentiments were expressed by another respondent who indicated that he needed information on “How plants benefit from grazing? How can negative impacts to the environment be avoided to maximize the positive impact grazing animals have on the rangeland?” Another land manager noted that “any cases where livestock can be used as a habitat tool would be good.”

Geographically Specific Ecological and Economic Data.

The need for geographically specific ecological and economic data was a common theme in respondents' answers. As an example, one rancher noted that he "would like to know lbs/acre available and nutrient content of the forage" for the areas his cattle graze. Another responded with a similar statement, expressing a need for information on "site potential, average production, ... and plants to increase forage production." Some respondents spoke of more universal needs, saying that "there are many areas in the state that still do not have complete soil maps and ecological site information. It would be great to have accurate, up-to-date information for the entire state." Several respondents noted that if this information could be provided at the scale of specific allotments, that would be most helpful.

Compiled Information on Best Practices. Quite a few respondents expressed a desire to have information compiled, reviewed, and distilled to 'best practices' that they could learn from. The types of information noted in these responses varied, ranging from general to very specific. As an example of the need for general best-practice information, one manager noted that they could make more informed decisions if they had knowledge of "improved ways to treat and control rabbitbrush...and address drought." Another simply noted that it would be useful to have "summaries of grazing livestock research." As an example of more specific needs, one respondent said:

For different biophysical settings and ecological sites, what is the appropriate duration of rest post-treatment (fire rehab or pre-suppression) given different weather scenarios? ... My concern is that the default "2 growing seasons" might be fine for certain (probably uncommon to rare) circumstances, but that it may also be wholly inadequate for most real-world observed circumstances.

Making Grazing-specific Information Available through a Central Online Repository. Several respondents noted they had to go to numerous individuals and agencies to compile the information they use to make grazing decisions. These respondents expressed a need for

any and all grazing-specific data to be compiled and made available online. One respondent succinctly noted, "an easily accessible library of available data would be most helpful." Another respondent provided more practical guidance, suggesting that "web-based information could be broken down by ecoregion." Another noted that in addition to data and information, a central online repository could provide information on current policy developments stating, "I have access to about everything, but need to be kept informed of new policies, etc."

Funding Needs

The funding needs of landowners and managers who make decisions regarding livestock grazing fell into three categories: funding for weed control; funding to facilitate collaboration; and more funding to existing programs.

Funding for Weed Control. Numerous respondents noted the need for more funding to support reseeding and weed control efforts. These needs tended to be expressed in fairly general terms; "more funding for reseeding and reseeding resources for both winter and summer ranges would help my situation." However, some respondents provided more explicit recommendations, "We need dedicated, dependable fire rehab funding, including money for ecologically appropriate seed. The current funding model is pretty bad — it creates a brittle system."

Funding to Facilitate Collaboration. While several respondents made note that "more" or even "any" funding would help them make more informed livestock grazing decisions, a greater proportion of respondents noted the need for future funding to support collaborative efforts across agency lines. For example, one rancher noted "I think funding resources that could facilitate bringing people together to solve problems would help. This would include the assistance with the transfer of information and relationship building." Another manager noted, "we need funding to help us to coordinate and be cooperative in getting landscape projects completed." Several respondents mentioned specific programs and agencies that promoted grazing management through

collaboration and partnerships. For example, one respondent said “we need more funding for programs that leverage partnerships, i.e. GIP and the WRI.”

More Funding to Existing Programs. Several respondents noted the need for increased funding to existing agencies. Repeatedly mentioned was the need to fund the NRCS, particularly for the purposes of completing ecological setting assessments, and the state’s GIP program.

Research Needs

Four broad categories of research needs emerged from the responses. These needs were: more research on how grazing can improve rangeland health; more research on vegetation dynamics and the control of invasive species; more research on adaptive management; and more social science research.

How Grazing Can Improve Rangeland Health. Numerous respondents noted a need for more research on how grazing can improve the ecological characteristics of rangelands. These needs, more often than not, referred to the need to understand how grazing can improve soils as well as water and nutrient uptake in vegetation. One respondent noted, “it would be great to have more research on the benefits of well-managed livestock grazing on a large-scale and its long-term sustainability.” Another noted, “we need more research to have a better idea of what sustainable grazing looks like.” Some managers expressed an explicit need for research on how grazing affects wildlife habitat with statements like “I need research on the impact of livestock on habitat and recovery of habitat post grazing.” A few managers expressed more explicit needs. For example, one respondent said they could benefit from more research on pasture rotations:

The benefits of pasture rotations in arid environments (is it necessary, if yes why, if no why not). How do plants benefit from grazing? How can negative impacts to the environment be avoided to maximize the positive impact grazing animals have on the rangeland?

Vegetation Dynamics and the Control of Invasive Species. Another common, and related research need expressed by respondents was for investigations into how grazing impacted vegetation, particularly in conjunction with other factors that affect rangeland vegetation (notably drought and wildlife). For example, one respondent noted “we need more research on how invasive and introduced plant species interact with native plant species. We also need more work on vegetation community recovery after disturbance events (natural recovery vs. human intervention).” Another respondent was more emphatic noting “we need more research on rabbitbrush treatment!! What is new and improved for herbicides? And we need training and workshops to show the benefit of improved management.”

Adaptive Management. Landowners and managers also made reference to problems with the inflexibility in current grazing policies and management frameworks. One manager noted the following:

It would be great to have more research on stocking densities verses adaptive management. It seems as an agency we stay within the lines of permitted numbers and rarely color outside the lines. The BLM is looking at managing some permits under an outcome based grazing that would allow for increased flexibility to manage under changing conditions. It would be nice to see some research that would support the value in it as there will be plenty that will show the opposite.

Often cited in comments about the need for research into adaptive management were concerns and complaints over the inability of grazing permitting systems to take into consideration other factors that affect a livestock operation. Most often these other factors were either related to the variable nature of wildlife populations or variable annual precipitation patterns. For example, one rancher speaking to wildlife/grazing conflicts noted a need for more research on the “impacts of buffalo. As they leave the area and graze before my permit allows me to graze my cattle.” A manager, speaking to the inflexibility of grazing systems to adapt to variable climates noted:

I'd like to see some exploration of what sorts of grazing systems might be expected to be able to succeed under future climate scenarios. And what infrastructure improvements and changes to practices might be required to support those grazing systems.

Social Science Research. The final research need expressed by respondents focused on the social and economic dimensions of livestock grazing. One respondent's statement highlights this need well.

Sociological and economic research is more needed than natural-resources technical research, I think. My gut feeling is, there's too many small, part-time operators to permit nearly anyone to do grazing well, either ecologically or economically. What would it take to get most of these people to sell out and do something else, so that the remaining (and greatly enlarged) operators could make a credible go of it?

Another respondent expressed similar sentiments:

A lot of the issues that are brought up by special interests, state agency employees, and even in working around some of the USGS researchers there seems to be a paradigm related to livestock grazing being an evil practice. I wouldn't mind seeing something on the social aspects of grazing and not just from either supporters or non-supporters.

Fisheries Management Decisions

I received 40 responses from individuals who said they make fisheries management decisions who, on average, have been making these types of decisions for 17.5 years ($SD = 13.2$) with ranges spanning 3 to 50 years of experience (Table 5). Approximately one-third of the decisions made by these landowners and managers affect streams and rivers or ponds (35.6% and 33.3% respectively). Less than 20% of these decisions affect either reservoirs (17.8%) or natural lakes (13.3%).

Only a few information sources were cited as useful to make these types of fisheries management decisions relative to the diversity of information sources reported for the other types of resource management deci-

sions (wildfire prevention and suppression, livestock grazing, and wildlife management). Half of all fisheries manager respondents reported using information provided by the Utah Division of Wildlife Resources to make their decisions. Slightly less than a third (28.6%) reported using information from a federal agency. Information from university programs and peer-reviewed articles was used much less frequently; only 7.1% of respondents reported using information from either source.

The most common types of information used from the Utah Division of Wildlife Resources included information obtained directly from state biologists as well as annual data on fish populations or fish habitats. The commonly cited types of information obtained from federal agencies included abundance data on sportfish and species of greatest conservation need. Aquatic habitat survey data as well as water quality and water temperature data were also explicitly mentioned.

Information Needs

All information needs of fisheries managers were related to four topics: a need for coordinated and authoritative data; for more information on noxious invasive species in lakes; for compiled and reviewed best practices; and for scientific literature to be made easily accessible.

Coordinated and Authoritative Data. Several fisheries managers noted a lack of coordinated and authoritative data on either fish populations or habitat. These same respondents also noted the highly variable availability and quality of data across the different agencies managing aquatic resources in Utah. One respondent summarized this point well, noting:

There is a ton of work to do in discovering, compiling, and serving up fish habitat information across agencies. The first information need is something like a customer needs assessment, to help determine what a shared data platform needs to offer in order to drive participation & cooperation. Some agencies (e.g. DEQ-DWQ) are still pretty primitive when it comes to data collection and archival (e.g., still on paper, in file cabinets, unused).

Another respondent expressed similar thoughts, specifically indicating a need for a “coordinated state-wide fish barriers GIS layer” and a “coordinated state-wide fish occupancy layer.”

Noxious Invasive Species in Lakes. Respondents expressed a need for more information on noxious invasive species in lakes. One respondent noted a specific need for more information on how best to control pond weeds and algae.

Best Practices. A few respondents indicated a need for “best-practices” to be compiled and distributed to specific agencies. One manager said there was a need for a “list of improvements that can be done to protect and enhance the streams and ponds” while another expressed a desire for information about “best practices related to stream management and riparian restoration methods.”

Easily Accessible Scientific Literature. Numerous fisheries managers expressed a need for peer-reviewed articles and gray literature related to fisheries management to be made more accessible. One respondent noted that they would “like to see the gray literature published in an easy-to-access format. Many reports are not published in journals, [like] annual performance reports, federal aid reports, etc.”

Funding Needs

More Flexibility in How Federal Funds are Spent.

Fisheries biologists and managers noted how restrictions on funds generated through the Dingell-Johnson Act hindered fisheries management within the state. The Dingell-Johnson Act allowed for an excise tax to be placed on sport fishing and boating equipment with the stipulation that any funds generated through the tax would subsequently be used to support sportfish restoration and education. One respondent expressed the belief that restrictions on how Dingell-Johnson funds were spent were too restrictive, noting:

Seriously, the constraints on the uses of Dingell-Johnson (DJ) funds are pretty severe. Most fish are not sportfish. Most fish habitats in Utah, and most source waters, do not contain sportfish. Or they do, and we wish they did not because of the problems they cause (e.g., the case of smallmouth bass in the Colorado River). A funding source allowing more manager latitude than DJ would be most appreciated.

Equipment. Another funding need expressed less consistently was the need for funding to purchase equipment that could facilitate more informed decision-making. Respondents explicitly mentioned: “additional water temperature probes to inform NorWeST models”; and the need for “eDNA equipment and filter processing to evaluate the success of fish removal (rotenone treatments).”

Research Needs

Impacts of Grazing on Fish Habitats and Populations.

The only common research need expressed amongst a majority of respondents was for more research on the impacts of grazing on aquatic habitat and fish populations. Expressed needs such as, “grazing impacts on stream and riparian areas” and “grazing and stream corridor compatibility” were not uncommon.



Other Research Needs. A variety of other unique research needs were expressed by individual respondents. These research needs included research into:

Current and projected habitat conditions statewide:

- Population-level responses to aerator installation in oxygen limited lakes;
- The human health effects of piscicidal rotenone applications;
- The relationship between stream restoration improvements and fish populations;
- What factors are necessary to complete a successful stream side egg take from native salmonids;
- What potential natural condition could look like for streams in Utah; and
- What receiving water characteristics lead to successful southern leatherside reintroduction.



Table 5. Characteristics of Respondents' Fisheries Management Decisions	
Characteristic	Percent
Years making fisheries management decisions (n = 18)	
>10	33.3
10 - 19	27.8
20 - 29	27.8
30 - 39	0.0
40+	11.1
Types of water for which fisheries management decisions affect (n = 20)	
Stream/River	35.6
Pond	33.3
Reservoir	17.8
Natural Lake	13.3
Information sources used to make fisheries management decisions (n = 14)	
Utah Division of Wildlife Resources	50.0
Federal Agencies	28.6
University Programs	7.1
Peer-reviewed Articles	7.1
Other (not-specified)	7.1

Wildlife Management Decisions

A total of 86 respondents indicated they make decisions regarding the management of wildlife (Table 6). These individuals reported making wildlife management decisions anywhere from 3 to 50 years; the mean length of time was 18.7 years ($SD = 12.4$). The total number of acres affected by respondents' wildlife management decisions ranged from 100 acres to 7.5 million acres. The majority of respondents (52.4%) make decisions that affect less than 50,000 acres. For reference, the Utah Division of Wildlife Resources manages just under 470,000 acres of land within the state.

Similar to fisheries management decisions (above), the primary source of information used by wildlife managers in Utah is the Utah Division of Wildlife Resources; 35.6% of respondents reported using data and information collected or provided by the agency for their decision making. Population statistics were the most commonly referenced piece of information used from the agency. Respondents specifically referenced "population status and trends data,"

"population survey data," and "survival and utilization data." Range trend information, species range maps, and data generated by the Utah Wildlife Migration Initiative were also heavily referenced as sources of information. Many wildlife managers also noted that they relied on personal consultation with wildlife biologists and managers to make their decisions.

Over a fifth (22.1%) of the wildlife managers who responded to the needs assessment survey reported using information provided by one federal agency or another. Species- or area-specific management plans were frequently cited. A few respondents noted that these pieces of information were used primarily as a "technical reference." Several respondents also noted relying on federal wildlife biologists for information as well. No other types of data or information collected or produced by federal agencies were mentioned.

University programs are also used relatively frequently by wildlife managers within the state; 18.3% of managers reported using information from

Characteristic	Percent
Years making wildlife management decisions ($n = 43$)	
>10	30.2
10 - 19	27.9
20 - 29	23.3
30 - 39	9.3
40+	9.3
Acres that wildlife management decisions affect ($n = 42$)	
< 10 thousand	26.2
10 thousand - 50 thousand	26.2
50 thousand - 500 thousand	31.0
> 500 thousand	16.7
Information sources used to make wildlife management decisions ($n = 41$)	
Utah DWR	35.6
Federal Agencies	22.1
University Programs	18.3
Other (not-specified)	13.5
Peer-reviewed Articles	8.7
U.S. Air Force	1.0
County	1.0

a university program to make their decisions. The Utah Community-based Conservation program was explicitly mentioned several times as were “research partnerships” with both Utah State University and Brigham Young University.

Only a few other sources of information were mentioned by wildlife managers. These included peer-reviewed articles, used by 8.7% of respondents, as well as information from the U.S. Air Force and county governments, both of which were only mentioned once (1%).

Information Needs

Respondents expressed a diverse array of information that has the potential to help them make more informed wildlife management decisions. These information needs can be classified into four broad categories: information on critical range conditions; information on the effects of vegetation treatments on wildlife; wildlife population statistics; and information on livestock/wildlife interactions.

Critical Range Conditions. Numerous respondents indicated that having data and information on critical range conditions for both the summer and winter ranges would help them make more informed decisions. While some respondents mentioned data and information generally with statements like “critical winter, summer, etc. range conditions would be helpful,” others mentioned a desire to have more information on how range conditions have changed over time, specifically citing a need for “range trend data.” Several respondents expressed a desire to have this information presented spatially, with statements like “I need habitat quality maps. What is the potential of an area vs how closely does it resemble that potential.”

Effects of Vegetation Treatments on Wildlife. A notable proportion of respondents also mentioned the need for information on how different vegetation treatments affect wildlife populations across the state. One respondent expressed a desire to have information on “changes in big game habitat selection after project implementation.” Another shared similar sentiments

by expressing a need for, “wildlife population-level response to vegetation treatment projects.”

Wildlife Population Statistics. Numerous respondents expressed a need for wildlife population statistics, in one form or another, to make more informed decisions. These expressed needs ranged from the very general with statements like, “I need herd counts and diversification of animals,” to very specific requests for information on “survival rates,” “the age classes of harvested animals,” and “total herd size and goals for herd size in a given area over a given time.”

Livestock/Wildlife Interactions. A few respondents expressed a need for more information on the interactions between livestock and wildlife. For example, one manager expressed a need for, “information on how grazing animals affect wildlife. How do I manage grazing in a way to improve wildlife habitat and help wildlife by promoting healthy productive range?”

Funding Needs

Funding needs to inform wildlife management in Utah fell into one of four categories: funding for long-term monitoring efforts; developing alternative funding mechanisms; funding to improve the communication between the state and private landowners; and continued support for existing programs.

Long-term Monitoring Efforts. Several respondents noted that long-term monitoring efforts were either underfunded or difficult to support over time due to variations in annual budgets. A few respondents suggested possible solutions, including establishing long-term partnerships between the state and universities. For example, one respondent noted:

What we seem to be missing are reliable sources of funding for the long-term monitoring partnership of wildlife populations or the effects of land management actions on natural resources. It may be appropriate to work with universities to set up some type of project monitoring programs that could be conducted by faculty and their students

who are pursuing degrees in range, wildfire, or agriculture. The faculty and students would work with the land manager to develop and implement projects and then set up a monitoring program for the project. They would receive valuable experience plus college credit toward their degrees. Each year new students coming into the programs would go back and monitor previous projects as well as plan their own. This would involve every university in Utah and every agency.

also noted the value of the Watershed Restoration Initiative in bringing together different types of partners and leveraging these partners' resources. Comments like the "WRI is a great resource" were mentioned by numerous landowners and wildlife managers.

Developing Alternative Funding Mechanisms.

Respondents noted that access to Pittman-Robertson funding was limited or that the restrictions placed on how those funds are spent limited the types of projects they could support. In response, wildlife managers suggested developing alternative funding mechanisms that would provide more "broadly accessible" and "stable" funding for the management of wildlife in Utah. For example, one manager suggested "funding similar to Pittman-Robertson and Dingel-Johnson on camping and other outdoor goods that could be made available to the states." This manager also suggested "potential funding from extractive resources such as oil/gas development that occur within wildlife habitat."

Improving Communication between the State and Private Landowners. Landowners expressed that it was not easy to know how to secure funding to improve wildlife habitat on their properties. These respondents noted,

We [landowners] need to be better informed of what funding options are available for habitat improvement projects, or land usage practices. Landowners also need to know what kind of return on investment they may have for each type of project. It may not be a dollar amount, rather, it may just be that some wildlife populations may be better protected or increase in the area.

Continued Support for Existing Programs. By far the most commonly cited funding need was increased support for existing programs. Statements like "continued legislative support" and more "legislative appropriations" were common. Numerous respondents



Research Needs

The majority of wildlife management research needs expressed by respondents fell into one of three categories: research to produce more accurate wildlife population estimates; research on the influence of range conditions on individual and population health; and research into wildlife predation.

More Accurate Wildlife Population Estimates. By far the most common research need expressed by wildlife managers and landowners was work to provide a better estimate of wildlife population numbers. Respondents were specific in how they expressed these needs. For example, one respondent noted “we need accurate population estimates, accurate harvest rates, and also accurate survival rates and ages of animals.” Several responses were specific to particular species; “I’d like to see bull elk to cow ratios, both actual ratios and targets. It would also be useful to have herd size targets and timing over which the state wants to achieve those goals.” Another respondent noted, “I would like to have the long term trend in mule deer populations throughout the state. It would also be useful to have population growth trends for mule deer and elk.”

The Influence of Range Conditions on Individual and Population Health. Several respondents expressed an explicit desire for research that evaluated the influence of range conditions on individual and population health. For example, one manager expressed a need for research that “related demographic performance to landscape habitat condition, with an eye to figuring out how much effort (money and acres) would be required to keep wildlife populations at levels society wants them at.” Another expressed a more general desire for more research that improves the “accuracy of holding capacity estimates.” Several respondents suggested that this research could be conducted in conjunction with existing vegetation improvement projects. For example, one respondent noted “we could benefit from research into individual and populations response to management actions. Are the management actions we are implementing making any difference in species conservation?”

Wildlife Predation. The final category focused on the need for research into either the impact of predation on wildlife populations or into the most effective ways to control predation. Cougars were the most commonly referenced predator in respondents’ comments.

Program Participation, Satisfaction, and Contribution to Sustainable Land Management in Utah

I asked landowners and managers to name which programs or associations they had either worked with or been involved in. The list of programs and associations for survey distribution were compiled based upon: (1) our professional experience working with these programs and associations; and (2) these programs and associations being willing to distribute the needs assessment survey to their program participant and/or membership lists. The programs or associations I asked about included:

- The Watershed Restoration Initiative;
- The Grazing Improvement Program;
- The Utah Division of State Forestry, Fire and State Lands;
- The Utah Association of Conservation Districts;
- The Cooperative Wildlife Management Units;
- The Utah Farm Bureau;
- The Utah Cattlemen’s Association; and
- The Utah Wool Growers Association.

Table 7. Program Participation and Organization Involvement of Respondents

Program or Organization	<i>n</i>
Watershed Restoration Initiative	57
UDAF Grazing Improvement Program	49
UFFSL	47
UACD	33
CWMU	31
Utah Farm Bureau	27
Utah Cattlemen's Association	25
Utah Woolgrower's Association	13

Number of Respondents Working with Each Program or Organization

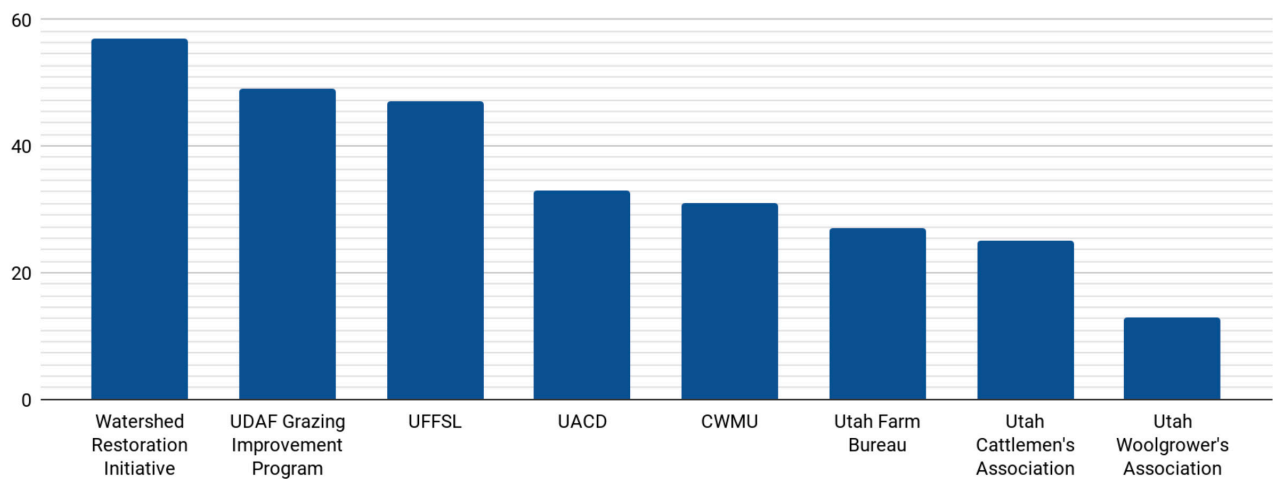


Figure 3. Program Participation and Organization Involvement of Respondents.

Participation in these programs and organizations ranged from just over 20% for the Watershed Restoration Initiative to under 5% for the Utah Wool Growers Association (Figure 3). The numbers of respondents who have been involved with each program and/or organization are shown in Table 7.

The length of time respondents had been involved in these programs/organizations were relatively consistent across the programs/organizations (Table 8). The length of involvement ranged from a mean of 8.7

years ($SD = 1.9$ years) for the Utah Division of Forestry, Fire and State Lands to 6.6 years ($SD = 3.5$ years) for the Utah Association of Conservation Districts.

Landowners and managers in Utah have generally been satisfied with their interactions with each of the programs/organizations asked about (Table 9). Landowners and managers were most satisfied with

Table 8. Years of Involvement by Respondents with each Program/Organization

Program or Organization	<i>n</i>	<i>M</i>	<i>SD</i>
Utah Division of Forestry, Fire and State Lands	42	8.7	1.9
Utah Woolgrower's Association	11	8.5	2.7
Utah Cattlemen's Association	23	7.9	3.1
Cooperative Wildlife Management Units Program	27	7.8	2.8
Utah Farm Bureau	24	7.7	3.3
UDAF Grazing Improvement Program	42	7.4	3.1
Watershed Restoration Initiative	52	6.9	3.4
Utah Association of Conservation Districts	31	6.6	3.5

Table 9. Satisfaction with Programs and Organizations

Program or Organization	<i>n</i>	<i>M</i>	<i>SD</i>
Watershed Restoration Initiative	53	4.3	1.0
Cooperative Wildlife Management Units Program	27	4.3	0.8
Utah Division of Forestry, Fire and State Lands	43	4.2	0.8
UDAF Grazing Improvement Program	46	4.2	0.9
Utah Cattlemen's Association	23	4.0	0.8
Utah Association of Conservation Districts	32	4.0	0.7
Utah Farm Bureau	25	4.0	1.0
Utah Wool Growers Association	10	3.6	1.2

Note. 1 = very dissatisfied; 2 = somewhat dissatisfied; 3 = neutral; 4 = somewhat satisfied; 5 = very satisfied

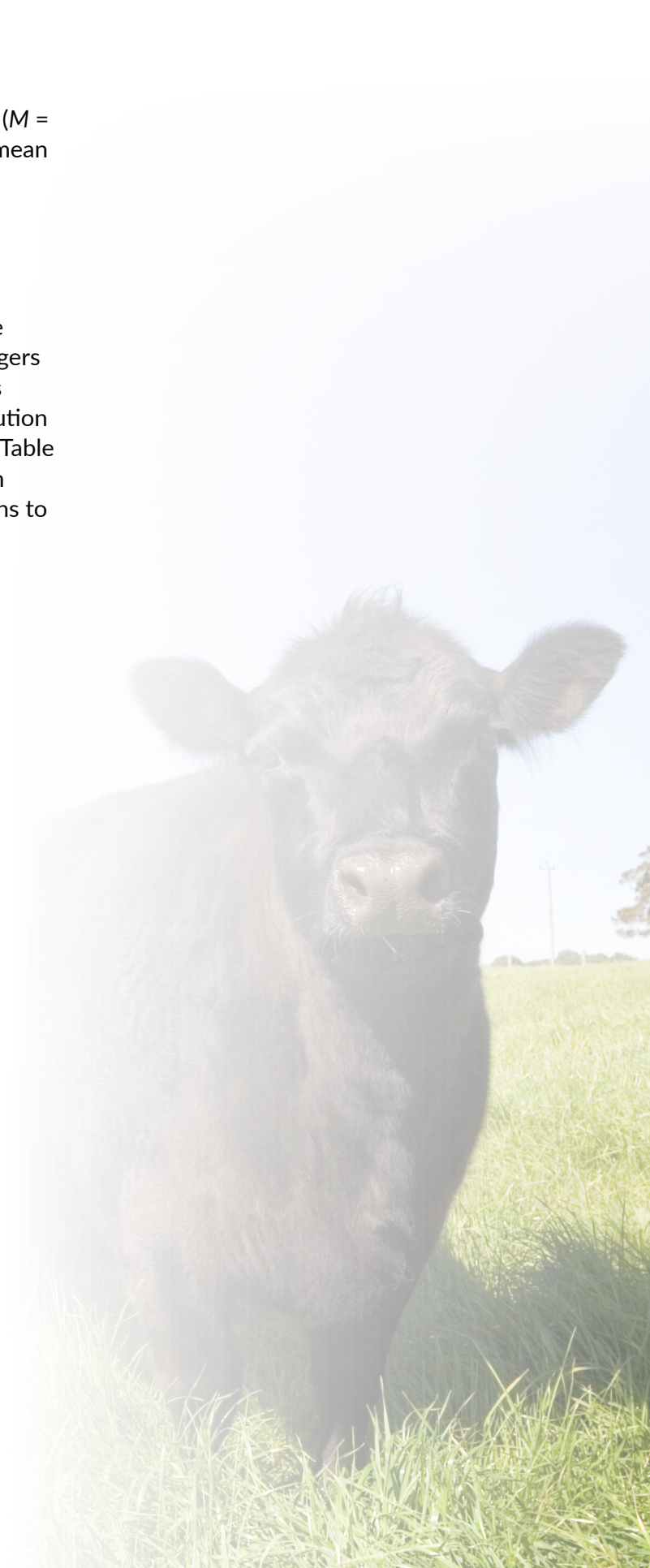
their interactions with the WRI program and the Cooperative Wildlife Management Units Program ($M = 4.3$; $SD = 1.0$). No program or organization had a mean satisfaction score below 3.0 (*neutral*).

I also asked respondents to indicate their belief whether each program or organization with which they had been involved contributed to sustainable land management in Utah. Landowners and managers indicated that each of the programs/organizations asked about were making at least a minor contribution to sustainable land management within the state (Table 10). The Watershed Restoration Initiative program was believed to be making the largest contributions to sustainable land management ($M = 3.8$; $SD = 0.4$).

Table 10. Perceived Contribution to Sustainable Land Management in Utah for Specific Programs and Organizations

Program or Organization	<i>n</i>	<i>M</i>	<i>SD</i>
Watershed Restoration Initiative	53	3.8	0.4
Cooperative Wildlife Management Units Program	27	3.6	0.7
Utah Farm Bureau	43	3.6	0.7
UDAF Grazing Improvement Program	46	3.5	0.7
Utah Division of Forestry, Fire and State Lands	23	3.4	0.7
Utah Cattlemen's Association	32	3.4	0.6
Utah Association of Conservation Districts	25	3.2	0.8
Utah Wool Growers Association	10	3.2	0.8

Note. 1 = no contribution at all; 2 = slight contribution; 3 = minor contribution; 4 = major contribution



SYNTHESIS AND RECOMMENDATIONS

The compiled list of needs for information, funding, and research across all four types of resource management decisions are shown in Table 11. The table provides a perspective across the different types of resource management decisions and identifies points of commonality -- shared needs -- that if met, have the potential to lead to more informed resource management decisions across Utah. I highlight three of these common needs.

Common Information Need: Authoritative Best Practices

The compilation, review, and distribution of best practices was identified as necessary for landowners and managers who make decisions regarding wildfire prevention and suppression, livestock grazing, and the management of fish populations. Federal and state agencies, as well as their university partners, could work towards developing authoritative best

Table 11. Common Information, Funding, and Research Needs Across Different Land Uses

	Fire Suppression and Prevention	Livestock Grazing	Fisheries Management	Wildlife Management
Information Needs	<ol style="list-style-type: none"> 1. Central Clearinghouse for Wildfire Prevention and Suppression Information 2. Real-time and Spatially-explicit Weather and Resource Condition Data 3. Best Practices and Case Studies 4. Options for Prescribed Fire 	<ol style="list-style-type: none"> 1. How Their Grazing Decisions Could Improve Rangeland Health 2. Geographically-specific Ecological and Economic Data 3. Compiled Information on Best-Practices 4. Making Grazing-specific Information Available through a Central Online Repository 	<ol style="list-style-type: none"> 1. Coordinated and Authoritative Data 2. Noxious Invasive Species in Lakes 3. Best Practices 4. Easily Accessible Scientific Literature 	<ol style="list-style-type: none"> 1. Critical Range Conditions 2. Effects of Vegetation Treatments on Wildlife 3. Wildlife Population Statistics 4. Livestock/Wildlife Interactions
Funding Needs	<ol style="list-style-type: none"> 1. Funding for Pre-suppression Efforts 2. Multi-year Funding that Lessens Administrative Burdens 3. More Funding for Existing Programs 	<ol style="list-style-type: none"> 1. Funding for Weed Control 2. Funding to Facilitate Collaboration 3. More Funding to Existing Programs 	<ol style="list-style-type: none"> 1. More Flexibility in How Federal Funds are Spent 2. Equipment 	<ol style="list-style-type: none"> 1. Long-term Monitoring Efforts 2. Developing Alternative Funding Mechanisms 3. Improving Communication between the State and Private Landowners 4. Continued Support for Existing Programs
Research Needs	<ol style="list-style-type: none"> 1. Vegetation Treatment Effects 2. Social Science Research on Communication/Collaboration 	<ol style="list-style-type: none"> 1. How Grazing Can Improve Rangeland Health 2. Vegetation Dynamics and the Control of Invasive Species 3. Adaptive Management 4. Social Science Research 	<ol style="list-style-type: none"> 1. Impacts of Grazing on Fish Habitats and Populations 2. Other Research Needs 	<ol style="list-style-type: none"> 1. More Accurate Wildlife Population Estimates 2. The Influence of Range Conditions on Individual and Population Health 3. Wildlife Predation

practices across different resource uses. University faculty whose positions are funded to support land management decisions (e.g., Extension faculty), as well as agency scientists who provide technical assistance to land managers, are well positioned to develop information on authoritative best practices. These types of organizations are also particularly well-suited to disseminate best practices to landowners and managers throughout Utah, as their missions often explicitly require them to produce actionable information that is accessible and useful to a diverse audience.

In many cases, the data and information needed to develop authoritative best practices already exists. However that data and information is distributed across numerous agencies and organizations making it difficult for any individual land manager to landowner to compile and synthesize easily. Groups like the Sage Grouse Initiative, Fire Science Exchanges, the SageWest partnership, and prescribed fire councils, are well positioned (similarly to university faculty and agency scientists) to expertly synthesize and disseminate information to land managers and landowners who could use it.

Information on authoritative best practices may take many forms, ranging from relatively simple webpages to more detailed and comprehensive online guidebooks. The appropriate medium through which these are delivered will depend upon the audience and land management issue. For example, the best practices for controlling noxious weeds like tamarisk on private lands can be conveyed relatively quickly through a web page or field guide, while best practices for stocking recommendations based on the goals of the livestock operator and ecoregion would require the detailed guidance more suitably disseminated through something like an online guidebook.

It is worth noting that creating authoritative best practices is not easy for a state as geographically diverse as Utah. The state includes portions of three ecoregions, the Great Basin, the Rocky Mountains, and the Colorado Plateau. This will compound the effort needed by land management agencies and university faculty to establish authoritative best practices that can be applied across the state. Several information

exchange networks, like the Fire Science Exchange, operate to disseminate geographically-specific information. State and federal land management agencies will need to work more closely with these programs if they are to generate best practices for Utah as a whole.

The common desire for information on authoritative best practices amongst Utah's land managers is an opportunity for federal and state agencies, as well as university and nonprofit partners, to collectively support the development of information that could be used widely and contribute to more informed land management decisions within the state.

Recommended Action: Federal and state agencies, as well as University and nonprofit organizations, should partner to develop and distribute authoritative best practices.

Common Funding Need: Multi-year Funding to Lessen Administrative Burdens

Multi-year funding to reduce the administrative burdens of already overtaxed local, state, and federal employees was a common need expressed across three of the resource management categories I asked about. Numerous respondents indicated that compliance with National Environmental Policy Act (NEPA) regulations was a significant barrier to implementing projects.

The creation of new or increased funding to assist with NEPA compliance or project administration tasks is not likely, given federal and state budgetary appropriations for natural resource management and conservation efforts have been flagging. However, there are existing programs which pool resources to facilitate the implementation of landscape-scale natural resource management projects. The Watershed Restoration Initiative is a prime example. The program is a partnership-based and state-led program supported by the Utah Partners for Conservation and Development. The WRI program works to leverage technical and financial resources from federal and state agencies, tribal governments, non-governmental

organizations, and individual landowners, in order to support mutually-beneficial conservation projects. Because the WRI is a partnership-based and state-led program, they are able to aggregate funding into a central location (the WRI program is housed within the Department of Natural Resources) to help administer conservation projects. The help provided by the WRI program includes: assistance with contracting and accounting; assistance with NEPA planning and cultural resource surveying; and assistance with project monitoring and reporting.

Federal and state agencies, as well as nonprofit organizations and large private landowners, could benefit from running projects through the WRI program if they are experiencing difficulties in meeting the administrative and legal requirements of project development and implementation.

Recommended Action: Engage in partnership-based programs, like the Watershed Restoration Initiative, to reduce the administrative burdens of developing and implementing conservation projects.

Common Research Need: A Better Understanding of the Interactions Between Grazing and Rangeland Conditions on Other Ecosystem Processes

Across three of the four types of land management decisions I considered, landowners and managers expressed a need for research that could provide a better understanding of interactions between grazing and rangeland conditions and other ecosystem processes. Livestock operators and managers who make decisions regarding livestock grazing expressed a need for research on how grazing can influence soils as well as water and nutrient uptake in vegetation. Numerous operators and managers also expressed a need for how they can manage grazing to improve wildlife habitat and promote healthy productive rangelands. Similarly, fisheries managers expressed a need for research into the impacts of grazing on aquatic habitat and fish populations. In fact, this was the only common research need identified by fisheries managers.

Federal and state natural resource management agencies could prioritize research that integrates social and ecological data to bring together range scientists with biologists and ecologists to investigate the central role that livestock grazing plays on the health of Utah's ecosystems.

Recommended Action: Fund interdisciplinary research that can produce a better understanding of how grazing affects environmental processes and overall ecosystem health.



CONCLUSIONS

In this needs assessment, I identified common needs for sources of information, funding, and research across a variety of landowners and managers who make land management decisions in Utah. It provides a high-level assessment of where federal and state agencies, nonprofit organizations, and private landowners can invest their time and resources to produce mutually-beneficial outcomes.

Although there was a broad spectrum of responses, commonalities could be found in expressed need for: (1) authoritative best practices related to land management decisions; (2) multi-year funding or support for existing programs that lessen administrative burdens; and (3) research that can provide a better understanding of the interactions between grazing and rangeland conditions on other ecosystem processes.

The future work of the ULMEAN can focus on facilitating discussions on how all Utah land managers might collaboratively work toward the common needs identified here. Doing so will increase the ability of public and private lands to generate benefits across multiple land uses, ultimately leading to a more sustainable use of the state's natural resources.

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