Research Note: A survey of current range research activity

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Abstract

Range scientist members of the Society for Range Management were surveyed to evaluate where research efforts have been concentrated in the recent past relative to current and future allocation of efforts, how research is funded, where it is published, how well the scientists perceive that clientele needs are met, and what obstacles scientists face. Range ecology and range improvements are the topics that were, and continue to be seen as the most important for investigation. Plant improvement, range watershed, range wildlife, and ecophysiology are important future research topics. In-house funding was the most frequent source of funds for all groups of range researchers. University scientists were the most likely to have other sources of funds. There are funding sources that may be underutilized. The 4 most frequently listed clients are livestock producers (73 listings), state and federal agencies (71), other scientists (46), and the private sector (27). Forest Service scientists appear to have the least restricted view of their clientele. Over 25% of the respondents felt that there were no client groups not being adequately served by range research. Others felt that livestock producers and the public were not being adequately served. The *Journal of Range Management* was the most frequently listed publication outlet followed by conference papers and symposium proceedings.

Limited funding was the most frequently listed obstacle to doing research, followed by poor communication between researchers and clients, and the need for more interdisciplinary interaction.

Key Words: research funding, research topics, publication patterns, clients

Among range professionals there has been a feeling of increased urgency in expanding and enhancing the range research agenda (SRM 1988). This sense of urgency is compounded by the fact that real dollar funding for range research has been declining at a time when increasing support is needed due to steadily growing pressure on the rangeland resource from a wide range of users. The Research Affairs Committee of the Society for Range Management evaluated the status and future of research in the context of these problems.

The committee identified several steps toward improving understanding of range research. Primary among these was an evaluation of research activities in the recent past including topics where research efforts have been concentrated relative to current and future allocation of efforts, how this research has been funded, where it was published, how well the scientists perceive that clientele needs are being met, and what obstacles range scientists face. A survey of range scientist members of the society was conducted to evaluate these concerns.

Objectives

1. Identify subject areas where range research has focused within the past 10 years.
2. Delineate subject areas where SRM range researchers think research should be concentrated within the next 10 years.
3. Discover principal sources of research funding accessed by SRM range researchers within the past 10 years.
4. Identify potentially underutilized sources of funding for range research.
5. Assess SRM range researchers' perceptions of clientele served.
6. Reveal principal publication outlets used by SRM researchers within the past 10 years.
7. Verify relative importance of funding as an obstacle to range research.

Methods

A mail survey was designed based upon Dillman's (1978) Total Design Method. The questionnaire was open ended in order to elicit an unbiased response to the questions (Table 1). The survey, with an explanatory letter and post-paid return envelope, was sent to all SRM members in the US who had identified themselves as range researchers on their membership information. A total of 309 questionnaires were mailed in August 1988, and a reminder mailing was sent several weeks later.

A response rate of 65% was achieved. Responses were entered verbatim into a database which allowed them to be sorted so that all responses to an individual question could be grouped together, or responses could be sorted and evaluated by other criteria, such

Table 1. Questions used in survey.

1. Are you now, or have you been in the last 10 years, involved in range research?
2. Do you work for:
___ University ___ Forest Service
___ ARS ___ Private Sector
___ Other(please describe)_____

3. What sources of funding have you utilized most successfully for funding your range research within the past 10 years?
4.What sources of funding for range research have you been unable to access?
5. Are there sources of funding for range research which you believe are underutilized? Please list.
6. In the first column please rank those areas in which you have done research within the past 10 years in order of 1-most effort, 2-next most effort etc...For equal effort, use a number more than once.
7.In the second column, rank your current research topic(s) as you did in first column.
8 In the third column please rank those topics which you believe are in the most critical need of research within the next 10 years(regardless of funding, employer goals or your personal interest or ability to actually do the research).

topic area	past 10 year' efforts	current research	we should do more of
range livestock production			
range animal nutrition			
herbivore bioenergetics			
plant physiology			
ecophysiology			
plant communities			
fire ecology			
range wildlife			
range economics			
forest grazing			
rangeland soils			
range ecology			
recreation on rangelands			
rangeland watersheds			
inventory and classification			
poisonous plants			
grazing systems			
range management sociology			
land use systems			
land tenure			
range extension methods			
history, policy, or law			
other...please list			

9. Please list the journals or other places where results of this research have been published

outlet	type of publication	number of publications

10. What principle client groups have been served by your research within the past 10 years?
11. Are there client groups which you believe we, as range researchers, are not adequately serving?
12. What do you see as being the major obstacles to doing both the types of research we should be doing, and serving the client groups we should be serving?

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as employer.

Results and Discussion

Respondent Characteristics

Of the 201 respondents, 40 were not involved in range research. All conclusions were drawn from the replies of the 161 respondents who were active in range research within the past 10 years. It should be noted that range research was not defined in the questionnaire, leaving the recipients to decide if their work fit within this category.

This survey does not constitute an accounting of all present range researchers, but is representative of 1988 SRM members who were listed in the SRM database as range researchers. There are a number of range scientists who do not belong to SRM. The society has not updated this employment database since 1985, thus newer researchers were underrepresented among respondents.

The respondents were grouped by employer (Fig. 1). The largest

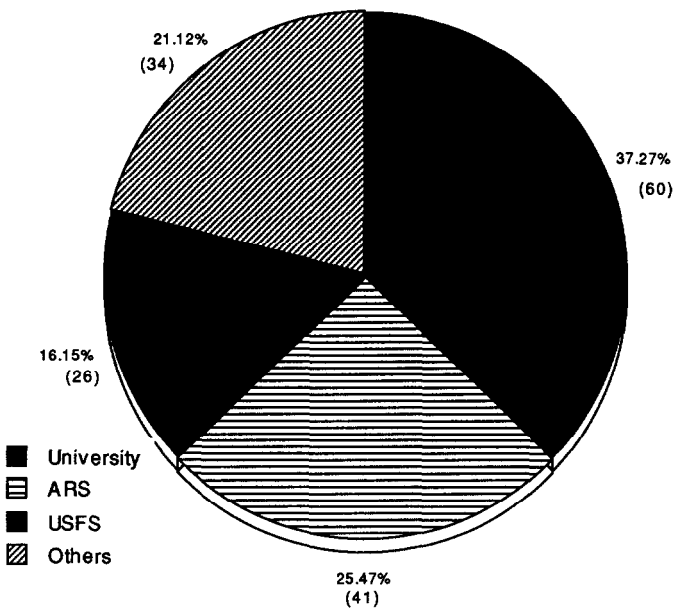

Fig. 1. Distribution of respondents by employer.

group represented were university researchers, 60 of whom replied (37% of respondents). Next most numerous were Agricultural Research Service (ARS) scientists (41, or 25%) followed by Forest Service (26, or 16%), and 34 (21%) "other scientists". Within the other scientists category, 31 of the 34 were employed by federal, state, or local government agencies.

Table 2. The 6 most frequently selected research topics for each time period (all respondents).[1]

Past 10 years	Currently	Future need	
range improvements	81 range ecology	58 range ecology	74
range ecology	78 range improvements	53 range improvements	55
plant communities	57 poisonous plants	53 plant improvement	55
range wildlife	50 plant communities	39 range watershed	55
plant improvement	46 plant improvement	36 range wildlife	53
plant physiology	43 range wildlife	31 ecophysiology	51

[1]Due to the open-ended nature of the questionnaire, it was not always clear if each group was mutually exclusive (e.g. land managers vs land owners). Many respondents listed individual state or federal agencies, or positions within agencies (e.g. SCS technical staff). These responses were grouped as state and federal agencies. Ranchers, cattlemen, livestock industry etc...were grouped as livestock producers.

Table 3. Sources of research (number of respondents giving any answer).

	Respondent				
Source of support	UNIV	ARS	USFS	Other	Total
In-house	27	40	26	14	107
"Federal"	10				10
NSF	5	1	1		7
USDA comp.	4	1	1		6
NASA	1			1	2
APHIS	2				2
USFS	10	1		1	12
BLM	6	2	4	3	15
Dept. Energy	2			1	3
SCS	3		2	1	6
U.S. Fish & Wildlife Service	3				3
OICD	1				1
USGS	1				1
AID	4				4
NPS	3		1		4
ARS and SEA	8				8
Pittman-Robertson				5	5
EPA		2		1	3
OSM		1		1	2
Military Sources	3				3
Foundations	3			1	4
"Contracts"	1				1
Industry	10	8	1	1	20
Personal funds	1				1
Consulting service	2				2
Private sector	6			1	7
Water board	1				1
State budget line item	1			1	2
Local grants	1				1
Landowners	5				5
Endowment	1				1
State Agencies	3	2	1	1	7
Regional projects	1				1
Utility company	1				1
Seam				1	1
State University-coop study		4	1		5
Local sportsmen				1	1
Livestock cooperators		2			2
Environmental group				1	1
NIPSAT			1		1
Short-term special project $			1		1
Total	130	64	41	36	271

Research Focus—Past, Present, and Future.

Respondents were asked to rank the topic areas to which they had devoted the most research effort. Not all respondents ranked the offered research topics in a consistent manner. Therefore the data were analyzed by the frequency of any given response. The 6 most frequent choices of all respondents for past and present efforts and for future importance are shown in Table 2.

Range ecology and range improvements are the 2 topic areas that were, and continue to be seen as the most important research areas. Plant improvement appears to be gaining increased importance perhaps due to newly available biotechnologies. The emphasis on plant community studies appears to be declining although some of this may be absorbed within the individual's definitions of range ecology. An interesting anomaly is the current activity in poisonous plant research in spite of less past and future research emphasis on this topic. Plant physiology was an area of research emphasis within the past 10 years whose importance dropped sharply in current efforts yet was seen as a future research need. Although the future need for plant physiology research does not place it within the top 6 topic areas, ecophysiology, a related

discipline, does appear within the top 6 areas for future emphasis.

There were some differences among groups of range scientists ranking the same topics. University range scientists make up the largest group of respondents and were the most diverse in their research activity. This might be expected considering the absence of any coordinated national programs directly guiding their research efforts. Within the past 10 years, university range scientists have focused most frequently on range ecology (1), range improvements (2), range wildlife (3), plant communities (4), fire ecology (5), and grazing systems (6). Current research efforts continue to emphasize range ecology and improvements but also include poisonous plants in a 3-way tie for first ranking. Plant communities (2), fire ecology (3), range wildlife (4), and grazing systems (5) remain important research areas. Plant improvement is the last of the top 6 rankings. Areas for future research emphasis diverge widely but range ecology remains in first place, followed by range wildlife, rangeland watersheds, and grazing systems tied for second ranking. Range economics enters with a third ranking. Seven additional topics are ranked either 4th, 5th, or 6th, with the newcomers being ecophysiology (5), range management sociology (5), rangeland soils (6), range animal nutrition (6), and land tenure (6).

Range scientists working in the Agricultural Research Service ranked range improvements as the most important research topic area. This top slot is currently shared with poisonous plants, a focus this group ranks as less important in the future. ARS range scientists ranked range ecology as an important topic, though slightly less so than to the entire group of respondents. In contrast, plant physiology has been a more important topic, as has plant improvement. Other research topics within the top 6 during the past 10 years include range livestock nutrition, ecophysiology, rangeland watersheds, and grazing systems. Current emphases after range improvements and poisonous plants are range ecology (3), plant improvement (4), rangeland soils (5), and rangeland watersheds (6). ARS scientists see range improvements (1), plant improvement (2), range ecology (3), and ecophysiology (4) as important areas for future research efforts, however, they also include range animal nutrition (4), plant physiology (4), grazing systems (5), and plant communities (6), as important future topics.

Forest Service range scientists listed range ecology (1), plant communities (2), range improvements, and range wildlife (tied for third) as their major research topics in the past 10 years. Emphasis on inventory and classification (4), range watersheds (5), and fire ecology (5) may be a reflection of the relationship to the National Forest System and its research needs. Ecophysiology (6) was also an important focus of past efforts. Currently, plant community work remains second only to range ecology while plant improvement and ecophysiology share third ranking. Current efforts are so diverse that there is not a clear-cut ranking beyond this point. Areas for future research emphasis are more straightforward. Ecology is followed by ecophysiology while plant physiology and fire ecology tie in third ranking. Range watersheds (4), range wildlife (5), and plant improvement (5) are major interests but continued emphasis on plant communities (6) and an interest in rangeland sociology (6) may be reflections of this group's unique mission.

The range scientists not representing any one major employer have invested their research time comparably to the entire group. The exact order of the topics sometimes varies, notably, range ecology ranked 5th with this group. Current efforts follow a similar pattern, but plant communities have the number 1 slot, followed by range improvements, range wildlife, and poisonous plants all tied

Table 4. Underutilized sources of funding (number of respondents giving any answer).

Source of support	Respondent				
	UNIV	ARS	USFS	Other	Total
NSF	5	3	2	1	11
Producer's org.	4	4		1	9
Private sector/industry	6	1	4	2	13
Military	1				1
SCS	1	2			3
State agencies	1	1			2
Regional authorities	1				1
Mining companies	2				2
State park depts	1				1
Environmental groups	2	1			3
Consulting groups	1				1
BARD	1				1
BLM	1	4		4	9
USFS	1	1		3	5
Recreationists	1				1
USDA		3			3
USDI		2		1	3
Foundations		1	2		3
Fish & Wildlife Service		1		1	2
EPA		1			1
Extension service		1	1		2
None underutilized	1				1
Total					78

Table 5. Major clientele served (number of respondents giving any answer) and rank within that group of respondents.

Client	Respondents									
	UNIV		ARS		USFS		Other		Total	
	N	Rank	N	Rank	N	Rank	N	Rank	N	Rank
Livestock producers	27	(1)	29	(1)	6	(2)	11	(2)	73	(1)
Federal & State agencies	19	(2)	27	(2)	11	(1)	14	(1)	71	(2)
Range researchers	13	(3)	17	(3)	6	(2)	5		41	(3)
Private sector	10	(4)	5		2		10	(3)	27	(4)
Universities	6		1		3		2		12	
Range Managers	6		0		5	(3)	4		15	
Extension	5		10	(4)	0		1		16	
Mine reclamation interests	11		6		4	(4)	4		25	
Land managers	1		2		11	(1)	2		16	
Wildlife managers	2		0		6	(2)	8	(4)	16	
Foresters	0		0		3		0		3	
Landowners	4		0		1		3		8	
Sportsman	0		0		0		4		4	

[1]Only those clients listed 4 or more times are included this table.

for second. Range ecology ranks third in current efforts. In the area of recommended future research focus, this group diverges somewhat from the entire group, although they share the opinion that range ecology is the most important area, followed by range improvements. Range wildlife ranks third, fire ecology 4th, and plant communities and range extension methods tie for 5th, with no clear-cut sixth choice.

Only a few distinctive differences appear when comparing the separate groups. University research is less diverse and independent of national initiatives than it first appears. National initiatives within federal base and formula funding programs might be expected to have some influence on individual faculties' research foci, as would dependence on extramural funding through grants and contracts. For example, university scientists' emphasis on plant communities may be partly a result of funding from the Forest Service for this activity and the emphasis on poisonous plants may represent collaboration with the Agricultural Research Service. Research within different groups may be related, and to an increasing degree, all are influenced by the availability of funds from government programs and extramural sources.

Sources of Research Funding

In-house funding was overwhelmingly the most frequent source of funds for all groups of range researchers (Table 3). University range scientists were the most likely to have other soruces of funds and have the greatest variety of funding sources, listing a total of 35 different sources of funds (as compared to ARS-11, USFS-11, and other scientists 16). Industry support was most important to university and ARS scientists. University researchers were the only group to report support from the military. In general, those who had any source of extramural funds had several sources, perhaps indicating a higher level of need, motivation, or skill in grant-seeking, or a research topic of particular interest to groups that support range research.

Twenty-three respondents reported that they had never sought other sources of support. This response was most common from the ARS scientists, 20% of whom had never sought other sources of research funding, and least frequent from university scientists, only 10% of whom have not. Four Forest Service scientists report only recently being directed to seek outside research funding.

Among the 138 scientists who have sought outside research support, 21 have tried but failed to secure NSF funding. This is the most frequently cited unsuccessful funding effort. Not receiving USDA competitive grants was the second most frequent disappointment reported (19), although only university and ARS scientists appear to apply to this program in significant numbers.

Foundation and private funding is only occasionally sought and rarely secured. In only 4 instances were land users, producers' groups (Cattlemen, Woolgrowers), or sporting groups listed as sources of research support, although the "industry" designation might have been intended to include some support from producers' groups.

Producers' groups become significant when we look at the respondents' opinions on underutilized sources of research funding (Table 4). Although individual respondents listed a number of potentially underutilized sources of funds, only a few of these were listed repeatedly: NSF, private sector/industry, the BLM, and Forest Service. As noted earlier, survey respondents expressed frustration at their inability to tap NSF funding, but the private sector/industry, BLM, and USFS were rarely cited as the target of unsuccessful proposals. There may be a perception that NSF and private/industrial sources grant larger sums, making them more visible as underutilized sources. As Table 3 illustrates, there are a number of other sources that have funded range research and these too may represent underutilized sources of funding.

It is interesting that livestock producers' groups did not appear on the list of funding sources but appeared frequently on the underutilized list. Individual landowners and livestock cooperators did appear several times as sources of support and these might be considered the same as "producers", but not the same as formal producers' groups. Given the general feeling that range research is not adequately funded, and that underutilized sources of funds may exist, it can be concluded that there are instances where range scientists could be more effective in soliciting research support.

Clientele Served

University scientists listed 32 different client groups, ARS 16, USFS 18, and other scientists 18. Major client groups are defined as those mentioned more than 3 the times by any 1 group (Table 5). The 4 most important client groups for all respondents are livestock producers (listed 73 times), state and federal agencies (71), other scientists (46), and the private sector (27). Of the 4 groups of range scientists, Forest Service scientists appear to have the least restricted view of their clientele, perhaps reflecting the agency's relatively long standing multiple-use tradition. Other range scientists are an important audience for university, ARS, and Forest Service scientists. It is interesting to note the relative emphasis on extension clients by the ARS range scientists.

When asked if there were clientele that the range research community was not adequately serving, only 25% of the respondents indicated none (Table 6). Almost half this many felt that producers were not being adequately served, and the public followed closely as the third most frequently cited group not being well served by range research. Environmenalists, although not in the 4 most frequently listed groups, were listed more frequently than conservation interests. A distinction between these 2 groups may or may

Table 6. Clientele not being adequately served by range research[1].

Client	Respondents									
	UNIV		ARS		USFS		Other		Total	
	N	Rank	N	Rank	N	Rank	N	Rank	N	Rank
None	21	(1)	12	(2)	7	(1)	5	(1)	45	(1)
Producers	8		13	(1)	1		4	(2)	26	(2)
Public	8	(2)	5	(3)	4	(2)	3	(3)	20	(3)
Wildlife interests	5		3		4	(2)	3	(3)	15	(4)
Recreation interests	6	(3)	3		4	(2)	2		15	(4)
Environmentalists	2		3		4	(2)	2		11	
Public land agencies	2		3		0		1		6	
Industry	3		1		1		1		6	
Watershed interests	1		3		1		0		5	
Land managers	2		0				0		5	
Conservation groups	0		3		0		1		4	

[1]Only those clients listed 4 or more times are included in this table.

Table 7. Outlets for research results (number of respondents giving any 1 answer and top 4 ranked outlets).

Client	Respondents									
	UNIV		ARS		USFS		Other		Total	
	N	Rank	N	Rank	N	Rank	N	Rank	N	Rank
J. Range Management	34	(1)	33	(1)	17	(1)	16	(1)	100	(1)
State Exp. Sta. Publ.	10	(3)	4		0		1		15	
Proceedings	13	(2)	14	(2)	11	(3)	8	(2)	46	(2)
Extension Publications	8		3		0		3		14	
Range Society Meetings	9	(4)	5		11	(3)	4	(4)	29	(3)
Books or book chapters	3		4		2		1		10	
Internal or dept. publ.	5		2		16	(2)	6	(3)	29	(3)
Other professional mtgs.	3		0		1		2		5	
Grant reports	6		0		0		0		6	
J. Soil & Water Conserv.	4		2		2		0		8	
Southwest Nat.	3		0		0		2		5	
J. of Animal Science	4		2		0		1		7	
Great Basin Nat.	3		0		3		3		9	
Weed Science	4		7		0		2		13	
J. Wildland Management	7		0		5		2		14	
Agronomy Journal	4		11	(3)	1		1		17	
Rangelands	7		3		6	(4)	3		19	(4)
Northwest Science	3		0		2		1		6	
Crop Science	0		6	(4)	0		0		6	
Journal Envi. Qual.	0		4		0		0		4	
Can. Journal Plant Science	0		3		1		1		5	
									367	

[1]did not distinguish SRM from other meetings.

not have been intended by the respondents.

When the information in Tables 5 and 6 are compared, several facts become apparent. First, among the major client groups, several are recognized as not being adequately served. This group includes livestock producers, land management agencies, private sector/industry, wildlife interests, and land managers. Another client group which range scientists see as not being adequately served includes the general public, recreation interests, environmentalists, watershed interests, and conservation groups. These data could be interpreted as evidence of range scientists' recognition that the audience for range research has broadened beyond the most frequently targeted client groups of the recent past, but that the needs of some of the more traditional client groups are still not being met.

Publication Patterns

As the official repository of scientific progress, publications offer additional insight into the range research activity of the past decade. There are many outlets for research results in addition to peer reviewed journals (Table 7).

University range scientists listed the greatest total number of outlets (70) while the ARS, USFS, and other scientists listed 39, 33, and 37 respectively. Most respondents who publish listed no more than 4 different outlets. It should be noted that some non-university range scientists are more prolific than some university range scientists. The university scientists' larger list of outlets may be due to this group's size and more diverse research opportunities, rather than a greater tendency to publish.

The *Journal of Range Management (JRM)* was the outlet most frequently listed by all groups. The next most frequent outlet was conference papers and symposium proceedings. Presentations at "range society meetings" and agency or in-house publications were the third most frequently listed outlets for the entire group and for all groups except Forest Service scientists, who listed this second most frequently. The frequency of listing of *JRM* and *Rangelands* is to be expected because all respondents are Society for Range Management members and receive both of these publications regularly. This points out the frequency with which members utilize this service of the society.

Of the most frequently listed outlets, only *JRM* is consistently refereed. Other outlets may be as rigorously scrutinized on an individual basis. Of the 4 groups of scientists, only ARS scientists list other refereed journals in their 4 most frequently used outlets. The *Agronomy Journal* was the third most frequently listed and *Crop Science* fourth. University scientists published in 46 different refereed journals, ARS 27, Forest Service 27, and the others, 18.

Obstacles

The respondents were asked what obstacles they saw to "doing the research we should be doing, and serving the clients we should be serving". Limited funding was the most frequent response, listed 3 times as often as the next most frequent responses: poor communication between researchers and clients, the need for more interdisciplinary interaction and poor extension and technology transfer (Table 8).

All groups agreed that funding was the most common obstacle. University range scientists' second most frequent obstacle is lack of

Table 8. Major obstacles to improved range research (number of respondents listing any 1 obstacle).

Client	Respondents				
	UNIV	ARS	USFS	Other	Total
Funding	20	17	12	7	56
Poor communication between researchers & clients	7	4	2	3	16
Need more interdisciplinary interaction	3	7	4	2	16
Poor extension/technology transfer	5	5	1	3	14
Short-term bias in project selection	4	1	1	6	12
Publication pressure	5	3	1	1	10
Lack of time	7	1	0	1	9
Livestock bias in range management	4	1	1	2	8
Poor public understanding & support of range research	4	1	2	1	8
Single use bias in problem solving	3	3	0	1	7
Total					156

time. Given the prevalence of split appointments between research, teaching, and/or extension, this is not surprising. Equally of concern to this group was "poor communication between researchers and clients". Publication pressure and poor extension/technology transfer tie for third place. These may be related as academic publication pressure is usually focused on refereed journals, which may not always be the ideal means of extension and technology transfer, hence this group feels 2 opposing pressures.

Agricultural Research Service range scientists see funding as an obstacle, followed by the need for more interdisciplinary activity. Poor extension and technology transfer and poor communication between researchers and clients are additional concerns of this group. Other than funding, the need for more interdisciplinary activity was the only frequent obstacle seen by most Forest Service range scientists. In contrast, after funding, the group of other scientists sees the short-term bias in project selection as the second most common obstacle.

A number of other practical (e.g., high overhead), philosophical, and public relations concerns were expressed, but none as frequently as those listed in Table 8. One optimist stated there were no obstacles while another viewed failures as individual rather than institutional. The majority, however, do see several significant obstacles to doing the work that needs to be done and serving all the clients we should be serving. University scientists listed 27 different obstacles, ARS 37, USFS 24, and the other scientists 20. Although ARS scientists listed more obstacles, they ran the gamut from practical to philosophical with no indication of obstacles that were unique to this group.

Conclusions and Recommendations

This survey explores the perceptions of range scientists about their research activities. It would be useful if the Society for Range Management membership database could be updated to make a larger percentage of the current research community readily accessible for further study of its collective efforts. Primary among the obstacles listed by respondents is a lack of funding for range research. The number of potentially underutilized sources of funds listed indicates that some scientists feel that funding could be increased from existing sources. The dependence on in-house funding and increased pressure on scientists to pursue extramural funding suggests that in-house funding is becoming increasingly inadequate. Yet, one scientist's in-house source may be another's extramural source. The fact that scientists who develop one outside source usually have several more suggests that grant-seeking success can be improved. Graduate student advisors would do well to ensure that all students are trained in grant-seeking as well as research skills. Providing training in grant-seeking may be a legitimate role for the Society for Range Management.

The respondents' perceptions of their clientele may not be consistent with their funding sources. Given the high degree of public funding, it may be necessary to demonstrate the public benefits from range research to better overcome the communication and public relations obstacles many of the range scientists described. Although the scientists were not asked to list specific obstacles to greater funding, greater public awareness and support of range research might result in better funding for this activity. Undoubtedly, range scientists are sincere in their belief that proper range management benefits everyone, but this argument may not be fully utilized in seeking public and private sector funds (e.g., conservation groups and foundations).

Making the public more aware of the benefits of well-managed rangelands is an important task for the range research community. As Wilkes (1990) argues, the public believes scientists, and it may be more efficient for the scientist to communicate directly with the public at times than to leave this to journalists whose objectives for communication may be quite different. This has implications for the publication patterns of scientists. Balancing publication in rigorously refereed technical outlets with popular and extension publications might increase public support for range research.

This leads to consideration of the future direction of range research. The respondents' opinions are discussed earlier, and summarized in Table 2. These can be compared with the Society for Range Management's 1988 recommendations on future topics for federal range research funding (SRM 1988): water quantity, quality, and management; basic ecology; soil, plant, and animal relations; integrating land uses; integrated systems research; plant improvement and protection; and weed and brush management. Technology transfer needs in the areas of improved pasture and rangelands; enterprise profitability, conflict resolution, multiple use techniques; and grazing lands and people were also listed.

The range research community should consider whether the direction of future research will be constrained if future range research funding comes from fewer and fewer sources. As scientists are increasingly directed to compete for the same sources of extramural funds and in-house funds of one group become the extramural source of other groups, the influence of particular initiatives increases. As noted earlier, university scientists are the most eclectic in their research, and have twice as many sources of research support as any other group of scientists. If creativity and diversity are to be nurtured within the research community, then a diverse range of funding sources should be developed and maintained to insure that the interests of a wide clientele, both present and future, are met.

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