2-1-1949

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University of Wyoming Agricultural Experiment Station

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Publication Information

University of Wyoming Agricultural Experiment Station (1949). "Bulletin No. 289 - The Range Lands of Wyoming, A Summary of the Record of 50 Years' Study by the Scientists of the Wyoming Agricultural Experiment Station." University of Wyoming Agricultural Experiment Station Bulletin 289, 1-36.
THE RANGE LANDS
OF WYOMING

A Summary of the Record of 50 Years' Study
by the Scientists of the Wyoming
Agricultural Experiment Station

UNIVERSITY OF WYOMING
AGRICULTURAL EXPERIMENT STATION
LARAMIE, WYOMING
FOREWORD

The scientists of the Wyoming Experiment Station have been studying the range vegetation of the state for more than half a century. Statements based on their observations and experiments have appeared in print from time to time. Many of the earlier published reports have long been out of general circulation and can only be found by careful search in libraries of scientific institutions. Recent discussions of the public land question give them a peculiar current interest. Therefore, it has seemed advisable to collect and print a fairly complete record of what the members of the Station staff have put in the printed record beginning with what Professor B. C. Buffum wrote in 1891. It should be clearly understood that this bulletin is merely a summary of the past record and in no way presumes to show more than what was said at the given time and place.

The work of compiling material was done by a committee of the Station staff consisting of A. F. Vass, Alan A. Beetle, Robert Lang, and Maurice Haag. The editorial work was done by Mr. Haag. He has been largely responsible for the comments which tie the quotations together thus giving them a measure of continuity. The members of the committee deserve great credit for the pains taken and care with which they performed their work.

J. A. HILL
THE RANGE LANDS OF WYOMING
A Summary of the Record of 50 Years' Study by the Scientists of the Wyoming Agricultural Experiment Station.

INTRODUCTION

The question of whether Western ranges are being overgrazed has been sharply debated for many years. More recently, the publication of strong statements on both sides of the problem has generated much heat and little agreement.

The area of disagreement is pretty clearly drawn. Within that area, it is quite evident that there are two points of view, both of which have accumulated a mass of supporting data, some of it factual and some of it in the nature of opinion.

Whether or not the ranges in Wyoming have been overgrazed has been a topic in which members of the Wyoming Experiment Station staff have been interested since the institution was started in 1891. Early botanists and agronomists at the station, in their travels about the state, observed and commented upon the condition of the range.

Records of the range study and observation at the Wyoming Experiment Station are set down in many of the 58 annual reports and the 287 bulletins, which the Station has published, and in articles published in scientific journals, magazines, and newspapers. It is only fair to point out that this record does not clearly support the overgrazing point of view, any more than it supports the view that Wyoming's ranges have at all times been well managed. The record does clarify certain areas of the question, and it does suggest some possibilities of reasonable agreement on a question which is building an ever-increasing barrier between two groups which should be on friendly terms.

At a meeting of the advisory council for the Wyoming Experiment Station, January 9, 1948, the members made reference to the studies of certain workers on the Station staff. The council members felt that various studies and publications accumulated in the 58 year history of the station would be of value in a situation clouded by many contradictory statements. It was accordingly voted by the council that the Station be asked to assemble and publish the work of Dr. Aven Nelson, Dr. A. F. Vass, Dr. A. A. Beetle, Mr. Robert Lang, and other workers to show whether or not the range is being injured by its use for livestock grazing.

The following excerpts represent a cross-section of what has been said and published on the question since 1891. The summary covers only the fields in which the Experiment Station has worked. There are many areas in range problem research which are still wide open for further study. The Station has not had the facilities to make a study of all
range problems. The writer has strayed a little from the original directive of the advisory council by bringing in some reference to the public lands question, since it has been the issue at the base of the overgrazing question.

HISTORY OF STATION INCLUDES REFERENCES TO OVERGRAZING AND EROSION

Workers on the Station staff, throughout its history, have expressed opinions about dangers in overgrazing. They have also stressed the need for erosion control and conservation programs. It should be pointed out that these people have maintained a distinction between overgrazing and erosion. They do not credit overgrazing with being the principal cause of erosion, but rather they list it as one factor among many causing erosion.

Concern about possible injury to ranges as a result of overgrazing is found in the first bulletin issued by the Wyoming Experiment Station. B. C. Buffum, the Station’s first horticulturist, writes (*The Organization and the Proposed Work of the Station*, Wyo. Agr. Expt. Sta. Bulletin No. 1, page 12, May, 1891):

“One of our most valuable grasses for pasture, the *Buchloe dactyloides* (Buffalo Grass), is being exterminated by civilization. Its patches of matted sod on the plains are, to all appearances, growing smaller and wider apart. In view of these facts, the study of, and experimentation with, the native grasses, to improve and perpetuate them, is of first importance.”


“...the route lay through a rather barren region, made doubly so by the large flocks of sheep that had been driven over the range. . . .”

Dr. Nelson, at a later date (*Some Native Forage Plants for Alkali Soils*, Wyo. Agr. Expt. Sta. Bulletin No. 42, page 25, December, 1899), mentioned changes in composition of range pastures as a result of close cropping and constant trampling:

“Probably it is true that the quality and kind of native forage is not identical with that of former years, since some species are less able than others to endure the heavy pasturing, the close cropping and the constant trampling to which they are subjected. In overirrigation and in unwise methods in the application of water we find other causes for the extinction of some species. Indiscriminate flooding drives out many valuable grasses which are replaced by
rushes and sedges, less valuable but for the fact that the yield is enormously increased above that of the unirrigated tracts.

"If this extinction occurs in soils in which other hardier species do not readily replace them it is a loss that must ultimately seriously affect the total forage resources unless it is met by adequate counter-acting influences."

Somewhat later in the Station history, A. L. Nelson, for many years head of the University of Wyoming operated dry-land farm at Archer, under a cooperative arrangement with the U. S. Department of Agriculture, speaks of destruction of vegetation. He refers here specifically to cropland rather than to dry-land pasture, but his statement has a general application to range areas (Soil Erosion, Archer Field Station, Wyo. Agr. Expt. Sta. Bulletin No. 208, page 3, October, 1935):

"It is obvious to most everyone that the prevention of soil erosion is of vital importance to the national life. Under average conditions nature produces but one covering of soil in an epoch; therefore, it is important that it be held in place and its productivity maintained.

"The natural factors which erode arable lands in this region are continued high winds and, to a less degree, downpouring rains, generally of short duration. The destruction of vegetation, the small amount of organic matter in the soil, the loose nature of the soil, especially if sandy, and the semi-arid conditions are other factors that contribute to the erosion problem."

The activity of mountain flood waters in carrying soil from the mountains is mentioned by Mr. Buffum in 1898. There is an implication in his statement that this process is a desirable one (Irrigation and Duty of Water, Wyo. Agr. Expt. Sta. Bulletin No. 8, page 8, October, 1892):

"... the streams are clear and cold the larger part of the year, and in flood time they bring down the soil of the (Big Horn) mountains, forming rich alluvial deposits along their valleys."

Erosion in Wyoming is a long-time process which has been going on since prehistoric times, long before the country was settled. We live within a framework of erosion which ticks away constantly. The question is one of whether our methods accelerate this process or whether it goes along at about the rate it has always done, regardless of what we do. W. C. Knight, geologist for the Station mentions this erosion process (Geology of the Wyoming Experiment Farms, Wyo. Agr. Expt. Sta. Bulletin No. 14, page 104, October, 1893) and says:

"Wind erosion plays an important part in the transportation of soils in Wyoming, and beyond a doubt has in the past, owing to the
incoherent state of the soils, due to the lack of clay. The arid regions of Wyoming, which are chiefly Tertiary and Cretaceous plains and tablelands, receive very little rain. Consequently the soils become loosened by great earth cracks and during the dry and windy winter weather are transported in dense clouds, which almost suffocate travelers, to the broken country and distant hills and mountains. In a single season it is not an uncommon sight to see banks of earth, like huge banks of snow, behind a reef of rock or in the lee of large bunches of sage brushes.”

Mr. Knight also speaks of the soil formation on the University of Wyoming Agronomy Farm at Laramie (Ibid, page 107):

“Following the glacial period was one in which a calcareous deposit formed over the glacial boulders, after which the erosion of the waters and wind completed the soil making of the plains. I should not say completed, for not a single windstorm sweeps these plains nor not a rainstorm causes the tiniest rill but the work of erosion goes on, and soil making continues as it has for these thousands of years.”

Indifference toward the erosion process is criticized by A. L. Nelson (A. L. Nelson, op. cit., page 33). His statement again applies specifically to the cropped land at Archer, Wyoming, but has some large implications for all range land:

“... .Suffice it to say that when civilized people become indifferent to the erosion of their soils there is but little care of fertility, in which case it is only a matter of time until the region reverts to a barren, wasted wilderness. Soil erosion is measured in terms of civilization. Therefore, the prevention of undue soil erosion revolves around the question as to whether there is a proper respect for the past, which produced the soil, and the future effects on those who will depend on the soil for their existence.

“However man is not given to exert himself greatly because of experiences long past or to react to distant future events until there is a definite tangible pressure which excites some instinctive emotion; therefore, soil erosion has not received sufficient serious consideration in the past. It appears that the present agitation is, for the most part, justified and therefore will receive attention from all who, under civilized conditions, have a respectable degree of consideration for the source of life’s necessities.”
IS THE RANGE OVERGRAZED AT THE PRESENT TIME?

The dangers of overgrazing were very much present in the minds of the early day workers at the Wyoming Experiment Station. Most of the foregoing statements, however, do not bear directly on the long-term effects of continued heavy grazing. Several members of the staff have been in a position to examine many types of native range which have been in use for a period of 50 to 75 years. The following excerpts have been obtained from these sources.

One of the first of these men to make a report upon the long-term effects of grazing was Dr. Aven Nelson, some of whose statements are quoted in the preceding section of this bulletin. Dr. Nelson travelled extensively through Wyoming during the period 1890-1900. He was perhaps as familiar with the distribution of plants in the range vegetative cover as anyone serving on the Station staff in its 58 year history.

Dr. Nelson touched upon the overgrazing problem in 1901 (The Brome-Grasses of Wyoming, Wyo. Agr. Expt. Sta. Bulletin No. 46, page 2, January, 1901). In his report he discussed a regional survey made in Montana, Wyoming, and Colorado. About 600 answers were received from ranchmen in these states. Among the questions asked in the survey was the following: "(2) Has the stock-carrying capacity of the ranges and pastures in your section been diminished through overstocking or other causes? If so, to what extent?" Answers to the question indicated that:

"...public opinion inclines to the belief that our ranges have at times been overstocked but that those areas, upon which only horses and cattle have been grazed, quickly recover during a period of rest, while those upon which sheep are grazed, during several successive years, recover more slowly or are even permanently changed in the character of the forage, if not wholly destroyed. Upon this question, there is, however, room for differences of opinion, since it can be shown that the ultimate effects upon the forage of a given area depend largely upon the character of the forage itself."

Dr. Nelson, in 1926, was asked to make a comparative study of the Red Desert area to determine if it had been injured in the time intervening since 1896, when he had spent a great amount of time in studies of the region. His unqualified conclusion (The Forage of the Red Desert, compiled in 1926, but unpublished) was that there had been no deterioration traceable to grazing:

"For the purposes of this report probably no further discussion of specific cases is necessary. The inquiry started merely to answer the question,—is the Desert deteriorating in its forage value? The question has been answered by saying 'No,' it is at least holding its
own. The fluctuations in its forage content are brought about by the various climatic conditions of the successive years. Whether these fluctuations are cyclic or not does not concern the present inquiry. Neither is the question of the advantage or the disadvantage of Public Control involved. That problem rests not upon the answer to the charge of overgrazing, a condition that might result in off years, under either form of management. Furthermore, an attempt to draw conclusions as to the best methods of management for an arid, treeless, winter pasture, with its peculiar forage, from experiences gained in the control of the normal forage of the humid National Forests would seem to be a hazardous venture."


"Counts of living and dead plants and reproductions tend to show that, except in a few areas within the Red Desert, there were sufficient reproductions to replace the plants which had died in 1936. Counts were made on four species."

and:

"...Comparison between the Rock Springs Grazing Association lease (a controlled grazing area) and the area which immediately surrounds it (an uncontrolled grazing area) showed no significant difference in grazing capacity on the Red Desert between the range upon which grazing is controlled and that upon which it is uncontrolled. This comparison was based on the Artemisia tridentata — Agropyron type which was the most common vegetative type in the Red Desert area."

Dr. Nelson is emphatic in saying that there was no observable overgrazing in the Red Desert area, which is not National Forest land. In the same report, however, he is equally emphatic in another direction with respect to the National Forests. He makes it unmistakably clear that grazing defeats in part the primary purpose of forest lands:

"...for certainly no one who is interested in the preservation of our forests would advocate an abandonment of our forest control. What we need would seem to be a more vigorous policy for the protection and development of our forest resources and this cannot be accomplished except through increased immunity from the destruction that seedlings and the young trees of the forests suffer because of the trampling and the browsing of cattle and sheep, notably the latter. We are already using the forests to such an extent as grazing areas to defeat, in part at least, that primary purpose of our National Forest policy, namely, 'the supplying of
repeated crops of timber and other forest products in perpetuity.' The preservation of grasses and other forms of forage is of little moment compared with the preservation of those forms of plant life that require long periods of time for their restoration. Most of the significant forage plants are herbaceous depending for their almost immediate reproduction upon seed or the perennial underground vegetative organs. An over-grazed pasture this year will, with water and rest, be completely restored in a year or two, at least, within a decade, whereas a new growth of timber, even under favorable conditions, may require centuries. Each generation, by forethought and industry, can produce the necessary feed for its flocks and herds but a supply of forest products can only be assured to any given generation by the altruistic efforts of the preceding ones. In view of this, it would seem that arguments for Public Control of lands suited only for grazing are not to be drawn from arguments for Public Control of our National Forests."

The views of Dr. A. F. Vass, present head of the University of Wyoming department of agronomy and agricultural economics, have been quoted widely by Western stockmen. Dr. Vass believes that overstocking of the range is far less prevalent than is generally thought to be the case. He also feels that the type of rainfall occurring in Wyoming is of a type which makes the problem of soil erosion of less import in Wyoming than in many other states. In an article written in 1931 (The Unappropriated Lands of the Western Range States, March 26, 1931), he says:

"The Southwest, with its summer torrential type of rainfall, may find it necessary to place considerable emphasis on erosion, whereas the type of rainfall occurring in Wyoming and similar areas does not make the question one of major importance. The remaining unappropriated lands in Wyoming are, as a rule, located in the comparatively level, semi-arid regions, where the precipitation is fairly uniform throughout the year. The heaviest precipitation, about one and one-half inches per month, comes in the form of wet snows during March, April, and May. The runoff and erosion taking place on these lands is very much less than that taking place on our owned lands, or National Forests."

Continuing the same article, Dr. Vass writes:

"The fact that there are many agencies trying to have the land put under their jurisdiction would also indicate that they have some value. The above agencies seem to feel that it is their duty to make two blades of grass grow where two grew before. The greater part of the remaining unappropriated lands in Wyoming need no supervision for this purpose, for two blades of grass are already growing where two grew before. Nature, in most cases in
our state has made provision for this, by making summer grazing very unfavorable and winter grazing favorable. The winter snows furnish the water which is not available in the summer, but which is needed by the grazing animals.

"Nature has another method of protecting this public land from overgrazing by covering certain areas with a blanket of snow. There is seldom a winter when all areas of the Red Desert are open for grazing. One area may be snowbound one winter and clear the next, while an adjoining area may be clear the first year and snow-bound the second. This condition has existed during the present season. It is not usual for the entire area to be grazed any one year. The present system of deferred, or winter grazing, which is now in use on our unappropriated lands is one of the best methods of preventing overgrazing, and deterioration of the range. It is a far better method of building up the forage than the one we now use on the National Forests, or on our own meadows."


"Some writers have said that the ranchers are attempting to exploit the range and that this will lead to the ruination of the forage, resulting in erosion, floods, and the destruction of our reservoirs by silt; and they advance the theory that grazing should be reduced or prohibited in order to improve the water shed. The value of Wyoming's unappropriated lands for grazing purposes is many times the value of the waters arising thereon, and any attempt to prevent the best use of these lands for grazing purposes in order to experiment in runoff and silt accumulation might well come under the heading of 'destructive conservation,' as the loss of forage would be many times any saving that might result from silt control, not to mention the fire hazard that would result from the unharvested vegetation in those areas where there is sufficient vegetation to influence the runoff. The rancher is vitally interested in the constructive conservation of forage, as his livelihood depends on the maintenance of a normal growth of forage. He does not need to advance some theoretical argument to prove that such is the case, for he knows that it is disastrous to attempt to use an overgrazed range.

"The cheapest and most profitable gains are put on range cattle during the grazing season, and these gains cannot be made on an overgrazed range. The point of diminishing returns on range beef production is reached long before the plants are killed by overgrazing. This law of diminishing returns explains the range forage
preservation in Wyoming, which careful studies show is in about the same condition today as it was forty years ago.

"Many of the ranges which have been reported to have been ruined by overgrazing have later been found to be back to normal following a season of favorable rainfall. The 'overgrazed' condition that one often hears reported is due to drought, and the range is readily brought back to normal by a year or two of favorable precipitation.

"The real test of range improvement is in the carrying capacity, that is, the number of animal units that a given area will carry for a certain period, and the condition of the animals. There have been no noticeable increases or decreases in the trends of number of livestock carried on our national forests since their establishment in 1908 up to the present time, 1932. The increases and decreases in the number of cattle and sheep in the national forests correspond very closely with the increases and decreases on ranches in the western states, which indicates that, if there is overstocking on the ranches, the same condition prevails in the forests.

"Careful investigations of the forage and carrying capacity indicate that the vegetation on the privately owned grazing lands, national forests, and unappropriated lands has undergone very little change during the last forty years. The following reasons may explain this lack of change in carrying capacity.

"1. Stockmen, from an economic standpoint, cannot continue to overgraze a range, as they must rely on the cheap summer gains for their profit, and their livestock will not put on satisfactory summer gains on a range that is overgrazed to the point of being detrimental to plant growth and propagation. Our best and most common examples of overgrazing are along trails, near bed grounds, and where wild game is permitted to propagate. In all of the above cases, food is a matter of life and death, rather than one of converting forage into meat in order to make a profit.

"2. A factor that makes it very difficult for an absentee landlord to show an improvement in forage is that dominant trait in human nature that causes the owner to take better care of his own property than he will take of the property he rents or leases.

"3. The forage plants growing on our western ranges are the result of thousands of years of elimination and adaptation, having been grazed by animal life for long periods, and are not easily improved upon or destroyed by man within a few years time."

Dr. Vass was among a group of witnesses who appeared before a subcommittee of the Committee of Public Lands and Surveys, U. S. Senate, 77th Congress, in 1941, at Casper, Wyoming. Part of his testimony before the committee was published later by three stock growers' organizations (Control and Value of Western Grazing Lands, published
by American National Live Stock Association, Wyoming Stock Growers Association, and Wyoming Wool Growers Association, 1941). In this published material (pages 6-7) Dr. Vass questions the seriousness of erosion in the Red Desert area and similar lands and mentions the fact that there is no great amount of silt accumulation on these lands. He also states that there has been no deterioration in the grazing capacity of this section.

"That run-off and soil erosion are relatively unimportant on the unappropriated lands of Wyoming is shown by the fact that some two and one-half million acres of land in South Central Wyoming located in a great basin with no outside drainage has no great amount of water or silt accumulation at its low point. If there were great run-off and silt losses from our unappropriated lands they would show up in this great basin.

"Our Wyoming studies show that there has been no measurable change in the carrying capacity of the privately controlled ranges during the past 40 years.

"A study of 1,764,314 acres of controlled grazing land in the Red Desert area showed that it would carry 225,000 head of sheep for 5 months or 18.8 acres per sheep for 12 months of grazing. This rate of stocking was used long before the advent of the Forest Service or Taylor Grazing control. The early stockman found that rate of stocking very satisfactory, and if I am properly informed, the Taylor Grazing people are using approximately that same rate on their lands in the area. The sheep now receive somewhat more supplementary feed than they did 40 years ago, but they also produce several more pounds of wool and meat per head."

Continuing (Ibid, page 7), he states:

"Fortunately or unfortunately, the vegetation on our western ranges has had to struggle along with grazing animals for thousands of years, without any assistance from man and his philosophy of proper land use. As a result, we have on our ranges plants that are very resistant to both grazing and drought. In fact, they seem to do better when they are grazed than when they are not. During extreme drought years, they protect themselves by not even sending up shoots, for that would take moisture from the roots. When the inexperienced man sees the barren ranges like they were in 1934, he immediately concludes that they have been ruined by overgrazing and that federal control must be increased to protect the stockman against himself;—hence the federal Taylor Grazing Act of June 28, 1934, our worst drought year on record, when cattle and sheep were dying from thirst and hunger. Western ranges were pointed out as horrible examples of misuse and abuse. Senate Document 199 in discussing "The Virgin Range" and "The White Man's Toll" showed by a diagram that Wyoming ranges had been depleted 51 to 75 per
cent due to the apparent indifference of those controlling the use of the range. The most startling statement for this report to make was that even the National Forests showed that more than 50 per cent of their lands had been depleted from 26 per cent to more than 50 per cent of their virgin forage. What was meant by the virgin range was never very clear. It must have been a year something like this one."

Further along in the same published booklet (Ibid, page 11), Dr. Vass emphasizes the tendency for an overstocking of investment-free, tax-free lands:

"That plants can be destroyed by continued overgrazing has been clearly demonstrated on wild life refuges, where it is a case of the survival or life and death of the animals, a condition which differs greatly from that of the rancher where his problem is to convert range forage into beef, lambs and wool at a profit. The greatest danger from overstocking and range depletion is on lands not owned or controlled by the operator, but on investment free, tax free lands, where the fees are low and the user tries to get as many head as possible on the area. He does not feel the same responsibility to these lands that he does to his own property. That is a trait in human nature we all have, and explains why the individual as a rule is more efficient than the group."

Again he cites (Ibid, page 17) in support of his position the view that it is uneconomic for a rancher to stock a range beyond its carrying capacity:

"The reason that our ranges have not been ruined by overgrazing is that the intelligent rancher knows that he cannot continue to overgraze his range to the point of destroying the plants and at the same time put on satisfactory gains, as his profits are in summer gains."

A report of the Casper hearing (Administration and Use of Public Lands, Hearings Before a Subcommittee of the Committee on Public Lands and Surveys, United States Senate, Seventy-Seventh Congress, Pursuant to S. Res. 241, Part 2, U. S. Government Printing Office, 1941) also carries a statement by Dr. Vass (page 537). Here he reiterates his belief that the good rancher does not find any profit in overstocked range:

"The argument that the rancher is not a good manager, is abusing the range by overgrazing, is not well-founded, for he knows there is no profit in running livestock on overstocked ranges. The point of diminishing returns on livestock production is reached long before the plants are killed by overgrazing. The 1934 drought offered an opportunity to blame the stockman and dry-land farmers
for a lot of things they have no part in. The enormous production from our ranges and dry-land farms this year certainly vindicates the farmers and ranchers, and disproves many of the statements on which much of the Federal control has been based."

In 1947, another congressional committee hearing was held at Rawlins, Wyoming, on the question of public lands administration. Two members of the Wyoming station staff, Mr. Robert Lang and Dr. A. A. Beetle, were asked to appear at the hearing. Both reported on surveys made in northern Colorado of national forest lands which were being grazed under permits.

Mr. Lang discussed four permit areas in the Routt National Forest. He reported that he had been unable to find any signs of deterioration from overgrazing (Public Lands Committee Hearings, Rawlins, Wyo., Hearings Before the Subcommittee on Public Lands of the Committee on Public Lands, House of Representatives, Eightieth Congress, First Session Pursuant to H. Res. 93., 1948, U. S. Government Printing Office):

"In view of the light utilization, both in 1946 and 1947, the relatively common occurrence of grass seedlings, the undamaged condition of timber reproductions, and the abundance of seed production on hairgrass and brome in 1946, and Idaho fescue in 1947, it is my opinion that if these areas ever supported more and better vegetation than at present, the cause of their deterioration must be sought from other sources, such as fire, climatic change, drought years, and so forth, rather than in overgrazing within the past few years."

Dr. Beetle, (Ibid, page 61) described a survey of vegetative types found on what are known as the Charles Vivion allotments at Rabbit Ears Pass, Colorado, on National Forest lands. Said Dr. Beetle:

"In conclusion, it may be stated, though only on the basis of one season's observation, that there is ample feed being left on the range this year, and in spots, to a point of waste. There is no evidence of long continued abuse on any of the vegetation classes. Fire is the main contributing factor to the present conditions which are being misrepresented by the Forest Service to indicate overstocking."

The implication of nearly all of these statements is that there is no general, large-scale overgrazing of range lands in Wyoming. Dr. Nelson makes an exception to this viewpoint in the case of forest lands, saying that grazing defeats the purpose of the forest area, but with the exception of his views, the general opinion leans strongly toward the position that there has been no serious after-effect from overstocking on most of the lands.
IS PUBLIC OR PRIVATE OWNERSHIP THE REMEDY FOR OVERGRAZING?

The knotty problem of public lands has been at the root of the overgrazing controversy, which would undoubtedly be far less of an issue otherwise. Both those who argue for more public ownership and control of Western lands and those who argue for less have injected overgrazing into the discussion. Because the two issues have been so closely inter-related, the following statements with respect to public lands by various members of the Wyoming staff are included in this summary.

Dr. Aven Nelson, whose views were quoted earlier, made a distinction between lands suited to forest and lands suited to grazing. He saw no overgrazing on the Red Desert, which is largely sagebrush and grass, with no trees. He pointed out that the case for public ownership of these lands could not be made on a premise of overgrazing. Dr. Nelson then went on to say, separating the sagebrush from forest lands, that more rather than less public control was needed on forest areas and that a more vigorous policy for the protection and development of forest resources was in order. He indicated that under public control (The Forage of the Red Desert, unpublished report, compiled in 1946):

“The grazing value of these forests is now more thoroughly utilized than was ever the case when grazing in the forests was unrestricted.”


“The setting aside by the General Government of large tracts of forest lands, in various parts of the United States, to be preserved perpetually as forests, has met with much favor in most parts of the country. Some criticism arose at first from a few who feared that private interests might suffer or that certain industries, such as mining, might be hindered in their development. Now, that fuller information has shown that the purpose of this forest legislation is wholly beneficient and that it is not intended that these laws shall work a hardship on any one, even those who were at first inclined to criticize are now warm advocates of the policy. The early criticism proves to have been a good thing. The attention of the whole country has been called to the great benefits we derive from forest covered lands.

“Shall not we, as citizens of the state which has most to gain, loyally support a policy that means so much to our arid plains? Under the past reckless management, or rather total want of supervision, enough timber has been destroyed by forest fires (often wantonly kindled) to bountifully supply the entire state for cen-
turies. Under a wise protective policy our forests can be made to yield all the timber that we can possibly use for domestic purposes, without in the least impairing their beauty, extent or productiveness. If we learn to know our forest resources and their value to us, then we shall come to appreciate them so highly that we shall stand as a unit for their protection from those who would destroy them for private gain. We shall also desire to protect them from the consequences of the present reckless indifference that allows the destruction of thousands of acres of valuable timber by fire. . . .”

Dr. A. F. Vass questions the advisability of turning the so-called unappropriated lands over to the U. S. Forest Service in an article written in 1931 (*The National Forests of Wyoming*, April 23, 1931):

“It is perhaps fortunate that the Forest Service did not propose the addition of all unappropriated lands to their holding, for they have a sufficiently large task in handling and improving the forest lands, without taking on the additional one of managing the grazing lands. It is the grazing problem on the national forests that has given them the most trouble, and even with all of their investigations and control methods, they have not been able to materially increase the carrying capacity of the grazing lands. Their best work has been with the forests.”

In the same article, Dr. Vass took the position that U. S. Forest Service administration had not increased forage production on national forest lands:

“It is a rather common statement that the Forest Service has doubled and tripled the forage on the national forests, but a careful study of the numbers and classes of animals grazed thereon during the last quarter of a century shows that there has been no measurable increase or improvement in the condition of the animals coming off the forest. This is nothing against the Forest Service, for they were not established to look after cattle and sheep, but rather to develop and care for the forests. It is not the only agency that has failed to make any great improvement in our ranges, as the state institutions have made no better progress, for it is a very stubborn problem. Improvements have been made by the Forest Service however in certain limited areas where overgrazing has been practiced. The regulations of the Service calls for good range management practices, and there is reason to expect more improvement on the ranges in the future. The fact that the unappropriated lands in the state are holding up as well as the grazing lands on the forests, may be explained by saying that due to the shortage of watering places in summer the deferred or winter system of grazing is used on the desert.”

In testimony before the senate subcommittee on public lands which held hearings at Casper in 1941 (*Administration and Use of Pub-
lic Lands, Hearings Before a Subcommittee on Public Lands and Surveys, United States Senate, Seventy-Seventh Congress, First Session Pursuant to S. Res. 241, (76th Congress), Part 2, U. S. Government Printing Office, 1941.), Dr. Vass suggested that "unappropriated lands whose chief use was grazing might be placed in private ownership and added to the tax roll as is the general practice in other areas of the United States":

"Dr. VASS. . . . I was very favorably impressed with the remark by Mr. Rutledge yesterday that he favored turning all these management decisions, difficult problems, over to the grazing district committees to decide. I might say I agree with Mr. Rutledge 100 percent; and I would go even further, I would turn the lands over to them. I feel that would make them even more responsible and perhaps more efficient use of those lands.

"Senator O'MAHONEY. You don't mean to turn the lands over to the committees, do you?

"Dr. VASS. To the users, Senator; to the users. We are all agreed on one thing, making our western grazing lands productive in an economic manner. I believe that point was brought out by Mr. Phelps, and I feel that will take care of ranch stabilization, conservation, soil erosion, overgrazing, and all the other calamities that we hear so much about; and the ones who can do that perhaps the best are those who know the most about them and who have had personal experience and who have a personal interest in them, and that would be the user.

"Many of the points I may bring out have been touched upon, but if it is a duplication, why probably it may give them special emphasis. We have never fully recognized the rights of the western agricultural producers to make a living by grazing livestock, and just why we all consider homesteading as farming has never been quite clear to me. I think of homesteading as establishing a home, perhaps by agricultural production, but just why it shouldn't include grazing country has never been quite clear. The land policy of this country has been to place the people on the land, giving them title so soon as they showed themselves worthy of trust. The Homestead Act, which is sound in principle, did this very thing for millions of farmers, but it failed to provide for ownership of western grazing lands. It is weak in respect to the size of the unit, which used acreage rather than production as a measure of size.

"If 160 acres in the Middle West could produce enough feed to support 120 animal units, then the size of unit for our western grazing lands should have been of sufficient acreage to support 120 animal units. The sole emphasis that was placed on farming and no consideration given to the rancher, who pursues that ancient and honorable and noble occupation of living by means of herds and
flocks, which biblically was quite an institution. . . . If he would not farm a certain area, then he could not homestead, and that, of course, we blamed on the Homestead Act, because it required the farmers to plow up a certain amount of grass. The weakness, I feel, was in the wording of the Homestead Act.

"Due to the failure to correct the size of unit stated in the Homestead Act we have as a result this maladjusted land-control pattern which hinders progress for the best land use and results in inequalities between ranches that is more important than management practices, and I presume it is the reason why you're holding the hearings here today.

"The grazing of livestock on our western ranges is an agricultural enterprise, the same as corn production in Iowa. The chief difference between producing livestock by grazing and by farming operations is that the rancher uses livestock to harvest his crop to which he has applied little or no tillage, whereas the farmer plants and tills his crop and harvests by machinery before feeding it to livestock. I would like to ask the committee a few questions, if I might. First, why should not the rancher be given the same consideration as the farmer in owning and managing his property? The second, why is it necessary or even desirable for the Federal Government to own and control one-half of the ranch property used in the production of agricultural products, and not apply the same reasoning to the Middle Western farmer?

"If this Federal ownership and control is a good thing, why not permit the farmer to own the land he farms and the Federal Government control his pasture lands? How can we secure equality between ranchers who, on the one hand, are using privately owned lands carrying interest and tax charges amounting to $5.29 per animal unit, while their neighbors may be using tax-free, interest-free Federal lands with one-sixth its cost?

"Why are there so many different Federal agencies controlling and managing lands of the same general characteristics, using different methods for granting permits, determining proper fees, and distributing the receipts? It may be desirable from the standpoint of experimentation but I doubt if it leads to what you are seeking in ranch stability.

"How long do you think the Federal Government will hold on to these so-called public lands if it had to pay the management, investment, and tax charges that privately owned lands have to pay? And if they cannot meet these charges that deeded lands pay, can you say they are being managed efficiently?"

The Wyoming economist, in a bulletin written jointly by himself and Harry Pearson, also of the Experiment Station staff, called attention in 1927 (An Economic Study of Range Sheep, Wyo. Agr. Expt. Sta.
Bulletin No. 156, page 16, July, 1927) to the uneconomic use made of “Free Range,” saying:

“This overstocking and death loss is one result of the use of the so-called ‘Free Range.’ In order to hold a given range one must keep it fully stocked during the good years which means that it will be greatly overstocked during the drought years. If the operator had some control over the range so that he would not have to keep it fully stocked during the good years it would mean that he could keep down his death loss. A range will produce more feed during a drought year if it has not been closely grazed during the previous year. By not being forced to overstock during the good years he would have fewer animals and more feed during the drought year, which would reduce his death loss.”

In the same bulletin, (page 16) Dr. Vass and Mr. Pearson describe the burden which public lands place upon the private taxpayer living in the same region:

“The people of the state of Wyoming own one-third of the land in the state. The land taxes of the state are carried by this one-third. The high assessed valuation of the land now owned is what discourages further ownership, and leaves the people, who are now land owners, carrying the burden of those remaining areas that are not privately owned. By placing a penalty on ownership of land we discourage the most vital thing in our whole agricultural system.”

There is an argument for coordinated grazing on adjoining forest and semi-arid range areas. Dr. Vass calls attention to this in the same bulletin (pages 64-67):

“The high, mountainous areas surrounding the Red Desert are the natural summer feeding grounds for the sheep that run on the Red Desert during the winter, and to operate successfully a wool grower should have access to both, be they national forests, privately owned lands, or public domain. To separate them is like separating water rights from arid lands to which the water rights have formerly been applied. The value of one depends on its combination with the other, for alone they are of little value. The attempt, that is commonly made, to determine the value of one in terms of what it is worth to the other is not a fair method. The values given the Red Desert lands is based on their use as a winter range, and would not be worth the values placed on them, if they had to be used for year-long grazing.

“Considerable has been made of the fact that a ranch on the Red Desert, which carries grazing permits on the forest, is worth more than one that does not have summer grazing permits. Some have interpreted this to mean that the permit is worth more than
The value of the summer range cannot be measured in terms of the value of the winter range, any more than the value of the winter range can be measured by the value of the summer range. The two go hand in hand, and can no more be separated than can arid lands and water rights thereon. . . . Combine them and they are valuable. The value of one cannot be measured in terms of the value of the other, and so it is with our summer and winter ranges, and just because the summer grazing permits adds to the value of the ranch, does not mean that the price paid for the permits is too low and that they should be raised to the point where they would not give value to the ranch land. This would be giving them the value of their own worth, plus the value of the ranch land or winter range, for without the summer range has very little value. Taking the summer range from the winter range is like taking the water rights from the arid lands, to which they have been granted.

"It is not the purpose of the writers to attempt to show that operators can run as well off, as on the forest. The forest ranges are our summer ranges and are essential to the operation of the winter ranges. . . ."

**IS RANGE DEPLETION ALWAYS DUE TO OVERGRAZING?**

There has been a tendency to attribute the extreme results of drouth on the range to overgrazing. There is no question but that in extreme drouth years, the symptoms of overgrazing are more easily seen. At the same time, it is sometimes too easy to assume that the failure of grass to appear during a dry year is due to longtime effects of heavy pasturing and not due to a lack of moisture in the soil.

The fluctuation of forage production from dry to wet years is very great. The ability of grass to come back following a dry season is also very great. The extent of this fluctuation, the ability of range to revive with a return of rain, are shown in several reports from the Experiment Station in past years.

The wide variations in forage production as a result of drouth are discussed by Robert Lang, associate agronomist at the Station, in a bulletin published in 1945 (*Density Changes of Native Vegetation in Relation to Precipitation*, Wyo. Agr. Expt. Sta. Bulletin No. 272, June, 1945). He mentions the experience of other research workers (page 4):

"Numerous other investigators report on changes in density and volume of native forage between drouth and wet or normal
years. They all seem to be in agreement that great reductions in the amount of forage must be expected during drouth years, and that many of the valuable forage plants are killed. However, with proper management the range vegetation will soon recover its former productiveness with the advent of years of normal precipitation.”

In the same bulletin (page 30), Mr. Lang writes:

“An eight-year study to determine the relationship between precipitation and density of native vegetation was conducted in parts of Converse, Campbell, and Weston counties, Wyoming.

“There was a striking relationship between the precipitation during any 12-month period beginning September 15 and the density of the vegetation in the following growing season.

“The relationship between the three vegetative groups: (1) grass and grass-like plants, (2) forbs, and (3) shrubs and semi-shrubs, did not remain constant. On the short-grass vegetative type the density of perennial grasses had decreased, while the forbs and shrubs had increased. On the cactus-grass type the density of all three groups had fluctuated in about the same proportion in accordance with fluctuations in precipitation. On the mixed grass vegetative type there has been a tendency for a decreased density of forbs while the shrubs remained relatively constant. On the abandoned farm land there has been a sharp decrease in forb density and a moderate increase in density of perennial grasses.

“Since the period of study covered some extremely dry years, as well as some relatively wet years, it has shown that density decreases of 50 per cent or more may be expected from wet to dry years.”

Two other members of the Station staff, O. K. Barnes, U. S. Soil Conservation Service technician, and A. L. Nelson, superintendent of the University of Wyoming-owned farm at Archer, record the fluctuation in range cover from year to year. In a bulletin also published in 1945 (Mechanical Treatments for Increasing the Grazing Capacity of Shortgrass Range, Wyo. Agr. Expt. Sta. Bulletin No. 273, page 6, June, 1945), they write:

“The fluctuation in the density during the five-year period was extreme. There was a difference of from 200 to 300 per cent between high and low years. In 1939 the density of perennial grasses on the shortgrass type was 7.48 per cent. In late summer of 1941 they had increased to a basal density of 19.40 per cent. The relative composition of the cover did not show such marked change. However, all of the mid-grasses increased during this period. Since 1941, the high year for growing season precipitation, the density of all perennial grasses has declined, although it is still considerably higher than the 1939 density.”

"Climate has been the most important single factor in controlling profits in livestock in this area, and it will long continue to be a very important one. If ranchers have their range fully stocked during the good grass years, it means overstocking during the lean years. The ranchers who carry over a surplus of feed during the good years and do not have to buy high-priced feed during the years of drouth are the ones who are producing cattle at the lowest cost. Cottonseed cake is being used on some of the ranches as a supplementary feed to carry the herd through the dry, adverse seasons."


"In all of the semi-arid and arid sections of the United States, moisture is the limiting factor in plant growth, and so it is but natural to expect that there will be a correlation between the amount of precipitation and the number of animals on the range. Up until 1902 there had been sufficient range feed for the sheep, even during the years of low rainfall, but at this point the increase of sheep from 2,800,000 in 1900, to 5,600,000 in 1903 was too much for the drought years to support and as a result the losses were enormous. The number in the state dropped 2,000,000 in two years."

Again (*Ibid*, page 72):

"The losses during the drought years are a difficult problem and are made worse by overstocking the range during the good years. Figure 5 (not given here) shows that the losses are very much greater in those drought years which occur at a time of overstocking. This is shown by the severe losses which occurred in 1902 and 1910. The precipitation in 1919 and 1924 was as low as during the above mentioned periods, but the losses were not nearly as great due to the fact that the sheep ranges were carrying about 3,000,000 less sheep, during the latter years. If we can keep the number of sheep on our ranges in the state around three and one-half million head instead of letting them go up to double that number it will aid in reducing the heavy drought losses. Our ranges will support three to four million sheep during the good years and leave a little surplus growth of feed, which is reflected in the better growth of the plant. More feed is produced by the plants during the drought years when they have not been over-grazed. The feed produced during the dry year will go further in feeding the smaller number, and thereby prevent loss. The wool growers should adjust their
operations and numbers so as to leave a little surplus plant growth during the good years to carry through the drought years. This will aid in reducing the disastrous winter losses, that we may be headed towards at the present time."

Dr. Vass cautions the public land users against trying to crowd too many livestock on Taylor grazing lands because of low fees (Proceedings of the First National Conference on Land Classification, Missouri Experiment Station Bulletin 421, December, 1940):

"I agree with Mr. Rutledge that the stockmen are guided by life long observations and experimentation with livestock and range and that they are not the agents of destruction as they are often pictured and if given control of the range take pretty good care of it. We have found that there has been no measurable change in the forage on Wyoming ranges during the past fifty years. The ranges are carrying as many and in many cases better livestock than they were carrying in the nineties. This is especially true of the ranges controlled by the livestock producer. Overgrazing and harm is, therefore, more likely to occur on grazing lands which he uses but which are not under his control; for example Taylor Grazing Lands on which he may be permitted to graze at a low fee, and in which he is in competition with other ranchers. Thinking it is a privilege to have these permits he may try to crowd on as many animals as possible, a thing he would not do if he was personally responsible for the range."

A comprehensive survey of the entire state was made in 1935, by O. A. Beath, following the great drouth of 1933 and 1934. His findings were published in one of the western livestock magazines in 1935 (Effect of the Drouth on Wyoming Ranges, National Wool Grower, August, 1935). Referring to the Red Desert, he writes:

"Winter fat (white sage) has been referred to by the author in his press articles and bulletins as one of the most desirable forages on the ranges of the state. This year winter fat occurring in the Red Desert was found to be of better quality and denser than has been observed at any previous time. Since it can withstand lots of drouth, is tolerant to alkali, palatable, and from a chemical point of view the best rounded out forage on the Desert, steps should be taken to extend its present distribution. . . .

"Saltbush, commonly known as salt sage, stood up under the arid conditions remarkably well. . . . While it is true that a few plants here and there were found to be damaged, yet a hopeful note was observed in the number of young plants that were present. Apparently the extreme arid conditions followed by copious amounts of moisture produced a favorable condition for seed germination.
"The brown sage was found to be in excellent condition. This is also a valuable sheep feed and extensive areas of it occur here and there throughout the Red Desert. In fact the only type of forage that has undergone a certain amount of damage in the Desert area pertains to some grasses. The wheat grasses were affected the least, June and rice grass the most, although many of the grass-crowns were found still to be supporting some active shoots. Any one who has given some consideration to the vegetation of the Red Desert has come to realize that it is not primarily a grass range and never will be except in a minor way.

"As a whole, the vegetation of the Red Desert as it now exists is on a par with that normally occurring over a period of years. Sheepmen may anticipate ample forage of a well-balanced type when the time comes for its use this fall and winter. . . ."

Of the Big Horn Basin, Mr. Beath says:

"A range observation was made during June of this year from points out from Cody, Greybull, Basin, Worland, and Thermopolis. The Owl Creek Mountains, the Riverton and Lander sections were also visited on the same tour. The author found very little evidence of vegetation being injured by the preceding dry weather at any of these points."

Concerning central and eastern Wyoming, he reports:

"Due to some special investigations being carried on last summer and fall by the author and his staff an opportunity was given for close contact with the ranges of central and eastern Wyoming. Inwardly it appeared at that time that the barren grass ranges of this section of Wyoming were gone. This was particularly apparent in the vicinity of Lusk, Newcastle and Sundance. The transformation brought about by the abundant spring rains could only be appreciated by actual visitation. In many areas desolate wastes of a year previous had given back dense growths of range grasses sufficiently developed to be cut for hay. The opportunity for seed maturity this year is the best that has occurred for many years.

"The Laramie Plains region was more favorably situated as to moisture during the general drought period. Livestock competed for the forage thus available, and it was feared the close grazing would seriously check this year's growth of grass.

"Southern Wyoming, Carbon, Sweetwater, and Uinta counties also present a most favorable range picture. Stockmen with years of experience have expressed surprise at the comeback of their ranges.

"Some areas in Laramie, Goshen and Platte counties suffered from soil erosion. Where residual soils are made up of volcanic ash (White River formation) it is only natural that in periods of extreme aridity there would be some soil drifting."
From these statements, it is clear that moisture deficiencies do have a direct effect upon the amount of forage present on range land. Where there is no forage produced, cattle are forced to rely on the carryover from the preceding year. If the normal cattle population is to live through, it is going to have to take the dead grass down to the roots. The complete removal of cover is going to open the range to more severe wind and water erosion, but the stockman is faced with an alternative of carrying through his breeding herd by using supplementary feed or taking some loss on damaging erosion in these years. Land that is not overgrazed in more normal times is going to look overgrazed, even if a minimum of breeding herd is carried through.

**CAN EXISTING RANGE BE MANAGED TO GIVE BETTER VEGETATIVE COVER?**

The difference in views over the "overgrazing" question has shown a tendency to ignore one outstanding fact. That is that proper management practices would very often provide a much larger production of forage. Such management, both on public and private lands, would permit the land to carry substantially larger numbers of cattle, while at the same time leaving a heavier vegetative cover than the land has ever had in the past. Research work at the Experiment Stations, as well as the practical experience of many ranchers, has demonstrated many new management practices. Without question, many other useful management practices will be developed in the future.

The Wyoming Experiment Station has made a number of contributions to the list of management methods which will make range more productive. Other stations are also doing constructive research, and in various statements, Wyoming staff members have called attention both to Wyoming and neighboring state practices useful for range pasture maintenance and improvement.

One of the first observed methods for improving range forage production in Wyoming seems contradictory in that grazing itself increases forage production. Early day sheepmen noticed an improvement in the Red Desert area rather than deterioration after the area had been grazed for a period of several years. This improvement is based entirely on the characteristic Red Desert range and the grazing procedure practiced there. Dr. Aven Nelson goes into this phenomenon in a bulletin issued in 1898 (*The Red Desert of Wyoming and Its Forage Resources*, U. S. Dept. of Agr., Division of Agrostology, Bulletin No. 13, page 22, 1898):

"How to improve the quality and increase the quantity of available forage in the Red Desert is a most difficult problem. The
soil conditions and water supply are such that not much may be hoped for through the expenditure of ordinary effort and means for the desert as a whole. Nor will any sudden or spasmodic effort suffice. Only forces and plans operating for a number of years can be expected to give noticeably great results.

"It is very evident, however, that the forces now at work are tending toward improvement. According to the most reliable sheep men the same areas that twenty years ago would only support one sheep will now better support from three to five. This they attribute to gain in the strength of the soil due to the accumulating manure. It seems probable that a more potent factor is found in the following: The vegetation chiefly depended upon for forage is composed of the large number of small shrubs of many kinds previously mentioned. The cutting down to the ground of such vegetation enormously increases the number of annual shoots. From winter to winter this shrubby vegetation has been browsed down closer and closer to the woody bases of the plants, until now the tender annual shoots are produced in much greater abundance. The effectiveness of this browsing is, of course, dependent upon the region being used as a winter pasture only, giving time for growth and recovery each summer."

Later in a Wyoming bulletin (Some Native Forage Plants for Alkali Soils, Wyo. Agr. Expt. Sta. Bulletin No. 42, page 30, December, 1899), Dr. Nelson also discusses this characteristic improvement in the Red Desert which follows upon grazing:

"... attention was called to the fact that the expansion or even the maintenance of the present stock industry is dependent upon the possibility of increasing the total amount of forage. No attempt will be made to show how this may be done except as to the forage of our alkali lands. On the large areas of these not much may be hoped for by the expenditure of any ordinary effort or means but nature will here do much to bring about the desired result. According to the best information obtainable from many of our closest observers, the amount of forage produced each year is perceptibly increasing in some of the largest alkali areas of the state. In these localities the forage chiefly depended upon is shrubby in its character. The cutting down to the ground of such vegetation enormously increases the number of annual shoots. From winter to winter this shrubby vegetation has been browsed down closer and closer to the woody bases of the plants, until now the tender annual shoots are produced in much greater abundance. The effectiveness of this browsing is, of course, dependent upon the region being used as a winter pasture only, giving time for growth and recovery each summer. If we so treat alkali plants of the greater plains that they shall have a chance to increase where they
already occur, introduce them to the saline soils where they are not now found and, if possible, irrigate those that will respond to this attention by an increased yield, we shall see a marked difference in the stock-supporting capacity of the state."

Regulating grazing to get the most feed from the range is the method at issue in determining whether or not the range is overgrazed. Dr. Vass’s 1926 bulletin (Range and Ranch Studies in Wyoming, Wyo. Agr. Expt. Sta. Bulletin No. 147, page 146, June, 1926) mentions controlled grazing and some of the points in its favor:

“Controlled grazing bears the same relation to forage production that controlled production does to marketing. If the animals are turned out early in the spring before the plants have had a chance to become established it is detrimental to the plant, and the harm done in early spring will continue through the season. More feed will also be produced if the plants are allowed to make a considerable growth before they are grazed off. It is through the green leaves and stems of the plant that the food from the air and soil are taken into the plant and there manufactured into plant tissue. The less leaves and stems a plant has the less its ability to manufacture more plant tissue. The plants should be allowed to obtain a good start, and occasionally they should be allowed to reseed. By meadow improvement and controlled grazing the carrying capacity of our ranches can be increased, and at a profit to the operator.”

Dr. Vass as co-author of a bulletin issued in 1938 (Hunter, Pearson, and Vass, Type of Farming and Ranching Areas in Wyoming, Wyo. Agr. Expt. Sta. Bulletin No. 228, page 51, July, 1938) again mentions the economic effects where range is overstocked and he urges a need for controlled grazing:

“Producing greater gains in weight with fewer animals is especially possible where there has been continuous overstocking. In attacking the problem it should be understood that the feed consumed by livestock is used (1) for maintenance or upkeep of the animal body and (2) for making growth or gains in weight. It should be further understood that the maintenance of the body is taken care of first and that the feed consumed in addition to that required for maintenance is then used in making increases in weight. Cows and three-year-old steers when on full rations use approximately 73 per cent of the feed they consume for maintenance, two-year-old heifers and steers around 70 per cent and yearlings about 63 per cent. Thus, it is seen, that by overstocking to the extent of about 30 per cent practically no feed is left for making increases in weight, for the maintenance of the body is taken care of first and the overgrazing would cause a material decrease in the total amount of range forage produced.”
He continues (Ibid, page 52):

"The shortage of grazing forage and supplementary feed during seasons of drouth must be duly considered in the adjustments of livestock numbers to feed resources if the maximum gains in the weight of the livestock carried over a number of years are to be obtained and if the carrying capacity of the grazing land is to be maintained. This may be done in large part by holding the number of livestock somewhat below the number that can be properly handled during years of average feed production; by carrying over into seasons of drouth the surplus supplementary feed produced during average and good years; by the construction of small storage reservoirs and the drilling of wells to provide water so that the range lands may be grazed more evenly without the livestock traveling long distances for water; by a much wider use of deferred and rotational grazing; and by maintaining, within the limits of diminishing returns, high percentage calf and lamb crops."

A bulletin by Robert Lang and O. K. Barnes (Range Forage Production in Relation to Time and Frequency of Harvesting, Wyo. Agr. Expt. Sta. Bulletin No. 253, page 30, June, 1942) shows a difference between short-grasses and midgrasses in relation to the amount of grass harvested and the time it is harvested. A summary from the bulletin follows:

"These preliminary experiments indicate that the short grasses (Bouteloua gracilis and Buchloe dactyloides) will yield considerably more dry weight when harvested frequently than when protected to the end of the season before clipping.

"The midgrasses can be expected to yield considerably less under frequent clipping than under only one clipping at end of season.

"The preliminary results obtained by these clipping experiments indicate that on a short grass range a system of grazing which would utilize some of the forage during June and July and the remainder at the end of the growing season would give a greater amount of more palatable forage than a system which deferred grazing until the end of the growing season.

"Possibly a system of intensive rotation grazing wherein units of the pasture or range were utilized near to the maximum each month would produce a maximum amount of forage from the short grass areas.

"The basal density of the short grasses was not observed to have been lowered after one year of frequent clipping. However, the density of these grasses after the second year of frequent clipping showed a slight decline.

"If one expected to get the maximum amount of forage from a midgrass range it would be necessary to defer it until the end of the growing season. However, these grasses become relatively
unpalatable when they mature as well as being high in fiber and low in protein. It is possible that the smaller amount received by frequent grazing would offset in quality the extra quantity received by end-of-season grazing."

Rotation grazing has some possibilities as a range management method, and in some degree is already practiced by many ranchers. The Wyoming Experiment Station is conducting a series of experiments at Archer and at Laramie which suggest that rotation grazing, properly handled, will produce much more forage than continuous grazing on corresponding range. These are preliminary results and need to be confirmed by more tests. Elias Nelson, an early member of the Station staff, suggested rotation grazing in 1901-1902. He also, at that early date, emphasized the value of individual or corporate holdings (deeded land) over the open range (public land) system. (Twelfth Annual Report, Wyoming Agricultural Experiment Station, pages 34-35, 1901-1902):

"There is no doubt but that the range may be grazed the year around without injury if the number of animals be small, but, when stocked to its utmost capacity, it is imperative that it be given a sufficient period of rest during the growing season. This would necessitate a division of the grazing lands into a number of fields and a pasturing of these in rotation. In this way, it is possible to maintain the productivity of the grazing land, and with such treatment a more economical use is made of the pastures. An intelligent management of the pastures is readily instituted on individual or corporate holdings, but how to guard against the deterioration of the open range through injudicious practices is still an unsettled question."

Mr. Nelson also speaks of permanent injury to range (Ibid, page 35):

"In the improvement of deteriorated grazing lands other means than that of rest must be employed in order to more speedily restore them to their former forage value. Unless enough grass remains to reseed the land, rest alone will not bring about the desired result. The range must be reseeded to pasture grasses whose merits are well known, and which are adapted to this region."

Mechanical treatments such as pitting are recommended on the native dry-land range in eastern Wyoming, and it is entirely possible they may have more extensive application than now seems to be the case. O. K. Barnes and A. L. Nelson (Mechanical Treatments for Increasing the Capacity of Shortgrass Range, Wyo. Agr. Expt. Sta. Bulletin No. 273, page 33-34, June, 1945) have this to say about pitting and grooving, another mechanical treatment:
"Group I pastures, including range land pitted with the eccentric disc and another grooved at 2 ft. intervals in 1939, and a non-treated check pasture, show a 4-year average of 11 per cent greater grazing capacity, and 6 pounds more lamb gain per acre from the treated range as compared to non-treated range. A greater volume of perennial grass remained at the end of the grazing season on the treated pastures.

"In the fourth year, the two treated pastures carried 36 per cent more sheep per acre with more grass left at the end of the season as compared to the non-treated pasture."

They continue:

"Group II pastures, including two pieces of non-treated range land and two adjoining pieces that were pitted with the eccentric disk in April, 1942, carried an average of 13 per cent more sheep per acre for the first two years. The lamb gain per acre was 25 per cent greater on the pitted range. Even though stocked heavier, these pitted pastures averaged more perennial grass left at the end of the grazing season than did the non-treated pastures."

Barnes and Nelson also point out:

"The effect of the closely spaced type of mechanical treatment on the range cover has apparently been a general stimulation of the vegetation. The thinning of the cover has apparently made more moisture and plant food available per remaining plant and these plants have equaled or exceeded in most instances the production on non-treated range. The tillage and thinning has brought about an increase in western wheatgrass and other desirable species at the expense of the blue grama grass. The increase of these species has increased the total forage production, increased the feed available in the early spring period, improved the ability of the range to hold and retain moisture, and improved the quality of the range feed through the greater volume of a variety of grass species. The pits and grooves have also served to retain excess precipitation."

Speaking of the same treatment in 1948, Barnes (Progress Report on Some Range and Grass Research, Archer Field Station, Wyoming Agricultural Experiment Station, page 3, June, 1948) reports on the six-year average production of a range pasture pitted in 1942.

"Table II (not given here) summarizes the grazing results from two native pastures pitted in 1942 and compared with two similar but nonpitted pastures. The six year average shows that the pitted pastures have carried an average of 31 per cent more sheep per acre each year with approximately 50 per cent more grass left each year. The lamb gain per acre shows about the same difference as the stocking rate difference, being 37 per cent more on the pitted pastures."
The kinds of grass to seed, and whether to seed in pure stands or in mixtures, all have a bearing on the amount of forage produced on range pastures. Mr. Barnes makes mention of results at Archer (Ibid., page 6) on a typical shortgrass range. These results do not apply in the more arid regions of western Wyoming, but they suggest that there are adapted species of grass which can be found for these areas, as well as for the typical shortgrass range on eastern Wyoming plains:

"The results of this study indicate the following points for practical application in this (Archer) or similar areas:

1. Standard crested wheat should be used in preference to Fairway, particularly as long as price favors Standard.

2. Crested wheat is the best spring grass.

3. Russian wild rye is excellent for any season. However, its grazing capacity doesn’t equal that of crested wheat in the spring. Russian wild rye has been unexcelled for summer and winter use due to its high palatability when crested wheat and other species become dry and coarse.

4. Western wheat, due to slow regrowth and slightly slower start in the spring as compared with crested wheat, has been used with good results as a late spring-summer pasture. Stocking just to keep up with regrowth has provided a palatable pasture with better results than when this species was treated strictly as a spring pasture.

5. The grass mixture of crested wheat, Russian wild rye, and western wheat appears to have nothing to recommend it over these three species in separate pure stands, fenced for grazing at optimum periods. The Russian wild rye has been taken early, to the exclusion of crested wheat, and the former has frequently been over-used and the latter under-used. The use of this mixture has been limited to spring grazing, whereas the pure seedings can and have been used in the spring and summer.

6. From a grazing standpoint, buffalo grass apparently should not be mixed with the blue grama. The sheep consistently take the blue grama close and go to buffalo as a last resort. Even when forced to buffalo grass they have consistently, each year, lost weight as soon as they are forced to eat it. In seeding these warm season species the southern strain of blue grama appears desirable. The production is high; the blue grama has survived six winters and thus would appear winter hardy.

7. A mixture of grass and alfalfa is a distinct advantage as measured in total production, length of grazing season, and maintaining productivity.

8. Production can be expected to fall off on the grass pastures after the first three or four years. We have not measured just when this decline occurs, however. Fertilizing is indicated, or in some cases breaking the ground for crops and reseeding older, dry cropland for pasture.
"9. From the standpoint of total ground cover, the seeded blue grama-buffalo grass pasture is the best. The density of this pasture was equal to that of good native range. Western wheat furnished the next best ground cover, followed by Russian wild and crested wheat, with about one-half the density of the blue grama and buffalo grass. The 35-inch row pastures have the lowest density, with about one-fourth that of the blue grama-buffalo grass pasture. The advantage in density held by the blue grama-buffalo grass pasture over the others comes largely from the buffalo grass."

Likewise, Mr. Barnes has obtained surprisingly good results with certain seeding methods on the Archer dry-land range (Ibid, page 8). These, although applying specifically in the Archer area, also suggest that seeding methods will influence results on more arid lands. Already we know that unless there is a favorable seedbed, there is little or no chance of getting a good seeding started:

"A study of various methods, seed beds, and dates of seeding various grass species on dry-land was started in 1940 and carried on until 1943. Briefly stated, the following points developed from this study may be useful to operators in this and similar areas:

1. Crested wheat, Russian wild rye, western wheat and a mixture of these species have been equal in ability to become established and maintain a stand. Blue grama and smooth brome are more difficult to establish and maintain.

2. Early September and early April seedings have been about equal and both have been better than October and late April seedings. Early spring seeding on clean tilled land is safer from blowing than early fall seeding.

3. Late April seeding for blue grama is better than early April. Fall seedings practically never survived.

4. With a mixture including alfalfa the early April seeding resulted in better stands of alfalfa than the fall or late spring seedings.

5. Use of nurse crop reduced the vigor of the stand in practically every case. The effect of the nurse crop is still evident in this sixth year for some plantings.

6. Seeding into undisturbed sudan stubble has been superior to seeding into wheat, rye, and oat stubble.

7. Better and more uniform stands were obtained from seeding on undisturbed stubble as compared with seeding on duckfooted or disked stubble."

Mr. Beath (Effect of the Drouth on Wyoming Ranges, National Wool Grower, August, 1935) opens up another possibility for getting more forage from the Red Desert area:
“With better understanding of the vegetative types occurring in certain portions of the Desert and through cooperation it would be possible to extend its use in the spring over a longer period for the reason that certain plants of high quality come and go between the present grazing periods.”

Mr. Beath’s suggestion is in line with the development of wells and watering places in more inaccessible places. These would permit the use of much forage that is now lost, due to the fact that sheep could get in and utilize the feed at the most favorable time.

Dr. A. A. Beetle offered a series of constructive proposals for the development of grazing on forest areas at the Congressional committee hearing at Rawlins in 1947. (Public Lands Committee Hearings, Rawlins, Wyo., Hearings before the Subcommittee on Public Lands of the Committee on Public Lands, House of Representatives, Eightieth Congress, First Session pursuant to H. Res. 93, U. S. Government Printing Office, 1948):

“....In order to end on a constructive basis, I’d like to present six resolutions, as a result of the summer’s work:

“(1) That more attention should be paid to water spreading, that is, spreading the water table where possible;

“(2) That research is needed for a more complete understanding of the place occupied by rodents, particularly the pocket gopher, in plant communities;

“(3) Reseeding on mountain meadows should be in large part done with native species. Commercial stocks of such species should be developed;

“(4) Reseeding after burns in forest or sagebrush should become a part of the business of all fire fighters;

“(5) Judging of range land should be either done by experts or abandoned, for it is easier to train nonexperts to administer proper use than it is to train them to evaluate the different factors that affect botanical composition; and

“(6) The thinking outlook of those charged with range administration should be in terms of more efficient use of the accepted principles of range research.”

Improvement of range land is a large topic. In the preceding pages, no effort has been made to cover the entire field. The only purpose has been to show that many methods are open to private operator and public agency alike and that these methods will help to run more livestock on a given area of land, without injury to the land by overstocking.
SUMMARY

The foregoing record of what the members of the Station staff have written and spoken about the range lands of Wyoming shows that the discussion has been concerned with two different types of public lands. Wyoming has within its border (1) dry, arid range lands running largely to sagebrush and saltbush and (2) more humid lands covered very largely with forest. The rules that apply to one do not apply to the other. This may have led to some confusion. The writings recorded here show that where the question has been discussed, the writers have expressed themselves in favor of private ownership of the arid regions as far as a feasible management policy can be worked out. When it comes to forest lands, the Experiment Station writers have never expressed any other opinion than that the first consideration is the protection of the trees, with the grazing of livestock to have a secondary priority. Whatever difference of opinion in regard to these lands there is hinges on the question of how much the timber production and regrowth is hindered by grazing of domestic livestock.

Writers outside the Wyoming Experiment Station have drawn attention to the fact that large areas are included in the boundaries of the National Forests, which provide practically no timber but are either desert or grassy, suited mainly to livestock production. Some writers have contended that these should be taken out of the forests. Areas of that type have not been of great importance in Wyoming and so the opinion of Experiment Station scientists on this point has not been recorded. But on the basis of their opinion in other cases, it may be expected that they would favor placing these large areas of non-forest grazing land in private ownership as far as feasible. There are smaller grazing areas intermingled with forest which nearly all writers agree do not lend themselves to separate ownership or administration. The record shows that the Station writers are in agreement that the general welfare is best served by using them as grazing lands as fully as is possible without forest damage.

Many of these smaller areas which are left in forests are capable of being stocked, sometimes quite heavily, with cattle and sheep. The whole weight of opinion expressed in the foregoing pages is that these should be used to their full capacity. In particular instances, the Station scientists have stated that, in their judgment, public officials have not allowed these areas to be grazed to full capacity or have been too conservative in the stocking.

In regard to the question of whether the range, either inside or outside the forest, has been or is being seriously damaged by the grazing of livestock, the statements quoted on foregoing pages pretty generally reflect the opinion that little or no permanent damage has been or is being done. There are some exceptions. For example, Professor Buffum wrote in 1891, "One of our most valuable grasses . . . . is being destroyed by civilization." However, Dr. Aven Nelson reported that the
The vegetation of the Red Desert was as good after thirty years of grazing as when he first studied it in 1896.

Vass and Lang have called attention to the fact that effects attributed to overgrazing may be due to drought and have shown that the power of the range for recovery in a series of wet years is remarkable. Dr. Vass has repeatedly expressed the opinion that the stockmen cannot continuously overgraze the range and remain in business. The animals are injured more quickly by overgrazing than the plants which make up the range cover.

Can the range be improved by proper management? The later workers, Beetle, Barnes, and Lang, are very sure that it can and have published results of experiments which show that it has been done in the cases under study. The recent writings have also reflected the opinion that all agencies should take a positive attitude toward the range and seek to improve it by proper management of grazing, eradication of pests and undesirable plants, and reseeding with desirable species.

So far as they have expressed opinions on the subject, all workers agree that there should be more research to study the effects of different rates of grazing on the range and upon forests. They also are on record showing that it is possible to make the range more productive by mechanical means, such as artificial seeding and proper grazing management. Here again the Station writers, especially in later years, have stressed the need for more research.

In conclusion, it is well recognized that this bulletin does not answer the single question, "Is Wyoming range overgrazed?" The Station has not had the resources to make the large-scale survey needed to answer that question. The opinion of most members of the Station staff in recent years is that overgrazing and overstocking are not general practices either on sagebrush lands or on forest lands in Wyoming. There is a feeling, supported by actual studies, that drought is often responsible for what many term overgrazing. The controversy over over-grazing of range land could in large part be resolved by application of range improvement methods and research on better range improvement practices. Range improvement, properly handled, is quite capable right now of permitting heavier stocking, plus a heavier vegetative cover and better erosion control.

The interests of conservation and of the efficient stockman are not opposed. They do coincide. The efficient stockman wants the heaviest possible vegetative cover of forage plants on the range, because, the sturdier and the more vigorous the plants in that cover the more assurance he has of feed. Cover of this type, produced by a combination of modern range improvement methods, will do far more to protect the land against erosion than the more limited cover left behind by restricted grazing alone.
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