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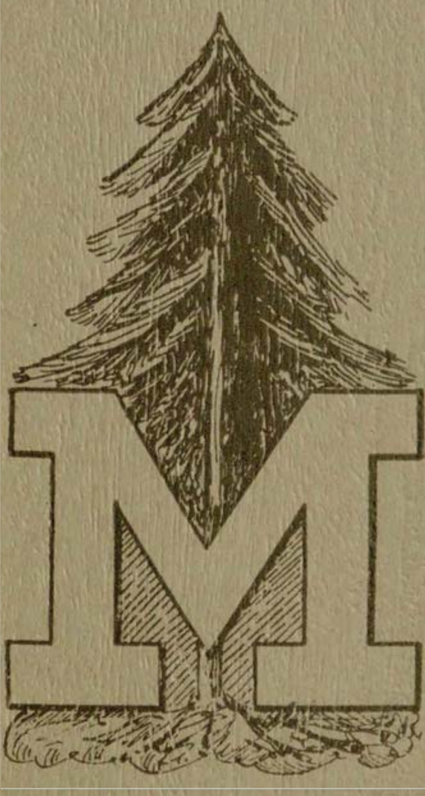

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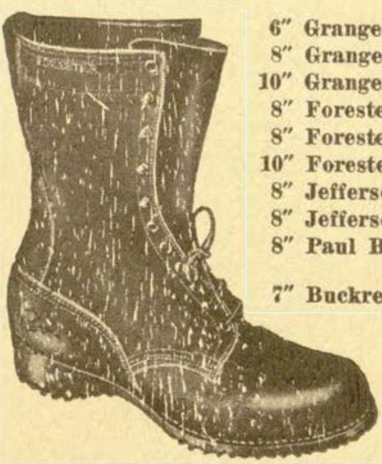

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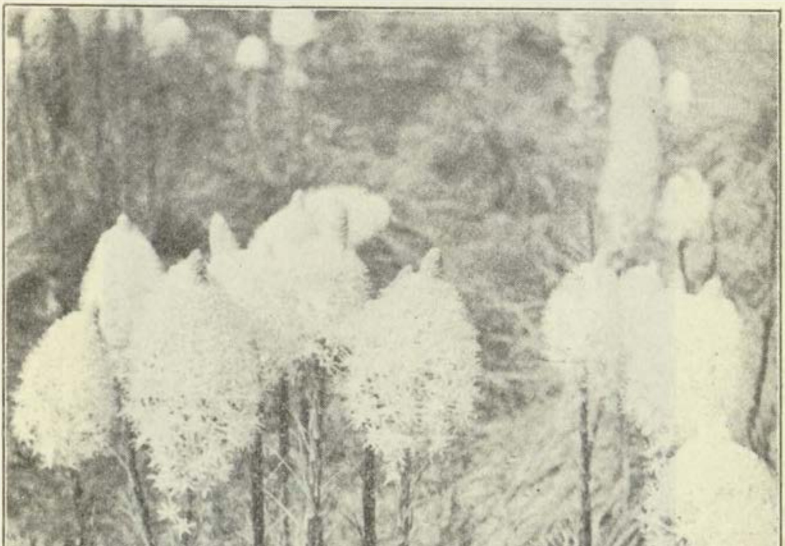
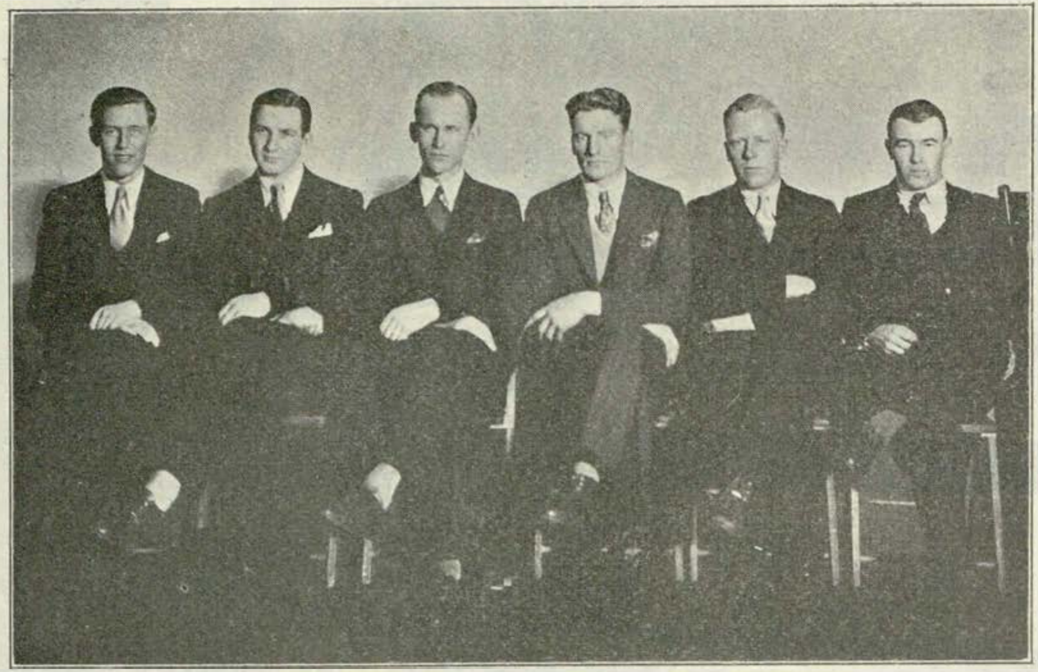


BEAR GRASS IN BLOOM

DR. J. W. SEVERY

FOR his fair dealing, his generous enthusiasm, his sincerity, and his helpful interest in our profession, we, the members of the Forestry Club of the State University of Montana, dedicate this issue of the *Forestry Kaimin* to Dr. J. W. Severy, Professor of Botany.

THE STAFF



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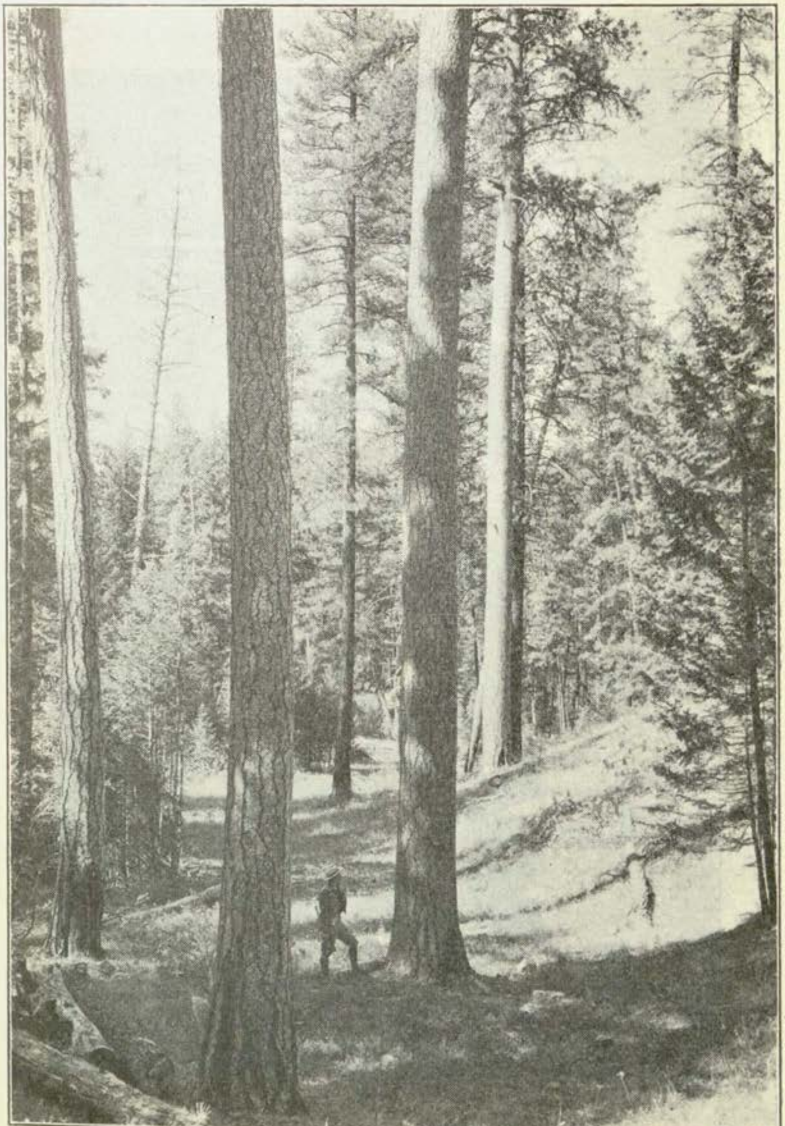

Choice Ponderosa Pine on Blackfoot River, Western Montana

Does Fire Protection in Ponderosa Pine[1] Pay?

By I. V. Anderson, *Associate Forester*
Northern Rocky Mountain Forest and Range Experiment Station

Ponderosa pine is no doubt the most important commercial pine west of the Great Plains. Its geographic commercial range extends over a tremendous area. It is the principal timber tree of the Black Hills region of South Dakota, the lumbering centers of western Montana, south central British Columbia, Oregon and Washington east of the Cascade Mountains, California, Arizona and New Mexico. The total volume of ponderosa pine contained within its commercial range is estimated at 251 billion board feet: a tremendous volume of timber when compared with the volume of California sugar pine and Idaho white pine, its only two western competitors in pine lumber markets.

When the 19 billion board feet of virgin Idaho white pine and the 36 billion board feet of virgin California sugar pine are gone, there will still be an enormous supply of ponderosa pine. Just how long this supply of timber will last is difficult to predict, because of the various factors effecting the rate of cutting which constitutes the greatest drain. During the past ten years the annual cut of ponderosa pine has averaged 2,655,441,000 board feet. This, of course, includes only that volume being manufactured into lumber. Insects, disease, and the elements (wind, etc.) are also important agencies that must not be overlooked in the annual harvest of ponderosa pine timber. However, the normal losses from these agencies are relatively unimportant when compared to fire, the agency that in a sense has been chiefly instrumental in the development of the composition and character of our virgin ponderosa pine stands as we find them today.

Fires throughout the past two or three centuries have resulted in stands ranging from seedlings to 600-year-old veterans. At regular intervals fires have destroyed and damaged the young growth of the stand leaving only the most hardy as survivors, many of which carry the scars of their struggle for existence throughout their lifetime. At first thought, the loss to the lumberman from fire seems negligible. Usually not more than 5% of the merchantable ponderosa pine trees are killed outright by a single fire, and rarely as high as 15%, depending upon the severity of the fire season and the amount of underbrush, advance growth, and associate species present in the stand. In fact, these losses have sometimes appeared so trifling that the desirability of fire protection has been questioned. If the actual number of merchantable trees killed outright by the fire was a true measure of the damage, fire protection might be omitted if placed on a strictly economic basis. However, it is not. Quality depreciation in the wood of the fire-scarred tree is a more serious loss.

A study recently made in the ponderosa pine stands of western Montana indicated that six trees out of twenty-six per acre showed visible signs of fire damage principally in the form of fire scar. Based on lumber prices prevailing in 1928, these trees each suffered an average loss of $1.81 in lumber selling value. The average selling value loss per acre would then

(1) Formerly called western yellow pine.

be 6 x $1.81, or $10.86. Chart 1 shows how this loss varies for the different sized ponderosa pine trees. As would be expected, the loss in value from fire increases with an increase in tree size. This is not a theoretical loss, but a measureable loss caused by recurring fires during the past century or so.

Chart 2 of this article shows an excellent example of the effect of recurring fires on old-growth trees. During its lifetime of 490 years, this tree withstood the ravages of not less than four fires, and at the time of logging it was still alive although in poor vigor. Naturally the butt log of the tree sustained the greatest damage from the fires. An analysis of the yield of lumber produced from the four logs obtained from this tree follows:

PER CENT LUMBER YIELD BY GRADES

Log Position	Select	1 & 2 Shop	3 Shop & Inch Shop	Common 1 & 2	Common 3	Common 4	Common 5
Butt	16	0	3	0	12	44	25
2	59	0	1	0	40	0	0
3	13	13	9	0	26	39	0
T	0	0	0	0	10	90	0

The small amount of select in the butt log, as indicated by the above figures, is no doubt entirely due to the fire scar. The yield of select for the butt cut was only 16% compared to 59% for the second log in the tree. It has been ascertained for sound overmature trees that the butt cut is consistently equal and usually better in quality than the second or third logs in the tree. An examination of the lumber produced from logs 3 and 4, which respectively produced 39% and 90% of number 4 common lumber, showed considerable rot. This condition is quite common in trees that are badly fire scarred and can no doubt be indirectly attributed to the fire damage.

A computation of the selling value of the lumber produced from this tree also shows the butt log to have a lumber value (green chain grade based on 1928 average prices) of $6.21, compared to $16.73 for the second log. Thus the net loss to the butt log from fire scar was $10.52, or the lumber produced from the butt cut was worth $20.70 per thousand lumber tally compared to $41.82 for the second cut — a startling loss for which the fire scar was directly responsible. Such a log as this can not be profitably converted into lumber under even normal market conditions. Consequently it should be culled out in the woods. This tree should have been long-butted at 8 feet above the stump cut and two 16-foot logs utilized above that point. The first log would have then yielded as good a grade of lumber as the second log actually did, while the next log would have also produced a good yield of select. Thus the number 5 common lumber could have been entirely eliminated, as well as more than half of the yield of number 4 common.

Another comparison of sound and of fire-scarred butt logs based on economic logging studies follows. It shows clearly the loss from fire damage.

Upper—Six ponderosa pine trees out of twenty-six per acre show visible signs of fire damage. Lower—Long-butting of ponderosa pine should be practiced in such cases as this. Note the mass pitch showing on top of the stump.

Values in this case were also computed from 1928 average annual prices:

BUTT LOGS 17″ DIAMETER SMALL END

	Taper	Per Cent of Volume Lost	Per Cent of Value Lost	Selling Value Per Log	Selling Value Per M
Sound	3	—	—	$8.94	$49.70
Fire Dam.	3	21	35	5.81	32.25
Sound	5	—	—	7.98	43.80
Fire Dam.	5	25	22	6.23	34.60
Sound	6	—	—	7.65	42.50
Fire Dam.	6	40	47	4.08	22.65
Sound	7	—	—	6.39	35.50
Fire Dam.	7	7	28	4.60	25.55

The logs used in the foregoing comparison were from trees 20, 22, 23 and 24 inches in diameter at breast height, respectively. The sound logs were selected from trees in the stand at random, with no effort to pick out trees of unusual quality. Even though the loss in volume of the fire-damaged butts ranged from 7% to 40%, the value loss was far greater and more consistent. It ranged from 28% to 47%, which represented a loss in dollars and cents ranging from $9.20 per M to $19.85 per M. The log that lost only 7% in volume depreciated 28% in value, or the value loss was four times as great as the volume loss.

The milling of this class of logs has been common practice for many years and no doubt was justified from a conservation standpoint. It does, however, result in a surplus of the poorer grades of lumber, namely, 4 and 5 common. This surplus is further supplemented by an additional amount of these grades that are normally developed from the heart of higher grade logs as well as the top logs of the tree. Consequently the lumberyard becomes choked with these non-profitable grades which have reduced the operator's average conversion value substantially. As a relief measure, judicious long-butting should be practiced. It is safe to say that any ponderosa pine tree should be long-butted if one-half or more of the tree butt has been burned away. Subsequent defects — such as worm holes, mass pitch, and rot — developing from the fire-scar wound are also just as important factors as the fire scar itself in determining the necessity of long-butting. In some cases, even where less than half of the butt has been destroyed by fire, these defects will develop to such an extent as to necessitate long-butting. Thus it is evident that no set of hard and fast rules can be laid down as a guide for long-butting. It does, however, seem entirely feasible to train the average woods sawyer of the Inland Empire to the intelligent application of long-butting.

The importance and seriousness of fire loss over a long period can best be illustrated by computing the loss sustained by a given logging unit. The Camas logging unit of the Flathead Indian Reservation in western Montana contains approximately 120,000,000 feet of ponderosa pine within a logical protection unit of 23,000 acres. The timber, however, is contained on about only two-thirds of this area, or 16,000 acres. This is a typical pine stand for this region, so it is assumed that depreciation from fires during the past century or so has been identical with the average. If this is true,

the total fire depreciation of this 120,000,000 logging chance during the past century or so has been $10.86 per acre, or $173,760.00 for the entire stand of timber. This depreciation figure is, of course, based upon the actual merchantable timber area of 16,000 acres.

Studies of rate of growth of ponderosa pine, after the virgin stand has been properly cut over leaving the young thrifty trees for a future crop, indicate that, with adequate fire protection, it will take 120 years to pro-

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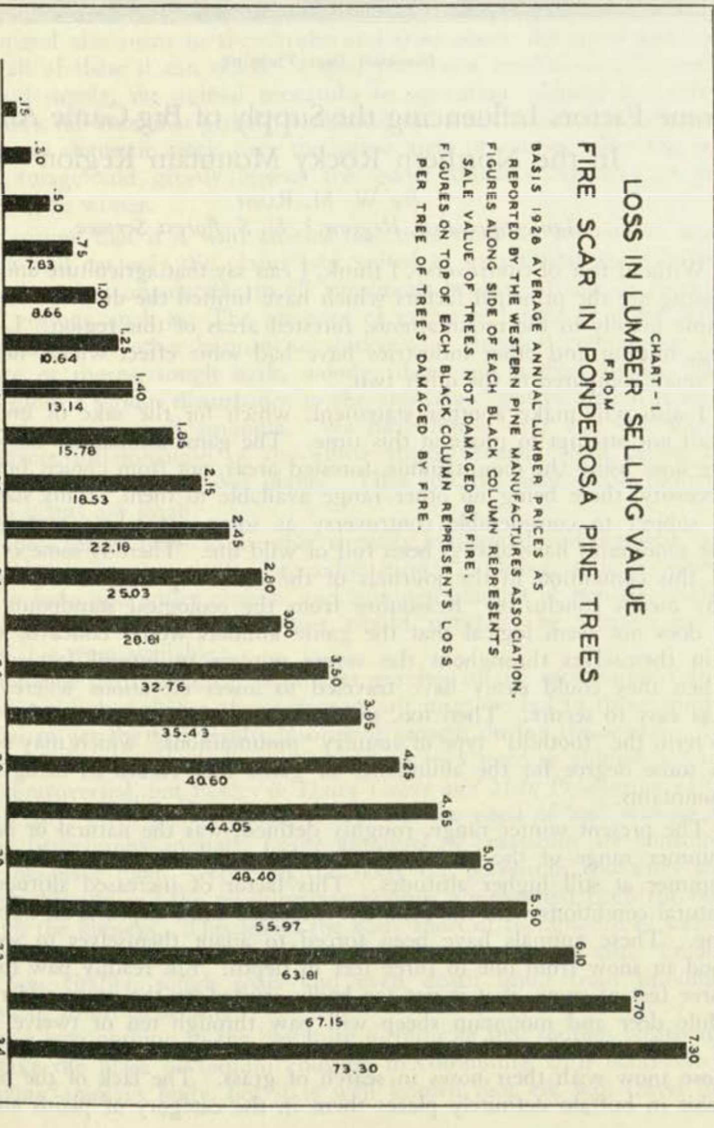
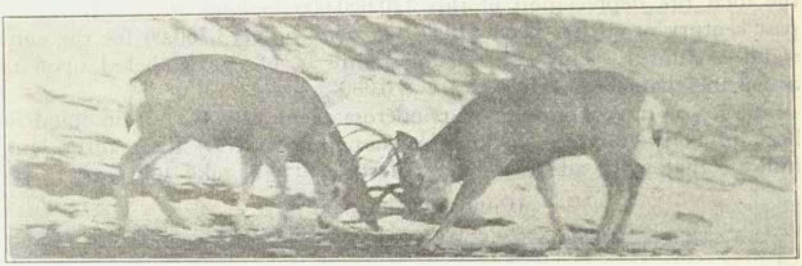




Blacktail Deer Fighting

Some Factors Influencing the Supply of Big Game Animals In the Northern Rocky Mountain Region*

By W. M. Rush
Game Specialist, Region 1, U. S. Forest Service

Without fear of controversy, I think, I can say that agriculture and stock-raising are the principal factors which have limited the distribution of big game mainly to the mountainous, forested areas of this region. Lumbering, mining and other industries have had some effect which, however, is small compared to the other two.

I also will make another statement, which for the sake of brevity, I shall not attempt to prove at this time. The game animals of this region are now using the mountainous, forested areas, not from choice, but from necessity, there being no other range available to them. This statement is subject to considerable controversy as some naturalists contend that the mountains have always been full of wild life. There is some evidence of this contention in the journals of the early explorer but it is not by any means conclusive. Reasoning from the ecological standpoint alone, it does not seem logical that the game animals would endeavor to sustain themselves throughout the severe winters in several feet of snow when they could easily have traveled to lower elevations where forage was easy to secure. Then too, the early explorers were somewhat prone to term the "foothills" type of country "mountainous," which may account in some degree for the abundance of game they record as being in the mountains.

The present winter range, roughly defined, was the natural or original summer range of the game animals; this game now grazes during the summer at still higher altitudes. This factor of increased altitude over natural conditions with the resultant increased snow depth is an important one. These animals have been forced to adapt themselves to securing food in snow from one to three feet in depth. Elk readily paw through three feet of snow, if it is not too badly crusted, to the grass underneath. Mule deer and mountain sheep will paw through ten or twelve inches of snow. Buffalo will not paw at all but will push through a foot of loose snow with their noses in search of grass. The lack of the pawing habit in buffalo definitely places them in the category of plains animals.

Buffalo would surely perish in the mountains if they were not artificially fed. Perhaps this pawing habit has either been acquired by deer and elk or else greater developed since the game has been confined to their present range where snow is such an important factor in limiting their food supply.

Concentration of the animals in the fall months is first to the areas of lighter snowfall, and as the snow becomes deeper, the concentration is to more limited areas. The deeper the snow the less an animal can uncover by pawing, and the animal has less and less choice of food plants to eat, until finally it is eating every vestige of plant life it uncovers. The animal also turns to the shrubs and trees above the snow and consumes all of these it can reach. Under the worst conditions of snowfall and food supply, the animal succumbs to starvation. Under less severe conditions, the animal is greatly weakened and unfit to nourish its young. Grazing of domestic stock over the game area, of course, takes the best of the forage and greatly lessens the game animal's "chances to pull through" the winter.

We assume that if a wild animal has an abundance of food to select from, it will eat only the plants best suited to its physical nourishment. Many plants are unpalatable to all ruminants because of one or more of several reasons, such as: The presence of excessive tannic or other acids, toxic alkalines or other harmful or unnecessary chemical compounds, the presence of thorns, tough bark, woody fibers and barbed awns. Such plants cause a serious disturbance to the animal's digestive system if eaten in any but very small amounts. We have found deer and elk with a very severe inflammation of the entire digestive tract from eating the coarse woody parts of browse plants. Then too, the nourishable elements in such plants are small.

An ideal forage plant is one that is easily masticated and digested, contains a large percentage of protein for muscle building, soluble mineral salts for bone and antler growth, and minimal amount of non-assimilative mineral salts. This type of plant would naturally be selected by an animal if it were available.

Experience with domestic ruminants grazing in the mountainous areas of this region has shown that common salt must be fed to these animals in order to get the best results in animal growth during the season. The subject of the physiological necessity of salt to a grazing animal is somewhat controversial, but Eckles in *Dairy Cattle and Milk Production* (1924, MacMillan), gives the following reason for the need of and craving for salt by herbivorous animals: Large amounts of potassium are consumed with the plant food. While in the body the potassium combines with sodium chloride and the resulting compounds are excreted from the body through the kidneys. This leaves the body short of the amount of sodium chloride needed and results in the well-known craving for salt. Emaciation, low vitality, rough coats and even death result from prolonged periods of insufficient salt.

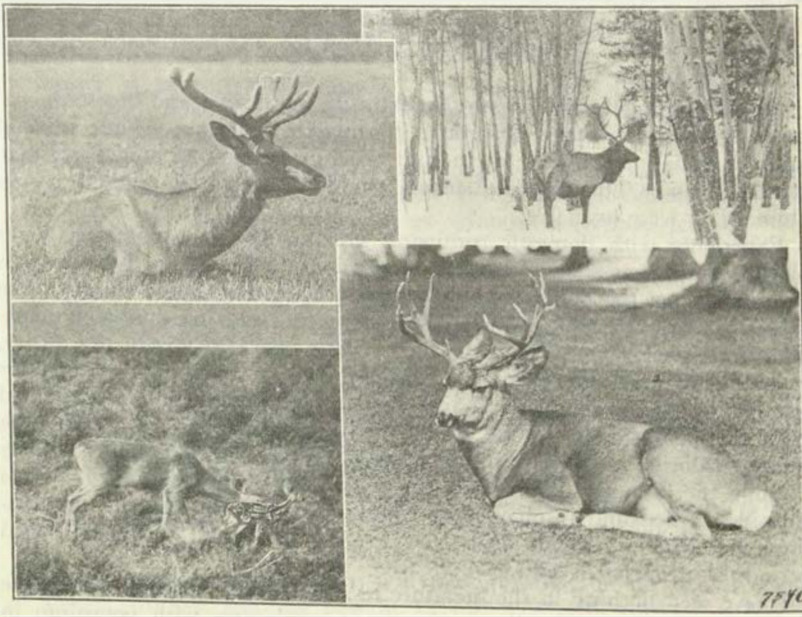
I have seen nothing in the literature to indicate that sodium bicarbonate will take the place of sodium chloride in combining with potassium in a grazing animal's body, but it is well known that elk will travel long

distances to "elk licks," the waters from which, our analyses show, carry about ninety times as much soda as salt. As these "licks" are comparatively few over large areas of the mountainous regions, I think it is safe to say that lack of salt (or possibly soda) is an important factor in our game animal problem.

Extermination of predatory animals has been sought over large areas in this region to protect both domestic and game animals, and these campaigns have been very successful with such species as grizzly bears, mountain lions and wolves. The coyote's intelligence and adaptability to changed conditions have saved it from being anywhere near the point of extermination. Predators are necessary to game animals in several ways. They kill and devour weakened and diseased animals, thus acting as a check on disease. Predators keep range-destroying rodents in check, and they keep game animals alert and speedy so that they are not such easy prey for humans.

Predators are detrimental to the game supply when they kill excessive numbers of healthy individuals, which makes some sort of control necessary. They also act as hosts to some of the parasites which infest game animals.

The use of poisons has been successful in killing coyotes and this method in the hands of careful, experienced men working under proper restrictions cannot be condemned. However, the poison method is easily abused and has resulted in some serious unbalances in our wild life. Improper handling of poison has resulted, in some cases, not only in greatly reduc-



Upper left—Young bull elk, June 10. Upper right—Mature bull elk. Lower left—Whitetail doe and fawn. Lower right—Mule deer, October.

ing the number of coyotes, but in local extermination of marten, badgers, weasels, owls, hawks and other carnivores whose staple diet is mice, gophers, ground squirrels, and other rodents. Removing this check on the range-destroying rodents allows them to increase enormously in numbers and creates a serious drain on the grazing herd's food supply. Also the extermination of bears, wolves, lions and coyotes removes a check on the deer family's increase and allows them to increase to numbers above the carrying capacity of the range, thus again tending to complicate the deer food-supply problem and favors the spread of disease through concentration. Thus it seems that the carnivora are essential to the well-being of both classes of animals they prey upon.

Game animals are subject to mineral deficiency diseases very much the same as cattle and sheep. These are due to a lack of sodium and phosphorus in the food supply, which results in softened and deformed bones.

The ingestion of large quantities of course, woody browse or of such material as pine needles, does not furnish a sufficiency of protein and fats, which results in emaciation, loss of vitality, and other complications. In addition, it sets up an acute inflammation in the digestive tract.

For an illustration of the manner in which game animals suffer from parasites, the deer lung worm will be cited. This lives in the lungs of the deer and deposits its ova in the bronchial tubes, where they are carried to the throat and swallowed, thus passing through the digestive tract and to the ground with the deer's excrement. Passing through several molts, the ovum develops into a migrant larvae which travels up grass stems and encysts. A deer eating this grass with the infective larvae becomes infected in the lungs with the mature worm. Light infections are comparatively harmless, while heavy infestations are fatal. Many of the parasites which infest game animals have a somewhat similar life cycle.

On our game ranges where the game animals concentrate, we have a concentration of ova from parasites, a concentration of infective larvae encysted on the forage plants, an approximately 100 per cent utilization of the forage and a very heavy reinfestation of the deer after each concentration.

The same general story holds good for the bacterial diseases, such as foot rot, lumpy jaw, calf diphtheria, streptococci infections, and some other diseases.

Recently a new disease has been discovered in the moose of Minnesota, in which the common wood tick acts as a carrier. This disease also is favored where moose are concentrated in yards.

Pneumonia in deer and mountain sheep has caused serious losses. In deer the pneumonia is caused by bacteria. Undernourishment, exposure to severe weather and heavy parasitization predisposes the animal to the attack. In sheep there are two types, in one of which scab mites denude the dorsal regions of the sheep of hair, thus removing the needed protection from extreme cold. In the other type, lungworm larvae invade the air cells of the lungs causing the verminous type of pneumonia. Both of these types of pneumonia are favored by heavy concentration on the winter ranges.

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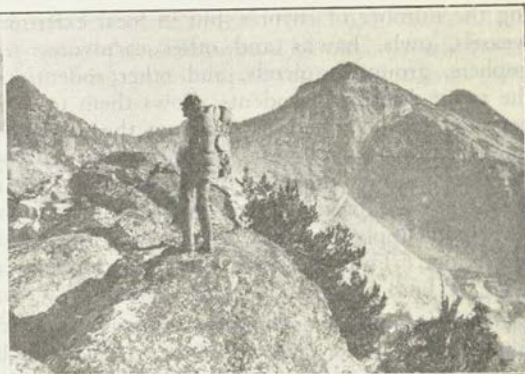


Seen-Area Mapping

By C. B. Sutliff
United States Forest Service

The selection of points to serve as detection positions of the fire-control organizations in the early days of Region One, and even through more recent years, was, as a rule, accomplished by comparatively simple methods. The greater task in those days was that of securing sufficient finances with which to man the position after selection. Such factors as peaks with great altitude, sharp, barren tops, great visible distances therefrom, within heavy lightning zones, etc., were given considerable weight in making final decisions. Final inspection for approval was usually made by the supervisor or his assistant, accompanied by the district ranger. Often this trip was made in midwinter on snowshoes. Mapping of visible area was seldom done; usually a cursory check of the foregoing factors constituted the basis for selection without further comparison or "weighing up" against other adjacent peaks.

Today, fire-control organization placement planning takes on an altogether different aspect. With appropriations greatly increased over those of past years, fire-control organizations are rapidly reaching a point where further intensity cannot be safely justfied by acceptable returns in the form of further reduced damages until comprehensive analyses and organization placement and transportation plans, based upon estimated potential values, presuppression and suppression costs, have been completed and allowable damages determined. Undoubtedly these plans and analyses will substantiate further intensity of fire-control forces upon some of the more valuable forested areas. It is just as probable that other low value areas will prove to be overmanned at present.

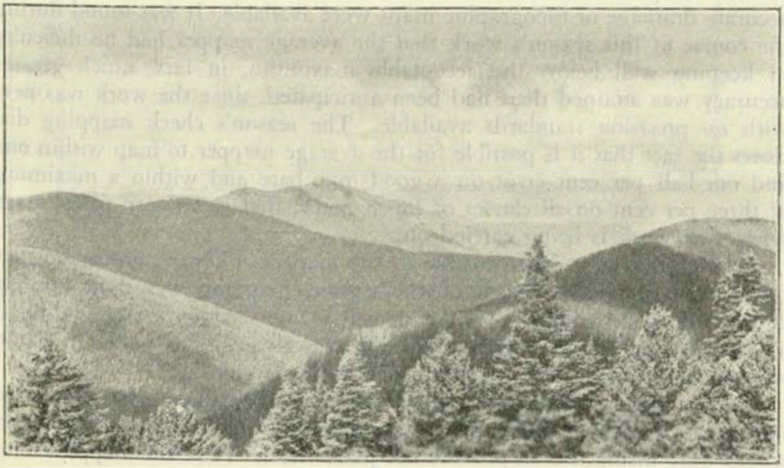
Fire-control organization placement and transportation planning were undertaken in earnest by the Forest Service of Region One in 1931 and 1932.

The first and most important factor, greatly influencing the degree of success of any fire-control organization, is the detection system. To effect

a thorough analysis of this phase of fire-control work, maps showing the exact area visible from each potential lookout point or patrol route within the unit to be analyzed must be available. The work of obtaining these maps for Region One was begun in May, 1932, by a corps of specially trained and equipped men known as seen-area mappers. The large majority of men selected for this work were experienced in woodsmanship, lookout and fireman duties and had demonstrated their skill as such by previous employment and by having attended a special training course. Forest school students comprised the majority of the mappers.

Training camps were held at Missoula for the benefit of forest school students and on several of the western forests where the work was to be done. Each camp was from two to three days duration and the average attendance was from six to eight trainees (except Missoula where a greater number attended) and the instructors, consisting of a representative from the Regional Office engineering staff, and the men in charge of the work upon the unit where held. The trainees were provided with complete outfits and taken to a lookout point where they were given intensive instructions, individual attention and training, and their ability thoroughly checked throughout the course, each trainee going through the entire procedure of mapping one position. Upon completion of a camp each trainee was carefully rated and in this manner the personnel of the 1932 season was chosen. To those selected was issued a book of detailed instructions for reference throughout the season.

The mapping equipment of each mapper consisted of a specially made packsack containing the following articles and weighed about 32 pounds: One Army sketching board, 16 x 16 inches, and tripod (collapsible); 1 compass and pocket map (also for fire duty); 1 abney level; 1 alidade; 1 16 x 16-inch map folio; 6 2-inch Bulldog clips; 1 profile chart; 1 belt axe; 1 pair tree climbers; 1 safety belt; 1 timber scribe; 1 6-inch scale; 1 protractor; 1 pair field glasses; 1 pair amber goggles. Besides the regular



Typical Seen-Area Mapper's Country

equipment mentioned, a supply of maps and tracing paper cut to 16 inches square, data record forms, profile paper, sandpaper, needles, erasers, pencils, correction map, note paper, diary and instructions were necessary. The addition of a few personal necessities and oftimes a kapok bed and a few rations, made the outfit a nice pack of some 40 to 60 pounds.

From the training camp each mapper was taken to his allotted area and a lineup of the points and territory to be worked was provided, his outfit checked, maps and other needs supplied and the actual seen-area mapping begun.

A synopsis of a seen-area mapper's instructions, allowable error and of the routine followed in mapping a position is worthy of mention.

Locating the point to be mapped is the first step and is accomplished by the three-point method using tracing paper over one-half inch map upon sketching board with alidade and extra hard, fine-point pencil. Location must be as nearly correct as is possible to attain, using the most accurately located points visible for alidade shots.

After determining location the actual mapping is done. All mapping is done upon the best one-half inch per mile map available. The mapper must keep his sketching board in proper orientation at all times, must use alidade constantly, must use profile chart as often as practical where suitable topographic map is provided, must show all area seen from main point in solid color and that from patrol vantages in hachure, changing angle of hachures for each patrol if more than one point is mapped on the same sheet. All visible and blind areas are mapped to a distance of fifteen miles defining as small an area from the surrounding as is possible under conditions existing at the time, usually to 200 acres near fifteen-mile limit and decreasing to a 50-acre minimum for nearby areas.

For the purpose of obtaining uniform accuracy in the seen-area maps and to provide a basis for check mapping, two percentage figures were adopted as maximums for acceptable precision — ten per cent where inaccurate maps had to be used as the base and five per cent where fairly accurate drainage or topographic maps were available. It was found during the course of this season's work that the average mapper had no difficulty in keeping well below the acceptable maximum, in fact, much greater accuracy was attained than had been anticipated, since the work was new with no precision standards available. The season's check mapping discloses the fact that it is possible for the average mapper to map within one and one-half per cent error on a good map base and within a maximum of three per cent on all classes of forest maps; that is, western forest maps where the work is being carried on.

Field glasses were indispensible to the mapper; likewise, amber goggles for certain occasions. Much of the distant mapping was done entirely dependent upon the glasses for detail such as intersections of seen and blind areas, pockets and low ridges. Mapping was always done in the direction where visibility was best, usually away from the sun.

Occasionally, in the lower country, the tree climbers and safety belt came into play. Timbered peaks had to be mapped from tree tops where open spaces were insufficient to provide adequate vision. Here the mappers were

(Continued on page 63)

Investigative Work *in the* Forestry School

A Glimpse at the Investigative Program Of the Forestry School

By Fay G. Clark
Professor of Forest Management, School of Forestry

Due to lack of funds for the purchase of equipment and heavy teaching loads carried by the faculty, the School of Forestry has never been in a position to carry on a great deal of research or investigative work. This year, with seven men registered for graduate work and a stimulus among the undergraduate students for work in Forest Problems courses, help has been made available for much needed work in Forest Management, Engineering, Products, Grazing, Mensuration and Pathology. A small allotment of funds enabled the school to purchase the most essential supplies and equipment and to cover the cost of transportation and overhead in the field.

The impetus to the present program was started last June when the author, on his own initiative, donated a considerable portion of his time to helping the Forest Service conduct an economic logging study on the Ohio Match company's operation in Idaho, and later some assistance was extended on the same type of study in yellow pine on the operations of the Anaconda Copper Mining company at Greenough and Bonner, Montana. The Forest School's co-operation in this work is a tentative promise to publish the results of the study when they have been completed by the Forest Service.

The School of Forestry was exceedingly fortunate in being able to take advantage of the offer of the R.F.C. to furnish labor for any investigative work that the school might wish to undertake. As a result of this, a thinning and sanitation project in a 40-year-old stand of Douglas fir and yellow pine was proposed on the school forest up Pattee canyon. A tract of 90 acres was about equally divided in three plots for heavy, medium and light thinning. The spacing of the residual stand was 12 feet by 12 feet, 9 feet by 9 feet and 6 feet by 6 feet, respectively. The trees to be left were marked by small pieces of paper fastened to the bark with tacks. A great portion of this marking was done by upperclass students, who took care to leave only the dominant, healthy trees in the stand.

Trucks for transporting the crew were furnished by the Forest Service, together with the necessary tools and equipment. The School of Forestry furnished the maintenance of trucks and equipment. "Big Lou" Vierhus was placed in charge of the woods end of the operation and pushed the project through to completion in a very creditable manner. Lynn Thompson had charge of the equipment and kept the costs on the project.

This project is the largest of its kind that has been attempted in this region, the object being to determine:

First: The best spacing for growth of this type of timber.

Second: The relative cost of the various degrees of thinning.

Third: The feasibility of eradicating mistletoe from the stand. (This stand was heavily infected.) Whenever noticed, all infected trees were removed, to the extent of clear cutting small areas.

Sample control plots are established on each of the three areas for the purpose of studying rate of growth, relation of increase of crown volume to the increase in volume of the stem, and the effect of the disturbance of the stand on the mistletoe infection.

All of the mature fir and cull yellow pine was removed from the area by the residents of Missoula under free fuel wood permits. With the ex-

Young Stand of Yellow Pine and Douglas Fir on Thinning Plots in Pattee Canyon, School Forest

ception of some mature yellow pine, this leaves the area covered with a 40-year-old stand of fir mixed with yellow pine of the same age class.

This project represents a total investment of nearly $4,000.

Ecological studies are to be conducted on the area to determine changes in the soil cover and rapidity of natural seeding. Permanent mil acre quadrates are to be established along a transcript for this purpose.

Additional permanent sample plots were established in fir, larch and yellow pine a year ago to determine the rate of growth from thinning, the rate of mortality in unthinned stands, and the effect on the residual stands of converting a mixed stand of fir and yellow pine to a pure stand of pine. In the short time these "conversion" plots have been established, the trend in behavior of the residual pine stand seems to indicate that this is not good practice. The trees become weakened from sun scald and are apparently more subject to attack from bark beetles. Pines mixed in a heavy stand of Douglas fir are seemingly escaping from this pest. This might have a decided bearing on the planting of yellow pine in regions subject to beetle infestations, where a mixed stand of fir and pine may have a better chance of survival than a pure plantation of pine. However, in this respect it is too early to draw any definite conclusions from the experiments.

Can any one give us a method of obtaining the crown volume of a tree in such manner that eccentric growth in the crown can be noted at the periods of remeasurement? That is a problem confronting us. Perhaps

our "pin hole" camera of other days and tracing cloth may be a solution: tracing the outline of the image together with a scale and then transferring that to a modified volume sheet similar to that of Reineke's.

We have designed a hypsometer for obtaining log lengths in economic selective cruising that does not require the observer to measure the distance to the tree, a distinct boon to cruisers in rough country at 3 o'clock in the afternoon. All that remains to be done is a field check into the accuracy of the instrument before definitely recommending it. To accompany this is a graphic volume table — designed by Millard Evenson — giving the volume of a tree according to its form quotient and merchantable length. An exhaustive field check is also needed on this simple instrument to determine its limit of error; also if a "merchantable form quotient" having a sliding top diameter (as in the case of economic logging) will give results sufficiently accurate for practical work in the woods.

Does the height of a crown on the bole of a tree affect the shape of the bole and how fast and when does a tree grow? We are planning on finding out the answers to these questions by pruning some trees, setting contact points at D. B. H. and base of crown, and measuring the weekly growth by a dial micrometer.

When a dense forest cover is removed what changes take place in the vegetation? Do mycorrhiza have any influence on this and, if so, what? "California" Gunterman is chasing the elusive mycorrhiza and after several severe struggles he has succeeded in capturing several. With these in captivity he hopes to determine if they are the cause of "fail places" in the stand of timber and if they have anything to do with the establishment of the beautiful grassy parks in our heavy stands of timber.

Pathology is also having its inning. Jack Shields and Stan Larson, with the suggestive aid of Drs. Severy and Waters, are trying to extend the knowledge of the profession relative to mistletoe, *Razomoufskya (Arceuthobium) douglasii,* in Douglas fir and its influence on the quantitative and qualitative growth of its host — together with possible method of control. In addition to learning many of the mysteries of microtechnique (on their own time), they have developed an apparatus, out of a lot of odds and ends of junked equipment, to make photographic enlargements of microslides. The same apparatus can also be used as a lantern to throw the image on a screen, when a single wood cell is so enlarged that it can be measured in terms of inches. How the trees are infected and the factors favorable to the infection are questions this investigation hopes to be able to answer. Permanent sample plots have been established on the school forest for observation, over a sufficient period of years, in order to obtain additional data on this forest parasite. It is an interesting piece of investigation which most unfortunately will require several years of labor before definite conclusions, if any, can be reached.

What type of roofing material has the best insulating qualities? This is a question that has long vexed architects and lumber dealers, as well as all those living in a rigorous climate who desire to build a warm habitation and cut down on the fuel bills. Larson, under the direction of Professor Ramskill, has decided to find out. Stan is not only an expert on thermocouples that are astonishingly sensitive to minute fluctuations in

temperature, but is also developing into a first-class carpenter and instrument maker. Ever try to make an automatic heat regulator? Ask Stan how to do it with a strip of copper cut from an old wash boiler and a few pieces of wire and discarded telephone batteries. Joe Woolfolk was the teacher, he in turn learning the mysterious business from Drs. Shallenberger and Little of the Department of Physics. Junk took the place of expensive equipment and answered the purpose fully as well. The most noted scientists followed the same identical plan. Perhaps it does not pay to have too much money to spend on laboratory equipment.

Woolfolk and Bob Cooney are busy continuing the work on seeds from range grasses, started by Barry Park, Chet Jackson and others several years ago. Woolfolk has designed an apparatus to give the fluctuating temperatures of the clear frosty nights and brilliant hot days of the highland pastures of our national forests. Whether he can fool the little seeds, coming from these locations, and coax them to sprout and grow into grass is the thing he is trying to find out, together with the length of time the coaxing takes and the percentage of the number that are fooled. This all has to do with range management in the particular matters of "deferred" grazing and when it will pay to practice it.

Cooney is carrying on another phase of the same work. How fast does grass grow and how much drought will it stand? What effect does the length of the day have on its growth? Like the prophet of old he has made the sun stand still. By means of a series of various types of electric lamps he can make a day of any duration to order. Not being satisfied with this miraculous work he is now trying to make *black sunlight*!

The work of Woolfolk and Cooney is a continuation of the work started several years ago in co-operation with the United States Forest Service. The Forest Service furnishes the seeds, collected from the various ranges on the national forests, and the School of Forestry is carrying out the testing of the seed under the direction of Dean Spaulding.

We have not confined ourselves altogether to technical forestry. Al Spaulding has side-stepped into the field of economics and is busily engaged in a problem of public finance on "The Comparative Trend of Taxation on Rural Property in Missoula County." Al is going back into the past for 30 years, delving through musty records in the county courthouse trying to determine the true values of parcels of cultivated, grazing and timber lands. He then will compare these with the assessed values for his comparative taxation basis. The object of all this is to determine the trend of taxation in the three classes of property to determine if timber lands are bearing more than their proportionate share of public expense.

All investigators meet every other Tuesday afternoon with the staffs of the Department of Botany and the School of Forestry to discuss the progress of the work and receive criticisms and suggestions from all those present. *We are making progress.*

Professor Cook (to Walt Pool inspecting split insulators)—"There must be another box of these as these are all females."

It is a good thing that Evenson's Ford doesn't go where he is looking.

The Douglas Fir Mistletoe

By John Shields, '32, *and* Stanford Larson, '32

The study of mistletoe offers a large field of investigation. Its effect in stimulating an abnormal bunching or brooming of branches on infected trees is a well-known sight to anyone familiar with western timber. It must be borne in mind that these very apparent bunches or brooms are not the plant of the mistletoe, but are branches of the tree abnormally developed as a result of stimulation by the parasite. The dwarf mistletoe, genus *Razoumofskya* (*Arceuthobium*), belongs to the family Loranthaceae, and differs radically from the true mistletoe, *Phoradendron*, of the same family, in the shape and form of aerial portions. Whereas species of *Phoradendron* appear to be related to true plants in having a woody stem and typical leaf structure, the aerial parts of species of *Razoumofskya* are limited to scale covered shoots, seldom over one and a half inches long. Lateral branching of the shoot often occurs. According to Weir,[3] the species of Conifers most subject to mistletoe injury in the Northwest are western larch, western yellow pine, lodgepole pine and Douglas fir; each of these trees is attacked by a particular species of mistletoe and, with few exceptions, each species is limited to its particular host.

The writers, although limiting the scope of their work to the species *Razoumofskya douglasii* (Eng.) Kuntze, occurring on Douglas fir, have also observed mistletoe infections on western larch and lodgepole pine, in the region immediately surrounding Missoula.

Let us trace in a general way the life cycle of the parasite. The ripening seeds of the mistletoe are borne in a capsule and toward the end of the growing season, September to October, the seeds are expelled with considerable force.[3] This force, sometimes supplemented by favorable wind movement, carries the seed to branches of near-by trees. The seed with its mucilaginous seedcoat sticks firmly to whatever object it strikes and so resists dislodgement by snow and wind. Seeds do not germinate at once but seem to require a period of rest before germination; also low winter temperatures seem to be benficial.[5] This leads us to suppose, until more is learned, that germination occurs the spring following dissemination. With the germination of the seed and the penetration of the radicle

PHOTOGRAPHS ON OPPOSITE PAGE

Top—Aerial shoots of Razoumofskya douglasii (Eng.) Kuntze, dwarf mistletoe, on Pseudotsuga taxifolia, Douglas fir. Lower right—Cross-section of Douglas fir branch showing radial sinkers, cortical strands and point of attachment of aerial shoots. Lower left—Cross-section of Douglas fir branch showing radial sinkers of the parasite.