SOUTHERN APPALACHIAN GRASS BALDS

By B. W. Wells

Plates 1–5 and 2 Text Figs.

INTRODUCTION

Scattered at infrequent intervals on the high ranges of the Southern Appalachian mountains are local openings in the forest, the central areas of which are dominated either by a shrub community or an herbaceous grass or sedge community. All such openings which, unlike clearings in the lower mountains, are relatively stabilized or permanent, have, from the earliest historical times, been called "balds." Those which are dominated throughout by a shrub complex, with grass or sedge confined to cattle or man-made trails, are shrub balds (if compact, locally known as "slicks") and are highly variable in size, composition, and site. In contrast, the grass and sedge balds exhibit a central area of varying size with the herbaceous perennials almost completely dominant and shrubs if present constituting a border community transitional to the environing forest. These grass balds are of restricted size ($\frac{1}{4}$–100 acres), and exhibit little diversity in composition and site. Roan Bald of a thousand acres is an exception having been greatly enlarged in the modern period. Both types of openings are called "balds" by the local mountain people and the government topographic maps. It is very important therefore to point out that in this paper we are dealing only with the grass bald (including for purposes of simplification the few closely related sedge types) which may always be recognized by the relatively high local dominance of the grasses or sedges on areas generally central, yet immediately surrounded by shrubs or in some directly by forest.

HISTORICAL

The grass balds have been an ecological puzzle to naturalists and apparently to the Indians as well. The Cherokees held to supernatural explanations. The white observers up to the present have insisted on "natural" causes in the sense of local impact of extreme climatic conditions and uncontrolled fire.

CHEROKEE LEGENDS

Because of their human interest and as evidence of the antiquity of the balds, the Cherokee legends deserve restatement here. Fink's (8) account of the most elaborate myth from the original report by Mooney (15) is given first:

"It seems that in the ancient days the Indian villages were subject to the incursions of a mythical monster, an ulagu, resembling a gigantic hornet, that would swoop down, snatch up a child in its claws and vanish so swiftly that pursuit was impossible.

"Every possible method of defense and offense was tried, with no avail. Meantime the raids continued, and the villages were fast being depopulated. At last sentinels were posted on the mountain tops and by this means the ulagu was finally traced to its lair, an inaccessible cavern high on a sheer, precipitous mountain side.

"While they had found its retreat, the Indians were little better off than before. In their extremity, they gathered together in a great council and implored Divine assistance. The Great Spirit heard their pleas, and sent to their aid the lightning, that at one tremendous stroke split off the whole side of the mountain. When the smoke and dust cleared away, there lay the ulagu, dazed but still alive. Quickly the Indians fell upon it with spear and ax, ridding themselves forever of the dread scourge. So pleased was the Great Spirit with their initiative in uncovering its hiding place, their piety in appealing for Divine aid in their extremity, and their bravery in the final combat, that it was His decree that in the future the tops of the highest mountains be bare of timber, to better serve as stations for sentinels should such another visitation ever occur."

In the original report the ulagu (Tsul 'kalu or Jutaculla) was definitely located on and in the region of Tennessee Bald which is one of the locally known "Jutaculla Fields" comprising the neighboring two Rough Butt balds together with Gage and Charley Bald.

On Joanna Bald on the Graham-Cherokee County line (not given on topographic maps) was the "lizard place" where a great lizard with glistening throat could be seen sunning himself.

Still another story relates that the balds were forbidden territory and a party of young braves boldly and in merriment entered the open ground of one, whereupon the devil in the form of a huge snake assaulted and swallowed fifty of them.

In the Mooney (15) report mention is made of Gregory Bald which the Cherokees called "the rabbit place" where the king of the rabbits lived—"a rabbit as big as a deer." Near Robbinsville is located a mountain having two small balds which were formed by "a mysterious being having the form of a giant with head blazing like the sun once alighted here and stood for some time. Later they found the herbage burned from the ground."

Another legend states that the Nunnehi (people who live anywhere), a race of spirit folk who inhabited the high mountains, "had a great many town houses on the balds ("udawagunta"—Cherokee name for bald mountains).

RECENT THEORIES

William Bartram who traveled in the Southern Appalachians in 1776, and the Michauxs, father and son, the first white naturalists to traverse the Southern Appalachians make no mention of the balds. They seem to have kept to the main lowland trails.

Gray (9) visited Roan Mt. Bald in 1841 but was not aware of the problem, since the extensive grazing probably led him to believe the entire bald was a mountaineer clearing. His plant list constitutes a valuable record.

Edson (7) is the first writer to attempt a scientific explanation. From observations on Roan she developed a theory of ice storm injury. The ice formation at certain places is so great, with the consequent repression of the trees, that grass comes to take the place of the injured woody plants.

Harshberger (10) naïvely adopts the Edson theory *in toto.*

Davis (6) describes the "grassy balds" of the Black Mt. range but offers no theory. There is "no legend or evidence of Indian occupancy."

Fink (8) under the title, "A Forest Enigma," holds that no theory yet advanced is adequate. He mentions the possibility of Indian origin only to point out what appear to him as unanswerable arguments against this idea. "Nor could they have been cleared by the Indians in prehistoric days for it would have been too gigantic a task, far beyond the possibility of their rude stone axes. Indian energy, or rather lack of it, would not have gone to such incredible labor without some vitally

compelling cause. And even had they done so in the centuries which must have elapsed, the clearings would have been completely reforested."

Camp (3) from observations on one bald; viz., Gregory Bald, believes the balds due to "local exposure to hot and dry southwesterly winds in dry seasons—a local climate theory comparable to the ice storm idea mentioned earlier.

Cain (1) goes no further than to assert that the grass balds must be "natural" phenomena but does not attempt to outline what the differential natural complex is which has produced them.

Wells (17) discusses the problem but offers no theory. In a later preliminary note (18) he calls attention for the first time to the artificial nature of the grass balds since a high percentage of them occupy gentle south slopes near springs, which data together with observations in successional relations, point toward an Indian theory of origin. The present paper is an elaboration of this position.

Wells (19) gives an account of Andrews Bald, using this bald as a basis for a very brief emphasis on the prehistoric human origin of that bald.

DESCRIPTION OF GRASS BALDS

Up to the present the isolated grass balds have not been seriously affected by modern civilization. The Federal high mountain roadway program will soon bring so many people to them that profound changes are certain to follow. In places such as Tennessee Bald the road will traverse the bald itself which will mean its destruction. It is thus highly desirable to record the salient facts concerning these ecologically interesting areas before their vegetation is destroyed in whole or in part.

Because of the isolation of the areas, frequent visits were impossible, and time on the balds was highly limited. No claim is made for completeness of the plant list, especially of the minor species. The few dominants, which are the significant plants in area control, have been very completely recorded.

In the bald descriptions to follow, the plants in the grass bald areas proper are not only listed but ranked as to dominance on a 1–5 scale as follows: 1, dominant; 2, subdominant; 3, frequent or common but not subdominant; 4, uncommon but not rare; 5, rare or a few specimens only present. Plants attaining ranks 1–3 are few in number and are listed in the description with rank 4 and 5 plants listed by number referring to the plant list given below. So far as possible Britton and

Brown's Flora of the Northern States and Canada has been followed in the matter of nomenclature. The location, altitude, month and year the bald was observed and approximate size are given for each bald, followed by the concise description.

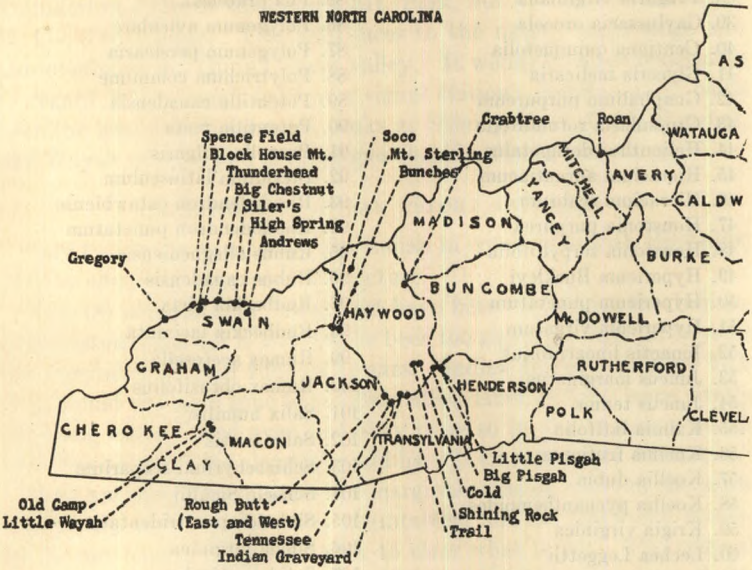

FIG. 1. LOCATION OF GRASS AND SEDGE BALDS DESCRIBED

PRELIMINARY GRASS BALD PLANT LIST

1. Achillea millefolium
2. Agrimonia gryposepala
3. Agrostis alba
4. Agrostis perennans
5. Alsine media
6. Anthemis Cotula
7. Aquilegia canadensis
8. Arctium lappa
9. Aster divaricatus
10. Aster patens
11. Aster oblongifolius
12. Aster surculosus
13. Aster Tradescanti
14. Azalea lutea
15. Carex communis
16. Carex crinita
17. Carex flexuosa
18. Carex intumescens
19. Carex normalis
20. Carex rosea
21. Carex varia
22. Cerastium viscosum
23. Chelone Lyoni
24. Chrysanthemum leucanthemum
25. Cirsium discolor
26. Corylus rostrata
27. Crataegus iracunda
28. Dactylis glomerata
29. Danthonia compressa
30. Dennstaedtia punctilobula
31. Deschampsia flexuosa
32. Diervilla sessilifolia

33. Dracocephalum virginianum
34. Drosera rotundifolia
35. Eragrostis spectabilis
36. Erigeron ramosus
37. Eupatorium urticaefolium
38. Fragaria virginiana
39. Gaylussacia orocola
40. Gentiana quinquefolia
41. Glyceria melicaria
42. Gnaphalium purpureum
43. Grossularia rotundifolia
44. Helianthus decapetalus
45. Hieracium aurantiacum
46. Hieracium scabrum
47. Houstonia purpurea
48. Houstonia serpyllifolia
49. Hypericum Buckleyi
50. Hypericum punctatum
51. Hypericum virgatum
52. Ionactis lineariifolius
53. Juncus marginatus
54. Juncus tenuis
55. Kalmia latifolia
56. Kneiffia fruticosa
57. Koellia dubia
58. Koellia pycnanthemoides
59. Krigia virginica
60. Lechea Leggettii
61. Leontodon Taraxacum
62. Leptilon canadense
63. Lilium philadelphicum
64. Lilium superbum
65. Lobelia inflata
66. Lysimachia quadrifolia
67. Mesadenia atriplifolia
68. Monarda clinopodia
69. Monarda media
70. Nepeta Cataria
71. Nothoholcus lanatus
72. Oxalis stricta
73. Oxypolis rigidius
74. Panicum meridionale
75. Pedicularis canadensis
76. Penstemon brevisepalus
77. Phlox ovata
78. Phleum pratense
79. Pieris floribunda
80. Plantago cordata
81. Plantago lanceolata
82. Plantago major
83. Poa compressa
84. Poa cuspidata
85. Poa pratensis
86. Polygonum aviculare
87. Polygonum persicaria
88. Polytrichum commune
89. Potentilla canadensis
90. Potentilla recta
91. Prunella vulgaris
92. Pteridium latiusculum
93. Rhododendron catawbiense
94. Rhododendron punctatum
95. Rubus allegheniensis
96. Rubus canadensis
97. Rudbeckia hirta
98. Rudbeckia laciniata
99. Rumex acetosella
100. Rumex obtusifolius
101. Salix humilis
102. Salix tristis
103. Schizachyrium scoparium
104. Senecio Smallii
105. Sibbaldiopsis tridentata
106. Silene virginica
107. Solidago bicolor
108. Solidago caesia
109. Solidago hispida
110. Solidago monticola
111. Solidago nemoralis
112. Solidago patula
113. Solidago speciosa
114. Stachys aspera
115. Specularia perfoliata
116. Trifolium pratense
117. Trifolium repens
118. Vaccinium corymbosum
119. Vaccinium hirsutum
120. Verbascum Thapsus
121. Veronica officinalis
122. Viburnum cassinoides
123. Viola lanceolata
124. Viola sororia
125. Xolisma ligustrina

TRAIL BALD. Tennessee Ridge. 6000 ft. July, 1936. Along many hundred yards of the high trail on the boundary line between Haywood and Transylvania counties. With the mountain oat grass (*Danthonia compressa*) strongly dominant on and along the sides of the trail for extended distances, this trail bald together with many others like it, furnishes evidence for the human origin of the larger and broader balds. The grass originally appearing in the trail seems to be slowly encroaching on the narrow shrub borders transitional to the forest. So thick is the grass on the sloping sections of the ridge top trail that complete protection from gullying has been given.

COLD MT. BALD. Haywood County, N. C. 5900 ft. 14 acres. Sept., 1935. Extends along south side ridge top near and on east side of peak; includes a gap. 1—*Danthonia compressa;* 2—*Potentilla canadensis;* 3—*Achillea millefolium;* 4—9, 12, 38, 40, 47, 60, 51, 57, 72, 104, 105, 107; 5—24, 36, 92, 97, 109, 120. Bounded below by shrub bald zone (*Vaccinium corymbosum* dominant), transitional to *Quercus borealis* forest. Above just over ridge top *Crataegus* sp., dominant *Quercus borealis* and at the gap *Fagus grandifolia.* Evidence of fire in last 5 years. Spring near bald, lower side.

An old mountaineer met on this bald stated that he could discern no noticeable change in the relative size of the grass and shrub areas in the 50 years he had been visiting the bald for blueberries.

Cold Mt. with its twin peak, Shining Rock, both having balds was called "Datsunalasgunyi" by the Cherokees.

ANDREWS BALD. Smoky Mt. National Park, Swain Co., N. C. (Fig. 2). Roughly square in outline, 5860 ft. Reported as 75 acres. Probably an overestimate. July, 1925. On gentle southwest slope at end of high ridge 2 miles south of Clingman's Dome. An extraordinarily large and fine example of the ancient herbaceous balds originated by the Indians. Strongly dominated by species of *Carex* with the emphasis on the upper and west sides shifting to the single species *Carex flexuosa* because of higher soil water. The sedge cover on this bald was the thickest of all seen; the sod very deep and heavy. Plants of the middle and lower area: 2—*Carex varia, C. radiata;* 3—*Carex flexuosa, Potentilla canadensis;* 4—9, 16, 19, 20, 22, 29, 35, 38, 41, 64, 99, 112, 124; 5—30, 47, 48, 49, 73, 78, 84, 91, 93, 122. In an earlier note (19) too great an emphasis was given to the oat-grass; this bald is fundamentally a sedge bald.

This expansive area is dotted with a few widely scattered relict shrubs, *Viburnum cassinoides* and *Ribes rotundifolium* being prominent. East

side bounded by a tree covered declivity near ridge top: north side by balsam-spruce climax with *Rhododendron catawbiense* along the ecotone: west side balsam-spruce with mixed shrub border grading into low *Rubus*: South side balsam-spruce with *Glyceria* and heavy *Carex* at one part indicating an almost marshy character of the bald here. Good spring near southwest corner of the bald. No evidence of recent fire or grazing.

MT. STERLING BALD. Haywood Co., N. C. (Fig. 3). 5800 ft. Small rectangular bald 100 x 350 ft. lying on gentle western slope near top of the mountain, long axis parallel to contour lines. June, 1935. Notable for the high dominance of *Carex flexuosa* to be correlated with its wet soil character due to drainage from the balsam-spruce above. The central body of the bald shows: 1—*Carex flexuosa;* 2—none; 3—*Potentilla canadensis, Viola* sp., *Fragaria americana;* 4—18, 19, 22, 83, 95; 5—14, 28, 67, 78, 104. On the margin socies of *Gaultheria procumbens, Dennstaedtia punctilobula,* and *Polytrichum* sp. were noted, also *Carex lucorum.* This bald is completely surrounded by the balsam-spruce climax. A spring is located a few yards from the lower trail entrance.

A bare area (Fig. 4) made on this bald on the tent site of Dr. H. L. Blomquist of Duke University during the summer of 1933 shows little seral progress. *Rumex acetosella* had appeared forming a marginal ring; the center was bare after two years.

ROAN BALD, N. C. Tennessee line near Bakersville, N. C. (Fig. 5) 5800 ft. Extends along ridge east of Carvers Gap, at present involving many hundred acres (most estimates 1000). Not visited since 1926. The relative dominance was not noted at that time. The common plants were *Danthonia compressa, Poa compressa, Trifolium repens, Potentilla canadensis, Houstonia serpyllifolia, Polytrichum commune, Veronica officinalis, Rumex acetosella, Deschampsia flexuosa, Agrostis alba.*

This is probably the largest high mountain grass area in the Southern Appalachians. All evidence indicates, however, that it owes its present large size to the activities of the early white mountaineers who destroyed large areas of forest for grazing purposes. The high North Carolina—Tennessee ridge at this point is unusually broad and flattened, making an extensive grazing area posssible here. Relict buckeyes (*Aesculus octandra*) were scattered on the lower slopes (Fig. 6). The limited area on the nearly flat top was the probable site of the original Indian bald. Here the *Danthonia* grass makes a heavy sod and the original bald must have closely resembled a bald like Gregory which

occupies a similar site. On the south slope the uncommon *Alnus Alnobetula* forms a thicket community. The surrounding forest border is of hard-woods of which beech and northern red oak are prominent.

This bald and its nearby forested peak (now cut over) were visited by the early taxonomists—Gray, Lamson-Scribner (13), Curtis, Buckley, and Chickering (5), none of whom discussed the probable origin and maintenance of such a grass area.

Lanman (14) reports an Indian tradition which tells of 3 great battles which were fought on this mountain, the Catawbas winning against the Cherokees. After these battles the Great Spirit caused "the forest to wither from the 3 peaks." Such a legend is an indication of the great antiquity of the bald.

SHINING ROCK GAP BALD. Haywood Co., N. C. (Fig. 7) 5700 ft. July, 1935. Two acres in the gap and extending up lower southwest slope. Gives way to shrubs on upper half of slope except for 2 small pure grass areas (1) a local level place, 30 ft. in dia. and (2) and acre-size area on the mountain top. Gap bald, 1—*Danthonia compressa;* 3—*Houstonia serpyllifolia, Vaccinium corymbosum* (relicts). 4—4, 32 (marginal), 47, 56, 89, 93, 95 (marginal), 99; 5—17, 66 (marginal), 71, 77. The upper two local balds are in almost pure mountain oatgrass broken by shrub relicts. The shrub bald ecotone to the forest is of an open type on the higher more gentle slope and massed on the lower steeper south-facing slope. *Kalmia latifolia* and *Rhododendron catawbiense* are the most abundant with *Pieris floribunda* represented. Beyond the shrubs is *Quercus borealis* and in a few places the shrub bald makes contact with the vast successional community of *Prunus pennsylvanicum.* On the higher side the grass and shrub areas are bounded by the quartz rock wall dike which gives the name to this peak. An excellent spring is located very near to the gap bald.

The shrubs of the upper slope and top are chiefly the blueberry (*Vaccinium corymbosum*) making this mountain one of the largest "berrying grounds" in the region (Fig. 8). The open character of the shrubs is due to this activity, the interlocking paths having grown up in oatgrass, a fact extremely significant in the problem of bald origin.

BUNCHES BALD. Haywood Co. near Soco Gap. 5700 ft. A small rectangular bald of two acres at the ridge top on the south slope. Notable for the presence in it of the northern *Hieracium aurantiacum.* 1—*Danthonia compressa* broken sharply in various small socies of fork dominants; 2—*Achillea millifolium* (socies); 3—*Erigeron ramosus, Potentilla canadensis,* low *Rubus* sp., *Chrysanthemum leucanthemum;* 4—

3, 22, 38, 45, 47, 71, 75, 76, 91, 99; 5—7, 60, 88, 104, 106, 117. The weedy character of this bald indicates recent disturbance in relation to the lumbering going on in the vicinity.

Bounded by a marginal shrub-community of *Vaccinium corymbosum, Lyonia ligustrina* and *Azalea calendulacea.* Also *Pteridum latiusculum* prominent. Back of the shrubs the *Quercus borealis* consociation surrounds the bald.

WEST ROUGH BUTT BALD. Boundary line between Haywood and Jackson counties. 5700 ft. June, 1936. Two almost contiguous areas of 5 acres each on west sloping ridge leading down from Rough Butt Mt. Lower bald of the two on a broad, gently rounded ridge top. Dominated by an almost pure stand of *Poa compressa.* 2—*Houstonia serpyllifolia;* 3—*Potentilla canadensis.* Bounded by mixed *Picea rubens* and *Quercus borealis.* Indications of heavy grazing.

TENNESSEE BALD. At junction of boundary lines of Haywood, Transylvania, and Jackson counties. June, 1936. 5622 ft. Six acres. A narrow rectangular bald occupying gap extended along gap ridge top lying on the long grade east slope, immediately below ridge top. 1—*Poa compressa;* 3—*Potentilla canadensis, Houstonia serpyllifolia, Juncus tenuis;* 4—1, 99, 121. The upper $\frac{1}{4}$–$\frac{1}{2}$ of the treeless area is in shrubs with *Vaccinium corymbosum* dominant. Upper boundary *Quercus borealis* with some *Picea rubens;* the lower boundary *Betula lutea* with a few *Abies Fraseri, Prunus serotina* and *Acer spicatum.* An excellent spring is found at the middle of the bald, a few yards into the forest.

This gap bald was a well known one in the early days. A main trail crossed it and today as indicated above it is the junction of three counties. The Cherokees called it "Tsunegunyi" and on it and its neighboring balds lived the great legendary hornet (or bird in another account) whose activities were described earlier.

SILER'S BALD. N. C.—Tenn. line, Smoky Mt. Park seven miles west of Clingman's Dome. Aug., 1936. 5600 ft. Five acres on south spur of Siler's Bald Mt. beginning at mountain peak. This bald must be dealt with in three sections:

East Section: The ridge top in *Danthonia compressa* with socies of *Potentilla canadensis.* The northwest slope below top in tall weeds and *Rubus.* Stumps of small beeches here showed recent cutting and fire.

Middle Section: Apparently was originally the main bald. The south slope at present in *Potentilla* and *Fragaria,* a ruderal society coming in after the *Danthonia* grass had been killed by the early 1936

drought. North slope dominated by *Solidago* with socies of *Helianthus*. On the moist lower slope of the middle section *Carex flexuosa* dominates with much *Rubus* under three feet.

West Section: Upper part at present chiefly in weeds, *Rudbeckia laciniata*, *Fragaria americana*, and *Potentilla canadensis*. Only two acres at base of bald with living *Danthonia compressa*.

This bald among many others was severely affected by the spring drouth of 1936 changing the high dominance of the oatgrass over to a mixed weed community.

HIGH SPRING BALD. N. C.—Tenn. line. Smoky Mountain Park. Five and a half miles west of Clingman's Dome. One-fourth acre. August, 1936. 5500 ft. A small bald to be correlated with a good spring on south side just below the ridge top. At present largely in weeds with *Phleum* prominent indicating recent human interference. The high spring found here is to be correlated with the water indicating *Carex* at east end, where subsoil drainage from neighboring ridge top passes on way to spring.

THUNDERHEAD MT. BALD. N. C.—Tenn. line, Smoky Mt. Park, near top of mountain. 5500 ft. Ten acres. July, 1936. This grass bald is exceptional in its location on a rather steep slope and that slope has a northwestern exposure. *Danthonia compressa* was in complete control and had been able because of the northern exposure of the site, to survive the 1936 spring drouth. It is bounded on its east side by a compact mass of *Rhododendron maximum* which extends up slope to the top of peak. A small oat-grass community 20 ft. in diameter covers the mountain summit. The western boundary is the high mountain hardwood forest dominated by *Quercus borealis*.

SOCO BALD. Haywood County, three miles from Soco Gap. July, 1935. 5400 ft. One and a half acres on south rather steep slope just below top of Soco Bald Mt. A mixed bald with low shrubs scattered through grass areas. On a relative dominance basis the record gives: 2—*Danthonia compressa*, *Vaccinium corymbosum;* 3—*Senecio aureus;* 4—*Lyonia ligustrina*. *Salix humilis*, *Erigeron ramosus*, *Pedicularis canadensis*, *Sassafras sassafras* (noteworthy), *Kalmia latifolia*, *Azalea calendulacea*. On the upper or ridge top side the bald is bounded by low *Fagus grandifolia*, *Azalea calendulacea*, and low *Castanea dentata*. Below, *Quercus borealis*.

This bald is introduced as a type of shrub bald containing enough grass to make its classification difficult. It is not a grass bald proper but represents a fire repressed shrub bald with a grass admixture.

BLOCK HOUSE MT. BALD. Near N. C.—Tenn. line. Two miles from

Thunderhead Mt., Smoky Mt. Park. July, 1936. 5400 ft. Three acres of bald proper (without trees). One on north slope of peak and two on south slope. On the upper $\frac{1}{4}$ of the latter the *Danthonia compressa* grass had been killed by the 1936 spring drouth and the area taken by weeds which in progressively decreasing size below gave way to the still living grass below. The north bald pure stand of oatgrass was unaffected by the drouth. The relative dominance of the weeds occupying the grass killed area was as follows: 2—*Solidago patula, Potentilla canadensis;* 3—*Rumex acetosella, R. obtusifolius, Aster* sp.; 4—*Phleum pratense.* The south bald is bounded on west by scrub *Fagus grandifolia* 1–4 ft. high on lower and east side by *Quercus borealis.* The north bald is entirely surrounded by beech.

Of especial interest is to be found on the forested mountain slope below the bald a great development of oatgrass under the trees extending down slope on the south side to Haw Gap, involving an area of 25 acres or more. Such an extensive grove of large old trees with almost pure grass beneath is very unusual in the high mountains. Its occurrence here may be ascribed to a combination of grazing and fire within historical times. The treeless areas above are regarded as true grass bald initiated by the Indians for game lures.

BIG PISGAH RIDGE BALD. Haywood County line ridge near Mt. Pisgah. 5340 ft. Aug., 1935. Two acres. A grass bald bordered by *Corylus rostrata.* Of rectangular shape, its long axis is on the ridge top, the south slope exposure being slightly larger than the north. 1—*Danthonia compressa;* 2—*Potentilla canadensis;* 3—*Phleum pratense, Pteridium latiusculum;* 4—24, 25, 57; 5—36, 66, 72, 91, 97, 99, 108, 112, 116, 118, (relicts), 125 (relicts).

Of especial interest on this and the following bald is the hazelnut (*Corylus rostrata*) border (Fig. 9) with a minor amount of *Salix humilis* on the south side. On the north side this shrub is massed in a pure stand between the *Quercus borealis* forest and the grass and by short rhizomes is slowly encroaching on the grass area. The west end of the bald opening is already choked. This bald is unquestionably being transformed into a *Corylus* shrub bald. The environing forest is that of *Quercus borealis.* Probably a lure bald as to origin; no spring was found near it.

LITTLE PISGAH RIDGE BALD. Near Haywood County line ridge, vicinity of Mt. Pisgah. 5330 ft. Sept., 1935. Only two small grass areas left amid the heavy *Corylus,* each roughly circular with diameters of 6 and 25 ft. respectively. The original bald opening was 8 acres.

1—*Danthonia compressa;* 3—*Potentilla canadensis, Pteridum latiusculum;* 4—*Cirsium discolor,* 5—*Prunella vulgaris.* This grass bald has been almost eliminated by the hazelnut, and gives an exact index as to the facts of the preceding. These two balds, now in transition from grass to shrub (*Corylus*), are the only ones of the kind noted. *Quercus borealis* surrounds the thick hazelnut community with some *Kalmia* and *Crataegus.*

INDIAN GRAVEYARD BALD. On south slope of a low mountain near Tennessee Ridge at headwaters of Pigeon River. 5300 ft. Aug., 1935. Four acres, roughly square in outline. At time visited the bald was dominated by *Solidago patula,* a successional stage following an earlier drouth. Scattered over this bald and in the surrounding forest as well were the mounds and depressions of a former extensive windfall. The mound axes are all parallel to the contour lines suggesting an artificial arrangement explained as "Indian graves" but in reality due to the uniformity of tornado wind direction. *Danthonia compressa* was developing between the masses of *Solidago* and was dominant on the mound tops. In addition to shrub relicts of *Cornus asperifolia* and *Vaccinium corymbosum* a few repressed trees of *Robinia pseudoacacia* are presented, their presence made possible here by the relatively low altitude.

On the west and south margins the bald is in contact with a vast area of *Rubus* and *Prunus pennsylvanicum* with no plants of these present in the bald. On the east border is found *Fagus* and *Cornus,* the contact sharp. On the upper or south side, *Quercus borealis* was dominant.

LITTLE WAYAH BALD, Macon Co., near top of peak east of Nantahala Gap. July, 1935. 5000 ft. One-half acre on the southeast slope. Lower three-fourths of the opening in grass. 1—*Danthonia compressa;* 3—*Potentilla canadensis, Fragaria americana;* 4—22, 36, 58, 77, 91, 104; 5—1, 24, 60, 66, 71, 74, 95, 106, 120. The upper fourth of the forest opening is in shrubs of which the east half is in *Salix humilis,* west half *Kalmia* and *Azalea calendulacea.* The bald is bounded by *Quercus borealis* with some *Fagus* especially on the west side. No spring near by. Apparently used as a lookout because of the proximity to the gap close by.

SPENCE (OR SPENCER) FIELD BALD, N. C.—Tenn. line, Smoky Mt. National Park near Thunderhead Mt., lying between the headwaters of the west fork of the Little River and Gunna Creek. July, 1936. A long undulating ridge top bald a mile long and involving at least 40 acres, including the broad main gap. *Danthonia compressa* normally

highly dominant but large areas of it on the south slope near the ridge top were killed by the 1936 spring drouth, being replaced by 1—*Potentilla canadensis* and 4—*Prunella vulgaris.* On the north slope the oatgrass was highly dominant 1—*Danthonia compressa;* 3—*Solidago spatula;* 4—24, 99, 104, 121. An excellent spring is found near the gap on the south side. The south boundary consists of *Quercus borealis*, *Aesculus octandra*, and *Fagus grandifolia.* On the north side *Aesculus* is dominant with some *Sorbus americana* present. To the east on the ridge, relict trees of *Acer saccharum. Quercus alba* and *Betula lutea* are present in all stages of degeneration, under the combined attack of the axe, fire, grazing, and drouth.

This bald has unquestionably been enlarged in modern times through the heavy grazing imposed upon it by the mountaineers. Its gap nucleus, however, dates back to the Indian days.

CRABTREE BALD. Haywood Co., near Crabtree, N. C. (Fig. 10). July, 1935. 5280 ft. A recently developed bald of 20 acres on north slope of mountain from top down to the gap. 1—*Poa pratense;* 2—*Agrostis stolonifera, Achillea millifolium;* 3—*Danthonia compressa, Oxalis stricta, Cerastium viscosum, Phleum pratense, Trifolium repens, Potentilla canadensis, Cirsium odoratum;* 4—8, 28, 53, 99, 100; 5—78, 80, 90.

Scattered over this bald were relict specimens of *Robinia pseudoacacia* in all stages of decay. Most of the trees were dead. One large mass of *Corylus rostrata* was noted near center and a few masses of *Dennstaedtia* fern. Above at the mountain top, the boundary forest was *Fagus* with *Aesculus octandra* relicts. Below the bald merged into a ridge meadow with abundant *Chrysanthemum leucanthemum.*

This bald is entirely of recent origin and is introduced here as an example of a bald made by the white pioneers who were able to extend their grazing areas with fire aiding their axes. Such balds are, however, not common.

BIG CHESTNUT BALD. On N. C.—Tenn. line peak in the Smoky Mt. Park at the head of Defeat Branch of Valley Creek. Sept., 1935. 4970 ft. Forty-five acres. An irregularly shaped ridge bald lying chiefly on the south slope. Much disturbed in recent decades and invaded by weeds and blackberry. At the east end lies a restricted area of typical oatgrass bald. 1—*Danthonia compressa;* 3—*Potentilla canadensis;* 4—66, 107, *Aster* sp., *Solidago* sp.; 5—64, *Lactuca* sp. One large *Acer saccharum* tree stands in this grass area.

In the vicinity of the ruins (chiefly a fallen-in chimney) of the old

Hall's cabin was a ruderal community as follows: 1—*Phleum;* 3—*Fragaria americana, Aster tradescanti, Rudbeckia laciniata;* 4—1, 2, 8, 72, 100.

This bald opening is surrounded by *Quercus borealis* trees which at the very top of the mountain above the bald reach the unusual height of 40–50 ft. in spite of wind exposure. *Castanea* and *Aesculus* also present.

GREGORY BALD. N. C.—Tenn. Line (Fig. 11). Smoky Mt. Park near west end of Park. Aug., 1935. 4948 ft. Seventy-five acres. This bald is one of the largest known. Roughly rectangular in shape, it is located on an unusually flat high prominence of the main ridge. It extends down on the north side but 20–50 yards while on the south side to fully 150–160 yards. 1—*Danthonia compressa;* 2—*Juncus tenuis;* 3—*Muhlenbergia sobolifera;* 4—22, 99, 102; 5—11, 24, 36, 42, 47, 48, 65, 71, 72, 104, 115, 116, 117, 120, relicts of 14, 125, *Vaccinium hirsutum* and *Aronia nigra.*

In the central region at the top is a rocky area of ½ acre with a weed community as follows: 1—*Trifolium repens;* 2—*Polygonum persicaria;* 3—*Polygonium aviculare, Juncus tenuis, Rumex acetosella.* The north boundary is of scrub *Quercus borealis* with a transition zone of shrubs (*Lyonia ligustrina, Vaccinium corymbosum* and others). The south tree boundary is also of *Quercus borealis,* but higher trees in front of which is a broad transition zone of mixed shrubs. Especially noteworthy here was the occurrence in large masses of the northern shrub willow *Salix tristis* which made the contact with the grass while *Vaccinium corymbosum* was next to the forest.

This bald was famous among the Cherokees as being "The rabbit place" (Tsistuyi). Here the chief of the rabbits lived. He was as large as a deer and ruled all of the rabbits of the Cherokee country.

Camp (3) holds "that the area was not originally a pure grassy meadow but one with numerous shrub islands of various types and mentions a tradition that this bald was "originally a blueberry meadow." He thus believes it was "once dominantly a heath bald containing open spaces with a heavy covering of grasses, sedges, and other herbaceous plants." He (4) later rightly states that it "bears on its great wind swept dome the most striking and choice assortment of ericaceous genera and species of any of the grassy balds." He found the hybridizing of at least 3 species of *Azalea* result in a polyglot population almost impossible to unravel.

OLD CAMP BALD. In gap 300 feet below Little Wayah Bald, near

Nantahala Gap. July, 1935. 4700 ft. One and a half acres. The undisturbed $\frac{2}{3}$ of this bald was dominated by oatgrass and closely similar to Little Wayah Bald nearby. Of especial interest was the composition of a semi-weedy disturbed area, the site of an old cabin and corral. 2—*Salix humilis;* 3—*Fragaria americana, Solidago* sp., *Danthonia compressa;* 4—*Prunella vulgaris;* 5—*Diervilla sessilifolia.* The bald opening was closely surrounded by a *Quercus borealis* forest.

The significant fact here was that of the reinvasion of the oatgrass into the weed community. Every indication pointed to the gradual restoration of dominance to this plant.

GENERAL DISCUSSION

The observation that typical bald communities had appeared on many hundreds of yards of the high ridge trails, was the basis for the idea that the prehistoric grass balds must have had a similar origin to the perfectly evident origin of the unrecognized linear balds of the trails. These trail balds, of which examples on Tennessee Ridge and Shining Rock Mt. (Fig. 12) have been described, could have had no other origin than that of the succession which took place after the trail became sufficiently unused to make possible the appearance in it of an herbaceous community. Fire conducting itself along a ridge-top and confining itself to the trail and immediate trail border is of course an absurdity.

The pioneer dominants must have been herbaceous for in many places on sloping ridge tops these bald trails are sunken, indicating a degree of use and weather erosion which eliminated the reproductive parts of woody plants, rhizomes, stolons, and seedlings. Following a brief weed-like pioneer stage initiated commonly by *Rumex acetosella,* these trail areas went over to a high dominance of the mountain oatgrass (*Danthonia compressa*). In many places, this remarkable grass seems to have extended its range laterally at the expense of the narrow zone of shrubs which commonly is found transitional to the all-environing forest.

From the trail bald it is a simple logical step to realize that the broader local areas recognized as "grass balds" must have had a similar origin though severe and intensive local human interference which as will be shown later, must occur, to initiate an herbaceous succession in contrast to the usual woody succession following fire or lumbering. These ancient grass balds such as Andrews and Siler's in the Smokies and Cold Mt. and Shining Rock in the Balsams are then essentially

expanded trails. Antidating, as most of them do, the coming of the white man, they unquestionably owe their origin to sufficient intensive local and continuous destruction of the woody vegetation to make possible the advent of an herbaceous complex, progressing rapidly to the stable *Danthonia* community on mesic soil habitats or *Carex* on wet ones. Having attained dominance these perennials with and apparently without the aid of fire are able to compete successfully against the woody plants.

Camp's (3) data on Gregory Bald (given previously) strongly supports this theory, though he does not use it as it is interpreted here. His movement from shrub to grass is due he believes to "hot southwesterly winds."

INDIAN CAMP SITES

It may now be clearly understood why 15 of the 22 old balds described herein are found on gentle warm south-facing slopes of high ridge tops, gaps or knobs, just above or near to springs. These are interpreted as summer time camp sites where the Indians may have gathered in large numbers for it is known that they preferred the ridge trails for hunting and travel over the stream side ones. Truett (16), a student of trade and travel before 1830, states:

"In the mountain and hill country the trails usually led along higher ground and ridges where the undergrowth was not so dense and where there were fewer streams to cross. The trails along ridges also afforded good opportunity for sighting game and enemies. These two factors determine to a great extent the location for paths."

The Southern Appalachian ridges are so massive that ascent and descent on the same day leaves little time for hunting or any other activity including ecological note taking (as the writer repeatedly discovered), hence the development of local high mountain camp sites would prove a real need for the Indian hunters. It is entirely probable that during the summer the women and children for varying periods would be taken to such camp areas. Further the large balds may have been refuges for large numbers of Indians in time of war.

Some of the balds which in the mind of the writer were originally major Indian summertime camp sites are: Shining Rock, Andrews, Tennessee, Siler's, Spence Field (near Thunderhead Mt.), Big Chestnut, Gregory, Roan. There are numerous minor grass balds such as High Spring Bald earlier described which were unimportant as a camp site but were significant as a meeting ground at the highly placed spring.

It must be stated that springs located near ridge tops are not frequent in the Southern Appalachian Mountains. In the eastern and more rugged half of the Smoky Mt. Park there are only a few places where water may be had convenient to the high trails.

The sharp angular character of the boundary of certain balds such as may be seen at Andrew's and Mt. Sterling balds, has a highly artificial appearance. In both of these, sharp right angles occur in the line of contact between balsam trees and the grass. No set of natural factors would be so arbitrary in a boundary line.

In contrast, a most important early trail crossing; viz., Indian Gap on the main Smoky ridge over which passed one of the great Indian war trails formerly showed but a few square yards of grass developed at the sharp ridge top. And no water is to be found within many hundred feet.

As to the time these camps were occupied nothing is known from the early records. The "between the lines" inference in the Cherokee legends is that the balds far antedated the 18th Century Cherokee. Their actual origin probably goes back many centuries before the advent of the white man and they may be relicts of a culture and of habits, about which the Cherokee of the DeSoto and Bartram periods knew nothing.

GAME LURES

After publishing a preliminary note (18) on the Indian theory of grass bald origin, the writer learned from Mr. Arthur Stupka, Smoky Mt. Park naturalist, an additional line of evidence. Near the Mt. Sterling Bald (previously described) Mr. Stupka met an old mountaineer, who reported that his grandfather had been told by the Indians that the Mt. Sterling Bald had been made by the Indians for a game lure. Deer and wild turkeys would be tempted into the opening and be easily shot with bow and arrow from the deep shadows of the environing balsam forest.

This contribution is especially interesting in light of the fact that the Mt. Sterling Bald is a wet bald dominated by *Carex flexuosa* and would in wet seasons be unfit for camping purposes.

Another bald of this probable origin and purpose is one located on the slope of the ridge between Clingman's Dome and Siler's Bald which from its shape may be known as Square Bald. These game lure balds unadapted for camping are few in number.

LOOKOUTS

A third type of bald is located near or on sharp summits and which seem to have been little more than lookout stations. Such a one is the small bald at the top of Blockhouse Mt., a neighboring peak to Thunderhead Mt. in the Smoky Mt. Park, but not on the main high N. C.—Tenn. ridge. This bald faces to the nearby main ridge and also overlooks the Gunna Creek valley. It would be most reasonable to regard such a small bald as a signal station. Similar small balds near the top of such strategic peaks as Shining Rock, Cold, Bunches, and Wayah seem to find their proper classification in this category.

OBJECTIONS TO INDIAN THEORY ANSWERED

Only two students mention the Indian in connection with the balds, only to eliminate him from the picture.

Fink (8) believes they "could not have been cleared by the Indians in prehistoric days for it would have been too gigantic a task far beyond the possibility of their rude stone axes. Indian energy, or rather lack of it, would not have gone to such incredible labor without some vitally impelling cause. And even had they done so in the centuries which must have elapsed the clearing would have been completely reforested."

If we are careful to subtract the marginal areas on many of the balds which were made by the white mountaineer and his cattle and horses, we do not have a "gigantic" task to clear what is left. The original balds were unquestionably at first highly restricted expansions of the trails at these strategic points which through decades of use and slow destruction of trees and shrubs for fire wood expanded to the size at which the white mountaineer found them. The rude axe of the Indian plus many decades, or even centuries, of time could easily have enlarged the balds to the size first noted by the white men. As has already been shown, shrub bald areas may apparently be reduced to grass with the aid of criss-cross trails alone, though in many of the very open balds such as Andrew's, mass camping would be indicated to account for the extreme reduction of the woody plants. Such mass activity could easily have occurred in the summer period in relation to hunting or large war parties.

That under abandonment the balds would have been reforested, does not follow. All the evidence indicates that at the higher altitudes balds are completely resistant to invasion. The competition of the remarkable oatgrass is too severe for the woody plants. This grass

(*Danthonia compressa*) is confined to the high altitudes where on mesic sites, it competes so successfully with all other herbaceous plants as to reduce them to very minor elements of the population.

Davis (6) merely asserts that there is no "legend or evidence of Indian occupancy." This is a correct statement insofar as historical records go. The absence of such evidence in early records, however, may only mean that most early visitors to the Cherokee region never raised the problem of bald origin. Ecological concepts were of little concern to the early naturalists. There is little hope of getting any help on the problem from old records. But this lack does not detract to any degree from the purely ecological evidence presented in this study.

NEGATIVE EVIDENCE

The great single fact which constitutes strong negative evidence is that the subsere following fire, lumbering, or these two combined is initiated and developed by woody plants. At the higher altitudes in the balsam-spruce areas following the destruction of the forest the familiar fire cherry (*Prunus pennsylvanicum*) appears like magic from its long-viable seeds and by means of root crown shoots preserves its dominance under repeated fire. In the shade of this seral dominant, the balsam and spruce return. Often associated with this tree as subdominants are the bramble (*Rubus allegheniensis* and often the thornless *R. canadensis*) and the red elder (*Sambucus racemosus*).

This successional forest may be observed today covering many square miles of the high Balsams where it came in some 17 years ago following the removal of the forest with succeeding fire. And nowhere is there any evidence of any part of this vast deciduous successional cover giving way to a weed or a grass complex without the additional interference of man.

A similar relation holds at the slightly lower altitude or in the northern red oak (*Quercus borealis*) zone contiguous to the balsam-spruce with the difference that the bramble and other shrubs such as *Corylus* tend to gain control quickly and hold it until the trees are slowly replaced.

Thus it may be stated categorically that if fire alone can produce a mountain grass bald, vast areas of the high Southern Appalachians would be in such balds. Yet the grass balds are but mere dots scattered widely over the vast mountainscape.

This important line of evidence together with the positive evidence

given earlier, constitutes strong support for the theory that the recognizably old or prehistoric grass balds are aberrant climaxes initiated through human interference (disclimaxes of Clements) which persist because of the highly competitive nature of the dominant grass in resisting encroachment of the woody vegetation at high altitudes.

It is worthy of record here that the dominant grass of the ecologically puzzling western high mountain deer parks, is a close relative of the eastern bald dominant; viz., *Danthonia californica* var. *unispicata*. Whether or not the theory developed in this paper could be made applicable to the western areas is for the consideration of those who know those openings better than does the author.

RECENT HUMAN INTERFERENCE

The influence of the white mountaineer on the balds has been through his use of these areas for grazing. In many cases by the use of his axe in addition to his stock, he has measurably enlarged the original balds. An excellent example of such a greatly enlarged bald is that on Roan Mountain which covers many hundred acres. It is interesting to note that those balds which show evidence on their margins of recent deforestation accompanied by grazing, are located at or near accessible, broad gaps, where the old mountaineer cross-ridge trails passed. Spence's Field near Thunderhead Mt. is another such bald enlarged and extended along the ridge by the mountaineer and his cattle.

More rarely a bald may be encountered which has been entirely initiated by the early native whites. Crabtree Bald, described earlier, is such a one. A few relict trees which survived the axe and fire are scattered over it in all stages of deterioration. Unlike nearly all of the larger balds, this one is on a north facing slope. The surest criterion, however, is the depth of the sod which in a bald of recent origin is notably thinner than in an ancient Indian initiated type such as Andrew's. The dominant Kentucky blue-grass, together with the relatively high dominance of a number of weeds, presents on this "bald" a completely different picture from that of the undisturbed true bald on which the mountain oatgrass or sedges are almost pure dominants.

RESPONSE TO GRAZING

The degree of grazing on the balds is most accurately indicated by *Juncus tenuis*, the path rush. On a heavily grazed and trampled area like that of Gregory, the rush attains a rank of 2 or that of a true subdominant with a marked suppression to a rank of 4 to 5 of the other

weed elements of the community. Andrews Bald shows no *Juncus* whatever. On the ½ acre at the top of Gregory where the cattle gather at night with consequent eliminating of the grass, a destructive ruderal flora and dominance is to be noted.

With the cessation of grazing, no matter how severe the destruction of the grass, the seral progression is toward the *Danthonia* disclimax. However, short or long the intermediate weed-like stages are they are for the most part highly successful in holding the areas against the woody plants.

It is interesting to note that a few of the pioneer weeds are able to persist in the mature *Danthonia* or *Carex* communities in a highly suppressed state, ranking only 4 or 5.

On Old Camp Bald, described earlier, on the site of the former corral where the vegetation must have been practically eliminated, the oatgrass was returning and entering into competition with the wild strawberry and the *Salix humilis*, which had been able to establish itself on the disturbed area. How long the pioneers or later herbs other than the oatgrass hold these disturbed areas is not known. The Indian Graveyard Bald has apparently been for a number of years dominated by the perennial *Solidago canadensis* which gained ascendancy during a drouth year. The only places where the oatgrass was making a successful ecesis was on the mound summits. In time, the oatgrass would regain dominance over the area.

The Big and Little Pisgah Bald, which are rapidly being eliminated by *Corylus rostrata* moving into them from the margins by means of rhizomes, present a problem. Why have not all of the grass balds long ago been taken by the hazelnut? The answer is to be found, we believe, in two facts: (1) The low altitude of these balds making contact with the hazelnut climatic zone and (2) the heavy grazing these balds have had in recent years weakening the grass in its competition with this one shrub which was unmistakably and rapidly erasing the herbaceous community from the local mountain picture.

THE DROUTH CYCLE

A severe drouth occurred in the early summer of 1936 which resulted in the death of the oatgrass (*Danthonia compressa*) over relatively large areas of many of the balds. Only where a shower had fallen in time or where the soil depth or other soil factors had made possible the persistence of available water had the grass remained alive. The Smoky Mt. Park balds suffered move severely than did those in the Balsams.

The initiation of the subsere following the death of the dominant grass was carried out by a few species of weed-like plants (*Potentilla, Fragaria, Solidago*), which as highly suppressed perennials under the subsequent rains and the removal of the root competition rapidly developed into maximum sized plants. These seral communities of ruderal aspect in a few years give way again to the oatgrass and the disclimax grass community is restored until the next drouth occurs.

One very instructive situation was observed on Block House Mountain Bald. The grass near the ridge top had been killed *en masse* but lower down the slope it had survived the drouth. Over the killed

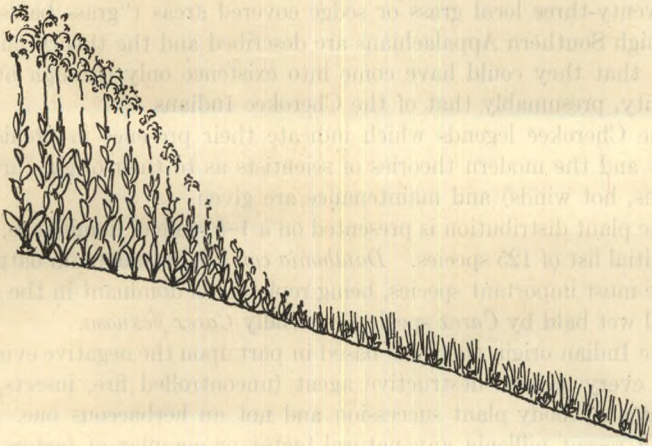

FIG. 13. DIAGRAMMATIC DEMONSTRATION OF INTENSITY OF COMPETITION SET UP BY THE OAT GRASS

At left, the response of the perennial goldenrod (*S. patula*) after the killing of the grass by drouth. Right, the repressed goldenrod in area of surviving grass.

area *Solidago patula* had assumed control but in the transition region to the living grass, the plants of this perennial species became progressively reduced in size until those which were hidden amid the luxuriant living grass became so suppressed by competition as to bear only two or three leaves (Fig. 13). This observation furnishes concrete evidence of the highly competitive nature of the oatgrass. When it is observed that these perennial goldenrods are kept almost completely suppressed it may be realized how impossible it would be for a seedling plant of any kind to become established and the explanation for the non-ecesis of the woody plants becomes apparent.

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SUMMARY

Twenty-three local grass or sedge covered areas ("grass balds") in the high Southern Appalachians are described and the theory put forward that they could have come into existence only through human activity, presumably that of the Cherokee Indians.

The Cherokee legends which indicate their presence in prehistoric times and the modern theories of scientists as to their origin (fire, ice storms, hot winds) and maintenance are given.

The plant distribution is presented on a 1–5 scale of dominance, with an initial list of 125 species. *Danthonia compressa* (mountain oatgrass) is the most important species, being replaced as dominant in the occasional wet bald by *Carex* species, especially *Carex flexuosa*.

The Indian origin theory is based in part upon the negative evidence that every natural destructive agent (uncontrolled fire, insects, ice) initiates a woody plant succession and not an herbaceous one. Also during recent millenia any natural factor or complex of factors that could initiate and maintain herbaceous balds would have reduced extensive areas of the high mountains to this state.

The positive evidence is derived from the following facts: Most of the balds are on gentle south slopes of rounded ridge tops or gaps near high "bold" springs, indicating clearings for summer camp sites. A few are isolated on steeper slopes and have been reported (Mt. Sterling Bald) as having been made by the Indians for game lures and certain small ones on peak tops are to be interpreted as lookout points.

A most important line of evidence is that observable on many of the high ridge trails, where long sections have developed the bald plant complex, showing that the grass community may appear only following a long and severe disturbance of the original vegetation at the soil level. A grass bald is in a sense an expanded trail.

Following abandonment of these intensively disturbed areas, a ruderal or weed stage ensues, followed by the permanent grass (*Dan-*

thonia) or sedge (*Carex*) community. During drouth summers much of the grass may be killed and a new subsere initiated by the ruderal plants. The high mountain grass and sedge are able to compete successfully with the woody vegetation without the aid of fire, accounting for the maintenance of these artificial areas through centuries of time.

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PLATE 1

Fig. 2 (top). Andrews Bald. Note luxuriance of sedge cover, shrub relict and *Lilium superbum* at right.

Fig. 3 (middle). Mt. Sterling Bald. Note sharpness of contact with the balsam forest.

Fig. 4 (bottom). Camp site of Dr. H. L. Blomquist on Mt. Sterling Bald. Little revegetation in 2 years.

PLATE 2

Fig. 5 (above). General view Roan Bald. Largely recent in origin.

Fig. 6 (below). Roan Mt. Bald. Note relict buckeyes. Chiefly recent in origin.

PLATE 3

Fig. 7 (above). Shining Rock Gap Bald. Note fire or pin cherry following logging and fire in the balsam area. No cherry whatever in the bald portion.

Fig. 8 (below). Shining Rock Gap Bald (foreground). Shrub bald broken by blueberry pickers, grass developing in the trails.

PLATE 4

Fig. 9 (above). Big Pisgah Bald. Note *Corylus* border encroaching laterally on grass area. *Cirsium discolor* along trail in foreground.

Fig. 10 (below). Crabtree Bald. Recent in origin. Note relict trees.

PLATE 5

Fig. 11 (above). Gregory Bald. Note sharp contact with northern red oak forest. *Salix tristis* in foreground.

Fig. 12 (below). *Danthonia compressa* dominant in trail.

PLATE 1

FIG. 2

FIG. 3

FIG. 4

PLATE 2

FIG. 5

FIG. 6

PLATE 3

FIG. 7

FIG. 8

PLATE 4

FIG. 9

FIG. 10

PLATE 5

FIG. 11

FIG. 12