Woodland Forage in the Arkansas Ozarks

RALPH A. READ

Research Forester, Ozark Branch, Southern Forest Experiment Station, Harrison, Arkansas

WOODLAND grazing is widespread in the Ozarks. Beginning about 1800, early settlers brought livestock to graze on the free public domain. The large areas of fairly open oak woodland, especially the drier sites, had abundant native bluestem grasses (Fig. 1A).

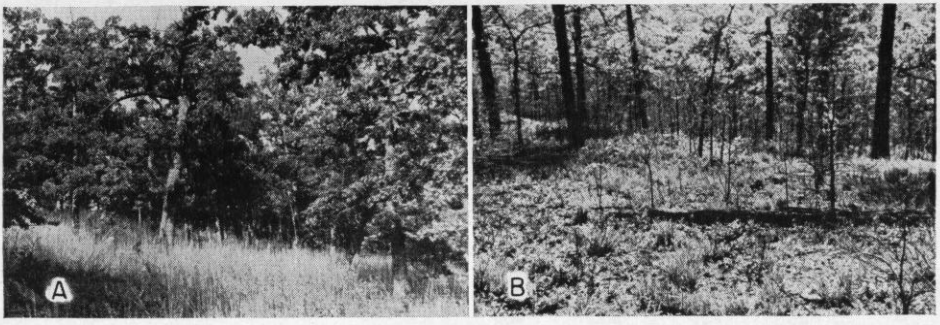

FIG. 1. Upland hardwood forest range in the Arkansas Ozarks. A. Relatively open oak-hickory stand, with abundant bluestem grasses, reminiscent of early-day open range grazing under virgin stands. B. Sparse, poor hardwoods, May 1948, two months after burning. Bluestem and weeds in openings, but vigorously sprouting hardwoods abound. Only fair grazing value.

As settlement proceeded, burning to reduce brush on woodland and to control sprouts on cut-over land became common practice. According to Sauer (1920), the results of uncontrolled grazing and fire were evident during the 1860's, at which time the stands of native bluestem grasses were becoming seriously depleted, except in the rougher, more remote areas. Grazing has continued to the present, though in recent years there has been a shift from open range to improved pasture land, supplemented with feed crops. By and large, however, traditional practices of uncontrolled burning and grazing persist in the extensive woodland areas.

The problem is primarily one of land-use capabilities. Does range grazing really fit into the best use of Ozark forests and farms? As an aid in evaluating this important aspect of the region's economy, special studies were made of forest range grazing in the Arkansas Ozarks. Information was obtained on forage production, values, and use under different forest conditions, with emphasis on the sparse, poor hardwood sites, mainly the post oak-blackjack oak type (Fig. 1B), in which the problem is most critical.

HERBAGE PRODUCTION IN DIFFERENT WOODLAND CONDITIONS

Woodland herbage production is influenced by kind and density of timber stand and by exposure, according to data obtained in 1946 on 88 farm woodlands throughout northwest Arkansas. Herbage estimates were made on 1,091 plots, each 9.6 square feet in size, using the method as described by Campbell and Cassady (1949).

The study, which was made in cooperation with the Arkansas Bureau of Re-

search, showed a decreasing amount of herbage as number of trees increased (Fig. 2). For example, an average of 600 pounds of herbage (green weight) per acre was produced by the end of May in sparse timber stands of 50 trees per acre 3 inches d.b.h. and larger; at the other extreme, only 100 pounds of herbage were produced in dense timber stands averaging 375 trees per acre.

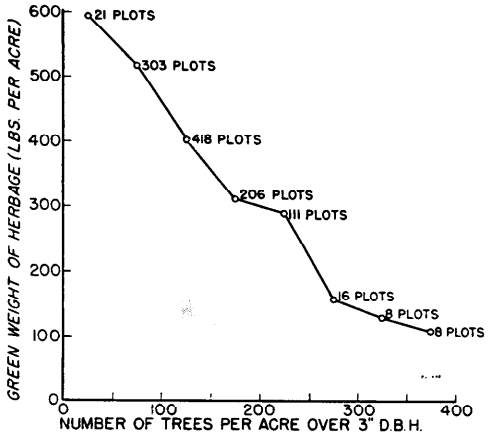

FIG. 2. Average production of total herbage (green weight) by density of timber stand, May 1946.

The influence of kind of forest and exposure on herbage production on the plots is shown in Table 1. The kind of timber is closely associated with exposure. On north and east exposures, where soil is moist and usually deeper than 24 inches, the predominant timber types are the white oak, the white-black-northern red oak, and the black oak-hickory (Arend and Julander, 1948). For simplicity in this paper, these more valuable commercial timber types are called good hardwoods, and when intermingled with shortleaf pine, are referred to as pine-good hardwoods. On south and west exposures, where the soil is dry and may be less than 24 inches deep, the predominant timber type is post oak-blackjack oak, referred to as poor hardwoods. These poor hardwood stands are often interspersed with pine or eastern redcedar. Only 321 pounds of herbage per acre were produced under good hardwood stands on north and east exposures, as compared to 490 pounds under poor hardwood stands on south and west exposures. As to grass alone, only 69 pounds per acre were produced on the better timber sites, whereas 152 pounds per acre were produced on the poor timber sites. That the difference is also reflected in ground cover was shown by Arend and Julander (1948) in a study of well-stocked oak sites. They found that herbaceous plants had an average density (square-foot density method) of only 1.6 percent on good forest sites and 2.3 percent on poor sites.

TABLE 1

Total green herbage production per acre (green weight) by exposure and kind of forest in 88 northwest Arkansas woodlands

Mean sampling date, May 23, 1946

KIND OF FOREST	SOUTH AND WEST EXPOSURES		NORTH AND EAST EXPOSURES	
	Sample plots	Production	Sample plots	Production
	No.	*Lbs. per acre*	*No.*	*Lbs. per acre*
Good hardwoods	119	494	285	321
Poor hardwoods	201	490	166	333
Pine-good hardwoods	71	346	43	296
Pine-poor hardwoods	86	587	74	378
Redcedar-hardwoods	30	451	13	318
All forests	510	484	581	330

In the 1946 survey of farm woodlands, it was found that over 50 percent of the poor hardwood stands, but only 20 percent of the good hardwood stands, had been burned recently. Since many fires are incendiary, to "improve" range grazing, it is likely that the poor hardwood areas are singled out for attention because

they normally produce more forage. Fire hazard in the poor hardwoods is particularly great because the sites are dry, and because there is usually a greater volume of dead grass and weeds. Consequently, the poor hardwoods, especially in sparse stands of 200 or less trees per acre, appear to be the critical area on which grazing and range burning problems exist in the Arkansas Ozarks.

Herbage in Sparse, Poor Hardwood Stands

Sparse, poor hardwoods, as defined above, occupy a considerable area, although they occur generally on ridges and south and west exposures in fairly small tracts intermingled with other kinds of forest. An improvement in management, whether for timber or grazing, or both, would aid in controlling fires and promote forestry and better land use generally throughout the Ozarks.

A special study of herbage production in sparse, poor hardwoods was conducted in Boone County, Arkansas, in 1947 and 1948. In April about 40 percent of the forest floor, not occupied by tree stems in the freshly-burned woodlands was covered by rock, chiefly fragments of chert and sandstone. Probably much of this rock was exposed because of the lack of organic matter accumulation, attributable in part to past burning and grazing abuses. The exposed rock thus represented an indirect measure of the detrimental long-time effect of burning on the productive capacity of the sites. In these burned woodlands, not only the rock, but also the other 60 percent of the ground surface was exposed bare soil and subject to erosion. Grass and weeds accumulated to cover only 27 percent of the soil and rock surface by August. Dead grass and hardwood leaf litter added only another 12 percent by October, although by winter there was a light covering of leaves over all the forest floor.

In similar though unburned woodlands, about 57 percent of the forest floor had a cover of old dead grass and tree leaves in April. By August, new green herbage growth covered 27 percent more of the surface, and by October, 73 percent of the forest floor was covered with live vegetation or litter—a much more adequate soil protection than was afforded by the 35 percent total cover on burned areas.

The effects of reduced plant cover are shown further by a study in the Missouri Ozarks, where it was determined that the average infiltration rate of four forest soils with all litter removed by raking was 18 percent lower than on soils with litter undisturbed (Arend, 1941). It was also found that six continuous years of woods burning lowered average infiltration rate of seven forest soils 38 percent in comparison with unburned woods.

In the Boone County, Arkansas, study, under generally moderate grazing, total green herbage (air dry) reached a high in August, with 665 pounds per acre on burned areas and 422 pounds per acre on the unburned. In practice, however, burned areas often are so closely grazed that they produce less total forage than comparable unburned areas. In one set of 20 plots in 1947, the burned woodland was grazed so closely that it produced only 281 pounds of herbage per acre (air-dry) after allowing for utilization by cattle. The moderately grazed unburned woodland, in contrast, produced 392 pounds of herbage per acre, or 40 percent more than the burned.

Species composition was rather uniform on all study areas, the herbage consisting chiefly of the following species, which are listed in order of abundance by classes:

Grasses and grasslike plants

Little bluestem (*Andropogon scoparius*)
Elliott bluestem (*Andropogon elliotti*)

Big bluestem (*Andropogon furcatus*)
Yellowsedge bluestem (*Andropogon virginicus*)
Slimleaf panicum (*Panicum linearifolium*)
Wideleaf panicums (*Panicum* spp.)
Poverty danthonia (*Danthonia spicata*)
Sedges (*Carex* spp.)

Forbs (Weeds)

Lespedezas (*Lespedeza violacea, L. virginica*)
Tickclovers (*Desmodium nudiflorum, D. glutinosum*)
Virginia tephrosia (*Tephrosia virginiana*)
Asters (*Aster* spp.)
Sunflower (*Helianthus divaricatus*)
Mints (*Monarda* spp.)
Plantainleaf pussytoes (*Antennaria plantaginifolia*)
Pencilflower (*Stylosanthes biflora*)
Hawkweed (*Hieracium vanosum*)

Shrubs and trees

Post oak (*Quercus stellata*)
Black oak (*Quercus velutina*)
Blackjack oak (*Quercus marilandica*)
Hickory (*Carya* spp.)
Blueberry (*Vaccinium vacillans, V. stamineum*)
Grape (*Vitis* sp.)
Catclaw sensitivebrier (*Schrankia uncinata*)

The main difference in species composition on freshly burned and unburned woodlands appeared to be that legumes and composites tended to take over in place of other weeds after fire. Production of shrub and tree browse was temporarily reduced the first growing season after burning. Herbage in freshly burned woods was 45 percent weeds or forbs and 35 percent browse, but in unburned wood it was 33 percent weeds and 45 percent browse. Grasses comprised about the same portions, 20 and 22 percent, in both burned and unburned woodland. Bluestems made up 60 percent of grass production.

Ozark forest ranges generally have more weeds than grasses. The original data in the study by Arend and Julander (1948), reveal that plots in 76 out of 86 locations had a higher density of weeds than grasses. Herbage weight estimates on a special study of deer browse showed three times as much weeds as grass. Practically all timber types and conditions sampled on the 1946 forest-farm survey showed a preponderance of weeds over grasses. This contrasts with Coastal Plain forest ranges, where at the peak of the growing season 80 to 90 percent of the herbage is grass and only 10 to 20 percent is weeds (Biswell, *et al.*, 1943; Campbell, 1946). In general, weeds are a less reliable source of forage than perennial grasses.

The proportion of total herbage that could be grazed by cattle was very low in both freshly burned and unburned woodlands, chiefly because much of it consisted of unpalatable weeds and shrubs. Only 22 to 26 percent of woodland herbage was considered edible, as contrasted with 50 percent or more on an unburned open bluestem grass meadow.

Nutritive Values

Chemical analyses of bluestem grasses from sparse poor hardwood stands in 1947 indicated that protein content was excellent to fair in spring. It was 15 percent in April, 11 percent in May, and 7 percent in June. After that it dropped below 5 percent. Satisfactory protein content for cattle breeding herds is considered to be about 9 percent. Protein in lespedezas and tickclovers also showed a downward trend as the season progressed, but these plants still contained more protein (about 10 percent) in the fall than any of the other forest range plants. This bears out the farmer's assertion that stock do well on the fall range of beggarlice, as these two plants are commonly called, in years when they make good growth. Composites such as sunflower and aster were high in protein during April and May only, as was sensi-

tivebrier, which contained 34 percent protein during the brief spring period in which it was grazed. Young leaves of blackjack and post oak sprouts on the burned areas averaged 15 percent protein during April and May, but generally were not grazed by cattle if any other forage was present.

Calcium was sufficient in all plants to meet the needs of growing animals throughout the season. In general, legumes and composites contained three times as much calcium as the bluestem grasses. Except for poverty danthonia in April and May, calcium content was above the minimum of 0.23 percent in all plants analyzed.

Phosphorus was above the required level of 0.18 to 0.21 percent in the green foliage of all plants analyzed during April and May only. It was lowest during the hot midsummer period in August.

There were no consistent differences in protein or phosphorus in forage samples from burned and unburned range. Calcium in bluestems and lespedezas averaged 30 percent higher in unburned woodlands than in freshly-burned woods.

Grazing Capacity

Medium to well-stocked stands of good hardwoods had an estimated grazing capacity of from 10 to 40 acres per cow-month. In moderately grazed, sparse, poor hardwoods, grazing capacity is from 4 to 6 acres per cow-month. In contrast, only 2 acres are required per cow-month on unburned, open, native grass "meadows" even during a dry year; while about 1 acre is required in years of normal rainfall. On the better soil sites, of course, improved pastures on farms will support a cow for the whole summer on only 3 to 5 acres.

The high grazing capacity of native grass meadows in contrast to that of the best woodland range suggests that study and research may some day benefit Ozark economy by finding practical ways of converting sparse, poor hardwood areas to perennial grass ranges without resorting to destructive fire. At the same time, it should be recognized that land areas capable of producing commercial timber and growing well-stocked stands do not support enough forage for more than incidental grazing, and therefore should not be burned nor grazed. Three possible alternatives in land management need investigation, although any solution will be a long process: (1) use of best forest sites for timber alone with total exclusion of livestock, (2) combined use of certain intermingled good and poor forest sites for timber and grazing, with increased acreage per cow so as to avoid grazing damage to valuable tree species, and (3) use of poorest dry forest sites for grazing alone by conversion of selected areas of sparse, poor hardwoods to perennial grass range.

Summary

Studies in the Arkansas Ozarks show that amount of herbage produced in upland hardwood stands is partly influenced by density and kind of forest. Stands with only 50 trees (3 in. d.b.h. or larger) per acre supported six times as much herbage as dense stands with 375 trees or more per acre. Poor hardwood forests, consisting mainly of post oak and blackjack oak on south and west exposures, produced an average of 53 percent more herbage than good hardwood forests, which include the white oak, white-red-black oak, and black oak-hickory types on north and east exposures.

The problem areas appear to be sparse, poor hardwood stands of less than 200 trees per acre on the south and west exposures. These areas grow more herbage, burn more readily, and are burned more frequently than good hardwoods.

There are more weeds than grasses generally in upland Ozark woodlands. Bluestems make up about 60 percent of the grasses and provide the most dependable forage for cattle. Forage production increases during spring and summer as plants grow, but declines after August as plants mature and dry up. Protein and phosphorus content of the forage also is high in spring, but taper off to below maintenance level after June.

Medium to well-stocked good hardwood stands sampled averaged from 150 to 350 trees per acre and had an estimated grazing capacity of 10 to 40 acres or more per cow-month. In contrast, only 2 acres or less per cow-month are required on unburned, open native bluestem meadows. Heavy grazing appears to prevent expected forage growth. The gain in forage from burning is negligible in dense, good hardwood stands, which furnish only incidental grazing in any case.

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RANGE PHOTOGRAPHY CONTEST AND EXHIBITION

At annual meeting of ASRM, Boise, Idaho
January 30, 31, and February 1, 1952

In Five Divisions; Four Black and White, and One Color

1.) Range landscape
2.) Individual range plant (without portrait lens)
3.) Range conditions and fence-line contrasts
4.) Close-up (with portrait lens or higher magnification)
5.) Color print, any size

All entries must have been taken by a member of the Society. All black and white photos must be mounted, unframed, and 8″ x 10″ or larger. Any range subject is eligible with the provision that neither animals nor mechanical devices shall be the principal subject.

Photos shall be accompanied by up to 25-word descriptions, plus name and address of photographer, typed on separate white background that can be attached to bottom of photo with gummed tape from back. These will be numbered at the annual meeting. (Names and addresses may be helpful to membership in locating good photos to illustrate publications.)

Individuals may enter up to but not over one photo in each of the five divisions. Photos will be taken to and from the exhibition room by the member displaying them or by someone for him who will attend the meeting.

Viewing members at annual meeting will vote on signed ballots to be deposited in box at exhibition. Voting will be for the one photo the individual likes best in each division; and for best in the show.—*E. J. Dyksterhuis*, Chairman, Program Committee.