JRM Rangeland Research Funding (1989-1993)

Justin D. Derner

Financial support for applied research involving U.S. rangelands continues to diminish as federal and state governments encounter budget constraints. Engle and Waller (1993) indicate the trend will become a critical issue in institutions where formula funds historically supported long-term, applied research. External funding is defined as financial support that is not provided "in-house" through the author(s)' employer. Potential sources of external funds include federal agencies, foundations, private businesses, and individuals. Examples of external funding sources include National Science Foundation (NSF) grants, USDA Cooperative State Research Service (USDA-CSRS) grants, foundation support (e.g., Caesar Kleberg Foundation for Wildlife Conservation), and mining and chemical company donations. Submission procedures have become more complex and competitive, for all funding sources, as the number of applicants increases. Currently, as many as 95% of all grant applications are unsuccessful (Decker and Decker 1993). This article assesses the relative financial contribution provided by external funds, Agriculture Experiment Stations (AES), and the USDA Agricultural Research Service (ARS), for published research articles that emphasized U.S. rangelands in the *Journal of Range Management (JRM)* during the past five years (1989-1993).

Approach

Information on financial support was obtained from the acknowledgements section of each article and the author(s)' employment affiliation at the time the research was conducted. Articles that did not emphasize research on U.S. rangelands (i.e., foreign articles) were not included. Each article was classified by the *JRM* section headings: Animal Ecology, Animal Physiology, Economics, Grazing Management, Improvements, Measurement/Sampling, Plant Ecology, Plant/Animal Interactions, Plant Physiology, Rehabilitation/Reclamation, and Soils/Hydrology. Articles not fitting one of the 11 different sections were not included. Each article was then categorized (if applicable) as receiving one or a combination of the 3 main financial sources acknowledged over the review period: external, AES, or ARS financial support. The USDA Soil Conservation Service (SCS), USDA Forest Service (FS), and USDI Bureau of Land Management (BLM) each financially supported a minimal number of articles, but they were not included as funding sources. If an article indicated sole financial support from the SCS, FS, and/or BLM the article was categorized as receiving no financial support. Articles with multiple sources of financial support were categorized as receiving support from all involved sources; therefore, totals of financial support within section headings can exceed 100%. Partial and full financial support were not distinguished. If an article indicated at least partial support from a particular source it was categorized as receiving financial support from the involved source.

Section headings are arranged in order of descending number of articles published over the 5-year period. The number of articles used for classification in each section is given, along with the relative percentages of financial support from external, AES, and ARS sources. Trends within each section regarding number of articles published and level of financial support from each source, if applicable, are shown. It should be noted that five years may be an insufficient period to detect accurate trends, but this information is of value to researchers evaluating today's rapidly changing funding base.

Results

A total of 447 articles was published with emphasis on U.S. rangeland research during the 5-year period reviewed (Table 1). Plant Ecology and Plant/Animal Interactions sections had the most articles published during this time span. Conversely, the Reclamation/Rehabilitation section had only 9 articles published in the 5 years. The number of articles published in the Plant Physiology section declined over the review period, while the numbers increased in the

Table 1. Distribution of *JRM* articles published emphasizing U.S. rangeland research within the 11 sections over the 5-year period from 1989-1993.

JRM Section	Section Total	Number of Articles Published 1989	1990	1991	1992	1993
Plant Ecology	91	19	21	12	25	14
Plant/Animal Interactions	80	13	7	11	32	17
Plant Physiology	62	14	19	14	9	6
Improvements	55	8	10	20	9	8
Grazing Management	37	13	2	10	2	10
Measurement/Sampling	29	4	3	9	6	7
Animal Ecology	27	5	12	2	3	5
Soils/Hydrology	25	4	10	4	3	4
Economics	17	1	0	7	3	6
Animal Physiology	15	1	9	0	5	0
Rehabilitation/Reclamation	9	2	0	7	0	0
TOTAL	447	84	93	96	97	77

Author is graduate research assistant, Department of Rangeland Ecology and Management, Texas A&M University, College Station 77843-2126

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Table 2. Percentage of *JRM* articles reviewed from 1989-1993 receiving some financial support from AES, ARS, and External sources.

JRM Section	Year	Funding Source Contributor AES	ARS	External
		%		
Plant Ecology	1989	58	21	32
	1990	62	29	38
	1991	50	42	25
	1992	72	36	36
	1993	79	14	7
	Section total	65	29	30
Plant/Animal Interactions	1989	62	31	23
	1990	86	0	29
	1991	46	46	27
	1992	75	53	22
	1993	88	41	36
	Section total	73	41	26
Plant Physiology	1989	43	57	14
	1990	63	32	42
	1991	79	50	57
	1992	78	67	44
	1993	17	83	50
	Section total	60	52	40
Improvements	1989	75	25	25
	1990	70	40	30
	1991	75	40	45
	1992	56	44	67
	1993	75	75	25
	Section total	71	44	40
Grazing Management	1989	92	15	46
	1990	100	100	0
	1991	90	30	10
	1992	100	50	0
	1993	70	40	50
	Section total	87	32	32
Measurement/Sampling	1989	75	50	25
	1990	33	67	0
	1991	78	33	33
	1992	50	17	17
	1993	57	0	29
	Section total	62	28	24
Animal Ecology	1989	60	40	40
	1990	83	8	33
	1991	50	50	50
	1992	100	0	100
	1993	100	0	40
	Section total	82	15	44
Soils/Hydrology	1989	75	100	0
	1990	40	50	30
	1991	0	75	25
	1992	33	100	0
	1993	25	50	0
	Section total	36	68	16
Economics	1989	0	0	0
	1990	0	0	0
	1991	71	14	29
	1992	100	0	0
	1993	83	0	50
	Section total	77	6	29
Animal Physiology	1989	100	0	100
	1990	78	33	33
	1991	0	0	0
	1992	100	0	40
	1993	0	0	0
	Section total	87	20	40
Rehabilitation/Reclamation	1989	0	0	100
	1990	0	0	0
	1991	57	43	29
	1992	0	0	0
	1993	0	0	0
	Section total	44	33	44
TOTAL		68	37	32

Plant/Animal Interactions and Economics sections. Acknowledgement of some funding support from AES, ARS, and external sources was indicated in 68, 37, and 32% of all the articles, respectively (Table 2).

Plant Ecology

A total of 91 articles was published in this section over the 5-year period. Levels of financial support were 65, 30, and 29% for AES, external, and ARS sources, respectively. Only 7% of the articles published in this section during 1993 indicated external support. The external support level in the previous 4 years was 25% or higher.

Plant/Animal Interactions

Articles published in this section during the past 5 years numbered 80. A majority (61%) of the articles have been published during the past 2 years (1992 and 1993), suggesting a potential resurgence of research in this area. Almost three-quarters of the published articles received AES support (73%), while the ARS and external sources supported 41 and 26% of the articles, respectively.

Plant Physiology

There were 62 articles published in this section throughout the 5-year period. A noticeable decline in the number of articles published was evident. Respective percentages of financial support from AES, ARS, and external sources were 60, 52, and 40%. The AES funding percentages precipitously declined in 1993 from levels of the 3 previous years. Conversely, ARS funding percentage increased each year beginning in 1990.

Improvements

The number of articles in this section totaled 55 from 1989-1993. The AES funded 71% of the articles over the 5-year period. Almost equal financial support was derived from external sources, 40%, and ARS, 44%. The level of AES support was remarkably consistent with nearly 70% of the articles in each year receiving support. In contrast, the level of external support ranged from 25% in 1989 and 1993 to 67% in 1992.

Grazing Management

Thirty-seven articles were published in this section from 1989 through 1993. Thirty-three of the articles were published in the odd-numbered years with only 4 articles published in the 2 even-numbered years. The AES supported 87% of the published articles; support during the first 4 years (1989-1992) was 90% or greater. Levels of external and ARS support over the 5-year period were the same, 32%. The level of external financial support jumped tremendously in 1993 to 50%, suggesting researchers in this area may be switching to external sources instead of relying on traditional AES support for research projects.

Measurement/Sampling

A total of 29 articles was published in this section from 1989 to 1993. Financial support through the AES was acknowledged in 62% of the articles. Funding from ARS

and external sources was found in 28 and 24% of the articles, respectively. The level of ARS support has continually declined from a high of 67% in 1990 to none in 1993.

Animal Ecology

Twenty-seven articles were published in this section during 1989-1993. Levels of financial support were 82, 44, and 15% from AES, external sources, and the ARS, respectively. Funding from AES was acknowledged in all of the articles published during the past 2 years in this section. All of the articles published in 1992 and 40% of the articles in 1993 received external support. In contrast, the ARS did not support an article in either year.

Soils/Hydrology

There was a total of 25 articles published in this section throughout the 5-year period. Some articles were published under the heading of Soils or Hydrology; others under Soils/Hydrology. Therefore, for this paper, the articles were combined under the umbrella heading of Soils/Hydrology. This section received the lowest level of financial support, in terms of percentage of articles supported, from external sources (16%) and AES (36%) of all of the sections evaluated. Yet, the level of ARS support (68%) for articles in this section was the highest. The levels of support from the external sources and AES were highly variable for years. Financial support from external sources ranged from none (1989, 1992, and 1993) to 30% (1990) while AES support varied from none (1991) to 75% (1989).

Economics

There were 17 articles published in this section over the 5-year period. Only one article was published in the first 2 years (1989 and 1990) while the remaining 16 have been published during the past 3 years of the review period. Levels of financial support for articles in this section were 77, 29, and 6% from AES, external sources, and the ARS, respectively. The ARS did not support any articles in 4 of the 5 years. The AES did not fund articles in the Economics section for the first 2 years. External support was not present in 1989, 1990, or 1992; however, in 1993, 50% of the articles published in this section received external support.

Animal Physiology

Fifteen articles were published in this section throughout the 5-year period with 14 of the articles published in the 2 even-numbered years. No articles were published in 1991 or 1993. Thirteen of the 15 articles (87%) acknowledged AES funding. External sources provided funding for 40% of all the articles while the ARS supported 20%. The ARS only funded articles published in 1990. External and AES support was evident in all 3 years articles were published.

Rehabilitation/Reclamation

Only 9 articles have been published from 1989 to 1993 in this section. Two articles were published in 1989 and the other 7 in 1991. External financial support was found in both articles in 1989 and 2 of the 7 in 1991; the AES support was also 44% for this section. The ARS supported 33% of the articles.

Conclusions

The decline in federal and state government appropriations for U.S. rangeland research has challenged researchers to seek and obtain external funding to undertake or maintain specific programs, projects, or research. Potential sources of external funds for rangeland research include federal agencies, foundations, private businesses, and individuals. Books by Bauer (1988) and Hall (1988) are excellent references for persons seeking external funds. Both books involve a "hands-on" approach to guiding an individual through the critical steps of proposal writing.

Agriculture Experiment Station funding was acknowledged in 68% of *JRM* articles published emphasizing U.S. rangeland research from 1989-1993. Articles in the Animal Physiology and Grazing Management sections had the highest percentage of AES support, while limited financial support was found in Soils/Hydrology articles.

Financial support from the ARS was noted in 37% of the articles reviewed. In contrast to the other two funding sources, the percentage of articles indicating ARS support was greatest in the Soils/Hydrology section. The ARS also provided support for a large proportion of Plant Physiology articles. Limited support from the ARS was found in the Economics section where only 1 of the 17 articles acknowledged ARS financial support. Large declines in ARS support occurred during the past 5 years for articles in the Measurement/Sampling section.

Overall, 32% of the articles published in the *JRM* over the past 5 years concerned with U.S. rangeland research acknowledged external support. The Reclamation/Rehabilitation and Animal Ecology sections exhibited the highest percentages of support from external sources. The lowest relative percentage of external support was found in the Soils/Hydrology section. Also, the level of external support dropped precipitously in 1993 for articles in Plant Ecology. This may suggest that potential authors in this section are using other avenues to disseminate their findings to position themselves for subsequent external funding opportunities.

Several interesting trends emerged from the distribution of articles within the 11 *JRM* sections over the review period. First, the number of articles in the Plant Ecology section remained relatively constant from 1989-93. Second, the number of articles published in the Grazing Management section consistently oscillated from low numbers in even-numbered years to high numbers in odd-numbered years. Third, a substantial decline in the number of articles published in the Plant Physiology section was evident. It is unclear whether this decline in Plant Physiology articles can be attributed to a diminishing interest (e.g., decline in carbohydrate research), publication of research results in other journals, or a reduction in the number of active researchers.

Rangeland researchers need to be aware of the changing funding conditions, especially within their respective

research areas, and position themselves to take advantage of the situation. Engle and Waller (1993) state funding for research will continue to focus on several research issues that enjoy broad scientific and public support. They caution that as research programs become more dependent upon grant (external) funds, the stability of long-term research priorities may be jeopardized by the volatile nature of grantor priorities (Engle and Waller 1993). Current job descriptions place a high degree of emphasis on an individual's ability to secure external funding. Classroom and hands-on experience involving procurement and management of external funds will, therefore, increase an individual's marketability. Individuals who are able to generate interesting, achievable, and worthwhile proposals and subsequently possess the skills to secure external funding for research programs will very likely make the greatest individual and institutional contributions.

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