Arizona Cooperative Extension Rangeland Monitoring Evaluation Report

2018-2019

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THE UNIVERSITY OF ARIZONA
Cooperative Extension

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Executive Summary

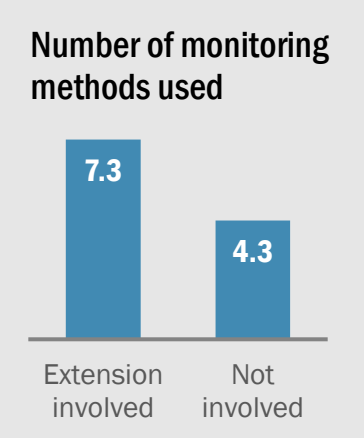
This project is an evaluation of the University of Arizona Cooperative Extension Rangeland Monitoring Programs. Using interviews, focus groups, and surveys, the Community Research, Evaluation, and Development (CRED) team examined attitudes and behaviors of ranchers and federal agency staff toward rangeland monitoring, and also examined the working relationships between the ranchers and the agencies. The work included all three Extension monitoring programs: the Arizona Cooperative Rangeland Monitoring Program, the Southeastern Arizona Rangeland Monitoring Program, and Reading the Range. The ranchers, mostly cattle growers, were located across the state, including central Arizona, southeast Arizona, and Mohave County. The agency staff represented both the Bureau of Land Management and the U.S. Forest Service.

Monitoring Practices

Arizona ranchers recognize the value of rangeland monitoring. All of the ranchers surveyed reported using one or more types of informal monitoring, making observations of such factors as grass quality, condition of the cattle, amount of available forage, and the weather. Most of the ranchers surveyed also reported that they used one or more forms of formal monitoring, including precipitation measurement, photo points, and vegetation measurement. Ranchers with USFS permits tended to use more formal monitoring methods than ranchers with BLM permits did.

100%

of ranchers used one or more informal monitoring methods



Ranchers who were involved with Cooperative Extension reported using significantly more formal monitoring methods than ranchers who were not, suggesting that involvement with Extension may encourage ranchers to do more monitoring across all land status types. In both surveys and focus groups, many ranchers said that they valued independent, third-party participation in rangeland monitoring. Cooperative Extension was particularly well regarded as an unbiased third-party.

The most commonly cited reasons for monitoring were to determine whether the quality of the rangeland is improving and to determine if management objectives are being met. In addition, some focus-group participants emphasized the usefulness for monitoring data to maintain or defend grazing permits. The participants who were involved with the Reading the Range program were somewhat more confident in their skill in understanding and using monitoring data. With respect to the frequency of formal monitoring, the focus-group participants with USFS permits felt the need for annual monitoring while those with BLM permits thought that every 3 to 5 years was sufficient.

Management Practices

The most commonly cited management practice used by ranchers was rotational grazing, followed by laying water pipelines, and destocking in times of drought. Ranchers with USFS permits were more likely to have management plans written each year. One potential area for future Extension

education is in the area of creating annual plans in order to access more sources of federal funds for ranch improvements.

Relationships with Federal Agencies

Rancher-agency relationship are complicated but potentially improving. Ranchers generally felt more positively toward the agency staff with whom they worked, and less positively toward the agencies themselves, or toward the federal grazing policies. Both ranchers and agency staff recognized the importance of good communication between the parties.

71%

of ranchers said their relationship with USFS has improved due to monitoring

40%

of ranchers said their relationship with BLM has improved due to monitoring

Some conflicts may be inevitable, given that the ranchers focus on the health of their livestock while the agency staff focus on the health of the land. However, most ranchers did feel that land management agencies were willing to work with them and listened to their concerns. Both groups highlighted the value of Extension rangeland monitoring programs in providing a common, trusted set of data and creating opportunities for dialogue.

Roles of Extension

Extension plays an important role in education, facilitation and relationship-building, and provision of reliable monitoring data. Survey and focus-group participants frequently cited Cooperative Extension workshops, agents, and publications as useful sources of information about improving their ranching operations. Furthermore, both the ranchers and the agency staff reported that Cooperative Extension was trustworthy and unbiased. Relationships between the two groups were thought to be better because of the presence of Cooperative Extension.

Extension monitoring programs are viewed as key sources of reliable data. Both ranchers and agency staff placed a high value on the multiple decades of consistent monitoring data that Extension has been able to provide. These data are widely used in permit renewals and environmental assessments. Multiple ranchers in focus groups expressed that they felt the future of their ranches depended on having reliable trend data like that provided by Extension.

88%

of ranchers said Extension services or information had increased their knowledge and understanding of rangeland monitoring.

When asked about what changes or improvements they would welcome, ranchers reported that they would like more workshops provided nearby and would also like more training on how to interpret and use monitoring data. Agency staff would like to see Cooperative Extension bring ranchers and other stakeholders together, and would like to continue or expand the Reading the Range program.

Litigation

The ranchers agreed that having rangeland-monitoring data over several years could help them defend themselves against possible litigation. Similarly, the agency staff reported that long-term monitoring data would be helpful to them in case of litigation.

Summary & Conclusions

As Arizona Cooperative Extension considers future directions in rangeland monitoring programming, Extension faculty and staff can build on the success of current programs in

encouraging the use of multiple monitoring methods, providing valuable and reliable data and expertise, and facilitating productive dialogue between agencies and ranchers. Extension can provide further education and training on topics relevant to agencies and staff, with a focus on creating spaces for multiple stakeholders to come together to talk about key issues facing rangelands. As federal agencies change the ways they work to monitor rangelands, Extension will need to adapt their rangeland monitoring programs to respond to the needs of both Arizona ranchers and agency land managers. However, given the overall value and trust placed in Extension by both ranchers and agency staff, it is clear that Extension plays an important role in the future of rangeland management in Arizona.

Introduction

The objective of this project is to evaluate the University of Arizona Cooperative Extension's Rangeland Monitoring Programs and to document the impact of the program in the following domains:

1. Arizona ranchers' and federal agency staff knowledge of the importance of monitoring, their confidence and competence in using and interpreting monitoring data, and the extent to which agencies are using monitoring data for management decisions, and
2. The quality of relationships between ranchers and federal agencies, specifically the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM).

University of Arizona Cooperative Extension's monitoring programs consist of three programs across Arizona, the Arizona Cooperative Rangeland Monitoring Program, the Southeastern Arizona Rangeland Monitoring program, and Reading the Range.

Arizona Cooperative Rangeland Monitoring Program

The Bureau of Land Management (BLM), which manages much of the public land where livestock grazing occurs, is mandated to conduct monitoring on these rangeland resources. With limited staffing resources, the BLM identified a need to increase their monitoring capacity in order to meet federal mandates. The purpose of the Arizona Cooperative Rangeland Monitoring Program (ACRMP) is to work side-by-side with the BLM, BLM lessees/permittees, and ranch managers in managing their land. Collecting, analyzing, and educating managers about their vegetative resources helps improve their ability to make informed decisions through science-based data and best management practices.

The ACRMP Agreement was funded and signed in 2004 between Cooperative Extension and the BLM AZ Strip Field Office. Funding for the program and working areas were expanded in 2012 to cover public lands administered by the BLM in Kingman field office and the Yuma field. In 2017, the Yuma program was moved to the Lake Havasu City field office, and the work in Yuma is completed through an Annual Monitoring Week.

Southeastern Arizona Rangeland Monitoring Program

The Southeastern Arizona Rangeland Monitoring Program was initiated in 2000 with a joint agreement between the University of Arizona Cooperative Extension, the Coronado National Forest, and the Gila District Bureau of Land Management. The program funds a research specialist in rangeland monitoring to assist in implementing a monitoring program in the geographic area covered by the agreements. The program goal is to implement an educational program on rangeland monitoring and inventory, and its objectives are to assist agencies in meeting rangeland monitoring mandates in response to public land policies, and to increase the ability of ranchers to develop and conduct their own monitoring programs on grazing permits and leases, and on private land.

Through the program, the research specialist conducts monitoring on individual allotments with ranchers and agency personnel, assists with local range monitoring workshops, and prepares allotment monitoring reports that are delivered to the agencies involved. While most of the monitoring is related to management of livestock grazing, agency needs may require monitoring in other areas of natural resource management.

Reading the Range

The Reading the Range program began in 2001 with the support of Tonto Natural Resources Conservation District, Natural Resources Conservation Service, and Gila County Board of Supervisors. The program coordinates and conducts rangeland monitoring on key areas in Tonto National Forest and provides education on monitoring to USFS permittees. Reading the Range is currently funded by Tonto National Forest and Tonto Natural Resource Conservation District.

Methods

Development of Data Collection Tools

The Community Research, Evaluation, and Development (CRED) team at the University of Arizona developed a focus group guide (reviewed by Extension Rangeland faculty and staff) to engage ranchers in exploring domains outlined above (see Appendix 2). In collaboration with Extension Rangeland faculty, the CRED team developed a survey instrument adapted from materials used in prior evaluations of Arizona Extension's Rangeland Monitoring program (in 2010 and 2002), and from a survey developed for a recent UA Udall Center National Institute of Food and Agriculture (NIFA) study of adaptive management (see Appendix 3). This survey was further refined based on data gathered through rancher focus groups. The CRED team also developed a guide for conducting semi-structured interviews with USFS and BLM staff with input from Extension Rangeland faculty and data collected through rancher focus groups (see Appendix 4).

This project was determined not to be human subjects research by the UA Human Subjects Protection Program, and so was deemed exempt from Institutional Review Board review.

Focus Groups

Extension Rangeland faculty identified and recruited ranchers from three broad geographic areas: the Arizona Strip, the Kingman region, and areas on and near the Tonto National Forest. Ranchers were asked to participate if they had taken part in Extension monitoring programs or trainings in the past; they were provided with lunch for participating. The CRED team conducted three 1.5-hour focus groups in each of the following areas: 6 ranchers participated in St. George, Utah (representing the Arizona Strip), 7 participated in Kingman, and 9 participated in Payson (representing the Tonto National Forest.). The focus groups were facilitated jointly by the CRED team and local Extension agents and staff. Data gathered through these focus groups were used to refine the survey instrument, and key findings have been integrated into this report. Focus group transcripts were coded using a grounded theory approach (Corbin & Strauss, 2008), where themes are developed through the process of coding the text. Consensus coding between two research staff was used as a means of ensuring intercoder reliability and reducing bias.

Surveys

The survey instrument was finalized in October 2018 and distributed between November 2018 and February 2019. Surveys were first distributed electronically to 180 ranchers in the Kingman and Arizona Strip regions and 100 ranchers in the Tonto National Forest region from lists of ranchers kept by local Extension offices, a regional Cattlegrowers Association, and Bureau of Land Management mailing lists. Given the preference for receiving surveys by mail expressed in rancher focus groups, 168 surveys were also distributed in the Kingman and Arizona Strip regions by mail, 251 surveys were distributed by mail to ranchers in southeastern Arizona (Pima, Santa Cruz, Cochise, Graham, and Greenlee counties), and 45 surveys were distributed by mail to

ranchers in the Tonto National Forest region. Reminders were sent via email two weeks, 1 month, and 2 months following the initial distribution of the survey.

The response rate for this survey, after removing the mailings that were returned as undeliverable, was 24.9%, substantially lower than that achieved by prior surveys conducted in 2002 (47%) and 2010 (49%). Electronic responses were particularly low (<10% in all areas), so we would recommend that future surveys within this population use mail distribution only. This low response rate may be due in part to the timing of distribution near major U.S. holidays. It also matches declines in overall survey response rates seen in other parts of the U.S. A recent analysis of forty years of mailed survey studies found that response rates have declined by approximately one percentage point per year since the 1970s (Stedman et al., 2019).

Mailed survey responses were entered using a Qualtrics survey. All surveys where at least 10 percent of questions were answered were used, with missing responses removed on an item-by-item bases. All data analyses were performed in R. Descriptive analyses were performed using frequency tabulation. Chi-square measures of nominal association were used to compare responses across groups, by Extension involvement, region, and agency permit status. Cross-tabulations for these three groups can be seen in table 1. Student's t-tests were used to examine differences in the mean number of management and monitoring practices, again by Extension contact, region, and agency permit status. Differences were considered significant at $p<0.05$.

Table 1. Survey respondents by group

Group comparison tabulations for agency permit status, extension contact, and region.

	Number	Percentage
Agency Permit		
BLM	40	54%
FS	34	46%
Total	74	
Extension contact		
Extension-involved	64	67%
Not involved	31	33%
Total	95	
Region		
Arizona Strip	20	21%
Kingman*	11	11%
Central	22	23%
Southeastern	44	45%
Total	97	

*Due to the small number of respondents in Kingman, this area was combined with Arizona Strip as the 'Mohave' region for analysis.

Agency Permit-Region			
	BLM	**FS**	**Total**
Mohave	26	0	26
Central	1	18	19
Southeastern	13	14	27
Total	40	32	
Extension Contact-Region			
	Extension-involved	**Not involved**	**Total**
Mohave	19	9	28
Central	20	2	22
Southeastern	23	19	42
Total	62	30	
Extension Contact-Agency Permit			
	Extension-involved	**Not involved**	**Total**
Mohave	19	9	28
Central	20	2	22
Southeastern	23	19	42
Total	62	30	

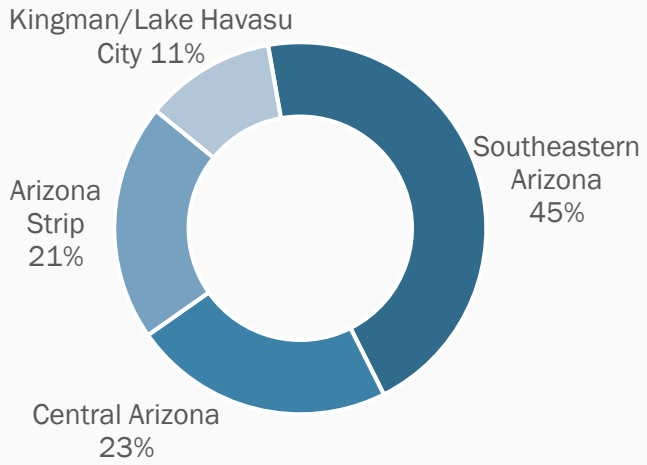
Interviews

Extension faculty identified 12 BLM and USFS staff for interviews to assess agency perspectives on the effectiveness of the monitoring program and its impact on the quality of relationships between ranchers and federal agencies. These staff represented range conservationists and field managers involved in monitoring within the field offices in the area. Ten staff, five from BLM and five from USFS, were willing and able to participate in interviews. Five staff were in a manager or assistant manager role, and five were in range staff or specialist positions. On average staff had four years of experience in their current role and twelve years of experience working in range management. Again, a grounded theory approach was used in coding interview transcripts with consensus coding used between two researchers.

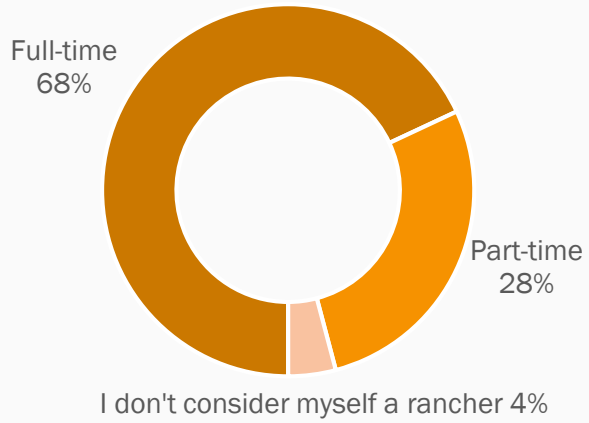
Respondent Characteristics

Nearly half of all survey respondents (45%) indicated that they ranched in southeastern Arizona (Pima, Santa Cruz, Cochise, Graham, or Greenlee counties). About a third of respondents (32%) reported their operation was in the proximity of Mohave County, either in the Kingman/Lake Havasu area (11%) or the Arizona Strip (21%). Approximately a quarter of respondents (23%) reported ranching in Central Arizona (near Gila County). The majority of respondents (68%) considered themselves full-time ranchers. Most respondents also reported their role as owner/manager (46%) or owner (40%) of the ranch. More than three-quarters of respondents (76%) indicated they run a cow-calf operation, with 13 percent running a cow-calf and yearling (stocker) operation. The proportion of respondents by type of operation in this survey were highly similar to those seen in a prior survey in 2002 (Fernandez-Gimenez, Ruyle, & McClaran, 2005).

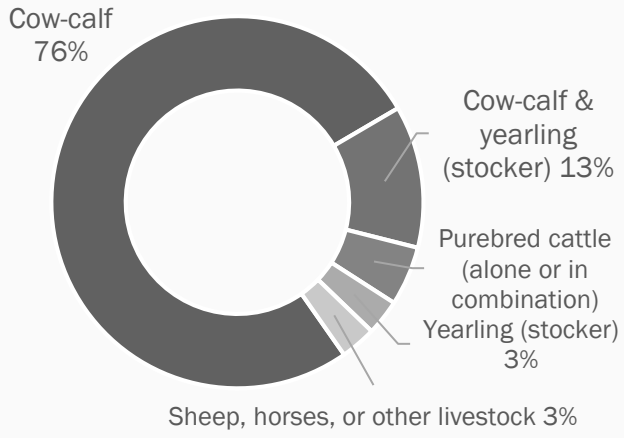
In what general area is your operation located? (N=97)



Do you consider yourself a full-time or part-time rancher? (N=97)



What type of your ranching operation do you run? (N=97)



What is your role on the ranch? (N=97)

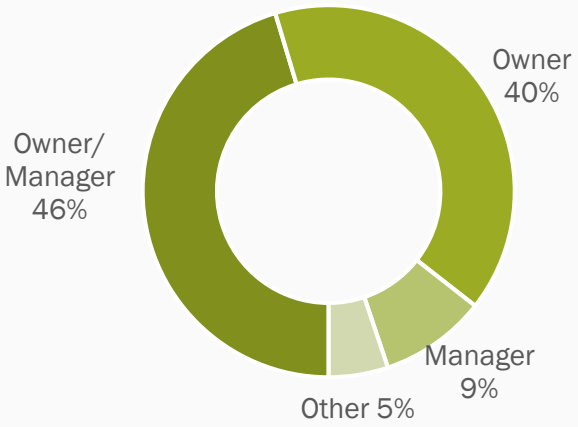


Figure 1. Respondent Demographics: Location, Role, and Type of Operation

Despite most respondents considering themselves full-time ranchers, most respondents also depend on other sources of income in their household. For over half (56%) of respondents, their livestock operation typically provides 50 percent or less of their household income. This was consistent with the results of a prior survey in 2002 that found that the average respondent derived 43 percent of their income from livestock (Fernandez-Gimenez et al., 2005).

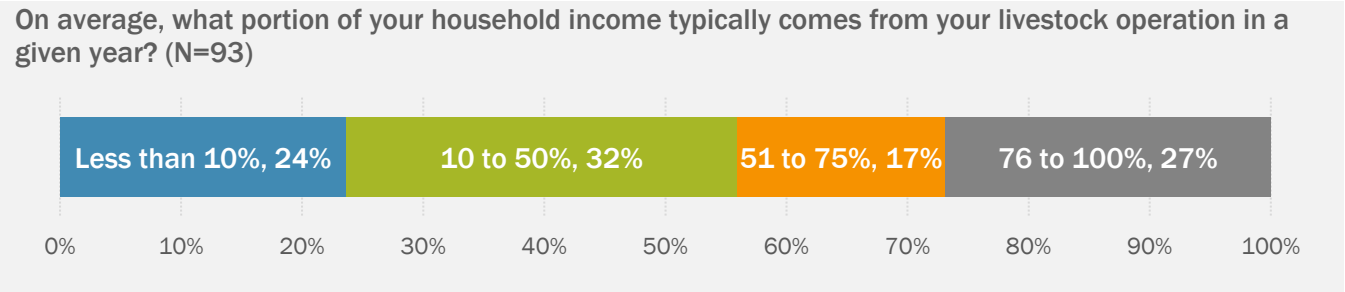
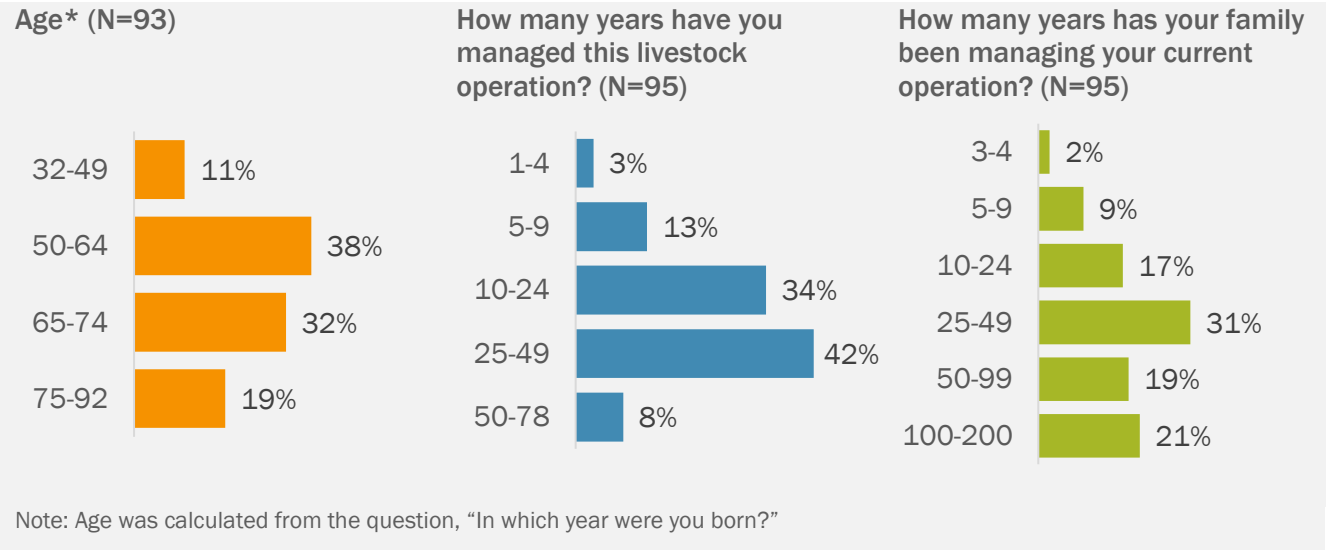


Figure 2. Income from Livestock Operation

The average age of survey respondents was 64 years old (median: 66 years), with a range of ages between 32 and 92. This average was slightly higher than the average age of 59 years old found in a prior survey in 2002 (Fernandez-Gimenez et al., 2005) and the average age of 59.4 years old for producers in Arizona as reported in the USDA's 2017 Census of Agriculture (United States Department of Agriculture, 2019). Respondents reported high levels of experience, with respondents reporting that they had managed their operations for 25 years on average, consistent with the findings of 23 years of management on average in 2002 (Fernandez-Gimenez et al., 2005). On average, respondents indicated that their families had been managing their operations for 50 years (median: 35 years), and more than one in five respondents indicated that their family had managed their operation for 100 years or more.

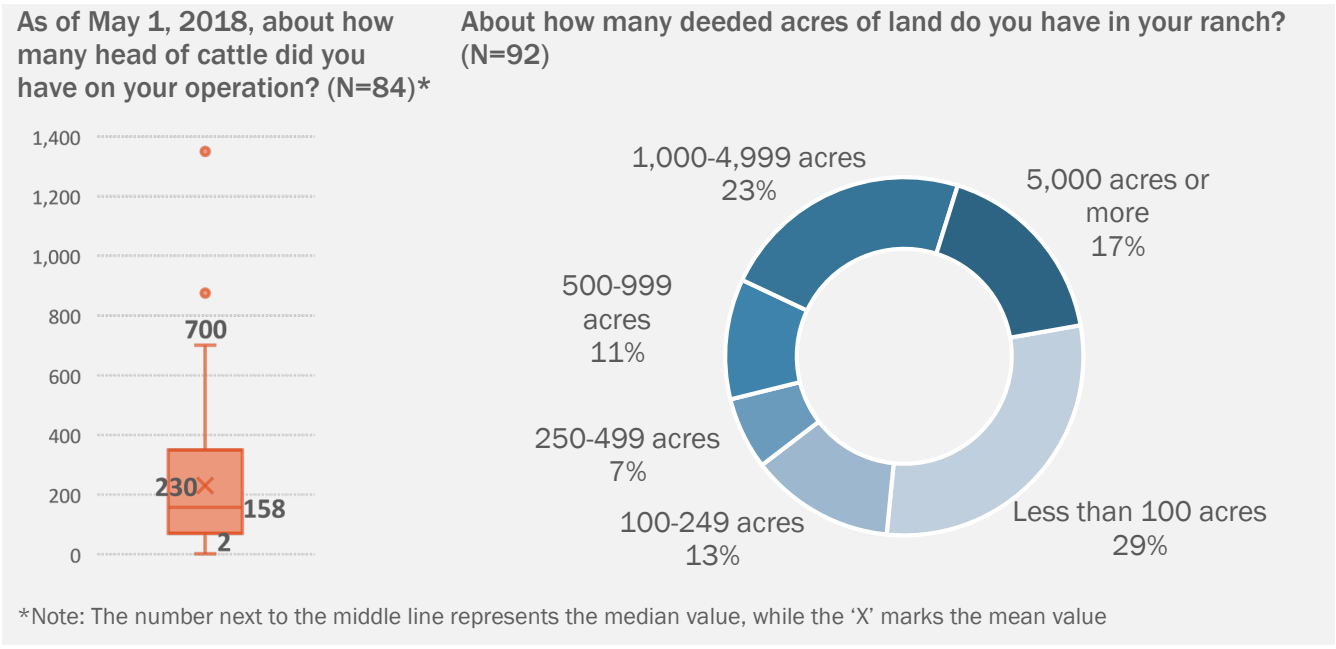


Note: Age was calculated from the question, "In which year were you born?"

Figure 3. Respondent Demographics: Age and Years of Experience

The majority of respondents (85%) reported that as of May 1, 2018, they had at least some cattle. Just over half of respondents (52%) reported that they had horses, and three percent reported they had sheep. The number of cattle ranged from two to more than 1,000 head of cattle, with a reported average of 230 head of cattle (median: 158), nearly identical to the average of 223

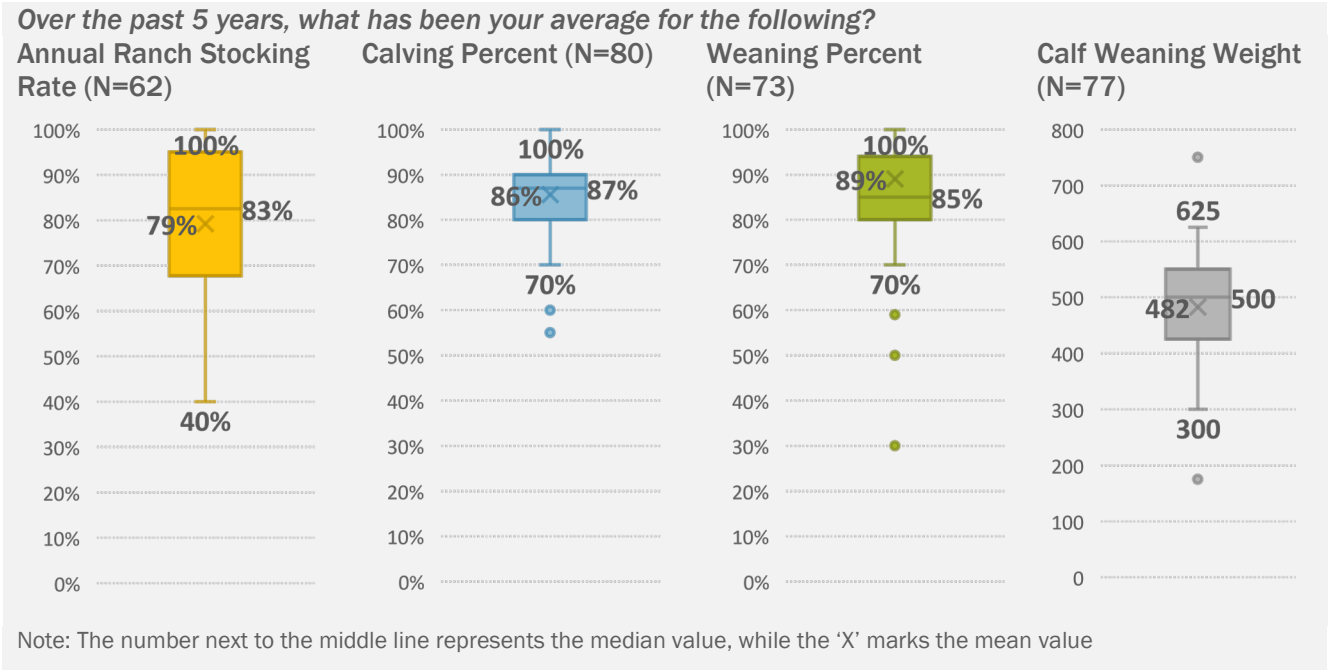
found in 2002 (Fernandez-Gimenez et al., 2005). The number of deeded acres reported also varied widely. Nearly a third of respondents reported that they had less than 100 acres, while 40 percent had 1,000 acres or more. This distribution of deeded acres was largely similar to that seen in prior evaluations (Fernandez-Gimenez et al., 2005; Peterson, 2010).



*Note: The number next to the middle line represents the median value, while the 'X' marks the mean value

Figure 4. Head of Cattle and Acres of Deeded Land

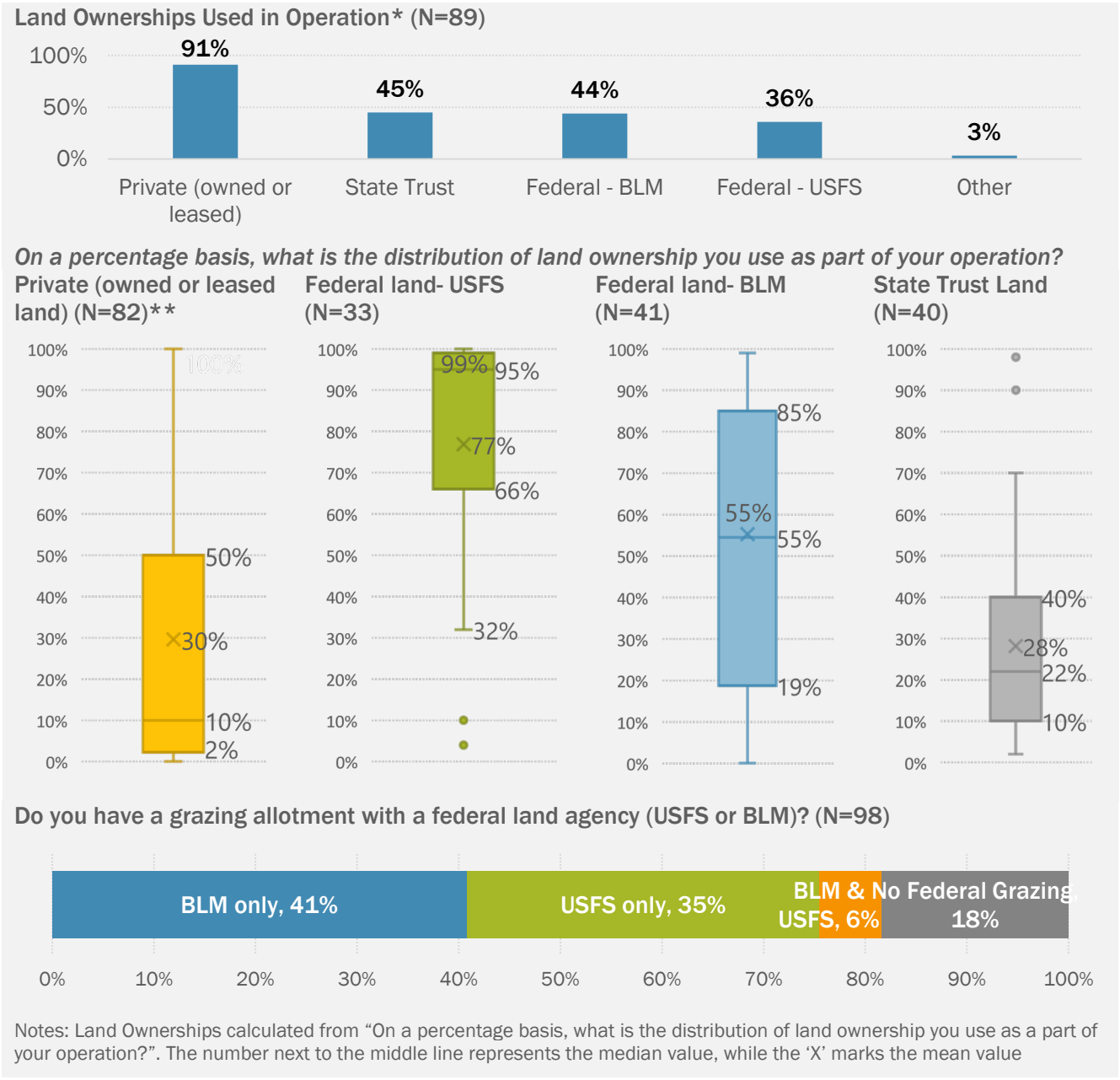
Respondents reported on average a ranch stocking rate of 79 percent, but rates varied from as low as 40 percent to as high as 100 percent. The average reported calving percent was 86 percent. Weaning percentages were mostly in the range of 80 to 95 percent with an 89 percent average. The average reported calf-weaning weight was 482 pounds, with an interquartile range of 425 to 550 pounds.



Note: The number next to the middle line represents the median value, while the 'X' marks the mean value

Figure 5. Ranch Characteristics: Stocking rate, Calving percent, Weaning percent, and Weaning weight

The vast majority of respondents (91%) used at least some private land in their operation, followed by state trust land (45%), BLM land (44%), and USFS land (36%). The composition of land ownerships varied largely by type of land. Private land and state trust land typically composed half or less of respondents' land use, while USFS land typically composed the majority of land used for those respondents utilizing USFS land. For those utilizing BLM land, BLM land on average represented just over half of land used but had wider variability than other land ownerships. Overall, 82 percent of respondents reported having a federal grazing allotment.



Notes: Land Ownerships calculated from "On a percentage basis, what is the distribution of land ownership you use as a part of your operation?". The number next to the middle line represents the median value, while the 'X' marks the mean value

Figure 6. Land Ownership Status & Federal Grazing Allotments

Monitoring Practices

Informal Monitoring

All surveyed ranchers reported doing at least some informal monitoring, specifically observing grass height, density and vigor. Almost all respondents reported observing the condition of their cattle, the amount of forage, and the weather. A substantial majority also reported observing erosion and wildlife. Other types of informal monitoring mentioned included recording rainfall, observing soil moisture, looking for specific species of plants and ground cover, and using photos for monitoring. Ranchers who were involved with Extension more frequently reported observing wildlife than those who were not involved with Extension.

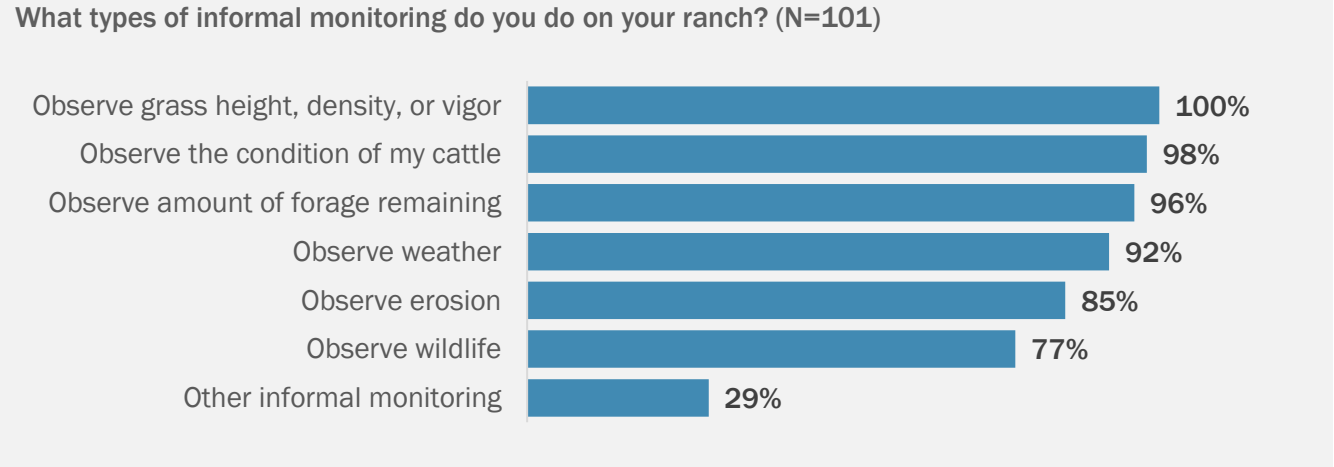


Figure 7. Informal Monitoring Practices

In focus groups, participating ranchers frequently referenced their own informal monitoring as a major driver of their management practices. Multiple individuals across different sites referenced the idea that "your cows will tell you what to do," that the condition of their cattle indicated when they needed to move pastures or change their current practices. Many ranchers discussed their years of experience getting to know the land they typically use for grazing and having an intuitive sense of when cattle need to be moved. Across focus groups, ranchers consistently emphasized the importance of regularly being out on the land observing their cattle and the grass in influencing their management decisions.

Formal Monitoring

The majority of respondents (86%) reported that they did formal monitoring on their ranch, slightly higher than the 79 percent rate reported in 2002 (Fernandez-Gimenez et al., 2005). The types of monitoring done varied depending on the land ownership status. On private land, nearly all respondents (93%) reported measuring precipitation, but less than a quarter reported using formal vegetation measurements. The second most popular method of monitoring used on private land was photo points. Ranchers reported most frequently using vegetation measurements on USFS land. Herbaceous utilization (70%) was the most popular measurement used, followed by dry weight rank (65%), pace frequency (63%), and clip biomass (63%). About two-thirds of ranchers with USFS land reported measuring precipitation (65%) and using photo points (68%). Similar rates of use of vegetation measurements as well as other measurements were reported by respondents with BLM and state land allotments. On BLM land, pace frequency (43%), browse utilization (40%), grazing exclosures (40%), and herbaceous utilization (37%) were the most popular vegetation measurements. On state land, pace frequency (41%), herbaceous utilization (41%), browse utilization (38%), and transact or plot-based cover estimates (38%) were the most popular vegetation measurements reported. More than three-quarters of BLM (77%) and state land (76%) users reported measuring precipitation, and more than half reported using photo points. Overall, USFS land users reported using the highest average number of monitoring methods (7.8), followed by BLM users (5.3), state land users (4.8), and private land (3.5). Comparing ranchers with BLM permits and those with USFS permits, ranchers with USFS permits reported using more than twice as many monitoring methods than those with BLM permits (USFS: 9.4; BLM: 4.1, $p<0.00$), a statistically significant difference. Ranchers who were involved with Extension also reported using significantly more methods than those not involved (Extension-involved: 7.3; Not involved: 4.3; $p=0.011$). This suggests that involvement with Extension may lead ranchers to do more monitoring than those who are not involved.

Table 2. In the past 10 years, what types of formal monitoring have you done on your private land, USFS and BLM allotments, or state land grazing leases?

Type of Monitoring	Private Land (N=71)	USFS (N=40)	BLM (N=30)	State Land (N=29)
Vegetation Measurements:				
Pace frequency	20%	63%	43%	41%
Herbaceous utilization	24%	70%	37%	41%
Browse utilization	20%	53%	40%	38%
Dry weight rank	10%	65%	23%	21%
Clip biomass (production)	10%	63%	13%	14%
Transect or plot-based cover estimate	11%	30%	30%	38%
Riparian utilization	15%	35%	23%	17%
Ocular estimates of cover	14%	33%	27%	14%
Grazing exclosures	17%	35%	40%	28%
Comparative yield	6%	30%	10%	3%
Line intercept	4%	18%	17%	17%
Parker 3-step	6%	28%	10%	10%
Riparian vegetation density or cover	10%	23%	13%	17%
Belt density	0%	8%	0%	0%
Other Measurements:				
Measure precipitation	93%	65%	77%	76%
Photo points	38%	68%	57%	62%
Upland Health Assessment	8%	38%	23%	14%
Water quality	23%	18%	17%	10%
Streambank stability	11%	15%	10%	7%
Wildlife habitat surveys	13%	20%	17%	14%
Other formal monitoring	1%	10%	3%	0%
Mean Number of Monitoring Methods	*3.5*	*7.8*	*5.3*	*4.8*

Who was involved also varied widely by land ownership status. Ranch owners were the most frequently involved participants across all land ownership statuses, with the highest participation reported on BLM land (90%), followed by state land (89%), private land (87%), and USFS land (85%). On federal lands, the next most frequently involved participant was the agency range conservationist (83% for USFS; 81% for BLM). Cooperative Extension agents or staff were the next most frequently reported participants for both USFS (66%) and BLM (45%) lands. NRCS (SCS) range conservationists were reported as involved most frequently on BLM, state, and private land, but still frequently involved with USFS land. Reported involvement of ranch planning teams in monitoring was very low across all land statuses, and involvement of hired ranch workers was low across most land statuses outside of USFS land. Nearly twice as many participants were reported as participating in monitoring on average by ranchers with USFS permits compared to those with BLM permits (USFS: 4.7; BLM: 2.4; $p<0.00$). Extension-involved ranchers reported more average monitoring participants than those not involved with Extension (Extension-involved; 4.0; Not involved 1.7; $p<0.00$). Ranch owners were most frequently reported as involved in the Southeastern and Central Arizona regions (Southeastern: 87%; Central: 82%; Mohave: 41%; $p=.014$).

Table 3. In the past 10 years, who has participated in monitoring on your private land, USFS and BLM allotments, or state lands grazing leases?

Monitoring Participants	Private Land (N=61)	USFS (N=41)	BLM (N=31)	State Land (N=27)
Ranch owner	87%	85%	90%	89%
Family member(s)	41%	51%	39%	37%
NRCS (SCS) range conservationist	41%	34%	42%	56%
Cooperative Extension agent or staff	18%	66%	45%	30%
Hired ranch worker(s)	16%	32%	16%	11%
BLM range conservationist	11%	0%	81%	22%
Private range management consultant	10%	34%	10%	4%
University faculty	10%	51%	26%	11%
State Land Dept. range conservationist	8%	2%	16%	41%
Ranch planning team	7%	5%	3%	4%
Other	7%	5%	6%	7%
USFS range conservationist	3%	83%	3%	4%

When asked about the importance of third-party involvement in monitoring, 86 percent of respondents indicated that having an unbiased third party participate in rangeland monitoring was "very important" or "somewhat important." This sentiment was echoed among focus group participants. Multiple ranchers in focus groups emphasized that they valued Extension monitoring programs because they viewed Extension as independent from federal agencies and that the data generated was accepted by all parties—ranchers, land agencies, and the public.

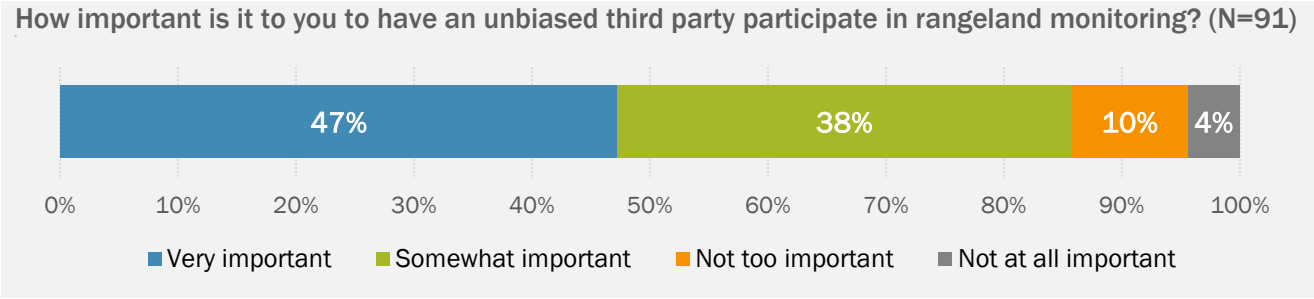


Figure 8. Importance of unbiased third party in monitoring

When asked specifically about the bias of resources, survey respondents rated Cooperative Extension agents or staff as the most unbiased (94% rated "completely" or "somewhat" unbiased), followed by NRCS (SCS) range conservationists (89% rated "completely" or "somewhat" unbiased). Agency range conservationists were most frequently viewed as somewhat unbiased or somewhat biased. There were no significant differences across regions, permit-status, and Extension-involvement in views of bias in Extension or either federal agency's range conservationists. BLM permittees more frequently rated NRCS (SCS) range conservationists as completely unbiased than USFS permittees (BLM: 59%; USFS 39%; p=0.045).

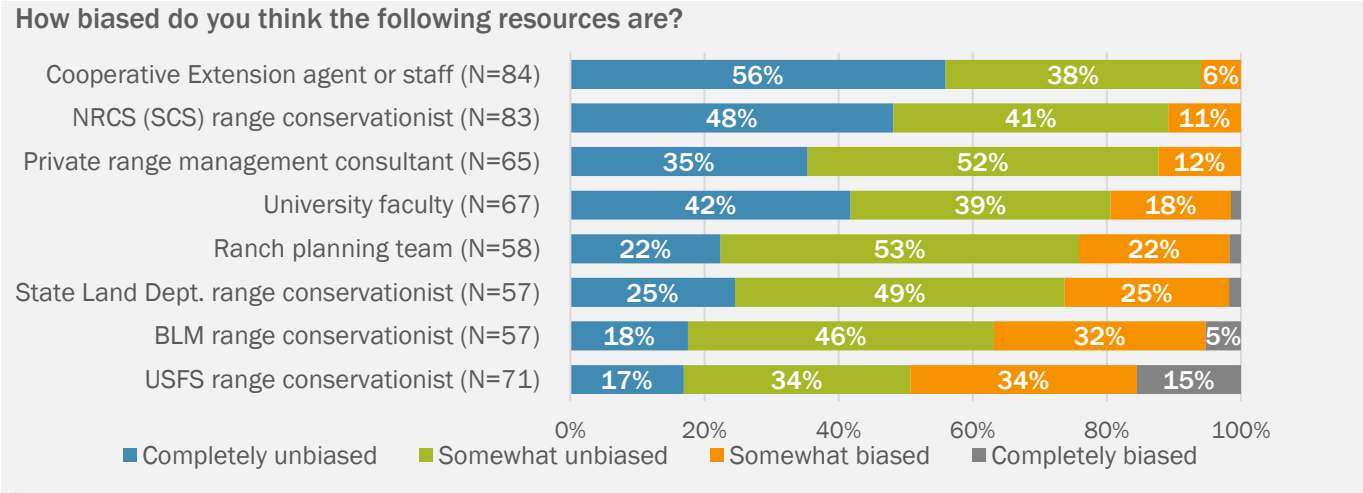


Figure 9. Bias of common rangeland management resources

Most respondents reported that the most important reasons for monitoring was to help them know if range conditions were improving (82% rated "very important"), followed by determining if management objectives were met (76%), and maintaining or increasing AUMS (64%). Respondents rated government program requirements and help getting government funding as the least important, even though some funding programs, such as the Environmental Quality Incentive Program (EQIP) require monitoring. This may suggest that ranchers are not currently pursuing these funds. The importance of monitoring for increasing credibility with land management agencies varied significantly by region; ranchers in Central Arizona much more frequently rated this reason as highly important than those in other regions (Central: 84%; Mohave: 53%; Southeastern: 31%; p=0.010).

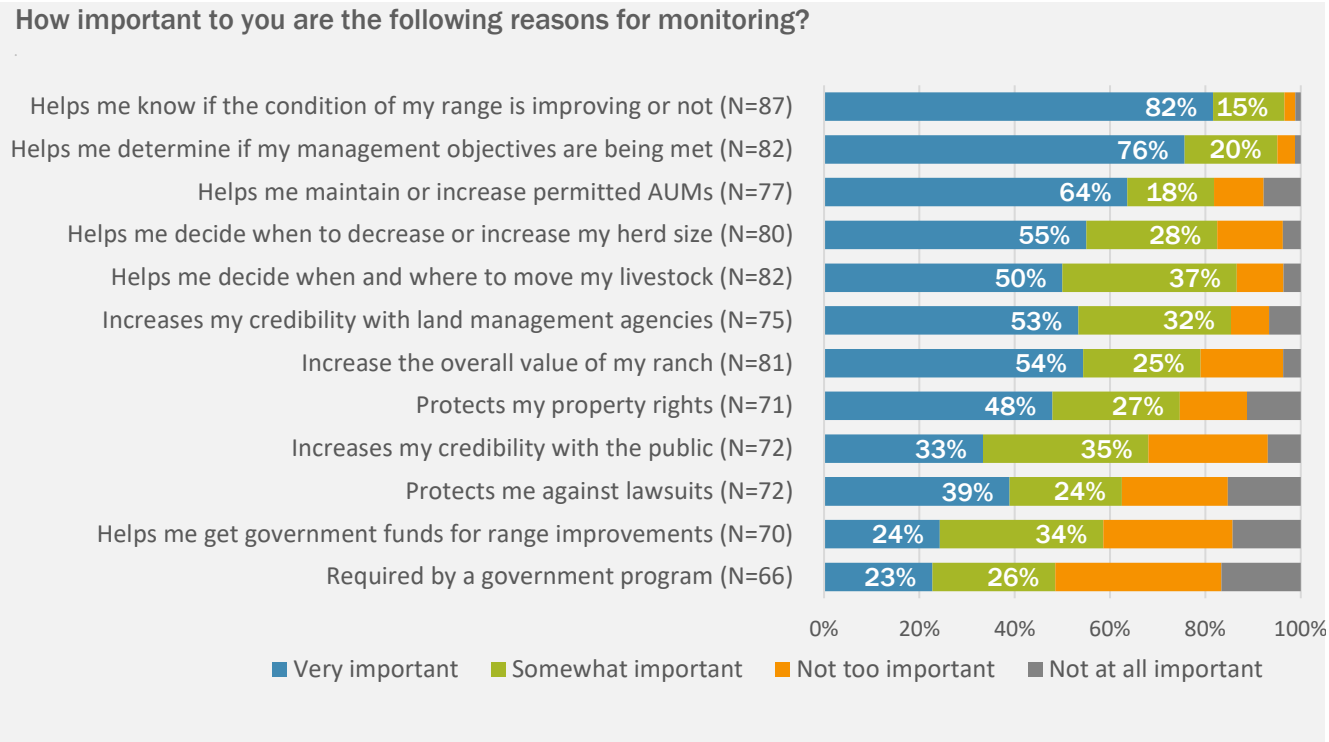


Figure 10. Importance of reasons for monitoring

In focus groups, almost all ranchers who participated recognized the importance of monitoring. Most focus group participants reported that monitoring happened regularly on their ranches. Several participants emphasized two-fold benefits of monitoring: first for providing a regular measure of range conditions and driving improvements, and second for maintaining grazing permits, especially in the case of litigation. However, rancher confidence and competence in using and interpreting monitoring data varied widely. Some ranchers, particularly those involved with the Reading the Range program, expressed a high level of confidence in their ability to understand the monitoring process and use the data to inform their management decisions. Others were less confident and saw monitoring processes and data as something that experts used but not directly relevant to them. For these participants, management decisions were driven much more by availability of water and feed determined through their informal assessments of range conditions. They still valued monitoring but predominantly for the data's utility in the permit renewal process and in the case of litigation over grazing permits.

Both in the focus groups and among ranchers surveyed, participants typically felt that they did sufficient monitoring but that there were always opportunities to do more. In focus groups, ranchers commonly linked their current monitoring practices or the need to monitor more back to the value of monitoring for land improvements and permit renewals. Among survey respondents, about half (49%) reported that they did about the right amount of monitoring, 14 percent reported that that they did more than enough, and 39 percent felt that they should do more. BLM permittees reported that they should do more monitoring significantly more frequently than USFS permittees (BLM: 49%; USFS: 21%; p=0.028). Ranchers involved with Extension more frequently reported that they did about the right amount of monitoring compared to those not involved with Extension (Extension-involved: 56%; Not involved: 22%; p=0.014). Frequency of monitoring came up in all three focus groups, but while ranchers with BLM permits were generally happy with monitoring occurring every 3 to 5 years, ranchers with USFS permits emphasized the need for annual monitoring data.

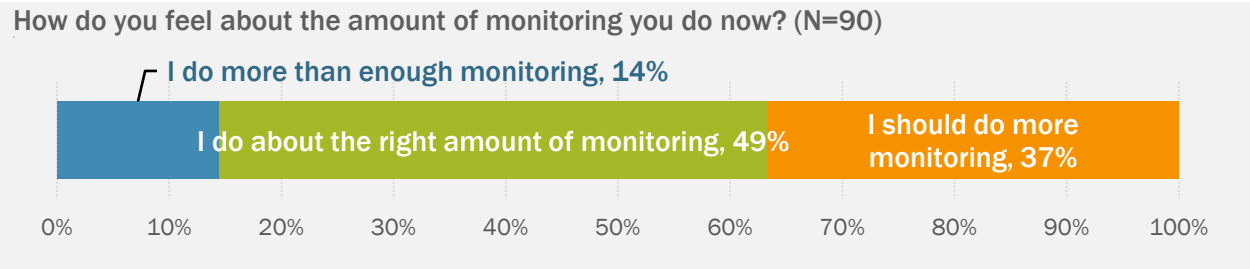


Figure 11. Attitudes about amount of monitoring done

When asked about barriers to monitoring, survey respondents most frequently rated lack of time (63%) and lack of help (63%) as factors that affected their decision to monitor "a lot" or "somewhat." These barriers were consistent across all areas and agencies for both Extension-involved and non-involved ranchers. Tediousness, lack of consistency in methods, lack of knowledge of methods, complexity of monitoring, and lack of confidence in monitoring skills were the next most frequently cited barriers to conducting monitoring. Only a small percentage of respondents rated agency behaviors or responsibilities as somewhat or greatly affecting their decisions to monitor. In focus groups, lack of knowledge and confidence interpreting monitoring

data were mentioned as barriers to using monitoring data to drive management decisions. Ranchers in Central Arizona significantly more frequently reported that they were not at all affected by the complexity of monitoring compared to ranchers in other regions (Central: 65%; Mohave: 19%; Southeastern: 17%; p=0.001). USFS permittees reported being less affected by the expense of monitoring; they much more frequently reported that the expense of monitoring did not affect them at all than BLM permittees (USFS: 50%; BLM: 16%; p=0.024).

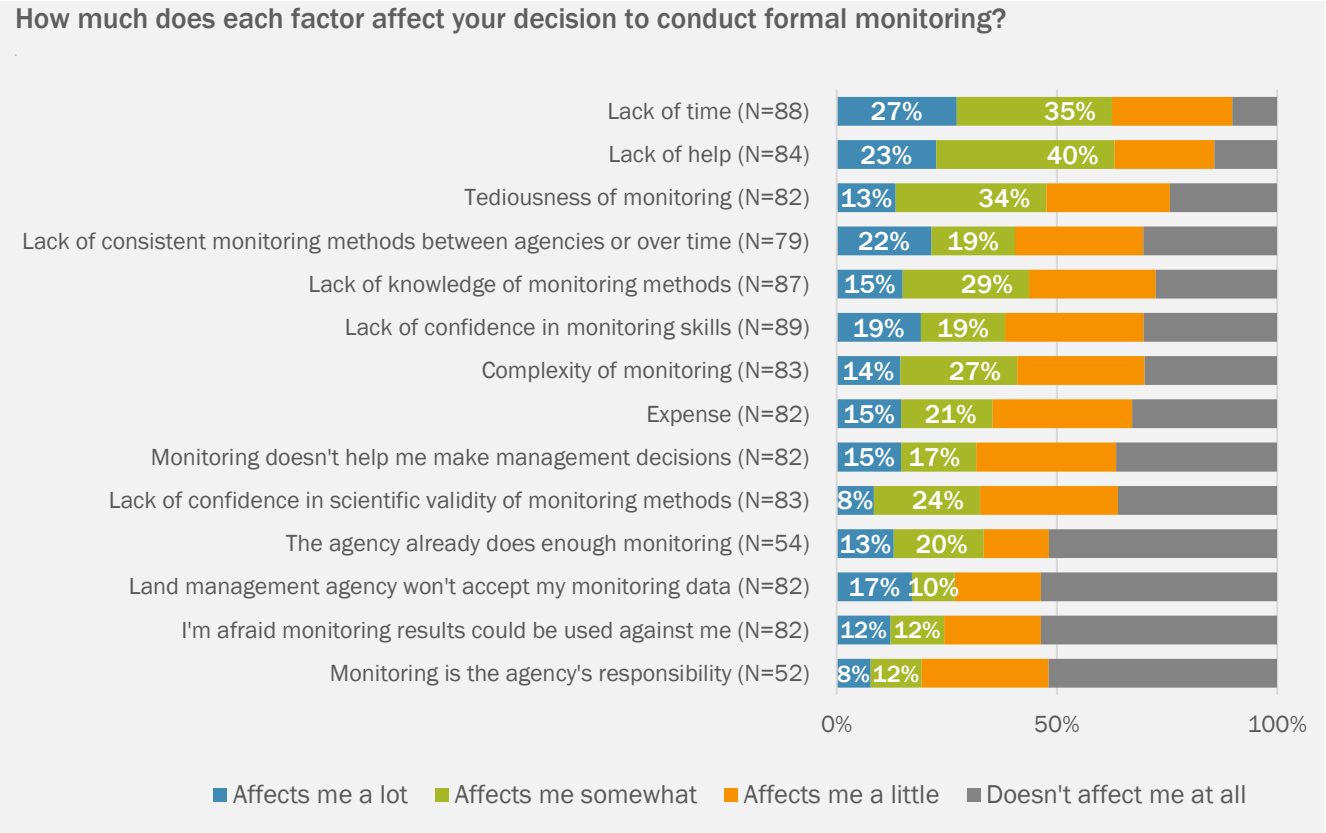


Figure 12. Factors affecting monitoring

Agency Perspectives on Monitoring

In interviews, federal land agency staff were asked about both their perceptions of permittee participation in monitoring as well as their perceptions of the value of monitoring and their own confidence and competence working with monitoring data. Almost all staff interviewed expressed that they want permittees to be involved in monitoring so that they understand the process, the data, and improve their own management practices. However, agency staff reported wide variability in actual permittee participation in monitoring. For some staff, nearly all of their permittees participated in monitoring, whereas others reported that only the most interested or engaged permittees took part, those who were "more interested in the science" or who were particularly hands on.

Different staff also encouraged different levels of engagement in monitoring—some simply wanted permittees to come out and participate in the process but not necessarily collect data on their own, while others encouraged those permittees with sufficient experience to go collect their own data. Staff also recognized that many permittees were more engaged in "basic" or "informal"

monitoring as part of their regular ranching practices than the more technical or "governmental" parts of monitoring. Overall, staff generally expressed that they felt those permittees who were more involved in monitoring were more likely to use monitoring data to inform their management practices. As one interviewee stated, "Monitoring primes learning to make them better stewards."

All staff interviewed highly valued monitoring, typically for multiple reasons. Across both BLM and USFS, monitoring was seen as part of the agency's regulatory mandate and an essential part of determining whether the agency was meeting its land management goals. Monitoring was also seen as a key component of the agency-permittee relationships. Staff described monitoring reports and the process of going out and monitoring as providing openings for conversations with permittees about reasons behind agency decisions, need for changes in management practices, and the overall condition of the land. Interviewees emphasized the importance of having long-term trend data on both landscape and local scales in order to justify management decisions to the broader public as well as to guide agency decision-making. Staff at both federal agencies most frequently reported using the data as part of National Environmental Policy Act (NEPA) analyses and land health assessments, indicating that, though data might not be used immediately, the accumulation of multiple years of monitoring data proves highly valuable when assessments need to be done.

The staff interviewed expressed a wide range of confidence using monitoring data. Some were highly confident in their own expertise to interpret monitoring data, while others reported leaning more heavily on agency specialists and Extension faculty to analyze and interpret the data. Multiple interviewees emphasized the importance of regularly going out to allotment sites to familiarize themselves with the on-the-ground conditions, as well as the role of experience in honing skills in interpreting monitoring data.

Management Practices

In the survey, ranchers were asked about the management practices they carried out in the past ten years on different land statuses. The most frequently-used management practice across all land ownership statuses was rotational grazing, which was most popular among USFS land users (91%) and least popular on private land (82%). The lower rate on private land may be due in part to the infrastructure requirements of rotational grazing, which include fencing and sufficient pasture to rotate through. In focus groups, ranchers commonly indicated that rotational grazing was part of the federal grazing permit requirements and that they rotated their cattle depending on the season and the availability of water. A few participants discussed creating their own rotation maps to ensure that each pasture received a full season of rest before it was grazed again. The majority of survey respondents also reported laying water pipelines and destocking during drought in the past decade.

Table 4. In the last 10 years, have you carried out any of the following management practices on your private grazing land, USFS or BLM allotments, or state lands leases?

Management Practices	Private Land (N=77)	USFS (N=44)	BLM (N=48)	State Land (N=43)
Rotational grazing	82%	91%	83%	86%
Laid water pipelines	65%	66%	56%	60%
Drought destocking	56%	73%	67%	65%
Mechanical brush removal	36%	18%	6%	21%
Erosion control structures	35%	16%	8%	23%
Continuous, year-round grazing*	32%	9%	23%	19%
Reseeding	29%	5%	8%	19%
Wildlife-friendly fencing	27%	45%	31%	26%
Herbicides	26%	5%	21%	28%
Install wildlife waters	22%	43%	21%	21%
Seasonal grazing of riparian areas	21%	45%	33%	14%
Non-use (other than drought)	19%	34%	31%	23%
Spring development	16%	48%	25%	12%
HRM or Savory grazing	10%	7%	15%	12%
Fenced streambanks or riparian areas	8%	18%	2%	2%
Prescribed burn	8%	25%	15%	7%
Mean Number of Management Practices	*4.9*	*5.5*	*4.5*	*4.4*

**Rotational and continuous grazing may not add to 100% due to difference in on-off permit grazing vs. on-allotment grazing.*

Some practices were common only within certain land status types—reported rates of use of wildlife-friendly fencing, spring development, seasonal grazing of riparian areas, installation of wildlife waters, and fencing streambanks or riparian areas were substantially higher on USFS land than any other ownership status. Herbicide use was much more common on private land, BLM land, and state land than USFS land. Overall, use of the highest number of management practices on average were reported on USFS land (5.5), followed by private land (4.9), BLM land (4.5), and state land (4.4). Ranchers involved with Extension significantly more frequently reported the use

of the following practices than those not involved: laid water pipelines (Extension-involved: 81%; Not involved: 55%; p=0.014), spring development (Extension-involved: 42%; Not involved: 13%; p=0.009), and fenced streambanks or riparian areas (Extension-involved: 22%; Not involved: 3%; p=0.042). There were not significant differences in the reported use of these practices between USFS and BLM permittees or between regions, indicating that Extension involvement is likely the main driver behind these practices. BLM permittees reported use of herbicide at a significantly higher frequency than USFS permittees (BLM: 43%; USFS: 12%; p=0.008).

Use of management plans varied among survey respondents with public grazing allotments. The largest group (38%) reported working in collaboration with the public land agency to write an annual written plan, while only 8 percent of respondents reported writing their own plans by themselves and 6 percent reported that the agency wrote an annual plan for them. About a third of respondents (31%) reported that they did not have an annual written plan but made an informal plan, and 17 percent of respondents reported making no annual plans.

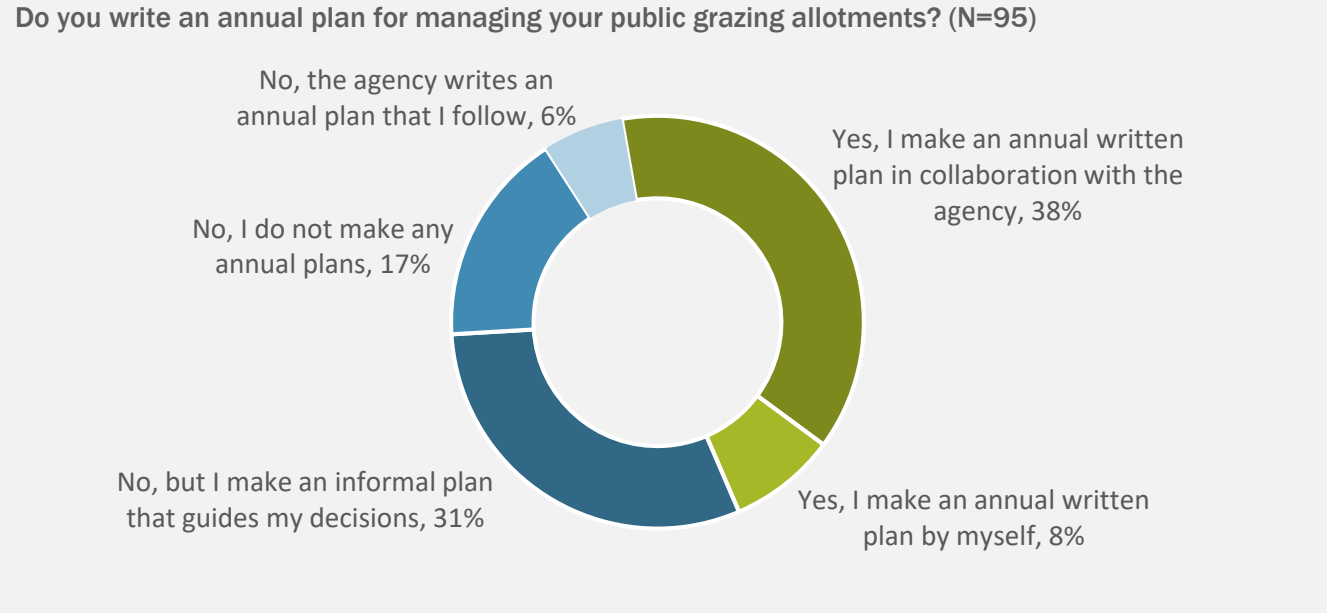


Figure 13. Use of annual plan for management

There were significant differences between the answers of survey respondents with USFS grazing permits compared to those with BLM grazing permits. Respondents with USFS permits more frequently report making an annual written plan in collaboration with the agency (USFS: 82%; BLM: 13%; p<0.000); those with BLM more frequently reported making informal plans (BLM: 45%; USFS:3%; p<0.000). This variability in planning practices is likely driven by agency policy. In interviews, USFS staff indicated that they meet and make plans with permittees annually as a part of regular operating procedure, whereas BLM staff did not have the same mandate for annual meetings, and meetings with permittees were driven more by permit status, ad hoc requests, and major changes in conditions on the ground, such as drought. One potential area for future Extension education is in the area of creating annual plans. Some funding opportunities, such as EQIP grants, require a management plan; thus, having annual plans may help ranchers be better positioned to pursue these funds. Developing plans, particularly plans for coping with drought, can

be particularly important for risk management for ranchers in Arizona (Brugger, Hawkes, Bowen, & McClaran, 2018; Hawkes, 2018; Tolleson, 2017).

Most ranchers reported that they made consistent changes to their plans for the ranch based on conditions on the ground. Nearly all survey respondents (99%) somewhat or strongly agreed that they make changes to their plan through the year based on what they see on the range, and the majority (79%) agreed that they make changes based on water availability. Opinions were much more mixed on adhering strictly to plans throughout the grazing season. The majority (62%) disagreed that they only made changes when asked to by the agency. As discussed in the Monitoring section, ranchers who participated in focus groups often discussed how their informal monitoring influenced their management decisions, particularly what they saw in terms of forage availability and water availability. There were no significant differences in answers by agency or by Extension involvement. Ranchers in the Mohave region were the most likely to indicate that they adapted their plans throughout the year, strongly disagreeing with the statement that they stuck to their plans for the grazing season (Mohave: 23%; Southeastern: 12%; Central: 11%; p=0.029).

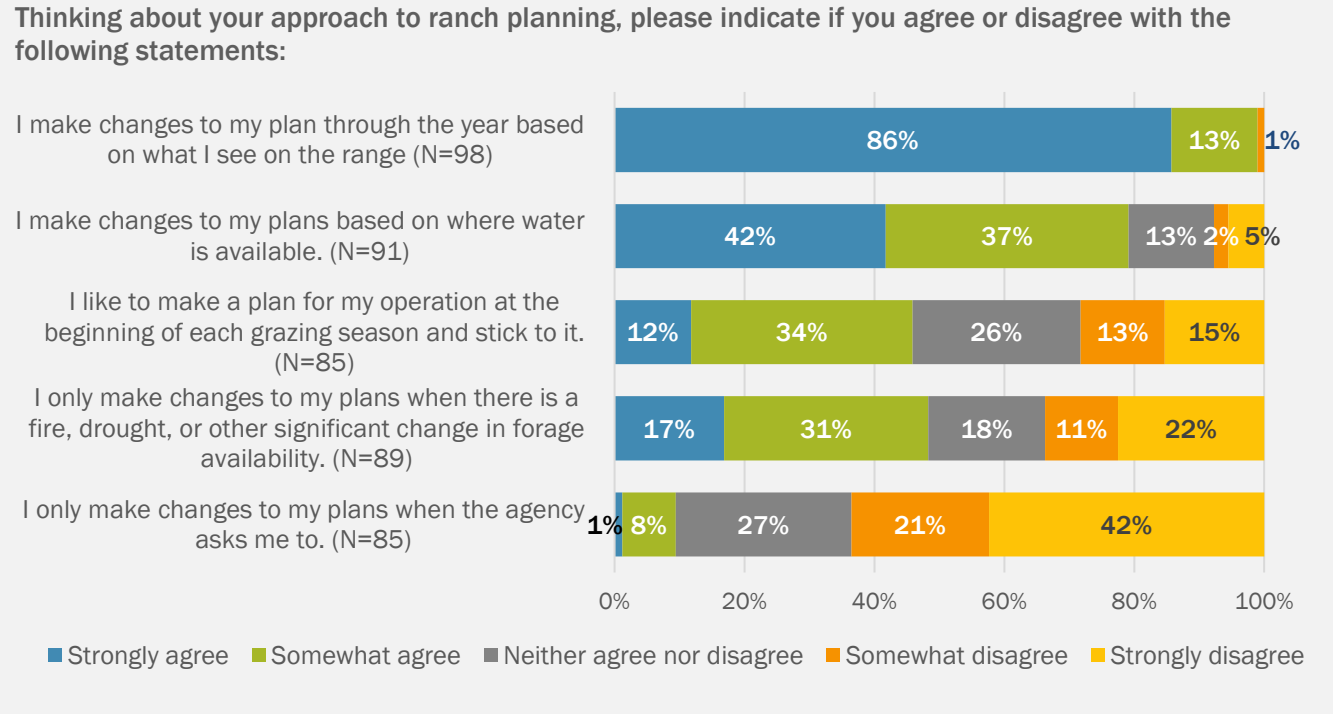


Figure 14. Approaches to ranch planning

Relationships with Federal Agencies

Surveyed ranchers were asked their perceptions of federal agencies and management processes. The majority of respondents (63%) strongly or somewhat agreed that the federal agencies were willing to work with them on changing management of their allotment, and nearly 60 percent agreed that the agency listened to their concerns. About half of respondents felt that the agency was a good partner and worked them to interpret monitoring data (54% & 53%, respectively). Only a small percentage (15%) felt the agency asked them to make changes that would not help the land. These items were highly correlated with one another (Cronbach's α=0.79), so the items were combined into a mean scale score. There were no significant differences in mean scale scores by Extension involvement, region, or agency permit status.

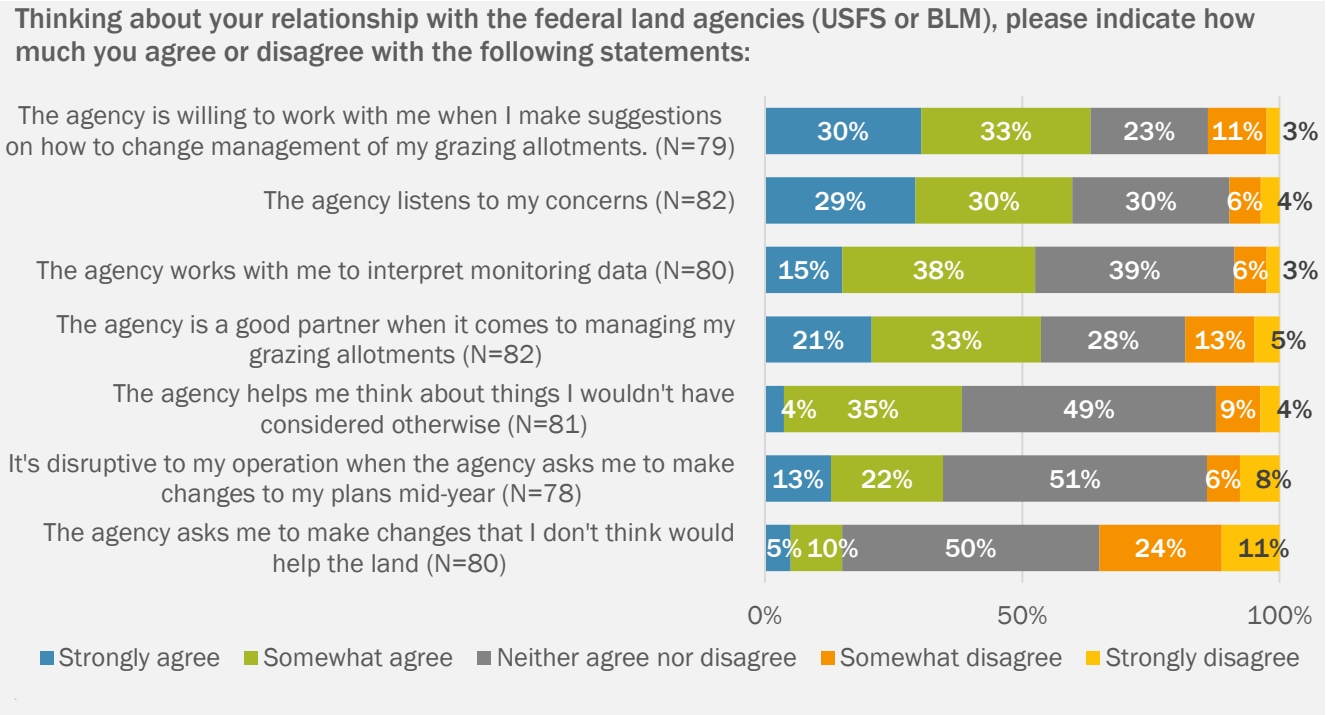


Figure 15. Relationships with federal agencies

However, survey respondents were much less positive in their attitudes toward federal laws and policies. Most respondents (77%) felt that federal laws and policies made ranch management harder, and only about a third (31%) felt that federal laws and policies provided necessary limitations on their management options. Again, there were no significant differences in the frequency of responses by Extension involvement, region, or agency permit status. These attitudes also clearly emerged in the focus groups as ranchers commonly expressed frustration with changes in federal policy, the slowness of the process of permitting, and perceptions of overwhelming bureaucratic red tape. Federal agency staff interviewed noted that there were often differences in permittee attitudes toward the local office of the agency compared to the agency overall. While permittees often had positive relationships with local agency staff through years of built trust, they still frequently expressed frustration with what was happening in larger policies or the agency as a whole.

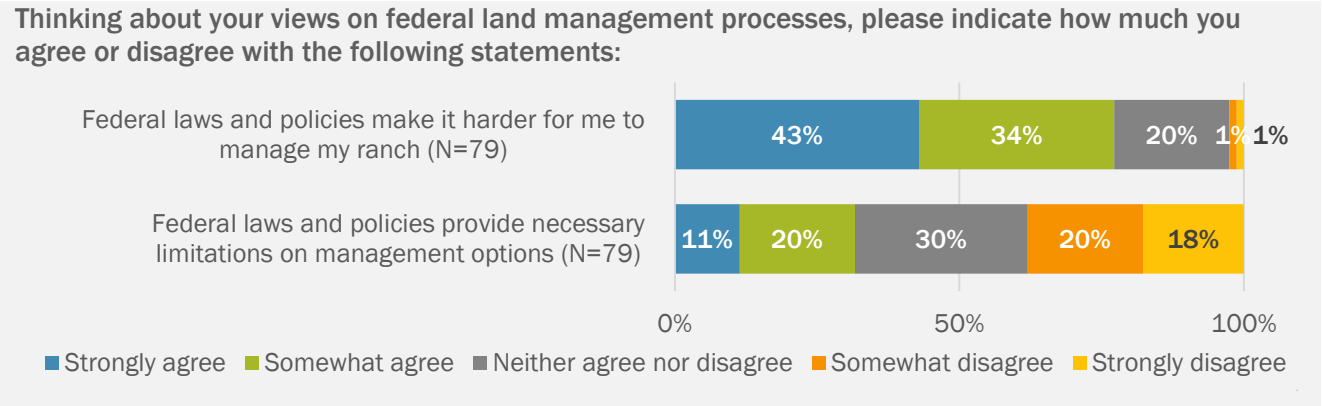


Figure 16. Views on federal laws and policies

The National Environmental Policy Act (NEPA) process was viewed negatively by both survey respondents and focus group participants. Among ranchers with federal grazing permits (N=76), 32 percent reported that their permit went through a NEPA process, 36 percent reported it had not gone through NEPA, and 33 percent reported they did not know. Most survey respondents (76%) strongly or somewhat agreed that the NEPA process took longer than it used to, and only 15 percent of respondents felt that on balance the NEPA process was more good than bad. While more than half (57%) agreed that federal agencies made sure they knew when a NEPA process was happening for one of their allotments, only 37 percent agreed that federal agencies communicated with them throughout the NEPA process. In focus groups, both ranchers with BLM allotments and USFS allotments repeatedly emphasized how long NEPA processes were taking, with some ranchers mentioning delays of up to a decade or more. In interviews with agency staff, lack of funding, fear of litigation, and lack of staff were cited as some of the factors leading to backlogs of permit renewals and environmental assessments. However, both ranchers and agency staff agreed that monitoring was especially important in the NEPA process, and some agency staff felt optimistic that the NEPA process will improve in the future.

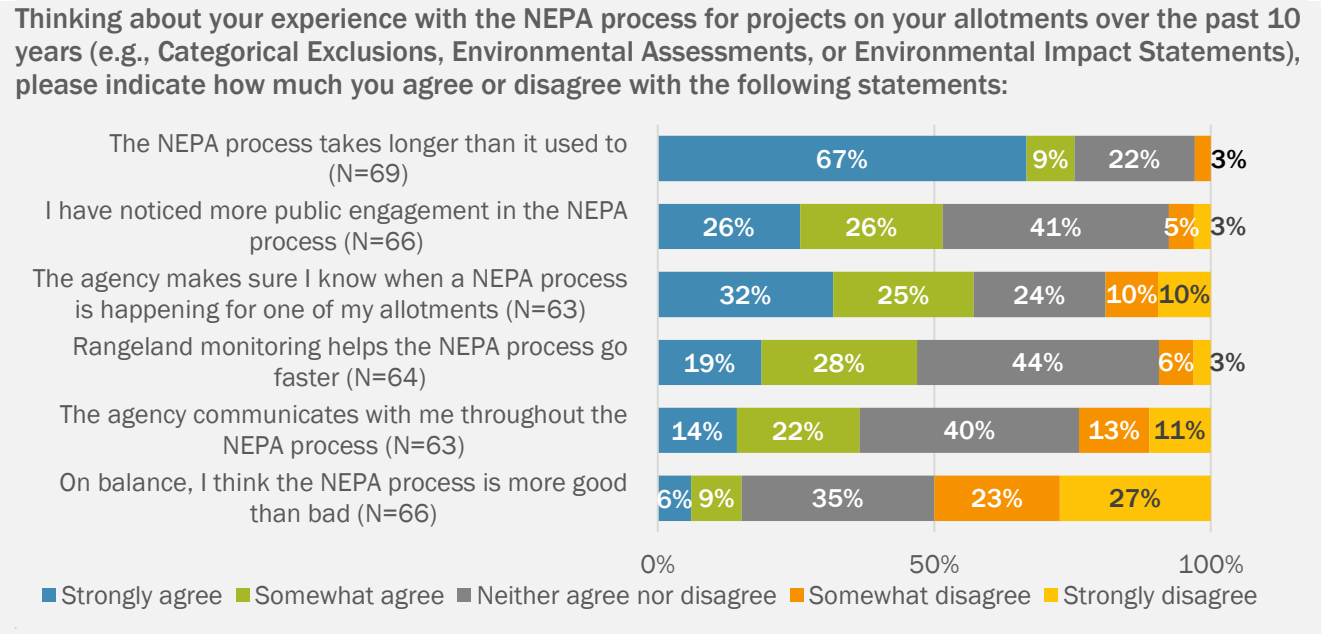


Figure 17. Views on NEPA

Most survey respondents felt that monitoring had improved or left unchanged their relationship with federal and state land agencies. The majority of respondents with USFS permits (71%) felt that monitoring had somewhat or greatly improved their relationship with USFS, while only 40 percent of respondents with BLM permits felt that monitoring had improved their relationship with BLM and a small percentage felt it had worsened the relationship. There were no major differences by Extension involvement or region.

To what extent has monitoring on your grazing allotments and leases improved or worsened your relationship with the following agencies?

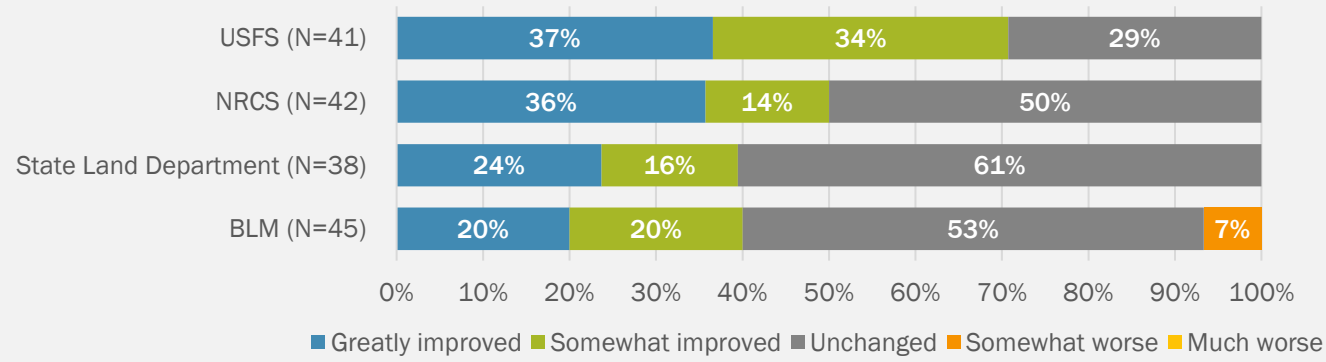


Figure 18. Effect of monitoring on relationships with land management agencies

Factors influencing the relationships between specific federal land agencies and ranchers are discussed the following sections.

Bureau of Land Management (BLM)

Surveyed ranchers reported mixed opinions on changes in their relationship with BLM. While 38 percent of respondents somewhat or strongly agreed there was now more collaboration between themselves and BLM, 21 percent disagreed with that statement. Equal shares of respondents agreed that they felt more respected as those who disagreed with that statement. There were no major differences by region or involvement with Extension. In focus groups, rancher relations with the BLM were largely determined by the area in which permittees were ranching. In one area, ranchers reported a very positive relationship with BLM. They identified staff longevity in the office and familiarity with the realities of ranching in the region as two major factors that positively influenced the relationship between BLM and local ranchers. In another region, ranchers reported a more contentious relationship with BLM, influenced in part by frequent staff turnover. Ranchers expressed frustration with continually having to build new relationships and frequent changes in policy and rules that often came when new staff were hired. They also felt that policy changes were not well-communicated and that even when their input was sought on policy changes it did not influence the agency's final decision. In this region, ranchers viewed BLM as biased against ranchers and recalled specific incidents of interpersonal conflict with particular staff.

Across both focus groups, participants agreed that communication was a key component of the relationship. Those ranchers who felt that agency staff frequently communicated with them and responded to their concerns generally reported more positive relationships with BLM. Ranchers expressed the desire for agency staff to recognize their role in stewarding the land in the area for

many decades and expressed concerns about future balancing of land management for multiple uses. Beyond concerns about what were perceived as "anti-cow" environmental groups, ranchers also worried about recreational users, particularly recreational vehicles, which they saw as a growing problem for range conditions.

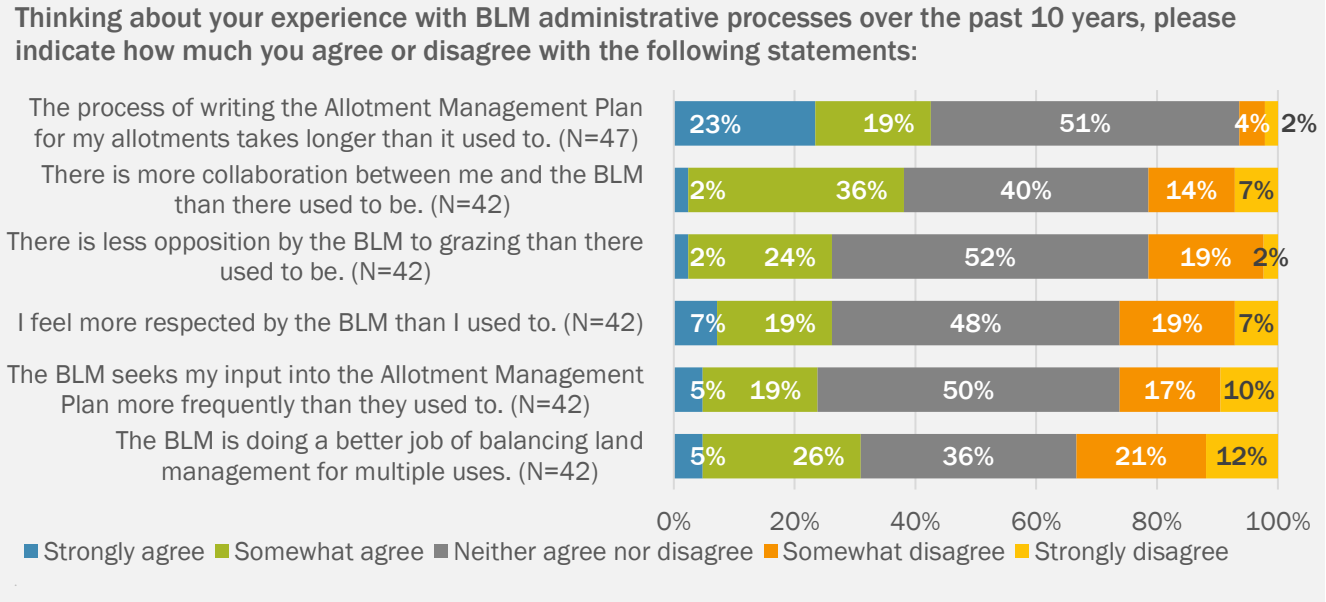


Figure 19. Attitudes toward relationship with BLM

BLM staff interviewed also recognized that rancher-agency relationships varied regionally. In one area, staff cited a multi-decade history of good relationships between their local office and ranchers in the region, driven largely by staff having a long tenure in the area and knowledge of the local context. All BLM staff interviewed highlighted the key importance of communication in agency-rancher relationships; being able to clearly communicate the agency's decisions and the reasons behind them were viewed as key for building trust. Several staff highlighted that the agency's priorities were focused around the health of the land, and while this generally aligned with rancher priorities, there sometimes was conflict between prioritizing land health and prioritizing livestock wellbeing. The Extension monitoring program was generally viewed as helping improve relationships by providing opportunities for dialogue with permittees and a common frame of reference for both staff and ranchers when making decisions.

Staff also noted the influence of external factors in their relationships with permittees. They noted that rancher attitudes toward the federal government in general could make relationships easier or significantly more challenging. Drought and the presence of endangered animals could add tension to relationships as staff needed to ask ranchers to change their management practices. Overall, staff highlighted the importance of communication and relationship-building as the key components of improving rancher-agency relationships. As one interviewee put it, "80-90% of [their] job is more people-related than cattle-related." Most staff emphasized the need for strong interpersonal skills to build healthy agency-rancher relationships.

Forest Service (USFS)

Surveyed ranchers expressed somewhat positive views of changes in their relationship with USFS. Well over half (61%) strongly or somewhat agreed that there was more collaboration between themselves and USFS, and nearly half (48%) felt that there was less opposition by USFS to grazing than there used to be. Substantially more respondents (42%) agreed that they felt more respected by USFS than they used to than disagreed (23%). There were no significant differences by Extension involvement or region. These sentiments were echoed in the rancher focus group. All participants agreed that their relationships with USFS has substantially improved in the past ten years, in part because of how poor relationships were ten years ago. Multiple participants referenced incidents that occurred in the 1990s and early 2000s as low points that broke their trust in the agency, but most felt that since then relations had greatly improved. Participants frequently pointed to the Reading the Range monitoring program as a key component in improving relationships through providing a common set of data that everyone trusted and was willing to base decisions on.

Ranchers noted that their relationship with USFS was highly dependent on the staff managing their allotments and communicated frustration with high turnover rates, which meant they had to frequently "educate" new staff about their allotments. They commonly classified staff as either "pro-cow" or "anti-cow" and discussed how important this was for working with staff. Participants expressed concern that many staff were not highly knowledgeable about the local context, noting that many USFS policies were designed around grass and left out the importance of browse for grazing on their allotments and that staff sometimes failed to recognize the local nuances in climate and conditions. Several ranchers discussed their desire to have USFS staff participate more frequently in monitoring with ranchers, as they felt that it was a valuable opportunity for relationship building and communication.

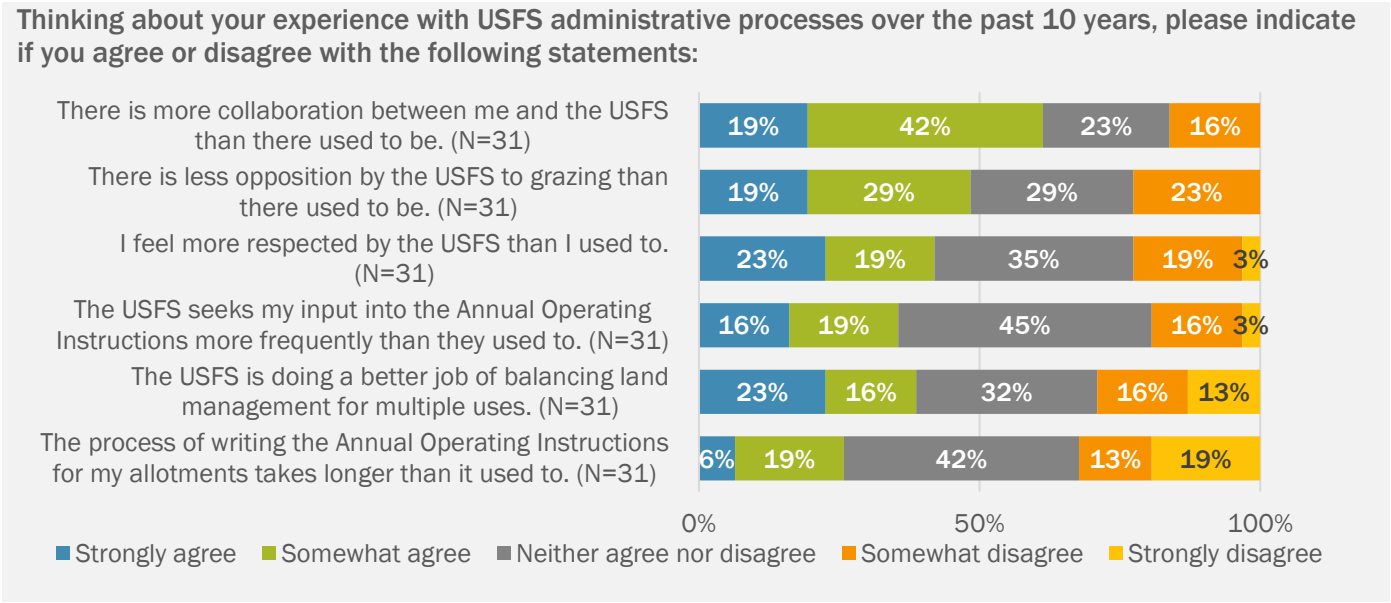


Figure 20. Attitudes toward relationship with USFS

USFS staff interviewed also felt strongly that the relationship between ranchers and the agency had greatly improved, largely because of the damage that drought destocking in the early- to mid-2000s had done to permittee-agency relations. Staff consistently pointed to the Reading the Range program as a key part of rebuilding trust. Participating in workshops and going out with ranchers to monitor created opportunities for dialogue, and having a common, trusted set of data helped build transparency around agency decisions. Multiple staff emphasize the importance of coming to decisions together with the permittee and clearly communicating the reasoning behind decisions. Similar to the sentiments expressed by BLM staff, USFS staff also highlighted that "managing range isn't about managing land—it's about managing people." Communication, collaboration, and transparency were consistently emphasized as critical to improving rancher-agency relations.

Roles of Extension

Through the survey, agency staff interviews, and rancher focus groups, Cooperative Extension was discussed as having multiple roles in rangeland management: serving as a resource for agency staff and ranchers; serving as a trusted, unbiased third-party; and providing direct monitoring services. In the rancher survey, Cooperative Extension workshops were listed as the second most popular source for information (76%) to improve ranching operations, second only to other ranchers (82%). Nearly half of respondents (49%) reported that they found information to improve their ranching operation from a Cooperative Extension agent (through either phone calls or visits). Cattle Growers associations (54%), agency range conservationists (48%), and industry magazines (45%) were other popular sources of information.

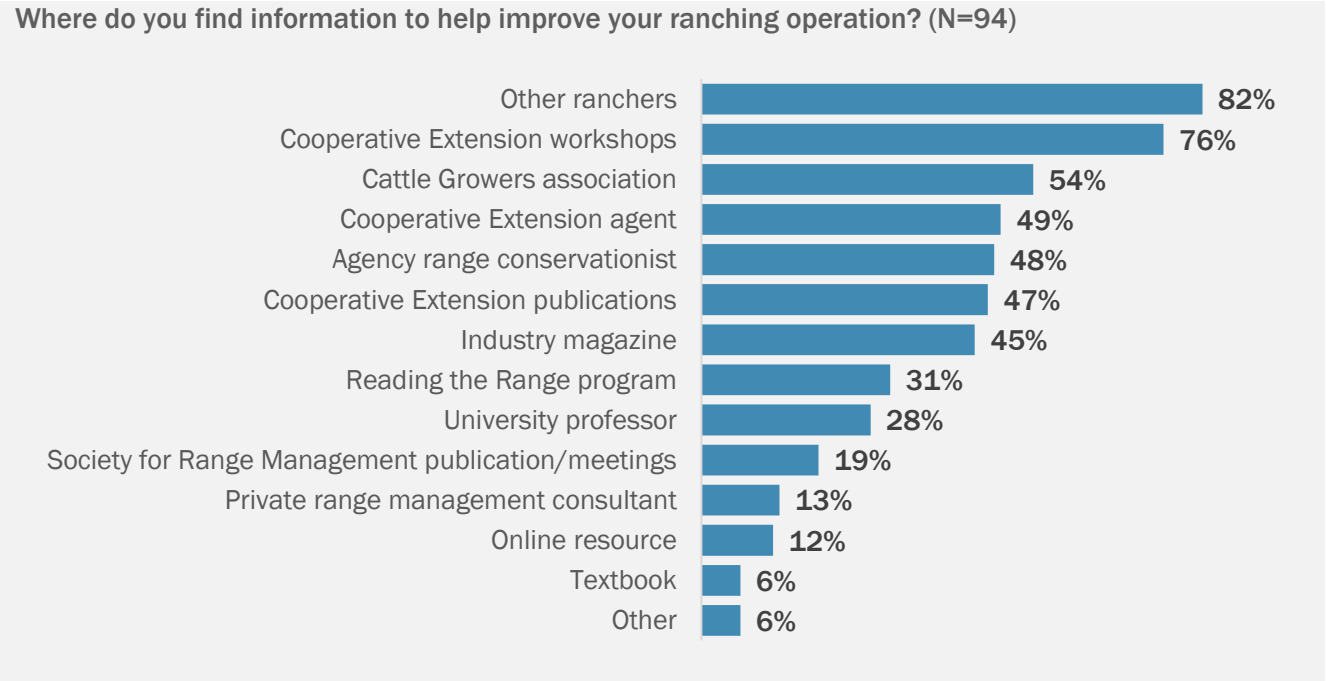


Figure 21. Sources of information for ranching

Most survey respondents reported that they had obtained rangeland monitoring services from Arizona Cooperative Extension. Of the ranchers that received services, 88 percent felt it had increased their knowledge and understanding of rangeland monitoring “a lot” or “somewhat,” and just over half (56%) indicated that it had affected their ranch or range management activities. There were no significant differences by region or agency permit status; both BLM and USFS permittees expressed similar response frequencies.

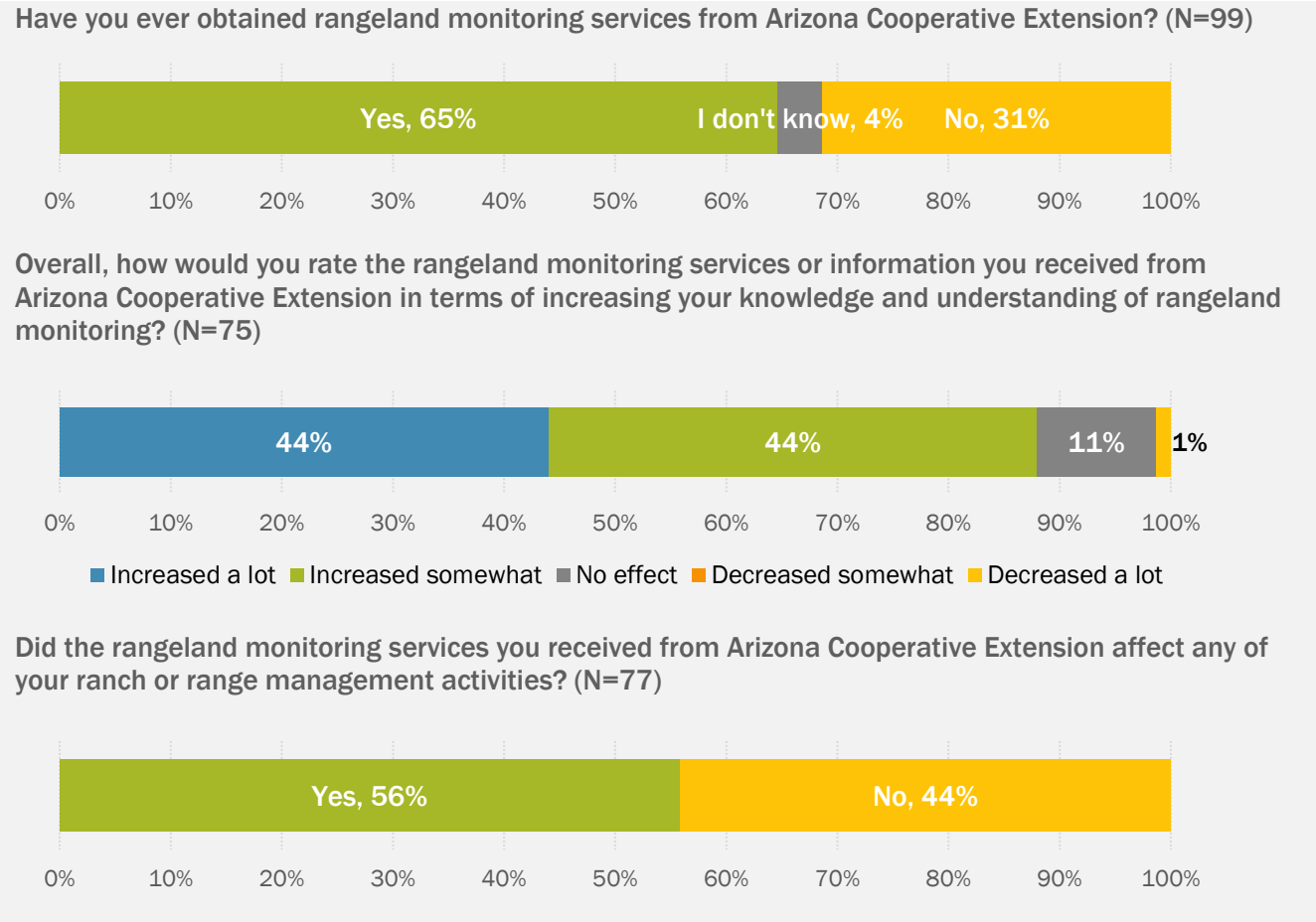


Figure 22. Involvement with Extension

In focus groups, both ranchers with BLM permits and those with USFS permits consistently said that Extension was an institution they trusted and viewed as an unbiased third party. Multiple ranchers indicated that they believed that Extension's involvement in rangeland monitoring had improved their relationship with federal agencies by serving as somewhat of a mediator and bringing everyone, both ranchers and agencies, to the table to talk about issues affecting them. Participants also communicated a high degree of trust in Extension agents' and staff's technical expertise and emphasized how educational their interactions with Extension personnel were, especially during monitoring activities. Ranchers clearly expressed that they wanted to be sure that Extension-collected monitoring data was included in NEPA processes on their allotments because they trusted the data collected by Extension more than that collected by the federal agencies.

Agency staff also expressed high levels of trust in Extension's technical expertise and the quality of monitoring data gathered through Extension monitoring programs. Staff generally highly valued Extension as a source of resources to help with their own education as well as educating ranchers about rangeland monitoring. Multiple staff discussed the value of being able to call an Extension agent and talk through monitoring data or potential issues; they viewed Extension agents as a trusted, third-party resource with good judgment and technical expertise about monitoring and management.

USFS staff in particular emphasized the value of the Reading the Range program in helping them keep up with monitoring across many allotments, especially when agency staff are often stretched thin. They also noted that the Reading the Range program has been a key contributor to getting ranchers involved in monitoring and improving ranch management practices. Extension-led drought workshops were especially highlighted as valuable to improving rancher-agency relationships in the face of challenging range conditions.

BLM staff had mixed opinions on the value of Extension monitoring programs. Interviewed staff consistently expressed that they valued the data collected by the Extension monitoring programs and the role that Extension played in building trust between ranchers and the agency. However, some staff had changes they wanted to see the program make, including aligning monitoring practices more closely with BLM management practices, providing more information on site selection criteria, improving training of Extension staff who work in BLM offices including adding more training on vehicle safety, and considering expanding the scope of work that Extension staff placed in BLM offices can be involved in beyond strictly certain kinds of monitoring.

Future Directions

Both agency staff and ranchers were asked what they would like to see from Cooperative Extension in the future. Surveyed ranchers expressed that they would like to see more on-site workshops, especially closer to where they live, and one-on-one visits. They also consistently indicated that they would like more training on how to interpret and use the monitoring data in their day-to-day management because some felt that currently the data just sat “on the shelf” and was not regularly used. Rancher focus group participants echoed many of these sentiments, expressing that they did not always feel confident enough to interpret monitoring results and that they would like to get their monitoring data back more frequently. Several survey respondents also suggested changes to the way dissemination of Extension materials occurred, including revising reports to be more accessible to a lay audience, providing more frequent feedback on monitoring results, and creating a listserv to disseminate Extension publications. Table 5 shows rancher suggestions for future workshop topics.

Agency staff had varying suggestions for future directions in Extension. Several staff indicated that they would like to see prioritization of ongoing workshops that bring multiple agencies and groups together because having Extension, ranchers, NRCS, USFS, BLM, and state lands all around the same table greatly helped with keeping everyone on the same page. USFS staff indicated that they would like to see more monitoring points to allow better pinpointing of pasture-level changes but recognized that this might not be feasible with current staffing. They also indicated that they would like to see more integration of soil and terrain data as well as help with riparian management and monitoring and with browse monitoring. Overall, USFS staff expressed that they highly valued the Reading the Range program, particularly the consistency it brought to the data, and that they wanted to ensure the program continued and even expanded.

BLM staff pointed to changes that are coming to BLM monitoring protocols and how that might affect the monitoring program. BLM is moving towards nationwide implementation of the Assessment, Inventory, and Monitoring protocols, which will focus more on landscape-level

monitoring with potentially different sampling points than currently used (Taylor et al., 2014; Toevs, Taylor, Spurrier, MacKinnon, & Bobo, 2011). As of early 2019, staff were still unsure what this new protocol would mean for legacy monitoring data, but they emphasized the value of having long-term trend data and indicated that they wanted to ensure this trend data was not lost. In most regions, BLM staff wanted to see the Extension monitoring program continue but indicated that there would likely need to be a shift away from a cooperative agreement toward a contracting process to make that possible. BLM staff also emphasized the value they saw in Extension workshops and engagement with ranchers and that they wanted to see these continue.

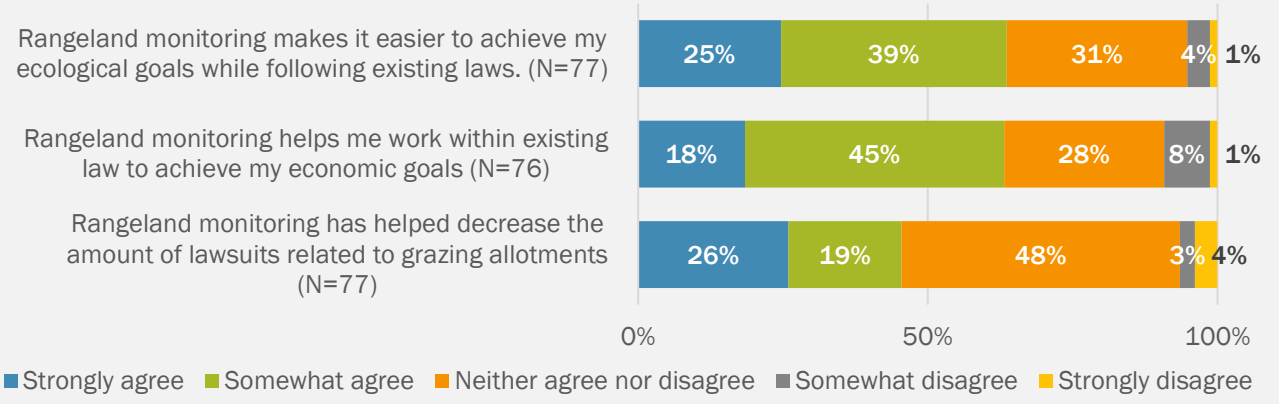
Table 5. Suggested Extension Workshop Topics

Region	Suggested Workshop Topics
All	Animal health
Arizona Strip	Livestock handling
	Control of Russian Thistle
	Historical weather patterns and changes
	How to select key areas
	How to interpret monitoring results
	Monitoring data analysis
Central Arizona	Cattle breed selection
	Genomic testing
	Distribution of cattle during drought
	Targeted grazing
	Riparian health indicators and grazing in riparian areas
	Grass identification
	Herbicide use on USFS land
	Remote sensing on vegetation
	How NEPA processes work
	Funding sources for ranches & ranch projects
	Record keeping and bookkeeping for ranchers
Kingman	Poisonous plants
	How NEPA processes work
Southeastern Arizona	Horse feeding & care
	Year-round calving
	Nutritional supplementation
	Seasonal riparian closures
	Forage species and seeding
	Erosion control
	Johnson Grass eradication
	Alternatives to full cow management
	Land management for multiple uses
	Effects of grazing on endangered species in riparian areas
	Financial strategies for raising cattle
	New technologies for monitoring (GPS, UAVs, theodolite)

Litigation

Surveyed ranchers generally agreed that rangeland monitoring helped them remain within the bounds of existing laws. Most survey respondents strongly or somewhat agreed that rangeland monitoring helped them achieve their ecological goals (64%) and economic goals (63%) while still following existing laws. They were less certain whether monitoring had contributed to a decrease in litigation; 45 percent strongly or somewhat agreed that monitoring had helped decrease the number of lawsuits related to grazing allotments while 48% neither agreed nor disagreed.

Thinking about your views on federal land management processes, please indicate how much you agree or disagree with the following statements:



This mirrored the conversation in all three focus groups. Participants were generally unsure whether the volume of litigation had decreased, and some felt that if there had been a decrease it was only due to the lack of NEPA processes being completed. Interviewed agency staff similarly did not feel that rangeland monitoring programs had necessarily led to a decrease in the volume of litigation. Several staff indicated that they felt litigation was consistently a given, due to the controversy of "grazing in the desert." However, all staff indicated that having long-term trend monitoring data was vital to defending their decisions in the case of litigation. Most staff felt confident they could easily win lawsuits because their decisions were backed up with reliable data. Rancher focus group participants echoed the same sentiment that monitoring data provides an essential defense in the case of litigation. Nearly all participants indicated that protection in the case of a lawsuit around their grazing allotment was a very important reason why they participated in monitoring. As one participant stated, "It's going to be increasingly important that we have this data to back up what we're doing out there and to show that we're not harming the range."

Summary & Conclusions

Both ranchers and agencies face a multitude of challenges and opportunities as they seek to manage public and private rangelands in Arizona. This mixed method evaluation revealed the following key findings:

- **Arizona ranchers recognize the value of rangeland monitoring.**

  All ranchers surveyed and those participating in focus groups used informal monitoring in their ranching operations, and the vast majority of ranchers also used formal monitoring methods. Monitoring was viewed as essential for maintaining grazing permits on public lands in the face of challenging conditions.

- **Involvement with Extension is linked to use of more monitoring methods.**

  Ranchers involved with Extension used more monitoring methods than those who were not involved. They were also more likely to report that they did sufficient monitoring compared to ranchers not involved with Extension. This suggests that involvement with Extension encourages ranchers to do more monitoring across all kinds of land ownership statuses.

- **Rancher-agency relationship are complicated but potentially improving.**

  Arizona ranchers did not have very positive views of federal laws and policies regarding rangeland management, particularly the NEPA process. However, most did feel that land management agencies were willing to work with them and listened to their concerns. USFS permittees in particular felt that their relationship with USFS had improved since its low point in the early 2000s. Both agency staff and ranchers highlighted the importance of communication, transparency, and staff tenure in building good relationships between permittees and federal agencies. Both groups also emphasized the importance of Extension rangeland monitoring programs in helping to facilitate relationship-building by getting all parties on the same page and creating opportunities for dialogue.

- **Extension monitoring programs are viewed as key sources of reliable data.**

  Both ranchers and agency staff consistently indicated that they value the data collected through Extension monitoring programs. For many areas, Extension has been involved in compiling multiple decades of consistent monitoring data, which is used widely in permit renewals and environmental assessments. The majority of ranchers surveyed indicated that they saw having an unbiased third party involved in monitoring as essential, and Extension was consistently viewed as the most unbiased resource available to ranchers. Multiple ranchers in focus groups expressed that they felt the future of their ranches depended on having reliable trend data like that provided by Extension

- **Extension is a trusted source of information and expertise.**

  Extension is viewed by both ranchers and agency staff as a valuable resource. Ranchers view Extension as unbiased and report using Extension workshops as one of their primary sources of information to help improve their ranching operations. Agency staff expressed

high levels of trust in the expertise of local extension agents. They also highlighted the role that Extension plays in bringing ranchers and agencies together and serving as a facilitator in the relationship between agencies and their permittees.

- **Future directions for Extension programming include further education and promotion of inter-agency collaboration.**

  Extension is valued by both ranchers and agency staff for its ability to bring a variety of stakeholders to the table. Through this evaluation, agency staff and ranchers raised ideas for education on specific topics as well as potential areas for further support with monitoring services. Both groups of stakeholders expressed desires for further workshops where multiple federal agencies, state agencies, and local groups could work together to plan for some of the challenges facing land managers in the West, particularly drought.

As Arizona Cooperative Extension considers future directions in rangeland monitoring programming, Extension faculty and staff can build on the success of current programs in encouraging the use of multiple monitoring methods, providing valuable and reliable data and expertise, and facilitating productive dialogue between agencies and ranchers. Extension can provide further education and training on topics relevant to agencies and staff, with a focus on creating spaces for multiple stakeholders to come together to talk about key issues facing rangelands. As federal agencies change the ways they work to monitor rangelands, Extension will need to adapt their rangeland monitoring programs to respond to the needs of both Arizona ranchers and agency land managers. However, given the overall value and trust placed in Extension by both ranchers and agency staff, it is clear that Extension plays an important role in the future of rangeland management in Arizona.

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Appendices

Appendix 1: Survey Tables

Table 6. What types of informal monitoring do you do on your ranch?

Informal Monitoring	(N=101)
Observe grass height, density, or vigor	100%
Observe the condition of my cattle	98%
Observe amount of forage remaining	96%
Observe weather	92%
Observe erosion	85%
Observe wildlife	77%
Other informal monitoring	29%
I do NO informal monitoring	0%
Mean number of methods	5.8

Table 7. Do you do any formal monitoring on your ranch (i.e. precipitation, vegetation, riparian, utilization)?

Formal Monitoring	(N=101)
Yes	86%
No	14%

Table 8. In the past 10 years, what types of formal monitoring have you done on your private land, USFS and BLM allotments, or state land grazing leases?

Formal Monitoring Types	Private Land (N=71)	USFS (N=40)	BLM (N=30)	State Land (N=29)
Vegetation Measurements:				
Pace frequency	20%	63%	43%	41%
Herbaceous utilization	24%	70%	37%	41%
Browse utilization	20%	53%	40%	38%
Dry weight rank	10%	65%	23%	21%
Clip biomass (production)	10%	63%	13%	14%
Transect or plot-based cover estimate	11%	30%	30%	38%
Riparian utilization	15%	35%	23%	17%
Ocular estimates of cover	14%	33%	27%	14%
Grazing exclosures	17%	35%	40%	28%
Comparative yield	6%	30%	10%	3%
Line intercept	4%	18%	17%	17%
Parker 3-step	6%	28%	10%	10%
Riparian vegetation density or cover	10%	23%	13%	17%
Belt density	0%	8%	0%	0%
Other Measurements:				
Measure precipitation	93%	65%	77%	76%
Photo points	38%	68%	57%	62%
Upland Health Assessment	8%	38%	23%	14%
Water quality	23%	18%	17%	10%
Streambank stability	11%	15%	10%	7%
Wildlife habitat surveys	13%	20%	17%	14%
Other formal monitoring	1%	10%	3%	0%
Mean Number of Monitoring Methods	*3.5*	*7.8*	*5.3*	*4.8*

Table 9. In the past 10 years, who has participated in monitoring on your private land, USFS and BLM allotments, or state lands grazing leases?

Monitoring Participants	Private Land (N=61)	USFS (N=41)	BLM (N=31)	State Land (N=27)
Ranch owner	87%	85%	90%	89%
Family member(s)	41%	51%	39%	37%
NRCS (SCS) range conservationist	41%	34%	42%	56%
Cooperative Extension agent or staff	18%	66%	45%	30%
Hired ranch worker(s)	16%	32%	16%	11%
BLM range conservationist	11%	0%	81%	22%
Private range management consultant	10%	34%	10%	4%
University faculty	10%	51%	26%	11%
State Land Dept. range conservationist	8%	2%	16%	41%
Ranch planning team	7%	5%	3%	4%
Other	7%	5%	6%	7%
USFS range conservationist	3%	83%	3%	4%

Table 10. How important to you are the following reasons for monitoring?

Reasons for Monitoring	Very important	Somewhat important	Not too important	Not at all important	Mean*
Helps me know if the condition of my range is improving or not (N=87)	82%	15%	2%	1%	3.8
Helps me determine if my management objectives are being met (N=82)	76%	20%	4%	1%	3.7
Helps me maintain or increase permitted AUMs (N=77)	64%	18%	10%	8%	3.4
Helps me decide when to decrease or increase my herd size (N=80)	55%	28%	14%	4%	3.3
Helps me decide when and where to move my livestock (N=82)	50%	37%	10%	4%	3.3
Increases my credibility with land management agencies (N=75)	53%	32%	8%	7%	3.3
Increase the overall value of my ranch (N=81)	54%	25%	17%	4%	3.3
Protects my property rights (N=71)	48%	27%	14%	11%	3.1
Increases my credibility with the public (N=72)	33%	35%	25%	7%	2.9
Protects me against lawsuits (N=72)	39%	24%	22%	15%	2.9
Helps me get government funds for range improvements (N=70)	24%	34%	27%	14%	2.7
Required by a government program (N=66)	23%	26%	35%	17%	2.5

*Values closer to 5 indicate high importance while numbers closer to 1 indicate low importance

Table 11. How do you feel about the amount of monitoring you do now?

Amount of Monitoring	(N=90)
I do more than enough monitoring	14%
I do about the right amount of monitoring	49%
I should do more monitoring	37%

Table 12. How important is it to you to have an unbiased third party participate in rangeland monitoring?

Importance of Third Party Monitoring	(N=91)
Very important	47%
Somewhat important	38%
Not too important	10%
Not at all important	4%

Table 13. How biased do you think the following resources are?

Bias of Resources	Completely unbiased	Somewhat unbiased	Somewhat biased	Completely biased	Mean*
Cooperative Extension agent or staff (N=84)	56%	38%	6%	0%	3.5
NRCS (SCS) range conservationist (N=83)	48%	41%	11%	0%	3.4
Private range management consultant (N=65)	35%	52%	12%	0%	3.2
University faculty (N=67)	42%	39%	18%	1%	3.2
Ranch planning team (N=58)	22%	53%	22%	2%	3.0
State Land Dept. range conservationist (N=57)	25%	49%	25%	2%	3.0
BLM range conservationist (N=57)	18%	46%	32%	5%	2.8
USFS range conservationist (N=71)	17%	34%	34%	15%	2.5

Table 14. How much does each factor affect your decision to conduct formal monitoring?

Monitoring Barriers	Affects me a lot	Affects me somewhat	Affects me a little	Doesn't affect me at all	Mean*
Lack of time (N=88)	27%	35%	27%	10%	2.8
Lack of help (N=84)	23%	40%	23%	14%	2.7
Tediousness of monitoring (N=82)	13%	34%	28%	24%	2.4
Lack of consistent monitoring methods between agencies or over time (N=79)	22%	19%	29%	30%	2.3
Lack of knowledge of monitoring methods (N=87)	15%	29%	29%	28%	2.3
Lack of confidence in monitoring skills (N=89)	19%	19%	31%	30%	2.3
Complexity of monitoring (N=83)	14%	27%	29%	30%	2.3
Expense (N=82)	15%	21%	32%	33%	2.2
Monitoring doesn't help me make management decisions (N=82)	15%	17%	32%	37%	2.1
Lack of confidence in scientific validity of monitoring methods (N=83)	8%	24%	31%	36%	2.0
The agency already does enough monitoring (N=54)	13%	20%	15%	52%	1.9
Land management agency won't accept my monitoring data (N=82)	17%	10%	20%	54%	1.9
I'm afraid monitoring results could be used against me (N=82)	12%	12%	22%	54%	1.8
Monitoring is the agency's responsibility (N=52)	8%	12%	29%	52%	1.8

Table 15. In the last 10 years, have you carried out any of the following management practices on your private grazing land, USFS or BLM allotments, or state lands leases?

Management Practices	Private Land (N=77)	USFS (N=44)	BLM (N=48)	State Land (N=43)
Rotational grazing	82%	91%	83%	86%
Laid water pipelines	65%	66%	56%	60%
Drought destocking	56%	73%	67%	65%
Mechanical brush removal	36%	18%	6%	21%
Erosion control structures	35%	16%	8%	23%
Continuous, year-round grazing	32%	9%	23%	19%
Reseeding	29%	5%	8%	19%
Wildlife friendly fencing	27%	45%	31%	26%
Herbicides	26%	5%	21%	28%
Install wildlife waters	22%	43%	21%	21%
Seasonal grazing of riparian areas	21%	45%	33%	14%
Non-use (other than drought)	19%	34%	31%	23%
Spring development	16%	48%	25%	12%
HRM or Savory grazing	10%	7%	15%	12%
Fenced streambanks or riparian areas	8%	18%	2%	2%
Prescribed burn	8%	25%	15%	7%
Mean Number of Management Practices	4.9	5.5	4.5	4.4

Table 16. Is there a difference in how you approach range management on your private land compared to public land grazing allotments?

Public-Private Differences	(N=91)
Yes	23%
No	77%

Table 17. Do you write an annual plan for managing your public grazing allotments?

Annual Management Plans	(N=95)
Yes, I make an annual written plan in collaboration with the agency	38%
Yes, I make an annual written plan by myself	8%
No, but I make an informal plan that guides my decisions	31%
No, I do not make any annual plans	17%
No, the agency writes an annual plan that I follow	6%

Table 18. Thinking about your approach to ranch planning, please indicate if you agree or disagree with the following statements:

Approach to Ranch Planning	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Mean*
I like to make a plan for my operation at the beginning of each grazing season and stick to it. (N=85)	12%	34%	26%	13%	15%	3.1
I make changes to my plan through the year based on what I see on the range (N=98)	86%	13%	0%	1%	0%	4.8
I only make changes to my plans when the agency asks me to. (N=85)	1%	8%	27%	21%	42%	2.0
I only make changes to my plans when there is a fire, drought, or other significant change in forage availability. (N=89)	17%	31%	18%	11%	22%	3.1
I make changes to my plans based on where water is available. (N=91)	42%	37%	13%	2%	5%	4.1

Table 19. Do you have a grazing allotment with a federal land agency (USFS or BLM)?

Federal Grazing Allotment	(N=98)
BLM only	41%
USFS only	35%
BLM and USFS	6%
I don't have any federal grazing allotments	18%

Table 20. To what extent has monitoring on your grazing allotments and leases improved or worsened your relationship with the following agencies?

Relationship to Agency	Greatly improved	Somewhat improved	Unchanged	Somewhat worse	Much worse	Mean*
BLM (N=45)	20%	20%	53%	7%	0%	3.5
USFS (N=41)	37%	34%	29%	0%	0%	4.1
State Land Department (N=38)	24%	16%	61%	0%	0%	3.6
NRCS (N=42)	36%	14%	50%	0%	0%	3.9

Table 21. Thinking about your relationship with the federal land agencies (USFS or BLM), please indicate how much you agree or disagree with the following statements:

Perceptions of Federal Agency	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Mean*
It's disruptive to my operation when the agency asks me to make changes to my plans mid-year (N=78)	13%	22%	51%	6%	8%	3.3
The agency is a good partner when it comes to managing my grazing allotments (N=82)	21%	33%	28%	13%	5%	3.5
The agency asks me to make changes that I don't think would help the land (N=80)	5%	10%	50%	24%	11%	2.7
The agency helps me think about things I wouldn't have considered otherwise (N=81)	4%	35%	49%	9%	4%	3.3
The agency listens to my concerns (N=82)	29%	30%	30%	6%	4%	3.8
The agency is willing to work with me when I make suggestions on how to change management of my grazing allotments. (N=79)	30%	33%	23%	11%	3%	3.8
The agency works with me to interpret monitoring data (N=80)	15%	38%	39%	6%	3%	3.6

Table 22. In what year was your federal grazing permit last renewed?

Permit Renewal Year	(N=55)
2001-2009	9%
2010-2014	29%
2015-2019	62%
Mean	2014
Median	2016

Table 23. If your grazing permit was renewed, did it go through the NEPA process to update the Allotment Management Plan?

NEPA Process	(N=76)
Yes	32%
No	36%
I don't know	33%

Table 24. Thinking about your experience with the NEPA process for projects on your allotments over the past 10 years, (e.g., Categorical Exclusions, Environmental Assessments, or Environmental Impact Statements), please indicate how much you agree or disagree with the following statements:

Perceptions of NEPA	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Means*
The NEPA process takes longer than it used to (N=69)	67%	9%	22%	3%	0%	4.4
The agency makes sure I know when a NEPA process is happening for one of my allotments (N=63)	32%	25%	24%	10%	10%	3.6
The agency communicates with me throughout the NEPA process (N=63)	14%	22%	40%	13%	11%	3.2
Rangeland monitoring helps the NEPA process go faster (N=64)	19%	28%	44%	6%	3%	3.5
I have noticed more public engagement in the NEPA process (N=66)	26%	26%	41%	5%	3%	3.7
On balance, I think the NEPA process is more good than bad (N=66)	6%	9%	35%	23%	27%	2.4

Table 25. Thinking about your views on federal land management processes, please indicate how much you agree or disagree with the following statements:

Perception of Federal Land Management	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Means*
Federal laws and policies make it harder for me to manage my ranch (N=79)	43%	34%	20%	1%	1%	4.2
Federal laws and policies provide necessary limitations on management options (N=79)	11%	20%	30%	20%	18%	2.9
Rangeland monitoring helps me work within existing law to achieve my economic goals (N=76)	18%	45%	28%	8%	1%	3.7
Rangeland monitoring makes it easier to achieve my ecological goals while following existing laws. (N=77)	25%	39%	31%	4%	1%	3.8
Rangeland monitoring has helped decrease the amount of lawsuits related to grazing allotments (N=77)	26%	19%	48%	3%	4%	3.6

Table 26. Thinking about your experience with BLM administrative processes over the past 10 years, please indicate how much you agree or disagree with the following statements:

Experience with BLM	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Means*
The process of writing the Allotment Management Plan for my allotments takes longer than it used to. (N=47)	23%	19%	51%	4%	2%	3.6
The BLM seeks my input into the Allotment Management Plan more frequently than they used to. (N=42)	5%	19%	50%	17%	10%	2.9
There is more collaboration between me and the BLM than there used to be. (N=42)	2%	36%	40%	14%	7%	3.1
There is less opposition by the BLM to grazing than there used to be. (N=42)	2%	24%	52%	19%	2%	3.0
I feel more respected by the BLM than I used to. (N=42)	7%	19%	48%	19%	7%	3.0
The BLM is doing a better job of balancing land management for multiple uses. (N=42)	5%	26%	36%	21%	12%	2.9

Table 27. Thinking about your experience with USFS administrative processes over the past 10 years, please indicate if you agree or disagree with the following statements:

Experience with USFS	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Means*
The process of writing the Annual Operating Instructions for my allotments takes longer than it used to. (N=31)	6%	19%	42%	13%	19%	2.8
The USFS seeks my input into the Annual Operating Instructions more frequently than they used to. (N=31)	16%	19%	45%	16%	3%	3.3
There is more collaboration between me and the USFS than there used to be. (N=31)	19%	42%	23%	16%	0%	3.6
There is less opposition by the USFS to grazing than there used to be. (N=31)	19%	29%	29%	23%	0%	3.5
I feel more respected by the USFS than I used to. (N=31)	23%	19%	35%	19%	3%	3.4
The USFS is doing a better job of balancing land management for multiple uses. (N=31)	23%	16%	32%	16%	13%	3.2

Table 28. Over the past 5 years, what has been your annual ranch stocking rate?

Annual Ranch Stocking Rate	(N=62)
40-59%	18%
60-79%	21%
80-89%	19%
90-100%	42%

Table 29. Over the past 5 years, what is your annual average for the following?

Calving percent?	(N=80)
55-69%	4%
70-79%	10%
80-89%	44%
90-100%	43%
Mean	86%
Median	87%
Weaning percent?	**(N=73)**
30-69%	7%
70-79%	18%
80-89%	38%
90-100%	37%
Mean	89%
Median	85%
Calf weaning weight (lbs.)	**(N=77)**
175-399	9%
400-449	19%
450-499	21%
500-549	22%
550-599	17%
600-750	12%
Mean	482
Median	500

Table 30. On average, what portion of your household income typically comes from your livestock operation in a given year?

Income from Livestock	(N=93)
Less than 10%	24%
10-50%	32%
51-75%	17%
76-100%	27%

Table 31. On a percentage basis, what is the distribution of land ownership you use as part of your operation?

Distribution of Land Ownership	Private (owned or leased land) (N=82)	Federal land-USFS (N=33)	Federal land-BLM (N=41)	State (state trust land) (N=40)	Tribal (N=3)	Other (N=5)
None	1%	3%	5%	0%	100%	40%
1-25%	62%	12%	29%	53%	0%	0%
25-49%	6%	9%	7%	30%	0%	40%
50-74%	11%	12%	15%	10%	0%	20%
70-99%	9%	48%	44%	8%	0%	0%
100%	11%	15%	0%	0%	0%	0%
Mean	31%	75%	53%	28%	0%	26%

Table 32. Does your ranch (including private, public, and state lands) contain any riparian areas (perennial or intermittent)?

Riparian Areas	(N=94)
Yes	60%
No	40%

Table 33. About how many deeded acres of land do you have in your ranch?

Deeded Acres of Land	(N=92)
Less than 100 acres	29%
100-249 acres	13%
250-499 acres	7%
500-999 acres	11%
1,000-4,999 acres	23%
5,000 acres or more	17%

Table 34. What organizations are you a member of?

Organizational Membership	(N=98)
State Cattlemen's/Cattle Growers association	63%
Regional Cattlemen's/Cattle Growers association	44%
National Cattlemen's/Cattle Growers association	37%
A local or regional collaborative conservation group	19%
Society for Range Management	17%
Other	12%
I am not a member of any organizations	19%

Table 35. Where do you find information to help improve your ranching operation?

Information Sources	(N=94)
Other ranchers	82%
Cooperative Extension workshops	76%
Cattle Growers association	54%
Cooperative Extension agent (personal visit or phone call)	49%
Agency range conservationist	48%
Cooperative Extension publications	47%
Industry magazine	45%
Reading the Range program	31%
University professor	28%
Society for Range Management publication/meetings	19%
Private range management consultant	13%
Online resource	12%
Textbook	6%
Other	6%

Table 36. Have you ever obtained rangeland monitoring services from Arizona Cooperative Extension?

Monitoring Services from Extension	(N=99)
Yes	65%
No	31%
I don't know	4%

Table 37. Overall, how would you rate the rangeland monitoring services or information you received from Arizona Cooperative Extension in terms of increasing your knowledge and understanding of rangeland monitoring?

Knowledge & Understanding of Rangeland Monitoring	(N=75)
Increased a lot	44%
Increased somewhat	44%
No effect	11%
Decreased somewhat	0%
Decreased a lot	1%

Table 38. Did the rangeland monitoring services you received from Arizona Cooperative Extension affect any of your ranch or range management activities?

Extension Effect on Ranch Activities	(N=77)
Yes	56%
No	44%

Table 39. In what general area is your operation located?

Location	(N=97)
Southeastern Arizona	45%
Central Arizona	23%
Arizona Strip	21%
Kingman/Lake Havasu City	11%

Table 40. Do you consider yourself a full-time or part-time rancher?

Rancher	(N=97)
Full-time	68%
Part-time	28%
I don't consider myself a rancher	4%

Table 41. What is your role on the ranch?

Role	(N=97)
Owner/Manager	45%
Owner	40%
Manager	9%
Other	5%

Table 42. What type of your ranching operation do you run?

Operation Type	(N=97)
Cow-calf	76%
Cow-calf & yearling (stocker)	12%
Purebred cattle (alone or in combination with other categories)	5%
Yearling (stocker)	3%
Sheep, horses, or other livestock	3%

Table 43. As of May 1, 2018, about how many head of cattle, sheep, horses, and other livestock did you have on your operation?

Cattle	(N=84)
2-49	16%
50-99	22%
100-199	19%
200-299	10%
300-399	14%
400-499	8%
500-1350	10%
Mean	225
Median	153
Horses (N=51)	**(N=51)**
1-4	39%
5-9	27%
10-24	29%
25-49	4%
Mean	8
Median	6
Sheep	**(N=3)**
Other livestock	**(N=5)**

Table 44. How many years have you managed this livestock operation?

Years Managing Operation	(N=95)
1-4	3%
5-9	13%
10-24	34%
25-49	42%
50-78	8%
Mean	25
Median	25

Table 45. How many years has your family been managing your current operation?

Years Managing Operation (Family)	(N=95)
3-4	2%
5-9	9%
10-24	17%
25-49	31%
50-99	19%
100-200	21%
Mean	50
Median	35

Table 46. Age, calculated from "In which year were you born?"

Age	(N=93)
32-49	11%
50-64	38%
65-74	32%
75-92	19%
Mean	64
Median	66

Appendix 2: Focus Group Guide

Rangeland Monitoring Rancher Focus Group Guide

Date:
Focus group leader:
Location:

Thank you all for taking the time to speak with me today. We would like to talk with you about your experiences with rangeland monitoring. Before I get started, we would like to record today's conversation so that we can listen to it again later to catch anything we missed in our notes. The recording will not be shared with anyone outside our research group. Does anyone object to being recorded?

[IF NO, TURN ON RECORDER]

Great, thank you. Let's start with introductions. I am _____. I work at the University of Arizona on the evaluation team for Cooperative Extension. We're working with [NAME LOCAL EXTENSION AGENT] to help determine the impact of Arizona Cooperative Extension's rangeland monitoring programs.

If you've never participated in a focus group before, let me tell you about how this works. I have some questions about rangeland monitoring that I'd like to hear all of your thoughts on. I'll ask the questions to the group, and anyone can answer. Ideally, multiple people – or everyone – will answer. If you don't feel like answering a question, that's fine. You can leave the focus group at any time if you are uncomfortable. All your thoughts and comments are valuable, and there are no right or wrong answers. We are using this information to help Cooperative Extension improve on their services. Your comments will be confidential outside of this room, meaning that they will not be connected to your name or specific location, so please be as truthful as you can. Are there any questions about how this will work?

To get started, let's go around and briefly introduce ourselves.

1. What does rangeland monitoring look like on your grazing allotments and private lands?
    a. What activities do you do to monitor your allotments?
    b. Who is involved in monitoring?
    c. Do you do anything differently on your grazing allotments compared to your private lands? If so, what are those differences?
    d. What do you do with the data that are gathered from monitoring?

2. For your operation, what do you see as the purpose of rangeland monitoring?
    a. How do you use rangeland monitoring data in your operation?
    b. How do you get information about rangeland monitoring?
    c. How does rangeland monitoring affect the financials of your operation? *(Further prompts: is it costly? Has it helped you maintain or increase your AUMs? Has it helped prevent any lawsuits?)*
    d. Who do you trust to help you make decisions about management practices? (*Further prompts: what are your most trusted sources of information? Are you a member of any organizations like the AZ Cattlemen's Association or Society for Range Management? Why are you (or aren't you) a member of those groups?)*

3. Thinking over the last 10 years, how would you describe your relationship with the BLM (agency)?
    a. Has your relationship changed over time?

b. What are the main things that have made your relationship better or worse?
c. How does monitoring affect your relationship with the BLM (agency)?
d. How does the BLM (agency) treat monitoring data?
e. How involved are you in the process of making the annual management plan for your allotments?

4. How much of an influence has Cooperative Extension had on your management decisions for your operation?
    a. What have been the most helpful things you've learned through your interactions with Cooperative Extension?
    b. What would you like to see Cooperative Extension do in the future? *(prompt for ideas specifically related to rangeland management and monitoring)*

Rangeland Monitoring Rancher Focus Group Mini-Survey

First Name: _____ **Age:** _____

What type of ranching operation do you run? *(check all that apply)*

☐ Purebred Cattle ☐ Cow-calf ☐ Yearling (stocker)
☐ Sheep ☐ Horses ☐ Other _____

Which of these land ownerships do you use as part of your operation? *(check all that apply)*

☐ Private (owned or leased land) ☐ Federal land- USFS ☐ Federal land- BLM
☐ State (state trust land) ☐ Tribal land ☐ Other _____

How many years have you managed your livestock operation? _____

Appendix 3: Survey Instrument

Arizona Cooperative Extension Rangeland Monitoring Program Survey 2018-2019

Thank you for taking the time to complete this survey. Your responses will help Arizona Cooperative Extension improve the services and education they provide to ranchers and public land agencies across Arizona. Your input will also help ensure that future Extension services and education meet your needs.

Your responses will remain confidential, which means no one who answers the survey will be named in the report and all survey answers will be reported grouped together. This survey will take about 20 minutes of your time.

1. What types of informal monitoring do you do on your ranch? **(Check all that apply)**
   - ☐ Observe grass height, density, or vigor
   - ☐ Observe amount of forage remaining
   - ☐ Observe the condition of my cattle
   - ☐ Observe erosion
   - ☐ Observe wildlife
   - ☐ Observe weather
   - ☐ Other informal monitoring (describe)_____
   - ☐ I do NO informal monitoring
2. In the past 10 years, what types of formal monitoring have you done on your private land, Forest Service and BLM allotments, or state lands grazing leases? **(For each land status on your ranch, please check all that apply.)**

   ☐ I do NO **formal** monitoring (SKIP TO QUESTION 7, PAGE 3)

	Private land	Forest Service	BLM allotment	State lands	Not familiar with method
A. Measure precipitation	☐	☐	☐	☐	☐
B. Photo points	☐	☐	☐	☐	☐
C. Grazing exclosures	☐	☐	☐	☐	☐
D. Upland Health Assessment	☐	☐	☐	☐	☐
E. Herbaceous utilization	☐	☐	☐	☐	☐
F. Browse utilization	☐	☐	☐	☐	☐
G. Riparian Utilization	☐	☐	☐	☐	☐
H. Riparian vegetation density or cover	☐	☐	☐	☐	☐
I. Streambank stability	☐	☐	☐	☐	☐
J. Water quality	☐	☐	☐	☐	☐
K. Wildlife habitat surveys	☐	☐	☐	☐	☐
L. Wildlife counts	☐	☐	☐	☐	☐
M. Vegetation methods	☐	☐	☐	☐	☐
N. Pace frequency	☐	☐	☐	☐	☐
O. Dry weight rank	☐	☐	☐	☐	☐
P. Comparative yield	☐	☐	☐	☐	☐
Q. Clip biomass (production)	☐	☐	☐	☐	☐
R. Parker 3-step	☐	☐	☐	☐	☐
S. Ocular estimates of cover	☐	☐	☐	☐	☐
T. Transect or plot-based cover estimate	☐	☐	☐	☐	☐
U. Line Intercept	☐	☐	☐	☐	☐
V. Belt Density	☐	☐	☐	☐	☐
W. Other formal monitoring (describe) _____	☐	☐	☐	☐	☐

3. In the past 10 years, who has participated in monitoring on your private land, Forest Service and BLM allotments, and State Lands grazing leases? **(For each land status on your ranch, please check all that apply.)**

	Private land	Forest Service	BLM allotment	State lands
A. Ranch owner	☐	☐	☐	☐
B. Family member(s)	☐	☐	☐	☐
C. Hired ranch worker(s)	☐	☐	☐	☐
D. Cooperative Extension agent	☐	☐	☐	☐
E. Private range management consultant	☐	☐	☐	☐
F. NRCS (SCS) range conservationist	☐	☐	☐	☐
G. Ranch planning team	☐	☐	☐	☐
H. State Land Dept. range conservationist	☐	☐	☐	☐
I. BLM range conservationist	☐	☐	☐	☐
J. Forest Service range conservationist	☐	☐	☐	☐
K. University faculty	☐	☐	☐	☐
L. Other (describe) _____	☐	☐	☐	☐

4. How important to you is each of the following reasons for monitoring? **(Check one box for each reason)**

	Very important	Somewhat important	Not too important	Not at all important
A. Helps me know if the condition of my range is improving or not	☐	☐	☐	☐
B. Helps me determine if my management objectives are being met	☐	☐	☐	☐
C. Helps me decide when and where to move my livestock	☐	☐	☐	☐
D. Helps me decide when to decrease or increase my herd size	☐	☐	☐	☐
E. Protects me against lawsuits	☐	☐	☐	☐
F. Increases my credibility with the public	☐	☐	☐	☐
G. Increases my credibility with land management agencies	☐	☐	☐	☐
H. Increase the overall value of my ranch	☐	☐	☐	☐
I. Helps me maintain or increase permitted AUMs	☐	☐	☐	☐
J. Required by a government program	☐	☐	☐	☐
K. Helps me get government funds for range improvements	☐	☐	☐	☐
L. Protects my property rights	☐	☐	☐	☐
M. Other reason (describe) _____	☐	☐	☐	☐

5. How do you feel about the amount of range monitoring you do now? **(Check one)**
   - ☐ I do more than enough monitoring
   - ☐ I do about the right amount of monitoring
   - ☐ I should do more monitoring

6. How important is it to have an unbiased third party participate in rangeland monitoring? **(Check one)**

Very important	Somewhat important	Not too important	Not at all important
☐	☐	☐	☐

7. How biased do you think the following resources are? **(Check one box for each resource)**

	Completely unbiased	Somewhat unbiased	Somewhat biased	Completely biased
A. Cooperative Extension agent	☐	☐	☐	☐
B. Private range management consultant	☐	☐	☐	☐
C. NRCS (SCS) range conservationist	☐	☐	☐	☐
D. Ranch planning team	☐	☐	☐	☐
E. State Land Dept. range conservationist	☐	☐	☐	☐
F. BLM range conservationist	☐	☐	☐	☐
G. Forest Service range conservationist	☐	☐	☐	☐
H. University faculty	☐	☐	☐	☐

8. Below is a list of potential factors that may affect how much formal monitoring people do. How much does each factor affects **your** decision to conduct formal monitoring? **(Check one box for each reason)**

If you do not do any formal monitoring, please rate how much each factor affects your decision not to monitor.

	Affects me a lot	Affects me somewhat	Affects me a little	Doesn't affect me at all
A. Lack of time	☐	☐	☐	☐
B. Lack of help	☐	☐	☐	☐
C. Expense	☐	☐	☐	☐
D. Lack of knowledge of monitoring methods	☐	☐	☐	☐
E. Lack of confidence in monitoring skills	☐	☐	☐	☐
F. Tediousness of monitoring	☐	☐	☐	☐
G. Complexity of monitoring	☐	☐	☐	☐
H. Lack confidence in scientific validity of monitoring methods	☐	☐	☐	☐
I. Land management agency won't accept my monitoring data	☐	☐	☐	☐
J. The agency already does enough monitoring				
K. Lack of consistent monitoring methods between agencies or over time	☐	☐	☐	☐
L. Monitoring doesn't help me make management decisions	☐	☐	☐	☐
M. I'm afraid monitoring results could be used against me	☐	☐	☐	☐
N. Monitoring is the agency's responsibility				
O. Other reasons (describe) _____	☐	☐	☐	☐

9. How confident are you in your ability to accurately interpret the data gathered through formal monitoring? **(Check one)**

Very confident	Somewhat confident	Not too confident	Not at all confident
☐	☐	☐	☐

10. In the last 10 years, have you carried out any of the following management practices on your private grazing land, USFS or BLM allotments, or State Lands leases? ? **(For each land status on your ranch, please check all that apply.)**

	Private land	Forest Service	BLM allotment	State lands
A. Rotational grazing	☐	☐	☐	☐
B. Continuous, year-round grazing	☐	☐	☐	☐
C. HRM or Savory grazing	☐	☐	☐	☐
D. Drought destocking	☐	☐	☐	☐
E. Laid water pipelines	☐	☐	☐	☐
F. Seasonal grazing of riparian areas	☐	☐	☐	☐
G. Spring development	☐	☐	☐	☐
H. Fenced streambanks or riparian areas	☐	☐	☐	☐
I. Non-use (other than drought)	☐	☐	☐	☐
J. Prescribed burn	☐	☐	☐	☐
K. Reseeding	☐	☐	☐	☐
L. Wildlife friendly fencing	☐	☐	☐	☐
M. Herbicides	☐	☐	☐	☐
N. Mechanical brush removal	☐	☐	☐	☐
O. Install wildlife waters	☐	☐	☐	☐
P. Erosion control structures	☐	☐	☐	☐

11. Is there a difference between how you approach range management on private lands versus public lands grazing allotments? **(Check one)**

    ☐ Yes

    ☐ No

    If yes, what is different about your approach?

    _____

    _____

    _____

12. Do you write an annual plan for managing your public grazing allotments? **(Check one)**

    ☐ Yes, I make an annual written plan by myself

    ☐ Yes, I make an annual written plan in collaboration with the agency

    ☐ No, the agency writes an annual plan that I follow

    ☐ No, but I make an informal plan that guides my decisions

    ☐ No, I do not make any annual plans

13. Thinking about your approach to ranch planning, please indicate how much you agree or disagree with the following statements. **(Check one box for each statement)**

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
A. I like to make a plan for my operation at the beginning of each grazing season and stick to it	☐	☐	☐	☐	☐
B. I make changes to my plan through the year based on what I see on the range	☐	☐	☐	☐	☐
C. I only make changes to my plans when the agency asks me to	☐	☐	☐	☐	☐
D. I only make changes to my plans when there is a fire, drought, or other significant change in forage availability	☐	☐	☐	☐	☐
E. I make changes to my plans based on where water is available	☐	☐	☐	☐	☐

14. Do you have a grazing allotment with a federal land agency (USFS or BLM)? **(Check one)**
    - ☐ BLM only
    - ☐ USFS only
    - ☐ BLM and USFS
    - ☐ I don't have any federal grazing allotments (SKIP TO QUESTION 24, PAGE 7)

15. To what extent has monitoring on your grazing allotments improved or worsened your relationship with the agency? **(Check one box for each agency)**

	Greatly improved	Somewhat improved	Unchanged	Somewhat worse	Much worse	I don't have an allotment with this agency
BLM	☐	☐	☐	☐	☐	☐
USFS	☐	☐	☐	☐	☐	☐
State Land Department	☐	☐	☐	☐	☐	☐
NRCS	☐	☐	☐	☐	☐	☐

16. Thinking about your relationship with the federal land agencies (USFS or BLM), please indicate how much you agree or disagree with the following statements. **(Check one box for each statement)**

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
A. It's disruptive to my operation when the agency asks me to make changes to my plans mid-year	☐	☐	☐	☐	☐
B. The agency is a good partner when it comes to managing my grazing allotments	☐	☐	☐	☐	☐
C. The agency asks me to make changes that I don't think would help the land	☐	☐	☐	☐	☐
D. The agency helps me think about things I wouldn't have considered otherwise	☐	☐	☐	☐	☐
E. The agency listens to my concerns	☐	☐	☐	☐	☐
F. The agency is willing to work with me when I make suggestions on how to change management of my grazing allotments	☐	☐	☐	☐	☐

G. The agency works with me to interpret monitoring data	☐	☐	☐	☐	☐

17. In what year was your federal grazing permit last renewed? _____

18. If your grazing permit was renewed, did it go through the NEPA process to update the Allotment Management Plan? **(Check one)**
    - ☐ Yes
    - ☐ No
    - ☐ I don't know

19. Thinking about your experience with the NEPA process for projects on your allotments over the past 10 years, (e.g. Categorical Exclusions, Environmental Assessments, or Environmental Impact Statements), please indicate how much you agree or disagree with the following statements. **(Check one box for each statement)**

	Strongly agree	**Somewhat agree**	**Neither agree nor disagree**	**Somewhat disagree**	**Strongly disagree**	**Does not apply to me**
A. The NEPA process takes longer than it used to	☐	☐	☐	☐	☐	☐
B. The agency makes sure I know when a NEPA process is happening for one of my allotments	☐	☐	☐	☐	☐	☐
C. The agency communicates with me throughout the NEPA process	☐	☐	☐	☐	☐	☐
D. Rangeland monitoring helps the NEPA process go faster	☐	☐	☐	☐	☐	☐
E. I have noticed more public engagement in the NEPA process	☐	☐	☐	☐	☐	☐
F. On balance, I think the NEPA process is more good than bad	☐	☐	☐	☐	☐	☐

20. Thinking about your views on federal land management policies, please indicate how much you agree or disagree with the following statements. **(Check one box for each statement)**

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
A. Federal laws and policies make it harder for me to manage my ranch	☐	☐	☐	☐	☐
B. Federal laws and policies provide necessary limitations on management options	☐	☐	☐	☐	☐
C. Rangeland monitoring helps me work within existing law to achieve my economic goals	☐	☐	☐	☐	☐
D. Rangeland monitoring makes it easier to achieve my ecological goals while following existing laws	☐	☐	☐	☐	☐
E. Rangeland monitoring has helped decrease the amount of lawsuits related to grazing allotments	☐	☐	☐	☐	☐

21. Thinking about your experience with BLM administrative processes over the past 10 years, please indicate how much you agree or disagree with the following statements. **(Check one box for each statement)**

☐ ***I do not have a BLM allotment*** (SKIP TO QUESTION 23)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
A. The process of writing the Allotment Management Plan for my allotments takes longer than it used to	☐	☐	☐	☐	☐
B. The BLM seeks my input into the Allotment Management Plan more frequently than they used to	☐	☐	☐	☐	☐
C. There is more collaboration between me and the BLM than there used to be.	☐	☐	☐	☐	☐
D. There is less opposition by the BLM to grazing than there used to be	☐	☐	☐	☐	☐
E. I feel more respected by the BLM than I used to.	☐	☐	☐	☐	☐
F. The BLM is doing a better job of balancing land management for multiple uses	☐	☐	☐	☐	☐

22. Thinking about your experience with USFS administrative processes over the past 10 years, please indicate how much you agree or disagree with the following statements. **(Check one box for each statement)**

☐ ***I do not have a USFS allotment*** (SKIP TO QUESTION 24)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
A. The process of writing the Annual Operating Instructions for my allotments takes longer than it used to	☐	☐	☐	☐	☐
B. The USFS seeks my input into the Annual Operating Instructions more frequently than they used to	☐	☐	☐	☐	☐
C. There is more collaboration between me and the USFS than there used to be	☐	☐	☐	☐	☐
D. There is less opposition by the USFS to grazing than there used to be	☐	☐	☐	☐	☐
E. I feel more respected by the USFS than I used to.	☐	☐	☐	☐	☐
F. The USFS is doing a better job of balancing land management for multiple uses	☐	☐	☐	☐	☐

23. Over the past 5 years, what has been your annual ranch stocking rate?
_____ % of total allocated

24. Over the past 5 years, what is your annual average for the following?
Number of cows? _____ head
Calving percent? _____ %
Weaning percent? _____ %
Calf weaning weight? _____ pounds

25. On average, what portion of your household income typically comes from your livestock operation in a given year?
- ☐ Less than 10%
- ☐ 10-50%
- ☐ 51-75%
- ☐ 76-100%

26. On a percentage basis, what is the distribution of land ownerships you use as part of your operation?
Private (owned or leased land): _____%
Federal land- USFS: _____%
Federal Land- BLM: _____%
State (State Trust land): _____%
Tribal: _____%
Other: _____%

27. Does your ranch (including private, public, and state lands) contain any riparian areas (perennial or intermittent)? **(Check one)**
    - ☐ Yes
    - ☐ No

28. About how many deeded acres of land do you have in your ranch **(Check one)**
    - ☐ Less than 100 acres
    - ☐ 100-249 acres
    - ☐ 250-499 acres
    - ☐ 500-999 acres
    - ☐ 1,000-4,999 acres
    - ☐ 5,000 acres or more

29. What organizations are you a member of? **(Check all that apply)**
    - ☐ National Cattlemen's/Cattle Growers association
    - ☐ State Cattlemen's/Cattle Growers association
    - ☐ Regional Cattlemen's/Cattle Growers association
    - ☐ Society for Range Management
    - ☐ A local/regional collaborative conservation group; Please specify: _____
    - ☐ Other: _____
    - ☐ I am not a member of any organizations

30. Where do you find information to help you improve your operation? **(Check all that apply)**
    - ☐ Agency range conservationist
    - ☐ Cooperative Extension workshops
    - ☐ Cooperative Extension publications
    - ☐ Cooperative Extension agent (personal visit or telephone call)
    - ☐ Reading the Range program
    - ☐ Other ranchers
    - ☐ Private range management consultant
    - ☐ University professor
    - ☐ Society for Range Management publications/meetings
    - ☐ Cattle Growers Association
    - ☐ Industry magazine (please specify) _____
    - ☐ Online resource (please describe) _____
    - ☐ Textbook (please describe) _____
    - ☐ Other (please describe) _____

31. Have you ever obtained rangeland monitoring services from Arizona Cooperative Extension (e.g., someone from Extension has helped you with rangeland monitoring)? **(Check one)**
    - ☐ Yes
    - ☐ No
    - ☐ I don't know

32. Overall, how would you rate the rangeland monitoring services or information you received from Arizona Cooperative Extension in terms of increasing your knowledge and understanding of rangeland monitoring? **(Check one)**

Increased a lot	Increased somewhat	No effect	Decreased somewhat	Decreased a lot	Did not receive any services or information
☐	☐	☐	☐	☐	☐

33. Did the range monitoring services you received from Arizona Cooperative Extension affect any of your ranch or range management activities? **(Check one)**
    - ☐ Yes
    - ☐ No (SKIP TO QUESTION 36, PAGE 10)

34. Please tell us one way that range monitoring services or information from Arizona Cooperative Extension affected your ranch operations.

    _____

    _____

35. Please give us your suggestions for how rangeland monitoring services or information from Arizona Cooperative Extension could be improved.

    _____

    _____

36. What topics would you like Arizona Cooperative Extension to cover in future workshops and classes?

    _____

    _____

37. In what general area is your operation located? **(Check one)**
    - ☐ Arizona Strip
    - ☐ Kingman/Lake Havasu City
    - ☐ Central Arizona
    - ☐ Southeastern Arizona

38. Do you consider yourself a full-time or part-time rancher? **(Check one)**
    - ☐ Part time
    - ☐ Full time
    - ☐ I don't consider myself a rancher

39. What is your role on the ranch? **(Check one)**
    - ☐ Owner
    - ☐ Manager
    - ☐ Owner/Manager
    - ☐ Other _____

40. Which of the following best describes your ranching operation: **(Check one)**
    - ☐ Purebred cattle
    - ☐ Cow-calf
    - ☐ Yearling (stocker)
    - ☐ Cow-calf and yearling
    - ☐ Cattle and sheep
    - ☐ Sheep only
    - ☐ Horses only
    - ☐ Other _____

41. As of May 1, 2018, about how many head of cattle, sheep, horses, and other livestock did you have on your operation?
    _____ cattle
    _____ sheep
    _____ horses
    _____ other range livestock (specify) _____

42. How many years have you managed this livestock operation? _____ years

43. How long has your family been managing your current operation? _____years

44. In which year were you born? _____

Appendix 4: Interview Guide

Rangeland Monitoring Agency Interview Guide

Date:
Interviewer:
Interviewee:
Interviewee Location:

I am _____. I work at the University of Arizona on the evaluation team for Cooperative Extension. We're working with [NAME LOCAL EXTENSION AGENT] to help examine the impact of rangeland monitoring programs in Arizona. I would like to talk with you about your experiences with rangeland monitoring and Cooperative Extension. This conversation will take about 30-40 minutes. Is now a good time, or would you prefer to find a time in the next few weeks?

Great, thank you. The following questions will help my team better understand the impacts of Cooperative Extension Rangeland Monitoring programs and the overall importance of monitoring for both ranchers and federal agencies. We're conducting interview like this with staff from the BLM, Forest Service, and Cooperative Extension along with focus groups with local ranchers. We'll synthesize our findings in a report on the impacts of rangeland monitoring in Arizona. All of your thoughts and comments are valuable, and there are no right or wrong answers. Your comments will be kept confidential, meaning that they will not be given back to anyone at your field/district office, so please be as truthful as you can. As part of our report, we may use some quotations in the final reports, but there will be no names or locations attached. We can also skip any questions that you don't want to answer, and you can stop the interview at any time. I expect the interview to last about 30-40 minutes. Is now a good time to get started? *If yes, proceed. If no, rescheduled day/time:* _____

Before I get started, I would like to record today's conversation so that I can listen to it again later to catch anything we missed in our notes. The recording will not be shared with anyone outside our research group. Are you okay with being recorded?

[IF YES, TURN ON RECORDER]

1. What is your role with your agency and how long have your worked in this role?
2. How are you involved with rangeland monitoring?
    a. Who from your office is involved in rangeland monitoring activities? (Prompt specifically about involvement with CE monitoring activities)
    b. Who do you work with regarding monitoring in your area?
    c. Do you encourage local permittees to monitor their grazing allotments?
    d. What do you (or other staff from your office) do with the data that are gathered from monitoring?
    e. How involved are you in the process of making the annual management plan for permittees in your area?

3. What do you see as the purpose of rangeland monitoring?
    a. How does your agency use rangeland monitoring data? (Prompt specifically about use of CE-collected monitoring data)
    b. How does your office use rangeland monitoring data?
    c. How do you see permittees use monitoring data?

d. How comfortable are you with interpreting rangeland monitoring data?
e. What influence (if any) do you think rangeland monitoring has had on litigation around the grazing permit process and/or environmental assessments (including NEPA)?
f. Who do you trust to help make decisions about the status and quality of rangeland?

4. Thinking over the last 10 years, how would you describe your relationship with the permittees in your service area?
    a. How do you typically interface with local permittees?
    b. Has your relationship changed over time?
    c. What are the main things that have made your relationship better or worse?
    d. How does monitoring affect your relationship with the local permittees?

5. How much of an influence has Arizona Cooperative Extension's Rangeland Monitoring program had on your relationship with local permittees?
    a. What have been the most helpful things you've learned through your interactions with Arizona Cooperative Extension?
    b. What would you like to see Arizona Cooperative Extension do in the future? *(prompt for ideas specifically related to rangeland management and monitoring)*