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LANDSAT RANGE RESOURCE INFORMATION SYSTEM PROJECT

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National Aeronautics and
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Johnson Space Center
Houston, Texas 77058

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TEXAS A&M UNIVERSITY
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by

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ABSTRACT

An economically, and resource-wise, diverse project area was chosen. The news media from the area was queried about present forms of range feed condition information. The consensus of opinion was that the present reports were little used and of little value because of their perceived inaccuracy and the slowness of transmission. Preferences for new forms of information were established. It was also established that the media is an information middle man and will respond to their constituents' demands for better information.

Ranchers of the project area were queried by mail questionnaire. Demographics, present information use, social affiliations and new information type preferences were established. Also a target group for a new product type test evaluation was selected.

Agri-business/technical personnel were queried. They have responded strongly positive. There should be no problems of acceptance and use of new data sources once the project progresses past a purely research stage. New information data preferences were established.

A flow diagram showing the relationship of users and information sources was prepared.

A literature review of several areas of research dealing with information diffusion in both industry and agriculture was completed. Key groups in the agriculture community were identified. Several general impediments to information flow were enumerated.

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LANDSAT RANGE RESOURCE INFORMATION SYSTEM PROJECT

1.0 BACKGROUND

1.1 Scope

Recently demonstrated techniques for estimating quantity of green biomass with the TVI parameter (Transformed Vegetation Index) have shown that range feed conditions can be monitored by computer processing Landsat Multispectral Scanner (MSS) digital data. Graphic products showing the areal extent of green biomass can be prepared in a timely manner through semi-automated processing.

The Landsat Range Resource Information System Project was designed to define the information and product requirements for various range management information needs. The time constraints, product format and content, user interest and transmission channels for both existing and proposed approaches to information transfer were evaluated. A range feed information format utilizing processed Landsat data has been developed and transferred to users for their evaluation of usefulness.

As outlined in the statement of work, this project consisted of five tasks. The first task was to define the existing information channels for dissemination of data on the state of rangeland. The second task involved evaluation of the adaptability of existing channels to information based on Landsat data. Task three was to query potential users to determine their information needs. Tasks four and five involved

the development and testing of various formats for the transfer of processed Landsat TVI range feed information to range resource managers or others actively interested in the range resource.

1.2 The Study Area

The geographical area under satellite pass #31 consists of 36 counties. The satellite pass area is approximately 50 miles either side of a line from Comstock to Quanah, Texas. This area includes portions of both the Edwards Plateau and Rolling Plains resource areas of Texas.

The portion of the Edwards Plateau with which this study deals is the western one-half of the plateau area. Soils are usually shallow with a wide range of surface textures underlain by limestone or caliche. Average annual rainfall is 15-25 inches with more years below than above the average (Gould 1975).

The plateau area is predominantly rangeland with an excellent mixture of forage plants. Frequently ranches are stocked with combinations of cattle, sheep and goats to make full use of the varied vegetation. Cultivation is largely confined to the deeper soils, valley bottoms and around the larger towns.

The Rolling Plains area with which this study dealt is a part of the Great Plains region (Gould 1975). Rainfall ranges from 22-30 inches with high summer temperatures and evaporation rates. Soils vary from coarse sands to tight clays. Over one-half of this region is in native rangeland. The primary livestock is cattle, frequently grazed on large ranches as cow-calf operations. In some sections of the region large

areas have been devoted to row crop farms of winter wheat, cotton, sorghum and beans or guar.

The Census of Agricultural Stastics (1974) was reviewed for information pertinent to the study area. In 22 of the 36 counties overflown there are 4,463 ranches controlling 10,413,665 acres. The average unit size is 2,333.33 acres. Carrying capacity for this average unit is approximately 145 animal units (au.). The modal class is 20-49 au. with 205 operators having more than 500 au. A 500 au. operation comprises approximately 8000 to 11,500 acres. The average operator age for these 22 counties is 55 years.

2.0 RANGE INFORMATION: NEEDS, USES AND DISSEMINATION

2.1 Generation and Distribution of Present Range Feed Condition Reports

Present range feed condition reports are generated by several sources. The Texas Crop-Weather Bulletin is issued weekly by the Texas Crop and Livestock Reporting Service (USDA-SRS) Austin, Texas. It is compiled by having the Texas Agricultural Extension Service county agents complete a form on Friday which is mailed to Austin and summarized for release on Monday afternoon.

Also on Friday the county agent completes a crop report for the Extension Service. It is mailed to the district agent, who summarizes the reports for the district and then mails them on to College Station for summary and issuance on Thursday afternoon.

A third report is developed from monthly mail questionnaire data by the Crop Reporting Board-Economics, Statistics and Cooperative Service-USDA. This is a map format summary of pasture and range feed conditions across the whole U.S. It is issued monthly April through December.

In addition to these government sponsored efforts, there are several reports which originate in the newspapers, farm magazines and commodities areas.

The mailing list for the Texas Agricultural Extension Service's Crop, Livestock and Weather Report was procured and analyzed to determine the current flow of available information on pasture and range feed condition. Business interests accounted for 40% of the subscribers (31/77). Governmental agencies and individuals account for 20% each while media followed

at 17%. It is noteworthy that one-half of the businesses on the mailing list were commodity brokers or commodity specialists.

2.2 The Role and Responses of the Media

A questionnaire was developed and persons interviewed to determine who was using as well as generating range feed condition information and its value. A complete listing of those surveyed, their affiliations and a sample questionnaire is included as Appendix A.

This questionnaire was designed to probe the area of information handlers. Those contacted included several persons each in the areas of newspapers, farm magazines, county agents and radio/TV. A recurring theme running throughout all of the media interviews was that the local populace is an information source for itself. If the media (radio/TV, magazines, or newspapers) had a column or spot rather than a prepared release there was invariably local input. The reporters call around to local stockyards, selected ranchers and friends and make many observations while traveling. All of this information is condensed, tempered with experience and reported as part of the local conditions.

The area of coverage of the several media vary. Small town newspapers seldom cover over 3-4 counties in the immediate vicinity. The newspapers in San Angelo, Abilene and Ft. Worth are regional, although Ft. Worth has a more urban readership than either of the others. The farm press, while fairly specialized in nature, is regional or statewide in scope. Several publications (The Cattleman, Livestock Weekly, Southwestern Farm Press) report readers in several states.

The ranchers' news sources in most cases are local. The electronic media, while regional in scope, are much too limited in time to report indepth coverage. In order to get more than immediate area (a county or two) coverage the rancher must go to a specialized publication. A frequently heard comment was that the ranchers are interested in range forage condition information on a regional scale.

Generally, the media criticized the presently available range and pasture feed condition reports as being of questionable accuracy and much too slow. These people pointed out that frequently the weekly reports were from 5 to 9 days old before they reached the final consumer. For critical decisions this length of delay was felt to be excessive.

A great deal of free news is available in the community. It originates from various sources, in most communities the A.S.C.S., S.C.S. and County Extension Agents each have several media outlets. Because the time for radio/TV and the space in print are limited, priority is given to commodity price reports, weather forecasts and technical items rather than a late, inaccurate range feed report.

When the media people were queried as to the information needed they frequently replied as an information consumer rather than as a reporter, i.e. A rancher could use... .

To preface any further discussion, the producibility of certain range related, Landsat-based products needs to be addressed. In the process of querying the several groups involved, the participants were given descriptions of potential Landsat-based products which we asked them to rank. Several of these products are not producible within the

time frame and technology available to this project. These products have been assessed by Dr. J. C. Harlan and are listed below according to the near-term capability to produce them.

Producible	Partially Producible	Not Producible
-Change in ground cover due to rainfall or drought	-Amount of noxious plant infestation	-Recommended stocking rates
-Rainfall distribution and amounts*	-Extent of frost, hail or fire damage	-Forage production by region
-Extent of brush density		-Insect damage
-Change in ground cover following range improvement practices		-Forage production forecasts
-Wildlife habitat maps		
-Vegetation type maps		
-Small grain pasture condition		

*Rainfall Distribution and Amounts is a product universally requested by the user groups which can be produced, but is not a Landsat-based product. This product is closely related to some of the Landsat-based items that it has been included in the producible list.

In this light, the media's preference for deliverable information by group was:

Farm Press	Newspapers	Radio & TV	County Agents
1. rainfall distribution and amounts	1. range growing conditions	1. general growing conditions	1. rainfall distribution
2. range growing conditions	2. rainfall data	2. rainfall distribution	2. small grain pasture condition
3. small grain pasture condition	3. small grain pasture condition	3. small grain pasture condition	

2.3 Resource Managers and Agri-business/Technical Groups

The next groups to be surveyed were the resource managers and agri-business/technical groups. The agri-business/technical groups can be defined as service organizations to agriculture and others. The lending institutions, S.C.S. and state or federally employed commodities specialists service the ranchers needs. Professional land managers are usually employed by a company to either manage land or deal in it (real estate). The environmental consultants work with the land but usually not on the same basis as ranchers. Private commodities brokers are financially interested in the changes which occur on range land but do not actively manage property.

Because the relatively small number of people involved in these activities have large impacts, a questionnaire/personal interview approach was taken. A more indepth evaluation of their product needs

could be undertaken through the interview process than by mail questionnaire.

Because the number of ranchers in the study area is quite large, a mail survey questionnaire was prepared. The process of selecting the ranchers for mail query has been discussed previously (Boyd 1978). To reiterate briefly, the USDA-ASCS office in each of the 36 counties was contacted and asked to furnish a 100 person mailing list for their county. After editing and several revisions, 3600 questionnaires were sent. The University of Texas Lands-Surface Leasing Division was contacted and the approximately 125 ranchers involved were included.

The returned questionnaires totaled 762 or a 21.17% reply. A reply of 650 was needed to be stastically reliable (95%). .The Census of Agricultural Stastics (1974) was consulted and the established age distribution for the 36 counties involved compared with our calculated results. The two sets of age data differ by only a few months. From this we feel that the data gathered accurately depicts the rancher community at large in the counties sampled.

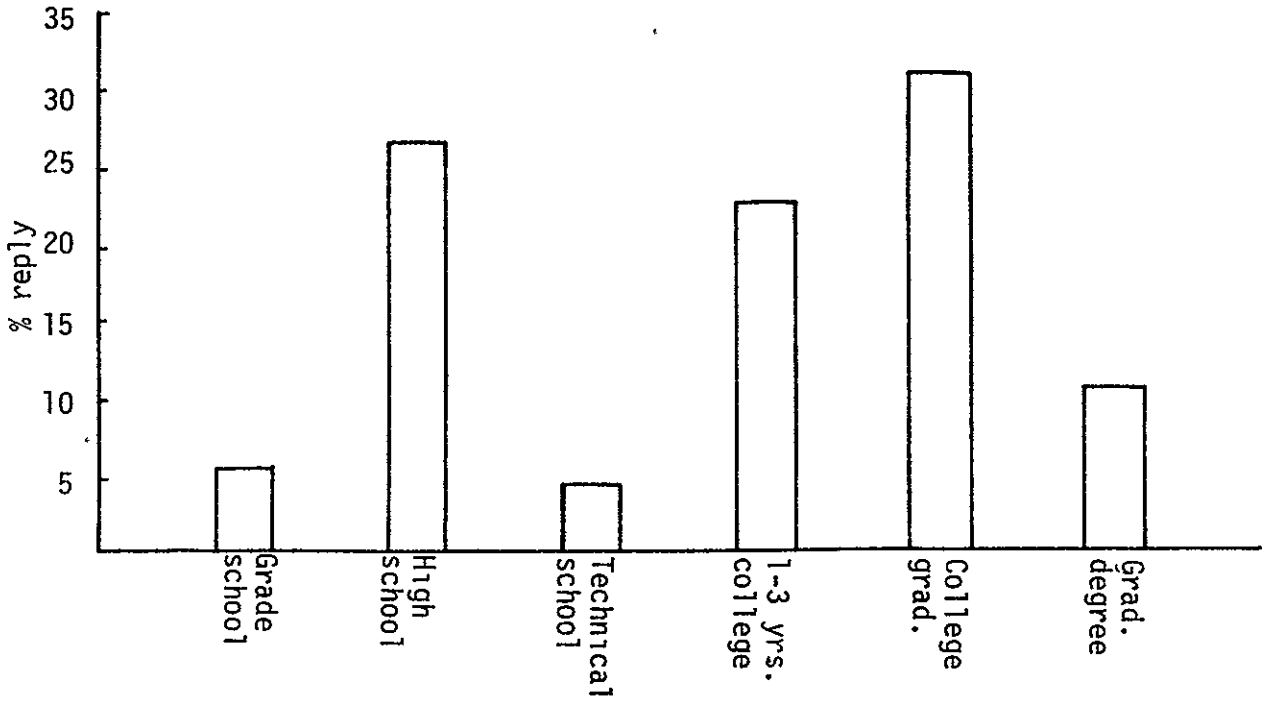
2.3.1 Ranchers

A sample questionnaire is included for reference as Appendix B. The first five questions dealt primarily with the demographics of our sample group. The average age of the sample is 48.66 years. The largest age group is greater than 60 years (30%), followed by the 55-59 class. The smallest group is less than 30 years (5%) (Table 2.1).

Table 2.1. Rancher age classification.

	%	#
greater than 60	30.1	227
55-59	14.5	109
50-54	14.2	107
45-49	13.1	99
40-44	8.5	64
35-39	7.7	58
30-34	6.9	52
less than 30	4.9	37
avg. 48.66 yrs		753

Figure 2.1. Rancher Education - Last completed.



Rancher education is graphically displayed in Figure 2.1. Approximately 30 percent are college graduates. A total of 60% of the respondents have either completed college or had college level exposure.

People queried in this survey were primarily ranchers Of the 762 replies 310 (40.7%) are solely ranchers. The next largest group is that of farmers who ranch (152,20%). Interpreted another way, 60.7% (462/762) of the respondents are either ranchers or ranching farmers as a primary occupation. Of the other categories listed, more than 2 or more than 3 sources of income were the next most important.

Question number three requested an estimate of the percent of net income over the previous five years which came from a variety of sources. Analysis revealed several surprises. Only 19.3% of the 705 respondents received all of their income from agriculture sources. About fourteen percent (14.2%) and 8.7% of the respondents received 90% and 80% respectively of their income from agriculture.

Sixty-seven percent (67.4%) received no income from hunting leases, indicating that leases are an untapped potential income source. The two categories "5% of income" and "10% of income" from hunting leases each received 9% of the rancher reply. The real surprise is in oil. Fifty-two percent (51.6%) of the people queried received no income from petroleum. The only noteworthy income response was in the category of "10% oil income" (12.7% reply). Ninety-nine percent (98.6%) reported no recreational income and 59% reported no income from other than listed sources. Of outside sources of income listed by the 234 respondents to the question, the most prominent were salaries (49/234 or 21%), investments (43/234 or 18%), or retail trade (21/234 or 9%).

Question number four defines the size of ranch operations. The total acreage operated by respondents to this survey was 9,912,357 acres or about 7% of the total state acreage. The modal class is 1001-2500 acres with 21% response followed by 5001-10,000 at 17%, 2501-5000 at 15.6% and 501-1,000 at 10.4%. These four acreage classes account for 64% of the operating ranches (Figure 2.2a). The acreage classes accounting for most of the land area involved, however, were those of greater than 5,000 acres operated (43% of the respondees operating 92% of the land). If only operators of more than 10,000 acres are considered, this is 26% of the ranchers and 82% of the land.

Acres owned is interesting in that 19% of the replies indicate no land ownership. Total acres owned by the respondents is 5,356,513 acres. The modal class is 1001-2500 acres with 12%. The categories of 1-10,000 acres owned account for 68% of replies (Figure 2.2b). Thirty-five percent (35%) of those queried indicate no leased land. The total acreage leased by survey respondents is 5,092,227 acres. The largest category of leased land is 1001-2500 acres at 21.7%. Categories 1-10,000 acres leased account for 52% of replies (Figure 2.2c).

Question five was designed to give us an indication of operational type and pasture usage. A brief listing of operation type and percentage reply follows in Table 2.2.

An interesting note here is that of the pasture selections offered, native range is the largest forage classification in every livestock option.

Figure 2.2 Ranch size, in acres.

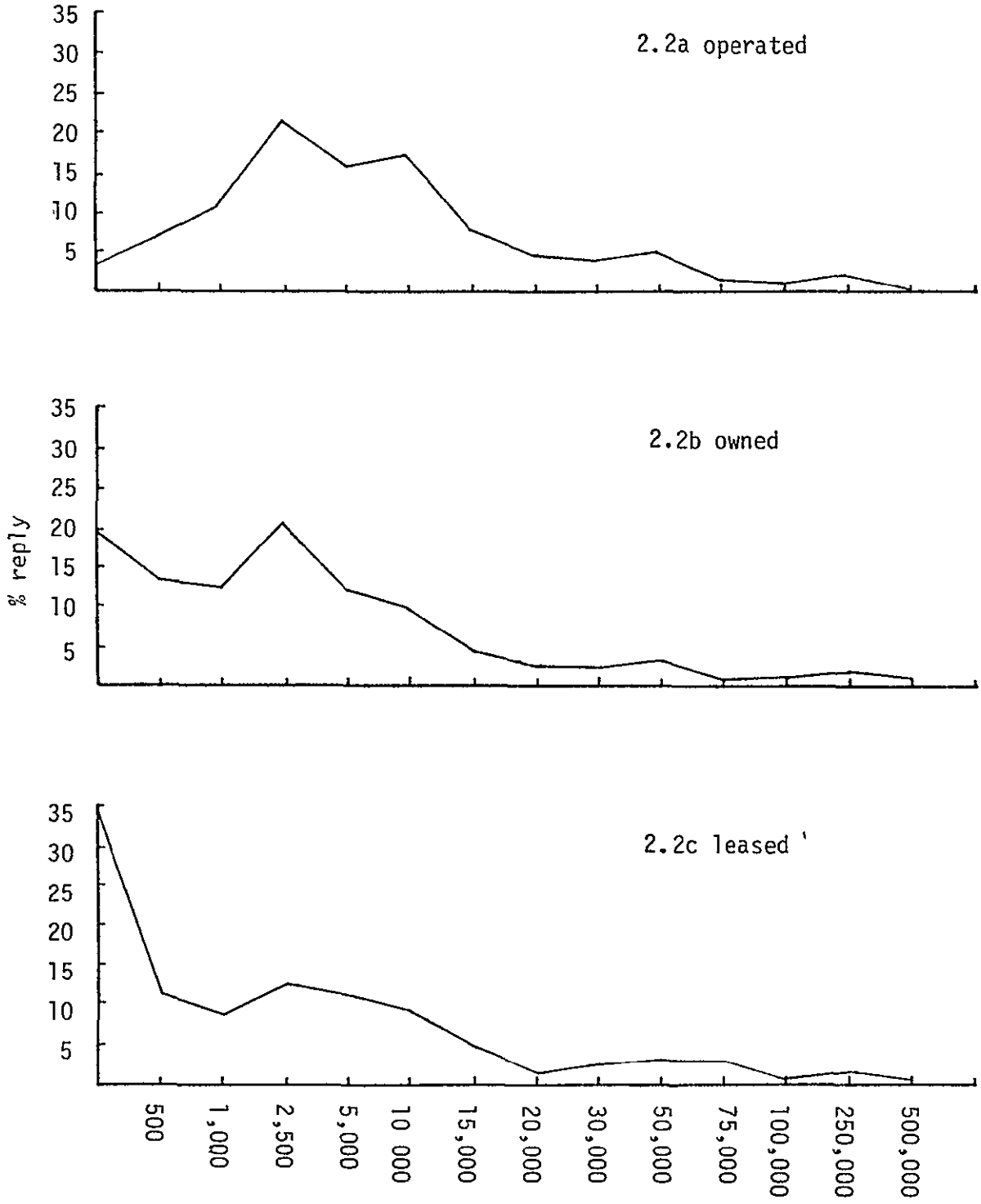


Table 2.2 Pasture Type

		Native	Tame	Small Grain	Farmed Forage	Combination
Cow/Calf	57%	72%	1.6	2.7	3.4	20.3
Steers	19	55.5	4.9	14.5	3.5	20.9
Cattle & sheep or goats	16	87.2	0.8	0.8	0.8	10.4
Cattle, sheep & goats	13	90	1	1	0	8
Sheep only	10	78	9.5	0	4.1	8.1
Steer & cow/calf	7	57.1	5.4	14.3	3.6	19.6
Goats only	7	93	0	3.2	3.2	0
Sheep & goats	4	93	3.5	0	0	3.5

Table 2.3. Information source and frequency of use to adjust stocking rates

	Weekly	Bi-Weekly	Monthly	Bi-Annually	Annually	Not Used
Onsite evaluation	57.7	10.7	19.5	6.8	2.1	3.1
Ranch personnel Reports	39.3	5.9	9.5	2.0	1.0	42.4
SCS Range Conservationist	3.5	.9	6.1	22.4	31.4	35.6
County Agent	2.8	1.3	8.3	12.8	13.6	61.0
Previous experience and records	32.5	4.5	23.2	14.6	15.8	9.1
Published Information	9.8	1.0	13.8	0.7	3.6	70.9
Other Sources	9.0	1.7	5.1	1.3	0.4	82.3

A corollary with the note on native range was the ranking of native range condition by respondents. Forty-three percent (43%) rated their range in fair condition, 30.5% in good condition, 22.4% in poor and 4% in excellent condition. These classifications were undefined in the questionnaire and are not to be equated with the Soil Conservation Service ranking system of ecological condition.

Questions six and seven define the sources and frequency of information used to make decisions on the ranch. The analysis of question six is summarized in Table 2.3.

The table indicates that the most frequent information sources are on-site evaluation (57.7%), ranch personnel reports (39.3%) and previous records and experience (32.5%). All of these are used on a weekly basis. The most frequently cited publications were miscellaneous and the Livestock Weekly. Neighbors were the most frequently cited other source. Seventy-eight percent (78%) of those answering this question felt that their present information was adequate to determine present range forage production.

Question seven addressed the forecasting of future range forage production. The results from this question are summarized in Table 2.4. Sixty-four percent (64%) (438/678) of those responding to this question indicated that they do forecast future range forage production. Extracting from the table we find that weather forecasts, present forage production and past forage production are most frequently used on a weekly basis to make future forage production forecasts. The most frequently used published source was Progressive Farmer. Experience was the most frequently cited other method. Fifty-three percent (52.6%) did not think that the

Figure 2.3. Information value vs ranch size.

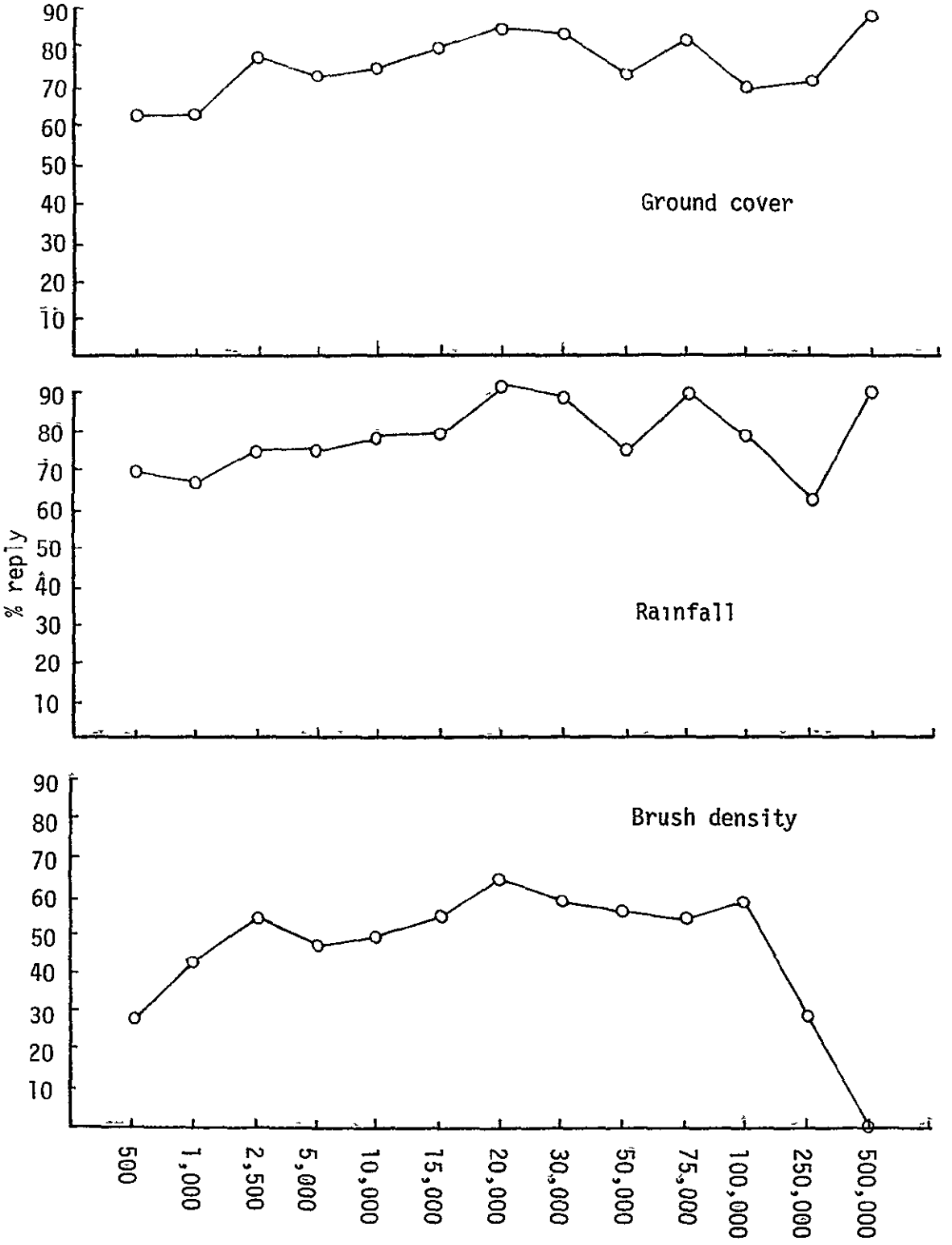


Figure 2.3 (cont.)

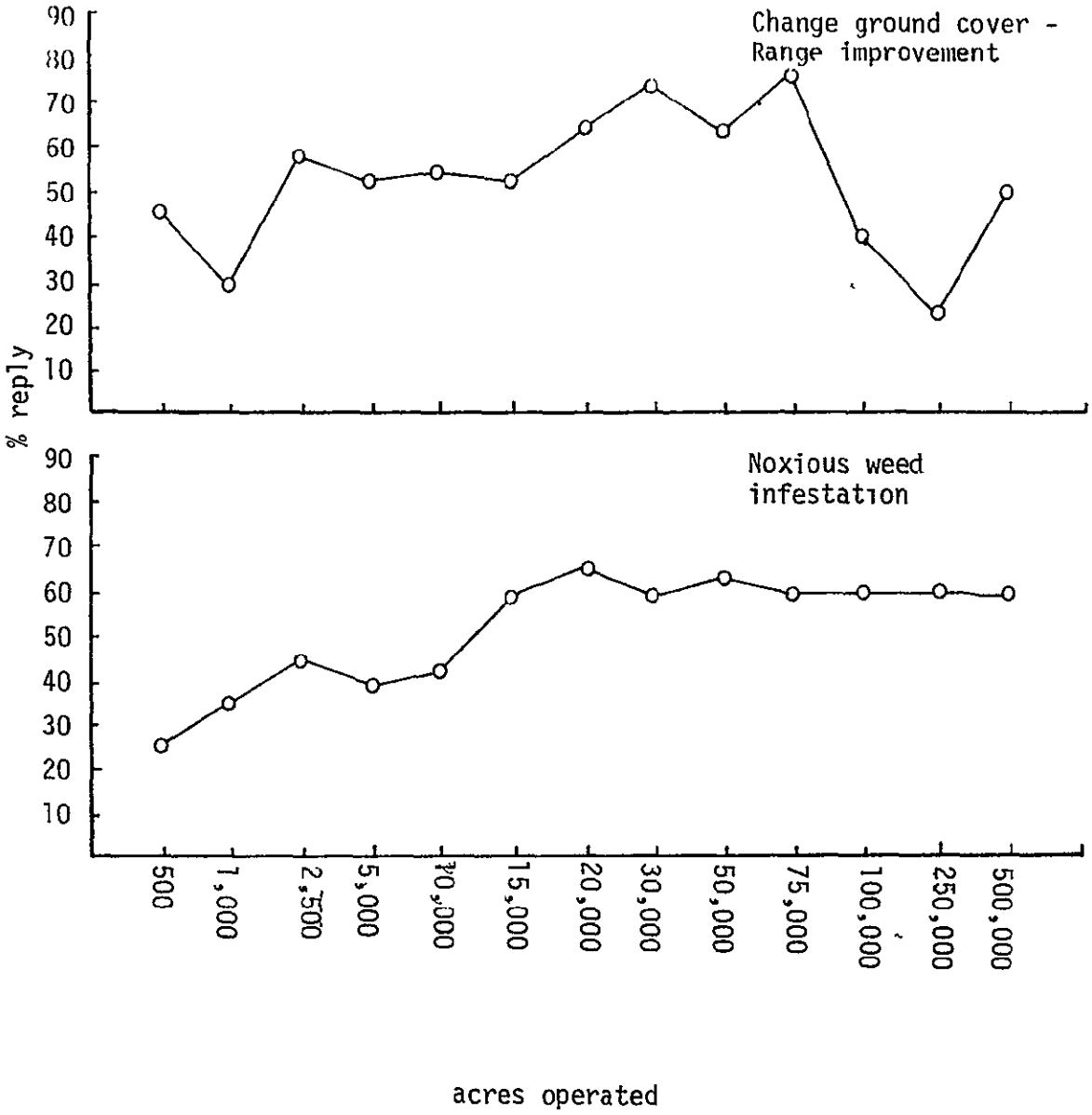


Figure 2.4. Publications subscriptions vs. ranch size

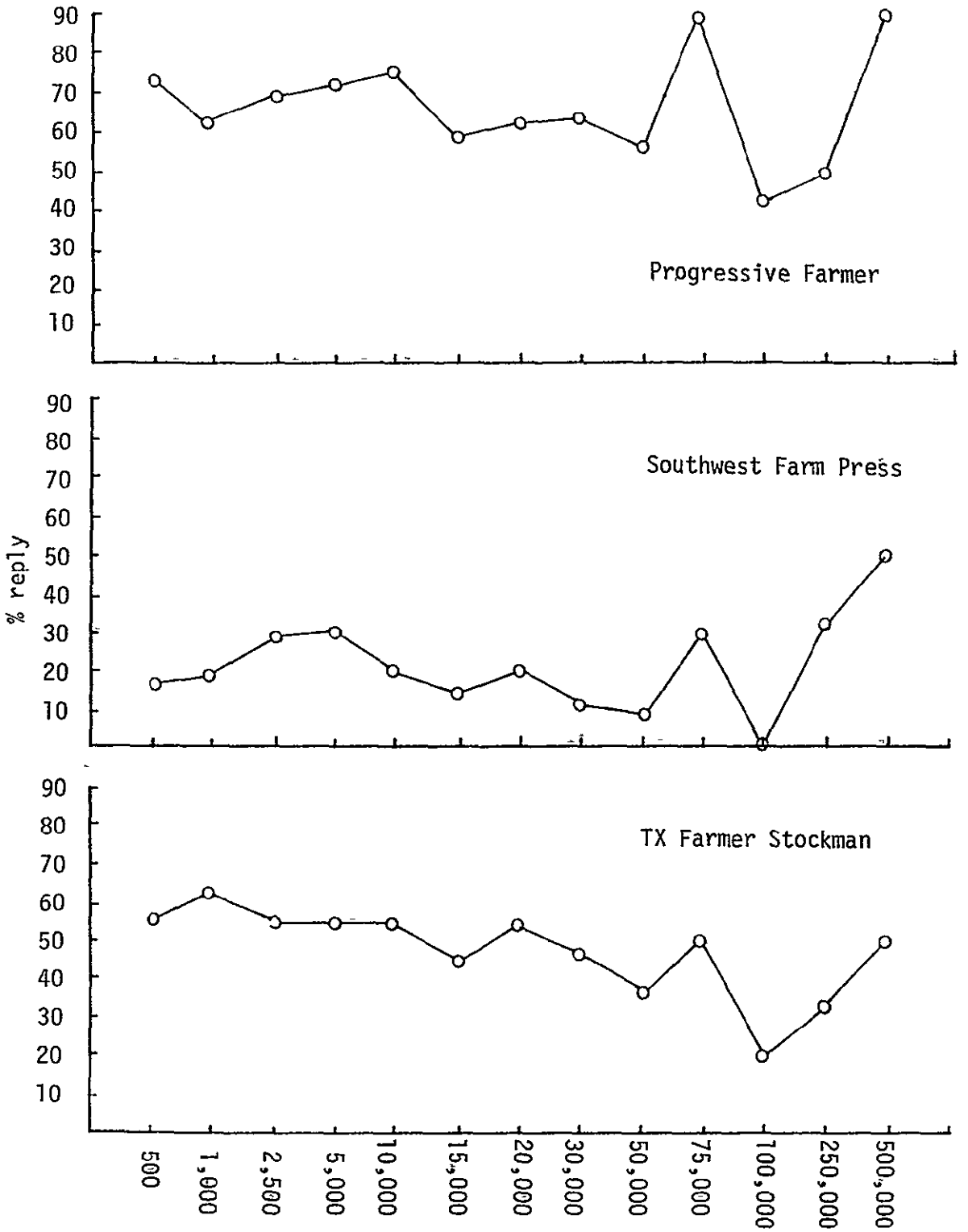
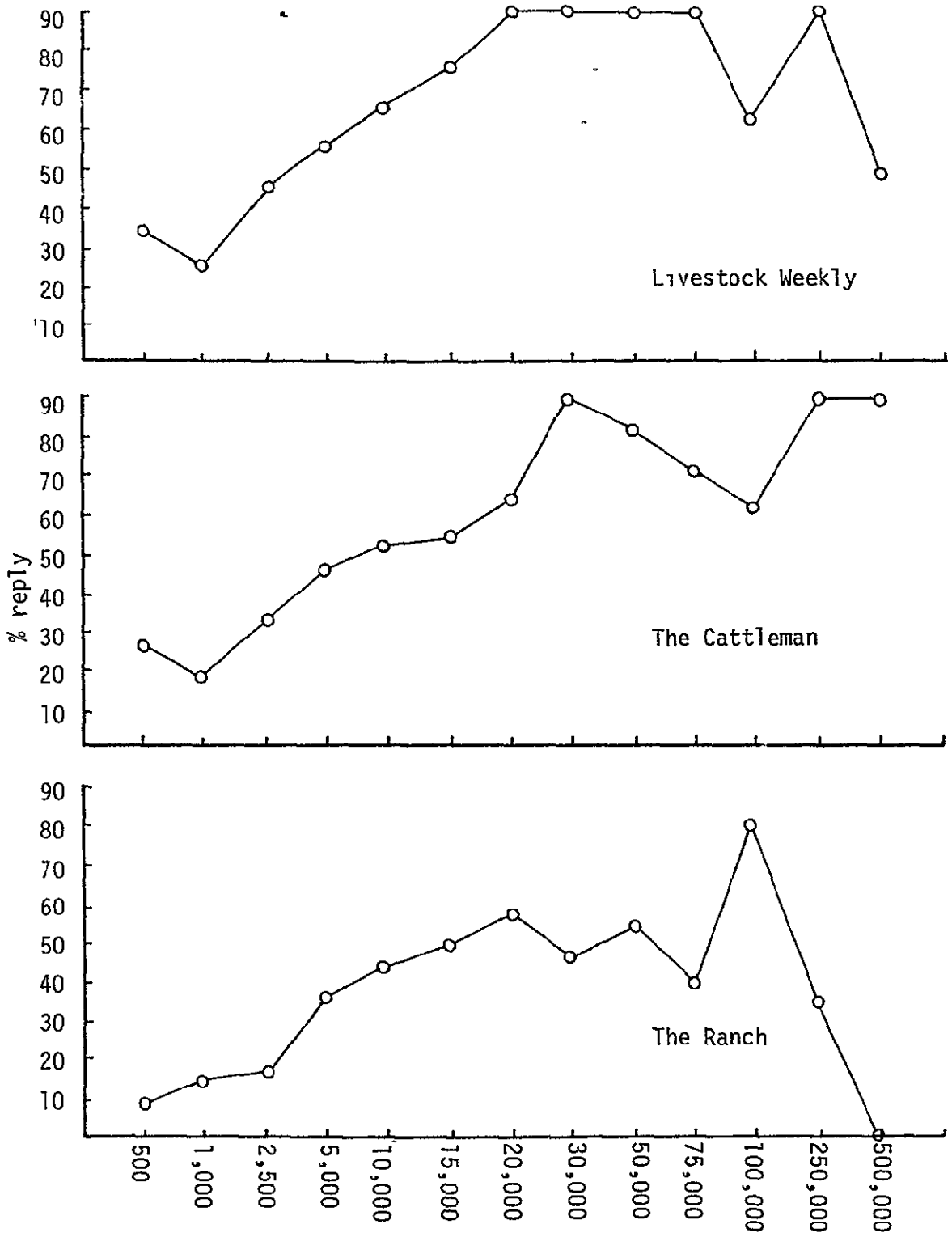


Figure 2.4. (cont.)



present methods of predicting future forage production were adequate

Questions eight, nine and ten deal with value and frequency of information on a ranch or regional basis. Data for question eight are summarized in Table 2.5. The table indicates that several items are considered extremely valuable. They are:

- Change in ground cover due to rainfall or drought
- Rainfall distribution and amounts
- Extent of brush density
- Change in ground cover following range improvement practices
- Extent of noxious plant infestation

If one graphs the five most valuable information types versus acreage operated, and compares it to the acres operated curve, the curve of all except for ground cover change due to range improvement practices and noxious weed infestations are essentially flat (Figure 2.3). It could be that range improvements are more economically feasible on large operations and are therefore more likely to be carried out. Subsequently, information about the vegetation recovery from these operations are more important. Also the difficulty of covering a large operation to assess the extent of noxious weeds as well as range recovery makes remotely sensed data attractive and valuable. The small number of operators in the highest acreage categories makes the upper end of the graphs unreliable in a statistical sense, but are helpful in evaluating the curve trends.

The replies to question nine are summarized in Table 2.6. It should be noted that in all except two cases, if the information is needed, the

Table 2.4. Sources and frequency of information to forecast future range forage production.

	Weekly	Bi-Weekly	Monthly	Bi-annually	Annually	Not Used
Weather forecasts	62.5	3.9	18.5	3.1	0.5	11.6
Present range forage production	48.2	9.3	28.9	8.0	1.6	4.1
Post range forage production	36.5	3.8	23.7	15.8	14.4	5.7
Published Information	7.5	1.3	8.8	0	1.3	81.3
Other Methods	5.8	0.7	2.9	2.2	2.2	86.3

Table 2.5. Rancher determined value of information on a ranch basis

	Extremely valuable %	Extremely and moderately valuable %
Change in ground cover due to rainfall or drought	75.15	88.25
Rainfall distribution and amounts	76.02	87.35
Extent of Brush Density	49.54	80.95
Change in ground cover following range improvement practices	51.61	80.65
Extent of noxious plant infestation	46.03	71.48
Recommended stocking rates	36.21	69.28
Extent of frost, hail or fire damage	45.15	68.36
Forage production by season	31.90	61.73
Wildlife habitat	25.36	57.84
Insect damage	27.44	56.36
Forage Production Forecast	19.93	46.74
Vegetation Type Maps	16.70	39.48

frequency is on a monthly basis. Spring green up data and brush cover are the two exceptions (needed annually). Small grain acreage and hay crops might be thought of as not being needed.

Questions ten and eleven deal with news and technology sources. Question ten asked for a preference of information. Would the ranchers want forage data in recommended stocking rate or pounds of forage per acre? The majority of response asked for recommended stocking rate. This type of response to question ten implies that the ranchers are more interested in having interpreted information (recommended stocking rate) rather than doing their own calculations from raw data (pounds of forage per acre). The replies to question eleven are summarized in Table 2.7. Progressive Farmer is the most frequent subscription. This confirms the idea in question 7 of Progressive Farmer being a frequently referenced source for input into future range forage production estimates. If we take each of the top six publications and plot them against acreage operated we find that each publication has a distinctive audience (Figure 2.4). The Progressive Farmer has a good readership which trends down at large acreage. The Texas Farmer Stockman is similar. The Southwest Farm Press peaks at about 3,500-5,000 acres and trends down with a relatively low readership at all levels. In contrast, the Livestock Weekly, Cattleman and the Ranch Magazine each reach the relatively few owners who operate large tracts.

The replies for question twelve are summarized in Table 2.8. When the top six sources of new information are plotted versus acreage operated we find that all except TV are essentially flat. TV trends down at

Figure 2.5. Rancher source of information on new ranching practices by acreage

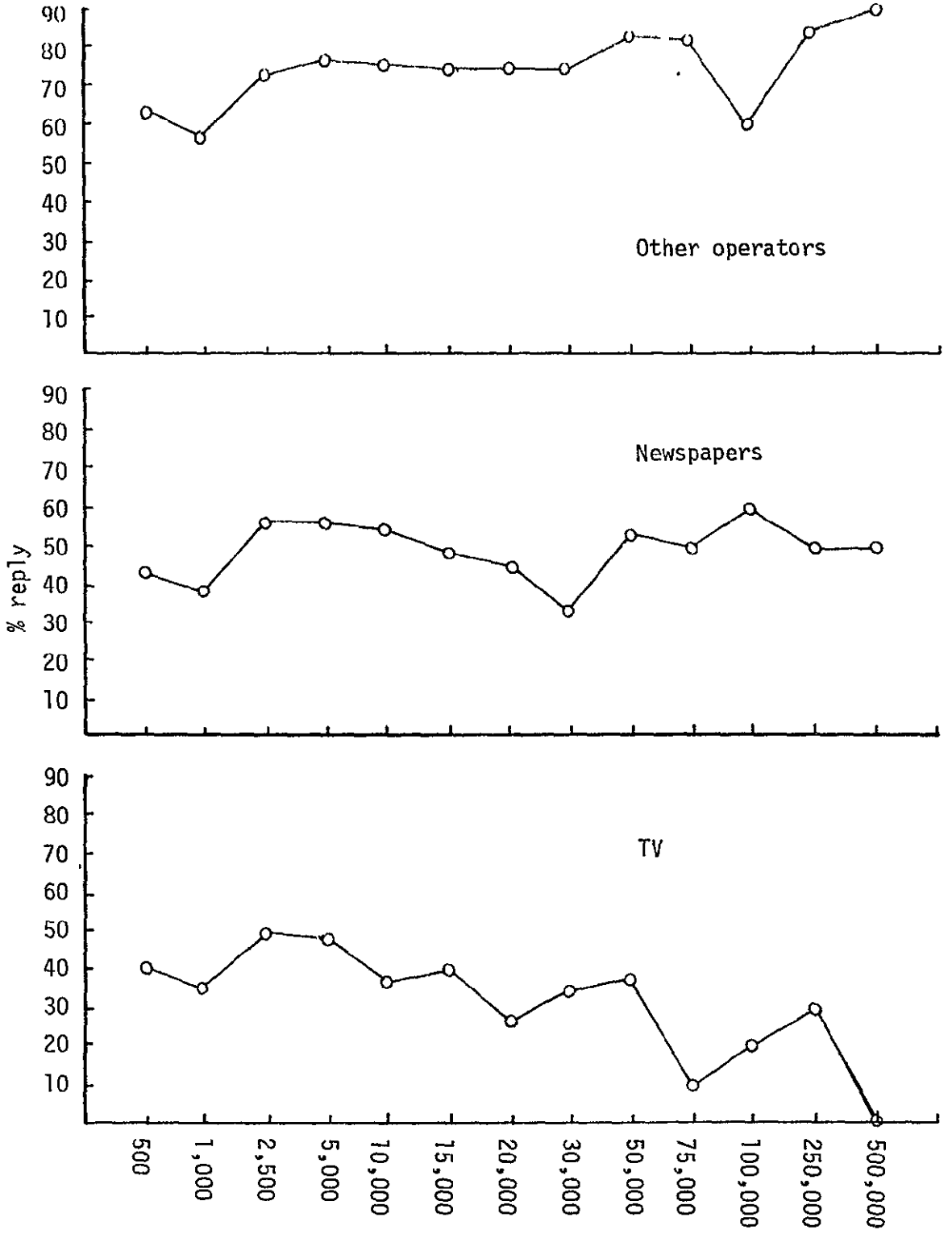
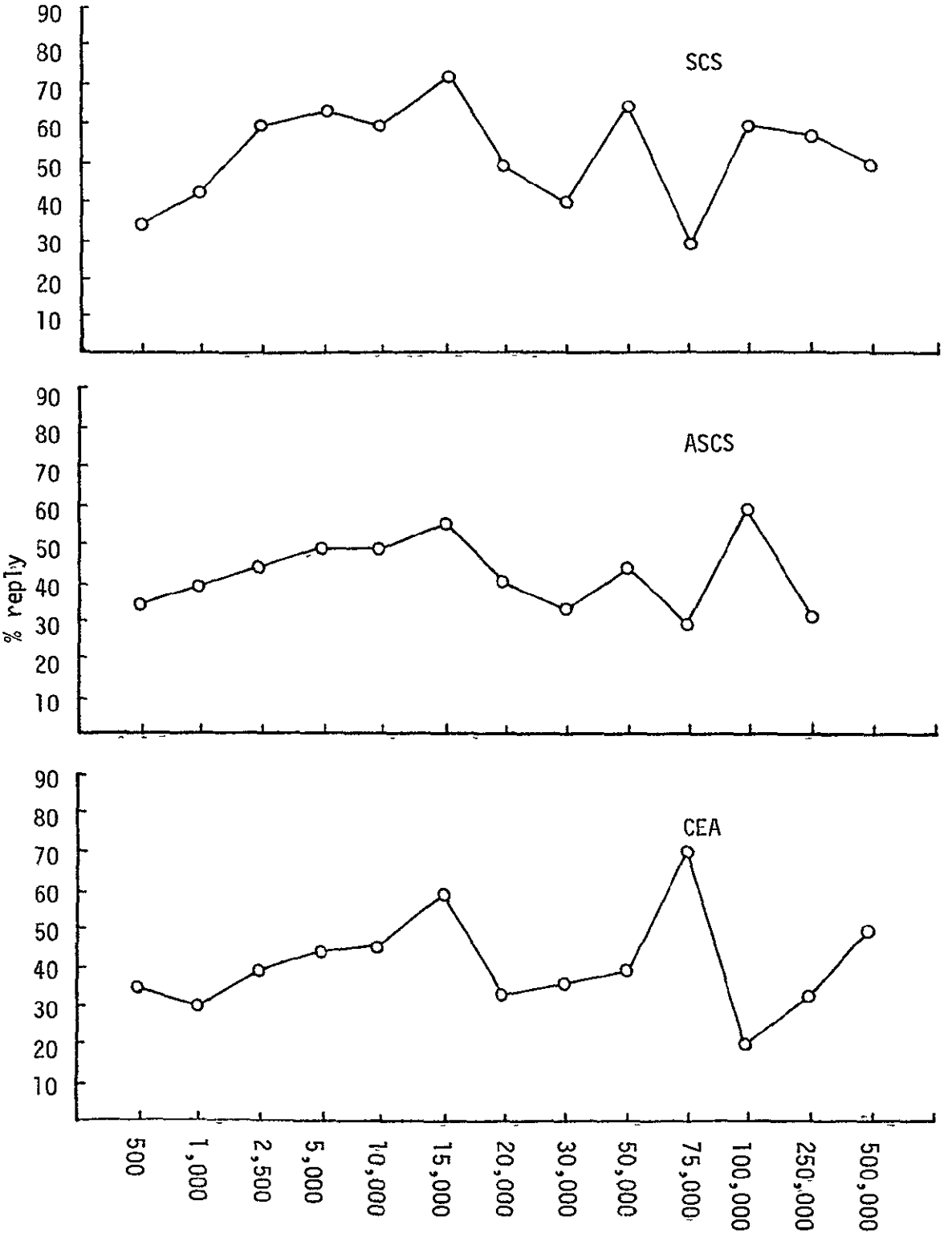


Figure 2.5. (cont.)



large acreages, while the remainder except for other local operators indicate a great degree of variability at large acreages. Contrasted to that are the SCS, ASCS and County Agent curves (Figure 2.5). Each of these three peak well to the right of the operated acres peak and indicate that larger operators use more high technology sources for their first information contact.

Questions thirteen and fourteen deal with long run planning activities in which Landsat based products may be useful. Table 2.9, summarizes question fourteen. Sixty-two percent (62%) of the ranchers contacted have implemented a planned grazing system within the last five years. Of these systems, 52% are deferred rotation type, 42% are decision deferred and 22% are short duration. Some planning or monitoring aspect of each of these practices can utilize Landsat based products. If one compares acres operated versus each of the improvement practices we see that all except burning are fairly widely used at all levels. Most increase at large acreage, probably due to a greater return on investment and more resources to be utilized when a large operation intensifies management (Figure 2.6).

Questions fifteen and sixteen evaluate membership in agriculture organizations. Table 2.10 summarizes the data for question fifteen. The table shows that the Texas and Southwestern Cattle Raisers have the highest membership, 38% (287/754), followed by Texas Sheep and Goat Raisers, 35% (272/753). Herefords are the most popular breed association and the Farm Bureau is the most popular other agriculture organization.

The replies for question sixteen are summarized in Table 2.11. It appears the best attendance is about 30% occasionally at the Society for

Table 2.6. Type and frequency of information needed on a county or regional basis

	Bi-Weekly	Monthly	Quarterly	Annually	Not Needed
Current forage production	9.3%	36.8	25	9.1	19.9
Spring green-up date	10.0	24.4	16.3	25.1	24.1
Future forage production estimates	6.8	30.7	30.2	13.2	19.1
Extent of drought	23.5	42.9	17.3	5.7	10.6
Extent & density of brush cover	5.1	16.9	20.6	38.4	18.8
Map of rainfall distribution	18.4	39.7	17.8	11.7	12.5
Extent of noxious plant infestation	8.2	25.7	23.7	24.7	17.6
Acres & forage production of small grain pasture	6.8	25.5	19.1	19.4	29.1
Acres & production of hay crops	6.2	22.2	21.7	20.1	29.1

Table 2.7. Rancher Publications

	% subscribing		% subscribing
Progressive Farmer	68.18	Wall Street Journal	18.64
Livestock Weekly	58.85	Doanes Newsletter	13.32
Texas Farmer Stockman	53.39	Texas Crop Weather Bulletin	7.60
The Cattleman	45.54	Journal of Range Management	5.06
The Ranch Magazine	32.22	None of the above	4.26
Southwest Farm Press	20.64	Range Man's Journal	2.93

Rancher sources of information on new ranching practices. Table 2.8.

	% up by
Other local ranch operators	72.11
Soil Conservation Service	55.53
Newspapers	50.86
Ag. Stablization & Conservation Service	44.42
County Extension Agent	41.70
TV or Radio	39.71
Texas Ag. Experiment Station	38.25
Texas Ag. Ext. Service Short Courses or Field tours	32.14
Extension Service Range Specialist	25.50
Feed dealers	22.18
Family members	17.55
Ag. Chemical Companies	14.80
Bankers, CPA or other	14.63
Society for Range Mgmt Meetings or tours	10.51
Vocational Ag Teachers	7.58

Range improvement practices implemented within the last five years. Table 2.9

Mechanical brush control	57.18
New water facilities	55.59
Aerial spray program	46.41
Cross fencing	40.30
Seeding	35.11
Changing kinds or classes of livestock	24.34
Planned burning	3.72

Table 2.10. Membership in agriculture organizations

	Percent
Texas & Southwestern Cattle Raisers Assoc.	38.1
Texas Sheep & Goat Raisers	36.2
Society for Range Management	5.3
Breed Assoc.	22
Other Ag. Organization	22

Table 2.11. Attendance of agriculture organizations

	Frequently	Occassionally	Seldom	Do Not Attend
TSCRA Meetings	4.1%	12.5	18.4	65.0
Breed Association Meetings	6.7	13.7	9.6	70.0
Texas Sheep & Goat Raisers	12.6	12.7	11.2	63.3
Society for Range Management Meetings or Tours	7.8	24.1	11.3	56.7
Extension Service Short Courses or Field Tours	15.5	36.7	12.8	35.2
Soil & Water Conservation District Meetings or Tours	13.4	30.4	17.4	38.8

Range Management meetings or tours, Extension Service short courses or tours and Soil & Water Conservation District meetings or tours.

Along with each questionnaire was a separate card. The question on the card asked if the rancher would like to take part in an evaluation of new Landsat-based range information products. A large majority (372/510) indicated that they were interested in these new products.

2.3.2 Agri-business/Technical groups

Five agri-business/technical groups were queried as to their information needs: commodities; environmental consultants; lending institutions; professional land managers; and government technical agencies. A final and complete listing of the 31 persons interviewed follows in Appendix C. Each of the groups has a different set of information priorities. A complete listing of the data needs and frequencies for the agri-business/technical groups are available in Tables 2.12 and 2.13. These data are summarized and extracted in the following discussions.

Of the several commodities people interviewed, the livestock oriented persons expressed the most interest in range or forage related products. Forage crop products of the type resulting from the LACIE (Large Area Crop Inventory Experiment) concept were also requested but are outside the scope of our present effort.

Table 2.12. Frequency of Information Requested by Technical/Agri-business Users

Product \ User Group	Commodities	Land Managers	Lenders	Soil Conservation Service
Current Forage Production	*B	M	Q	M
Spring Green Up date	A	A	A	A
Future Forage Production	B	Q	M	M
Extent of drought	B	M	Q	Q
Extent and Density of Brush	----------	A	A	Q
Rainfall distribution & amount	B	M	---	Q
Noxious plant infestation	Q	Q	A	A
Acres & forage prod. of small grains	B	---------	Q	A
Acres & prod. of Hay	B	M	A	A
Soil Moisture	B	M	---	B

A = annually
B = Bi-weekly
M = monthly
Q = quarterly

* Values represented are averages within an information user group.

TABLE 2.13. VALUE OF INFORMATION (BY TYPE) TO TECHNICAL/AGRI-BUSINESS GROUPS

USER GROUP / PRODUCT	COMMODITIES		LAND MANAGERS		ENVIRONMENTAL CONSULTANTS		LENDING AGENCIES		SCS	
	*	**	*	**	*	**	*	**	*	**
Recommended Stocking rate	0%[1]	25%	83%	100%	50%	50%	80%	80%	40%	100%
Forage production by season	50	75	83	100	50	75	40	60	40	100
Forage production Forecasts	75	75	50	100	25	25	20	60	40	80
Rainfall distribution and amounts	100	100	34	100	50	75	20	40	40	100
Changes in ground cover	75	75	83	100	25	50	40	60	40	100
Insect damage	25	50	50	100	50	50	0	40	60	80
Extent of frost, etc.	0	25	17	67	---	---	0	40	40	40
Brush Density	---	---	67	84	50	100	60	60	80	80
Noxious plant Infestation	25	25	50	67	25	50	40	50	40	60
Acres & Production of Hay crops	100	100	34	51	---	50	20	20	20	40

TABLE 2.13 (cont.). VALUE OF INFORMATION (BY TYPE) TO TECHNICAL/AGRI-BUSINESS GROUPS.

	COMMODITIES		LAND MANAGERS		ENVIRONMENTAL CONSULTANTS		LENDING AGENCIES		SCS	
(CONTINUED)	*	**	*	**	*	**	*	**	*	**
Vegetation type maps	----------		34%	99%	50%	100%	60%	100%	100%	100%
Acres of small grains	100%	100%	17	82	0	25	0	40	20	40
Changes in ground cover due to range Improvement practice	---------		50	100	20	40	--------		40	80
Wildlife habitat type maps	---------		34	100	75	100	40	100	40	100

* Extremely valuable

** Extremely + Moderately Valuable

[1] Values represent % of users by type who indicated interest in a product

More specifically, the livestock people were interested in (by priority):

- Rainfall distribution and amounts
- Acres and forage production of small grains
- Acres and production of hay crops
- Forage production forecasts
- Changes in ground cover due to drought or rainfall
- Forage production by season

All of these products except for forage production forecasts were requested on a bi-weekly basis. Forage production forecasts were wanted on a quarterly basis.

Should these products become available, they would be used to update or augment regularly available (monthly) reports derived from conventional sources.

Both environmental consultants and lending institutions have several similarities. Each expressed grave doubt about the utility of Landsat-based products to their businesses. Reasons for this are complex. Bankers are notoriously conservative and several were not interested in second guessing their clients management or motives. The environmental consultants quite frequently deal with projects not directly related to items addressed by this project's product selection.

Another similarity of these two groups is that they do not need products on a regular basis. Their interests are in products as the need arises related to a particular project and site location or lending requirements.

Environmental consultants are interested in

- Brush density
- Vegetation type maps
- Wildlife habitat maps
- Changes in ground cover due to range improvements
- Rainfall distribution and amounts
- Forage production by season

Lending institutions are interested in

- Vegetation type maps
- Wildlife habitat type maps
- Recommended stocking rates
- Brush density
- Forage production by season
- Changes in ground cover due to drought or rainfall

Professional land managers are very interested and appear to be quite receptive to new information approaches. In general, they are usually involved in managing or evaluating several pieces of property at a distance from a centrally located office. This distance precludes a constant checking of ground conditions and Landsat-based products on a fast turnaround basis would help these people make better decisions. The same could be said for either large or geographically separated units of a ranch.

Land managers are interested in the following types of products:

- Recommended stocking rate
- Forage production by season
- Forage production forecasts
- Rainfall distribution and amounts
- Changes in ground cover due to rainfall or drought
- Vegetation type maps
- Wildlife habitat maps

Uses of the Landsat products by land managers could include such things as planning herbicide spray programs based upon satellite-derived habitat and vegetation maps. Decisions about the effectiveness of range improvement practices and the extent of drought might be monitored.

The last technical group contacted was the Soil Conservation Service (SCS). The SCS is not only the federal government's "free" consultation service to agriculture but is also required by law to inventory soil and water resources and perform such natural resource duties as congress may mandate. The state agency similar to the SCS is the Agricultural Extension Service.

In their capacities, the SCS and Extension Service require a much wider range of information type than any other sector. The SCS's information preferences are as follows:

- Vegetation type maps
- Wildlife habitat maps
- Rainfall distribution and amounts
- Change in ground cover due to range improvement practice
- Extent of insect damage

2.3.3 Synopsis of Results

In the agri-business/technical sector the commodities group and the S.C.S./Extension Service are the most readily impactable groups. Product types proposed for generation and evaluation by the commodities groups are:

- Changes in ground cover due to drought or rainfall
- Rainfall distribution and amounts.

The S.C.S./Extension Service not only has a wide range of interests but is also an important source of information to the rancher community. Products which could be generated for and evaluated by the S.C.S./Extension Service include:

- Rainfall distribution and amounts
- Vegetation type maps
- Change in ground cover due to drought or rainfall.

The professional or commercial land manager's needs closely parallel the information requirements of the larger rancher. The products developed for the rancher could be transmitted through conventional channels to the professional land manager.

Landsat-based information is of most interest to the larger, more innovative rancher. He is generally more technically minded and gets his information from more technical sources. The products this type of rancher needs, and we propose to furnish and have him evaluate, are:

- Change in ground cover due to rainfall or drought
- Extent of brush density
- Change in ground cover following range improvement practices
- Rainfall distribution and amounts.

Weather data of the type proposed is of general interest to the agricultural public and should be included in any list of products to be tested

It is essential to remember that as Landsat data or derived products become generally quickly available to the public, a strong education program must accompany its general introduction before either wide usage, acceptance or proper use can occur.

From the data gathered in steps 2 and 3 a finalized information flow chart was developed (Figure 2.14). We feel it accurately depicts both the sources and the relative importance of data in the agricultural community. If it appears that the business community and technical agencies were neglected this is because the information base for these groups is so large and diverse it defies modeling in the time, space and with the resources available. Each group is reachable, but each will require a specific industry approach.

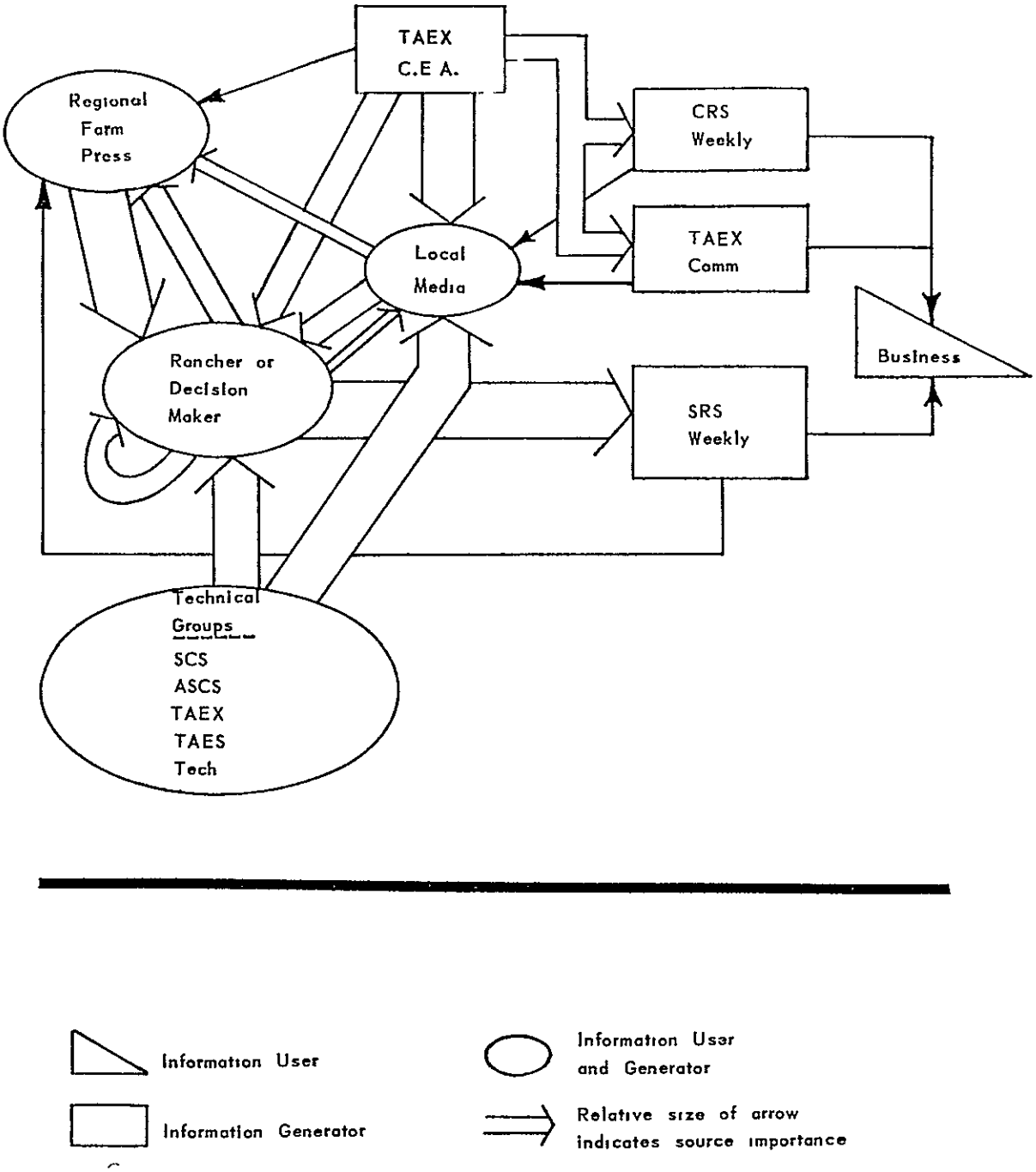


Figure 2.14. Final Range Information Transfer Flow Chart

3.0 TRANSFER OF RANGE INFORMATION AND TECHNOLOGY: PERSPECTIVE AND APPROACH

The problem of moving new technological innovations, inventions or ideas from developer to user is one of wide concern. Although a well recognized problem, studied by a number of groups, for several years these groups did not cross-correlate their studies. For this reason a cross-discipline literature review was initiated to bring into perspective exactly what the various questionnaires, interviews and other data this project has generated mean in light of previous experience.

Of the various sources, rural sociology and industrial development research provided the bulk of the pertinent references. Other areas which have literature relevant to technology diffusion include economics, politics, anthropology, industrial history, marketing, sociology, communications, information science, and direct studies of technology diffusion (Hough 1975).

Before we start discussing the intricacies of technology diffusion a comparison of nativelands agriculture and engineering systems would be enlightening. The points stressed are primarily differences and if they are kept in mind during the rest of the discussion, will help to maintain a perspective.

Engineering Systems	Range Agriculture
1. Fast technical personnel turnover	1. Slow technical personnel turnover
2. Specialization of personnel	2. Generalists
3. Industry and personnel concentrated	3. Industry and personnel dispersed
4. Highly organized structure	4. Loosely organized structure
5. High return on investment and high cash flow-"young industry"	5. Low return and low cash flow-"mature industry"
6. Fast moving technology frontiers	6. Slow moving technology frontier (complicated, highly variable resource and environmental conditions require long periods to experience full cycle range)

In many cases, engineering companies are made up of specialized professionals who are concentrated not only within a company but a geographical area. The company has a highly organized structure and personnel can move freely from company to company. The return on investment is high and the cash flow and therefore ability to pay for technological innovation is high. Cash for speculative technology use and development exists.

On the other hand ranching is a mature industry. Cash flow, and therefore the ability to pay for new technology, is poor. Return on investment (both land and animals) is relatively low.

The rancher is a generalist. Usually there are a very few people involved in management positions that could incorporate new technology

into the operation. Turnover of management level personnel who would influence the acceptance of new technology is slow. The total number of people involved is low and they are geographically dispersed.

One further point should be made. Row crop farming differs from range agriculture. Farming enterprises are capitalized at the level of small or medium business. They are in nearly perfect competition and new products or processes enter freely. This agricultural sector ingests technology faster than most economic sectors (Hough 1975). Row cropping is a much more dynamic industry and the speed with which operators succeed or fail is very high.

Because of the variety of disciplines that research the area, terminology can be difficult. At this point a few definitions would help to clarify the following discussion.

Technology transfer is the utilization of an existing technique in an instance where it had not previously been used (Gruber and Marquis 1969). This transfer can occur from agency to agency, sector to economic sector or discipline to discipline (horizontal rather than vertical movement). Technology transfer is a form of communication, where communication is the process of transferring a message from source to receiver. Once a technology has moved from one group to another its incorporation into the new social system is by diffusion.

Diffusion is a special type of communication which deals with how an innovation spreads within a social system (Rogers and Bundge 1972).

Adoption is the acceptance or rejection, at the individual level, of a new idea. Diffusion is the sum of many individual acceptances or rejections.

A change agent is one who attempts to secure changes in the behavior of his constituents. In most cases the change agent is a local-level bureaucrat (Rogers 1960). A champion is one who advocates, favors or supports an idea or technology. These people usually appear within an organizational hierarchy rather than as primary field personnel (change agents). The champion must be willing to stake his job or professional career upon the use of new technology. He most likely approaches his task with an almost religious zeal and uses all forms of power and persuasion to achieve his ends (Doctors 1971).

Figure 3.1 represents the interaction of the mechanisms and personalities described above.

Diffusion is a sociological phenomena. The actual acceptance or rejection of a new idea or technology occurs at the individual level. There are several phases through which the individual passes before he makes a total commitment. These phases are (Bohlen 1962):

1. Awareness - the individual learns of the existence of the idea or practice but has little knowledge about it.
2. Interest - the individual develops interest and seeks more information about it. General merits are considered.
3. Evaluation - makes mental application of the idea and weighs it's merits for his own situation. Decides whether or not to try it.

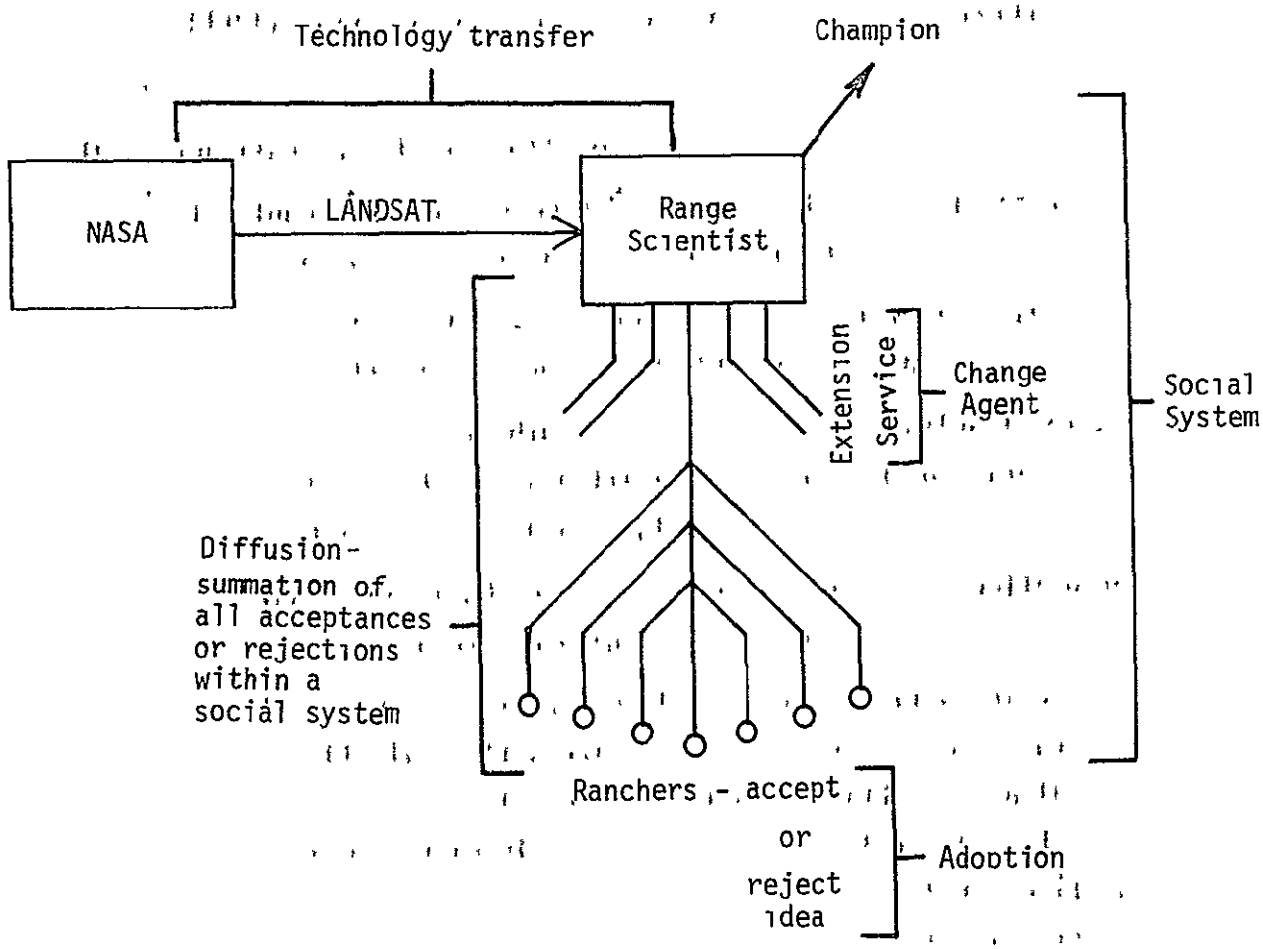


Figure 3.1 Technology Diffusion for Landsat Range Information.

4. Trial - small scale test. Thorough understanding of technical intricacies of the process.

5. Adoption or rejection - continued use or rejection.

An integral part of the diffusion process is the communication of information at each stage. Generally the various channels are:

1. Mass communications media
2. Peers
3. Commercial product representatives
4. Direct contact with technical specialists

When phases and communication channels are combined in an agricultural context you have as follows:

1. Awareness - primarily mass media
2. Interest - general information sources
    a. Mass media
    b. Technical specialists and agencies (extension workers, SCS, A.S.C.S. and Vocational Ag. program)
    c. Peers (neighbors and friends)
3. Evaluation stage - information from sources which have demonstrated abilities to consider new ideas in terms of the local situation.
    a. Agricultural technical agencies
    b. Peers

4 Trial - specific information for small scale test

a. Agricultural agencies

b. Peers

c. Commercial product representatives

5. Adoption - information to evaluate trial results

a. Peers

b. Agricultural agencies

Diffusion, being a sociological phenomenon, has a multitude of factors which affect the process. These factors can be loosely grouped into three classes. These classes are:

1. Human
2. Technological
3. Economic

In any group of people, there are those who will be open to and first to use new technology. These people have been called opinion leaders. In most cases, the others in the social system will follow the example set by these two classes where most ideas are concerned [two step flow of communication theory (Lazarsfeld 1948)]. Rogers (1961) believes that opinion leaders for agricultural technology adoption:

1. conform more closely to social system norms than average
2. use more impersonal, technically accurate and cosmopolite sources of information than their followers
3. have more social participation and higher social status their followers
4. innovate more than their followers
5. do not have followers on all subjects

Specifically the opinion leaders referenced are innovators and early adopters. Innovators are the first 2.5% of farmers to adopt new farm practices. Early adopters are the next 13.5% of farm adopters.

Rogers (1961) study of innovators furnishes a personal profile of these venturesome individuals.

The major findings of his study are:

1. Innovators have more education, higher social status, younger age, and higher reading level.
2. Innovators' farms are larger, more efficient, more specialized and more profitable than the norm.
3. Innovators have direct contact with agricultural scientists, read research literature and read more farm magazines than other adopters.
4. Innovators tend to be more venturesome, cosmopolitan and use more credit than the average farmer.
5. Innovators become aware of new farm practices at a relatively earlier date and require less time to pass from awareness to adoption of new practices than the average. Innovators are perceived by both themselves and others as deviant from social norms. Coleman (1966) found many of these same characteristics in innovative family doctors.

Early adopters differ from innovators only in degree, not substance (Rogers 1962). Early adopters are more integrated into the local social system than innovators. This adopter category has the greatest degree of opinion leadership in the social system and is sought by the local charge agent as a local missionary for speeding along new ideas. They serve as a role model and are the embodiment of successful and discrete

use of new ideas.

There are similar personalities in industry. They have been labeled as technological gatekeepers by Allen (1977) and generally are more performance oriented than your "normal" engineer.

The perceived newness of an innovation for the individual determines the individuals reaction. Several characteristics which contribute to different rates of adoption are (Rogers and Bundge 1972):

1. Relative advantage - the degree to which an innovation is perceived as better than the idea it supersedes. This includes social prestige factors, convenience and personal satisfaction. The greater the perceived advantage of the innovation, the quicker its rate of adoption.
2. Compatibility - is the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of the receivers. The less change that new technology requires in pre-existing socio-cultural values and behavioral patterns, existing facilities, equipment and procedures, the more likely is its rapid diffusion (dynamic conservation; Hough 1975).
3. Complexity - is the degree to which an innovation is perceived as difficult to understand and use. For fastest flow to occur the technological level of the innovation should be matched to that of the acceptor company.
4. Trialability - is the degree to which an innovation may be experimented with on a limited basis.
5. Visibility - practices also vary in the extent to which their operation and results are visible or shown. The easier the results are to see, the faster the idea will spread.

6. Communication - every social system develops a coding system with which to order its world. This system enhances the efficiency of communication among those who hold it in common (Katz 1966). For the new technology to be accepted quickly, the language spoken by the champions or change agents must be the same as the users.

7. Cost - the higher the cost, the slower the adoption. The subjective risk that a person associates with a new practice may also be related to his adoption of it.

The accessment of cost has various aspects. Haas (1965) found that, among other factors, firms become aware of and take interest in new processes or products when the present products output does not give the desired rate of return; and when components of the present product are unavailable or in short supply. Gruber and Marquis (1969) cite other cost factors involved in innovation.

1. Willingness and ability to develop and utilize new technology is a function of competitive pressure, size of market, profitability and size of firm.

2. The more competitive the situation the faster new technology is used so to provide the "edge".

3. The shortage and cost of labor make it more profitable to accept new technology.

Mansfield (1963) related that the probability of a firm introducing a new technology was a function of profitability and the proportions of firms doing it and a decreasing function of the size of investment required. McClelland (1969) related that transfer of technology is fastest during those periods of history where society is most achievement oriented and lowest when institutions of low achievement

(ex: government or a profession) are in vogue. Transfer of technology is more likely to occur when the process is need oriented (problem specific) (Doctors 1971).

Factors found to be related to innovations of English industrial firms (Carter and Williams 1959) are:

1. A favorable attitude toward science as evidenced by the status given scientists in the firm.
2. Cosmopoliteness as indicated by the worldwide travel of executives, and lack of secretiveness with plant visitors.
3. Adequate information sources as measured by the subscriptions to scientific journals and degree of contact with universities.
4. A high growth rate for the firm.
5. Lack of "shop-floor resistance to innovation" as evidenced by the conservatism of foremen and union resistance.

Another economic factor affecting adoption is windfall profit. Windfall profits to the first adopters of the new idea are earned in reduced cost. The increase in production is insignificant until many others use the innovation reducing cost and driving down prices for all. The innovator must take risks in order to earn these windfall profits. They are a reward for innovativeness and a penalty for laggerdness (Rogers 1962; Kislev and Shchori-Bachrach 1973).

An important link in the diffusion of agricultural technology is the change agent. Historically, the Agricultural Extension Services-County Agent has been the prime mover at the grassroots level.

Much of the research information disseminated by the C.E.A. has been generated by the several state Agricultural Experiment Stations. This has evolved because millions of farm operators could not independently afford or justify the expense for agricultural research. This supported research benefits the farmer directly, but benefits the consumer indirectly. Farm people generally believe that most agricultural research is performed by scientists of the several experiment stations rather than by commercial researchers. Farm people place more creditability and value in publicly funded research than in commercial research (Roger and Bundge 1972). Farmers perceive the county agent as their most important link with agricultural scientists. Generally, farmers have a favorable attitude toward most government agricultural agencies (C.E.A., S.C.S., Vo. Ag.) with the possible exception of the ASCS because of some of the payment programs.

Today the change agent's role is to explain and expand new ideas the farmer may already be aware of from mass communication media. The key audience for the change agent are both the innovators and early adopters (Rogers 1961). Numerous research studies indicate that change agents are utilized most by those who have the least need for assistance (Rogers and Bundge 1972). How can such a system be effective? It is effective because the change agent reaches community opinion leaders and the idea then "trickles down" to the others in the community from the local leaders (innovators and early adopters).

Factors which are important in a strategy of change are (Rogers 1962):

1. The programs should be tailored to fit local cultural values and past experiences (i.e., a local community boundary impedance match in both language, perceived technical sophistication and change agent social orientation.)
2. The systems client must perceive the need for an innovation before it can be successfully introduced. The change agent can help develop such a need.
3. Change agents should be more concerned with improving their clients' competence in evaluating new ideas and less with simply promoting innovations Per se.
4. Change agents should concentrate their efforts upon opinion leaders in the early stages of diffusion.
5. The social consequences of an innovation should be anticipated.

Information sources and information systems are a key to technology diffusion. Previously, agricultural people's information sources have been discussed as a factor in technology adoption. In general, the users of an information system are decision makers. If such a system does not meet the needs of the decision makers, then is deficient and of limited value. Therefore, for a system to be effective it must involve the ultimate users in the development and design phases (Baumgardner et.al. 1977).

A point to remember is that decision makers rarely use raw data. Bonnen (1975) includes not only the production of data, but also the

analysis of it in a useful problem oriented light, in his definition of an information system.

Since the efficient functioning of the agricultural sector depends upon a large volume of accurate, timely information, would there be any value of a system to furnish more timely accurate information? A study by Econ, Inc. (Lietzke 1975) used gross estimates on western rangeland to establish information priorities. This study showed that alternative measurement systems become clearly competitive when measurement frequencies are high and data lags are short. It was to the rangeland producers' advantage to sacrifice measurement accuracy for timeliness.

4.0 SUMMARY

A summary of the important points from each section will help to crystallize the recommendations to follow.

An economically, and resource-wise, diverse project area was chosen. News media representatives from the area were queried about present forms of range feed condition information. The consensus of opinion was that the present reports were little used and of little value because of their perceived inaccuracy and the slowness of transmission. Preferences for new forms of information were established. It was also established that the media is an information middle man and will respond to its constituents' demands for better information.

Ranchers of the project area were queried by mail questionnaire. Demographics, present information use, social affiliations and new information type preferences were established. Also a target group for a new product type test evaluation was selected.

Agri-business/technical personnel were queried. They have responded strongly positive. There should be no problems of acceptance and use of new data sources once the project progresses past a purely research stage. New information data preferences were established.

A flow diagram showing the relationship of users and information sources was prepared.

A literature review of several areas of research dealing with information diffusion in both industry and agriculture was completed. Key groups in the agriculture community were identified. Several general impediments to information flow were enumerated.

5.0 RECOMMENDATION

The agri-business technical and media communities are service groups to ranchers. Both groups will readily accept and use new data if it is appropriately formatted. For media that would mean simple, ready-to-use maps or charts on general conditions on a county, regional or state basis. TV might use color slides or video tape with voice-over. Radio needs hard copy narrative, with the press using black and white maps with written narrative.

The agri-business/technical community can utilize a much more sophisticated and varied product format. There will be no problem other than education in this group.

The most difficult group to reach and have accept new data sources are ranchers. They are very numerous and widely dispersed. In order to be effective the community leaders must be reached. The literature review identified the salient characteristics of the two leadership classes. Combining the survey results and the literature review points to several things.

In this case the people to reach are those that:

1. belong to the larger stock growing associations (Texas and Southwestern Cattlemen, Texas Sheep and Goat Raisers) (these people have more diverse news sources, more cash flow and larger operations).

2. Those that attend the various Extension Service short courses, field days and Society for Range Management tours and meetings (more technically minded and innovative).

3. Those that read the Livestock Weekly, Progressive Farmer, The Cattleman and The Ranch Magazines (an article in each would reach the most innovative group).

In order to reach and make people familiar daily, the newspaper and radio/TV should be utilized. Newspapers are an important information source for almost everyone.

The Extension Service system and SCS need to have the data available and be thoroughly trained in its use at a grass roots, local office level.

The only non-existing method foreseen is to incorporate the new information into livestock market reports from the Texas Department of Agriculture and others.

A method for getting special products, or other than regional information, needs to be developed.

Should the system become operational, a feedback loop needs to be established and a system review plan developed to keep product type and quality abreast of the technology as well as moniter the user needs more closely.

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Appendix A

Persons contacted:

Doug Perkins - The Cattleman - Ft. Worth

Worth Wren - Ft. Worth Star Telegram

Joe Brown - Wichita Falls Record News & TV-3

Earl Sargent - KWFT Radio - Wichita Falls

Lowell Cure - County Extension Agent - Seymour

Orlin Brewer - Vernon Record

Carrol Koch - Quanah Tribune Chief

Mark Geeslin - County Extension Agent - Jayton

Richard Parish - The Reporter - Sweetwater

W. T. Wilson - County Extension Agent - Abilene

Harry Holt - KRBC - TV & Radio - Abilene

J. T. Smith - Abilene Reporter News - Abilene

Elmer Kelton - The Livestock Weekly - San Angelo

Calvin Pigg - Southwestern Farm Press - Dallas

Roddy Pepples - VSA Radio Network - San Angelo

Jerry Lacky - San Angelo Standard Times

R. G. Jordon - San Antonio

Ben Woodson - Del Rio Times - Del Rio

Appendix A cont.

Questionnaire for Originators of Information on
Pasture and Range Feed Condition

1. Name of Organization_____

2a. Name of person responsible for preparing information_____

_____

2b Other persons who advise and assist in preparation_____

_____

3. Sources of Material concerning pasture and range feed condition (percent from each and specific information obtained from each).

	%
Staff activities	
Texas Tech	
TAMU	
TAEX. County agent	
Range specialist	
Texas Department of Agriculture	
USDA	
Ranchers	
TAES	
Others (specify)	

In your opinion does the source (s) adequately describe the true ground condition?_____

4. Timeliness:
   a. Is present frequency of information sufficient?_____
   b. Could you use range feed condition information more frequently? (Yes, No)_____or more accurate (complete) information? (Yes, No)_____
      Specify
      How frequently_____
      What type_____

5 What type of information is prepared by your organization on pasture and range feed condition?_____

_____

6. Preparation of pasture and range feed condition information is done

In house_____%

By outside Consultant_____%

By Contractor_____%

Report information prepared by others_____%

7. Based on your contacts with users of pasture and range feed condition information, please indicate the type of information that is most needed by users.

a. _____Quality of forage

b. _____Pounds of forage per acre available

c _____Possible green-up date

d. _____Optimum stocking rates

e. _____Brush cover

f. _____Effect of "X" inches of rainfall

g. _____Winter pasture acreage

h. _____Effect of range fire

i. _____Range growing conditions

j. _____Others (please specify)_____

8. What size of area would be ideal?

a. Individual pasture_____

b. Individual ranch_____

c. Individual county_____

d. Trade area_____

e. TAEX district_____

f. West Texas_____

g. Other, specify_____

PRINTED MEDIA

1. Type of publication (i.e., brochure, newsletter, research report, news column, ag. magazine)._____

a. Is publication sent.

at random? Yes____ No____

upon request? Yes____ No____

by subscription? Yes____ No____

b Frequency of publication (i e., monthly)_____

Number sent out_____

c. Area covered by publication_____

d. Breakdown of recipients

Ranchers, Ranch Managers_____%

Agribusiness, Banks_____%

SCS, Extension personnel_____%

e Have studies of readership for publication been done (Yes, No)

Results._____

f. Source of mailing list:

Customers_____

Requests_____

Area Ranchers_____

Purchased mailing list_____

Association membership_____. What association?

2 Describe content of material (attach copies if possible), percent devoted to reporting pasture and range data_____%

Other areas covered (i.e. gardening, livestock nos. and prices)

Please list:_____

_____

3. What methods are used on a regular basis in presenting information on pasture and range feed condition.

	Yes	No
Narrative description only	_____	_____
Charts	_____	_____
Graphs	_____	_____
Maps	_____	_____
Other Methods _____	_____	_____

Do you feel that your information is effective and that it is being utilized (Yes, No). What is it used for?_____

_____

ELECTRONIC MEDIA

1. Type of Programing

frequency-daily_____ Other (specify)_____

format-length_____

_____

2. Area of coverage _____

_____

3. Have market surveys been conducted (Yes, No). By whom_____

_____

Results_____

_____

4 Describe content of programming, percent devoted to reporting pasture and range data_____%

Other areas covered (i.e. gardening, livestock nos. and prices)

Please list._____

_____

_____

5. What percent of ranchers in service area do you estimate you are reaching?_____%

6. What methods are used on a regular basis in presenting information on pasture and range feed condition.

	Yes	No
Narrative description only	_____	_____
Charts	_____	_____
Graphs	_____	_____
Maps	_____	_____
Other methods_____	_____	_____

Personal opinion questions (may need to ask different persons in organization).

1 What methods of presenting information on pasture and range feed condition have you used and found successful?_____

_____

_____

_____

_____

2 What recommendations would you have for improving the way pasture and range feed condition information is presented? (i.e., maps, charts, narrative, etc.)_____

_____

_____

3. What is your estimate of the present cost of preparing the information on pasture and range feed condition? (May be given as a per issue cost, per program cost, etc.)_____

_____

_____

Appendix B

INFORMATION REQUIREMENTS OF RANCH MANAGERS

The Remote Sensing Center at Texas A&M University has been retained by the National Aeronautics and Space Administration to investigate the use of satellite data to provide management information for ranch managers Your experience and ideas will help us determine the information requirements of ranch managers Please complete this questionnaire and return it to the Remote Sensing Center by following the instructions on the back of the questionnaire The information you give will be held in strict confidence and no individual reply will be revealed

Age (please check applicable category)

less than 30_____ 45-49_____

30-34_____ 50-54_____

35-39_____ 55-59_____

40-44_____ 60 and over_____

Education (check last completed)

Grade school_____ 1-3 years of College

High school _____ College graduate

Technical school _____ Graduate degree

Years of experience in ranching_____, Years on this ranch_____ If ranching is not your primary occupation, please indicate (✓) other occupations and/or operations in which you are involved

Professional (Law, M D , D V M , etc)_____

Business (retail or wholesale trade)_____

Farming_____

Banking_____

Oil or gas investment or production_____

Cattle or animal trading _____

Manufacturing_____

Cattle feeding_____

Others_____(Please specify_____

_____ _____)

On a percentage basis, what portion of your net income over the last 5 years came from the following sources?

(Example) Agriculture - 80% Hunting leases - 10% Oil & gas - 10%

Agriculture	_____
Hunting leases or trespass rights	_____
Oil and gas (Production or leasing)	_____
Recreational activities	_____
Others (please specify)_____	_____
	100%

Approximate acres you operate _____, acres owned _____, acres leased _____

Please indicate the stocking rate and type of pasture for your specific types of operation If you operate several ranches, please give your best estimate of the stocking rate

Example

Type of Operation	Stocking Rate (Animal Units Per Section)	Type of Pasture: Native	Tame	Small Grain	Farm Forage (sorghum forage, etc)
Steers	10	✓	☐	☐	☐

Type of Operation	Stocking Rate (Animal Units Per Section)	Type of Pasture: Native	Tame	Small Grain	Farm Forage (sorghum forage, etc)
Steers		☐	☐	☐	☐
Cow/Calf		☐	☐	☐	☐
Both of Above		☐	☐	☐	☐
Sheep only		☐	☐	☐	☐
Goats only		☐	☐	☐	☐
Sheep and goats		☐	☐	☐	☐
Cattle and sheep or goats		☐	☐	☐	☐
Cattle, sheep, and goats	_____	☐	☐	☐	☐

Do you consider your native range to be in excellent_____ good_____ fair_____ poor condition _____ ?

Appendix B cont.

6 To adjust stocking rates on your ranch or ranches, how often do you use the following sources of information? Please check (✓)

	Weekly	Biweekly	Monthly	Twice Yearly	Annually	Do Not Use
On site evaluation	☐	☐	☐	☐	☐	☐
Reports from ranch personnel	☐	☐	☐	☐	☐	☐
Assistance from SCS Range Conservationists	☐	☐	☐	☐	☐	☐
County Extension Agent	☐	☐	☐	☐	☐	☐
Previous experiences and records	☐	☐	☐	☐	☐	☐
Published information (please name)_____	☐	☐	☐	☐	☐	☐
Other sources of information (please specify_____)	☐	☐	☐	☐	☐	☐

Do you consider the above sources of information adequate for determining present range forage production? Yes ___ No

7 Do you forecast future range forage production on your ranch? Yes____ No____ If yes, how often do you use the following to forecast future range forage production?

	Weekly	Biweekly	Monthly	Twice Yearly	Annually	Do Not Use
Weather forecasts	☐	☐	☐	☐	☐	☐
Present range forage production	☐	☐	☐	☐	☐	☐
Past range forage production	☐	☐	☐	☐	☐	☐
Published information (Name _____)	☐	☐	☐	☐	☐	☐
Other methods (Specify _____)	☐	☐	☐	☐	☐	☐

Do you consider the above methods adequate for predicting future range forage production? Yes_ No_

8 Please indicate (✓) how valuable accurate information on the following items is to you in operating your ranch

	Extremely Valuable	Moderately Valuable	Minimal Value	Undecided	Not Needed
a Recommended stocking rate	☐	☐	☐	☐	☐
b Forage production (lbs/acre) by season	☐	☐	☐	☐	☐
c Forage production forecast	☐	☐	☐	☐	☐
d Rainfall distribution and amounts	☐	☐	☐	☐	☐
e Change in ground cover due to rainfall and/or drought conditions	☐	☐	☐	☐	☐
f Extent of insect damage	☐	☐	☐	☐	☐
g Extent of frost, hail or fire damage	☐	☐	☐	☐	☐
h Extent of brush density	☐	☐	☐	☐	☐
i Extent of noxious plant infestation	☐	☐	☐	☐	☐
j Vegetation type maps	☐	☐	☐	☐	☐
k Change in ground cover following range improvement practices	☐	☐	☐	☐	☐
l Wildlife habitat	☐	☐	☐	☐	☐

Appendix B cont.

9 How often would you like to have these types of information on a county or regional basis?

	Biweekly	Monthly	Quarterly	Annually	Not Needed
Current forage production	☐	☐	☐	☐	☐
Spring green-up date	☐	☐	☐	☐	☐
Future forage production estimates	☐	☐	☐	☐	☐
Extent of drought	☐	☐	☐	☐	☐
Extent and density of brush cover	☐	☐	☐	☐	☐
Map of rainfall distribution	☐	☐	☐	☐	☐
Extent of noxious plant infestation (i e broomweed, bitterweed)	☐	☐	☐	☐	☐
Acres and production of small grain pasture	☐	☐	☐	☐	☐
Acres and production of hay crops	☐	☐	☐	☐	☐

10 Please indicate your preference (✓) for information on range forage production Pounds of forage per acre , or Recommended stocking rate

11 Do you subscribe to any of these publications? Check where applicable

Journal of Range Management	Progressive Farmer
The Cattleman	Livestock Weekly
The Ranch Magazine	Wall Street Journal
Doane's Newsletter	Texas Crop-Weather Bulletin
Texas Farmer-Stockman	Southwest Farm Press
Rangeman's Journal	None of the above

12 Where do you hear about and become familiar with new ranching practices? Please indicate (✓) your sources of information on new practices

Other local ranch operators	Soil Conservation Service (SCS)
T V or Radio	Publications, specify
Feed dealers	Bankers, P C A 's, other financial institutions
Newspapers	Agriculture Stabilization and Conservation Service (ASCS)
Texas Agricultural Experiment Station	Society for Range Management meetings or tours
Texas Agricultural Extension Service	Family members
County Extension Agent	Vocational agriculture teachers
Range Specialist	Agricultural chemical companies
Short courses or field tours	Other sources , please specify

13 Within the last five years have you implemented a planned grazing system? Yes No If yes, please indicate type of grazing system

decision deferred system short duration grazing system 2, 3 or 4 pasture deferred rotation

14 Within the last five years have you improved part of your range by (Please check applicable practice)

Planned burning	Implementing aerial spray program
Mechanical brush control	Seeding
Cross fencing	Adding new water facilities
	Changing classes or kinds of livestock

15 Are you a member of the (Check applicable organization)

Texas and Southwestern Cattle Raisers Association	A breed association (Please specify)
Texas Sheep and Goat Raisers Association	Other agricultural organization (Please specify)
Society for Range Management	

16 How regularly do you attend	Frequently	Occasionally	Seldom	Do Not Attend
TSCRA Meetings	☐	☐	☐	☐
Breed association meetings	☐	☐	☐	☐
Texas Sheep and Goat Raisers Association meetings	☐	☐	☐	☐
Society for Range Management meetings or ranch tours	☐	☐	☐	☐
Extension Service short courses or field tours	☐	☐	☐	☐
Soil and Water Conservation District meeting or tours	☐	☐	☐	☐

Your assistance in completing this questionnaire is appreciated If you would like a copy of the survey results, please return the enclosed card to the Remote Sensing Center or put your name and address on the questionnaire

When you have completed all questions on the questionnaire, please fold so that the return address is visible and tape or staple the form together and place in the mail Thank you

TEXAS A&M UNIVERSITY
REMOTE SENSING CENTER
COLLEGE STATION TEXAS 77843

2.	Jerry Frost	Trust Department - Land Management Frost National Bank San Antonio, Texas
3.	John Reesing	Corporate Secretary Federal Land Bank Houston, Texas
4.	Abner Beck	Real Estate Investments The Prudential Insurance Co. Houston, Texas
5.	Ray Twehouse	Metropolitan Life Insurance Co. Denton, Texas
6.	Harold Hasckke	Director of Agricultural Investments Dallas, Texas
7.	Roy W. Wright	Equitable Life Assurance Society of the US Temple, Texas
8.	Glenn Beadles	Agricultural Investment Division Connecticut General Life Insurance Dallas, Texas

Consultants:

1. Scott Ellis - Ecology Consultants, Inc. - Ft. Collins, Colo.
2. Bill Mudagh - EG&G Environmental Consultants - Houston, TX
3. Gerald Baker - Woodward Clyde Associates - Houston, TX
4. Michael Noel - Dames & Moore - Houston, TX
5. Roy Martin - Rangeland International - Mancos, Colo.

Appendix C

Land Managers:

1. Clyde Monts - Doone Agricultural Services - Irving, TX
2. Bill Schott - Nortrust Farm Management - San Antonio, TX
3. Louis Rinenger - American Sportsmans Club - San Antonio, TX
4. J. W. Goss - Pennzoil Company - Houston, TX
5. R. B. Hutchinson - Nortrust Farm Management - Denver, Colo
6. Kenneth Wendland - Western Farm Management - Canyon, TX

Commodities:

1. David Campbell - Clayton Brokerage Company - Dallas, TX
2. Max Nimo - E. F. Hutton - Dallas, TX
3. Cecil Campbell - Bach Halsey Stuart Shield - San Antonio, TX
4. Roland Smith - Texas Ag. Extension Service - Grain Marketing Specialist - College Station
5. Quentin Banks - U.S.D.A. Western Livestock Reporting Project - Denver Colo.
6. Ed Uvacek - Texas Ag. Extension Service - Livestock Marketing Specialist - College Station
7. Ellis Adderton - Santa Fe Railroad Crop Report - Amarillo,TX

Soil Conservation Service - Temple, TX

1. Frank Sprague - Wildlife Biologist
2. Rhett Johnson - Range Conservationist
3. Jerry Waller - Agronomist
4. Gary Vallentine - Wildlife Biologist
5. Hew Everets - Plant Materials Specialist

Lending Institutions:

1. Wayne Jordon — Vice President and Head Agricultural Loans
   Fort Worth National Bank
   Fort Worth, Texas

The REMOTE SENSING CENTER was established by authority of the Board of Directors of the Texas A&M University System on February 27, 1968 The CENTER is a consortium of four colleges of the University, Agriculture, Engineering, Geosciences, and Science. This unique organization concentrates on the development and utilization of remote sensing techniques and technology for a broad range of applications to the betterment of mankind


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