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An Ecological Study of the Distribution of Animals on Mt. LeConte and Along LeConte Creek

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To the Graduate Council:

I am submitting herewith a thesis written by Gervase W. McClure entitled "An Ecological Study of the Distribution of Animals on Mt. LeConte and Along LeConte Creek." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Wildlife and Fisheries Science.

Edwin B. Conor, Major Professor

We have read this thesis and recommend its acceptance:

George Bentley

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

UNIVERSITY OF TENNESSEE

23

Upon the request of the Committee on Graduate Study
the under-signed have examined the thesis entitled

An Ecological Study of the Distribution of Animals

on Mt. Leconte and Along LeConte Creek

presented by Gervase W. McClure

candidate for the degree of Master of Arts

_____, and hereby certify that it
is worthy of acceptance.

Edwin B. Cowen
J. M. Bentley

Examiners.

AN ECOLOGICAL STUDY OF THE DISTRIBUTION OF
ANIMALS ON MT. LECONTE AND ALONG LECONTE
CREEK

A THESIS

Submitted to the Graduate Committee
of the

University of Tennessee

in

Partial Fulfillment of the Requirements
for the degree of
Master of Arts

GERVASE W. MCCLURE

August 1929

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AN ECOLOGICAL STUDY OF THE DISTRIBUTION OF ANIMALS ON
MT. LECONTE AND ALONG LECONTE CREEK

The Great Smoky Mountains

Location

The term Smoky Mountains is somewhat synonymous with the Unaka Mountains which continue westward the entire border line between Tennessee and North Carolina to Georgia. But according to the latest maps of this region only that part of this range bounded by the Pigeon River which breaks through from North Carolina on the northeast, and the Little Tennessee River on the southwest can be called the Great Smoky Mountains proper. (See Map of the Great Smoky Mountain region, facing page 2.)

Physiography

The entire length of the Smoky Mountain, which is approximately sixty miles, for the most part forms the water divide between Tennessee and North Carolina. The width of the mountains varies extensively, according to the formation of the conglomerates and rate of erosion, but it is approximately thirty miles. The acreage has been estimated to be more than 450,000. The altitude varies from 1,500 to over 6,600 feet above sea level,

forming the steepest vegetative slopes in America. The temperature varies from 100 degrees F. at the base in the hot summer days to 20 degrees F below zero on the summit in the coldest winter nights.

Geology

Geologically the Great Smoky Mountains are the oldest mountains in America.¹ They are composed of lime stones, shales, slates, sandstones, quartzites, conglomerates, gneisses, schists, and perhaps granite. They range from the Mississippian to the Archean period, and most of them are Pre-Cambrian. They are apparently non-fossiliferous. So far as is known there are very little minerals or ores of economic importance found in this locality.

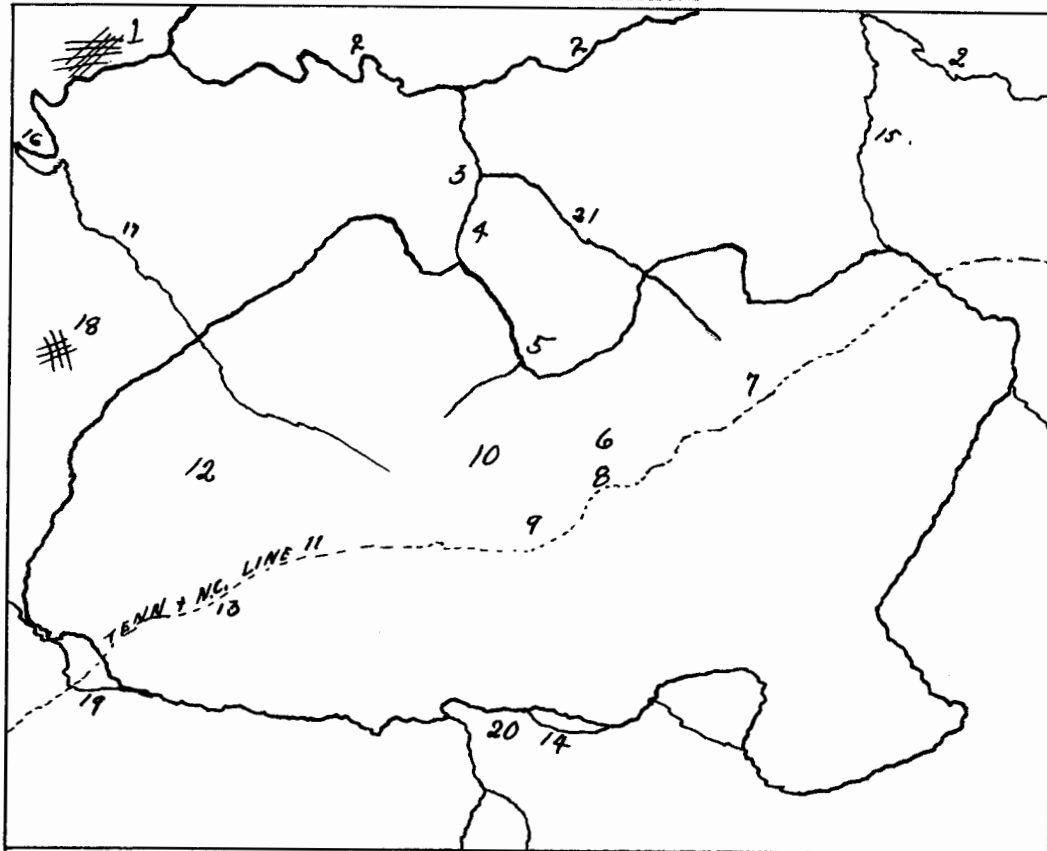
Peaks

More than twenty-eight miles along the crest of the mountain rise over a mile above sea level. Among the most important peaks are Mount Guyot, Clingman's Dome, Siler's Bald, Thunderhead, Laurel Top, Mount Collins, Briar Knob, and many others. But the

¹ Glenn, L. C., "The Geology of the Proposed Great Smoky Mountains National Park", Journal of the Tennessee Academy of Science, Vol. I, No. 2, April, 1926. P. 31.

MAP I

THE GREAT SMOKY MOUNTAINS



1. Knoxville.
2. French Broad River.
3. Sevierville.
4. West Fork Little Pigeon River.
5. Gatlinburg.
6. Mount LeConte.
7. Mount Guyot.
8. Indian Gap.
9. Clingman's Dome.
10. Sugarland Mountains.
11. Thunderhead.
12. Cades Cove.
13. Gregory's Bald.
14. Bryson City.
15. Pigeon River.
16. Tennessee River.
17. Little River.
18. Maryville.
19. Little Tennessee River.
20. Tackasegee River.
21. Little Pigeon River.

most outstanding is Mount LeConte.

Streams

The region as a whole is mesophytic. Scarcely does a day pass that there is not a drenching rainfall in some section. Hence there are numerous streams throughout the whole mountain region. Among the largest, as known by the natives, are the Little Tennessee, Little River, Little Pigeon, and Pigeon, with their tributaries.

Coves

There are numbers of rich coves at the base of the mountains that are inhabited by Anglo-Saxon stock. Among these are Jones Cove, Emerts Cove, Weares Cove (Valley), Tuckaleechee Cove, Cades Cove, Cosby Cove, and many others.

1 Trees

The forest as a whole may be classed deciduous, although coniferous trees dominate the summits

1 Maddox, R. S., "The Trees of the Great Smokies", Jour. of Tenn. Acad. of Science, Vol. 1, No. 2, April, 1926. P. 21.

of the higher peaks and may be found throughout the slopes. The hard woods include many species, chief of which are poplar, basswood, white oak, black oak, chestnut, sugar maple, buckeye, birch, and beech. The soft woods consist of white pine, shortleaf yellow pine, hemlock, spruce, balsam, Virginia scrub pine, and pitch pine.

Shrubs and Plants

Among the trees along the slopes are found mountain laurel (ivy), rhododendron, sand myrtle, dogwood, redbud, huckleberry, snowball, dog hobble, flame azalea, trilliums, orchids, trailing arbutus, Virginia bluebell, sorrel, violets of many species, and over two hundred varieties of flowering shrubs¹ and plants varying from semi-tropical to those of the Canadian region.

Ferns, Liverworts, and Mosses

There is a great number of ferns, liverworts, and mosses throughout the entire section. In many places the ground and ledges are completely covered,

¹ Shaver, J. M., "Flowers of the Great Smokies", Jour. of the Tenn. Acad. of Science, Vol. I, No. 2, April, 1926. P. 17.

especially at the higher altitudes, where large beds of sphagnum and mountain fern-moss form a carpet more than a foot deep.

Animal Life

To the average person animal life may appear comparatively scarce. Yet a naturalist may find a large number of wild life in the various habitats. Along the lower levels occur animals that are common in East Tennessee. A large variety of snails, spiders, centipedes, including scorpions, are typical. Of the insects most of the orders are represented by one or more species. Spring-tails (Collembola) are abundant on the moist ground everywhere. Grasshoppers, crickets, katy-dids, and cock-roaches are abundant on the forest margin and lower slopes. May-flies and stone-flies are found near the water, and the nymphs are abundant in the swift streams. A few dragon-flies may also be found. There is a large number of Hemipterous insects found both in the water and on the flora. Of the beetles, ground and wood-boring species are more prominent. Scorpion-flies may be noted in the thick field strata along the trails. In the streams numerous caddice fly nymphs may be found. Butterflies and Hymenopterous insects are found wherever there are flowers at

any level.

In many of the streams and brooks there can be found bass, perch, rainbow, and speckled trout.

The most abundant of all amphibia are the salamanders. More than nine species are known to be taken from the water and moist slopes. Toads are abundant, while frogs are found in the low altitudes. There are also a few land and fresh water turtles.

A few varieties of snakes are found. The two most dreaded are the rattler and the copperhead, these being the only two known to possess poisonous fangs. The black snake, blue racer, fox snake, water snake, garter snake, king snake, and the small ring-necked are present, but are not often encountered.

The summer dwelling birds¹ number less than one hundred. Among the most common dwelling near the settlements and along the mountain sides are sparrows, bob whites, doves, woodpeckers, flickers, goldfinches, towhees, cardinals, indigo buntings, yellow-breasted chats, wood thrushes, brown thrashers, wrens, robins, and various warblers. These that choose the higher

1 Ganier, A. F., "Summer Birds of the Great Smoky Mountains", Jour. of the Tenn. Acad. of Science, Vol. I, No. 2, APRIL, 1926. P. 31.

altitudes are the ruffed grouse, wild turkey, yellow-bellied sapsucker, Canada warbler, Wilson thrush, brown creeper, pheasant, golden eagle, northern raven, and the duck hawk. Chimney swifts, chickadees, and the Carolina juncos are the most abundant.

Many of the mammals that once roamed the forest have become extinct. Others have become so scarce that weeks are required to locate them. Among the animals that are left in the Smokies are the Virginia opossum, Virginia deer, wood hare, Carolina wood vole (mouse), wood chuck, eastern chipmunk, red squirrel, raccoon, Carolina weasel, Carolina skunk, American black bear, gray fox, red fox, wild cat, shrew, bats.

The Problem

The ruggedness of the area, the height of the peaks, the depth of the valleys, and the unexampled variety of trees, flowering shrubs and plants, the innumerable host of animal life, have attracted scientists and nature-loving tourists from every part of the United States, and from many parts of the world.

So little attention has been given the fauna of this region from an ecological stand-point that any attempt on my part would seem futile. Nevertheless

there is an unusual opportunity to study life, environment, and heredity in its natural state undisturbed by the agencies of man.

The greatness of the task at once presents itself and to prepare such a paper would require years of study and volumes of manuscripts.

Mount LeConte is typical of the whole region and my data will be confined to that section along LeConte (Mill) Creek, beginning at the Cherokee Orchard and continuing upward to the point directly between Main Top and West Peak.

Thus we begin the problem of the summer ecological distribution of animals in the vicinity of LeConte Creek.

MAP II

MAGNETIC BEARING MAP
OF
LECONTE CREEK
SCALE 1:100,000 - 1500 FT.

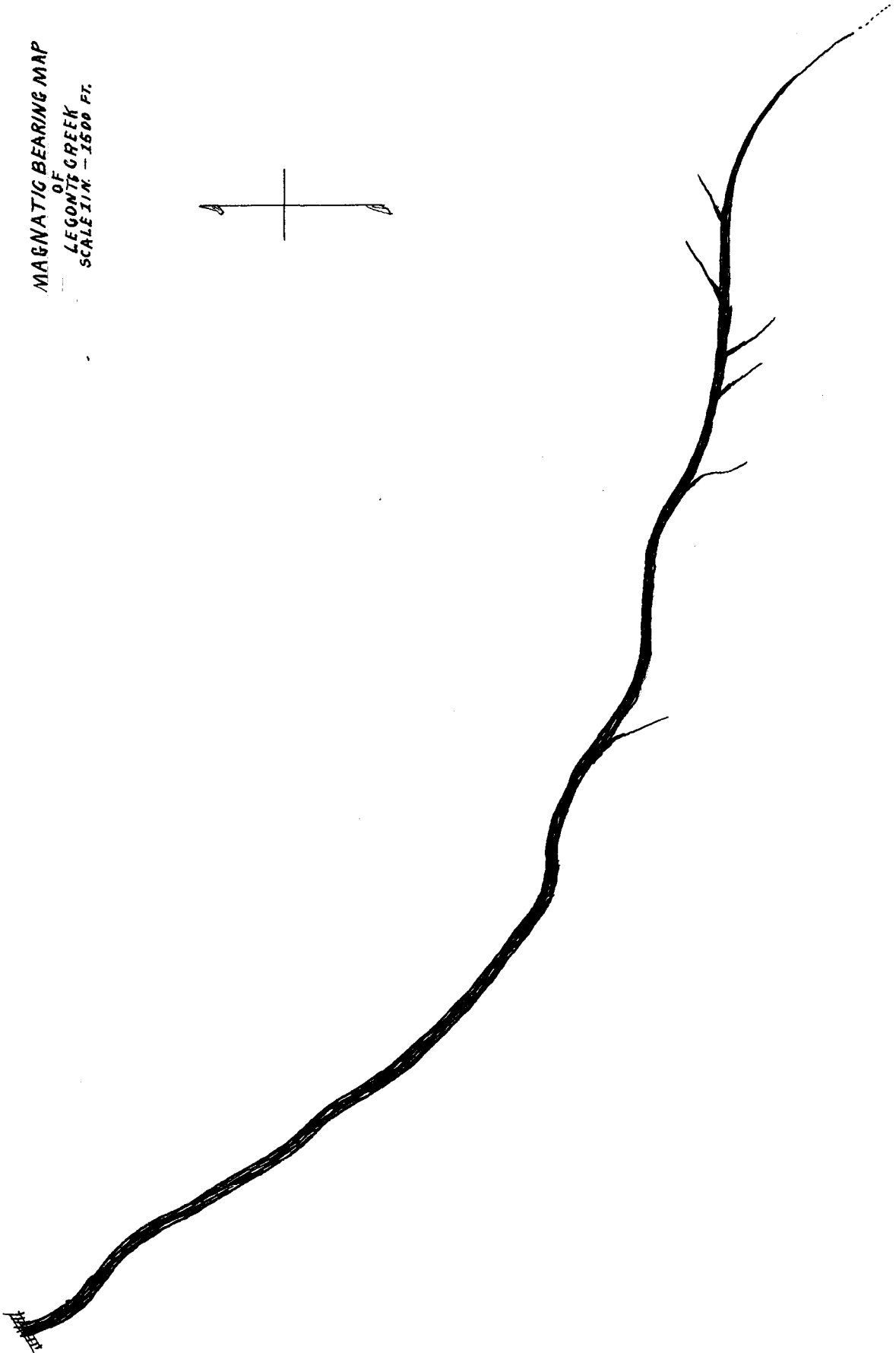


Table I

Compass Traverse of LeConte Creek

The compass traverse of LeConte Creek (see graph facing page 13) beginning at the bridge in Cherokee Orchard and continuing upward to the source, and from thence up the valley to the lowest point between Main Top and West Peak, is as follows:

Call No.	Direction	Distance
1	S 20 E	350 Ft.
2	S 60 E	500
3	S 53 E	350
4	S 45 E	400
5	S 37 E	100
6	S 21 E	150
7	S 55 E	200
8	S 20 E	250
9	S 40 E	200
10	S 20 E	150
11	S 15 E	200
12	S 45 E	150
13	S 60 E	300
14	S 35 E	550
15	S 35 E	150
16	S 31 E	200
17	S 47 E	300

Table I (continued)

Call No.	Direction	Distance
18	S 52 E	300 Ft.
19	S 57 E	600
20	S 68 E	550
21	S 60 E	150
22	S 45 E	150
23	S 85 E	350
24	S 70 E	350
25	N 77 E	350
26	S 75 E	500
27	S 42 E	200
1	S 40 E	
28	S 87 E	150
29	S 57 E	300
30	S 65 E	200
31	S 70 E	200
32	N 65 E	550
33	E	600
34	S 67 E	550
35	S 53 E	250
36	S 84 E	100
37	N 82 E	100
38	S 73 E	200
39	S 47 E	100
1	S 7 W	
40	E	400

Table I (continued)

Call No.	Direction	Distance
41	S 80 E	550 Ft.
42	S 85 E	250
1	S 30 E	
43	S 65 E	150
44	S 83 E	350
45	N 83 E	100
1	S 30 E	
46	N 71 E	500
47	S 85 E	200
48	S 60 E	150
49	N 83 E	150
50	S 75 E	250
1	S 83 E	
51	S 55 E	100
52	S 66 E	350
1	S 85 E	
53	S 43 E	300
1	S 25 E	300
2	S 15 E	
54	S 39 E	250
55	S 47 E	150
56	S 25 E	200
57	S 37 E	150

Table I (continued)

Call No.	Direction	Distance
58	S 18 E	150 Ft.
59	S 15 E	100
60	S 30 E	500 Top.

GRAPH I

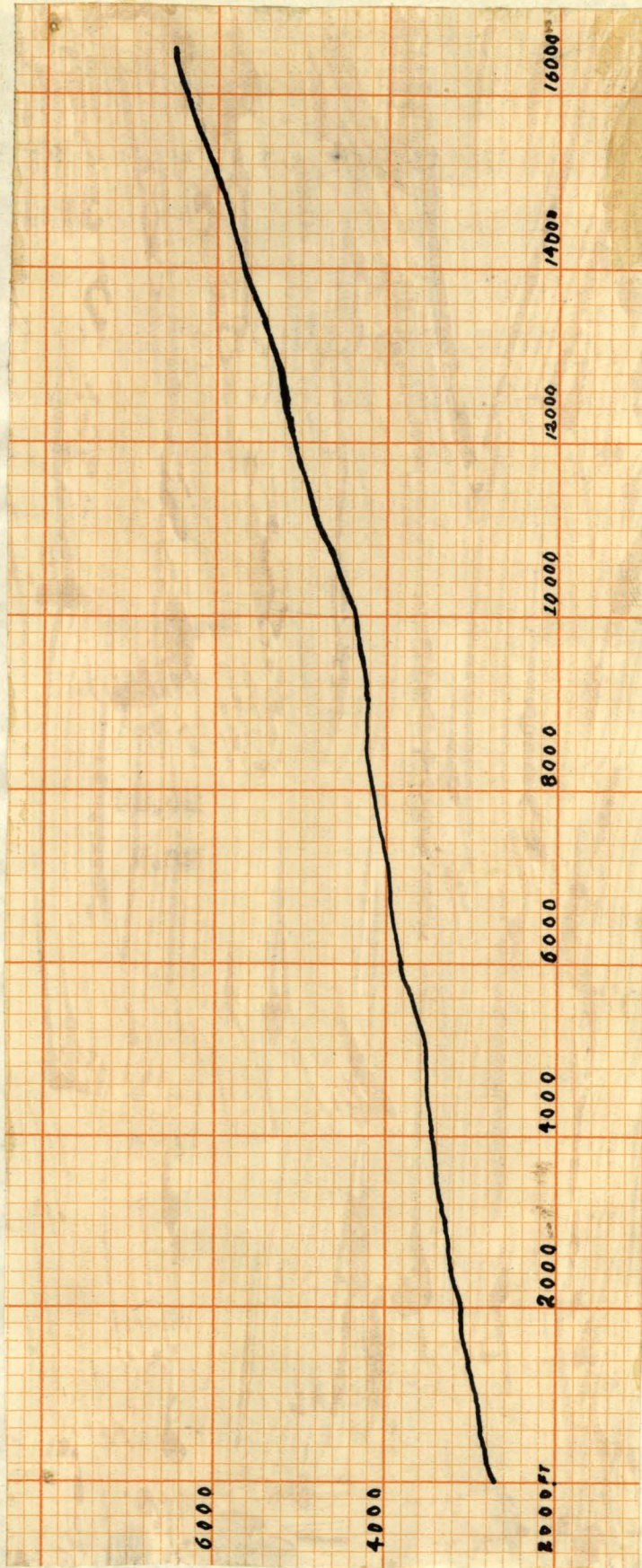


Table II

Barometric Leveling of LeConte Creek

The table shows the barometric pressure in inches and the altitude in feet of LeConte Creek (see graph facing page 13), beginning at the bridge in Cherokee Orchard and continuing upward to the source, and from thence up the valley to the lowest point between Main Top and West Peak. Each plot represents 1,000 feet.

Plot No.	Pressure	Altitude
0	27.2 in.	2800 ft.
1	27.05	2950
2	26.82	3150
3	26.7	3300
4	26.6	3450
5	26.5	3550
6	26.3	3850
7	26.1	3950
8	25.9	4150
9	25.8	4250
10	25.75	4325.6 U.S.BM.
11	25.25	4800
12	25.	5100
13	24.85	5300
14	24.55	5650
15	24.25	5950

Table II (continued)

Plot No.	Pressure	Altitude
16	23.9 in.	6350 ft.
17 (500 ft.)	23.82	6450 Top.

Description of LeConte Creek

A close observation of the valley has been made and it has been zoned according to the vegetation, which is composed of virgin timber.

Chestnut Zone

The first zone which includes the first seven plots is largely composed of oaks, birches, buckeyes, hemlocks, poplars, and beeches, which obtain a very large size. But the dominant tree is the chestnut; this is being destroyed by the chestnut blight and apparently is being replaced by oaks. Numerous shrubs and plants are present. A number of large trees have fallen and are in a decaying state.

The stream in this zone has an average of about 16% fall and is for the most part shallow containing numerous large boulders, some of which

are covered with moss and rock ferns. Several deep pools are formed where the water plunges over the large rocks. Two or three small islands are formed at the bases of the coves; these contain trees and other vegetation.

The slopes of the sides of the valley vary somewhat, but in general they are not very steep. An old deserted house and two log barns stand within a few hundred feet of the stream at the edge of the Cherokee Orchard which continues about one-half of the zone. The LeConte trail leads along the left side of the stream the entire length of the Chestnut Zone.

Transitional Zone

This zone includes the next three plots which end at Rainbow Falls. It consists of hemlock, buckeye, hard maple, red maple, black cherry, white ash, birch, oak, and many small shrubs, plants, mosses and ferns. The trees are not as large as those in the previous zone, but are, however, much thicker and taller. The dominant tree is not outstanding and has not been determined.

The stream has an average fall of 10%, and contains larger boulders and is intercepted by falls

and rapids. A small branch enters from the west about mid-way of the zone.

The valley is not as wide in this zone, but the slopes are steeper. Rhododendron covers the entire west side of the valley to the water's edge. On the east large cliffs are prominent, and large rocks prevail throughout the entire zone.

The trail leads along the east side of the stream the entire length of the Transitional Zone.

Rainbow Falls



Rainbow Falls marks the end of the Transitional Zone, and is the only large natural barrier in the entire stream. The altitude at the top is 4325.6 according to the U. S. BM. Here the water makes a plunge of 85 feet, and while the falls itself

is only a few feet wide, the cliff is more than three hundred feet wide.

Birch Zone

This zone includes the next three plots, and is composed of birch, buckeye, balsam, spruce, white maple, viburnum, and rhododendron. Here the trees are larger and not as thick as they are higher up the zone. In the openings there is a variety of flowering plants. Moss and ferns are prevalent.

At Rainbow Falls the stream is wide and as it ascends it becomes narrower and swifter, having a fall of 32%. The falls are larger and the rapids more frequent.

In general the valley becomes somewhat narrow, and the slopes very steep. The large boulders and cliffs are partially covered with moss and ferns. About a third of the way a small stream flows from the west. Here the valley is somewhat wider. At the upper end of the zone there is a small western cove, from which flows a small stream. Here a small delta has been formed upon which are a few large trees.

The trail crosses the creek twice in the Birch Zone.

Balsam Zone

This zone includes the last three plots of our area. It is composed of balsam, spruce, red cherry and white ash, which are typical to Canadian forests. Balsam is far the most abundant and the trees are so thick that the ground is continually shaded. White maple, snowball, and huckleberry shrubs are prevalent on the crest. After a short transitional section the ground is completely covered with fern-moss, sorrel, and ferns.

Here we find the stream steepest, having a fall of 34%. After a few hundred feet there are few large boulders and high cliffs. The stream is fed by a large number of seeps a few hundred feet from the crest, which is directly between Main Top and West Peak.

After a few hundred feet the valley widens extensively and forms a long gentle slope.

Near the top the trail leaves the stream and leads directly east one-half mile to LeConte Lodge.

Summary

According to the United States Biological Survey, Fourth Provisional Zone Map, the forest ranges from the Transition to the Canadian. The summit is

covered with fir, typical to this zone. Sphagnum, fern-moss, and ferns completely cover the ground. As the mountain slowly erodes the deciduous forest appears, principally birch and buckeye. Replacing these at a lower level are the chestnuts and oaks.

The stream is classed hyeropsyche, containing numerous falls, rapids, large boulders, and a few deep pools and shoals.

The entire valley contains virgin forest, flowering shrubs and plants. The slopes are steep, containing many cliffs practically covered with moss and ferns. Numerous boulders are exposed along the valley for the most part.

A more detailed discussion of succession will appear later.

Technique and Methods

During the winter months numerous trips were made to Mount LeConte and winter conditions were studied. Time and other duties would not permit a complete seasonal distributional study. More detailed observations were made during the months of June and July. During this time the observer was continuously on the ground.

The plans and methods pursued in securing data for this paper were as follows:

The entire stream was surveyed and plotted. A United States Engineering compass was used to secure the calls. A surveyor's chain was used to measure the distance. At the end of each thousand feet a tag, numbered from one to seventeen, was tacked to a tree. The pressure and altitude were taken with an aneroid barometer. The animals were collected in their natural state without the use of trapping, baiting, or any method of congregating them.

The subterranean ground strata are not complete and are not tabulated in this paper, but the method pursued is as follows:

A plot 10 x 10 feet square was dug to the depth of three inches and all of the animals collected, accurately labelled, and preserved. For the earth worms a space 12 x 12 inches was taken from the plot and the worms were counted.

For the field and stream communities the following materials were used. A butterfly net to collect all specimens on the wing. Two dip nets, one cloth and the other screen wire, were used for specimens found in the stream. Cigar boxes, jars, and vials were used to preserve specimens.

The time consumed at each plot was approximately equal.

Plate II.
Leconte Trail Longitudinal Distribution of Animals

Common Name	Scientific Name	PLOT NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL	
Snails	<i>Helix</i> sp.		13	32	15	30	13	22	34	18	20	24	141	19	14	2	3	4	7	411	
Harvestmen	Phalangidae		9	8	18	26	19	6		8	1	1		2	2					100	
Spiders	<i>Hypochoilus thorelli</i>		48	29	34	8	11	4	23	10	6	67	20	10	12	2				284	
Spiders	<i>Tetragnatha elongata</i>		1	9	26	26	2	2	3			1								70	
Spiders	<i>Uloberus americanus</i>		2	2	17	8	5		3		1		2							40	
Spiders	<i>Leucauge venusta</i>		8	4	3	1	2	3	2	1			1	1						26	
Other spiders	Araneida		9	3	8	8	4	4	2	11	15	90	33	28	18	3	5			241	
Spring-tails	Collembola									8	1	1								10	
Grasshoppers	Orthoptera		1	1				1												3	
Katydid	<i>Pterophylla camillifolia</i>		1			1														2	
Lace-wing fly	Neuroptera			4	1		1													6	
May fly	Ephemera				5		4	3			11	5		2	1					22	
Stone fly	Plecoptera		3	1		2	2		2					23	8	11	1			55	
Bug	Hemiptera		3	2		1	1		1					1	1					10	
Beetles	Coleoptera		6	8	20	63	9	4	2	5	3	3	2	9	6		1	1	5	147	
Butter fly	Lepidoptera		6	2	3	7	4	2	1	3		1	18	14		8	1		3	73	
Fly	Diptera		3	4	4	5	3	2	1	2	8	3	35	13	18	6	1			5	125
Stinging insects	Hymenoptera		1	19	1	2	1			1	4		4		2					8	49
Toads	<i>Bufo</i> sp.			1	1			2	1	1				1						7	

An attempt was made to make observations under as uniform weather conditions as possible.

It is impossible to measure all the controlling factors of this region, and the best avenue of approach is to determine the quality and quantity of the animals that inhabit each zone.

Conclusions are based upon observation and not merely upon the small number that was captured.

Observation and Discussion

Succession

Life, whether animal or vegetable, is a struggle for existence. That is, it rises, grows, matures, and dies. Hence a two-fold purpose is involved. First, to live its life, and second, to reproduce its kind. If the sum of all the factors is favorable the number of individuals increases. Hence, any change brought about upon the factors bears evidence upon the group. "Succession," then, may be used in terms of "a universal process of . . . development".¹

If we assume that the earth's surface is

1 Clements, F. E., Plant Succession, p. 3.

populated to its fullest capacity, succession, then must depend upon factors producing changes upon the surface of the land. Prime factors, therefore, to be considered are: erosion, deposit, flooding, drainage, elevation, and subsidence. Secondary factors may be climatic, fire, man, or animals.

The presence of Archean rocks indicates that elevation and erosion have been the prime factors.

The rate of erosion has not been sufficient to prevent the growth of lichens and other vegetation that may have been present. Consequently a thick layer of humus was deposited, providing a suitable surface for a growth of firs, which has shaded the ground and prevented rapid evaporation, thus forming a suitable humus for a thick growth of moss and ferns.

As the surface erodes, conditions become favorable for the birch, which is continuously encroaching upon the fir.

The accumulation of leaf-mold under the birch is such that in time there is sufficient humus formed to enable the oaks to enter. This is followed by maple and a continuous succession of plant life.

By means of plant succession, then, we may

predict the vegetation of the mountains as it approaches and reaches sea level.

Since animals show direct responses to physical conditions, so far as food-supply, shelter, and protection are concerned, it follows that each zone contains definite environmental factors that are favorable to existing animals.

The factors, then, controlling the zones are altitude, temperature, rainfall, rate of evaporation, light, condition of soil, rock formation, velocity of the stream, density and variety of the vegetation.

Animals of the Balsam Zone

(For the number and location of the animals of the Balsam Zone, see Plates I and II, facing page 22).

Before a study of the animals of this zone is made, the following factors should be borne in mind.

1. The forest is chiefly of balsam and spruce, and very little sunshine is able to penetrate the thick branches.

2. A thick blanket of moss and ferns cover the entire surface of the ground, preventing rapid evaporation.

3. The humus is thick and is kept moistened by the constant rainfall.

Animals, then, living in this zone must be adapted to carry on their life processes under the conditions existing.

The animal best adapted for living on the ground in this zone is the red-gilled salamander (*Blethodon jordani*). This salamander is more abundant in this zone. A great many variations have been observed to occur among the species. The gills vary from a deep red to a pale yellow. A number of the specimens had brown spots on their backs. A study of the color phase is being made by William G. Hassler¹ (Department of Reptiles and Amphibians, American Museum. 1929).

There is a land snail (*Helix* sp.) that occurs in this zone that was not taken elsewhere. It resembles *Helix polygyra* and may be a variation of this species. It has a thicker shell and the color is much browner.

A caddice-fly nymph sp. that makes a small cylindrical case of sand dominates the stream in this zone.

This zone is characterized by the balsam beetle, (*Cerambycidae*).

¹ Hassler, W. G., "Salamanders of the Great Smokies", Natural History, Jan.-Feb., 1929.

Mammals are scarce, the most prevalent being the red squirrel, "mountain boomer", (*Sciurus hudsonicus*) and the Carolina wood vole (*Evotomys carolinensis*). Other mammals present are the wood hare and Carolina weasel.

The birds that are not found in the other zones are typical to the Canadian Zone. They are the ruffed grouse, yellow-bellied sapsucker, mountain solitary vireo, black-throated blue warbler, Canada warbler, northern raven, winter wren, brown creeper, and the redbreasted nuthatch.

Animals of the Birch Zone

It must be remembered that a large number of other trees grow in this zone, and that among the controlling factors are:

1. In a deciduous forest the trees are taller, the branches longer, and the leaves from the trees create a different humus from the balsam.
2. Light penetrates the branches more readily, changing the condition of the surface.
3. The conditions of the surface of the ground are favorable to a different type of vegetation.

Hence, the environmental factors are such that a different type of animals is observed to be present.

The most conspicuous animal is a species of snail which apparently lives on the ground, and after a long rain it is abundant on the trunks of trees. As many as fifty have been taken from a single tree. It is a small snail having a thin lip, and regular brown spots on the dorsal aspect of the shell.

Another species which may be the *Polygyra albolabris*, may be noticed under ledges of rocks. They were usually associated with crane flies.

There is still another snail, *Succinea* sp., having a very thin shell, with a small spiral and a long flowering aperture, found most abundant on the field strata in this zone. It is found only occasionally in the other zones.

A small caddice-fly nymph having a square case made of wood was observed in greatest numbers in this zone.

A large number of spiders are prevalent, but the one of most abundance was a small spider, *Theridon* sp. It was first observed in the Transitional Zone and reached its climax in the Birch Zone.

The number of butterflies depends largely upon the flowering vegetation. At this season flowers appeared to be more abundant here than in the

other zones. Naturally a larger number of butterflies were observed here than elsewhere.

Salamanders are prevalent throughout the length of the stream. The two salamanders dominating this zone are a small species of *Desmognathus*, that has large brown irregular spots on its back; and an orange-colored species, *Gyrinophilus danielsi*.

An occasional toad, gray squirrel, red squirrel, wood chuck, and chipmunk was observed.

A number of birds was observed, but the two most common were the Carolina junco, and the chimney swift.

Animals of the Transitional Zone

This zone contains a large number of deciduous trees that are common to the Birch Zone. It is well to note that for the first time the hemlock appears. Other trees such as the bass wood, and an occasional oak makes their appearance in this zone.

Among the controlling factors three of the most outstanding should be borne in mind, namely:

1. Rainbow falls, which has a fall of eighty-five feet, marks the end of this zone, and is the only large natural barrier along the entire stream.

2. Below the falls are numerous large boulders that hinders the progress of the field strata, and forms a habitat suitable to spiders.

3. There are many factors common to the preceding and succeeding zones, this being a transitional zone.

The falls being the greatest barrier to upward migration we look to the stream for its effects. This is clearly manifested by the abundance of salamanders just below the falls. (See Plate 1, facing page 22).

A large semiaquatic drab-colored salamander, *Desmogathus* sp., seemed to dominate the stream. Fifty-two were counted lying upon the moist rocks by the observer at one time. One of these was taken and placed in a jar with other small species, and within a short time the smaller species were devoured by the larger one.

Another drab-colored salamander somewhat smaller than the one mentioned above was found to be very abundant. Still another, a long-tailed yellow spotted salamander, *Eurycea bislineata*, is found in great abundance.

There is a caddice-fly nymph, *Limnophilus* sp., called "stick bait" by the natives frequently

found in this zone, and perhaps more here than in any other zone studied.

Among the snails taken in this zone the outstanding one was a large species, *Helis* sp., with a smooth lip. It was prominent near the stream, and as many as a dozen were taken within an area of a few yards.

The large stones provided a favorable habitat for the Arachnida. A gray harvestman, Phalangidae, was observed to be more abundant here than elsewhere. Many species of spiders were taken, but the most conspicuous one was the rock spider, *Hypoehilus thorelli*. This spider was first described from this region by Dr. George Marx (¹'88).

The woodchuck and chipmunk were prevalent among the mammals.

The birds observed in this zone were woodpeckers, flickers, yellow-breasted chats, wood thrushes, juncos, and a variety of warblers. These were also common in the Chestnut Zone.

Animals of the Chestnut Zone

The chestnut trees of this zone constitute a small portion of the vegetation. Many other trees are present in large numbers. The zone was named

¹ Comstock, J. H., The Spider Book, pp. 257-262.

Chestnut because, from evidence, at one time the zone was dominated by the chestnut. Because of the chestnut blight a large number of these trees have died, and many of the dead logs prevail throughout the entire zone. Among the controlling factors that appear to play an outstanding part are:

1. The chestnut blight killing the chestnut timber permits a succession of oaks, which apparently will dominate the zone in a few years. Hence a succession of the field strata.

2. Cherokee Orchard being located at the base of the zone, animals of the prairie naturally migrate to the forest edge.

3. The zone has a lower altitude than the others and is suited to a greater variety of vegetation. Hence there is a greater variety of vegetation and, therefore, a greater variety of animal life.

Animals of this zone are similar to those found commonly over East Tennessee.

Many varieties of snails (See Plate II, facing page 22) are found in abundance in this zone. The greatest number is a species of *Helix*. A large species that resembles *Helix polygyra* is most noticeable. Slugs, *Philomycus* sp., are more abundant here

than elsewhere.

A greater variety of spiders were taken here than in other zones. Among the most prominent are: the large rock spider, *Hypochilus thorelli*; a slender water spider, *Telragnatha elongata*; a large humped spider, *Uloborus americanus*; and a species tinged with silver and black markings on the dorsal side of the abdomen, *Leuchuge venusta*. A red harvestman, different from the one found in the Transitional Zone, was prevalent here.

Insects of most of the orders are represented in this zone, and especially along the forest edge.

A number of amphibians and reptiles are found, among which are land and water turtles, salamanders, toads, lizards (*Sceloporus undulatus*), rattle snakes, water snakes (*Atrix* sp.), garter snake (*Tropidonatus* sp.), and the small ring-necked snake (*Diadophis punctatus*).

The stream contains a large number of nymphs. The may-fly and the stone-fly were most abundant.

The only fish observed throughout the entire stream was the rainbow trout, *Salmo shasta*, which for the first time made its appearance in this zone. Some of these obtain the length of twelve to

fourteen inches.

Among the most common birds were the sparrows, bob whites, doves, woodpeckers, flickers, goldfinches, towhees, cardinals, yellowbreasted chats, wrens, and a number of warblers. As a whole, a greater number and a greater variety of species were observed to live in this zone than in any of the previously mentioned zones.

Summary

In this discussion we have tried to show the ecological distribution of the animals of Mount LeConte and along LeConte Creek, by first giving a brief description of the Great Smoky Mountains in general, its vegetation, and a number of animals that are known to be present in their various habitats.

A more detailed description of LeConte Creek has been attempted, and the area has been zoned according to the kind of vegetation that appears to be dominant.

A detailed discussion of the methods and technique are given to enable the reader to surmise the immensity of the problem attacked.

The animals peculiar to the various zones have been discussed briefly.

The animal dominant in the Balsam Zone seems to be the Red-gilled salamander, *Plethodon jordani*; that of the Birch Zone, a snail, the species not determined; that of the Transitional Zone, a large semi-aquatic drab-colored salamander, *Desmognathus* sp.; and that of the Chestnut Zone, snails, most of which are of the genus *Helix*.

As a whole, the animals of LeConte are scarce compared to those of the lower altitudes, but in general a great number exist in their various habitats.

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