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Pine Ranges
Burgess Spring

L. R. Short
September 4, 1936

PROGRESS REPORT
ON GRAZING CAPACITY AND TREE REPRODUCTION STUDIES
Period July 17 to August 13, inclusive

This summary incorporates the results of two 14-day periods which are usually reported on separately. However, summaries of results for both periods are shown in the accompanying tables, as well as the results for previous periods for which data has been obtained.

The period just ended is of particular interest. Noteworthy is the trend in livestock weights, the change in diet of the 15 steers on the area, the loss in moisture content of some of the "key" forage species, the increase in water consumption by the animals, the arrival at and the passing of peak values for water losses, and soil and air temperature fluctuations. Trends for some of the other factors measured may be obtained from a study of the accompanying tables.

Climate

The dust was settled on two occasions by slight showers which resulted in a total of 0.03 inches of rainfall for the period from July 31 to August 13. Air temperatures rose steadily during the first period, the average maximum being up 12° over the preceding period, with average minimum up 7°. During this period, the highest air temperature of the season was recorded — 95° F. Average maximum air temperatures for the second period had dropped 6° to 82° F, but the average minimum temperature for the period had risen 1° above that for the first period. The minimum air temperature for the two periods was 46° F and 48° F respectively. Soil temperatures one quarter of an inch below the ground surface skyrocketed during the first period to an average maximum of 160° F for the entire period, and possibly set a new "high" for the Eastside

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CUMULATIVE PROGRESS REPORT SUMMARY
BURGESS SPRING EXPERIMENTAL RANGE
June 19 to August 13, inclusive

	6/19 to 7/2	7/3 to 7/16	7/17 to 7/30	7/31 to 8/13
1. Precipitation (inches)	0	T	0	.03
2. Air temperature (°F)				
Max.	89	84	95	86
Av. max.	80	76	88	82
Av. min.	47	46	53	54
Min.	36	40	46	48
3. Soil temperature (°F) (1/4" below ground surface)				
Max.	157	158	167	162
Av. max.	151	144	160	148
Av. min.	42	41	46	47
Min.	30	36	36	40
4. Relative humidity (%)				
Av. max.	62	72	64	—
Av. min.	16	20	22	—
5. Wind movement (miles/day)				
Max.	33	35	42	55
Av.	20	25	29	36
Min.	5	7	18	14
6. Evaporation				
Porous cup atmometer (cc's/day)				
Max.	90	99	102	105
Av.	72	64	88	76
Min.	60	15	77	31
Water trough (gallons/day)				
Max.	10	11	12	12
Av.	8	8	10	8
Min.	6	3	8	3
7. Water consumption (gallons/day/steer)	6	7	9	9
8. Water yield, Cone Troughs well (estimated % of capacity)	100	100	100	100
9. Salt consumption (lbs/day/steer)	0.11	0.09	0.06	0.06

10. Animal weights, lbs. (Av./steer)

Breed	No.	6/19	7/3	7/17	7/31 1/	8/15	Total gain to 8/15/animal
Angus	5	711	772	821	851	879	168
Hereford	5	776	835	872	896	921	145
Shorthorn	5	781	847	903	940	971	190
All breeds	15	756	818	866	895	924	168
Gain per day for period			4.4	3.4	2.1	1.9	
Cumulative total gain from June 19 to end of period			62	110	139	168	

~~1/ The weight of one Hereford steer for this period had to be thrown out because an unsatisfactory record of his weight was obtained; therefore, totals and averages for this period are based on 4 steers for the Hereford group, and 14 steers for the total of all animals.~~

11. Plant utilization by cattle

The 12 key species utilized during each period are listed approximately in order of preference and volume consumed. Number 1 denotes top rank and number 12 bottom rank.

	6/19 to 7/2	7/3 to 7/16	7/17 to 7/30	7/31 to 8/13
	Order of preference or rank			
Carex sp.	1	3	7	6
Festuca idahoensis	4	1	5	4
Bromus marginatus	3	6	8	7
Sitanion hystrix	5	8	6	5
Crepis acuminata	6		gone	
" monticola	2		gone	
Eriogonum nudum?	7		10	
Balsamorhiza sagittata	8	5		
Stipa elmeri	9	11		
Phacelia heterophylla	10			
Senecio aronicoides	11		gone	
Purshia tridentata	12	2	2	3
Aster sp.		4		
Achillea millifolium		7		
Geum triflorum		9		
Gilia leptalea		10		
Eriophyllum sp.		12	11	
Arctostaphylos patula			4	12
Lupinus sp.			1	1
Circium sp.			9	
Stipa occidentalis			12	
Bromus tectorum			3	2
Astragalus purshii				8
Gayophytum sp.				9
Wyethia mollis				10
Trifolium cyathiferum				11
Approximate average moisture content of forage for period	66	61	48	—

12. Pine seedling record

No. alive, end of period	2302	1404	975	747
No. died during period	1097	932	433	228
Cumulative mortality from June 19 to end of period	1097	2029	2462	2690
Estimated mortality for period by causes (%)				
Climatic factors	85	81	82	—
Rodents, insects, etc.	10	17	17	—
Livestock	T	2	1	—
Unknown	5			

Pine type as far as records are concerned when the mercury rose above the 167° F point on one occasion. For this first period the average minimum soil temperature was 46° F, with the minimum for the period dropping to 36° F. During the second period, average maximum soil temperatures dropped 12°, whereas the average minimum rose 1°. The lowest soil temperature recorded for either of the two periods was 4° above the freezing point. It may be said, therefore, that if temperatures critical to growth were reached during either of the past two periods, it was in the upper temperature levels rather than in the lower ones.

Relative humidity values dropped slightly during the first of the two periods, as might be expected with the high prevailing temperatures. Air movement near the ground surface rose steadily, the average for the first period being 29 miles per day, and for the second period 36 miles per day. The observation that trends in evaporation follow air temperature and humidity more closely than wind movement is again borne out since losses from the evaporation trough rose from the previous record of 8 gallons per day to 10 gallons per day for the first period, and dropped back again to 8 gallons per day for the last period, even though there was an actual increase in average wind movement of 7 miles per day for the last as compared to the preceding period. (The exposed water surface of the evaporation trough is approximately 53 square feet.)

Forage

The moisture content of the forage changed rapidly during this 28-day period. Averages for 15 "key" species dropped from 61 percent for the period covered in the last report to 48 percent for the first of the last two periods.

While figures for the period just ended are not as yet available, they will unquestionably show much lower moisture contents for the species included, particularly the herbs. The mass drying of the forage is well on its way to completion.

Results that will startle administrative grazing men of the Region continue to pour in with respect to the species that the cattle are taking, as determined by actual observation. Based upon the frequency that one plant species is taken as compared to another, the results show that there has been an appreciable change in the diet of the animals as compared to previous periods. Lupinus sp. ranked first for each of the last two periods. This species was a newcomer to the list of the first 12 species in order of preference. Purshia tridentata continued to rank high for both periods; it was in second place the first period, and third place the period just ended. More surprising, however, is the selection of Bromus tectorum by the animals. Very soon after drying, the steers began to take it in appreciable quantities, and for the first of the last two periods it was the third most sought for species, while in the last period it was in second place! Carex sp., Festuca idahoensis, Bromus marginatus and Sitanion hystrix continued to form an appreciable part of the diet. Perhaps the greatest surprise of all will be that Arctostaphylos patula was quite heavily grazed by the cattle. For the last two-week period Astragalus purshii, Gayophytum sp., Trifolium cyathiferum and Wyethia mollis have been taken in appreciable quantities. It appears that the diet of the cow is in general composed of the more succulent plants on the area, partly with respect to different species, but largely with respect to the various stages of succulence within a given species.

Livestock

Average gain per steer per day for the first period was 2.1 lbs. and for the second 1.9 lbs. -- still comparable with feed-lot gains. The Shorthorn steers continued to make the largest gains for the two periods, followed fairly closely by the Angus steers; the Herefords were again last.

An indication of the immediate effect of handling and weighing the animals as reflected by their weights was obtained at the time of the last weighing. On the day scheduled for the weighing, the stock were found in three groups in the main pasture. Considerable difficulty was encountered in trying to get each group into the corral. Only 10 were finally caught and the remaining 5 could not be handled. The 10 steers were weighed after standing overnight in the lane. They were then allowed to drift out to the 5 missing animals (a distance of about 1/4 of a mile) and then all were worked back to the corrals. The 10 head were reweighed along with the remaining 5. The cattle had free access to water up to the time of weighing each time. Comparing the two weighings of the same steers, it was found that there had been an average loss of 17 pounds per animal. More careful handling of the stock is intimated from these results.

To determine the true value of the range is a problem quite distinct from the problem of determining when and to what extent the critical changes in the value of the forage (as reflected by the weight of the animals) take place. Emphasis is for the present being placed on the latter problem. The weight of the animal is unquestionably the most accurate and useable yardstick yet available in measuring the value of the forage on the range, and it certainly should not be abandoned as such. The season's experiences to date stress the need for more care in the selection of experimental animals, with particular emphasis on quiet temperament. Other refinements in procedure,

such as weighing the animals before, rather than after watering, may improve the value of the data in future seasons. And while it would be extremely helpful to know to what extent the immediate losses in weight of the animal due to handling are reflected in the final weight at the end of the grazing season, this information is not vital to the solution of the present problem.

Water consumption for each of the two periods was 9 gallons per day per animal — an increase of 2 gallons per day over the previous period. Salt consumption followed the usual downward trend as the season advances, the "take" per steer having dropped from 0.09 lbs. to 0.06 lbs. per day.

Because of the controversy between the two groups of cattlemen concerning the advisability of salting away from or near water, devices for automatically recording the time that salt and water are taken are being perfected, with the hope that the results obtained will be of value in settling the question as to whether or not cattle go immediately to water after taking salt.

Some of the possible sources of loss of salt from the salt boxes, other than salt consumed by the cattle, are salt taken by deer, rodents, etc., salt lost through cracks in the bottom of the salt boxes when scooped up for weight determinations, and losses due to weathering. In order to reduce to a minimum such possible discrepancies in salt consumption, the cracks in the salt boxes were plugged up during the last period, with notches being cut in the lower side of the box to allow water to run out in the event of a rain. Duplicate check salt boxes, covered with rodent-proof wire mesh were set up in the site-factor-station enclosure to measure losses due to weathering, but to date these losses have been almost negligible. Open salt boxes were also installed in a cattle exclosure to measure possible losses due to rodents, deer, etc., but here too the losses have been quite negligible in comparison to the amount of salt taken at the regular livestock salt grounds.

Seedlings

Four hundred thirty-three pine seedlings died during the first of the last two periods, with an additional 228 passing out in the course of the last period. This leaves but 747 live seedlings on August 13. Summaries for the first period show causes of mortality to be as follows: climatic factors, 82 percent; rodents, insects, etc., 17 percent; and livestock, 1 percent. It was not surprising that climatic factors were by far the greatest cause of mortality during this period, because of the extremely high soil temperatures, as well as increased air temperatures and wind movement, accompanied by low humidities.

Plot work

No attempt was made to reexamine the quadrats for utilization during either of the past two periods as the field force was engaged in the more urgent task of keeping the systematic records up to date. It is planned to complete one more utilization examination of the quadrats at the end of the grazing season.

During the last period an initial attempt was made to determine by means of clipping the average size of some of the more important forage species on the area. Counts have been made of the number of "bunches" or plant units of the various species found on the quadrats. If the quadrats represent the area, and the average size of the various plant species is determined, it will be possible to express the yield for the present season on the area. Ungrazed plants selected at mechanically spaced intervals over the area are being clipped, it being planned to clip from 500 to 1,000 units or bunches of each species. Species clipped or in the process of being clipped include Festuca idahoensis, Sitanion

hystrix, Lupinus sp., Carex sp., and Wyethia mollis. It is planned to begin in the near future a clipped-yield examination of grazed specimens of some of the same species included in the group just mentioned. Differences in weight between grazed and ungrazed members of a given species may serve as a basis for determining the bulk of forage consumed by the animal.

Work on a vegetation type map, which was about 10 percent complete on the first of July, was resumed. The field work consists of listing either as conspicuous or inconspicuous the plant species present surrounding each quadrat. From this data it will be possible to construct a distribution map of each species present on the area; and it may be of use in determining what the plant succession is on the area if brought up-to-date each year.

Plant collection

Herbarium specimens collected to date include about 142 species of the estimated 175 or more plant species present on the area. It will be impossible to add appreciably to the collection this year, as most species have passed the peak of development.

Seeds of 47 different species have been collected. It is planned to germinate and grow a number of these species in the greenhouse, and use them as an aid in identifying some of the more puzzling species encountered in field work during the first part of the field season in future years.

Personnel

The five C.C.C. forestry-student technicians assigned to the range project for the summer have returned to school. As a result the work, particularly in the office, has been greatly retarded. While we are continuing to obtain the same basic data in the field as in the past, it will in the future be more difficult to have the summaries of these results completed in

time to be incorporated in the progress reports, without sacrificing valuable field time on the part of technical field men. The work that was performed by the group of student technicians is highly commendable, and it is felt that future provision for assistance of this sort should be strongly endorsed. One point should be borne in mind, however, when personnel assignments are made for future field seasons: these students are available for but three months or less of the summer vacation period, whereas the experimental field season extends for several weeks before and after this period. The season's research program must therefore be based largely upon the number of men that can be made available for the entire field season.

Present assignments on the Burgess Spring Experimental Range project include Hormay (in charge), Short, Gardner, and Daniels. Bentley is to replace Daniels near the end of the month. Four regular C.C.C. enrollees are also available, but an excessive amount of supervision is necessary before they can be used to assist in obtaining or analyzing experimental results. It is therefore planned to use them largely on construction types of work.

Visitors

Mr. A. L. MacKinney, from the Silvicultural division of the Appalachian Experiment Station, was the only official visitor at the Burgess Spring Experimental Range during the last two periods. He spent part of one day in looking over the experimental set-up.