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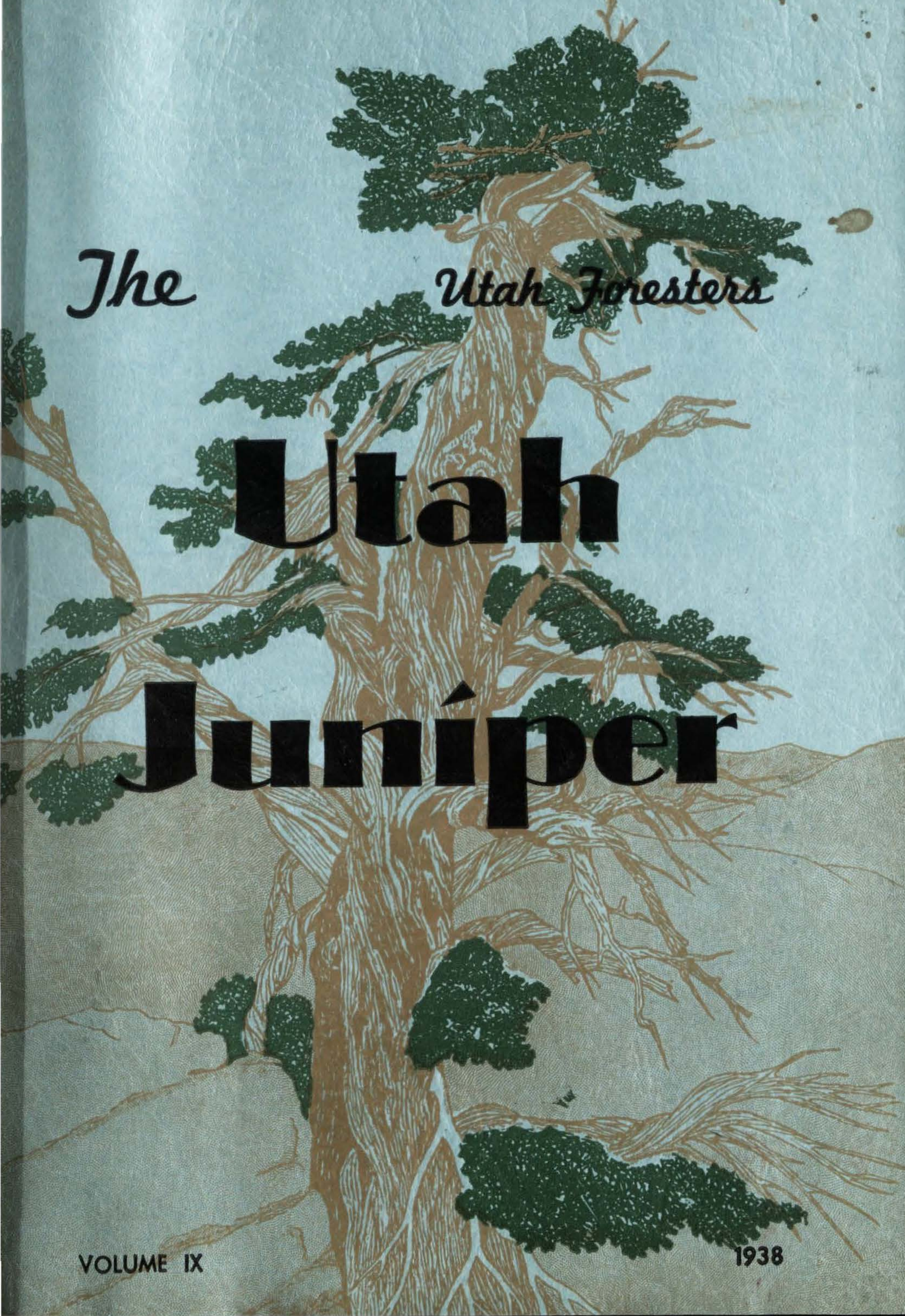
Utah State University

Utah For alumni



The Utah Foresters

Utah Juniper

VOLUME IX

1938

THE UTAH JUNIPER

Unmolested!

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UTAH STATE AGRICULTURAL COLLEGE

LOGAN, UTAH

VOLUME 9 1938

View From A Point On The School Forest

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To Paul M. Dunn, Dean Of The School Of Forestry, We The Forestry Club, Respectfully Dedicate This The Ninth Edition Of The Utah Juniper.

His efforts have been untiring in bringing about better teaching facilities and recognition to our school. Under his guidance we have grown to a full fledged school, recognized throughout the country.

"Paul's" friendly attitude and personal interest in our welfare has won him a warm spot in the hearts of all who know him.

FORESTRY FACULTY

Back Row: Dunn, McLaughlin, Floyd, Rasmussen
Front Row: Kelker, Stoddart, Smith, Barnes

FORESTRY FACULTY

Paul M. Dunn .... *Dean, School of Forestry*

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.... *Professor of Forestry, in Charge of Range Management*

Dr. Robert P. McLaughlin .... *Associate Professor of Forestry*

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.... *Assistant Professor of Forestry, in Charge of Wildlife Management*

Arthur D. Smith .... *Assistant Professor of Range Management*

THE RELATIONSHIP OF VEGETATION AND SOIL TYPES IN THE SEMI-ARID GRASSLANDS OF THE SOUTH-WEST AND THE EFFECT OF DIFFERENT GRAZING INTENSITIES

By Evan L. Flory, *Ecologist*
Soil Conservation Service, Albuquerque, New Mexico

The nutrition of plants is dependent upon the accessibility of moisture and nutrients. The absorption of moisture and nutrients is dependent upon numerous contacts between the roots and the soil. Soil texture, structure, and chemical composition determine the rate at which water will infiltrate the soil, the depth to which it will penetrate, the water holding capacity and usability of this water, as well as the extent of drainage and aeration. The common range plants can only develop where soil moisture is present and where the soil is well drained and properly aerated. The extent and ramifications of their root systems are therefore limited to the soil mass where the above conditions are present. The root system of each species conforms rather closely to a specific pattern.

No recording device has ever been developed that expresses the summation of environmental factors as effectively as vegetation. The plant cover reflects the degree of soil development, soil texture, in many cases parent material, and, in arid or semi-arid regions, the effectiveness of rainfall. The vegetative cover is most sensitive, however, to different intensities of use by livestock.

Other factors being favorable, the presence and dominance of a species on a particular soil will depend, among other things, upon the infiltration of water and the storage of this water in the soil in a usable form where the particular conformation of the root system of this species can utilize it in the most efficient manner.

Specific plant associations occupy definite soil types, and soil depletion is always reflected by a change in vegetation. A vegetative association not only develops in response to a specific environment, but is at the same time the expression and indication of the environment. Changes in vegetation reflect the degree of soil depletion, and also forecast the degree of restoration with proper land use after depletion.

Soil and water conservation on the badly depleted and eroded overgrazed areas of the Southwest depends largely upon the restoration of the original vegetative cover.

Natural revegetation proceeds slowly through a definite series of plant successions on each soil type, the climax for the region under undisturbed conditions, being developed coincident with the maturity of the soil type. Knowledge of such succession in relation to erosion control and moisture conservation is necessary in developing the most economical and practical methods of conservation.

Knowledge of succession entails not only a knowledge of the sequence of vegetative types, but also of the intricate relationships of the associated species in each successive stage to each other, and to the soil origin, texture, structure, depth, degree of maturity, and other factors influencing vegetative development. Some plants have rather general preferences for certain factors and specific preferences for others. If it were possible to determine the needs of every single species, its occurrence in a given location would tell within the limits of its tolerance the amount and quality of each habitat factor present in the environment. Such information not being available or obtainable with present methods, attention must be confined to species which have a distinct preference for one factor or combination of factors, or plants within a community which, by their association, indicate specific preferences because of such association.

As previously mentioned, one of the most important factors of environment that influences type of plant cover is the condition or type of soil. The soil is not a static natural body, but one that is constantly developing or changing until it comes into general equilibrium with climate, vegetation, and other environmental conditions. Changes in either the vegetative cover, climate, or soil produce environmental conditions to which either the soil or plant must adjust itself. It is apparent, therefore, that under a given climate, progression or regression of soils or plants is interdependent, and development or degeneration of each is coincident.

There are, in any climate, soils that have been recently deposited, or that, for other reasons, are undeveloped, and, therefore, do not have the chemical, physical, or biological properties of a mature soil under the existing environment. Due to different periods or rates of deposition or erosion, or exposure of parent rock, soils of various stages of maturity can, therefore, be found in any region. In general the degree of maturity of a soil can be judged by the development of the "B" horizon or subsoil. In the process of soil development, the finer soil particles and mobile organic or soluble chemical constituents move downward with percolating rainwater to relatively slight depth, resulting in the gradual formation of a heavier textured or chemically enriched "B" horizon.

On undeveloped soils, or those which have been depleted by overgrazing, trampling, and consequent erosion, a very early stage in plant succession will be represented by a thin stand of annual weeds. Undeveloped soils containing high percentages of clay and collodial materials usually have sufficient quantities of such materials in the unleached surface to retard the rate of moisture penetration, and consequently, to limit the amount of water absorbed during any period of precipitation. Undeveloped soils with a coarse texture, even though moisture penetrates them readily, are not capable of retaining sufficient moisture within the zone of root occupation to support a more advanced stage of succession. The soils which have been depleted by overgrazing and trampling have had their ability to absorb water destroyed by excessive compaction or by the removal to various degrees of the permeable surface. The remaining surface, or exposed subsoil, has been rendered impervious by compaction, and the sealing up of root channels and other pore spaces. In any of the above conditions only sufficient moisture is absorbed and retained to support a sparse annual growth, which can complete its life cycle within the period of the growing season having the heaviest precipitation.

On the coarse textured undeveloped soils, the translocation of the finer particles together with organic materials to the subsoil, will provide storage capacity for increasing amounts of moisture. On the heavier-textured undeveloped soils, and the depleted soils, roots and various forms

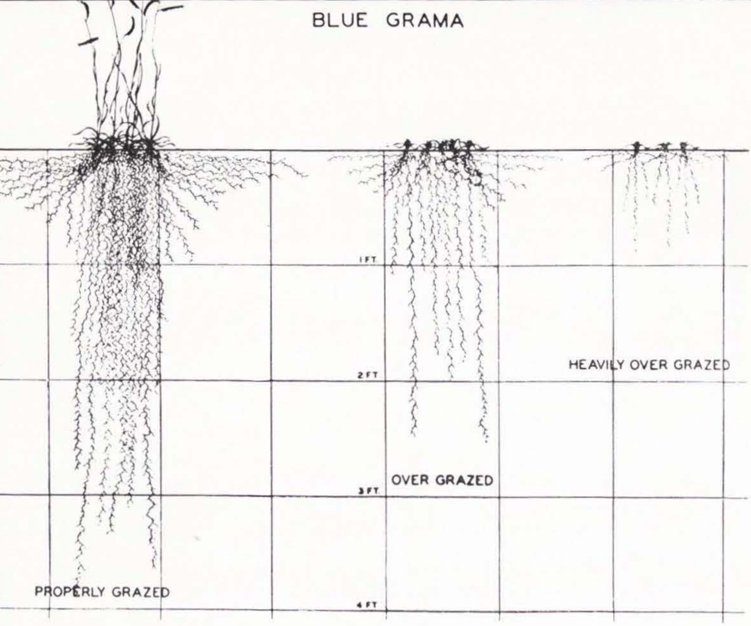


Fig. 1.—Blue grama (Bouteloua gracilis (H. B. K.) Lag.) showing the effect of different degrees of utilization.

of macro and micro organisms tend to loosen up the soil mass. In addition, the accumulation of vegetative debris checks the runoff and gives moisture more time to be absorbed. The above processes will give rise to better soil development and a second stage in the succession characterized by a heavy growth of the same weeds, and the advent of a few annual grasses. In the next stage of the succession, the annual grasses will largely displace the weeds, and, in turn, deep rooted perennials will begin to obtain a foothold because of soil conditions encouraging deeper water penetration. The next stage in the succession will consist largely of relatively deep rooted perennial shrubs with an increasing percentage of pioneer perennial grasses. In the final stage of the succession, as the soil matures or a regeneration nears completion on a depleted soil, the vegetation approaches the climatic terminal community or climax.

The *density, composition,* and *volume growth* of the vegetative cover quite commonly, however, does not express the maximum development possible under given climatic conditions because of undeveloped or eroded soils.

Climax grasses of the desert grasslands are characterized by a dual root system. The major portion of this system consists of widely spread, finely branched roots that thoroughly impregnate the surface few inches of soil. This arrangement facilitates the rapid absorption of the infrequent light rains before they are dissipated because of the rapid evaporation characteristic of this habitat. The minor portion of the root system consists of roots that more or less thoroughly occupy the soil mass to a depth of approximately four feet. (See Fig. 1.) The grass plant is able to sustain itself through the long protracted drought periods by drawing upon the stored water in this zone.

By intercepting the water as it enters the surface soil, the roots of climax grasses effectively cut off the moisture supply to the deeper soil layers. This water, then, does not become available to the deep root systems of the pioneer plants, or invaders upon depletion of a former climax. The deep, sparsely branched root systems of the perennial shrub stage are no longer effective in supplying water to the plants. Dead roots of the pioneers or invaders are often encountered under climax grass covers that have developed in periods of one to three decades.

The root systems of climax grasses have developed in harmony with a type of soil development which allows them to utilize the factors of the habitat for maximum ground coverage and foliage production. The effectiveness of the climax cover for protection against wind and water erosion is demonstrated by the maturing of the soil coincident with the development of the climax.

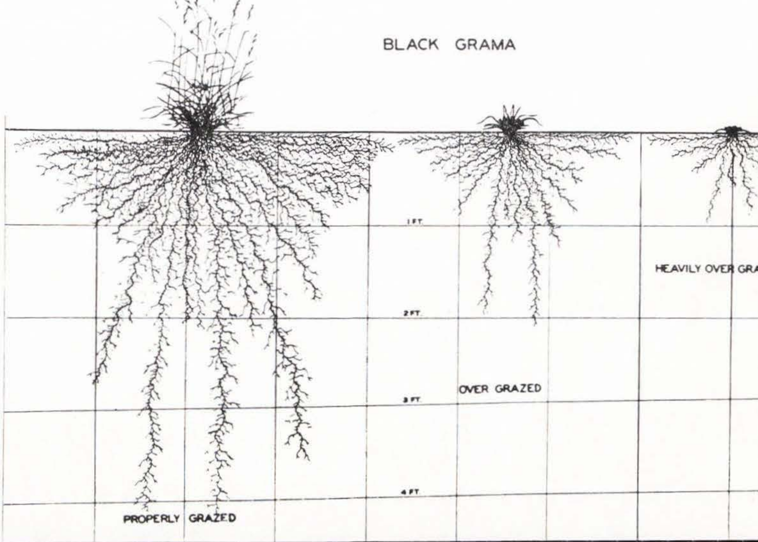
Since black grama (*Bouteloua eripoda* (Torr.) Torr.) is the dominant species of the low plains and blue grama (*Bouteloua gracilis* (H. B. K.) Lag.) of the high tablelands in the semi-desert grasslands of the southwest, these species will be discussed in their relationship to soil types and grazing to represent the general conditions for the plant formation.

These species occupy soils which show a relatively mature development. During the development of these soils a large proportion of the clay and colloidal material has been leached to the depth of the average maximum penetration of moisture. This layer of soil ("B" horizon), because of its heavy texture, is able to store large quantities of moisture. The overlying soil layer ("A" horizon), because of the removal of finer particles, is relatively coarse textured, open, and friable; allows water to penetrate readily; and serves as a protective mantle against excessive loss of moisture from the subsoil.

The heavy textured "B" horizon in a normal, uneroded soil, begins at depths of 6 to 15 inches below the surface depending upon the percentage of clay resulting from disintegration of the parent material, and also upon the precipitation.

A large percentage of the rainfall comes in light showers which penetrate only a few inches. High temperatures and high rate of evaporation will dissipate the moisture in a very few hours after the showers. The two gramas have developed root systems that absorb much of the moisture before it can evaporate. A species in order to thrive in such a habitat, must have numerous very finely branched roots close to the surface so that moisture can quickly be taken up by the plant. The gramas are

Fig. 2.—Black grama (Bouteloua eripoda (Torr.) Torr.) showing the effect of different degrees of utilization.



particularly well equipped in this respect. In addition to the shallow roots, the gramas also have deeper penetrating roots which draw upon stored moisture to maintain the plant through the sustained drought periods. Occasionally rains occur which penetrate to and moisten the heavier textured "B" horizon.

Extensive areas formerly covered by a dense stand of grama grasses have been depleted. The gramas have been greatly weakened and their productivity limited by the effects of trampling and overgrazing or they have been replaced by worthless and sometimes poisonous weeds.

The gramas when properly utilized maintain their full vigor as shown by the plants on the left of Figs. 1 and 2. Under such conditions the leaves are allowed to develop and remain exposed to sunlight sufficiently long for the manufacture of food enough to bring about the extension and maintenance of a normal root system and the development of viable seed. Grass plants may be maintained in this condition by grazing in the dormant season, and by judicious grazing in other seasons with provision made for occasonal rests during the growing period. Ranges where the grass still retains this degree of vigor are the exception rather than the rule.

Ranges occupied by vigorous grass stands will guarantee the stockman sustained high yields as long as the vigor of the grass is maintained. The soil mass is so thoroughly occupied by finely divided grass roots that soil removal is exceedingly slow. Weeds and other less desirable forage or erosion control species are not able to obtain a foothold.

The center plants in Figs. 1 and 2 represent the condition of grass plants on the average range in the Southwest. The number and extent of the roots has been materially impaired by consistent removal of the leaves. An insufficient photsynthetic area remains exposed to the sunlight for maintaining the vigor of the plant, and the root system is restricted to conform to the lessened food supply. Less thorough occupation of the surface soil and destruction of some of the grass plants renders the surface soil more vulnerable to the action of water. The water becomes even more effective in that it attains greater velocity due to less surface obstruction resulting from decreased amounts of leaves, stems, and vegetative debris. Sheet erosion is evident in various degrees on all ranges in this condition. Less palatable invaders now have a chance to compete with the weakened gramas for factors of the habitat and they continue to assume a more dominant role since the stock do not graze them and the grass continues to be heavily overgrazed. Three of the most common invaders are shown in Fig. 3. The roots of invaders on an overgrazed area are much less effective in erosion control than those of the climax grasses. The roots are coarser, and not so profusely branched. Very few occur near the soil surface. It is fortunate, however, that the root systems of the invaders are of such a character for otherwise they would retain complete possession of the habitat once they established dominance. When the gramas are given an opportunity to regain their vigor in overgrazed areas, the extensive occupation of the surface few inches of soil by grama roots enables them to completely shut off the moisture of light rains from the deeper roots of the invaders. When a season occurs where all rains are of this character it is no uncommon thing for practically all of the invaders to be killed if the vigor of the grass has been restored and if it has sufficient density.

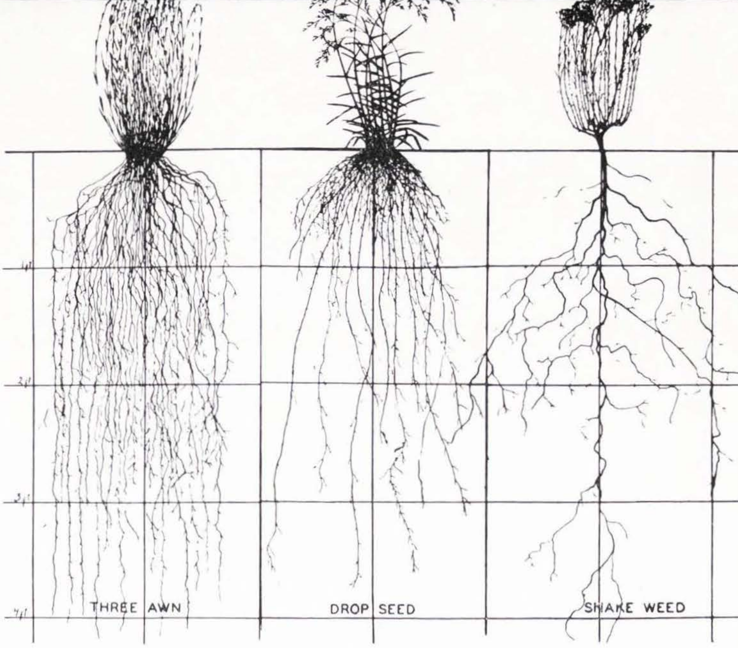


Fig. 3.—Three of the most common invaders of Southwestern Grama grass ranges, which result from overgrazing and soil erosion.

Grass in the condition shown in the center plants of Figs. 1 and 2 is still able to maintain a fair stand provided a relatively heavy textured subsoil lies within reach of most of the deeper penetrating roots, but the grass stand will be materially lesser if the upper limit of the heavier textured subsoil is deeper than 8 or 10 inches. Where the soil is relatively coarse textured throughout or where the heavier textured subsoil lies deeper than the above limits, there is not sufficient moisture storage capacity to maintain the plants through protracted drought periods. Many such areas formerly covered by a dense grass stand are now barren, and, aside from local hearsay, the only evidence of former conditions is the numerous root relics still readily perceptible in the subsoil. In many areas the character and abundance of these root relics not only indicate the species formerly present, but also to some extent their abundance. In areas where the grass still persists, root relics give an indication of their former extent and penetration. Root relics show that the root systems of the plants in the left (properly utilized) and the center (overgrazed) of Figs. 1 and 2 were at one time similar.

The plants on the right in Figs. 1 and 2 show the condition of the two grama grasses when grazed very heavily through successive growing seasons. Grass plants persist in such a weakened condition only during a period of adequate rainfall or where a heavy textured soil exists within a distance of 4 to 6 inches from the surface. Cases have been encountered where the grass persisted over extensive areas under such usage and in such a weakened condition, but upon the advent of the serious and protracted drought of 1934 hundreds of acres of grass died completely where a heavy textured soil was deeper than mentioned above. The grass has persisted in spite of the weakened condition and drought where a heavy textured soil began at depths from 2 to 6 inches from the surface. The best condition prevails where this heavy soil was closest to the surface.

The well developed soil will absorb water readily and store it within the general feeding level of grass roots. Here rainfall attains its greatest efficiency, maintains the greatest vegetative density, and yields the greatest volume of growth. Soils with an impervious surface absorb very little moisture, while immature soils that are coarse textured throughout, soon dry to depths below the feeding zone of grass roots. In soils having these characteristics, rainfall has a very low efficiency; grass roots are shortened rapidly under overgrazing and the grasses give way very soon to annuals in the case of impervious soils, and to deep rooted woody or unpalatable perennials in the case of coarse textured soils. Soils with a coarse texture throughout the profile may be able to retain sufficient moisture to sustain a good stand of grass under high rainfall, but the grass will withstand very little usage, because the soil mass occupied by the shortened and restricted root systems of heavily grazed grass plants cannot hold enough moisture to maintain the grass stand through prolonged drought periods. The latter two soils will need lighter stocking to make an appreciable recovery than would be the case with the first soil mentioned.

Since the most desirable erosion control and grazing species are not able to withstand equal utilization on different soil types it is desirable to locate stock tanks, corrals or other structures which cause a concentration of livestock upon soil types which can withstand the heavy grazing and trampling with the least harm to the grasses.

The frequency and degree of grazing which will give the greatest sustained yield of forage over a period of years is, also the frequency and degree of grazing which will maintain the greatest plant vigor; that this will vary with different soil types is beyond question.

Best results from the grass cover for soil and water conservation and forage production can only be obtained when full recognition is given plant-soil relationships in the formulation of range management plans. A careful consideration of soil relationships is as necessary in the production of natural vegetation as in the production of cultivated crops.

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WATER CONSERVATION AND LAND-USE MANAGEMENT

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Utah Agricultural Experiment Station

Foresters and engineers have a common interest and a common responsibility—both of vital concern to society. America has come more and more to look to the foresters for leadership in conservation of forest areas and maintenance of their productivity, and to the engineers for well directed efforts toward conservation, control, and efficient use of water resources. The ability to manage forest areas efficiently and to conserve, control, and use water resources for the good of all, increases in proportion to the growth of understanding of the numerous interrelated, complex, variable factors with which one must deal. Schools of forestry and engineering in the colleges and universities of America have both the obligation and the opportunity of increasing knowledge of how to conserve and use forest and water resources by conducting painstaking, scientific research. They have also the major responsibility of perpetuating the knowledge of these vital aspects of conservation. Knowledge alone is not enough; unity of purpose and of action is also essential. It has been well said that, "when knowledge becomes too great for unity, we are lost." As pointed out recently by Dr. Isaiah Bowman, president of the Johns Hopkins University, "The unifying elements of watersheds have been described over and over again. The next step is to secure general recognition of this truth. Attention to the influence of vegetation alone will not solve the long-range headwater problems of water and land. We cannot break up a watershed problem into parts, look at the parts, and consider the problem as understood. *Values and uses of watersheds as wholes have first to be determined.* This is fundamentally a social question with aesthetic, economic, political, and educational aspects. After that comes the question as to how accepted values and uses are to be achieved. At this point science comes in, but science guided always by the practical considerations of cost."

Arid Regions

Agriculture in arid regions is vitally, if not wholly, dependent on water for irrigation, and where storage reservoirs are lacking, this water must be supplied by late-season flows of creeks and rivers. The precipitation on mountain and forest areas, and the management of these areas with special reference to preservation of vegetative cover, maintenance of soil permeability and water absorption, retardation of runoff, prevention of floods and excessive soil erosion are of major importance. All of these influence basically the quantity and the reliability of late-season water for use in irrigation.

The problems of forestry in relation to watershed management and water conservation and use are of general interest and general concern—they are by no means restricted to arid regions. However, this article deals with aspects of land and water use which are of particular significance to the perpetuation of civilization in arid regions. The basic factors which limit the welfare and growth—indeed, the very existence—of such civilization are: the precipitation on forest and mountain areas; the management of watersheds and their seasonal and annual yields of water; the methods of storage, conveyance, distribution, and application, of the water yield; and the provision for adequate drainage and preservation of the productivity of the valley soils.

Objectives

Civilization has been defined as the development by society of the capacity to live together in large numbers. It is apparent that water conservation and intelligent land use are basic to the perpetuation of western civilization. To perpetuate and advance civilization; to banish the adversities which result from scarcity of food, clothing, shelter, and other material needs; to develop a safe foundation, and build part of the superstructure required for all of the material comforts essential to the abundant life of the individual—these are the objectives of water conservation and land-use management.

Methods

Continued and persistent use of the sciences, notably the physical and biological sciences, promises great achievement in water conservation and betterment of land use.

Water supplies for every use—culinary, irrigation of farm crops, growth of native vegetation, power, transportation, and recreation—come from rain and snow. Transpiration from millions of plant surfaces, and evaporation from the land and water surfaces, made possible by the energy which comes from the sun, provide the atmospheric moisture from which the snows and rains come and thus we have the continuous hydrological cycle; the understanding of which is so vital to civilization, because of its effects upon water conservation and land use. Since the day modern irrigation was founded in America, tremendous advances have been made in the applications of the sciences through engineering methods. Knowledge concerning water-supply studies; yields of river systems; relations between precipitation and forest and range management; construction and management of storage reservoirs; generation of hydro-electric power; coordination of power development with irrigation needs; and efficient water conveyance, delivery, and use in irrigation has been greatly increased. Interest has recently been developed in water-supply and river-yield studies as related to mountain hydrology, to proper distribution of the water of a river system in relation to land productivity and needs, to efficient application of water on the farm, and to proper drainage, all in their relation to land-use management and welfare of all the people.

Mountain Hydrology

Concerning the interrelationships of vegetative cover, streamflow, floods and erosion there is a paucity of specific reliable research data. Dean Thorndike Saville, College of Engineering, New York University, asserted recently that "in spite of all the welter of talk" only two scientifically controlled experiments had yet been conducted in America. From these two experiments, both of which were conducted in the West, and other less accurate observations, he draws three generalizations, namely:

"(a) Removal of vegetative cover will appreciably increase the surface runoff from precipitation, or, conversely, forestation or vegetation reduces the average flow of water in streams.

Fig. 1.—Snow covers like this are nature's storage reservoirs, which are of greatest value when the earth mantle has capacity to absorb the water as fast as the snow melts. This picture shows the snow cover in Flat Canyon before melting. (Courtesy Utah Agricultural Experiment Station.)

(b) The ordinary flood heights are reduced in magnitude for forestation or vegetative cover.

(c) There is less erosion when the soil has a forest or proper vegetative cover."

The foregoing generalizations are clearly of vital significance to western agriculture and industry, but caution is essential in their quantitative application to particular areas. Further comprehensive research is needed.

In most of the valleys of the West, the precipitation which falls directly on the irrigated land is relatively unimportant. This is true, first, because the percentage of the total water used during the growing season by cultivated crops and pasture, that is provided by direct precipitation, is relatively small and, second, because most of the direct precipitation comes during the dormant or non-growing season and, therefore, is used less efficiently. The depth of the annual precipitation on the mountains is almost invariably higher than in the adjacent valleys. For this reason—and the fact that the mountain areas from which part of the rain water and melted snow water flows, are much larger than the areas of irrigated land—a *very large* percentage of the water used by cultivated crops comes from the mountain areas. Therefore, on the basis of the generalizations by Dean Saville, it would seem evident that to justify their perpetuity, the values of the vegetative and forest cover, namely: stream regulation, flood control, and reduction of erosion, must exceed the losses due to reductions which they make in the average flow of streams. It is essential to measure the amount of water (snow and rain) that falls from month to month and year to year on the mountain areas, and to know when and how fast the snow melts, what part of the water content of the snow is held in the forests and on the high areas in large drifts and secluded depressions, and in the soil and rock mantles of the mountain slopes and valley fills for late-season melting and retarded flow to the creeks, rivers, valleys, canals, pumps, and irrigated lands (Fig. 1). In those areas where the construction of artificial storage reservoirs is impracticable or prohibitive in cost due to high slopes and excessive erosion, studies of mountain hydrology are of particular significance to all who are interested in water conservation and land-use management.

Reservoirs

If all of the storage reservoirs in the West could be filled to capacity annually, the volume of water probably would be sufficient to cover, each year, all of the western irrigated land to a depth of two feet or more. This

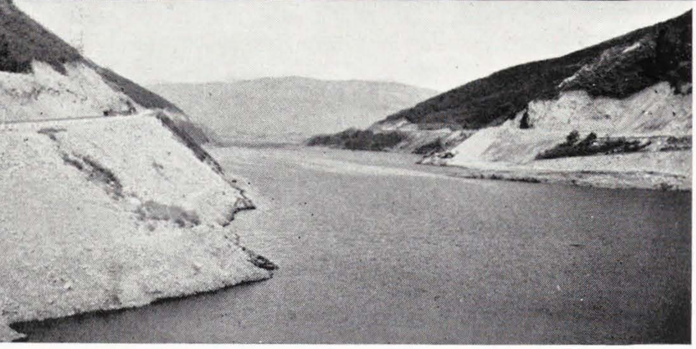


Fig. 2.—The United States is wisely advancing millions of dollars to help western farmers build storage reservoirs with a view to providing water in abundance for all needs. The Pineview Reservoir, shown here, has a storage capacity for more than a million acre-feet of water, and is Utah's latest addition to its reservoir system. (Photo by the author.)

would supply a substantial proportion of the water needed to irrigate the land, and would probably continue to do so for untold centuries. In spite of this progress, there are vast areas of arid land yet unirrigated, and also thousands of acres inadequately irrigated because no storage water is available. The need for construction of more reservoirs is urgent and will continue to be so for many years. The Pineview reservoir (Utah), as seen from the dam in Ogden Canyon, is typical of many that will yet be constructed in mountain valleys (Fig. 2). Engineers are interested not only in the design, construction, and maintenance of these much-needed reservoirs, but also in safe and efficient conveyance of the stored water to the lands which it will make productive.

Conveyance

One of the most serious causes of water loss in the West is inefficient methods of conveyance. In many of the irrigated valleys, a large number of small, poorly designed, leaky canals are used—canals which could and should be replaced by a few of modern design and construction. Control of weeds, one of the most perplexing problems in Utah and other irrigation states, could be greatly advanced by abandoning many small canals; thus eliminating their weed-growing and seed-producing banks, and using the land now occupied by them for production of valuable farm crops. Thus, both water conservation and land use may be advanced by improved methods of water conveyance.

This will require consolidation of canal companies in many instances, an action which of itself would make possible diverse ways of water conservation, not only in the valleys of the West, but also in the mountains. Consolidated irrigation companies could easily eliminate many of the present petty controversies concerning water rights. They could also eliminate unnecessary parallel canals and contribute much to improved methods of water distribution.

Better Distribution

The very dry years, 1931 and 1934, focused attention on the fact that in many western valleys owners of the low-lying or bottom lands *hold* the prior and superior water rights, whereas the owners of the higher lands, which are generally more productive, provided they are properly irrigated, have secondary and inferior rights to water for irrigation. To change this condition is a delicate and difficult task because it involves exchange of property rights of great but intangible value. Yet the need for improvement in water distribution is urgent. This betterment will come as the problem becomes more clearly and more generally understood and the demand for water conservation more acute. Improvements in methods of water distribution will not only contribute directly to water and soil conservation, but also to the ability of farmers to apply water to their lands more efficiently.

Efficient Application

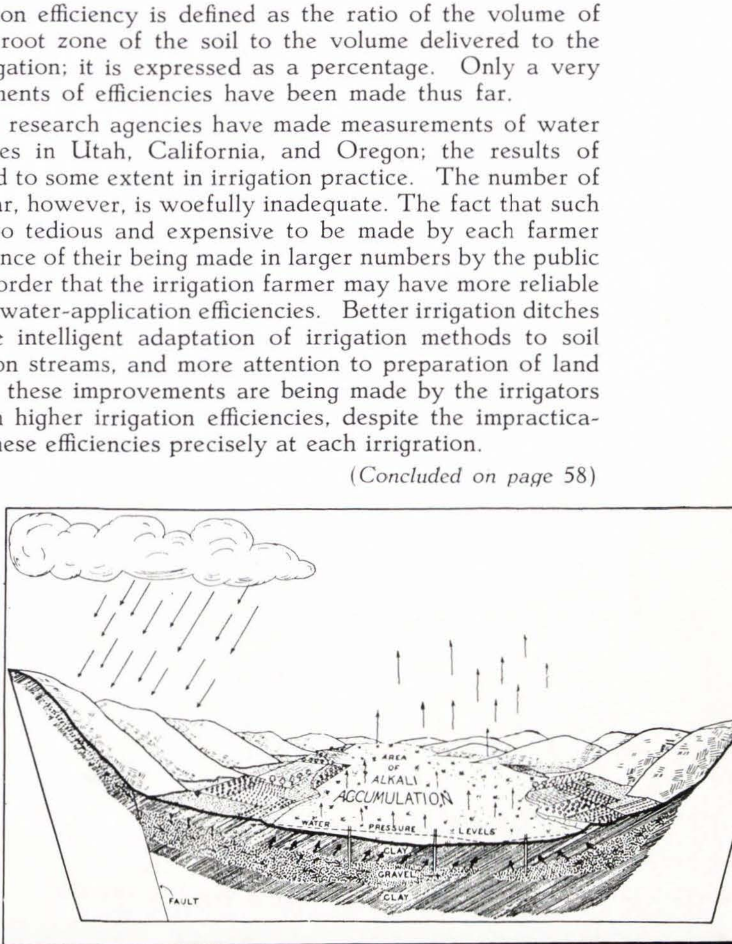
It is just as impossible to store one-half acre-foot of water in the surface foot of the soil of one acre of properly drained land as it is to store a quart of water in a pint cup. However, hundreds and probably thousands of irrigators apply at each irrigation more water than their soils have capacity to hold. Excessive amounts are not applied willfully or with malice of forethought; but rather unwittingly, because it is impossible for irrigators to see the leaks caused by deep percolation from their soils. There are no generally-understood "rule of thumb" measurements by which the amount of the leakage can be determined. At every irrigation, water is stored in the soil as capillary and film moisture. The amount thus stored and retained for a period of two or three days after irrigation, may be only a small fraction of the amount delivered to the farmer, or it may be three-fourths or more, depending on how efficiently the farmer irrigates. Of course, the nature of the soil, its texture, structure, and depth; the topography, slope, and smoothness of the land surface; the size of irrigation stream used; and other less important factors influence the final and net result.

Water application efficiency is defined as the ratio of the volume of water stored in the root zone of the soil to the volume delivered to the farm at a single irrigation; it is expressed as a percentage. Only a very few actual measurements of efficiencies have been made thus far.

Public irrigation research agencies have made measurements of water application efficiencies in Utah, California, and Oregon; the results of which may be applied to some extent in irrigation practice. The number of measurements thus far, however, is woefully inadequate. The fact that such measurements are too tedious and expensive to be made by each farmer increases the importance of their being made in larger numbers by the public research agencies in order that the irrigation farmer may have more reliable guides for increasing water-application efficiencies. Better irrigation ditches and structures, more intelligent adaptation of irrigation methods to soil types and to irrigation streams, and more attention to preparation of land for irrigation—all of these improvements are being made by the irrigators who desire to obtain higher irrigation efficiencies, despite the impracticability of measuring these efficiencies precisely at each irrigration.

(*Concluded on page* 58)

The effects of the never-ending water-vapor cycle on problems of water conservation and land use management are not yet sufficiently considered. This diagram illustrates the facts that alkali accumulation on some of the lower lands is inevitable and that the "rim" lands of the valleys are highly productive when properly irrigated. (Courtesy Utah Agricultural Experiment Station.)



RANGE MANAGEMENT FOR SOIL AND WATER CONSERVATION

By Liter E. Spence
Range Examiner, Soil Conservation Service, Washington, D. C.

On February 16, 1929, the 70th Congress of the United States authorized the establishment of Soil Erosion Experiment Stations under the direction of the Bureau of Chemistry and Soils. Between March 23, 1929, and September 15, 1932, ten such stations were established in as many different physiographic regions of the country. Three additional stations have since been established.

On September 29, 1933, the Soil Erosion Service was set up as a branch of the Department of Interior, and supported by Public Works Administration funds. Dr. H. H. Bennett, who for 25 years had studied and written on the enormous soil losses occurring in the United States and who had done much to make the country erosion conscious, was made director of the new organization.

The purpose of the Soil Erosion Service was "to demonstrate the practical possibilities of curbing erosion and its allied evils of increasing floods and costly silting stream channels, irrigation ditches, and reservoirs."[1]

"On April 27, (1935) the President formally approved an Act of Congress (Public 46, 74th Cong.) declaring it to be 'the policy of Congress to provide permanently for the control and prevention of soil erosion . . .', and authorizing the Secretary of Agriculture to establish an agency to be known as the 'Soil Conservation Service' to effectuate this policy. In accordance with the language of the act authorizing the Secretary to 'utilize the organization heretofore established,' the Secretary designated the Soil Erosion Service as the Soil Conservation Service."[2] The Soil Erosion Experiment Stations were likewise changed to Soil Conservation Experiment Stations, and placed under the jurisdiction of the Soil Conservation Service.

Range Management for Soil and Water Conservation

There is a growing recognition of the need for the fullest use of range and pasture resources conditioned on soil and water conservation, flood control, and watershed protection. The period of time which is established for range restoration is highly important. A long period of 25 to 50 years may allow so much damage by depletion of soil moisture, physical condition of the soil and actual soil loss that attempts at range reestablishment may result in destruction of the range. The Soil Conservation Service looks upon a program of range restoration on the basis of (1) limiting stocking to carrying capacity of desirable perennial plant species; (2) the adoption of definite systems of grazing; and (3) a degree of utilization such that all the available palatable forage may be completely utilized only in years of lowest production. For every year that the forces of accelerated erosion are allowed to continue the more difficult it will be to obtain satisfactory range recovery by any practicable methods.

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[1]The Land—Today and Tomorrow—Vol. 1, No. 1, Page 1.
[2]Report—Chief of the Soil Conservation Service—1935. Page 2.

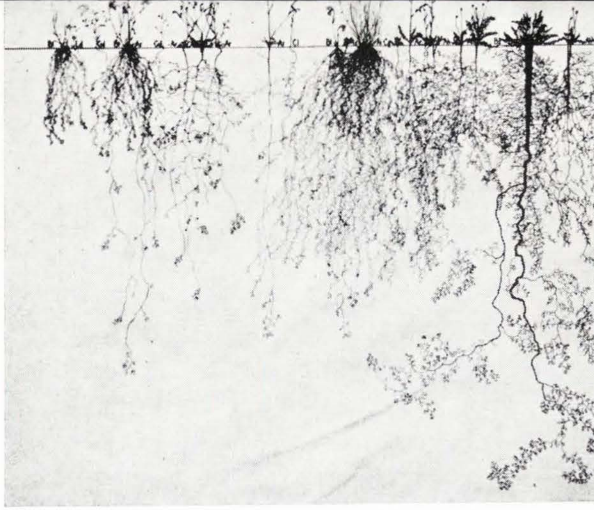

Fig. 1.—A bisect through a subclimax pioneer community in Southern Idaho.
(Note also Fig. 2.)

There has been a tendency for many students of agriculture and range management to think of methods in soil conservation as involving entirely new principles of management. If this were true, where and how did the present workers obtain their training? The fact is that the principles of range management are unchanged. However, the methods of applying these principles in the Soil Conservation Service program are different. Students and workers trained in range management require several months of intimate association with the program of the Soil Conservation Service in order to become oriented in the application of methods necessary for soil and water conservation. It has been found that the student with the broadest knowledge of his field and related fields of study, who is likewise familiar with the literature of such fields more quickly acquires the concept of range-management practices necessary for soil and water conservation.

The objective of the range-management program of the Soil Conservation Service is to reduce soil and water losses to the normal, and incidentally, to develop more and better feed and forage for livestock. Reduction of soil and water losses cannot be obtained by reversing the priority of these two objectives, but the second objective naturally accompanies the first and probably even precedes it. It is acknowledged that for range conservation the operator will have forage remaining on the ground when the area is properly grazed, but if the effects of years of low yield are to be reduced, this must be done. These plant residues, before they decompose, materially aid in protecting the young growth in the following spring.

The increase in yield of forage comes relatively soon with proper management due almost entirely to increase in vigor of the established plants. Marked reduction of soil and water losses will be very much slower. It will take time and very careful utilization to obtain an effective cover of duff on the soil surface from plant residues. The increase in number and extensiveness of the roots will depend a good deal on the extent to which the soil has been depleted and upon climatic conditions. Even under favorable conditions, these changes will be slow. The establishment of new plants will be even slower and several years may elapse before a combination of a good seed year, favorable weather conditions for germination, and establishment occur simultaneously. These are the changes which must take place to reduce soil and water losses before the increase in forage can be utilized fully by grazing.

One viewpoint often overlooked is that plant materials may be left standing after the grazing season and may yield an even greater return than if used for forage. This excess top growth catches and holds snow, retards the rate of melting, slows up the movement of water over the soil surface, obstructs water and soil particles by forming miniature dams of stems and leaves, encourages greater penetration of water, and reduces run-off and soil loss.

In preparing a complete soil conservation plan for a ranch, the range examiner must be familiar with basic agronomic principles and practices, because relief to over-used ranges will be materially influenced by the agronomic program. In connection with the degree of utilization, the following illustration is given for clarification. In a certain agricultural area, a 5 to 7 year rotation including biennial sweetclover and grass is recommended for a soil building crop. It is plowed up during the summer or fall of the second year. A livestock operator, who also raises wheat, grazes his rotation crop so heavily that sufficient residues are not left for green manuring. Realizing this and unwilling to decrease his grazing use of the rotation crops, he corrects the situation by rotating sweetclover and grass every 3 to 4 years on his land instead of every 5 to 7 years. Another example of the need for cooperation is found in planning the number of acres to be annually seeded to rotation crops. Where annual or biennial forage crops can be grown, they offer excellent means for range relief in that they can be used for hay or pasture. It is desirable to have a uniform yearly acreage so that the additional hay or forage supply can be used each year in the range management plan. The Agronomist and Range Examiner must, of necessity, combine their programs of management in order to properly balance the production of feed and forage and at the same time avoid materially changing the operator's cash income.

The planned non-use of annual species is likewise a change necessary for soil and water conservation, with a few exceptions. Consider the top growth of soft downy brome (*Bromus tectorum*), a widely distributed species, which often forms rather dense cover. (Fig. 3) It has been observed throughout the range of this species that complete cover will not prevent soil movement over the surface. A more serious fact is that soft downy brome is so severely infested with smut that it has been almost completely eradicated in certain areas. Because of these facts, the general use of annuals is not basic to good erosion control and they are not dependable for forage. In many instances where soft downy brome range has been placed under management to encourage the remaining perennial grasses, the latter are predominating in only two years time. More severely depleted ranges have shown little change and some, due to smut infestation of the annual brome have become further depleted.

Now consider the underground parts of perennial grasses, annual grasses, and forbs in the light of soil and water conservation. Figures 1 and 2 are bisects of a pioneer community and a climax community respectively, excavated and drawn to scale. In the bisect through the pioneer community (Figure 1), the only fibrous-rooted plant is a single specimen of beardless wheatgrass (*Agropyron inerme*), a relic of the original cover.

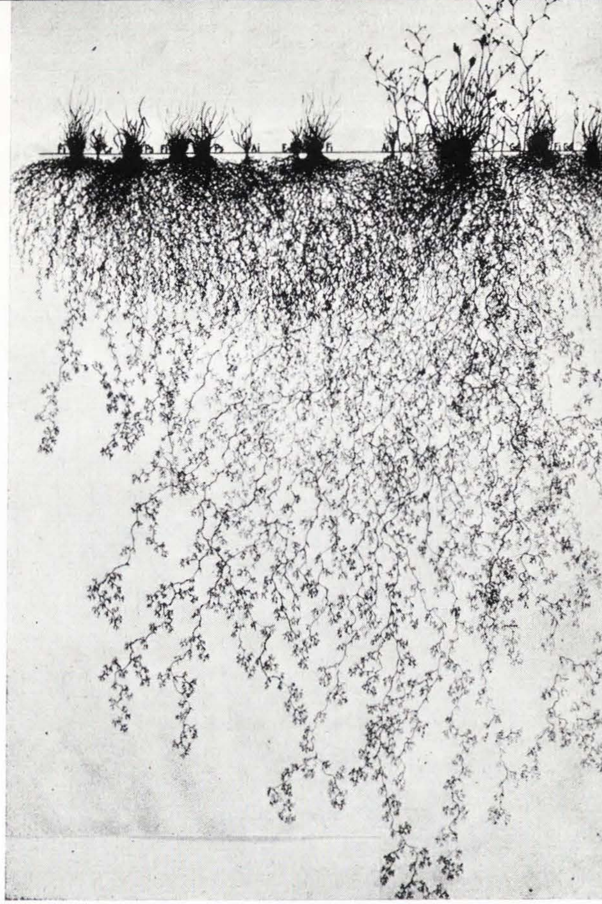

Fig. 2.—A bisect through a climax community of a palouse prairie in Southern Idaho.

The failure of the roots of this community to permeate the upper few inches of soil is clearly in evidence. Soft downy brome is probably the most effective member of the community, but the roots of even this species lack the lateral spread and density characteristics of the perennial grasses found on better ranges.

The scattered bunch pattern portrayed by the ærial portion of the climax community (Figure 2) is in direct contrast to the complete ramification of the soil mantle by the underground components of the same community. The lateral spread of the fibrous root systems is largely responsible for this condition. The roots of perennial grass plants two inches in diameter commonly occupy a column of soil 20 inches in diameter. These are especially well adapted to maintain the top soil in an open condition conducive to absorption yet tightly bound against the action of surface run-off water. Only 25 per cent of the roots of perennial grasses are shown in the drawing in order to give a more nearly accurate perspective in a flat plane drawing.

Further evidence of the importance of the influence of live roots in soil and water conservation can be had from the root study work of Pavlychenko.[3] A three-year-old crested wheatgrass plant (*Agropyron cristatum*)

[3]The Soil Block Washing Method in Quantitative Root Study. Canadian Journ. of Res. Vol 15. Series C. pp. 33-57, 1937.

had 315 miles of live roots. Imagine the extensiveness of such a network of roots and resulting root channels which are being left annually by dead and decayed roots, and the significance in maintaining the porosity of soils which in turn means greater and more rapid penetration of surface waters. A study of the relative rates of erosion on virgin and depleted range areas substantiates the conclusion that the fibrous-rooted species of the climax community are much more effective in reducing soil washing than are the top rooted species of the pioneer community.[4]

It is on the basis of this discussion that the Soil Conservation Service believes that, with few exceptions, range conservation must be founded on only the use of perennial grasses.

In discussing the restoration of the range, it was indicated that the aim of the Soil Conservation Service on range land is generally the re-establishment of the climax community. It is necessary to elaborate on this point so that there is no misunderstanding. Under climax vegetation, soil and water and the productiveness of the range are conserved. However, plant associations which will reduce soil and water losses to normal has been stated as the objective. If a plant community lower in the stages of plant succession than the climax community will accomplish this end, and will likewise satisfy the livestock operator in supplying the best and most feed per unit area, there is no advantage in attempting to bring this community up to the climax. It may be more difficult, however, to maintain the sub-climax community under certain systems of grazing use, in which case the most stable plant community will have to be obtained or a system of use adopted which will permit the maintenance of the plant community which will conserve soil and water. There are sites in the higher rainfall areas of the Southwest where the native bunchgrasses have been completely killed out and Kentucky bluegrass (*Poa pratense*) has invaded and produced a sod cover. The same is true of bulbous bluegrass (*Poa bulbosa*) in the Pacific Northwest. There is no reason why any attempt should be made to replace these species with the native bunchgrasses, so long as these invaders can reduce erosion to the normal and be maintained in competition with native vegetation.

Dr. L. A. Stoddart[5] initiated range surveys as a part of Soil Conservation Service erosion studies in the Pacific Northwest region early in 1935. In developing forage types, he used five classes of vegetative condition, based on their relation to the climax community, which was also based simultaneously on the ability of the respective type of range to recover. One example will show the importance of this approach. Often, pure stands of the blue bunch wheatgrass (*Agropyron spicatum*) are found, which seemingly are climax yet accelerated erosion is taking place. On closer study, it is found that Sandberg bluegrass (*Poa secunda*) is a component of this particular climax type, filling in between the bunches, thus decelerating erosion. In this case, while it makes up a small percentage of the whole, Sandberg bluegrass is essential to the control of erosion in this type. Details of the root systems of these plants can be seen in figure 3.

Studying the stage or stages of plant succession in improving ranges

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[4]The Relation of Vegetation to Soil Conditions and Erosion on Granite Soils in Idaho. Geo. Stewart. Intermountain Forest and Range Exp. Sta. Manuscript.

[5]Professor—Range Management; School of Forestry, Utah Agri. Col. Logan, Utah.

to control soil and water losses is dependent on several factors. Of these the nature of the ærial and underground parts of the vegetation, the soil, and the kind and character of precipitation, are most important. As changes in composition of vegetation take place, and their effect on reducing soil and water are measured, densities and compositions of various types for erosion control will be determined.

Mechanical Structures in Range Control

The justification of mechanical structures in range conservation is difficult when compared to range management as the first line of defense. Fencing is excepted in this discussion for it is generally conceded to be a necessary measure in range conservation.

Earthen or masonry dams for impounding water for stock are justifiable when based upon the need for both permanent and temporary water. They are also justified in regions of heavy summer rainfall where slope, soil, and vegetation permit water spreading, a form of flood irrigation. Dams on range land for water conservation alone are expensive and not justified because proper range management will accomplish the same purpose at much less cost. For range improvement, the various large types of contour furrows and ridges are generally not justified. However, where such structures are very shallow and spaced closely like those constructed in the southern Great Plains, they may be highly efficient in range restoration.

Results in the past four years have shown conclusively that, in most instances, the most practical and inexpensive means of range conservation is proper land use and complete range planning.

What does complete range planning include? First of all, it includes a complete inventory of all livestock, feed and forage, facilities for handling livestock, and related ranch operations necessary for the growing of livestock. This inventory, based upon the needs for soil and water conservation, will give the carrying capacity under a year-long operation. The first requisite of proper range planning is adjusting the number of livestock to the carrying capacity of the ranch. Now, let this point be considered in more detail. First, it has been shown that by using good grade range stock instead of poor grade a third less stock can yield a greater net income on comparable pasture. The reason is obvious. The lesser number of animals would have more and better feed. Likewise less time and energy would be expended in securing feed. Consequently better and cheaper gains would be attained. This problem can be met by improving the grade of animals through careful selection of breeding stock.

If the present number of livestock is destroying the range, or merely allowing maintenance, matters are going to become increasingly worse until large areas must be abandoned at total loss to the owner. Is it not wiser, under any condition, to suffer now and begin to rebuild on investment than to continue to gamble year after year, and finally end with a total loss of property? The problem becomes even more serious when the welfare of future generations is considered.

Adjustment of numbers of livestock to the carrying capacity of the range is not enough, any more than adopting a definite system of grazing is sufficient. Notice the statement is "a definite system of grazing." There are instances where the ranch setup is such as to prevent the adoption of

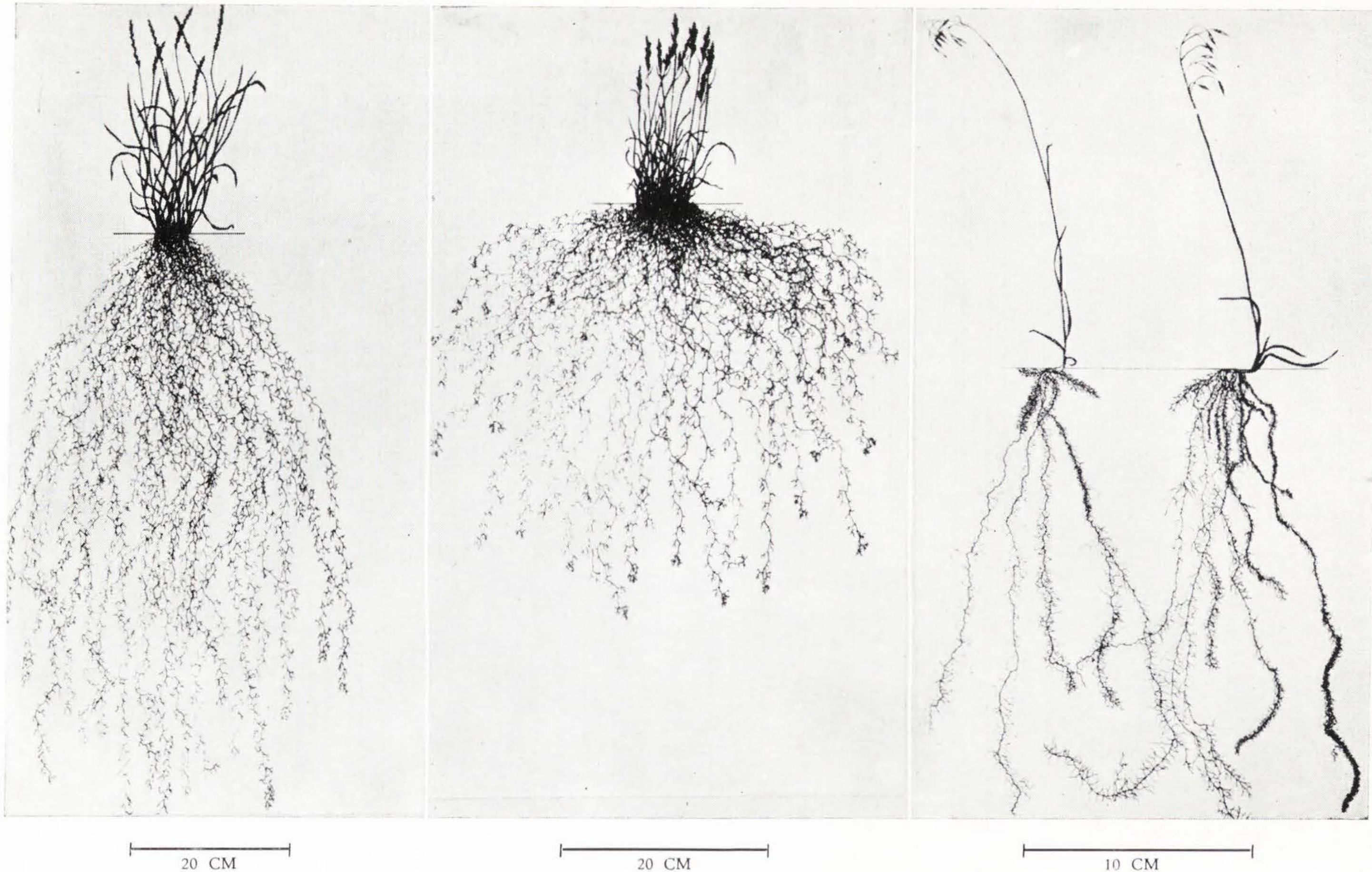


Fig. 3.—Bisects of three dominating grass species of the Pacific Northwest grasslands. At the extreme left is Blue bunch wheatgrass, (Agropyron spicatum (Pursh) Scribn. and Smith) a climax dominant. In the center is Sandberg bluegrass, (Poa secunda Presl.) a climax sub-dominant. At the extreme right is Downy brome, (Bromus tectorum L.) and annual sub-climax invader.

the most desirable system, and then it is necessary to initiate a second best. It goes without saying that all systems of management should be based upon the growth requirements of those species which are being encouraged on the range. Even though the composition is as low as 5 per cent of the total vegetation, the chances that improvement will take place are greater than they would be with artificial reseeding. It is becoming more and more evident in the progress of the soil conservation work that by and large proper range management offers not only the soundest form of soil and water conservation, but the least expensive as well.

Remember that the objective of the Soil Conservation Service is to reduce soil and water losses to the normal and that the methods employed must be practical and economical, as well as technically sound.

THE RIVER'S VINDICATION

It's true I've gone on the warpath,
I've smitten your cities and homes,
I've cracked the walls of your stately halls
I've threatened your spires and domes.

I've spoiled your gardens and orchards,
I've carried your bridges away;
The loss is told in millions of gold;
The indemnity you must pay.

But had I not cause for anger?
Was it not time to rebel?
Go, ask of the springs that feed me;
Their rock-ribbed heights can tell.

Go to my mountain cradle,
Go to my home and see,
Look on my ruined forests
And note what you did to me.

These were my sylvan bowers,
My beds of bracken and fern,
The spots where I lie and rest me
E'er to your valleys I turn.

These you have plundered and wasted,
You've chopped and burned and scarred,
Till my home is left of verdure bereft,
Bare and lifeless and charred.

So I have gone on the warpath;
I've harried your lands with glee.
Restore with care my woodlands fair
And I'll peacefully flow to the sea.

—*F. W. Nash.*

THE ROLE OF ECOLOGY IN A LAND USE PROGRAM

By W. P. COTTAM, *Conservationist*
Intermountain Forest and Range Experiment Station, Ogden, Utah

After three centuries of lethargic indifference to the unregulated exploitation of natural resources, America, like Van Winkle of the Catskills, has suddenly awakened to the fact that her house is tumbling down. A decade marked with disastrous floods, failing crops, depleted forests, starving cattle, and "deserts on the march" has done much to convince a great nation that the real basis of all national wealth is the soil. Whether we like it or not, the judgment day of uneconomic land use is at hand, and the temporal salvation of this generation and generations yet unborn demands a sane, unified, scientific planning of the resources of the earth that sustain us.

That the science of ecology should play an important role in a program of land use is evident from the definition and scope of this subject. Ecology is one of the newer phases of biology and the term is derived from the two Greek words—oikos="house," and logos="a discourse."

This "home" environment of living creatures is necessarily complex because it involves the relationship of organisms, not only to one another, but to their inorganic world as well. Ecology is really a synthetic science and depends for its success on the help of all the biological and physical sciences. The technical fields of botany and zoology are needed for an understanding of the basic structure and life functions of organisms; and in order for one to comprehend the influence of the inorganic environment, the sciences of meteorology, geology, geography, chemistry, and physics are indispensable.

Ecology is largely an outgrowth of the evolutionary concepts of biology and applies the principles of living dynamics to the origin and development of biotic societies. This point of view gives rational significance to the peculiar distribution of organisms over the face of the earth and lends new meaning to the advantages and disadvantages attending social aggregation. No longer can the forest be regarded as a mere assemblage of trees. Myriads of creatures live in cooperative relationship and maintain with one another a delicate balance of action and interaction. The over-ascendency of one form of life or the destruction of another is bound to upset the equilibrium of the whole and may even threaten the very existence of the entire biotic community.

Nature, undisturbed by man, tends always to establish dominant types of vegetation peculiarly adapted to climate. Hence, the great deciduous forests of eastern United States, the vast expanse of grasslands over the prairie and plain states, the northern and southern desert types of the Rocky Mountain region, and the coniferous belt of the Northwest are all vegetational expressions of these broad climatic belts. For any region, moisture and temperature conditions, as well as the potential productivity of the soil, can be predicted within narrow limits of error, through a careful study of the native vegetation found growing there. Since these are the chief factors on which the success of most agricultural enterprises depend, the importance of ecology in land use considerations is obvious.

Utah, because of its topographical diversity and geographic position, supports, to a limited extent, most of the great vegetative types of North America. In the Dixie area of southern Utah, one may, in a single day, traverse all the temperature belts one would encounter in a trip from lower Sonora, Mexico to the Arctic circle. But despite this diversity of climate and vegetation, land use in Utah is unusually limited. The vast majority of the area is desert in its nature, and without irrigation is totally unadapted for crops. Mountainous areas are poor in commercial timber, but they are of extreme importance as a source of water, without which the fertile but parched valleys below would be useless for human habitation. Thus, from the land use standpoint, the vast surface expanse of Utah is limited to two principal pursuits: agriculture, including crop and livestock production, and recreation. The economic welfare of the state depends upon an intelligent use of these limited resources.

Agriculture

The oldest and the most important land use in Utah is agriculture. The applications of ecology to agricultural management may be discussed under the topics of farm crops and grazing, although the two are obviously interrelated. It is clear, for instance, that crops are dependent for the most part on irrigation water, supplied by streams that have their source in high mountainous range-watersheds. The flow characteristics of these streams, which determine to a very great extent the usability of the water for irrigation purposes are closely related to the extent and manner of vegetative utilization, principally by livestock.

There are but 2.5 per cent of Utah's lands under irrigation, and since water is the limiting factor, the possibilities of increasing greatly the number of tilled acres is not promising. A more scientific and prudent use would seem the only method of greatly increasing the economic returns from this limited resource. Fortunately, increased crop production through a more enlightened application of the principles of crop ecology is possible in rural Utah.

The possible application of ecology to crop production in Utah would involve such questions as:

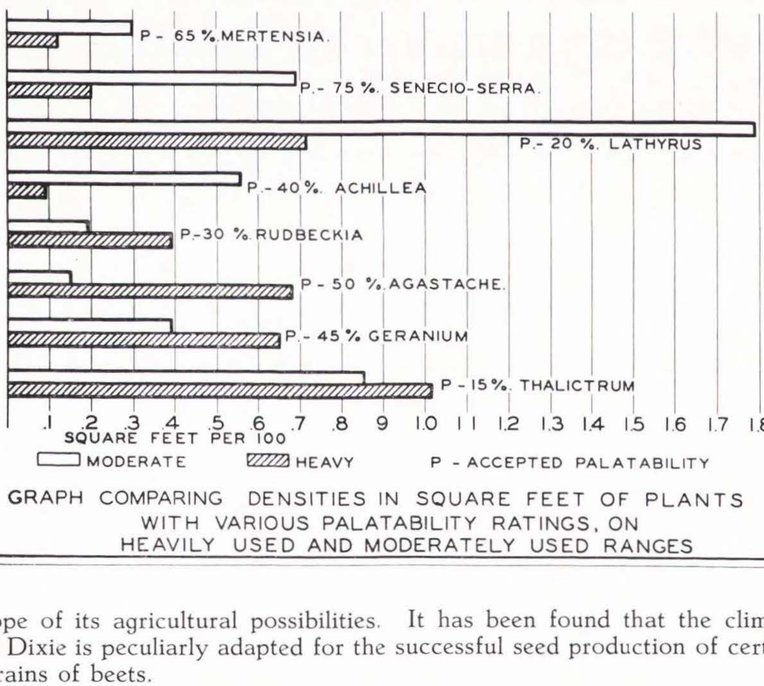
1. Is irrigation water, which is undoubtedly Utah's most precious resource, receiving the most efficient and practical use? Such a problem has several aspects. It involves investigations regarding crops in their relationship to water requirements, and the feasibility of using the present water supply on better land. There is a need for more accurate knowledge regarding the amount of water required by various crops that may be grown on a given soil, as well as cultural methods which may better conserve water. Lands brought under cultivation during the pioneer days of Utah were selected frequently for their accessibility rather than for their potential productivity. Other lands, formerly productive, have become water-logged and alkali charged because of seepages from neighboring farms occupying higher elevations. The whole problem of marginal irrigated lands is one in which ecology may lend a helping hand.

2. Are the crops now grown best adapted to the soil? Every successful farmer is a practical ecologist, for he must recognize that soils vary

tremendously in their adaptability to crops. The type of native vegetation originally present on the land is the best possible indication for the crops which are likely to be successful.

If the unfortunate people who placed their life's earnings on the pumping project of the ghost town of Mosida, located on the west shore of Utah Lake, had realized that greasewood and shadscale are indicators of poor crop land, they would have saved grief for themselves and preserved many acres of good early-spring range from the plow.

3. Are present crops best adapted to climate? The admirable researches of the Department of Agriculture on the adaptability of the Dixie area for beet seed production has given to the people of this section much needed



GRAPH COMPARING DENSITIES IN SQUARE FEET OF PLANTS WITH VARIOUS PALATABILITY RATINGS, ON HEAVILY USED AND MODERATELY USED RANGES

hope of its agricultural possibilities. It has been found that the climate of Dixie is peculiarly adapted for the successful seed production of certain strains of beets.

Much research is needed on the effects of climate on the quality as well as the quantity of all crop production. It is recognized, for instance, that the best quality of fruit is frequently found in the coldest climatic areas where such crops may be successfully grown. Ecological consideration of climate in its relation to dry-farming could have saved the entire western United States much of the tragic consequences of uneconomic land use. Ecological principles certainly must play a major role in the rehabilitation of these abandoned farms and miniature dust bowls. Plants adapted to pioneer roles in nature must be sought and reseeding methods based on careful experimental data must be determined.

Grazing

The important subject of range management may be considered as applied range ecology. The successfully managed range calls for intimate knowledge of the complicated interrelationship of the animals and plants which comprise the forage associations. The range operator must be able to detect evidence of retrogressional succession, to determine its cause, and to plan practical remedial measures which will provide for a sustained forage yield. This is a big order in a country such as Utah with depleted ranges everywhere, with economic pressure allowing for little adjustment in stocking, and with attitudes regarding personal liberties which still seek to foster the rugged individualist of a generation ago.

Range betterment will depend chiefly on an educational program which can produce an enlightened citizenry. The public must demand that the primary use of mountain areas shall be for watershed purposes and that practices leading to the depletion of the plant cover, with resultant floods and damaged water supplies, must cease.

A planned management of ranges and an educational program shorn of propaganda will depend on important ecological investigations, some of which are:

1. More accurate methods of forage inventories. During the spring of 1937 some particular county in almost every western state was selected for a complete range survey. The survey, known as the Western Range Survey, was a cooperative enterprise of the State Agricultural Experiment Stations and several governmental agencies interested in conservation. It had as its major objective a complete forage inventory and other data on range conditions, which might serve as a basis for management plants designed to stop range deterioration where it was found to occur and to insure the maintenance of the range at its most productive level. There is obviously a need for a reliable inventory of the vegetation of all range lands if a sustained forage yield is to be maintained or successional trends detected. The surveys of 1937 should serve as valuable guides for future programs of this sort. As was to be expected, these initial surveys demonstrated many inadequacies, not only in present survey methods, but also in methods of estimating stock carrying capacity from the data on plant cover.

Ecological questions pertinent to range surveys in general, include:

(a) Should a volumetric method for determining available forage be substituted for the present density methods? After all, it is the actual pounds of forage present which is important, so far as stock are concerned, and not the percentage of land surface actually covered by vegetation.

(b) Could the general objectives of a range survey be attained, and considerable cost avoided if more accurate data were secured on one or a few key forage species rather than information on all the plant species of the range, regardless of their prevalence or grazing importance? It is realized, of course, that if successional trends of vegetation are determined, data on all vegetation must be secured. Special areas for this purpose could be selected.

(c) Is it safe to apply fixed palatability values to plant species on ranges of variable forage composition, and do the accepted palatability ratings of many forage species need further revision? Forage utilization is one of the most complex and baffling of all range problems, yet more precise data must be secured on the subject in order to place range rehabilitation and maintenance on a scientific basis. The importance of the palatability rating is evident when it is considered that the forage-acre factor is a product of average density times palatability. Palatability is defined as that percentage of the current year's growth of a plant utilized by grazing animals on properly stocked and managed ranges. If the palatability ratings ascribed to the various forage species are essentially correct, it should follow, as a rule, that overstocked ranges exhibit low densities of species with high palatability, and high densities of species with low palatability. The accompanying graph, which compares the densities of common range species on moderately and heavily used grazing lands ecologically similar, throws serious doubt on the correctness of the palatability values ascribed to some of these forage plants. It suggests a seemingly valid ecological check on palatability tables in general.

2. In an educational range program it should be the duty of the ecologist to assemble all available data which might help to ascertain more accurately the pristine nature of the great plant associations which occupied deserts and mountains prior to the advent of the white man. Such information would be of great importance because it would establish a definite goal for range rehabilitation by pointing out the extent of economic loss, through range deterioration, that unwise range practices have entailed.

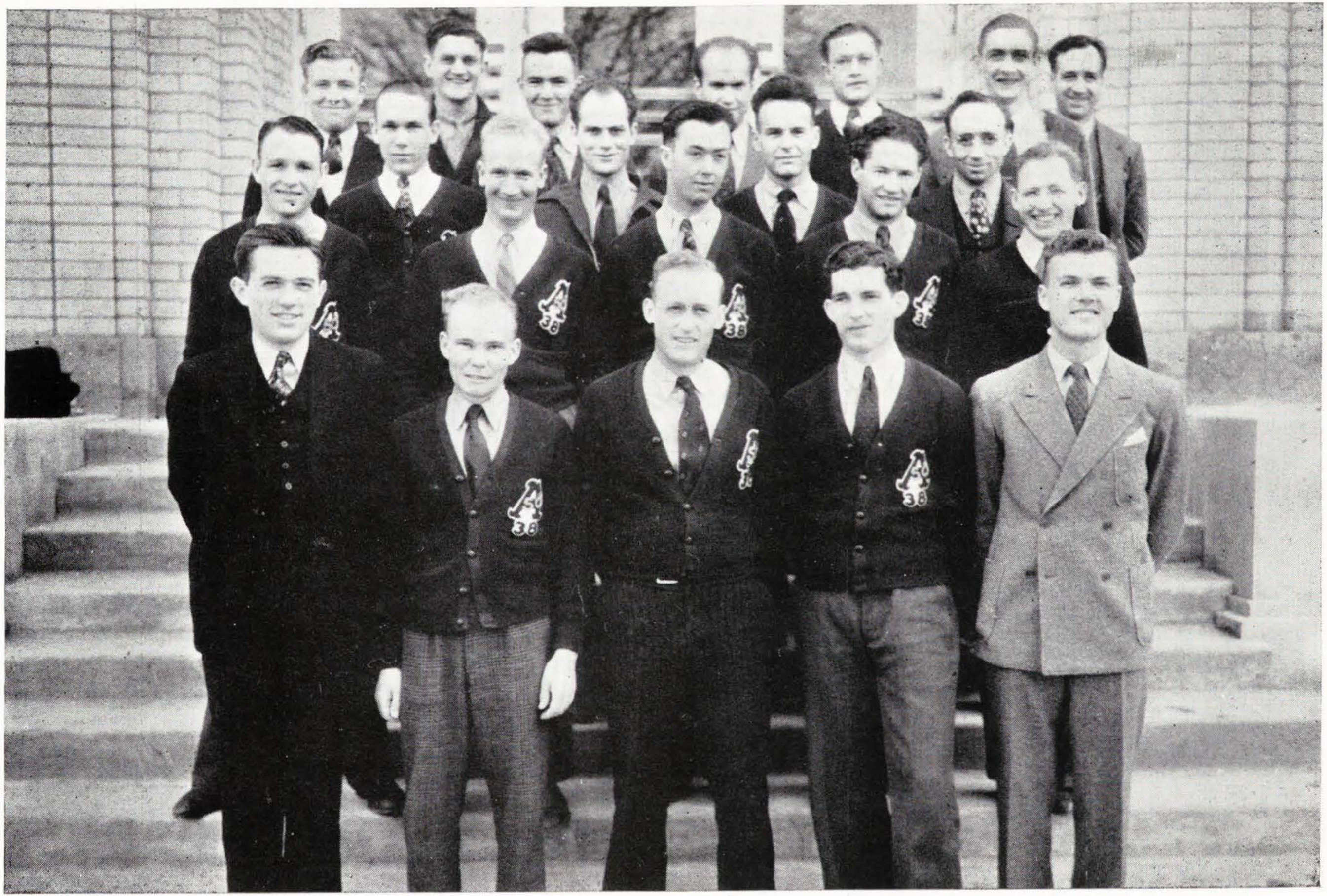
It may be contended that it is for the historian and not the ecologist to attempt a valid picture of the nature of vegetation of a century ago. In fact certain writers within the past year have attacked the problem almost entirely from the historical standpoint and have reached rather definite conclusions that forage remains in substantially the same luxuriance in Utah today as it was before the white man came.

The spirit and methods of science demand that all pertinent facts relating to the problem of determining former vegetation must be assembled, classified, and analyzed in their relationship to one another before basic conclusions are drawn. The value of the historical record is not to be discounted. On the other hand, the casual written or verbal statements of historical personages cannot be too literally applied to a scientific problem without careful scrutiny of the background of the individual who made them or the circumstances under which the statements were made. Historical statements regarding the specific nature of Utah's plant associations of pioneer days are extremely meager and, as should be expected considering the training of those who made them, somewhat contradictory.

Ecology has found that the most reliable data concerning the past historical record of vegetation as well as its present successional trends are to be found in the vegetation itself. Considerable quantitative information on the character and degree of recent floristic changes in various association types of Utah's vegetation is being assembled at the Intermountain Forest and Range Experiment Station. Sources of data in these investigations include age classes of important plants within the association, vigor of competing forms, and comparisons of present association types with isolated areas known to be of a relict nature.

(*Concluded on page* 54)

Graduates and School Activities



SENIORS, RANGE MANAGEMENT

First row. Hinchcliff, Bunderson, Dale, Spear, Jones.—Second row. McDonald, Peterson, Anhder, Jensen, Bell.—Third row. Noble, Clark, Harris, Shipley.—Fourth row. Hales, Armstrong, Hurst, Harris, Winters, Johnson, Anderson.

GRADUATES, RANGE MANAGEMENT 1938

WILLIAM ANDERSON, Huntington
Utah Foresters, President
'35 U. S. F. S.
'36-'38 U. S. S. C. S.

NORMAN ANDREWS, Mount Pleasant
Utah Foresters
'34-'35 C. C. C.
'36 U. S. F. S. Fire Guard.
'37 A. A. A. Range Inspector

THEO E. ANHDER, Hyrum
Utah Foresters
Rifle Team
'36-'37 U. S. F. S. Exp. Sta.

HERBERT C. ARMSTRONG, Logan
Utah Foresters
Buzzer Photographer
'34 U. S. B. A. I. Bangs Dis.
'37 U. S. D. G.

SHELDON BELL, Tonopa, Nev.
Utah Foresters
Delta Nu
'36 U. S. F. S. Adm. Guard.
'37 A. A. A. Range Inspector

VICTOR BUNDERSON, Emery
Utah Foresters, Reporter
'36 U. S. F. S. Exp. Sta.
'37 U. S. D. G.

STERLE E. DALE, Jackson, Wyoming
'28-'30 Kansas State A. C.
Phi Gamma Rho
'33 U. S. F. S. Road Const.
'34 U. S. F. S. Fence Const.
'35 U. S. F. S. T and T Maintenance
'37 U. S. F. S. Fuel Type Mapping

HOWARD R. FOULGER, Ogden
'32-34 Weber Jr. Col.
Utah Foresters
'33 C. C. C.
'34 U. S. F. S. Surveying
'36-'37 U. S. F. S. Exp. Sta.

DOYLE C. HALES, Ogden
'32-'33 Weber Jr. Col.
Utah Foresters
'33 U. S. B. P. R.
'37 U. S. F. S. Fire Guard

RICHARD C. HARRIS, Logan
Utah Foresters
'35-'36 C. C. C.
'37 A. A. A. Range Inspector

FREDRICK B. HARRIS, Brigham City
'32-'35 Weber Jr. Col.
Utah Foresters
Box Elder Club
Weber Club
Pi Kappa Alpha
'37 U. S. F. S. Fire Guard.

HOWARD HINCHCLIFF, Ogden
'32-'36 Weber Jr. Col.
Utah Foresters
'34 C. C. C.
'35 U. S. F. S. Fire Guard.
'36-'37 U. S. F. S. Grazing Sur.

WILLIAM D. HURST, Panguitch
Utah Foresters
Phi Kappa Iota
'37 U. S. F. S. Adm. Guard.

CYRIL JENSEN, Logan
Utah Foresters
'34-'37 U. S. F. S. Forest Guard.

GEORGE L. JOHNSON, Brigham City
Utah Foresters
'34 C. C. C.
'35 U. S. F. S. Insect Survey
'36 U. S. F. S. Exp. Sta.
'37 U. S. D. G.

JOHN McDONALD, Heber City
Utah Foresters
Utah Juniper, Bus. Mgr.
Phi Gamma Rho
'35 C. C. C.
'36 Resettlement Adm.
'37 A. A. A. Range Inspector

RALPH NELSON, Smithfield
Utah Foresters
'33-'35 Weber Jr. Col.
'34 C. C. C.
'36 U. S. F. S. Exp. Sta.
'37 U. S. F. S. Range Survey

MYRVIN NOBLE, Smithfield
Utah Foresters
Phi Gamma Rho
Phi Kappa Phi
'36 Resettlement Adm.
'37 Western Range Survey

VIRGIL PERTERSON, Fairview
'33-'34 Snow Jr. Col.
Utah Foresters
Alpha Zeta
'37 A. A. A. Range Inspector

VAL B. RICHMAN, Teton City, Idaho
Utah Foresters
'36 U. S. F. S. Adm. Guard.
'37 A. A. A. Range Inspector

J. GRAYDON ROBINSON, Kanab
'27-'30 Brigham Young Univ.
Utah Foresters
'31 U. S. F. S. Fire Guard.
'32 U. S. F. S. Adm. Guard.
'34-'35 U. S. F. S. Range Sur
'36 U. S. F. S. Game Management
'37 Resettlement Adm.

RICHARD ROYLANCE, Ogden
'34-'36 Weber Jr. Col.
Utah Foresters
Weber Club
'37 U. S. D. G.

ROY L. SHIPLEY, Logan
Utah Foresters
'35-'38 U. S. F. S.

AARON SPEAR, Salt Lake City
Utah Foresters
Phi Gamma Rho
Phi Kappa Phi
'35-'36 U. S. F. S. Exp. Sta.
'37 U. S. D. G.

VICTOR A. SURFACE, Chicago, Illinois
'31-'33 Crane Jr. Col.
Utah Foresters
Utah Juniper Editor
Phi Kappa Phi
Phi Gamma Rho
'34-'35 U. S. F. S. Exp. Sta.
'36-Present, U. S. S. C. S.—J. R. E.

REED THOMPSON, Logan
Utah Foresters
'37 A. A. A. Range Inspector

ARTHUR O. WINTERS, Mt. Pleasant
'33-'35 Snow Jr. Col.
Utah Foresters
'36 C. C. C.
'37 U. S. B. P. R.

SENIORS, FOREST MANAGEMENT

First row. Ellison, Webb, Decker, Roylance, Johnson.—Second row. Egan, Rob erts, Hayes, Jeppson, Henderson.—Third row. Owens, Peters, Cliff, DeMoisy.

GRADUATES, FOREST MANAGEMENT 1938

GLADE ALLRED, Manti
'31-'34 Snow College
Utah Foresters
Delta Phi

HERMAN BLASER, Logan
Utah Foresters
'35-'37 U. S. F. S.

OLIVER CLIFF, Ogden
'33-'35 Weber Jr. Col.
Utah Foresters
Phi Gamma Rho
'35 U. S. F. S. Forest Guard
'36 U. S. F. S. Grazing Survey
'37 A. A. A. Range Inspector

RALPH G. DeMOISY, Provo
Utah Foresters
Sigma Chi
Alpha Zeta
Scabbard and Blade
Football
Basketball Mgr.
Buzzer Editor
'34 U. S. F. S. Fire Guard
'35-'36 Utah Road Com.

EUGENE A. DROWN,
Pocatello, Idaho
Utah Foresters
Phi Gamma Rho
'35 C. C. C.
'37 U. S. F. S. Erosion Survey

GILBERT S. EGAN, Ogden
'35-'36 Weber Jr. Col.
Utah Foresters
Weber Club
Beta Kappa

DON J. ELLISON, Nephi
Utah Foresters
'31 U. S. F S. Laborer
'33 C. C. C.
'35 Utah Road Com.
'36 U. S. S. C. S.

WILLIAM S. HAYES, Logan
'33-'35 Univ. Idaho So. Br.
Utah Foresters
Intercollegiate Knights
Phi Kappa Iota
Football
'34 A. A. A. Asst. Field Sup.
'35 U. S. F. S. Rec. Guard.
'36 U. S. F. S. Fire Guard.
'37 U. S. F. S. Adm. Guard.

FLOYD A. HENDERSON,
Evanston, Wyoming.
Utah Foresters, President
Opera
Little Theater
'35 U. S. F. S. Insect Control
'36 U. S. F. S. Timber Survey
'37 U. S. F. S. Forest Guard.

EARL F. JEPPSON, Brig. City
Utah Foresters
Ag. Club
'35-'36 C. C. C.
'37 U. S. F. S. Blister Rust

MORRIS JOHNSON, Ogden
'33-'36 Weber Jr. Col.
Utah Foresters
Weber Club
'37 U. S. F. S. Exp. Station

MORRIS W. LEWIS, Kamas
Utah Foresters
'30-'31 U. S. F. S. R and T Maintenance
'32-'34 U. S. F. S. Insect Con.
'35-'37 U. S. F. S. Rec. Guard

LAWRENCE MATTHEWS,
Grantsville
Utah Foresters
Phi Kappa Iota
Football
'37 U. S. F. S. Adm. Guard

RHODELL E. OWENS,
Fort Duchesne
'33-'35 Westminster Jr. Col.
Utah Foresters
Phi Gamma Rho
Utah Juniper Editor
'33 C. C. C.
'37 U. S. F. S. Forest Guard

LEWIS G. QUIGLEY, Moab
Utah Foresters
Opera
Glee Club
'33-'34 C. C. C.
'36 U. S. F. S. Mistletoe Con.
'37 U. S. F. S. Forest Guard

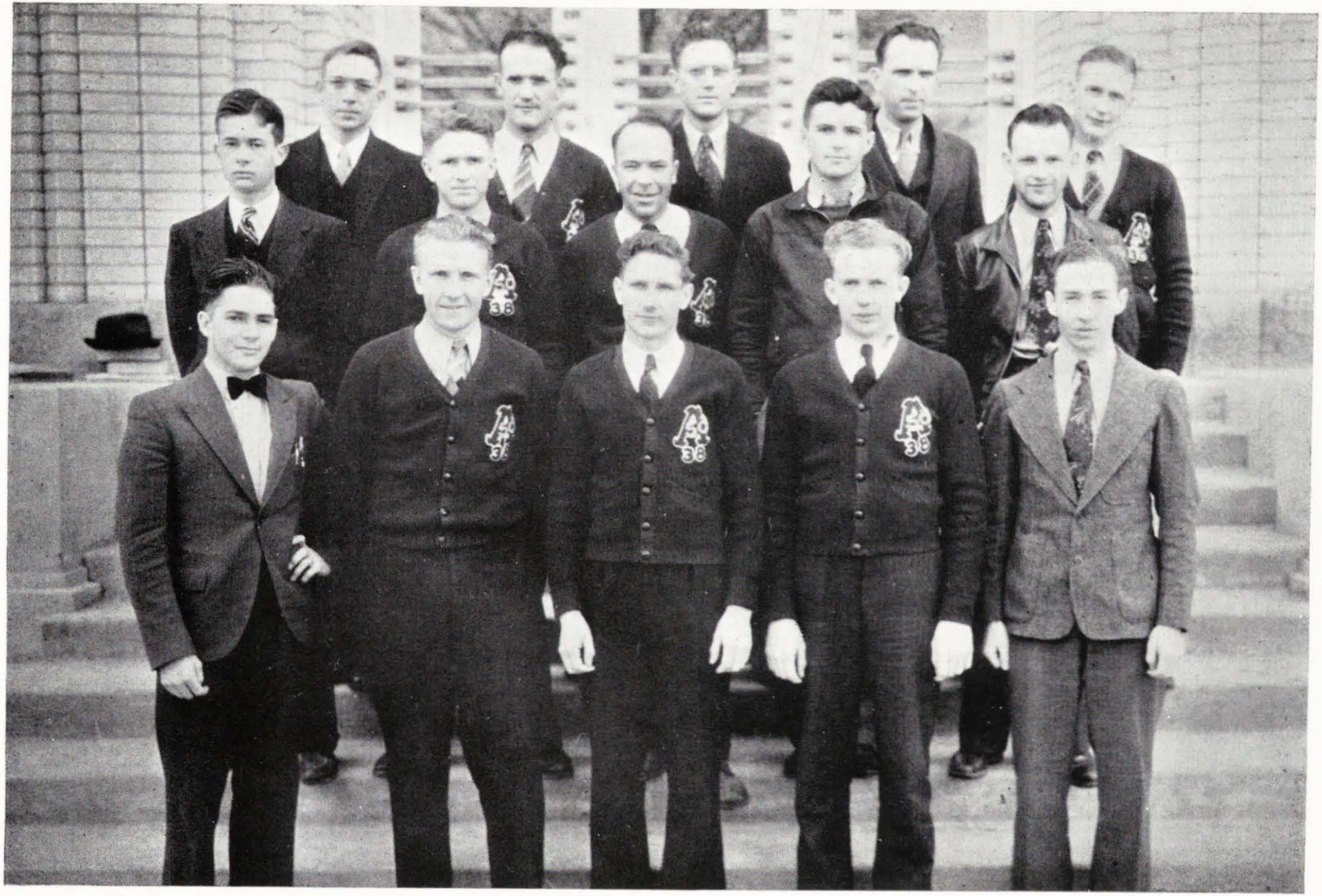
RAYMOND C. ROBERTS,
Ogden
'32-'36 Weber Jr. Col.
Utah Foresters
Rifle Team
'36 U. S. F. S. Forest Guard
'37 U. S. F. S. Rec. Guard

FINLEY W. ROYLANCE,
Springville
Utah Foresters
Intercollegiate Knights
'35 C. C. C.
'37 U. S. F. S. Blister Rust

HAROLD B. SCHOLES, Logan
Utah Foresters
Tennis
'35 C. C. C.
'37 U. S. F. S. Adm. Guard
'37 U. S. A. C. Nursery Foreman

MARK SHIPLEY, Bancroft, Ida.
Utah Foresters
'34-'35 U. S. A. C. Nursery Foreman
'36 U. S. F. S.-J. F.
'37 U. S. B. A. E. Agent

DAYL J. WEBB, Richmond
Utah Foresters
'35 C. C. C.



SENIORS, WILDLIFE MANAGEMENT

First row. Mir, Romero, Nelson, Holladay, Jones.—Second row. Dargan, Blair, McBride, Rabb, Ellison.—Third row. Pierle, Allred, Doman, McFarland, Heywood.

GRADUATES, WILDLIFE MANAGEMENT 1938

WARREN J. ALLRED, Afton, Wyoming
Utah Foresters
Glee Club
'35 C. C. C. Foreman
'36 U. S. F. S. Rec. Guard
'37 U. S. F. S. Rodent Control

RAY BLAIR, Logan
'33-'36 Univ. Idaho So. Br.
Utah Foresters
'36-'37 U. S. F. S. Fuel Type Mapping

LUCAS DARGAN, Darlington, So. Car.
'34-'36 No. Carolina State Col.
Utah Foresters
Phi Gamma Rho
Alpha Zeta
'37 U. S. F. S. Game Management

EVERETT DOMAN, Huntsville
'31-'32 Weber Jr. Col.
Utah Foresters
Weber Club
Phi Gamma Rho
Phi Kappa Phi
'37 A. A. A. Range Inspector

PHAY ELLISON, Ogden
Utah Foresters
Barbs
Little Theater
Freshman Play

REVILO FULLER, Phoenix, Ariz.
'32-'34 Phoenix Jr. Col.
Utah Foresters
Sigma Chi
Buzzer Staff

BENJAMIN HEYWOOD, Panguitch
'34-'35 Univ. Utah
Utah Foresters
Barbs
Ag. Club
'35 C. C. C.
'37 A. A. A. Range Inspector

CLIFTON M. HOLLADAY, Santaquin
Utah Foresters
Barbs
Phi Gamma Rho
Phi Kappa Phi
'35 C. C. C.
'37 A. A. A. Range Inspector

ROY D. HULL, Logan
Utah Foresters
Sigma Chi

DOUGLAS M. JONES, Nephi
Utah Foresters
'35 U. S. F. S. Timber Survey
'37 U. S. B. S. Stu. Biologist

CLAIR O. LUND, Brigham City
Utah Foresters
Box Elder Club
Barbs
'36 U. S. F. S. Range Survey
'37 A. A. A. Range Inspector

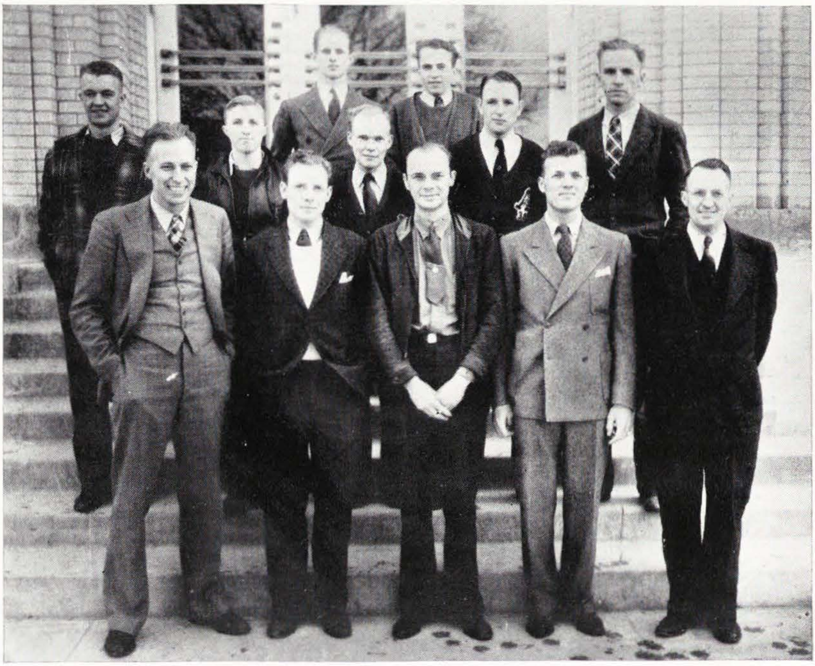
RAY McBRIDE, Pingree, Idaho
Utah Foresters
'37 U. S. S. C. S. Rodent Inv.

JOE MIR, Logan
Utah Foresters
'35 C. C. C.
'36 U. S. F. S. Exp. Sta.

MARCUS NELSON, Brig. City
Utah Foresters
"B" Club
Barbs
'37 U. S. B. S. Stu. Biologist

CONWAY E. PARRY, Cedar City
'32-'33 Utah State B. A. C.
Utah Foresters
B. A. C. Club
Phi Kappa Iota
'37 C. C. C.

CHARLES PIERLE, Logan
'27 Univ. West Virg.
Utah Foresters
Little Theater
Theta Chi



CLUB OFFICERS AND JUNIPER STAFF

First row: Stoddart, Henderson, Holmes, Jones, Floyd.
Second row: O'Niel, Todd, Bunderson, McDonald, Chatelain.
Third row: Owens, Gessel.

CLUB OFFICERS

Floyd Henderson	*President*
Glen R. Jones	*Vice President*
Elmer J. Holmes	*Secretary-Treasurer*
J. Whitney Floyd	*Faculty Adviser*
Victor Bunderson	*Reporter*
Edward Chatelain	*Reporter*

JUNIPER STAFF

Rhodell E. Owens	*Editor*
John McDonald	*Business Manager*
Dr. L. A. Stoddart	*Faculty Adviser*

Assistants

Frantzen Todd	*Assistant Editor*
Stanley Gessel	*Assistant Editor*
Edward Chatelain	*Assistant Business Manager*
Edward J. O'Niel	*Assistant Business Manager*
Elmer J. Holmes	*Staff Writer*
Herbert Armstrong	*Photographer*

THE UTAH FORESTERS

By FLOYD HENDERSON, *President,* 1937-38

The Utah Foresters are finishing their tenth successful year. Holding to and building on the foundation of past club policies, the officers have tried to make the year eventful and worthwhile for the club members.

Speakers, especially trained in various fields of conservation, have helped to make our meetings educational and interesting. The United States Forest Service, the United States Soil Conservation Service, and the United States Biological Survey have each contributed individuals for this purpose. The club extends its sincere thanks to these agencies and particularly to the men who have represented them at its meetings.

Social functions, well attended as usual, have been high lights of the year. The Fall Outing, made more interesting by the presence of several forest officers from the Ranger Training School held at Tony Grove, furnished fun, excitement, and food to 225 men. The success of this affair was due, in no small measure, to "Heb" Bingham who supervised the serving of hambergers hot-off-the-griddle; coffee, the way a Forester likes it; and apple pie, the kind anyone enjoys.

The fall semi-formal dance was acclaimed by everyone as a high spot in the social calendar. Certainly, from the turn out of good-looking girls, one must admit that the foresters have eyes for beauty other than that found in green clad hills. A roller-skating party after the Christmas holidays had the girls falling for the boys and vice versa. The annual banquet, bigger than ever, drew more than thirty guests from out of town, the entertainment drew thunderous applause, and the toastmaster's stories drew blushes from the waitresses.

At present elaborate plans are under way for a dance where Paul Bunyon and Babe, the Blue Ox, will be special guests, there to honor our old friend and new dean, Paul M. Dunn.

In the fourth week of April elections will be held, with a sigh of relief, a wistful look backwards, and a thousand wishes for success, the incumbent officers will hand over the administrative reins to the officers of 1938-39. It will be their job to engineer the spring canyon party to which every forester looks forward as a fitting climax to another Utah Foresters' Year.

FORESTERS' BALL

The annual informal winter ball of the Utah Foresters was held at the Dansante on Friday evening, December 10. Some 200 foresters, faculty, and friends were gathered to observe the social amenities which even the women-haters sometimes long for. Although the "Big Apple" made its hesitating debut in the northwest corner of the hall, the majority maintained their allegiance to those forms of the art which are less likely to twist a good skiing ankle.

The hall was atractively decorated—a painting of Paul Bunyan, his head in the clouds, occupying a central position. The programs were

(*Concluded on page* 62)

THE UTAH FORESTERS

THE UTAH FORESTERS

PHI GAMMA RHO FRATERNITY
First row: Smith, Passey, Hobson, Doman, Owens, Stoddart, Floyd, Kelker.
Second row: Blaisdel, Holliday, McLaughlin, Jones, Cliff, Spear, Baker.
Third row: Owen, Drummond, Dargan, Mason, Barnes, Noble.
Fourth row: Drown, Schmutz, Schafer, Gaufin, Low, Dale.

PHI GAMMA RHO FRATERNITY

Phi Gamma Rho honorary forestry fraternity was organized on the Utah State campus March 26, 1936. It now enjoys a secure and ranking position among other fraternities of its kind on the campus.

Briefly, the organization attempts to stimulate high scholastic attainment among students of conservation, promote fraternal relationships among earnest workers in forestry, and irradiate ideals of conservation to the general public.

This year it has featured a program of educational talks given by campus personalities such as J. Stewart Williams, Dr. Romney, Dr. Bert L. Richards, Dr. C. L. Anderson, and others.

Members of Phi Gamma Rho are selected from juniors and seniors in forestry who are outstanding in scholastic achievement and who have demonstrated interest and activity in practical forestry work.

Active members of Phi Gamma Rho are: Everett Doman, President; Dean Hobsen, Vice President; Rhodell Owens, Secretary; Arthur D. Smith, Faculty Advisor; Eugene Drown, Clifton Holiday, Aaron Spear, Nolan West, Glen Jones, Myrvin Noble, Howard Passey, D. I. Rasmussen, L. A. Stoddart, R. P. McLaughlin, Paul M. Dunn, George Barnes, Whitney Floyd, George Kelker, Oliver Cliff, Marshall Gaufin, Pershing Blaisdell, Lamar Mason, Sterle Dale, Lucus Dargan, Lyle Baker, Erwin Schmutz, Don Drummond, Clyde Low, Niel Owen, Paul Schafer, Stanley Gessel, Victor Surface, Julian Thomas, John McDonald and DeWitt Grandy.

FORESTRY SUMMER CAMP

By R. P. McLaughlin, *Associate Professor of Forestry, U. S. A. C.*

In order to provide students of the Utah State School of Forestry with a more adequate training and experience, the summer camp program will be extended in 1938 to eight weeks. This will allow more laboratory work to be conducted in the field, which should give the student a better practical understanding of complex wild land management problems and how to cope with them. The field instruction, as in the past, will consist chiefly of forest surveying, timber cruising, forest protection, dendrology, silviculture, range reconnaissance, wildlife management, and recreational development. A manual setting forth a series of daily problems, has been prepared so that the student will know in advance what is expected of him each day, and will have a concise, permanent record of the procedures to incorporate, along with his completed problems, in his notes.

Through cooperation with the Forest Service, the camp is situated at the Tony Grove C. C. C. camp twenty-two miles up Logan Canyon from the city of Logan by surfaced highway. Here the school has purchased and leased approximately 3,000 acres of forest and range land within forty-five minutes walking distance of the camp. In the forest, several important timber types of the region are represented by mature and immature stands, which makes it possible for students to study all phases of management and silvical problems. Many range types are also represented. Streams and forests offer infinite sources for fish and game study. It is planned, in the near future, to acquire title to all this forest area, and to block this out with additional acreage suitable for research and instruction in forest, range, and wildlife management. The Forest Service plans to construct a road in 1938 which will pass from the camp through the heart of the study area and will greatly facilitate instruction.

Other important sources of information available in the immediate vicinity are: two small sawmills with cutting operations within an hour's drive of the camp, where the process of manufacture can be observed from the tree to the finished board; a range research pasture in operation; adjacent areas of intensive natural grazing where range reconnaissance problems may be studied and methods practiced; and a new forest tree nursery developed by the Forest Service for reforestation throughout Region 4. The new road to Tony Grove lake has made accessible for study additional forest stands, grazing areas, recreational development areas, and the excellent area for wildlife studies which surrounds White Pine Lake. Logan River,

Summer Camp Students.

which passes along the lower side of the camp, provides excellent waters for fish reconnaissance.

In 1937 it was necessary, because of the large number of seniors unable to attend the 1936 camp, to hold two separate camps, one during the month of June and the other during September. These were attended by twenty-two and fifty-two students respectively. With the excellent cooperation of the Forest Service and the college, the camp accommodations and facilities have been increased to such a point that only a single period will be required to provide for all students attending the 1938 camp.

FORESTERS' BANQUET

The eleventh annual banquet of the Utah Foresters was held in the banquet room of the Bluebird on Friday evening, March 4. One hundred and thirty-four members and guests were seated at two long tables, with the speaker's table placed on a dais at one end. The tables were tastefully decorated with white and red carnations, and distinctive menus served as place cards.

Fred Harris, genial maestro of "swing," in the role of toastmaster, kept the program running at a spicy tempo throughout the evening. With rare

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INTRAMURALS

The intramural activities of the Utah Foresters, under the able direction of co-managers Scott Brown and Lynn Johnson, have been such that our organization is now in second place. We have placed above sixth in every event entered, and in the "B" basketball series our team placed first. Cal Spilsbury, center, and G. L. Johnson, forward, were selected on the intramural honor team. Other members of the team were Harold Scholes, Roy Hull, Van Haslam, Ed. Scholes, and Russell Johnson.

The Foresters took third places in pass football, wrestling, softball, and "A" basketball; and did well in swimming, volleyball, and open house. The men representing the club won the cup at the snow carnival in Logan canyon. Reid Olson came through in brilliant fashion to win the difficult slalom event. A second place in handball was due to the efforts of the doubles team composed of Doyle Hales and Torvall Nelson; and the singles champion Oliver Cliff.

We regret the loss of co-manager Scott Brown who left school at the end of the winter quarter. He has been a leader in the intramural events, and has done much toward putting us in second place. He won his match in wrestling, and has had 59 points awarded him in intramural standing. Other high point makers are G. L. Johnson, Harold Scholes, Dean Purrington, Doyle Hales, Steve Ellis, and Lloyd Andrews.

Johnson and Brown
Intramural Managers

FALL BARBECUE

By VICTOR BUNDERSON

The Utah Foresters Annual Fall Barbecue, held Saturday, October 9, at picturesque Guinevah Park was a huge success. In the final scoring for the events of the day it was found (Oh, unhappy thought) that the Freshmen walked off with 1st place, scoring a total of 52 points. The Juniors surprised even themselves by taking 2nd with 38 points. The Seniors (are our faces red) 3rd with 36 points, and the Sophomores (is Chat's face red) 4th with 28 points. The Rangers, Faculty, the Alumni placed 5th with 7 points; however, they were very good sports and entered men in every event and supplied some very lively competition despite a few Bay windows and an obvious lack of wind.

After a strong senior team had defeated all comers in softball, no, I didn't forget the freshmen placed second and the juniors third, the feature of the day took place, the tobacco spitting contest. The contestants found that Professor Art Smith's words were only too true. Predicted Art, "He who spits against the wind spits in his own face." We all expected better things from the President and vice-president of the club in the way of expectorating. Floyd and Glen failed to place in the art at which they were once so efficient. Maybe Glen's newly acquired spouse has curbed, shall we say, his less gentlemanly habits. But as for Floyd there is no excuse, although he did spit a beautiful stream it didn't have the push behind it to place against such masters of the art as Elmer J. Holmes, Tom Evans, Gilbert Smith, Reed Olsen, and Chat. Most of the contestants failed on account they couldn't get enough altitude, though this wasn't Chat's alibi. We rather expected some stiff competition from the Professors in this event but it seems here is one place the profs could take a few lessons from the students.

The Rangers, Faculty, and Alumni won their lone first place in the egg throwing contest when "Pink" Madsen tossed his egg higher (he thought) than Mt. Logan and caught it without breaking the hen fruit. It was rumored Pink won the contest with a hard boiled egg until Prof. Smith broke said egg in "Soy" Beans' hair.

Just as Old Sol was beginning to turn the lavenders, yellows, pinks, and indigo red of beautiful Logan canyon a deeper hue, we all retired—error—rushed for a place in line to get in on the delectable hamburgers, pie, coffee, and cocoa prepared for us by Heb Bingham of the Pig Stand. Whew! what a blessing a feed like that was for us "batchers." Heb sure puts out a feed, how about it, you Foresters who were at the Barbecue and the Spring canyon party last year! A vote of thanks goes to Paul Rattle, chairman of the eats committee and his willing helpers.

After all of us, with the possible exceptions of Stan Gessell and Ollie Cliff, had gorged ourselves until we all looked a little full in the face, we gathered around the fire and enjoyed an excellent program prepared by Fred Harris. Mr. Darley of the U. S. Forest Service started the program by leading the group in singing "The Utah Trail," after which Mr. Darley sang "The Forest Ranger," a very touching little song. This was followed by two numbers from those super swingettes, Carver, Blakely, Hobson, and R. Harris. Grant Harris then went to town with "The Wreck of Old 97," played on his squeeze box. Luke "The Terrible" Dargan favored us with a very sad little poem about, I don't what it was about, Luke's mind must have been wandering while he was reciting. It left the whole group somewhat saddened and there were a few stray tears in the eyes of some of the more tender hearted of the crowd, notably Professor Dunn's. After Luke's saddening effect on the crowd Scott Brown showed his versatility by proving he could make us laugh as well as direct the events of the day. He sang something about a gal named "Duck-foot Sue" and then made the ex-sheepherders appreciate what they are leaving behind (they hope) by singing "I Never Knew What Misery Was 'Til I Started Herding Sheep."

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SUMMER CAMP

By Stanley Gessel

"Whoops we're here!" Such was the greeting expressed by 26 vivacious young foresters as we reached our destination, the 1937 summer camp in Logan canyon. Inactivity was not for us, and led by Professor Barnes, we immediately set out on an orientation trip of the surrounding country with the definite purpose of exploring thoroughly the school forest. Unfortunately it is located at the very top of the Bear Lake-Logan Canyon divide. The way was rough, very muddy, and in many places snow was up to our waists, consequently it wasn't long until all were ready to turn back. But Professor Barnes was merciless. He drove us on with the spirit of a Columbus until the evening shadows began to close upon the silent mountains. Then, and only then, did our weary steps turn campward. That night 26 dejected, completely exhausted fellows dropped into bed to sleep fitfully and dream of Swiss Alps and professors with horns and long tails.

Stiff joints, sore muscles and bruised bones were forgotten the next day when "Whit" Floyd came into camp. He fanned the flickering spark of learning in our systems and we set out with vim and vigor to survey the nearby terrain. Up hill, down hill, through jungles of brush we blazed trails and ran compass lines, took elevations and did all the other things which good surveyors do. We finished the job in a blaze of glory by lugging a 75 pound plane table and alidade to the tops of all the high cliffs. The week end saw the finish of our surveying class and incidentally the finish of some of the surveying instruments. Chains suffered the heaviest casualties, chiefly because of "Slim" Anhder's habit of throwing them across the river in one piece and retrieving them when possible in three. A number of the boys used range poles to catch up on their rattle snake extermination, but this proved to be as hard on the poles as on the snakes.

Leaving camp over the weekend was strictly taboo (except after dark) so Saturday evenings were spent in playing pinochle and fighting C. C. C.'s who were our next door neighbors. Night life really began at eleven. With the extinguishing of the lights, no bed was allowed to stand on four legs and the air was filled with flying missiles, making any travel extremely dangerous. Sleep would silently and slowly creep over the camp until by midnite the stillness would be broken only by the noise of would-be woodcutters and an occasional moan of some unhappy lover.

"Doc" McLaughlin, ambitious soul that he is, was up early one Sunday morning to get us away on a trip to the "Old Juniper." Not all had the fortitude to make this trip but those who did were well rewarded for on the way up two girls were overtaken. Unfortunately they were being escorted by two fellows, which put a damper on our romantic aspirations. On arrival at the tree "Iron Man" Bringhurst equipped with his antique camera, bequeathed to him by his great grandfather, gave a good demonstration of how not to take pictures. The return trip was uneventful, chiefly because of self restraint, for which the two escorts should be thankful.

Ah woeful me! The peaceful quiet and solitude of our Monday morning camp was broken when that demon of deep thought, Professor Arthur

D. Smith blew into camp and immediately began to expound to us his theories on relative consumption of grass, weeds, and browse by cattle, sheep, and deer. He changed our attitude of wild guessing into one of thoughtful estimation and we became range management students "pure and simple." His "ice-cream" plants, "preferred blondes" (or other plants) and similar idiocracies soon tired our overtaxed minds and we were glad to be rid of him, but not until he had taken us on a trip to Bear Lake, and lost us in an effort to find White Pine Lake. The trip to Bear Lake was singular in the fact that some of the boys became slightly "dis-oriented" while boating.

Great joy came over the camp when Professor Barnes reappeared in our midst in the capacity of mensuration teacher. He who had so violently and rashly betrayed us the first day now received his just dues. Our work was being done at the top of a steep ridge and we being accustomed to climbing by this time could really climb that hill. He would make a brave attempt to lead us but before the top was reached would be puffing and blowing barely ahead of "Screwball" Scherbel, whose customary duty was to bring up the rear. The scene of work was an even more dangerous and trying place for the "Old Woodsman." With inexperienced loggers such as "Wahoo" Player felling trees and rolling rocks, Professor Barnes' life was one of holy terror. To make the misery more complete he was compelled to listen to the untrained voices of Floyd "Benelli" Vincent and the shrill cackles of Frantzen Todd, not to mention the numerous other individuals who were training for grand opera. In return for such suffering we had to burn the proverbial midnight oil compiling yield tables, growth charts, and other statistical measures of trees.

Forest and range having been mastered in our minds at last, we turned our attention to the problem of wildlife. Under the direction of "Doc." Rasmussen we studied all phases of the subject, birds, game, fish, rodents, and predators. The trappers, led by Phay Ellison and his crew, kept us supplied with animals, while Roy Hull with his trusty rod and reel did not let us want for fish.

The saddest part is yet to tell; the judgment day arrived. Under the stern eyes of the faculty we filed into a dim, dark room. With long pencils we worked for three hours, to emerge finally, nervous wrecks, pencils gone, and finger nails chewed to the quick. But why reminisce over bad memories? The happy ones stand out clearly and will be remembered for years to come.

THE PROGRESS OF THE CLARKE-McNARY NURSERY

By J. Whitney Floyd, *Assistant Professor of Forestry, U. S. A. C.*

During the past nine years many changes have taken place in the Clarke-McNary nursery. Probably the old "Grads" would hardly recognize it as the same "tree-plant" they knew. There are those among the alumni who remember very well the development of the first five transplant beds and the half-dozen seed beds that were so carefully planned and planted in 1929. Those same men will also remember the rush season of 1930 when slightly over 15,000 trees were lifted, packed, and distributed to Utah farmers during the early spring.

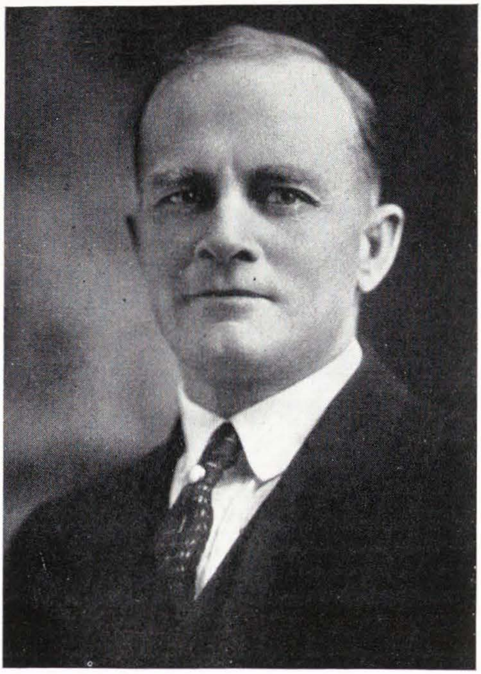
That was the beginning of a tree planting program in Utah. Evidently it was a good start because since that time the steady demand for more trees and the need for experimentation have exerted influences that have made a program of yearly expansion necessary. Each successive year new ground has been prepared, new pipe lines installed, and more seed beds planted until at present there are approximately five and one-half acres under pipe.

Through a cooperative agreement in 1933, between the Nevada State Extension Service and the Utah State Extension Service, a tree distribution program for Nevada was made possible. That same year the Utah State Agricultural College nursery began shipping to the neighbor state. This created a greater demand for trees and the already accelerated tree planting program in Utah brought the distribution figure up to 31,472 during the spring of 1933. The program with Nevada has continued and although her demand for trees is not large (only 10,000 trees shipped last year) the total distribution reached 105,000 trees for the two states during 1937. This enlarged program has created the necessity of maintaining for 1938 twenty-three transplant beds, with a capacity production of 150,000 salable trees for 1938 and a reserve of 1-0 and 1-1 stock for 1939.

An attempt has been made during these years to determine the type of trees best suited to farm forestry for the state. An important consideration has been to choose trees that would withstand transplanting and adverse climatic conditions. Fourteen species were tried in 1930. In 1931, five new kinds were planted and one of the 1930 "trial trees" was discontinued. During these two years and the succeeding six years, twenty-two different tree species have been grown in the nursery and shipped to Utah farmers for woodlot and windbreak plantings.

From this number, eleven species have proved adaptable to Utah, and are being distributed in large numbers each year. They are, blue spruce, ponderosa pine, Russian olive, Siberian elm, green ash, black locust, black walnut, honey locust, hardy catalpa, Siberian pea tree, and golden willow. The eastern red cedar is being tried for the first time this year.

In addition to the tree planting, considerable work has been done on research in native plant propagation. During the past five years more than 25 species of native shrubs have been grown from seed collected in the vicinity of Logan Canyon. Mature plants of the majority of species are being grown to supply seed for future investigations. In addition, the range department is utilizing two transplant beds for research in the propagation of grasses and forage plants.



IN MEMORIAM

Hopkin I. Rice, affectionately known as "Hop" to his many friends and associates, passed away on the fifteenth day of February, 1938. With his death the forestry profession and the field of conservation lost a true friend and fellow worker. The students of forestry at Utah State especially will miss one who helped to make the name of a forester respected and honored.

Mr. Rice entered the Forest Service July 15, 1908, after taking a special course offered for foresters at our institution. For 30 years he served his fellow men through the Forest Service, and was to have been retired from the service on May 26th of 1938 at the age of 62. His chief concern through these many years was the restoration of the natural beauties of Logan Canyon. It had been badly treated in the early days, used as a stock trail and dipping ground, with little concern being given to the more valuable resources of the canyon. He, seeing the seriousness of the situation, looked with intelligence into the future, planned ahead, and by hard work carried out his plans so that today, chiefly through his efforts, Logan Canyon is the beauty spot of northern Utah and the playground of Cache Valley. His monument, a restored Logan Canyon, will stand for ages for all to see and enjoy. The highest tribute deserved by any man can be paid to him: he left this world a better place in which to live.

TO THE ALUMNI

By Paul M. Dunn, *Dean*

Greetings to all the 112 alumni. This word comes from your friends at Utah State. It is hoped that all of you whether working in the Central-west, or the Pacific Coast States will find time to stop a bit, think about your school and drop us a line which will tell us about what you are doing. We have tried to make contact with each of you during the past year, but our returns have not been complete. The directory that was compiled was as accurate as we could determine, but the recurring changes are hard to keep on record.

The school has had a good year taken as a whole. Even though the registration dropped for the first time in years, there still were enrolled nearly 400 men in forestry, range management, and wildlife. The number of range men is increasing and this is a good sign. It is to be expected that for the next period, there will be a decrease in the number of students in forestry at this and other schools. Good men, however, will always be in demand, we are certain.

In November, word was received from Professor H. H. Chapman, president of the Society of American Foresters, that the Utah State School of Forestry was on the approved list of forestry schools. Eighteen schools teaching forestry are now on the list. This announcement was received with a great deal of pleasure and at this time I want to express appreciation to President E. G. Peterson of the college, the board of trustees, and to the present and the previous faculty members who have helped bring this about. We believe it possible to further improve our school, and this is our aim.

In March, as you may have heard, President Peterson gave further recognition to the School by placing it on a par with the other six schools on the campus with a dean at its head. This will be of material advantage in furthering the forestry program in this Intermountain region.

Two new men were added to the staff this past year. Professor George H. Kelker arrived in August to handle the wildlife management courses following the resignation of Professor H. H. Hoyt. Professor Kelker received his Bachelor's degree in forestry and his Master's degree in wildlife management, and has completed most of the work for his Doctor's degree from the University of Michigan. Arthur D. Smith, an "Aggie" graduate of 1936, came in June to assist in range management. "Art" received his Master's degree under Doctor A. W. Sampson at Berkeley, California, in May, finishing with honor at that school.

The faculty now numbers eight, including Dr. Rasmussen of the wildlife research unit, whom we claim. They all are doing some very fine work, each in his particular field.

The forestry summer camp was held in two sections last year, but will be lengthened to eight weeks starting June 13, this year. With approximately 3000 acres of land under purchase and lease and a very good physical arrangement, this phase of instruction has great possibilities. Here is an invitation to drop into the camp in Logan canyon and have at least one of Chef Cooley's fine meals.

The employment situation, while not at its best, will no doubt smooth out and we sincerely expect that the bulk of the men will be permanently placed. We have to date, held an enviable record, unequalled by any other forestry school, in regard to the employment of graduates. The fact that the regular civil service examinations are not being given this year, will help the men who are on the list. There are 35 of our men on the eligibility lists of the forester, range examiner, biologist, and park ranger examinations; some passing as many as three of these tests.

I will say again, *greetings* and *best wishes* to all of you from the faculty of the school at Logan.

ALUMNI DIRECTORY

1930

ADELBERT FAUSETT—Associate Range Examiner, U. S. F. S., Region 5, in charge of range surveys and studies. Married, daughter, age 5. 760 Market St., San Francisco, California.

J. DELOY HANSEN—Associate Range Examiner, U. S. F. S., Region 4. Ogden, Utah.

1931

V. I. BENTLEY—Assistant Technician, Uinta N. F., Road Locator and W. P. A. Foreman. R. F. D. No. 3, Box 644, Provo, Utah.

E. P. CLIFF—Associate Regional Forest Inspector, U. S. F. S., Region 6. In charge of wildlife studies. Married, 1 child. 4306 N. E. Mason St., Portland, Oregon.

W. L. HANSEN—District Forest Ranger, Cache N. F., married, one child. Pocatello, Idaho.

C. P. STARR—Associate Range Examiner, U. S. S. C. S. In charge of Range Management in Utah. 41 East 9th South, Salt Lake City, Utah.

MARRINER SWENSEN—Junior Forester, Calif. Forest Experiment Station. Has supervision of brushfield planting studies. Married, has two children. 1031 Peralta Avenue, Berkeley, Calif.

1932

OWEN DESPAIN—District Forest Ranger, La-Sal N. F., married, one child. Moab, Utah.

D. M. EARL—District Forest Ranger, Kaibab N. F., Kanab, Utah.

J. L. JACOBS—District Forest Ranger, Caribou N. F. Married. Idaho Falls, Idaho.

ODELL JULANDER—Instructor in Forestry, in charge of Range and Wildlife management, Iowa State College. Married, three children. Forestry Dept., Iowa State College, Ames, Iowa.

J. D. SCHOTT—Assistant Forester, Soil Conservation Service, project forester, Utah. Married, one child. 908 Park Row, Salt Lake City, Utah.

ALVIN STEED—Assistant Range Examiner, Soil Conservation Service, surveys, administration studies and land use planning. Married, two children. 409 N. Carlisle, Albuquerque, New Mexico.

1933

W. S. ASTLE—District Forest Ranger, Powell N. F., Escalante, Utah.

FRANK O. FONNESBECK—P. O. Box 286, Logan, Utah.

W. M. JOHNSON—Assistant Forest Ecologist, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

C. C. MICHAELS—Assistant Range Examiner, Soil Conservation Service. Range administrator, sub-district No. 2, San Pedro-San Simon watershed. Married, two children. Safford, Arizona.

C. S. THORNOCK—District Forest Ranger, Shoshone N. F., Valley, Wyoming.

1934

R. C. ANDERSON—District Forest Ranger, Nevada N. F., Married, two children. Box 231, Las Vegas, Nevada.

L. H. CARLSON—Junior Forester, Payette N. F., Timber Sales. Cascade, Idaho.

MILTON SILL—District Forest Ranger, Boise N. F., Atlanta, Idaho.

GORDON VAN BUREN—District Forest Ranger, White River N. F., Yampa, Colorado.

1935

RUSSEL R. BEAN—Las Vegas, Nevada.

BASIL CRANE—Junior Range Examiner. Humboldt N. F., Range Surveys. Elko, Nevada.

JOHN M. CROWL—Junior Forester, Nursery Supt., Gardner N. F., married, three children. Licking, Missouri.

ARDEN B. GUNDERSON—District Forest Ranger, Gallatin N. F. Married, one child. Bozeman, Montana.

WALTER O. HANSON—Junior Forester, Timber Surveys. Pike N. F., Fairplay, Colo.

FLOYD LARSON—Assistant Range Examiner. Married. TC-BIA. Soil Conservation Service, Rapid City, South Dakota.

WAINE LARSEN—Assistant Range Examiner, U. S. Div. of Grazing, Range Surveys. Married, one child. 503 Federal Bldg., Salt Lake City, Utah.

ANDREW McCONKIE—District Forest Ranger, Salmon N. F., Forney, Idaho.

LEGRAND OLSEN—Junior Range Examiner, U. S. F. S., Albuquerque, New Mexico.

JOHN D. REDD—Junior Range Examiner, Soil Conservation Service, Moab, Utah.

M. R. STOCK—District Forest Ranger, Gallatin N. F. Married, one child. Ennis, Montana.

1936

FLOYD J. ALLEN—District Forest Ranger, Wasatch N. F., Hanna, Utah.

HORACE M. ANDREWS—Mt. Pleasant, Utah.

FRED R. BAUGH—Junior Forester, Wyoming N. F. c/o Standard Timber Co., LaBarge, Wyoming.

ALDEN N. BREWER—District Forest Ranger, LaSal N. F. Married. Blanding, Utah.

LEWIS CLARK—Junior Forester, Uinta, N. F., Provo, Utah.

JOE COUCH—Logan, Utah.

EDWIN ENGLAND—Forest Guard, Nevada N. F. Box 231, Las Vegas, Nevada.

CARL G. ERIKSSON—U. S. Forest Service, Albuquerque, New Mexico.

RICH FINLINSON—C. C. C. Foreman in charge of Tony Grove Nursery, Cache N. F., Logan, Utah.

J. WHITNEY FLOYD—Assistant Professor of Forestry and Extension Forester, U. S. A. C. Married, 2 children. U. S. A. C., Logan, Utah.

PAUL A. GROSSENBACH—Junior Forester, Wasatch N. F. Salt Lake City, Utah.

ALVIN C. HULL—Junior Range Examiner, Intermountain Forest and Range Experiment Station. Research in artificial reseeding. Married, one child. Forest Service, Ogden, Utah.

JAY P. JONES—Spanish Fork, Utah.

MARK JONES—Soil Conservation Service, 1585 Major St., Salt Lake City, Utah.

WALLACE MANNING—Recreational Planner, Uinta N. F., Provo, Utah.

FERRIS McDERMAID—Junior Forester, Santa Fe N. F., Santa Fe, New Mexico.

LEONARD RAMPTON—Junior Forester, Ashley N. F. Vernal, Utah. On leave for graduate study, Oregon State College, Corvallis, Oregon.

LAMONT ROHWER—Junior Range Examiner, U. S. Division of Grazing. Married. Box 429, Reno, Nevada.

ARTHUR D. SMITH—Instructor, Dept. of Range Management. U. S. A. C., Logan, Utah.

NATHAN SNYDER—Junior Range Examiner, U. S. F. S., Albuquerque, New Mexico.

VICTOR STOKES—District Forest Ranger, Teton N. F., Moran, Wyoming.

GEORGE SWAINSTON—Junior Forester, Soil Conservation Service, Morgan, Utah.

MONT SWENSON—Junior Range Examiner, Farm Security Administration, Malad, Idaho.

JOHN TAGGART—Ogden, Utah.

WILLIAM TOWNSEND—Jr. Agr. aid, U. S. S. C. S., Albuquerque, New Mexico.

BERT TUCKER—Burley, Idaho.

L. G. WOODS—District Forest Ranger, Wyoming, N. F. Married. Afton, Wyoming.

1937

LELAND F. ALLEN—172 No. 3rd West, Logan, Utah.

WAYNE ALLEN—Assistant Forest Ranger, Ozark N. F., Caso, Arkansas.

LLOYD J. ASTLE—336 No. 1st East Street, Logan, Utah.

JACOB BERG—Junior Forester, U. S. F. S., Missoula, Montana.

MAX BRIDGE—Logan, Utah.

VANCE DAY—Fillmore, Utah.

FLOYD DORIUS—Ephraim, Utah.

DON DRUMMOND—Foreman, Forest Nursery, U. S. A. C., Logan, Utah.

JOHN P. DRUMMOND—Technician, Soil Conservation Service, Morgan, Utah.

THERON GENAUX—Logan, Utah.

RALPH K. GIERISCH—Graduate student, Botany Department, U. S. A. C., Logan, Utah.

ANDERSON M. GRAY—Graduate student and assistant at Wildlife Research Station, Alabama Polytechnic Institute, Box 1031, Auburn, Alabama.

LEE GRINER—Rodent Control, U. S. Biological Survey, D. G. 34, Blanding, Utah.

MARVIN HANSON—Tremonton, Utah.

SHERMAN HANSON—Graduate student, Utah State Agricultural College, Logan, Utah.

CLARK B. HARDY—Hinckley, Utah.

BRADFORD HATCH—Draftsman, A. A. A., Logan, Utah. Married. 256 East 6th No., Logan, Utah.

ERNEST W. HENDERSON—Junior Range Examiner, Soil Conservation Service, Soda Springs Camp, Rt. 5, Yakima, Washington.

ROYCE D. HERMANSEN—Ass't. Technician, Range Surveys, Humboldt N. F., Elko, Nevada.

WILLIAM H. HIRST—Provo, Utah.

ARTHUR E. HOLT.—Second Lt., U. S. Army, Fort MacArthur, San Pedro, Calif.

MAX S. JENSON—Brigham, Utah.

ELDORES S. JORGENSEN—Field Assistant, Rodent Control, U. S. Biological Survey, Salt Lake City, Utah.

JOHN FRANCIS KANE—Logan, Utah.

HENRY L. KETCHIE—Ogden, Utah.

GERARD J. KLOMP—Graduate student, Botany Dept., Iowa State College, Ames, Iowa.

FRED LAVIN—Ogden, Utah.

CLYDE T. LOW—Graduate student, Utah State Agricultural College, Logan, Utah.

JESSOP B. LOW—Graduate student, Zoology Dept., Iowa State College, Ames, Iowa.

DOYLE S. LUND—Brigham, Utah.

CLYDE R. MADSEN—Field Ass't. Bureau Biological Survey, Box 1510, Reno, Nevada.

EARL J. McCRACKEN—Ass't. Technician, Powell, N. F., Panguitch, Utah.

LEO MOLLINET—Brigham, Utah.

BLAINE C. MORSE—Junior Forester, Soil Conservation Service, Price, Utah.

CLIFFORD OVIATT—Junior Forester, Manistee N. F., Cadallic, Michigan.

NIEL W. OWEN—Logan, Utah.

HOWARD B. PASSEY—Graduate student, Range Management Dept., U. S. A. C., Logan, Utah.

SCOTT B. PASSEY—Logan, Utah.

JACK L. REVEAL—Logan, Utah.

VERNON B. RICH—Ass't. Technician, U. S. F. S., married, Ogden, Utah.

JAY L. SEVY—Forest Ranger, Nevada N. F. Married. Austin, Nevada.

WELDON O. SHEPHERD—Graduate Assistant, Agronomy Department, University of Nebraska, Lincoln, Nebraska.

EMERY SNYDER—Tooele, Utah.

WAYNE TRIBE—Ogden, Utah.

C. DOUGLAS WADSWORTH—Junior Forester, Cache N. F. Married. Pocatello, Idaho.

SYLVAN D. WARNER—District Forest Ranger, Nevada N. F. Married, two children. Baker, Nevada.

ELDON M. WATSON—Draftsman, A. A. A. Married, two children. Logan, Utah.

KARL J. WILKINSON—Field Assistant, Western Range Survey. Married. 324 No. 1st St., Missoula, Montana.

ANTONE G. WINKLE—Ass't. Agr. aid, Experiment Station. Married, three children. Dubois, Idaho.

EVERETT C. WOOD—Levan, Utah.

MILTON M. WRIGHT—Project Superintendent, Roosevelt N. F. Married, one child. Fort Collins, Colorado.

HAROLD M. WYCOFF—Ogden, Utah.

The Role of Ecology in a Land Use Program

(*Concluded from page 30*)

3. The researches of ecology should establish a basis for a more enlightened range management by ascertaining:

(a) The effects of various degrees of utilization and seasonal use on the physiology of the plant.

(b) The physiological basis for palatability.

(c) The sociological role of various plants and animals within the association which tend to disturb or to establish the organic equilibrium of the type.

(d) The relationship of grazing practice and plant cover to soil and water conservation.

In the application of the subject of ecology to agriculture, no attempt has been made to catalogue all the problems of an ecological nature that need solution. Neither has there been an attempt to discuss methods of ecological experimentation. Obviously, the problems of crop and range ecology need the most careful quantitative analysis that modern science can devise. Ecology, being rather a new point of view in the science of biology, has been justly criticized for its broad generalities and ponderous terminology used to describe common phenomena. Qualitative generalizations, as a method of ecological analysis, must be supplanted by accurate, quantitative, statistical treatment of the problems at hand.

Ecology should and does play a major role in the management of specific areas set aside for recreational purposes. Since a primary objective is to preserve for this and future generations all biotic communities in as nearly natural condition as possible, the ecological problems of parks and monuments are, in their major aspects, essentially similar to those already discussed under the topic of range lands. However, the successful ranger soon discovers that information on the intricacies of natural history, so necessary for sound management of the park, is of absorbing interest to the visiting public. An additional function of ecology in a land use program is demonstrated.

ROSTER OF SCHOOL OF FORESTRY 1937-1938

SENIORS MAJORING IN FORESTRY

Allred, Glade
Blaser, Herman
Cliff, J. Oliver
Demoisy, Ralph G.
Downs, Elvin
Drown, Eugene A.
Egan, Gilbert
Ellison, Donnell
Gessel, Homer
Hayes, William
Henderson, Floyd A.
Jeppson, Earl
Johnson, Morris A.
Lewis, Morris W.
Matthews, Lawrence
Owens, Rhodell
Peters, Edward
Quigley, Lewis Glen
Roberts, Raymond
Roylance, Finley
Scholes, Harold
Shipley, Mark
Webb, Dayl J.

JUNIORS MAJORING IN FORESTRY

Bagley, Andrew S.
Baker, Lyle A.
Baker, Harold L.
Brown, Scott R.
Carlson, Merrill H.
Curtis, Clyde
Davis, Don Q.
Decker, Rex
Gurr, J. Boyd
Hanson, Robert L.
Holman, Elmo H.
Jorgenson, Jack
Krueger, William
Ladle, Orval H.
Nelson, Torvall
Player, Garnett C.
Rich, Harvey
Rhoton, Royal W.
Robinson, Reed
Shepard, Erschel E.
Smith, Gilbert
Turner, Duane
Vance, Herbert G.
Vincent, Floyd

SOPHOMORES MAJORING IN FORESTRY

Ahlm, S. Arthur
Albrecht, David M.
Calderwood, Spencer G.
Call, Garland D.
Carter, Ralph S.
Clinkinbeard, Max
Cooper, Talmadge Jr.
Coray, Max S.
Dedrickson, Lorin
Fennimore, Arthur C.
Fernstrom, Edward J.
Frischnekt, Neil
Gabardi, Clarence
Grace, Harry
Gooding E. Bob
Haake, Edwin D.
Halls, Devere
Hempler, Wilfred
Johnson, Maurice
Major, Jack
Mitchell, Albert
Morrison, John
McGarry, Wendell
Okeson, Kenneth W.
Olsen, Reid P.
Palmer, Marcel
Paskett, Grant Jr.
Payne, Richard W.
Ralph, Sidney
Rattle, Paul S.
Richardson, D. Silas
Scholes, Edward

FROSH MAJORING IN FORESTRY

Backstrom, Norman
Badger, Philip
Bernhard, John T.
Birch, James O.
Bowens, William
Burton, Albert
Carten, Harry P.
Colton, Lawrence J.
Cook, Loyal B.
Cowley, David H.
Cox, Elmer C.
Foote, Franklin
Gooch, Ken
Hanson, Lamar
Hermanson, Burl
Hey, Robert
Hiner, Harold
Hofer, Ernest
Howe, Ralph D.
Hubner, O. L.
Jacobson, Dewitt
Janson, Reuel G.
Jenson, Lyle H.
Keate, Kenneth
Lake, L. Bruce
Larson, Willard
Lindsay, Ellwood
Maycock, Clyde P.
Miller, LaVell
Norwood, Grant
Noyes, Edward T.
Paskett, Grant R.
Patrick, Walter L.
Patterson, James A.
Perry, Wilmer
Peterson, Hugo H.
Peterson, Rulon
Putnam, Max L.
Quayle, Jack
Remund, Junius
Robbins, Thomas R.
Saylor, Burwin
Secrist, Dean
Shaw, Grant L.
Shaw, William D.
Sjoblom, Duane C.
Smith, B. C.
Smith, James N.
Speakman, Daniel V.
Staples, G. Emmett
Taylor, Howard
Taylor, J. Warren
Tingey, Reid H.
Tinseley, Kenneth
Tucker, Phil J.
Weaver, Rex R.
Wright, LaMar

SENIORS MAJORING IN RANGE

Anhder, T. E.
Anderson, William
Andrews, Norman
Armstrong, Herbert
Barney, Marvin
Bell, Sheldon
Bunderson, Victor
Clark, Noal F.
Dale, Sterle
Farrer, Wells F.
Foster, D. Monroe
Foulger, H. R.
Hales, Doyle C.
Harris, Fred
Harris, Richard
Hinchcliff, Howard
Hurst, William
Jenson, Cyril
Johnson, Harold
Johnson, Lynn G.
McDonald, John E.
Nelson, Ralph
Noble, Myrvin
Peterson, Virgil
Richman, Val B.
Robinson, J. G.
Roylance, Richard
Schmutz, Ervin
Shipley, Roy
Sorenson, Leon J.
Spear, Aaron
Surface, Victor
Thompson, Reed
Winters, Arthur O.

JUNIORS MAJORING IN RANGE

Blaisdell, James P.
Bishop, Merlin
Carver, Orlo
Christensen, Rangwell
Cooper, Harold
Ellis, Steve
Erickson, H. K.
Gessel, Stanley
Goody, Dallas T.
Goudie, Gavin
Grandy, DeWitt
Handy, Harley
Harris, Grant
Harris, Paul R.
Hawkes, Gene J.
Hinton, Clemons
Hughes, H. B.
Jones, Glen R.
Mason, Lamar
Mellor, R. Keith
Phillips, Tom
Purrington, Dean
Rees, Max P.
Roundy, Ace Robert
Scherbel, Paul
Shafer, Paul S.
Spiers, Harold K.
Spendlove, Earl
Thomas, Julian
Todd, Frantzen
Wheeler, Seaton E.

SOPHOMORES MAJORING IN RANGE

Anderson, Ray W.
Bower, Kenneth

Jenson, Avril
Jensen, Ned L.
Keilman, Lester
Larson, Floyd
McCleneghan, S. R.
Napper, Delbert G.
Nielson, Kirk
Robinson, Benjamin F.
Robinson, Max E.
Rogers, Max L.
Seamon, Forest
Sevy, Thomas H.

FROSH MAJORING IN RANGE

Carey, Robert R.
Clayson, Keith
Finlinson, J. L.
Foster, James S.
Guymon, Wayne
Halling, Oscar L.
Hart, Clyde
Haycock, Wallace
Howard, Paul L.
Jenkins, Paul M.
Killpack, A. E. R.
Landes, Lee
Lofthouse, Edwin
Neerings, Ted
Pope, Dick
Rosenberg, Ephraim
Terry, Karl
Truden, Andrey
Wilcox, Niel C.

SENIORS MAJORING IN WILDLIFE

Allred, Warren
Blair, Ray
Dargan, Lucas
Doman, Everett
Ellison, Phay
Fuller, Revilo
Gaufin, Marshall
Heywood, Benjamin
Holladay, Clifton M.
Hull, Roy
Jones, Douglas M.
Kowallis, Reinhart
Lund, Clair O.
Mir, Joseph
McBride, Ray
Nelson, Marcus
Pierle, Charles B.
Romero, Forrest
Spiers, Donald

JUNIORS MAJORING IN WILDLIFE

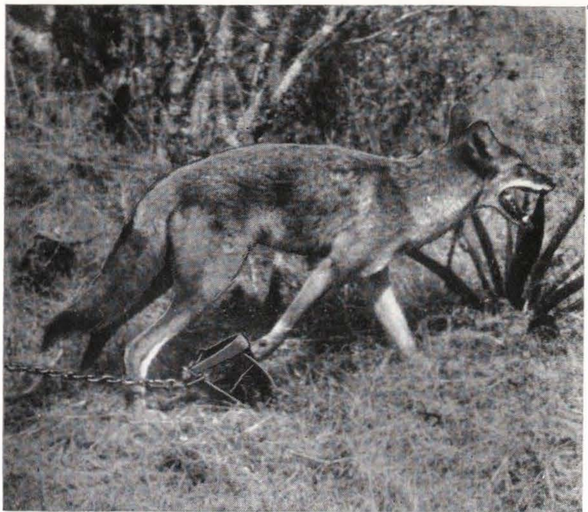
Andrews, Lloyd
Blakely, Robert
Bringhurst, Frank
Crouch, Dave
Farr, Jedd
Gunther, Lloyd
Hobson, Dean
Kittams, Walter
Nelson, Nolan D.
Neilson, Jack
Onstatt, Oscar
Phelphs, James
Rabb, Joe
Roberts, Kenneth
Shaw, Wesley
Snyder, Stephen O.
Taylor, Thomas A.

SOPHOMORES MAJORING IN WILDLIFE

Austin, Lawrence
Brown, D. Thomas
Buckley, Dearl
Chatelain, Ed. O.
Davis, D. Lawrence
Fager, J. C.
Holmes, Elmer J.
Koller, Paul Alfred
Lowham, George W.
Madsen, Vaughn D.
Meibos, John K.
Millard, Edward
O'Neill, Ed. J.
Ramelli, Lloyd
Reavley, Wm.
Smith, Eldon H.
Snapp, Nathan
Udy, Jay R.
Wacker, William

FROSH MAJORING IN WILDLIFE

Bylund, Creed
Demke, Raymond
Dexter, Jack
Diehl, Bruce
Gardner, Coy F.
Hedborg, Carl E.
Killian, Clinton
Lipman, Nathan
Logan, Stanley H.
November, Harry J.
Pearson, Clifford H.
Thorell, Roy D.
Young, Robert D.



Water Conservation and Land-Use Management

(*Concluded from page* 17)

Inefficient methods of water conveyance, faulty distribution, and wasteful application inevitably contribute to a general rise of the water table in the soils of the low-lying areas. Ground water near the land surface causes annual waste of many thousands of acre feet of water through excessive evaporation, and also equally serious waste of land through concentration of alkali in the surface soil. (Fig. 3) To prevent these wastes in many western valleys, drainage becomes a positive necessity.

Adequate Drainage

Not all of the irrigated lands in arid regions are adequately drained. In some western valleys the areas in urgent need of drainage range from 15 to 30 per cent of the irrigated land. Drainage contributes to water conservation and land improvement. When the water table rises to elevations near the land surface, water moves upward, is evaporated, and leaves accumulated alkali salts. Upward water movement through soil is always harmful.

The nature of the water-vapor cycle, and the conditions which cause an annual waste of large amounts of water is shown in Fig. 4. It illustrates the fact that some of the water which falls on the high mountains percolates down the mountain sides, through the mantle of earth and rock; then through the gravelly subsoils toward the middle of the valley; and finally upward through the soil to the land surface where it is evaporated into the atmosphere to be started again on the unending cycle.

As illustrated also in Fig. 4, the land around the sides of the valley is not alkaline, but is highly productive, supporting prosperous communities. On the other hand, the land near the middle of the valley is relatively non-productive, inert, and non-profitable; not because of lack of water or essential plant-food elements, but because of excessive water, excessive evaporation, and alkali accumulation.

In order to maintain high productivity of the low-lying valley soils drainage conditions should be such that excess water always flows downward through the soil.

In parts of many valleys, artificial drainage is essential to assure downward percolation and prevent upward movement. Under parts of the low-lying lands of Cache Valley, (Utah), for instance, the water pressure in the gravels from 40 to 60 feet below the land surface, is so intense as to cause water to rise in a tube from 10 to 20 feet or more above the surface. The first and essential step toward reclamation and efficient use of these lands is to remove the pressure by pumping water from the artesian aquifer; thus permitting proper drainage and downward flow through the soil.

Drainage not only preserves and improves the soil but also prevents the wasteful evaporation of thousands of acre-feet of water annually. In order to be most effective and economical, the design of drainage systems must be based on thorough and comprehensive study of the water and soil conditions of each project.

Conclusion

Water conservation in the West is intimately related to the management of forest lands, range lands, and valley lands. The tasks of water conservation and land-use management demand the united efforts of many. In these tasks the role of the engineers and the foresters is one of vital importance. By their superior skills, understanding, foresight, and judgment, they must demonstrate that wise use of water and lands constitutes the basis of welfare for all. This is indeed the basis of perpetuation and advancement of civilization in arid regions, and may supplant scarcity of the material requisites of life with abundance for all. These are at once their goals and opportunities.

The challenge of perpetuating agriculture and civilization in arid regions is theirs. The way to meet it is clear. The applications of the sciences to agriculture, our basic industry, must be continued and enlarged. A liberal proportion of intelligence, energy, and funds must be allotted to studies of conservation and use of natural resources: forest, range, mineral, wild life, water, soils. Wise use and preservation of natural resources, guided by the sciences in all of their branches, will insure the perpetuation of civilization insofar as material needs are concerned.

Foresters' Banquet

(*Concluded from page 44*)

dips into their private lives, he introduced the following guests who in turn introduced members of their groups in attendance: George Craddock, of the Intermountain Forest and Range Experiment Station; A. R. Standing, of the regional Forest Service office; A. G. Nord, of the Cache National Forest; James E. Gurr, of the Wasatch National Forest; and Professor Ralph R. Wilson, of the University of Idaho, Southern Branch, at Pocatello.

Thornton G. Taylor, former head of the school of forestry, now connected with the Soil Conservation Service, was principal speaker. His reminiscences of the school's beginning, and his forecasts for the future of the school and the profession were interesting and hopeful. His remarks were doubly appreciated when it was learned that they had precipitated President Elmer G. Peterson's announcement of the elevation of Professor Paul M. Dunn to the deanship. The attendance of President Peterson and Frederick C. Champ, President of the Board of Trustees, was appreciated, and their remarks were appropriate to the occasion.

Some of the high spots of the evening were the entertainment features presented by the trumpet trio composed of Judd Harris, Mark Smith, and Junior Rampton; the songs by Alice Baugh, which made some staid professors pensive over their apple pie; the songs of the Merrill sisters; and the original skit announced by Frantzen Todd and produced by our rising freshmen constellations, Harry J. November and B. C. Smith. The dinner music presented by Eldon Hansen, piano; Junior Rampton, trumpet, and Eugene Peterson, saxophone; provided a pleasing atmosphere.

Committee members responsible for the evening's success were: Sheldon Bell, B. C. Smith, Dean Purrington, Paul S. Rattle Jr., Roy Shipley, Sam McClenaghan, and Eugene Hawks. Patrons included Dean Paul M. Dunn, Professor R. P. McLaughlin, Professor J. Whitney Floyd, Professor George H. Barnes, Dr. D. I. Rasmussen, Dr. L. A. Stoddart, Professor G. H. Kelker, and Arthur D. Smith.

Fall Barbecue

(*Concluded from page 45*)

The last events of the day, chopping, bucking, rope climbing, and the tug o' war were held after the program. Floyd Henderson and Ed Peters showed the effects of wrong living when they failed to place in the two-man bucking contest as did Glen Quigley when he petered out in the one-man bucking. The rope climbing was won by the Freshmen and Prof. J. Whitney Floyd brought up the rear, he still insists his time was good but it got dark while he was climbing the rope so we didn't get the exact time; I'll bet my shekels on "Whit" in an endurance contest though. Gee! but he was up there a long time. "Doc" McLaughlin must have been rooting for the Juniors in the tug o' war because he always stood where the men on the other end of the rope would have to pull the Juniors past that PIPE of his. You can't blame them for not wanting to pass that incinerator of "Doc's."

Congratulations, Freshmen, on the winning of the barbecue and also on your cooperativeness and enthusiasm. You were a big factor in the success of the day and the upper classmen are proud to have you in the club.

Barbecue Sidelines

The impossible has happened! The lowly and humble freshmen have taken the seniors' places. Stick up your noses, freshmen, when you pass an upper-classman.

Remember the thrill of ecstasy we got when Elmer J. Holmes strode up, with the remains of his practice sessions still darkening his chin, and contemptuously outspat all the contestants, including the ranger entry, who had twenty years of practice behind him. The official distance was 18 feet. Congratulations, Elmer. When bigger and better marks are made, you'll make 'em.

Todd did his best to increase the beefsteak enrollment of our party but all his efforts went for naught. The best he could garner was a dizzy cow and a wrecked car. We've got to thank him for trying, however.

The seniors and the Yanks! That combination should go places. Even so, we might say that the Yanks need a couple of pitchers, and the seniors a little more practice.

That frosh finger puller really does things. What a drag he must have. We don't mind a little infraction of the "One Piece of pie rule," but when Andrews nonchalantly strolled up and asked for a fifth piece, the time for drawing the line had come.

* * *

Notice!

E. J. Holmes lost one well used pipe (used for inhaling) at the outing. Anyone finding it please contact Elmer.

Foresters' Ball

(*Concluded from page 39*)

well-suited to the occasion, and the copious punch bowls were centers of genuine conviviality.

Committee members responsible for the complete arrangements for the dance were Forrest Romero, Frantzen Todd, Paul Harris, Acil Roundy, Clyde Hart, and John Morrison. Patrons and patronesses for the evening were Dean and Mrs. Paul M. Dunn, Dr. and Mrs. L. A. Stoddart, Dr. and Mrs. R. P. McLaughlin, Dr. and Mrs. D. I. Rasmussen, Professor and Mrs. J. Whitney Floyd, Professor and Mrs. George H. Barnes, Professor and Mrs. George H. Kelker, and Mr. Arthur D. Smith.

As we go to press, all Foresters are intent upon Paul's Party—scheduled for the evening of Friday, April 8. The dance will be financed by the student body organization and sponsored by the Foresters club. Active advertising in the form of a Forestry issue of the Student Life, and an assembly on the day of the dance is planned. Old Paul Bunyan with his Ox provide the theme for this dance which is to celebrate the elevation of the school to full status.

NATIONAL FORESTS OF REGION 4

Forest and State	*Headquarters*	*Supervisor*	*Gross Acreage*
ASHLEY (Utah and Wyoming)	Vernal, Utah	Taylor, A. L.	1,115,537
BOISE (Idaho)	Boise, Idaho	Mains, G. B.	1,614,933
CACHE (Idaho and Utah)	Logan, Utah	Nord, A. G.	1,050,826
CARIBOU (Idaho and Wyoming)	Montpelier, Idaho	Benedict, M. S.	741,988
CHALLIS (Idaho)	Challis, Idaho	McKee, E. E.	1,358,749
DIXIE (Nevada and Utah)	Cedar City, Utah	Betenson, Blaine	943,439
FISHLAKE (Utah)	Richfield, Utah	Mattsson, C. A.	1,524,006
HUMBOLDT (Nevada)	Elko, Nevada	Torgerson, A. R. (acting)	1,182,586
IDAHO (Idaho)	McCall, Idaho	Shank, H. M.	1,815,231
LA SAL (Colorado and Utah)	Moab, Utah	Heywood, L. D.	543,441
LEMHI (Idaho)	Administered as part of Challis and Salmon		1,379,316
MANTI (Utah)	Ephraim, Utah	Humphrey, J. W.	796,847
MINIDOKA (Idaho and Utah)	Burley, Idaho	Price, C. E.	636,998
NEVADA (Nevada)	Ely, Nevada	Larson, Geo. C.	1,197,959
PAYETTE (Idaho)	Boise, Idaho	Stewart, J. O.	1,351,079
POWELL (Utah)	Panguitch, Utah	Folster, A. C.	1,056,593
SALMON (Idaho)	Salmon, Idaho	Godden, F. W.	1,723,872
SAWTOOTH (Idaho)	Hailey, Idaho	Moore, F. S.	1,246,436
TARGHEE (Idaho and Wyoming)	St. Anthony, Idaho	Scribner, S. C.	1,419,699
TETON (Wyoming)	Jackson, Wyoming	West, J. W.	1,830,222
TOIYABE (Nevada)	Reno, Nevada	McQueen, Alexander	2,198,499
UINTA (Utah)	Provo, Utah	DeMoisy, Chas. Jr.	939,944
WASATCH (Utah and Wyoming)	Salt Lake City, Utah	Gurr, J. E.	1,007,723
WEISER (Idaho)	Weiser, Idaho	Raphael, J.	665,030
WYOMING (Wyoming)	Kemmerer, Wyoming	Arentson, C. B.	1,710,219
		Total For Region	31,051,172

UTAH FORESTER ELECTIONS

On the 28th of April the Utah Foresters met to elect the officers for the coming year. In the final balloting the results were as follows: Dean Hobson defeated LaMar Mason for the presidency; LaMar Mason was elected vice president by acclamation; Elmer Holmes was retained as secretary, also by acclamation; Stanley Gessel defeated Frantzen Todd for the editorship of the Utah Juniper and Ed Chatelain was elected business manager by acclamation; Paul Rattle defeated B. C. Smith for the position of club reporter.

Congratulations, fellows; may your tasks be successful and enjoyable.

PHI GAMMA RHO ELECTIONS

At the annual election meeting of Phi Gamma Rho, held Thursday, May 5, the following officers were installed to head the fraternity for the coming year: President, Stanley Gessel; Vice President, Ervin Schmutz; Secretary, Thomas Evans; Ranger, DeWitt Grandy.

NOTICE

Copies of this issue may be obtained from the School of Forestry, Utah State Agricultural College, Logan, Utah, at a cost of fifty cents per copy.

To all the alumni and former students the editors are grateful for the financial support. We also appreciated the many interesting letters.

FOREST TREES

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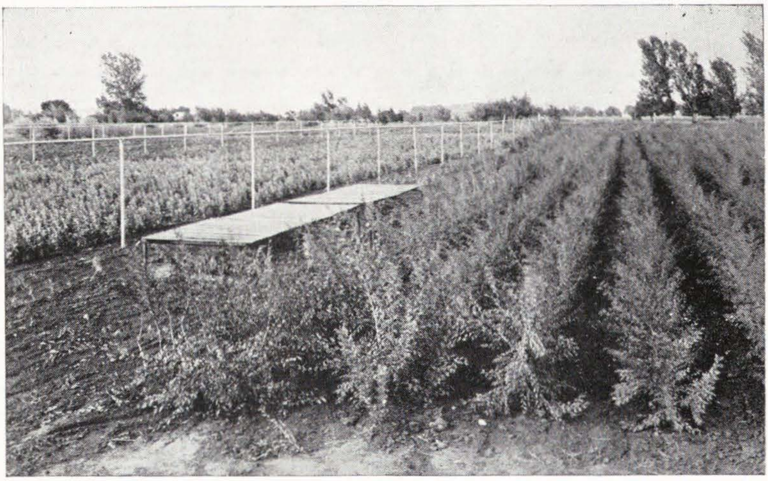

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