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Nevada State Crop and Resource-Use Needs Assessment: Stakeholder Perspectives on Crop, Resource Use, Pest and General Agricultural Needs

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Nevada State Crop and Resource-Use Needs Assessment Executive Summary

Need assessments are a critical component of Extension's program development. The purpose of this study was to determine which crop and resource-use needs are important for growers across the state and will serve as a guide to develop and deliver programs that address critical needs and issues. Extension educational programs are based on critical needs of the community, identified through formal need assessments conducted by Extension faculty and staff members. Building on this framework, Extension collaborated with the University's College of Education and Human Development to design a survey and key informant interview protocol for learning the statewide grower's need via various avenues. Issues identified in research literature and communication with growers became the initial step that helped form the foundation of this statewide needs assessment.

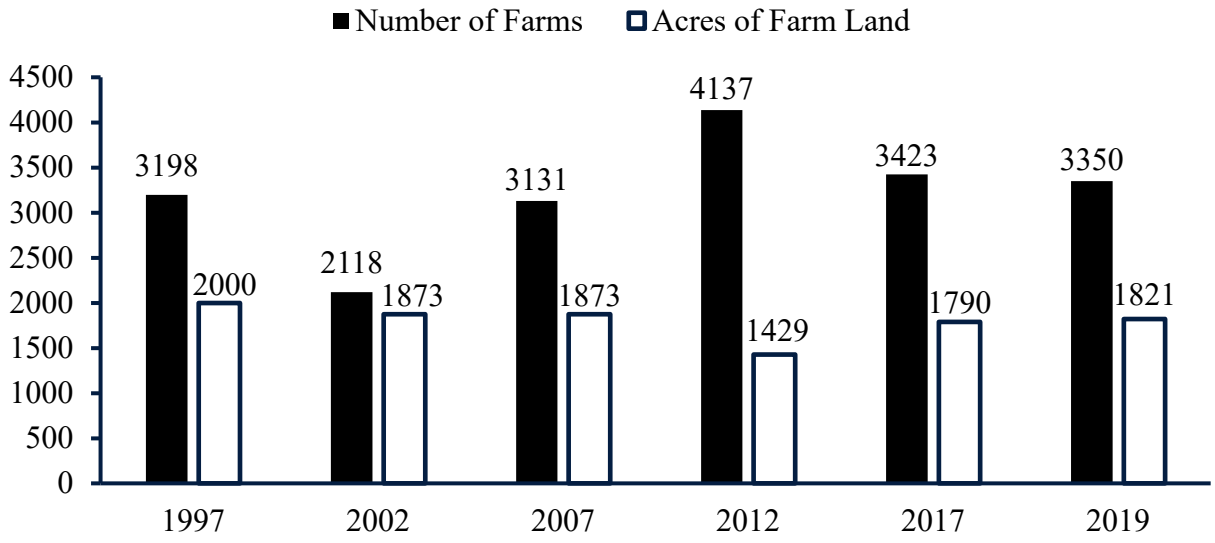
A mixed-method assessment strategy comprising of a statewide online survey and key informant interviews were conducted. The survey was available online for completion from mid-April through mid-October 2020 and resulted in 215 completed surveys of Nevada citizens. The survey was distributed via email to statewide Extension Educators, administrators, federal agencies, links posted to various social media accounts, websites, newsletters and outreach activities. A snowball survey method was employed to ensure broad exposure and maximize the response rate. Key informant interviews were conducted from the end of August through early November 2020 and included 22 stakeholders statewide. These key informant interviews provided in-depth crop and resource-use perspectives as they focused on Strengths, Weaknesses, Opportunities and Threats (SWOT) in addition to a few questions related to crops and soils.

In summary, various program topics were identified as significant needs through analysis of results from both the online surveys and interviews. The top concerns, as identified through surveys and key informant interviews, were: low-water use crops, specialty crops, cover crops, soil health, nutrient and irrigation management, noxious weed management, pest management, pollinators and their health, and new crop production and marketing. It should be noted that while this is a statewide crop and resource-use needs assessment, the identification of a need does not imply Extension should address all the identified needs. Expertise, staffing, and other organizations addressing priority needs all influence Extension future programming. Nevertheless, this assessment identified several significant issues that will guide continuing and future educational and research-based Extension programming.

Chapter 1: Introduction

Nevada is the driest state in the United States, with an average annual precipitation of approximately 4.5 inches in the south and 7.5 inches in the north. Despite being the most arid state in the nation, agriculture remains one of Nevada's vital industries, with 3,350 farms and ranches contributing $4.7 billion in 2020 to the state economy (NDA, 2021). Agriculture production is a particularly integral part of rural Nevada's economy, with the greatest number of farms and ranches in Elko County (526), followed by Churchill County (504). Storey County has the fewest farms (2) in Nevada (USDA NASS, 2017). Nevada's agriculture operations have remained stable over the last three decades, with the number and size of farms and ranches fluctuating slightly over the years (Figure 1). Alfalfa hay is the leading cash crop of the state. The additional crops grown in Nevada include potato, barley, winter wheat, spring wheat, corn, oats, onions, garlic and honey.

Figure 1: Number of farms and average farm size acreage in Nevada



Despite the significant contribution of the agriculture sector to the state economy, only a small portion of land is available for private agricultural use. This is principally due to Nevada's large expanse of public lands, accounting for 86% of Nevada's 71 million acres (BLM, 2006). The Bureau of Land Management (BLM) manages two-thirds (48 million acres) of the state's land. They provide grazing permits to livestock producers (BLM, 2006), thus supporting the state's largest sector, livestock production. Cattle and calves are the leading agricultural sector, and the state crop sector supports the state's livestock industry, as well as export markets by growing alfalfa, hay and other feed crops.

"Thank you for conducting the survey and working for Nevada agriculture."

Nevada is a large state in terms of land area, and many agricultural operations across the state are geographically isolated. While the state's agricultural operations are located primarily in rural counties, 74% of Nevada's total population (3.1 million) resides in Clark County in southern

Nevada. Approximately 19% of the state's population lives in northwestern Nevada, including Washoe, Carson City, Storey and Douglas Counties (USDA NASS, 2020).

Photo by: Lindsay Chichester

Purpose and Method

The University of Nevada, Reno houses Extension within the College of Agriculture, Biotechnology & Natural Resources. Extension serves as a bridge between the University and communities and engages Nevada's communities through direct education and applied research. Educational programs designed to address critical community needs are based upon needs assessments conducted by Extension faculty and staff. In assessing needs, Extension faculty seek input from stakeholders, which enables faculty to respond directly through the development of research-driven and evidence-based programs. Extension programs are evaluated regularly to assess their effectiveness to address community needs identified through needs assessment.

> "Keep conducting research and field trials for our north central region of Nevada."

To conduct a statewide needs assessment related to crop and soil concerns, Extension partnered with the University's College of Education and Human Development in the fall of 2019 to design and implement a comprehensive needs assessment strategy. First, the research team developed and implemented a statewide online survey, followed by key stakeholder interviews statewide. This multi-method strategy sought to understand current and emerging agricultural practices and needs throughout the state. The Convergent Parallel design (Creswell and Plano, 2011) and PEARL (Propriety, Economics, Acceptability, Resources and Legality) strategy (Donaldson and Franck, 2016) of developing priorities from identified needs was employed to synthesize the various types of data and formulate priorities.

> "Keep up the good work. This survey is a wonderful start!"

The survey targeted growers, ranchers, stakeholders, crop consultants/advisors and other

agricultural representatives across the state to determine what needs are critical to maintain or improve crop production in Nevada. The research team created an anonymous survey in Qualtrics and distributed the link via email to statewide Extension educators, administrators and federal agencies. The research team also posted the link to various social media accounts, websites and newsletters. A snowball survey administration method was employed to ensure wide exposure and maximize the response rate. The survey instructions encouraged respondents to complete and/or share the survey link through their listservs, contacts and organizations to potential interested respondents. The survey was open from mid-April through mid-October, 2020, and included 37 multiple-choice and open-ended items covering pest management, crop needs, natural resource issues, general agriculture, preferred ways of receiving information, land holding, irrigation practices, produce marketing, years in the farming business and respondent demographics. The open-ended questions asked respondents to list their three most important crop and soil needs, and share their satisfaction with crop production and agriculture in general, as well as provided them an opportunity to write any additional agricultural needs not previously identified.

Photo by: Steve Foster

The research team also conducted 22 key informant interviews from the end of August through early November 2020. The interview guide, which included questions pertaining to strengths, weaknesses, opportunities and threats (SWOT analysis), along with some additional crop and soil related questions, guided structured interviews with each key informant. The first author can provide details of survey and interview protocol upon request.

"Thank you for helping to make a difference in Nevada's Agriculture!"

The purpose of this report is to present the results from the statewide survey using descriptions, charts and quotations (Chapter 2); outcomes of the study's interviews of 22 statewide key informants (Chapter 3); and a summary of findings, limitations and future programming needs (Chapter 4).

Chapter 2: Survey Results

This research project received the University's Institutional Review Board (IRB) approval prior to all data collection. Respondents completed the online survey using Qualtrics, and researchers analyzed the results using Excel (quantitative) and Dedoose (qualitative) programs. In this chapter, we first describe the respondents who participated in the survey, including demographics, profession, operations and land holdings. Second, we will discuss the quantitative results from the survey, which address pest, crop, resource-use and general agricultural needs. Finally, we will present the qualitative results, which supported the findings from the quantitative components of the survey and highlight additional needs identified in the qualitative component.

Photo by: Adeel Ahmed

Respondents

The survey received a total of 215 valid survey responses. We identified duplicate responses by identifying duplicate information in multiple fields, such as IP address, name, phone number, email, address, age, gender and county. For respondents who provided multiple survey responses, researchers kept the most recent unless it was significantly less complete than a prior response.

Fifty-three percent of respondents identified as male, 29% as female, and 19% failed to identify. The average age for respondents (n=176) was 55 years old, with good representation across age groups (Table 1). Four respondents entered answers for age that were not numeric (e.g., "it does not matter" and "old"), which researchers coded as "Other." The majority of respondents (80.4%) also identified as White/Caucasian. The average age of respondents by racial identification also varied. Respondents who identified as White/Caucasian were significantly older (m = 54.8) than respondents who selected one of the other options provided, including "other" (pooled; m = 58.2), t (31) = 2.18, p = 0.04.

Table 1: Respondents' age group by county

County	Under 30	30-44	45-59	60-74	75+	Other	Total
Washoe	1	6	6	13	2	1	29
Clark		8	9	4	1	2	24
Elko	1	4	1	12	1	1	20
Churchill		5	6	6	1		18
Douglas	1	6	7	3	1		18
Nye	1	2	2	9	1		15
Lyon	1	1	4	4			10
Pershing		2	3	3	1		9
Eureka		3	1	3			7
Humboldt	1	2	2	1	1		7
White Pine	1		1	2	1		5
Lander		1	2	1			4
Lincoln		1		2	1		4
Mineral		1	1	1			3
Carson City		2					2
Esmeralda				1			1
Grand Total	7	44	45	65	11	4	176

Agricultural Operations

Survey respondents work in a variety of fields related to agriculture. About half of respondents identified their industry, with most identifying with farming/ranching[1] (68), Agri-business (15) and educators (10). Twenty-six respondents identified their profession as "other,"[2] and described a variety of related fields including business (5), government (2), part-time farming or hobby farming (8) and multiple occupations (8). Among respondents who identified as farmers/ ranchers, land holdings and agricultural operations varied, with respondents reporting as few as 0.04 acres and as many as 15,000 acres of farm land. Additionally, two respondents also mentioned having more than 100,000 acres of rangeland in use under the Bureau of Land Management. Self-reported years in farming also varied from less than one year to 70 years.

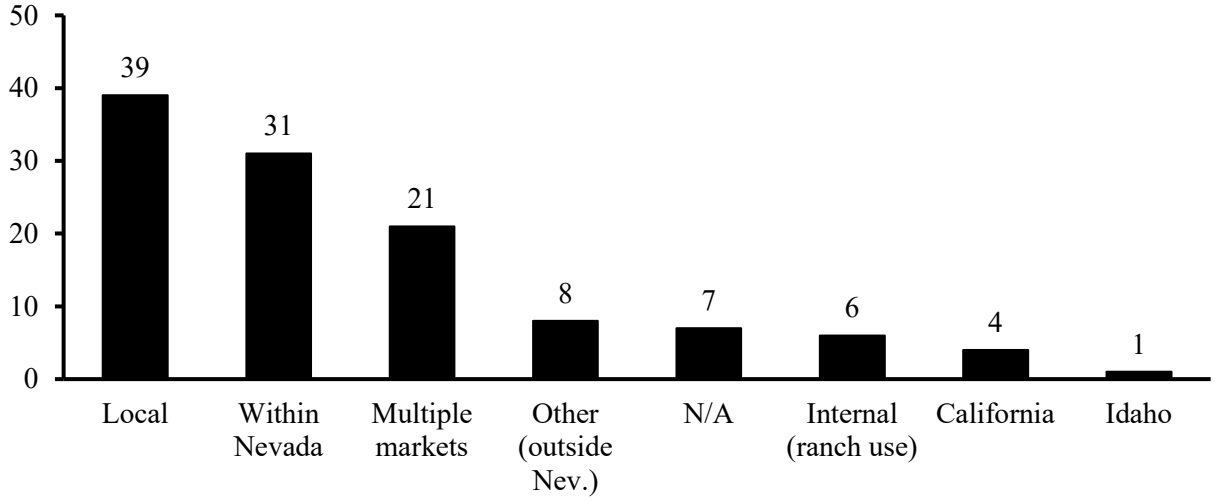
Markets Outlets

Survey respondents indicated whether they sell their farm products locally, within Nevada or outside of Nevada (Figure 2). The majority of respondents indicated that they sell their end products locally (39) or within Nevada (31). However, 47 respondents selected "Outside Nevada (please specify)." Seven of these respondents indicated none, not selling, or "N/A" in their comments, while others indicated the specific market, or multiple markets, where they sell their products. Additionally, six respondents indicated that they use the end products they grow internally in their operations, for example as livestock feed, as opposed to selling it.

[1] Several respondents selected "other," but provided text indicating that they were a farmer/rancher or educator, or in agri-business and consulting.

[2] Several respondents selected "other," but provided text indicating that they were a farmer/rancher or educator, or in agri-business and consulting. These respondents are counted within their professional groups, and not with "other."

Figure 2: Markets for selling end-products produced at farms throughout Nevada

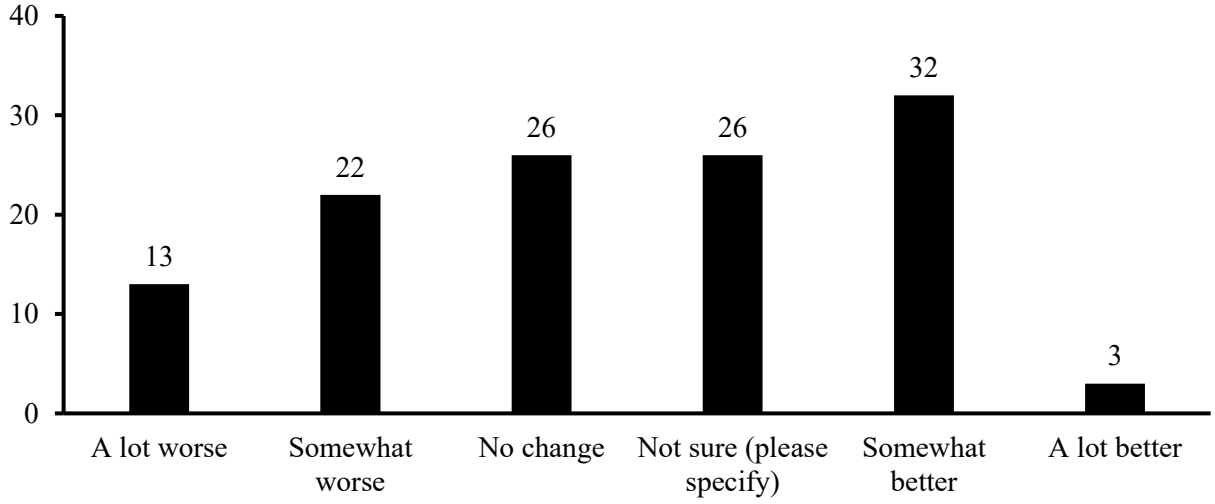


Note: Number on top of each bar represents number of respondents.

Assessing Nevada Agricultural Conditions

Respondents indicated whether they believed the conditions of Nevada agriculture had become better or worse in the past five years (Figure 3). Thirty-five respondents indicated that they thought conditions had improved, with three respondents indicating that conditions were "a lot better," and 26 respondents indicating that conditions were "somewhat better." Another 35 respondents indicated that they thought conditions had declined, with 13 respondents indicating that conditions were "a lot worse," and 22 respondents indicating that conditions were "somewhat worse." Twenty-six respondents indicated that there had been no change, and another 26 respondents indicated that they were not sure. Ninety-five respondents provided additional information about their response to this question.

Figure 3: Respondent perceptions of five-year change in Nevada agriculture conditions



Note: Number on top of each bar represents number of respondents.

Agricultural Needs

In this survey, respondents rated their perception of the importance of agricultural issues from 1 (low need) to 7 (high need) in four different content areas: pest needs, crop needs, resource-use needs and general agriculture needs.

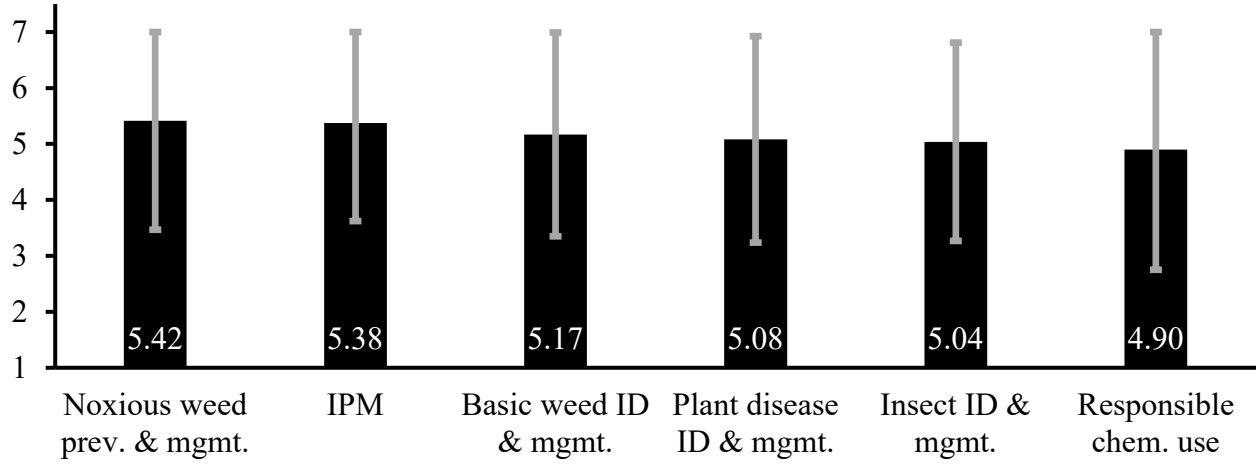
Photo by: Wendy Hanson Mazet

Pest Needs

Noxious weed prevention and management (*m* = 5.42) and integrated pest management (*m* = 5.38) were the most highly rated needs in the pest needs list among respondents (Figure 4). The average rating for each of the pest needs that respondents rated was above the scale's midpoint, indicating a moderate to high perceived need for each item.

> "Knowledge of noxious weeds that are poisonous/harmful to livestock and horses."

Figure 4: Average rating of pest needs throughout Nevada



Note: The number of respondents who answered each question varied between 197 and 211. The figure includes bars to show the standard deviations for the means presented.

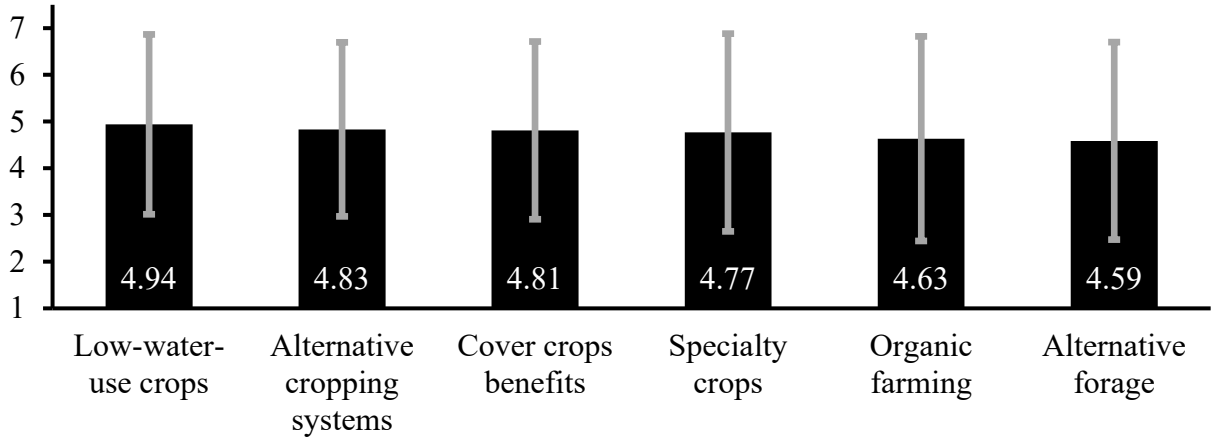
Photo by: Steve Foster

Crop Needs

> "Crop research in varieties that would work in our specific climate."

Low-water-use crops (*m* = 4.94), alternative cropping systems (*m* = 4.83), and cover and specialty crops (*m* = 4.81 and 4.77, respectively) were the most highly rated needs in the crops needs list (Figure 5). The average ratings for all of the crop needs for respondents who responded to each item were between 4.59 and 4.94, indicating a moderate to high perceived need for each item.

Figure 5: Average rating of crop needs throughout Nevada

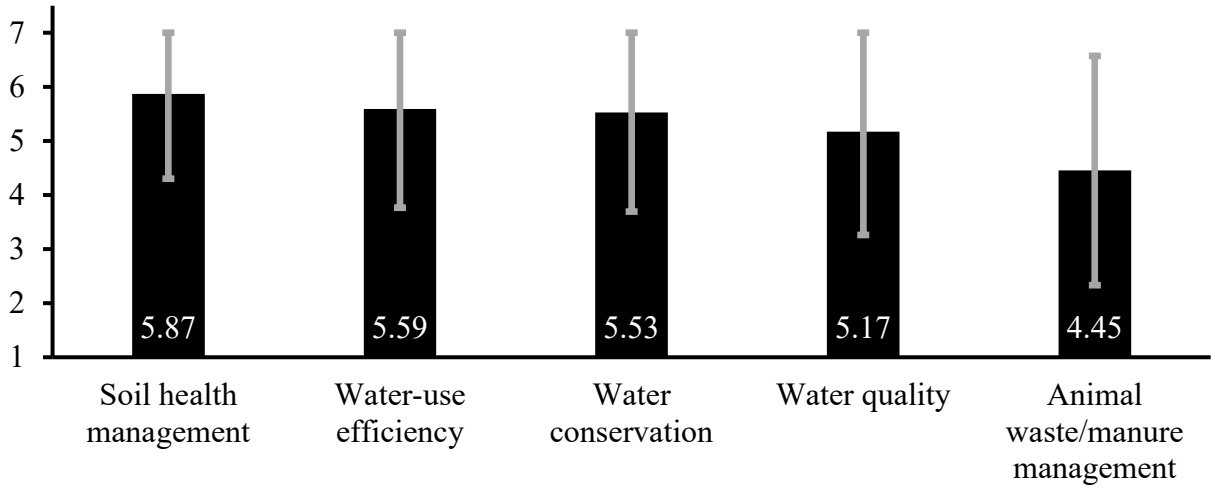


Note: The number of respondents who answered each question varied between 169 and 202. The figure includes bars to show the standard deviations for the means presented.

Resource-Use Needs

Soil health management (m = 5.87) was the most highly rated need in the resource-use needs list (Figure 6). The average ratings for all of the resource-use needs for respondents who responded to each item were between 4.45 and 5.87, indicating a moderate to high need for each item.

Figure 6: Average rating of resource-use needs throughout Nevada



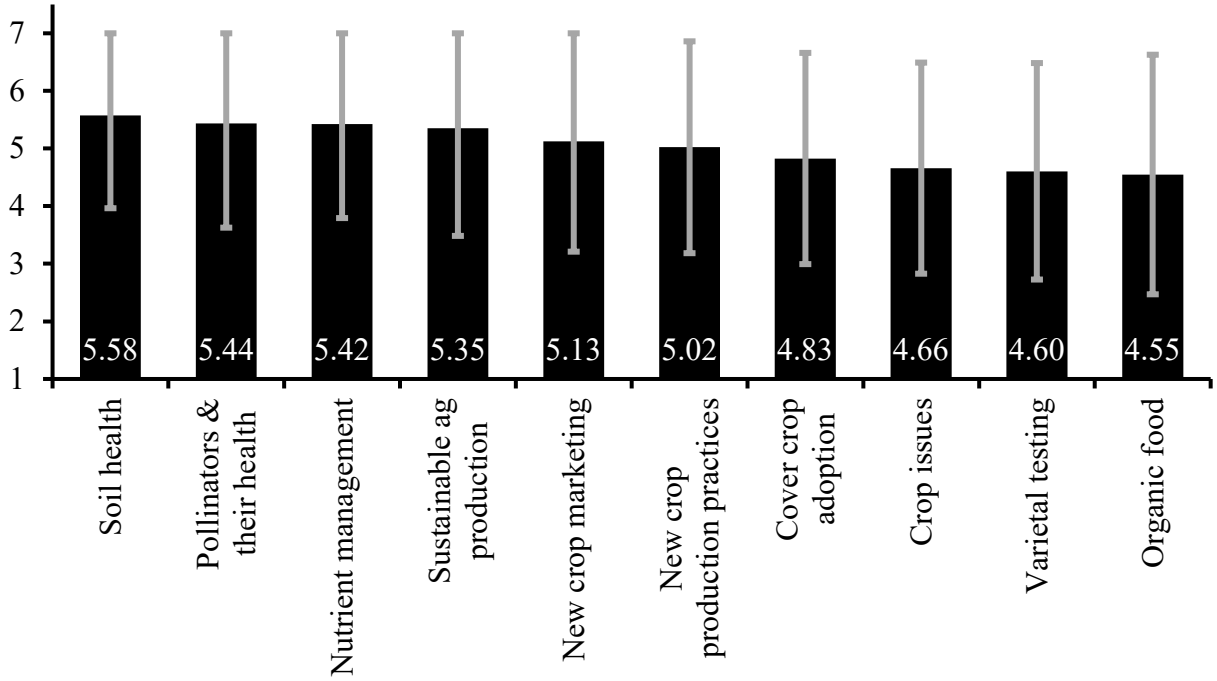
Note: The number of respondents who answered each question varied between 188 and 203. The figure includes bars to show the standard deviations for the means presented.

Photo by: Donald Deever

General Agriculture Needs

Soil health (m = 5.58) was the most highly rated need in the general agriculture needs (Figure 7). The average ratings for all of the general agriculture needs for respondents who responded to each item were between 4.55 and 5.58, indicating a moderate to high perceived need for each item.

Figure 7: Average rating of general agricultural needs throughout Nevada



Note: The number of respondents who answered each question varied between 172 and 194. The figure includes bars to show the standard deviations for the means presented.

Open-Ended Item Results

> "I think it would be a helpful to include 'How to grow food crops in Nevada'."

For this survey, respondents rated their needs within the four topics above: pest, crop, resource-use and general agriculture. After each broader topic, respondents could share additional needs not covered in the response options or add additional context to their responses. The open-ended responses were coded, and then codes were clustered into organizing themes. Another round of coding was used to determine whether the data contained any emergent subcodes. Some comments fit with more than one code or did not fit with any significant codes. This section summarizes the results of the analysis of open-ended items, and tables with code counts for each specific question can be found in Appendix A.

Additional Pest Management Needs

A total of 60 respondents provided substantive comments for this question. Many respondents provided additional detail regarding their needs for pest management, encompassing the themes presented in the pest needs list (Appendix A, Table 1). For example, respondents who discussed

insect/bug-related pest management needs identified aphids, crickets, grasshoppers and Africanized bees as problematic pests. Additional topics that were not covered in the needs list included natural control of pests (including weeds, insects, fungus, etc.) and management of animal pests (including ground squirrels, gophers and deer).

Additional Crop Needs

A total of 41 respondents provided substantive comments for this question, covering a variety of topics. Twenty (49%) of the respondents who responded discussed specific crops, with hemp mentioned most (n= 9). Respondents also mentioned economic concerns, lack of equipment, water needs and water-use concerns, and pest and soil needs. Additionally, respondents mentioned the need for consultations and better support for distribution. Overall, no major organizing themes emerged from this question. Appendix A, Table 2 demonstrates examples of these themes.

Photo by: Kim Hunter Steed

Additional Resource-Use Needs

A total of 27 respondents provided substantive comments for this question, covering multiple topics. The most common topics mentioned pertained to water and soil. Nine respondents commented on topics related to water, including water rights and irrigation, and eight respondents commented on topics related to soil, such as soil amendments and compost. Appendix A, Table 3 demonstrates examples of these themes.

"A lot of people don't know where or how to get started with an alternative crop."

Additional General Agriculture Needs

A total of 24 respondents provided substantive comments for this question, covering multiple topics, with the most popular topics pertaining to

"Regenerative agriculture practices with no outside inputs."

conservation, restoration and holistic approaches (n=5); and marketing, processing and distribution (*n* = 6). Appendix A, Table 4 demonstrates examples of these themes.

Respondent Ratings of Top Three Needs

Respondents had the opportunity to rank their top three crop and soil needs, based upon the needs already covered in the previous survey questions. Resource-use needs were the most commonly mentioned needs across all three positions, and within resource-use needs, more respondents mentioned issues related to soil health more than any other issue. Appendix B, Table 1 presents a detailed table that breaks down the top-cited needs for each rank position, as well as provides a weighted total for each concern.

Photo by: Maninder K. Walia

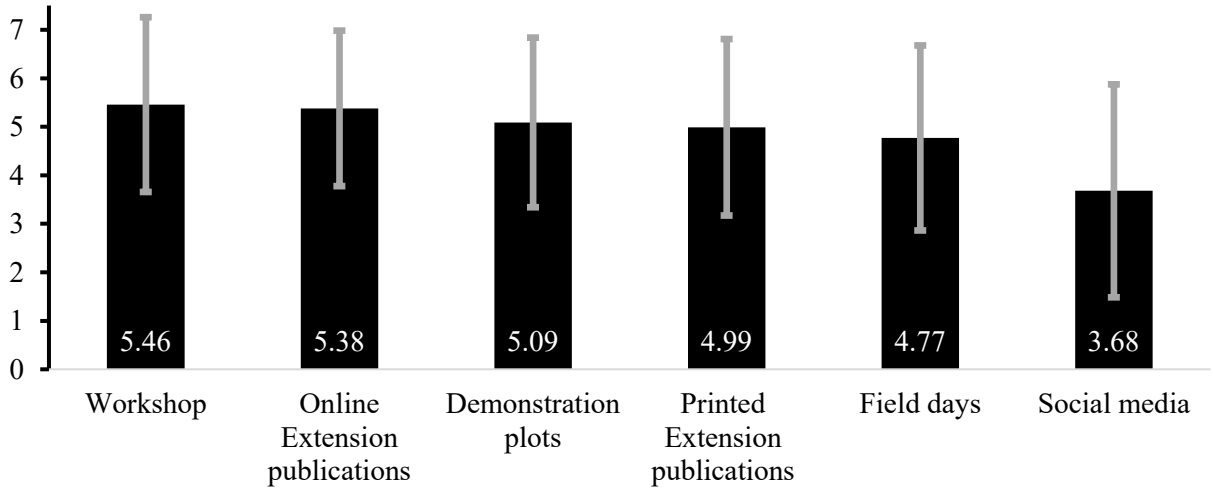
Respondent Preference for Receiving Information

Respondents rated their preferences for six specified avenues of communication for receiving information about agriculture and agricultural practices. Overall, respondents preferred workshops, followed by online Extension publications and demonstration plots, over the other specified methods. Social media was the least preferred method (Figure 8). An additional 42 respondents provided open-ended comments indicating additional preferences for communication methods. Several of the responses reflected the

"We would love to see a co-op for Nevada hemp growers and where to market our end product."

options that were provided for rating. Underscoring the preference for hands-on learning, five respondents specified workshops, and two respondents specified in-person demonstrations. However, with the exception of social media, the average ratings for all forms of communication were above the midpoint.

Figure 8: Average rating of communication preference throughout Nevada



Note: The number of respondents who answered each question varied between 179 and 194. The figure includes bars to show the standard deviations for the means presented.

Photo by: Wendy Hanson Mazet

Chapter 3: Key Informant Interview Outcomes

In collaboration with Extension educators from their respective counties, the first author identified one or two key stakeholders from each county in Nevada and conducted telephone interviews with 22 participants. The interviews consisted of questions related to the stakeholders' perceptions of the most critical concerns for crop production in Nevada and employed a SWOT framework to assess the strengths, weaknesses, opportunities and threats to Nevada agriculture, in addition to a few questions related to crops and soils. Phone interviews ranged between 10 and 45 minutes.

In collaboration with an administrative assistant, the first author conducted and reviewed the interview transcripts and excerpted summary responses to each question. The interviews were followed by a thematic analysis of the answers provided by interview participants to determine the key issues presented across these interviews.

> "It's an ongoing battle for water and it doesn't matter where you are in the state."

Photo by: Staci Emm

Strengths

Nine interview participants mentioned that Nevada is ideal for raising livestock, with comments including the availability of open rangelands and landscape features (wildfire resistance, vast size and emptiness, climate/landscape) as important. Seven participants commented on Nevada's success growing forage. Three participants mentioned hemp production as a strength of Nevada agriculture.

Weaknesses

> "One of the problems we have is lack of access to equipment."

Interview participants were very consistent about their perceptions of Nevada agriculture's primary weaknesses: water, climate and soil conditions. Seventeen participants commented on water issues in Nevada, including water rights, access to water and water management. Eleven participants also commented on the climate in Nevada, including concerns related to climate change, as well as simply trying to grow to produce in a desert climate. Concerns about soil conditions were also common among interview participants, with a total of eight participants commenting on this theme.

Opportunities

> "You know, as far as their practices and everything, it's so well,… that's the way my father did it. That's the way my grandfather did it."

Eleven participants mentioned soil health as an opportunity when allowed to provide additional comments at the end of the interview. Nine participants identified support as an opportunity, including support for new farmers, opportunities to pool resources, and more support for Nevada agriculture from lawmakers and regulators. Seven participants identified education and water management as opportunities, and six participants identified crop diversity as an important opportunity for Nevada agriculture.

Threats

The primary threat that the interview participants identified was a lack of water. This included comments by 17 participants about drought conditions, water availability and water costs. In addition, six participants mentioned the climate in Nevada, including statements about diurnal temperature changes, desert heat and windstorms. Participants also mentioned pests and invasive species, market concerns and urban development as threats to Nevada agriculture.

> "There's got to be crops that will grow here and can be grown successfully. But again, I think part of the issue is a market for those crops."

Additional Questions

In addition to the assessment of strengths, weaknesses, opportunities and threats, interview participants responded to questions about the need for and adoption of alternative crops, soil health and additional thoughts.

Adoption of Alternative Crops

The majority of interview participants (n=16) agreed that their county has an increased need for alternative crops. Seven participants discussed cover crops, six discussed low-water-use crops, and six discussed teff. Twelve participants mentioned other types of crops, including specialty crops and alternative forages. Twenty-two interview participants described why they thought the adoption of alternative crops would be difficult in Nevada. The most common reason cited was Nevada's climate and lack of access to agricultural

> "Financially difficult to change over, need more study support from university, equipment needs, land needs, need water allocations, cost sharing to start up."

equipment. Other concerns included not having a market for the crops and other resources to grow alternative crops, and "attitude" or "mindset" of the producers.

Soil Health

Interviewees indicated whether there was any interest from stakeholders in their county regarding soil health. The majority of participants (n=16) indicated that there was interest, and an additional two participants indicated that there was some interest. Four participants expressed financial concerns including the cost of soil testing and the need for incentive programs.

Expectations From Faculty

> "People need to see somebody else doing it. And doing well."

Interview participants voiced their expectations for faculty for improving crop production in Nevada. The answers participants provided were diverse, but a few themes indentifying needs emerged. Seven participants identified demonstrations, four identified research publications, and four identified public outreach.

Additional Thoughts or Comments

At the end of the interview, participants were invited to share any additional comments they wanted to add to the conversation. Five participants commented on the need for recommendations for what to grow in Nevada. Four participants commented on the need to diversify agriculture. A few participants also commented on the need for agreements and cooperation with regulatory agencies.

Photo by: Maninder K. Walia

Chapter 4: Discussion, Limitations and Summary

This statewide needs assessment was based on a mixed-method approach, including an online survey with open-ended questions and key informant interviews. The Convergent Parallel design (Creswell and Plano, 2011) and PEARL (Propriety, Economics, Acceptability, Resources and Legality) strategy (Donaldson and Franck, 2016) of developing priorities from identified needs was employed to synthesize the various types of data and formulate priorities. The observations, limitations and findings for future programming needs are discussed.

The identified needs within each broad area of this assessment are listed below in their priority rankings, from 1 to 5.

Pest Needs

Within the survey, the top five identified pest needs were:

1. Noxious weed prevention and management
2. Integrated pest management
3. Basic weed identification and management
4. Plant disease identification and management
5. Insect identification and management

Survey respondents had the opportunity to write additional pest needs that they would like to include (Appendix A, Table 1). There were five additional needs identified:

1. Insect identification and management
2. Basic weed identification and management
3. Responsible chemical use
4. Noxious weed prevention and management
5. Miscellaneous (e.g., rodents, animals, and natural and chemical-free control)

In the online survey, respondents had the opportunity to indicate their top three overall needs. The research team then sorted these into the program area categories. The top three priority needs were (Appendix B, Table 1):

1. Noxious weed prevention and management
2. Responsible chemical use
3. Basic weed identification and management

Crop Needs

Within the survey, the top five identified crop needs were:

1. Low-water-use crops
2. Alternate cropping system
3. Cover crops
4. Specialty crops
5. Organic farming

Survey respondents had the opportunity to write additional crop needs that they would like to include (Appendix A, Table 2). There were five needs identified:

1. Specialty crops
2. Low-water-use crops
3. Cover crops
4. Organic farming
5. Miscellaneous (e.g., marketing, processing and water supply)

In the online survey, respondents had the opportunity to indicate their top three overall needs. The research team then sorted these into the program area categories. The top three priority needs indicated were (Appendix B, Table 1):

1. Low-water-use crops
2. Specialty crops
3. Cover crops

It is also important to note that throughout the different open-ended questions, many participants mentioned the need for information about what crops grow best in Nevada and how to grow them, and referred to hemp as an important crop for Nevada.

Resource-Use Needs

Within the survey, the top five identified resource-use needs were:

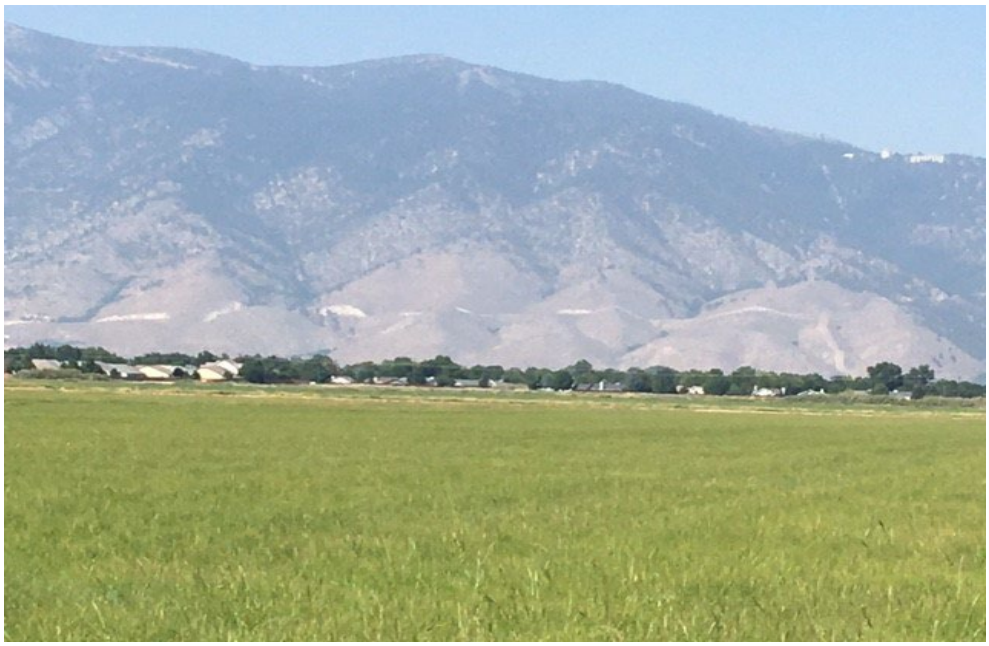
1. Soil health
2. Alternate irrigation methods to enhance water-use efficiency
3. Water conservation
4. Water quality
5. Animal waste/manure management

Survey respondents had the opportunity to write additional resource-use needs that they would like to include (Appendix A, Table 3). There were five needs identified:

1. Soil health
2. Water quality
3. Water conservation
4. Alternative irrigation methods to enhance water-use efficiency
5. Miscellaneous (e.g., amendments and compost)

The survey respondents had the opportunity to indicate their top three overall needs. The research team then sorted these into the program area categories. The top three priority needs indicated were (Appendix B, Table 1):

1. Soil health
2. Nutrient management
3. Water conservation



General Agriculture Needs

Within the survey, the top five identified general agriculture needs were:

1. Soil health
2. Pollinators and their health
3. Nutrient management
4. Sustainable agricultural production
5. New crop production and marketing

Survey respondents had the opportunity to write additional general agriculture needs that they would like to include (Appendix A, Table 4). There were five needs identified:

1. Sustainable agriculture
2. New crop production and marketing
3. Soil health
4. Crop varietal testing
5. Miscellaneous (e.g., conservation, restoration, marketing, processing and distribution)

The survey respondents had the opportunity to indicate their top three overall needs. The research team then sorted these into the program area categories. The top three priority needs indicated were (Appendix B, Table 1):

1. New crop production and marketing
2. Sustainable agriculture
3. Pollinators and their health

Through thorough analysis of all results, low-water-use crops and their marketing, alternate cropping system, soil health, noxious weed management, and water conservation were the top needs identified across all areas of focus and their ratings.

Limitations

This study deployed a mixed-method approach, and findings from each program area component converged to strengthen the conclusions. However, this study does have some limitations. The survey was distributed using a snowball sampling method, which can bias the sample, as respondents could be more likely to refer people who are similarly situated or share their opinions on the topic. This approach might have increased participation, but the lack of a representative sample needs to be noted when interpreting results. Another limitation is the lack of representation of our diverse statewide residents in the online survey, as most respondents (80.4%) identified as White/Caucasian. For the open-ended items, respondents had different interpretations of the prompts, resulting in diverse answers that did not easily fall into discrete themes or categories. Several respondents included BLM lands as well as their own personal land holdings when reporting the size of their operation, while others wrote qualitative descriptions such as “a lot.” Therefore, we were not able to explore differences by the relative sizes of respondents’ active agricultural lands. Finally, several interview participants and survey respondents mentioned specific concerns, which could be tied to the time of year during which they participated, so responses captured at different points in the growing season could reflect very different concerns, especially regarding pests and weather challenges.

Future Programming Needs

Through analysis of all results, including an online survey, open-ended questions and interviews, significant program and research priorities were developed from the statewide crop and resource-use need assessment findings (no particular order; Figure 9):

- Alternative crop program, including alternative low-water-use and specialty crops
- Soil health program, including nutrient management and cover crops
- Irrigation management, including water conservation and alternative irrigation methods

- Pest identification and management, including noxious weeds, pollinators health education
- New crop marketing

Figure 9: Infographic of future programming needs

Summary

This mixed-method approach has identified several critical statewide needs focusing on crop and resource-use. While current Extension employees can work on priority identified needs, there are some needs beyond our expertise and/or staff to address, such as irrigation, pollinator health, marketing, entomologist, pathologist and weed specialist. Given current resources and staffing, Extension has to continue to assess how best to offer pest management education. It is the intent of the authors to create a publication that identifies and ranks statewide crop and resource-use issues that residents face. The outcomes of this statewide needs assessment using a mixed-method approach are intended to serve as a roadmap for developing, delivering and evaluating educational programs to address the knowledge gaps statewide to enhance Nevada citizens' quality of life. Current results reveal ongoing interest in a variety of preferred methods of educational communication, and Extension will continue hosting field demonstrations and workshops and developing publications for growers throughout Nevada to access the information when needed.

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Appendix A

The tables in this appendix show the code counts for the open-ended responses that participants provided for each content area. For example, Table 1 demonstrated that insect identification and management was the pest control need most identified in the open-ended responses, while it was the fifth-ranked need in the quantitative measures (Figure 4).

The numbers in each table of this appendix reveal the number of respondents who mentioned each need, but does not provide a quantitative rating of the relative importance of the need. In most cases, the information obtained through coding the open-response items supported the quantitative ratings and added additional information. However, certain needs were overemphasized in the open responses as compared to the relative importance captured in the quantitative ratings. It also should be noted that fewer people responded to the open-ended questions than to the quantitative items and many participants mentioned more than one need in their open responses.

Appendix A - Table 1: Code counts for additional pest management needs (n=85)

Code Counts for Matched Codes	
Insect Identification and Management	20
Basic Weed Identification and Management	7
Responsible Chemical Use	6
Noxious Weed Prevention and Management	3
Plant Disease Identification and Management	3
Integrated Pest Management	1
Miscellaneous (e.g., rodents, animals, and natural and chemical-free control)	30

Note: Sum of code counts will not match total "n," because some respondents provided lengthy comments that fit more than one code, and others wrote comments such as "none," which are not included in the table.

Appendix A - Table 2: Code counts for additional crop needs (n=59)

Code Counts for Matched Codes	
Specialty Crops	12
Low-Water-Use Crops	10
Cover Crops	2
Organic	2
Miscellaneous (e.g., marketing, processing and water supply)	21

Note: Sum of code counts will not match total "n," because some respondents provided lengthy comments that fit more than one code, and others wrote comments such as "none," which are not included in the table.

Appendix A - Table 3: Code counts for additional resource-use needs (n=45)

Code Counts for Matched Codes	
Soil Health Management	11
Water Quality	3
Water Conservation	3
Enhance Water-Use Efficiency	4
Miscellaneous (e.g., amendments and compost)	5

Note: Sum of code counts will not match total "n," because some respondents provided lengthy comments that fit more than one code, and others wrote comments such as "none," which are not included in the table.

Appendix A - Table 4: Code counts for additional general agriculture needs (n=36)

Code Counts for Matched Codes	
Sustainable Ag Production	5
New Crop Marketing	3
Soil Health	2
Crop Varietal Testing	2
Pollinators and Their Health	1
Miscellaneous (e.g., conservation, restoration, marketing, processing and distribution)	11

Note: Sum of code counts will not match total "n," because some respondents provided lengthy comments that fit more than one code, and others wrote comments such as "none," which are not included in the table.

Appendix B

Appendix B - Table 1: Top three most important needs as identified in open-response items

	Position #1 (n = 150)	Position #2 (n = 133)	Position #3 (n = 123)	Weighted Total
Resource-Use Needs	**74**	**65**	**46**	**398**
Soil Health	35	29	13	176
Nutrient Management	14	19	15	95
Water Conservation	15	12	10	79
Enhancing Water-Use Efficiency	9	7	9	50
Water Quality	6	3	4	28
Crop Needs	**48**	**45**	**36**	**270**
Low-Water-Use Crops	13	8	10	65
Specialty Crops	12	9	6	60
Cover Crops	4	9	7	37
Traditional Cropping Systems	8	4	2	34
Organic Farming	3	4	2	19
Alternative Cropping Systems	0	4	6	14
New Crop Production Practices	0	1	1	3
Pest Needs	**30**	**17**	**23**	**147**
Noxious Weed Prevention and Management	8	4	4	36
Responsible Chemical Use	8	3	4	34
Basic Weed Identification and Management	5	4	6	29
Insect Identification and Management	4	0	3	15
Plant Disease Identification and Management	1	1	4	9
General Agriculture Needs	**4**	**9**	**7**	**37**
New Crop Production and Marketing	3	0	1	10
Sustainable Ag Production	0	3	3	9
Pollinators and Their Health	1	1	2	7

Note: Sum of code counts will not match total "n," because some respondents provided lengthy comments that fit more than one code, and others wrote comments such as "none," which are not included in the table. This table details the code counts for text comments provided by survey respondents answering an open-ended question about their top three identified needs. While each of the quantitative measures presented in Chapter 2 allows for a relative comparison of the rated importance of each factor, people could (and did) rate each factor as equally important. This open-ended question allowed respondents to address factors across thematic areas, and forced ranking needs ordinally (e.g., they could include both a pest control need and a crop need, and then rank their relative importance).