Management Report

ENVIRONMENTAL ANALYSIS OF THE PROPOSED
BLUE RIDGE PARKWAY EXTENSION
FROM OCONALUFTEE TO DEEP CREEK CAMPGROUND

Management Report No. 9

Volume I

NATIONAL PARK SERVICE
SOUTHEAST REGIONAL
UPLANDS FIELD RESEARCH LABORATORY
GREAT SMOKY MOUNTAINS
NATIONAL PARK

NATIONAL PARK SERVICE
Department of the Interior

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National Park Service, Southeast Region
Uplands Field Research Lab
Great Smoky Mountains National Park
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This report was prepared by the staff of Uplands Field Research Laboratory with the assistance of the Southeast Regional Office, the staff of Great Smoky Mountains National Park, and local universities. The following people contributed to the make-up of this report.

Flagging the route	April 1-15, 1976	James Walker
Introduction	September, 1976	James Walker
Water Quality		
Aquatic Fauna	May 24-31, 1976	Dan Stoneburner, PhD. Rex Lowe, PhD. Lawrence Zucchino
Water Quality	May-June, 1976	Harold Plastas, PhD. Linda Plastas, PhD. David Silsbee
Trout Population Assessment	June-August, 1974	Alan Kelly
Trail and Campsite Conditions	May-July, 1976	Jill Baron Matthew Hickler Susan Bratton, PhD. Lawrence Zucchino
Rare and Endangered Plants and Special Protection Areas	May, 1976 August, 1976	Matthew Hickler Lawrence Zucchino Ronald Peterson, PhD.
Scenic Values	May-August, 1976	Lawrence Zucchino Jill Baron
Geologic Survey	April 26-30, 1976	Ruth W. Atkins Raymond Herrmann, PhD.
Mammal Survey	July, 1976	Tom Burst
Archeological Survey	June, 1976	Ellen Murphy
Vegetation Survey	June-August, 1976	Jill Baron Lawrence Zucchino Patricia Dych Carolyn Bacon
Vegetation Analysis	August-September, 1976	Jill Baron Susan Bratton, PhD.

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INTRODUCTION TO THE ENVIRONMENTAL ANALYSIS OF THE PROPOSED BLUE RIDGE PARKWAY EXTENSION

The Blue Ridge Parkway Extension through Great Smoky Mountains National Park was proposed in 1968 by Governor Moore of North Carolina. The Blue Ridge Parkway now terminates at Ravensford, North Carolina, near Oconaluftee Visitor Center. The extension would lengthen the road approximately 14 to 18 miles to end at Deep Creek Campground, 2 miles east of Bryson City, North Carolina (see Map #1). The remaining 2 miles would qualify and be built as an Appalachian access road.

The road was suggested as an alternative to a road along the north shore of Lake Fontana. This road, from Bryson City to Deal's Gap, had been promised in 1943 by the U.S. Department of the Interior in return for some 44,000 acres of land acquired by the TVA and donated to the park. The North Shore Road was to replace an existing highway which was flooded by the rising waters of Fontana Reservoir. Six-and-one-half miles of the road were built, but pressure from conservation groups caused the exploration of other alternatives.

The proposal was revised in 1975 as the key part of a 10-point "package" developed by a consortium of individuals representing diverse interests. The 10-point proposal has received substantial support from the parties to the 1943 agreement - Swain County, TVA, United States Department of the Interior, and North Carolina.

Three major watersheds, Mingus Madcap, Cooper, and Indian Creeks, drain a great majority of the slopes over which the Blue Ridge Parkway Extension would pass. All are spring-fed mountain streams. Mingus Creek, the smallest of the three, flows generally southward.

Great Smoky Mountains National Park

CORRIDOR FOR PROPOSED BLUE RIDGE PARKWAY EXTENSION

map 1

It meets with Madcap Branch and together they flow eastward into the Oconaluftee River. Mingus Creek is the source of drinking water for the town of Cherokee, North Carolina; the water treatment intake plant is located at the stream's junction with Madcap Branch.

Cooper Creek originates within the park and flows southeastward into the Cherokee Indian Reservation. About one-half of the creek is contained within the park. It joins the Tuckaseegee River near the town of Ela, North Carolina.

Indian Creek is located entirely within the park. Of the three watersheds, it receives the greatest amount of visitor use. It flows south between Thomas Divide and Sunkota Ridge and converges with Deep Creek approximately 1-1/2 miles above Deep Creek Campground.

The proposed road locations have been divided into three sections, each corresponding to one of the three watersheds. Four routes (Alternatives 1-4) have been suggested for the Mingus-Madcap section (See Map #2 and Table 1).

Alternative 1 originates at Ravensford and ends at Mingus Ridge, 3.6 miles away. It begins with a grade separation (bridge) across Newfound Gap Road (U.S. 441) and ascends to the northwest on a +7 percent grade along the east-facing slopes above the Oconaluftee Visitor Center. The route enters the Mingus Creek watershed above Mingus Mill and continues on a +7 percent grade along the north slopes of Fox Knob and Mt. Noble to elevation 3400, approximately 200 feet below the crest

of Mingus Ridge. There a tunnel through the ridge, approximately 1000 feet long, is required to connect with Alternative 5. The slopes of Mingus Ridge are steep, 30-40 degrees, necessitating large road cuts and fills, probably with extensive retaining walls, cribs, or half-bridges, and possibly short tunnels. The length of Alternative 1 including the tunnel, is 3.8 miles.

Alternative 2 is the same as Alternative 1 for the first 2.6 miles, to elevation 2840. There, at a small knob 2500 feet north of Fox Knob, it makes a "switchback" to reverse direction and ascends in a southeasterly direction on a +6 percent grade to another small knob located 3000 feet northeast of Fox Knob. It turns sharply to the right around this knob, crosses the park boundary and enters the Cherokee Indian Reservation. The slopes here are very steep, as much as 40 degrees or more. It then ascends the south slope of Fox Knob on a +7 percent grade to cross the low point (elevation 3700) on the ridge between Mt. Noble and the Mt. Noble fire lookout tower. At the crest it turns sharply to the northwest and descends on a -5 percent grade, re-enters the park at elevation 3550, and ascends on a +2 percent grade to an unnamed gap (elevation 3600) on Mingus Ridge. This point, at which it enters the Cooper Creek Drainage, is directly above the tunnel location described in Alternative 1. A tunnel is not needed here for Alternative 2. The length of Alternative 2 is 6.8 miles.

Alternative 3 is the same as the Alternative 1 for the first 2.6 miles, to elevation 2840. There at a small knob 2500 feet north

of Fox Knob, it makes a "switchback" to reverse direction and ascends in a southeasterly direction on a +6 percent grade to another small knob (located 3000 feet northeast of Fox Knob). It turns sharply to the right (almost 180 degrees) around this small peak; the route crosses the park boundary twice in making this turn; approximately 600 feet of the route is in the Cherokee Indian Reservation. The route continues to ascend the north slopes of Fox Knob and Mt. Noble on a +6 percent grade to elevation 3600. Then it bears northwest on a level grade to cross Mingus Ridge through the same unnamed gap at which Alternative 2 crosses. Alternative 3 also does not require a tunnel here. Alternative 3 is 5.7 miles long.

Alternative 4 does not enter the Mingus Creek Watershed. It begins with a grade separation (bridge) across Newfound Gap Road (U.S. 441) and ascends to the southeast on a +6 percent grade on east and south-facing slopes to cross the park boundary and enter the Cherokee Indian Reservation at the 0.5 mile point. The route continues on a +6 percent grade along the south slopes of Fox Knob and Mt. Noble and along the west slope of Mt. Noble to elevation 3550. The route then proceeds on a 0 percent grade to re-enter the park at the top of the ridge 2200 feet northwest of Mt. Noble. There the route continues to the northwest on a +2 percent grade to cross Mingus Ridge at the same unnamed gap (elevation 3600) traversed by Alternatives 2 and 3. The length of Alternative 4 is 5.8 miles, of which 4.8 miles are located in the Cherokee Indian Reservation.

For the second section, entirely within the Cooper Creek Watershed, only one general route corridor is proposed: Alternative 5. Alternative 5 originates at the unnamed gap on Mingus Ridge at elevation 3600 (or, if Alternative 1 of the first section is used, at elevation 3450 at the tunnel exit). Its terminus is at Deeplow Gap, elevation 3715. A virtually level grade would connect the two gaps but some variety of plus and minus grades will permit location of the route on more desirable sideslopes and provide better scenic viewpoints.

A number of small bridges across minor drainages will be required. The route shown on Map #2 begins by going northwesterly on the Cooper Creek side of Mingus Ridge on a 0 percent grade for 0.6 miles. Then it climbs on a +6 percent grade, crosses Cooper Creek at elevation 3640, ascends (still on +6 percent grade) the east slope of Thomas Ridge, and crosses two tributaries of Cooper Creek to reach elevation 4080 at the point of a spur ridge which juts southeast of Thomas Ridge. From here it descends on a -6 percent grade to Deeplow Gap. The length of Alternative 5 is 4.1 miles.

Two alternative routes have been proposed for Section 3 (in the Indian Creek Watershed). Alternative 6 begins with a tunnel approximately 800 feet long under Deeplow Gap to prevent deep cuts and fills. The tunnel curves sharply to the northwest; then the route descends on a -6 percent grade, crosses Georges Branch and Estes Branch, to

cross Indian Creek at elevation 2880. It continues to descend on a -6 percent grade on the east slope of Sunkota Ridge until it reaches an old unsurfaced road on the west bank of Indian Creek. Generally following the old road, the route proceeds on an average grade of -4 percent to the confluence of Indian Creek and Deep Creek where it crosses Indian Creek to continue its descent along the east bank of Deep Creek. After crossing Deep Creek the route parallels that stream along its west bank past Deep Creek Campground to the park boundary. The slopes from Deeplow Gap to Indian Creek range from 15-35 degrees. The length of Alternative 6 is 7.3 miles.

Alternative 7 begins by descending from Deeplow Gap to southwest along the west slope of Thomas Ridge on a -7 percent grade. A tunnel under Deeplow Gap would not be necessary but may be desirable to reduce environmental damage to the gap. The -7 percent grade is sustained until the route joins an existing unsurfaced road along the east bank of Deep Creek at a point 1500 feet south of the Deep Creek-Indian Creek confluence. After crossing Deep Creek the route parallels that stream along its west bank past Deep Creek Campground to the park boundary. Alternative 7 is 6.2 miles long.

The western face of Thomas Divide is steep, with slopes in excess of 35 degrees around the face of Mt. Hober. Road cuts and fills would, of necessity, be extensive and severe.

PROPOSED ROUTE ALTERNATIVES

map 2

Table 1. POSSIBLE COMBINATIONS OF ALTERNATIVE ROUTES AND THEIR LENGTHS

1.	Section 1; Alt. 1	3.8 mi.	2.	Section 1; Alt. 2	6.8 mi.
	Section 2; Alt. 5	4.1 mi.		Section 2; Alt. 5	4.1 mi.
	Section 3; Alt. 6	7.3 mi.		Section 3; Alt. 6	7.3 mi.
	Total	15.2 mi.		Total	18.2 mi.
3.	Section 1; Alt. 3	5.7 mi.	4.	Section 1; Alt. 4	5.8 mi.
	Section 2; Alt. 5	4.1 mi.		Section 2; Alt. 5	4.1 mi.
	Section 3; Alt. 6	7.3 mi.		Section 3; Alt. 6	7.3 mi.
	Total	17.1 mi.		Total	17.2 mi.
5.	Section 1; Alt. 1	3.8 mi.	6.	Section 1; Alt. 2	6.8 mi.
	Section 2; Alt. 5	4.1 mi.		Section 2 Alt. 5	4.1 mi.
	Section 3; Alt. 7	6.2 mi.		Section 3; Alt. 7	6.2 mi.
	Total	14.1 mi.		Total	17.1 mi.
7.	Section 1; Alt. 3	5.7 mi.	8.	Section 1; Alt. 4	5.8 mi.
	Section 2; Alt. 5	4.1 mi.		Section 2; Alt. 5	4.1 mi.
	Section 3; Alt. 7	6.2 mi.		Section 3; Alt. 7	6.2 mi.
	Total	16.0 mi.		Total	16.1 mi.

SCENIC VALUES, CULTURAL VALUES AND SPECIAL PROTECTION AREAS

The scenic values of the proposed Blue Ridge Parkway Extension are of primary importance from the perspective of the park visitor. In this study, considerable emphasis was placed on evaluating the scenic attractions of the routes, as well as possible impact on views from the surrounding area.

An inventory of the major scenic attractions was completed (See Map #3). Four important categories were investigated along each of the routes:

1) sight lines from potential routes;
2) mature and virgin timber, and exceptional wildflower densities;
3) waterfalls, cascades, and streams;
4) historical sites, including cemeteries.

Alternative 1

Most of Alternative 1 passes under 3000 feet, and thus, the vistas are restricted to about 13 miles of local ridgetops. These ridges include upper Thomas Divide near Newton Bald, and the ridges directly to the north above Mingus Creek. If overlooks were placed on the northern slopes of Fox Knob and Mt. Noble, nearly 10 miles of local ridgetops could be seen, as well as the Mingus-Madcap Valley, and 5 miles of distant ridgetops, including those lying east beyond Oconaluftee Visitor Center and Hughes Ridge.

There is a large concentration of wildflowers on the north-facing slopes below Fox Knob. A short nature trail would exhibit

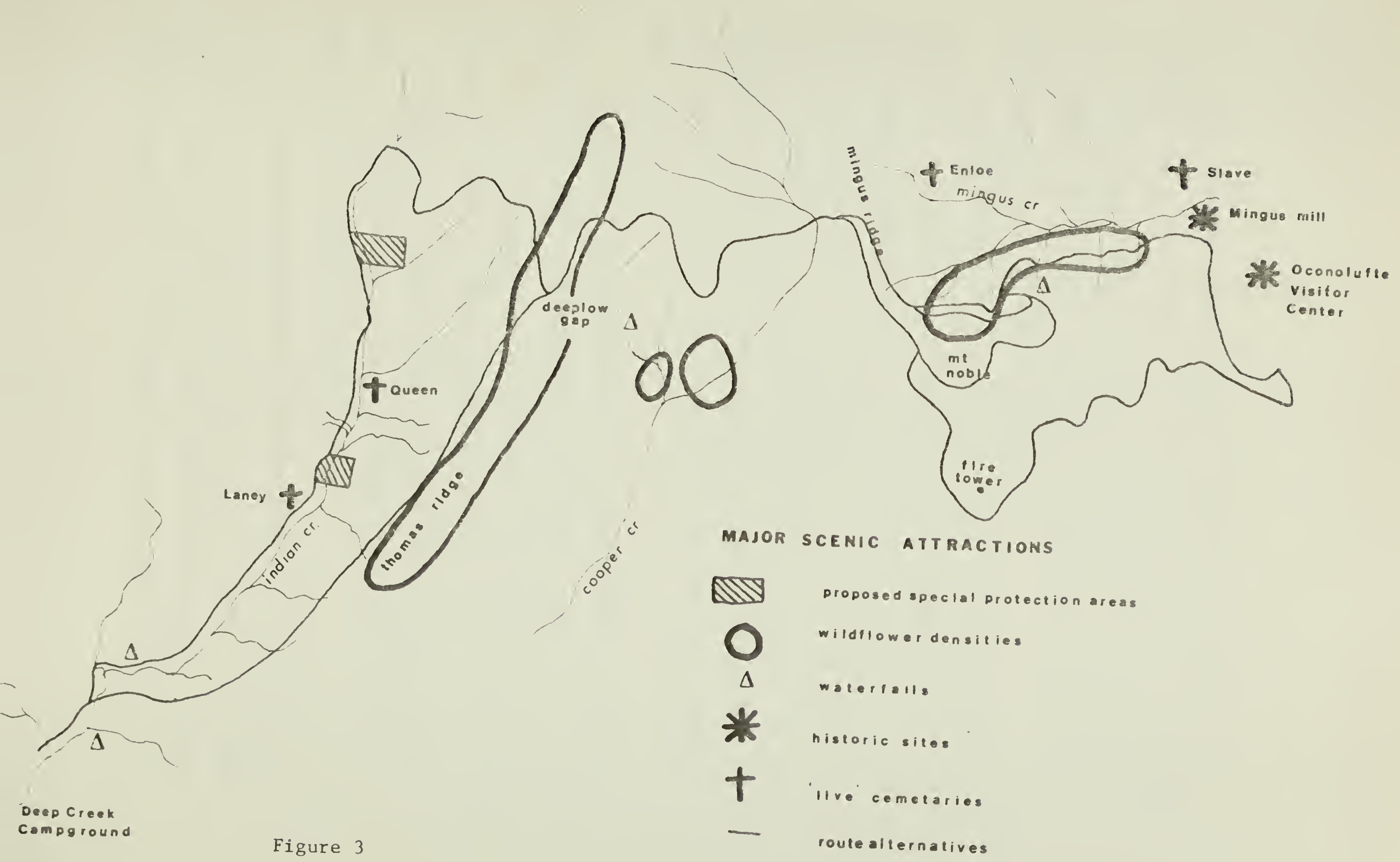

Enloe
Slave
mingus cr
Mingus mill
mingus ridge
Oconolufte
Visitor
Center
deeplow
gap
mt
noble
Queen
Laney
thomas ridge
fire
tower
indian cr.
cooper cr
Deep Creek
Campground
MAJOR SCENIC ATTRACTIONS
proposed special protection areas
wildflower densities
waterfalls
historic sites
'live' cemetaries
route alternatives

Figure 3

this area. However, these slopes are very steep (35 degrees and greater), and would not be attractive to most visitors. Furthermore, the north-facing slopes are very moist; the extensive herb communities are particularly sensitive to human disturbance, and a nature trail would be harmful to the plants themselves.

A second nature trail might be established along an existing trail which runs southeast along Mingus Ridge toward Mt. Noble. The trail passes through large oaks and hickories and provides views of the surrounding ridges. A trail through this area would be much easier to maintain than the first one described, because of the resiliency of this forest type. Both nature trails would have to be very carefully constructed and managed to avoid excessive damage to herb communities.

Alternative 1 passes through more than 500 meters of moist cove forests with exceptionally diverse understories. The route passes over a very large concentration of showy orchis (*Orchis spectabilis*) and would destroy this population of an uncommon plant.

There are few views of Mingus Creek or Madcap Branch on the route. A cascade on one of the tributaries of Mingus Creek is located within 100 meters of this route.

Two maintained cemeteries, Slave and Enloe, are located within 500 meters and 100 meters, respectively, from the route. The Enloe Cemetery would be affected by road construction activities. Mingus Mill and Oconaluftee Visitor Center are both within 500 meters of

the route and would be visible. Conversely, the road would be seen from both these areas.

Slightly more than 1.5 miles of the road would be visible from existing park roads and the Blue Ridge Parkway. The eastern slopes facing U.S. 441 would be seen by north and south-bound traffic on that highway; to west-bound traffic on the parkway, west of Soco Bald; and also from the Balsam Mountain Road. Road cuts on Mingus Ridge near the proposed tunnel site would also be seen by south-bound motorists on U.S. 441 and from the Mingus Mill parking lot. The road on the front of Mt. Noble could be seen from one section of the Appalachian Trail near the Sawteeth. Hikers on Cooper Creek to Newton Bald would also be within visual and hearing distance of this route.

<u>Alternative 2</u>

Alternative 2 provides the most extensive vistas of all the routes. Fifty-five miles of distant ridges can be seen from elevations above 3700 feet on Mt. Noble. These include 10 to 15 miles of the Plott-Balsam Mountains to the southeast, nearly 10 miles of the Balsam Mountains to the northeast, and 10 miles of the Cowee Mountains to the south. Additional miles of distant ridgetops can be seen, and views of the valleys and coves surrounding Bryson City, Cherokee, and Ravensford. Newton Bald, Mt. Noble, and Fox Knob are local peaks visible from this route.

Alternative 2 avoids the large showy orchid population along Alternative 1, but still passes through rich forest herb communities on the north side of Mingus Ridge. Impact on cemeteries and historic sites would be identical to that imposed by Alternative 1.

Although this route would present more mileage of scenic views, it would also expose the maximum mileage of road cuts to existing park roads. Again, the 1 mile stretch on the east slope facing U.S. 441 would be visible to motorists on U.S. 441 and the Blue Ridge Parkway. One-and-one-half miles on the south face of Mt. Noble and Fox Knob would be clearly visible from several points west of Soco Bald on the Blue Ridge Parkway and from points along the Balsam Mountain Road. A 1/2 mile stretch on the southwest face of Mt. Noble would be visible from the Clingman's Dome Observation Tower. This route would be within hearing distance of the Cooper Creek trail to Newton Bald.

Alternative 3

Alternative 3 offers little in the way of extensive vistas. Newton Bald, Mt. Noble, and Fox Knob will be visible, as well as Hughes Ridge and 5 miles of ridgetops beyond Oconaluftee Visitor Center.

Alternative 3 does not avoid the showy orchid population. Furthermore, by ascending the extremely mesic north slopes of Mt. Noble, it will destroy a large portion of this fragile life zone.

A vegetation sample of these slopes showed a richer flora than anywhere else in the three watersheds. Many showy wildflowers, common and rare, were seen; among them *Panax quinquefolia*, *Aralia nudicaulis* and *Diphylleia cymosa*.

The cascade below Fox Knob is within a short distance of this route. There are few other views of streams along the corridor.

Impact on cemeteries is the same as Alternative 1 and 2.

This road would be visible from Mingus Mill and Oconaluftee Visitor Center. One mile of the route, which parallels U.S. 441, would be visible from the highway and, conversely, U.S. 441 could be seen from the parkway extension. About 1/4 mile of the south face of Fox Knob would be seen from several points west of Soco Bald on the Blue Ridge Parkway and from points along the Balsam Mountain Road. This same area would be clearly visible from U.S. 441 in the town of Cherokee.

Alternative 4

Alternative 4 provides 65 miles of scenic views. It is similar to Alternative 2, but travels at a slightly lower elevation. The ridges east, beyond Oconaluftee, and those surrounding the upper Mingus Watershed can be seen. Newton Bald, Fox Knob, Mt. Noble, Cherokee Valley and the Tuckaseegee River Valley are visible from this route.

An important factor concerning this route is that by passing mostly outside the park it avoids contact with all the historical and natural sites mentioned in connection with Alternatives 1 and 2.

Two miles of Alternative 4 would be visible to west-bound motorists west of Soco Bald on the Blue Ridge Parkway, and from Balsam Mountain Road, the first .5 mile and an additional 2.0 miles on the face of Mt. Noble and Fox Knob can be seen from a short section of U.S. 441. Approximately 1 mile of Alternative 4 on the southwest side of Mt. Noble would be visible from the Clingman's Dome Observation Tower.

The present site of the Mt. Noble fire tower would make an excellent location for the construction of an observation tower. The tower would allow extensive views of the vistas described above. Since the area is already heavily disturbed, construction would have little detrimental effect on the environment.

Alternative 5

Alternative 5, connecting the Mingus Ridge with Deeplow Gap offers 43 miles of distant ridgetop panoramas. The two most important vistas are found on the south and east sides of the Thomas Divide Spur. More than 30 miles of ridges are visible from elevations over 4000 feet, including the Plott Balsam Mountains and Alarka Mountains to the south and the lower end of Noland Divide to the west. Distant ridges east of Oconaluftee Visitor Center beyond Hughes Ridge can also be seen as well as local mountains in the

Mingus-Madcap Watershed. Newton Bald, Mt. Noble, Deeplow Gap, and the Cherokee Valley can be seen.

Alternative 5 crosses Cooper Creek and two of its main branches, accounting for the only stream exposure. A major waterfall, Little Creek Falls, is less than 1 mile from Deeplow Gap.

Deeplow Gap and possibly Mingus Ridge are visible from the road to Clingman's Dome and the observation tower on top, exposing a minimum of .5 mile of road cuts. Road cuts at the Mingus Ridge, Deeplow Gap, and the Thomas Divide Spur would be visible to motorists west of Soco Bald on the Blue Ridge Parkway, and from points on the Balsam Mountain Road. The Cooper Creek Trail would come in contact with the route at two points. A quarter mile of the trail from Deeplow Gap east would be obliterated. One-half mile of the trail from Cooper Creek to Mingus Ridge would likewise be destroyed.

Alternative 6

The upper end of Alternative 6 from Deeplow Gap to Lone Pine Ridge provides a moderate number of scenic vistas. From the west slopes of Thomas Divide and Lone Pine Ridge, 4 miles of lower Thomas Divide, 2 miles of Sunkota Ridge and a good portion of the Indian Creek Valley are visible. In addition, 3.5 miles of lower Noland Divide can be seen to the west. The lower 4 miles of Alternative 6, which closely follow Indian Creek, provide only local views of Thomas Divide.

Alternative 6 passes almost entirely through heathy understory. When rhododendron and mountain laurel are in bloom, the route will be lined with clusters of these showy flowers.

Two areas along this route have been proposed as special protection areas by local university faculty. In addition to virgin forests and large numbers of wildflowers, 13 rare or endemic mushroom species are found in these sites. One species found here, *Gloeocanthareflus purpurascens*, is known to occur in only one other place in the world. This mushroom is located in a 100m x 200m area surrounding the Indian Creek Road loop. Alternative 6 passes within 100 meters on both sides of the area. *Gloeocantharellus purpurascens*, has been nominated for national status as an endangered species, and destruction of its habitat could be a legal matter.

To preserve this site, at least 200 meters on all sides must be left intact. The road and construction activities will have to be moved far enough away that drainage of the site and the surrounding forests will be unaffected.

The second special protection site would be directly in line with Alternative 6, midway between Laney and Queen Cemeteries. The 12 species found here are: *Hygrophorus deceptivus*, *Entoloma squamulosum*, *Entoloma rimosum*, *Entoloma brunneum*, *Entoloma carolinense*, *Entoloma stipitatum*, *Entoloma albo-umbonatum*, *Entoloma subgriseum*, *Entoloma caeruleorubescens*, *Entoloma papillatum*, *Entoloma squamodiscum*

and *Entoloma scabrinellum*. Again, the route would have to be moved far enough upslope that neither drainage nor plant communities are affected. Both areas containing rare fungi could be easily destroyed by construction activities. The canopy should not be opened at or near the sites and any alteration in drainage by cut-and-fill-type construction should be avoided. Careless use of construction machinery near the sites could eradicate a species in either area. Construction machinery poses an extra threat if it is brought to the road route via Indian Creek Jeep Road, or if it is parked near the special protection area. Moving Alternative 6 higher on the slope, is necessary to avoid disturbing the special protection areas, but may present engineering difficulties and will probably increase the expense of construction.

Alternative 6 runs along 3 miles of streams. Two waterfalls, Indian Creek Falls and Tom's Falls, can be seen from the route.

Two maintained cemeteries, Laney and Queen, are located within 100 meters and 200 meters, respectively, from Alternative 6. Both are on small knolls overlooking the roadway, and little direct impact would be expected. Increased visitor access to the short trails leading to the cemeteries may result in vandalism.

One-half mile of road cuts at Deeplow Gap and along the west slope of Thomas Divide would be visible from the Clingman's Dome

Observation Tower, from several points along the Clingman's Dome Road, and from the Newfound Gap Road and parking lot

Alternative 7

Nearly 10 miles of ridgetops could be seen from Alternative 7. These include Noland Divide, Lone Pine Ridge and Sunkota Ridge.

Three small tributary streams of Indian Creek intersect the route. None provides significant scenic attractions. The final mile of Alternative 7, at and below the Deep Creek confluence, would provide a number of attractive cascades and one major waterfall, Tom's Falls. A major advantage of the route would be the preservation of the two proposed special protection areas. There would be damage to an unusual spring wildflower population, however. Thomas Divide is unusual in that much of its oak forests do not support heath understories. Instead, there is a showy herb community. In the late spring these flowers, which include columbines, *Thalictrum* spp. and *Clintonia umbellulata*, appear in larger numbers than are seen anywhere else in the park.

Another disadvantage is that a completed, though unpaved, motor nature trail already cuts across the slopes of Thomas Divide. Construction of an additional route along these slopes would create an unusually high total construction and visitor impact on an area which presently has minimal human interference.

Table 2

PROXIMITY OF ROAD ROUTES TO MAJOR SCENIC ATTRACTIONS

Scenic Attractions	Sites located within distances given						
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6	Alt.7
Cemeteries							
Enloe	100 m	100 m	100 m	1 km	5 km	-	-
Slave	500 m	500 m	500 m	2 km	5 km	-	-
Laney	-	-	-	-	-	100 m	100 m
Queen	-	-	-	-	-	500 m	1 km
Wiggins-Watson	-	-	-	-	-	1 km	1 km
Historical							
Mingus Mill	500 m	1 km	500 m	2 km	5 km	-	-
Oconaluftee	500 m	1 km	500 m	1 km	5 km	-	-
Waterfalls/Cascades							
Mingus Cascades	100 m	100 m	10 m	1 km	5 km	-	-
Little Creek Falls	5 km	5 km	5 km	5 km	1 km	1 km	1 km
Tom's Falls	-	-	-	-	-	100 m	100 m
Indian Creek Falls	-	-	-	-	-	100 m	500 m
Wildflower Densities							
Thomas Divide	-	-	-	-	0 m	0 m	0 m
North Slope Mingus	100 m	100 m	100 m	1 km	2 km	-	-
Showy Orchid	100 m	1 km	100 m	1 km	2 km	-	-
Lady Slippers	-	-	-	-	5 km	1 km	500 m
Special Protection Areas							
Indian Creek Loop	-	-	-	-	-	100 m	-
Lower Indian Creek	-	-	-	-	-	1 m	-

	[illegible] Ridge				[illegible] Ridge	Deep Creek [illegible]	
	Alt. 1	Alt. 2	Al[illegible]	Alt. [illegible]	Alt [illegible]	Alt. [illegible]	A[illegible]
Clingman's Dome Observation Tower	Not Visible	[illegible]	.25	[illegible]	[illegible]	.25	3.5
Clingman's Dome Road	Not Visible	[illegible]	Not Visible	Not Visible	Not Visible	.25	[illegible]
U.S. 441 near Newfound Gap	Not Visible	Visible	Not Visible	Not Visible	Not Visible	.25	[illegible]
U.S. 441 near Oconaluftee	Not 1.25	Not 2.0	Not 1.5	Not [illegible]	Not Visible	Not Visible	Not Visible
Blue Ridge Parkway	1.25	.25	[illegible]	2.0	1.5	Not Visible	Not Visible
Balsam Mountain Road	.25	1.0	.25	.25	[illegible]	Not Visible	Not Visible
Total Visible Mileage	3.0	5.75	[illegible]	[illegible]	3.5	7	[illegible]

* Approximate mileages

Table 4.

MAXIMUM VISIBLE MILEAGE OF ROAD ROUTES FROM
PRESENT GREAT SMOKY MOUNTAINS NATIONAL PARK TRAILS

(Trails within hearing distance of traffic)*

	Ravensford to Mingus Ridge				Mingus Ridge to Deeplow Gap	Deeplow Gap to Deep Creek Campground	
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
Appalachian Trail - Sawteeth	Not Visible	Not Visible	Not Visible	Not Visible	1.00	1.00	Not Visible
Appalachian Trail - Mt. Buckley	.25	Not Visible	Not Visible	Not Visible	.75	.75	Not Visible
Appalachian Trail - Forney Creek Burn Scar	.25	Not Visible	Not Visible	Not Visible	.75	.75	Not Visible
Thomas Divide North of Deeplow Gap	Not Visible *	Not Visible *	Not Visible *	Not Visible *	* .5	* .5	Not Visible
Thomas Divide at Deeplow Gap	Not Visible *	Not Visible *	Not Visible *	Not Visible *	* .1	* .1	* .1
Thomas Divide South of Deeplow Gap	Not Visible	* .4	* .4	* 1.0	* .6	* 2.5	* 3.0
Access Trail to Thomas Divide	Not Visible	Not Visible	Not Visible	Not Visible	Not Visible	* .1	* .5

Table 4 - Cont.

	Ravensford to Mingus Ridge				Mingus Ridge to Deeplow Gap	Deeplow Gap to Deep Creek Campground	
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
Indian Creek from Deep Creek Campground	Not Visible	Not Visible	Not Visible	Not Visible	Not Visible	* 6.0	* 5.5
Madcap Branch Trail	* 1.75	* 1.0	* .2	* .2	Not * Visible	Not Visible	Not Visible
Cooper Creek Trail	Not * Visible	Not * Visible	Not * Visible	Not * Visible	* .1	Not Visible	Not Visible
Sunkota Ridge Trail	Not Visible	Not Visible	Not Visible	Not Visible	Not Visible	* 4.5	* 4.5

ARCHEOLOGICAL SURVEY

An archeological study team located 47 sites within the proposed Blue Ridge Parkway extension area. Corridors outside the park boundary were not inspected. All of these prehistoric and historic sites are situated near a source of water on level ground. Site location does not appear to be dictated by altitude so much as by the availability of level terrain. Eighteen sites affected by route alternatives will be recommended for nomination to the National Register of Historic Places. A list of these sites and their cultural affiliations are as follows:

1.	NPS 43-SW 76	Pioneer homesite
2.	NPS 4-SW 76	Pioneer homesite
3.	NPS 5-SW 76	Pioneer homesite
4.	NPS 6-SW 76	31 SW^V 64 Middle and Late Woodland
5.	NPS 7-SW 76	Laney Cemetery
6.	NPS 8-SW 76	Stevenson homesite
7.	NPS 9-SW 76	Widow Stiles homesite
8.	NPS 10-SW 76	Hardy Stiles homesite
9.	NPS 11-SW 76	31 SW^V 21 Early and Late Woodland
10.	NPS 12-SW 76	William Laney homesite
11.	NPS 13-SW 76	31 SW^V 20 Middle Archaic
12.	NPS 14-SW 76	Queen Cemetery
13.	NPS 15-SW 76	Nancy Rogers homesite
14.	NPS 16-SW 76	Archaic and Woodland
15.	NPS 17-SW 76	Old road and bridge
16.	NPS 18-SW 76	31 SW^V 10 Middle Archaic, Early and Late Woodland Cherokee
17.	NPS 19-SW 76	Bryson Place
18.	NPS 20-SW 76	31 SW^V 56 Middle and Late Archaic

Several native American sites including some not mentioned above, have been studied in detail. These are listed below:

31Sw^{v}18

Site located on wide "bench" on Deep Creek (Bryson Place). No stratigraphy. Early Woodland material. Site distinguished by its location on one of two peat bogs found in the park.

31Sw^{v}19 (number 16 of the above)

Site on "bench" on Indian Creek in area of juncture of four streams. Artifacts Middle Archaic, Early and Middle Woodland. Site unique because all artifacts are manufactured from vein quartz.

31Sw^{v}20 (number 11 of above)
Site on "bench" on Indian Creek. No stratigraphy. Artifacts Middle Archaic. Site significance difficult to assess because of sample size.

31Sw^{v}21 (number 9 of the above)

Site located on "bench" on Indian Creek. No stratigraphy. Middle Archaic and Early and Middle Woodland components. Site illustrates presence of Early and Middle Woodland ceramics in the middle elevation zone.

31Sw^{v}22

Site located on "bench" at juncture of Georges Branch and Indian Creek. No stratigraphy. Middle and Late Archaic, Early and Middle Woodland components. Materials indicate only hunting activity for all periods.

This study was conducted merely as a preliminary survey. Assessment of most sites along the route alternatives was not completed. It is recommended that a final survey be made prior to any road-building activities. Archeological salvage can be conducted, if warranted.

TRAIL AND CAMPSITE EROSION SURVEY

Data for the trail and campsite erosion survey was collected as part of an ongoing, all-park study. The original intention of the investigators was to locate high impact trails and campsites, damaged areas, and trouble spots. An attempt was made to quantify the physical conditions as they now exist, and, from the data, begin to answer the following questions:

1. Which sections of trail are under-used or can tolerate considerably more impact?
2. Which trails, with minor changes in maintenance, could absorb more hiker use?
3. Which trails have areas of severe erosion or extensive mud holes?
4. Which trails are eroding due to horse or vehicle use?
5. How are trail conditions related to forest type, slope, elevation, and other environmental variables?
6. Which campsites are the most heavily damaged?
7. What is the impact of the campsites on the native flora?
8. What are the patterns of illegal camping in the park?
9. Where are there concentrated enforcement or damage problems related to illegal sites?
10. Where should new legal sites be established?

11. Where do poor trail conditions indicate that no new sites be established or that old sites by removed?

12. Where should use be encouraged?

13. Where should use be discouraged?

14. Where is horse use presently limiting foot traffic?

Data collection for each of the trails in the park consisted of a series of measurements for width, depth, slope, aspect, forest type, etc. Basic tools used were a Brunton pocket transit and a 30 or 50 meter tape measure. Each trail was segmented into 1/3 mile segments. At the end of each segment a series of measurements was collected for a single point on the trail. The total amount of erosion for that trail segment was estimated. The trail was then given an erosion rating and an overall quality rating. All data were computerized. Each trail and, ultimately, each section was rated on a scale of 1-5, where 1.0 signifies the lowest amount of total erosion and 5.0 the highest. Trails with ratings over 3.0 are generally considered above their carrying capacity.

Campsites were measured and ranked according to how much damage each was imposing on the area. Location and legal status was recorded, as well as forest and understory types. Illegal sites are categorized as; a) emergency type, b) occasional use, c) heavy use, or d) developed illegal (with clearing or improvements such as shelter frames). Site dimensions were recorded, and topography was measured.

The trails in the park were divided into geographical sections for ease in data tabulation. Deep Creek section includes those trails which are located in the Mingus Creek, Cooper Creek, and Indian Creek Watersheds, as well as those which access these areas. The Deep Creek section is bounded on the north and east by U.S. 441 and the road to Clingman's Dome. Its southern boundary is the park boundary, and its western boundary is the Noland Divide Trail.

Trails in the Deep Creek area are on the average in excellent condition. The mean erosion rating was 2.06 (standard deviation, s=1.15 and variance, v=1.32). The overall erosion rating was 1.96 (s=1.08 and v=1.17). The Deep Creek section was compared with three other sections in the park to show its relative condition (Table 5). The Boundary Trail is in good condition. The other two are heavily used and in fair-to-poor condition. The good condition of the Deep Creek section is due to a number of factors. These are not heavily used paths. Noland Divide, Deep Creek, and Thomas Divide Trails do not provide easy loops back to their origin. Additionally, parking lots are not provided at the trailheads. The ridgetop trails have no water sources, making them less desirable than streamside trails. Many trails run through drier vegetation types--oaks and hickories--which are better able to absorb impact than more mesic zones. Trail slopes, on the whole, are more gentle than those of the three sections compared. This may affect the flow of surface water during

Table 5.

A COMPARISON OF AVERAGE SLOPE AND EROSION OF MAINTAINED TRAILS

Section	Width (cm)	Tread Width (cm)	% Tread	Depth (cm)	Trail Slope°	Environ Slope°	% Mud	% Rut	% Roots	Computer Erosion Rating
Deep Creek (Section 12)	96.0	40.6	42	0.9	3.4	17.8	3.5	2.7	3.8	2.1
Boundary Trail (Section 8)	107.8	42.6	40	2.8	3.7	22.7	4.1	6.8	1.1	2.2
Appalachian Trail (Section 1)	123.2	104.1	84	7.8	4.7	15.2	12.9	12.9	12.6	3.0
Le Conte (Section 6)	145.5	111.5	77	8.5	6.2	18.9	9.0	19.4	15.4	3.1

wet periods. Erosion is much more likely to be serious on a steep slope than on a gentle one.

The Blue Ridge Parkway Extension would make this area far more accessible to day-hikers and backpackers. There is no doubt that the trails and campsites would come under much heavier use than at present. It must be recognized that an increase in trail maintenance and back-country patrol would be necessary to keep the area from deteriorating rapidly. New back-country campsites would have to be developed to absorb the greater numbers of campers.

The individual trails and campsites are discussed below. Data for each trail can be found in Table 6. Please refer to Figure 4 for locations. Longer trails have been divided into natural segments on the basis of major intersections, maintenance and past use histories.

The Deep Creek Trail was divided into four such segments; Trail 1 is 2 miles of a recently abandoned road. It is gravelled and graded at jeep width. Maintained drainage ditches have helped to keep erosion of the trail to a minimum, and the trail is in good condition. This segment is very heavily used by day-hikers taking advantage of the swimming, tubing and waterfall attractions.

Above Jenkins Place the trail has been laid on an older jeep and logging road. Horse-plowed mud holes and moderate surface erosion along the entire length are apparent. The campsite at Bryson Place is provided with facilities for horses; both horse parties and

backpackers are frequent. The remaining two trails (3 and 4), are foot trails leading to U.S. 441. Their condition was poor, having ratings of 3-4. The trail cut in some areas is too narrow, causing side erosion. Eight maintained campsites help accommodate the large numbers of fishermen who are among the trail's most frequent users. While four of the campsites (56, 58, 59 and 60) are in adequate condition, the others have been overused; the vegetation damage surrounding these sites is extensive. There were two illegal sites on the Deep Creek Trail at the time of the survey. The investigators recommended abandonment due to their proximity to other legal sites.

The Pole Road Trail (5) connects the Deep Creek Trail to the Noland Divide Trail at Sassafras Gap. It is rarely used, and in excellent condition. There was one small, infrequently used illegal campsite. The area cleared is on a 10 degree slope.

The Fork Ridge Trail (6) provides access from the Clingman's Dome Road to the Deep Creek Trail at Poke Patch Campground (53). The first mile of the trail passes through a spruce-fir forest and is in extremely poor condition. Excessive water erosion has caused ratings of 4's and 5's. Trail conditions improve outside the spruce-fir zone. Vegetation types may correlate with trail hardiness. The rating for those sections of the trail in oak-hickory forests and deciduous hardwood forests was 2. West of Poke Patch Campground was a heavily used campsite. It may absorb overflow from Poke Patch.

The Noland Divide Trail was divided into three segments and is tabulated under trails 7-9 in Table 6. It is a maintained foot trail from Deep Creek to the Clingman's Dome Road. The upper section of the trail to Roundtop Knob is in poor condition. The area is subject to water erosion and the trail runs with the slope through spruce-fir forest. There are large areas of mud, ruts, and exposed roots. Backpackers are the most frequent users of this area. Middle Noland Divide is in excellent condition, except south of Beaugard Ridge, which is only in fair condition. Vistas on Beaugard Ridge attract many day-hikers from Deep Creek Campground. There were five illegal campsites on the Noland Divide Trail, all of them small. A legal site could be established at Cold Spring, near Coburn Knob. This is one of the few areas along the Divide with flat ground and water. Its establishment might discourage use of the less attractive illegal sites.

The Indian Creek Road (10) is a restricted use road that once led into a settlement of more than 300 people. There are two "living" cemeteries, Laney and Queen, that are visited periodically. The road is a surfaced, well-graded path with maintained drainage ditches. There is no erosion, nor will there be, even with a great increase in either horse or foot traffic. There are no legal campsites along the route, and few illegal sites. A developed site could be established in the old field near Queen Cemetery.

A foot and horse trail (12) leads from the end of Indian Creek Road to Martins Gap, on Sunkota Ridge. Martins Gap is the intersection of trails leading to Deep Creek, Sunkota Ridge, Indian Creek and Thomas Ridge. It is frequently used by day-hikers leaving and returning from Deep Creek Campground. The trail is in excellent condition and could tolerate more use than it presently has. One old illegal campsite was found.

The Sunkota Ridge Trail (11) is a manway (unmaintained trail) that joins Martins Gap with Deep Creek. It is used lightly by day-hikers. The trail is in excellent condition, and an increase in hikers would help to keep it passable. Some of the slopes are too steep for heavy use and rerouting the trail, before major traffic is encouraged, would avoid serious problems. There are no campsites on Sunkota Ridge, and also no water.

A foot and bridle trail connects Bryson Place on the Deep Creek Trail with the Thomas Divide Trail at Newton Bald. This 7 mile stretch can be separated into two use categories. The 1-1/2 mile between Bryson Place and Martins Gap is moderately used by horsemen and hikers connecting the Deep Creek and Indian Creek Trails. The trail is in good condition and increased use would no reduce its quality. The remainder of the trail to Newton Bald is rarely used. There is little drinking water near the trail, and the one campsite, Newton Bald, is the only legally designated camp in the park with no

water. While increased use could be expected from visitors funneling in from the Blue Ridge Parkway Extension, damage is expected to be slight.

Thomas Divide is a long trail that was segmented into four blocks (14-17). It extends from U.S. 441 to Indian Creek. The trail is in excellent condition along its entire length, and is rarely used by backpackers and day-hikers. The lack of campsites and water has probably discouraged use. There was some evidence of hog rooting. The short access trail connecting Thomas Ridge to Indian Creek runs through mesic forests, and in some places shows evidence of erosion. It could be rerouted above the cove bottom to alleviate this problem.

Georges Branch Trail (18) is an old jeep trail that joins Thomas Divide at Deeplow Gap to Indian Creek. While it is as rarely used as the other trails in this section, erosion is extreme at the mesic lower end. Vehicle ruts, slope, numerous springs and small creeks combine to create erosion problems. If the road is built and more hikers are expected, increased maintenance would be critically needed. The upper half of the trail passes through sub-xeric forests. Erosion is minimal. There are no campsites along Georges Branch.

There is an unused motor nature trail that traverses the western slope of Thomas Divide. It was built in the 1960's to connect Galbraith Creek Road with Georges Branch Trail. The completed road would have made a loop back to Deep Creek Campground via the Indian

Creek road. It was not sampled.

The Cooper Creek Watershed supports three foot and horse trails. There is an unimproved road, the Cooper Creek Road, leading to the park boundary from U.S. 19. A gated jeep road extends approximately one mile further to the Cooper Creek Trail. An old logging or jeep road extends from there up to Deeplow Gap past Little Creek Falls, a major attraction. Erosion is high because of several small streams which cross the road. Maintenance is required now, and more will be needed if the trail becomes heavily used. There are no campsites along the route, but an old homesite about three-fourths of the way up the trail could be developed.

The other fork of the Cooper Creek Road extends 3 to 4 miles to Mingus Mill on U.S. 441. The trail is used by day-hikers starting from the Mingus Mill end. Rich coves and a scenic creek are the main attractions. This stretch, which follows Mingus Creek and Madcap Branch, has considerable lengths of highly eroded areas. These are caused by seepages and side branches flowing on the trail. When the trail parallels Cooper Creek, it again shows evidence of considerable erosion. Several illegal campsites were found on Mingus Ridge toward the Cherokee Indian Reservation. Their main use seems to be for poaching. An old field on Cooper Creek would make an excellent area for a developed campsite, should one be needed in the future. Mingus Creek serves as the water source for the town

of Cherokee, and contamination might occur if any sites were established in its drainage.

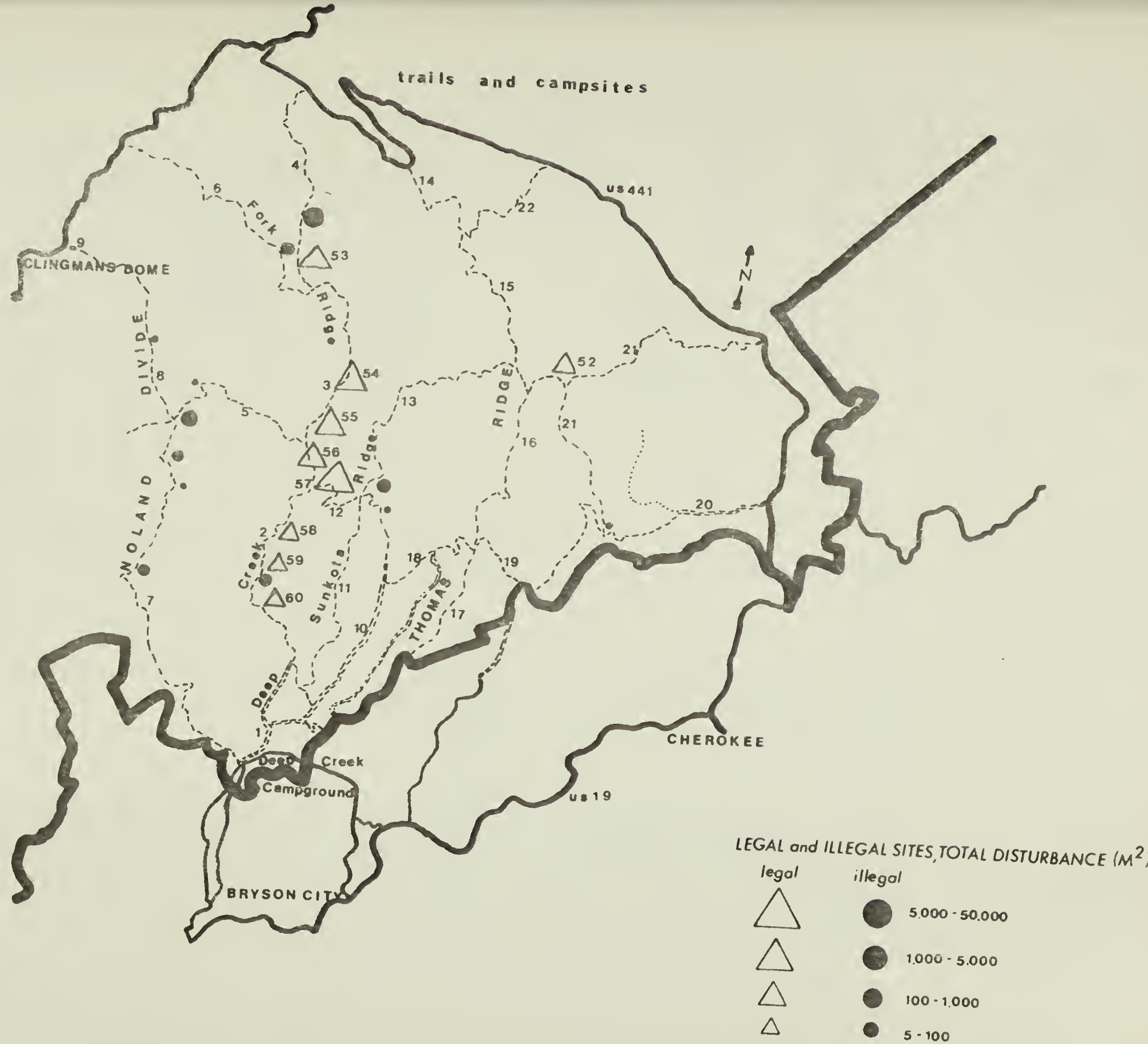
At Mingus Ridge the Cooper Creek Trail branches up to Newton Bald, and from there to Smokemont Campground on U.S. 441 (21). It is used rarely by backpackers and possibly by some horse traffic. The trail is in excellent condition and could easily take an increase in foot traffic without serious deterioration.

The Kanati Fork Trail (22) provides access to the middle of the Thomas Divide Trail from U.S. 441. It is rarely used by hikers and horsemen. The path is in excellent condition over its 3-mile length, except for where small streams dissect the trail. Use of the trail is primarily for access to Thomas Divide. There are no campsites.

Although the trail system in Deep Creek is in relatively good condition, a number of changes would be necessary to accommodate the increased number of hikers brought into Deep Creek area by a new road. Several trails including Deep Creek, Georges Branch and Cooper Creek would need more intensive maintenance. The trail from Deeplow Gap to Little Creek Falls would probably require rerouting and surfacing material. Deep Creek Trail is already heavily used and should not be subject to an increase in hiker traffic unless maintenance is greatly expanded or horse use is eliminated. The addition of some nature trails or short loops for day-hikers would be desirable but would be restricted by the steep slopes.

The new road would create additional demand for back-country camping in the area. Some expansion of the back-country campsite system for Deep Creek area is possible but there are a number of limitations. Mingus Creek watershed should not be used for campsites because they would be too close to a public water supply. The ridgetop trails including Thomas Divide and Noland Divide provide very few large flat areas for tent sites; and in general, there is no water available near the trail. Deep Creek Trail is already heavily used for camping, and has a high density of campsites, so any increase is undesirable. Cooper Creek has suitable flat areas, but most of this drainage will be too close to the road to provide secluded back-country camping. If Alternative 6 were constructed, these locations would be too near the road to use. If Alternative 7 were constructed, at least two campsites could be established on Indian Creek.

In summary, many of the trails in Deep Creek area are in good condition, but a number of the trails most likely to absorb increased visitor use would require greater maintenance. New sections of trail would provide opportunities for day-hikers near the road. Back-country camping can only be expanded to a limited extent, due to the lack of sites. Further development of back-country campsites is restricted both by topography and the placement of the road itself.


trails and campsites
us441
us19
CLINGMANS DOME
NOLAND
DIVIDE
Fork
Ridge
Sunkota
Ridge
RIDGE
THOMAS
Deep
Creek
Deep Creek
Campground
BRYSON CITY
CHEROKEE
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60
LEGAL and ILLEGAL SITES, TOTAL DISTURBANCE (M^2)
legal
illegal
5,000 - 50,000
1,000 - 5,000
100 - 1,000
5 - 100

Figure 4

Table 6.

CAMPSITE DATA IN M^2

Name and No.	Location	Bare Soil	Vegetation Leaf Litter	Total Distribution
52 Newton Bald	Thomas Divide Trail	200	50	250
53 Poke Patch	Deep Creek	260	1100	1400
54	Deep Creek	170	300	2475
55	Deep Creek	260	4400	4400
56 Deep Creek	Deep Creek	4	200	1176
57 Bryson Place	Deep Creek at Indian Creek Trail	625	10800	10800
58	Deep Creek	2	312	312
59	Deep Creek	6	80	236
60	Deep Creek	4	60	350

Illegal Sites

Location	Bare Soil	Vegetation Leaf Litter	Total Distribution
Deep Creek above 53	341	341	3200
Deep Creek between 59 and 60	1	30	30
Fork Ridge Trail west of 53	70	20	90
Sassafras Gap Trail toward Deep Creek	16	16	16
Noland Divide below Roundtop Knob	8	12	12
Noland Divide near Lower Sassafras Gap	1	1	1
Noland Divide at Sassafras Knob	24	24	24
Noland Divide at Sassafras Gap	192	320	320
Noland Divide at Cold Spring Coburn Knob	16	16	16
Martin's Gap	64	64	64
Martin's Gap Trail	4	4	4
Thomas Divide near Newton Bald	4	4	4

Table 7.

SUMMARY OF DEEP CREEK TRAIL CHARACTERISTICS

Trail No.	No. of Readings	Width (cm)	Tread Width (cm)	Depth (cm)	Trail Slope Degree	Environment Slope Degree	% Mud	% Rut	% Roots	Overall Erosion Rating
1	7	635	451	0.	1.5	15.1	0.	0.	0.	2.0
2	12	224	175	6.1	4.3	21.1	4.0	0.1	3.5	3.5
3	12	192	97	4.6	1.5	13.8	10.6	0.6	3.8	3.8
4	11	149	87	1.1	4.5	25.5	4.4	0.2	0.6	2.8
5	9	166	62	2.0	4.0	21.2	1.0	0.	1.6	1.1
6	14	79	33	0.3	3.9	24.6	3.4	0.7	19.4	2.9
7	20	103	40	1.6	3.5	18.7	0.2	2.0	0.6	1.4
8	13	113	65	2.7	3.5	10.3	19.2	14.6	26.9	2.2
9	3	353	230	5.3	4.0	14.6	0.	3.3	0.	2.0
10	10	501	288	0.6	1.8	15.8	0.	0.	0.	2.0
11	13	72	15	0.	3.4	19.1	0.	0.	0.	1.0
12	9	124	26	0.	3.9	20.3	0.	10.0	2.2	1.3

Table 7 - Cont.

Trail No.	No. of Readings	Width (cm)	Tread Width (cm)	Depth (cm)	Trail Slope Degree	Environment Slope Degree	% mud	% Rut	% Roots	Overall Erosion Rating
13	14	70	47	0.	1.6	21.0	0.	0.7	0.8	1.3
14	6	62	40	0.	1.7	13.8	0.	0.	1.0	1.5
15	5	41	18	0.	3.6	18.6	0.	0.	2.0	1.4
16	8	50	8	0.	2.4	9.5	0.	0.	0.6	1.0
17	14	90	12	0.	4.8	17.9	2.1	0.	0.	1.4
18	8	173	73	0.	5.8	17.	10.6	36.2	6.3	2.4
19	12	149	50	0.	4.2	16.6	6.0	0.2	0.	2.4
20	9	256	94	1.3	4.7	16.3	11.0	0.7	0.	3.1
21	9	74	.0	0.	3.0	10.3	0.	0.	0.	1.0
22	8	51	17	0.	4.4	29.1	0.	0.	0.	1.5
23	14	56	26	0.	2.3	11.8	1.8	0.	0.	1.6
24	4	208	23	2.0	2.8	20.0	0.	3.5	0.	1.5

GEOLOGIC CONDITIONS

The basic parameters covered in this report which have a bearing on slope stability for each route area are geological conditions, precipitation and topography. Other factors which require consideration prior to parkway construction are spring seepage areas, the stabilizing effects of vegetation (root depth), and stability of alluvial and colluvial materials.

Geology

The outcropping rocks of the study area consist of the thick mass of metamorphosed sedimentary rocks comprising the Thunderhead sandstone. This unit is of late Precambrian Age and within the area rests uncomfortably on a basement complex of granites and gneisses (Figure 5). Narrow alluvial deposits occur in the major stream valleys only.

The Thunderhead Ss is described by Hadley and Goldsmith (1963) as a massive thick bedded variously metamorphosed feldspathic sandstone and fine arkosic conglomerate with interbedded gray siltstone and slate, phyllite, feldspathic quartz-mica schist, garnet schist, kyanite-staurolite schist, and granite and quartzite cobble conglomerate. The intensity of metamorphism within this unit increases to the south and the study area lies within the area of most intense metamorphism, the hyanite-staurolite zone.

The sandstone and conglomerate members of the Thunderhead formation are not likely to directly cause slope failure. However, in areas underlain by the relatively impermeable foliated members (slate, phyllite, or schist) the potential for movement along dip slopes resulting from increased hydrostatic pressure following heavy rainfall can develop. This condition can be exacerbated by road fills if not properly drained. Slippage will have a greater likelihood of occurrence where the road cuts along a dip face (see Figure 6).

Areas which have potential for rock movements are indicated on Figure 6 and are just northeast of Deeplow Gap at Area A, on Thomas Ridge at Area D, between Indian Creek and Deeplow Gap at Areas E and F and L, and along Indian Creek from Point G to Point H. These areas are those where dip slopes and/or the foliation of rocks provide for slide potential. Proper engineering will mitigate this threat--permeable, stable fill materials and/or underdrainage are suggested where cut-and-fill operations are required.

Outcropping within the study area but not directly contacting the road route, at the Ravensford end of the extension, and near Bryson City are plutonic rocks of the basement complex. These consists of generally stable complexes of augen and flaser gneiss, granite, quartz monzonite, and granodiorite, and minor amounts of amphibolite and layered gneiss.

The Greenbrier Fault, a low-angle thrust fault, near the Oconaluftee Visitor Center dips ESE, brings Precambrian granitic basement rocks into contact with Thunderhead sandstone. A highly weathered zone is not evident in this case and no renewed movement on this Ordovician Fault is expected. Thus, no unusual engineering problems should be encountered.

Because of the documented hazard due to the geochemical instability of the sulphide minerals in the Anakeesta Formation which overlies the Thunderhead Ss, within Great Smoky Mountains National Park and the reported occurrence of pyritic slate, Anakeesta-like materials, interbedded in the Thunderhead at Copper Gap, to the northeast of the study area, a field review was completed to assess any possible threat because of acid drainage from rock materials over the proposed extension routes. Anakeesta Formation was not expected in the study area and none was found. Surficial field evidence of sulphide minerals in the Thunderhead Ss was not found within the study area.

The potential for mass wasting exists throughout the lower portions of the various drainages in the study area. Evidence for large scale unstable colluvial deposits was not observed. Locally unstable colluvial materials may occur and detailed field mapping of alternative routes prior to construction is recommended. If stabilizing vegetation is removed or if these deposits are unloaded, they will move down slope.

Precipitation

Precipitation falling within the study area varies from 50-80 inches per year. Care should be taken, because of the high degree of variability, to construct the roadbed well above flood levels as established by stage records of the United States Geological Survey.

Short-term heavy precipitation, given the relatively high stream gradients (640 ft./mi. - unnamed tributary joining Indian Creek 0.6 mile northeast of Martin's Gap; 600 ft./mi. - Indian Creek above this tributary; 1020 ft./mi. - Estes Branch), create the potential for flash flooding from side tributaries.

Areas of heavy precipitation and rapid discharge can also become locations for debris slides which are associated with flash flooding and/or slope failure owing to increased hydrostatic pressure within rock materials. Spring seeps (not mapped) occur along major drainages. Parkway segments paralleling streams should be constructed with this in mind or periodic interruptions in traffic flow will result.

Topography

Many slopes of the study area are steep (30 to 40 degrees). Thus, prior to beginning construction the final route must be evaluated relative to gradient and geologic structure. In general, the

topographic gradient (about equal 30 degrees) from the Oconaluftee Ranger Station, 2.2 miles along Mingus Creek C to B (Figure 6), is very steep. The proposed road route is near the divide but within the Mingus Creek Drainage. Activities within this drainage may affect the public water supply for the town of Cherokee, North Carolina. Thus, construction and other activities on these slopes should be avoided and the southernmost routes are recommended. Structure and orientation of foliation should not be a factor.

Conclusions

From the existing published data and field review it may be suggested that:

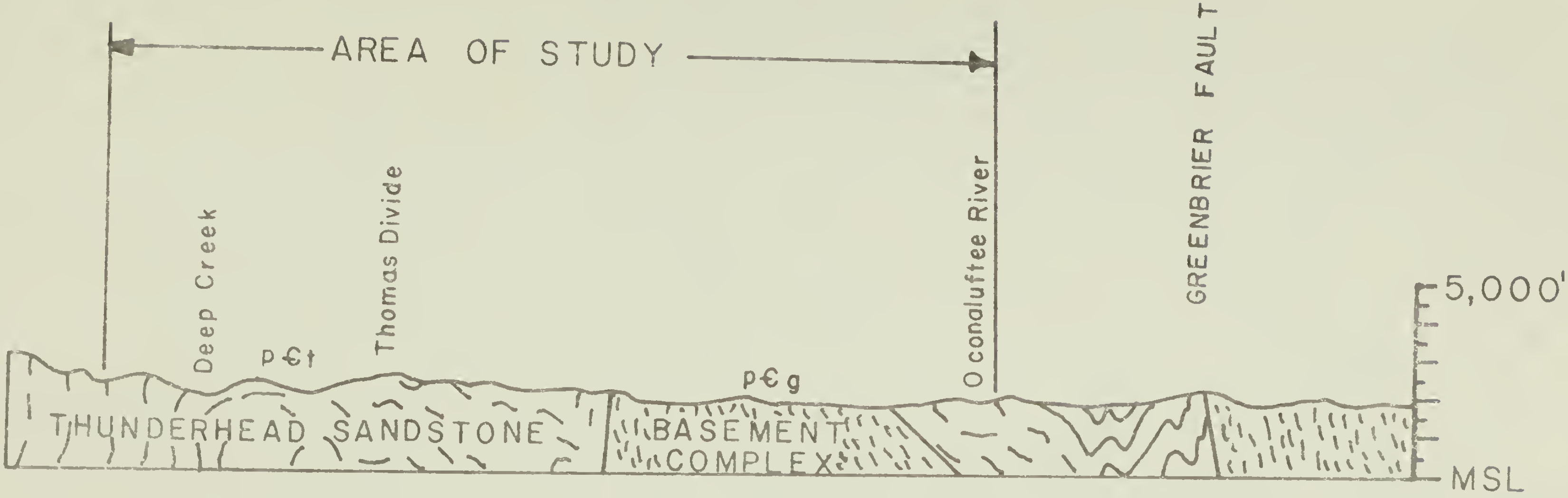
1. Of the east-west section routes, the northernmost route to Deeplow Gap is plagued with steep slopes requiring extensive engineering solutions to protect established public water supplies.
2. The east-west routes to the south of the crest of Mt. Noble and remaining to the south of Mingus Creek Drainage avoid the trouble area within this watershed and are, because of lessor slope gradients, less susceptible to slope failure. This route, however, traverses the Cherokee Indian Reservation.

3. The route just west of Thomas Ridge follows undisturbed slopes from Deeplow Gap to Deep Creek Campground, and encounters some structural complexities near D (Figure 6) and is quite steep in places.

4. The Indian Creek route contains some rockfall or slide hazards, but generally follows an existing roadbed along the creek.

5. Engineering alternatives should be considered to avoid massive cuts and fills on steep slopes where feasible.

6. Geochemical acid drainage problems are not expected.



GEOLOGIC CROSS SECTION
(Hadley et. al. 1968)

Scale 1:62,500

Figure 5

PROPOSED ROUTE ALTERNATIVES

Figure 6

WATER QUALITY

Each of the three watersheds was assessed for water quality by two procedures, kicknet samples and bacterial tests. The kicknet samples determined the extent and diversity of the aquatic macroinvertebrate communities. The bacterial tests determined fecal coliform and fecal streptococcus concentrations in the water.

Kicknet Samples

A series of kicknet samples were taken in each of the streams and selected tributaries, five on Mingus-Madcap, nine on Cooper Creek and eight on the Indian Creek-Deep Creek drainages. The data collected were analyzed for stability of the aquatic macroinvertebrate community with the Shannon-Weiner Diversity Index, based on $\log_e$ (Shannon and Weaver, 1963). This index provides an indication of stream water quality based on community diversity. In most cases, higher diversity within a stream's macroinvertebrate community indicates greater biological stability, and by inference, higher water quality. Evenness is an index of the chance of encountering the same species on a number of chance encounters (Pielou, 1975). A high evenness index indicates reduced biological stability and, by inference, indicates water quality. The two indices are normally interpreted together to obtain an indication of overall water quality.

Tables 8-10 present the diversity and evenness figures computed from the samples collected from each watershed.

The macroinvertebrate diversity and evenness indices indicate that all three watersheds, within the park, are presently of extremely high water quality. In most cases, the tributaries seem to be of higher quality than the main streams. A list of the macroinvertebrate taxa collected is presented in Appendix I.

Diatom communities were sampled and identification to species was accomplished in most cases. One very abundant diatom had not been described before. A list of the taxa collected is presented in Appendix I. Commentary on some sample sites is offered below (Lowe, personal communication). Refer to Figure 9 for sample sites.

IC-A-1

This community is of medium diversity relative to others. The great abundance of *Meridion circulare* and *Eunotia rhomboidea* suggests the habitat is cool and circumneutral to acid in pH. The high relative abundance of *Achnanthes* sp. #1 was observed in several samples. A continued attempt is being made to find a name for it.

Table 8.

INDIAN CREEK	IC-A-1	IC-B-2	IC-C-3	IC-D-4	IC-E-5	IC-F-6	IC-G-7	IC-H-8
Total Number of Taxa Per Station	35	37	29	21	28	34	44	37
Total Number of Individuals Per Station	172	366	71	86	98	311	254	295
Diversity (d)	4.50	3.95	4.48	3.91	4.58	3.79	4.68	4.06
Evenness (e)	0.88	0.76	0.92	0.89	0.95	0.74	0.86	0.78

Table 9.

MINGUS CREEK/ MADCAP BRANCH	MCB-A-1	MCB-B-2	MCB-C-3	MCB-D-4	MCB-X-4	MCB-E-5
Total Number of Taxa Per Station	18	31	43	27	10	30
Total Number of Individuals Per Station	143	153	230	85	24	247
Diversity (d)	3.16	4.17	4.22	4.30	2.92	3.92
Evenness (e)	0.76	0.84	0.78	0.90	0.88	0.80

Table 10.

COOPER CREEK	CC-A1	CC-B2	CC-C3	CC-D4	CC-E5	CC-K6	CC-J7	CC-I8	CC-H9
Total Number of Taxa Per Station	29	52	35	28	35	25	22	32	38
Total Number of Individuals Per Station	911	523	192	223	249	135	175	209	221
Diversity (d)	3.06	4.72	4.20	3.77	4.18	3.83	3.52	4.39	4.24
Evenness (e)	0.63	0.83	0.82	0.78	0.81	0.82	0.79	0.83	0.81


IC-A-1
Estes Br
IC-B-2
Georges Br
IC-C-3
IC-D-4
IC-E-5
Indian Creek
Queen Br
IC-F-6
IC-G-7
IC-H-8
CC-A1
CC-B2
CC-C3
CC-D4
Cooper Creek
CC-E5
CC-K6
CC-J7
CC-I8
CC-H9
Adams Creek
Mingus Creek
Madcap Br
MCB-A-1
MCB-B-2
MCB-C-3
MCB-D-4
MCB-E-5
* KICK NET
Δ COLIFORM
DEEP CREEK
CAMPGROUND

Figure 7.

IC-B-2

The relatively low diversity, 1.45, of this sample is due largely to the great relative abundance of *Achnanthes* sp. #1. If this species behaves as others of the genus, this large relative abundance may reflect swift currents influence in this community.

IC-C-3

This sample contained a community that does not appear too significantly different than IC-B-2. The community structure is again greatly influenced by the great relative abundance of *Achnanthes* sp. #1.

IC-D-4

This sample, like the past two, has large amounts of *Achnanthes* sp. #1. *Achnanthes lanceolata* is also quite abundant. This taxon is normally rheophilous or even rheobiontic and is characteristic of small neutral to alkaline streams. Cholnoky (1968) indicates that *A. lanceolata* requires high oxygen concentrations. The low diversity of these past three samples may be due to the physical stress of swift current.

IC-E-5

This community was relatively diverse, $\bar{d}$ = 2.83. Although *Achnanthes* sp. #1 was abundant, 20.8% it was not as abundant as in previous samples. *Meridion circulare* and *Eunotia rhomboidea* suggest that this station is cool and neutral to acid. Large amounts of *Synedra ulna* often are interpreted as evidence of increased dissolved organic matter but its ecological tolerances are too broad to allow any conclusions. The increased diversity here could reflect a community that developed in reduced current. This may be a microhabitat characteristic rather than a general characteristic of whole stream.

IC-F-6

This community had moderate diversity of 2.53. The species of *Achnanthes* were still quite abundant. *Achnanthes* was over 40% of this community.

IC-G-7

This community was quite similar to IC-E-5 in composition and structure although IC-G-7 is somewhat less diverse. This is

due to slightly increased relative abundance of *Achnanthes* sp. #1. The rheophilous genus *Achnanthes* is again most numerically important. The station appears to be cool (possibly shaded) and circumneutral to acid in pH.

IC-H-8

This community was the most diverse of any of the IC series. *Achnanthes* sp. #1 at 11.8% was the only taxon greater than 10% in relative abundance. *Fragilaria virescens*, a species of streams and ditches that is indifferent to current was more relatively abundant in this sample than in any others of the IC series. Its pH optimum is somewhat less than 7. This sample contained a relatively large number of taxa (58).

MCB-A-1

The lowest diversity of community, 1.12, was observed here. This lack of diversity was due largely to the great relative abundance of *Achnanthes* sp. #1. Until this species is identified (it may be undescribed) not much can be concluded about this sample. Conditions certainly seem to be optimal for *Achnanthes* sp. #1; possibly the current has something to do with it.

MCB-B-2

Achnanthes was again the overwhelming numerical dominant in this sample comprising over 75% of the sample. This surely reflects swift currents. The presence of *Diatoma hiemale* var. *mesodon* and *Eunotia pectinalis* var. *minor* indicates neutral to acid pH. The diversity here is relatively low.

MCB-C-3

This community along with MBC-A-1 had the lowest diversity of all samples. As with MCB-A-1 the low diversity reflects a great relative abundance of *Achnanthes* sp. #1.

MCB-D-4

The community in this sample was the most diverse of any samples in this series. Only one taxon, *Pinnularia intermedia*, reached greater than 10% relative abundance. The abundance of *Navicula contenta* var. *biceps* suggests that this collection was made from an aerophilous habitat, or at least from highly oxygenated water. The lower relative abundance of *Achnanthes* and increased abundances

of such biraphid genera such as *Navicula*, *Cymbella*, and *Pinnularia* further suggests a community n t under the influence of strong current.

MCB-E-5

This community was also quite diverse (2.94) but not as diverse as the previous sample. The community appears to be well developed and 40 taxa were observed. The high relative abundance of *Synedra ulna* should be noted. Some authors might attribute this to organic enrichment but this speculation is dangerous since *S. ulna* tolerates a broad range of ecological conditions.

CC-A-1

This community had a high diversity of 3.08. The most relatively abundant taxon was *Fragilaria virescens* which is widely distributed in fresh water. *Eunotia rhomboidea* and *Meridion circulare* characterize the habitat as cool and circumneutral to acid.

CC-B-2

This community was of moderate diversity (2.39). *Meridion circulare* and *Diatoma hiemale* var. *mesoden* accounted for 50% of all individuals. Both of these taxa prefer cool flowing water with the latter preferring fairly high nutrient content (mesotrophic). *Achnanthes* sp. #1 is also quite abundant here.

CC-C-3

This community is quite similar to CC-B-2 with large numbers of *Meridion circulare* and *Diatoma hiemale* var. *mesodon* The relatively large population of *Anomoeoneis serians* var. *brachysira* is unique to this sample. This taxon is tolerant of brackish water.

CC-E-5

Only 29 taxa were recorded in the analysis of this sample. *Meridion circulare*, *Eunotia rhomboides*, *Diatoma hiemale* var. *mesodon* and *Achanthes* sp. #1 accounted for almost 75% of the community, thus the diversity was lower than previous samples in this serive (2.24). These 4 taxa are typical of cool, neutral to acid streams with a moderate current.

CC-H-9

This community was the most diverse of any studied in this project (3.31). Only one taxon, *Meridion circulare*, had a high relative abundance (15.6%). There was a total of 46 taxa. This is a well developed community from what appears to be a cool, soft, slowly flowing stream of circumneutral to acid pH.

CC-I-8

The diversity of this community was 2.59. *Achnanthes* sp. #1 was very abundant here and probably reflects a relatively swift current.

CC-J-7

This community had a diversity of 2.93. *Achnanthes* sp. #1 was the most numerically abundant taxon. *Meridion circulare* and *Eunotia rhomboidea* again suggest a cool slightly acid stream.

CC-K-6

The diversity of this community, 2.36, is about average for these samples. *Achnanthes* sp. #1 had a relative abundance of 19.2% but another species of this rheophilous genus *A. linearis* had the greatest relative abundance of any taxon in this community, 20.4%. This taxon is thought to be alkaliphilous to indifferent to pH and thrives in high oxygen concentrations. It is especially abundant in mountainous regions.

Analysis for fecal coliform and fecal streptococcus bacteria was accomplished by the membrane filtration method. Samples were collected from the three major creeks draining the area: Mingus Creek, Cooper Creek and Indian Creek. The following results were obtained:

Sample site	Fecal Coliform per 100 ml.	Fecal Streptococcus per 100 ml.
Mingus Cr. below Mingus Mill	0	137
Cooper Cr. at Park Boundary	5, 1, 2	82, 55, 76
Cooper Cr. at U.S. Rt. 19	111, THTC	422, 350, 350
Indian Cr. below Indian Cr. Falls	6, 4, 14	181, 256, 135

Fecal coliform bacteria are definite indicators of fecal pollution from warm-blooded animals. Maintained drinking water sources are required to be completely free of fecal coliform organisms. Counts of over 200 per 100 ml. are considered unsafe for swimming. Most major back-country streams in the Great Smoky Mountains National Park give coliform counts averaging around 4. These three streams, then, seem to be average. The high count for Cooper Creek at Route 19 may be due to the fact that it was sampled after considerable rain.

The much larger numbers of fecal streptococcus than fecal coliform tend to indicate that this contamination is from animal rather than human sources. This is normal for back-country water.

At present, the streams investigated inside the park boundary appear to be relatively free from contamination, and water quality is quite good.

In summary, it is uncertain what effect road building activities will have on the various communities of organisms. The streams support a highly diverse system of aquatic life and are relatively free from contamination and disturbance. Siltation from bank erosion is generally believed to be detrimental to some of the more sensitive species. Road cuts on steeper slopes will have to be wider, and more soil erosion will result. Certainly those alternatives which propose crossing or running parallel to the least number of streams will have

the lowest immediate impact upon the streams and the communities of aquatic organisms within them. These include Alternative 4, 5, and 7.

TROUT POPULATION ASSESSMENT

The U.S. Fish and Wildlife Service conducted a fish population assessment of the Mingus, Cooper, and Indian Creek Watersheds in 1974. Eight sample pools were electro-shocked to stun the fish which were then classified, counted, and weighed. Rainbow trout were found, as well as some non-trout species. The population of rainbow trout is tabulated below in numbers of fish per acre and number of pounds per acre. Refer to Figure 8 for locations.

Table 11.

Sample No.	Location	Fish per acre	Pounds per acre	pH of water	Elevation in feet
1	Mingus Creek	186	9.0	6.8	2320
2	Mingus Creek at Water Intake	524	23	6.8	2340
3	Cooper Creek	194	13	6.5	3200
4	Indian Creek	55	4	6.8	2200
5	George's Branch	214	16	6.5	2600
6	Indian Creek at End of Road	179	10	6.8	2600
7	Indian Creek-Right Branch	263	18	6.7	3008
8	Indian Creek-Left Branch	167	11	6.7	3020

TROUT POPULATION ASSESSMENT

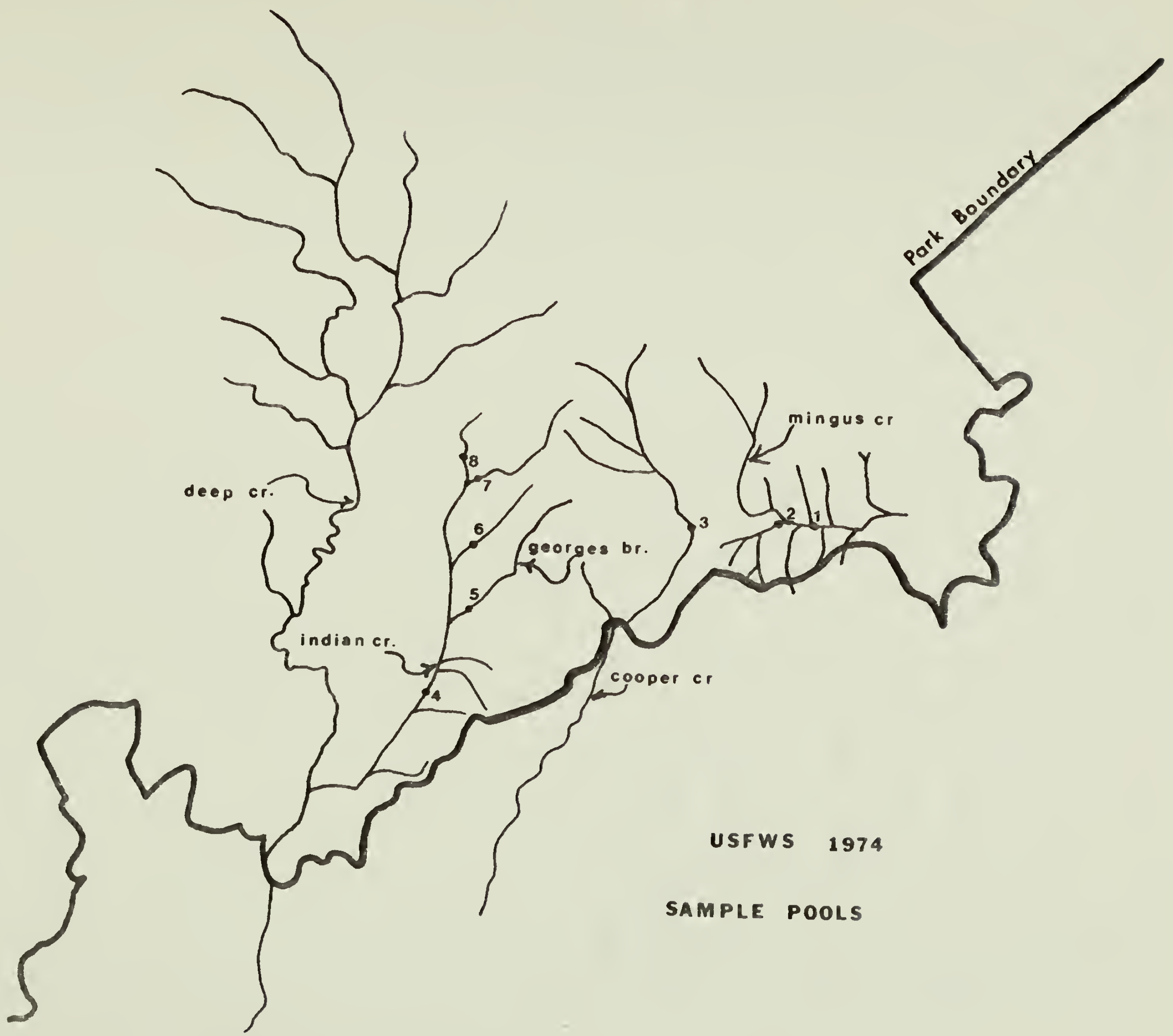


Figure 8.

Siltation from construction activities will almost certainly have an adverse effect on the trout populations. The trout species present, however, is non-native and can be restocked. Alternative 1 would cause the greatest damage to Mingus Creek. Alternative 4 would cause the least damage to Mingus Creek, but would effect streams outside of the park. Alternative 5 would disturb Cooper Creek and poses a severe threat to a private trout-rearing operation immediately outside the park boundary (Woody's Trout Farm). Alternative 6 is much closer to Indian Creek than Alternative 7 and would cause much more siltation. Construction activity on Indian Creek could cause excessive damage to trout and other aquatic species.

MAMMALS

The populations and types of mammals found in the area affected by the proposed road route extension were estimated in a number of ways. Small rodents were trapped in live trap boxes, and bears were baited with sardines. In addition, direct observations, "signs," and literature were used to determine which mammals inhabit the area. Results are given in Figure 12.

The number of sardine baits eaten by bears (2 of 19) in five days was low when compared with bait lines on the Tennessee side of the park, where the population has been estimated at one bear per square mile (Marcum, 1974). The complete lack of bears frequenting the Deep Creek Campground also indicates a low population. There were no obvious deficiencies in habitat. Poaching, campground activity, hikers, etc., may be the reason for the lack of bears observed in the campground and for the apparently low population in the back-country.

Deer are common in the park, although the populations are thought to be low in the back-country as compared to the maintained historical areas. The construction of the parkway would cause a change in the forest to an earlier successional stage, with grasses and forbs growing near the road. This would cause a localized improvement in the habitat for deer. An increased potential for road kills would also occur.

There were no caves, limestone or other, found in the area, hence, trogoloxenic bat populations would not be harmed. The Indiana bat, an endangered species, has not been recorded for this area.

Grey and red fox, bobcat, longtail weasel, mink and raccoon all inhabit areas of the park along the proposed extension. Construction of the parkway would affect several species of small mammals differentially. Grassland and early successional species such as the jumping mice would enjoy an increase in habitat until the roadsides could return to a later successional stage. The mast-users, such as the squirrels, would lose a small portion of their habitat.

Table 12

SURVEY OF MAMMALS IN DEEP CREEK AREA

Trapping

24 captures and 1 miss in 88 trap nights
20 Deermice (*Peromyscus maniculatus*)
1 Woodland Vole (*Microtus pinetorium*)
3 unidentified

Baiting

2 of 19 baits taken by a bear in 5 days

Observations

1 Eastern Chipmunk (*Tamias striatus*)
1 European Wild Hog (*Sus scrofa*)
2 Striped Skunks (*Mephitis mephitis*)
1 Gray Squirrel (*Sciurus carolinensis*)

"Sign"

Red Fox (*Vulpes vulpes*)
Gray Fox (*Urocyon cinereoargenteus*)
Bobcat (*Lynx rufus*)
White-tailed Deer (*Odocoileus virginianus*)

Literature Search

The proposed extension of the Blue Ridge Parkway is within the range of the following mammals as shown in Burt and Grossenheider (1964). Those species with an asterisk before the common name also appear in Linzey and Linzey (1971).

Marsupialia	
Didelphidae	
*Opossum	*Didelphis virginiana*
Chiroptera	
Vespertilionidae	
*Little Brown Myotis	*Myotis lucifugus*
*Keen's Myotis	*M. keenii*
*Indiana Myotis	*M. sodalis*

Small-footed Myotis	*M. leibii*
*Silver-haired Bat	*Lasionycteris noctivagans*
*Eastern Pipistrelle	*Pipistrellus subflavus*
*Big Brown Bat	*Eptesicus fuscus*
*Red Bat	*Lasiurus borealis*
Hoary Bat	*L. cinereus*
Evening Bat	*Nycticeius humeralis*
*Rafinesque's Big-eared Bat	*Plecotus rafinesquii*
Insectivora	
Soricidae	
*Masked shrew	*Sorex cinereus*
*Smoky shrew	*S. fumeus*
*Southeastern Shrew	*S. longirostris*
*Longtail Shrew	*S. dispar*
*Pygmy Shrew	*Microsorex hoyi*
*Least Shrew	*Cryptosis parva*
*Shorttail Shrew	*Blarina brevicauda*
Talpidae	
*Star-nosed Mole	*Condylura cristata*
*Eastern Mole	*Scalopus aquaticus*
*Hairy-tailed Mole	*Parascalops breweri*
Lagomorpha	
Leporidae	
Snowshoe Hare	*Lepus americanus*
*Eastern Cottontail	*Sylvilagus floridanus*
*New England Cottontail	*S. transitionalis*
Rodentia	
Sciuridae	
*Woodchuck	*Marmota monax*
*Fox Squirrel	*Sciurius niger*
*Southern Flying Squirrel	*Glaucomys volans*
*Northern Flying Squirrel	*G. sabrinus*
Castoridae	
*Beaver	*Castor canadensis*
Cricetidae	
*Eastern Harvest Mouse	*Reithrodontomys humulis*
*White-footed Mouse	*Peromyscus leucopus*
*Golden Mouse	*Ochrotomys nuttalli*
*Eastern Woodrat	*Neotoma floridana*
*Rice Rat	*Oryzomys palustris*

*Hispid Cotton Rat	*Sigmodon hispidus*
*Southern Bog Lemming	*Synaptomys cooperi*
*Gapper's Red-backed Mouse	*Clethrionomys gapperi*
*Meadow Vole	*Microtus pennsylvanicus*
*Rock Vole	*M. chrotorrhinus*
*Muskrat	*Ondatra zibethicus*
Zapodidae	
*Meadow Jumping Mouse	*Zapus hudsonicus*
*Woodland Jumbing Mouse	*Napaeozapus insignis*
Carnivora	
Procyonidae	
*Racoon	*Procyon lotor*
Mustelidae	
Least Weasel	*Mustela nivalis*
*Longtail Weasel	*M. frenata*
*Mink	*M. vison*
*Spotted Skunk	*Spilogale putorius*

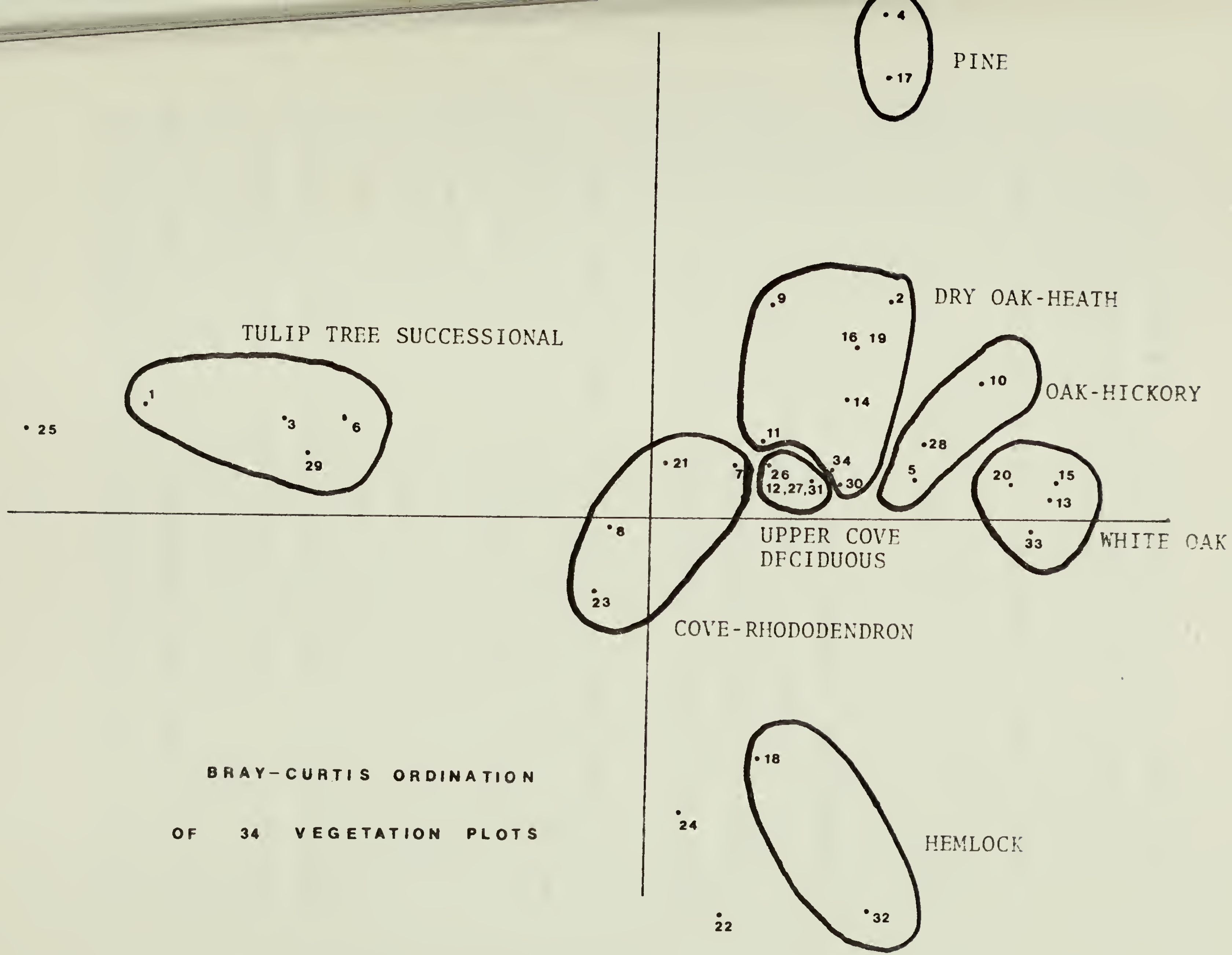
VEGETATION SURVEY

A vegetation survey of the three watersheds was conducted in the summer of 1976. Vegetation types vary along environmental gradients. To include the full diversity of forest types, sample plots were selected on a variety of slopes, aspects, elevations and moisture conditions. Tree samples consisted of 34 50m x 20m plots. The trees were classified and ranked according to dominance by their basal areas and numbers. Some trees were cored with an increment borer and aged by the annual growth rings. Each tree plot was subdivided into six 5m x 10m shrub plots, where shrubs and saplings were identified and counted. Percent cover was calculated for each species. Trees, shrubs and saplings were arbitrarily separated by size of stems. Stems with a diameter greater than 4cm at breast height (dbh) were called trees. Stems greater than 1 cm dbh but less than 4cm were named shrubs. Those woody stems less than 1cm dbh were called saplings.

Each shrub plot was further subdivided into three 1m x 1m herb plots. The herbs were classified and quantified by percent cover. In addition, herbs that fell outside herb quadrat, but within the 50m x 20m plot were listed and added to the data.

The minimum number of tree species in any given plot was six (plot 12). The maximum number was 18 (plots 5 and 12). The average number of species was 13 per plot. This wealth of

diversity made it difficult to classify some of the vegetation on a basis of species presence or absence. Eight broad-forest types were derived from species dominance or groups of species codominance with the aid of the Bray-Curtis Ordination Process (Bray and Curtis, 1957). The ordination ranks sample plots according to percent similarity of each plot to two plots chosen for their dissimilarity to each other. In other words, two plots are chosen to represent two extremes, and the others are ranked according to how extreme they are. The ordinations were graphed two-dimensionally, and forest types were derived from the plots which clumped together. Graph 1 illustrates the ordinations used to derive forest types. Clustering was due to the similarity of plots to each other. Three clusters can be consistently discriminated in the ordination, defining the hemlock, pine and tulip tree second growth types. These three types were characterized by strong dominance of the typical species. Conifers tend to exclude other species, and tulip tree is the first tree to succeed into abandoned agricultural areas. Plots 22 and 24 are successional plots of tulip tree dominance, located on moist, lowland flats. Their ordination near hemlock and cove rhododendron plots can possibly be explained by understory composition. Many species of mesic hardwoods are of shrub and sapling height now. When they reach canopy size these areas will have succeeded to a cove forest type. Species diversity is low in these forests. In most of the area, however,



BRAY-CURTIS ORDINATION

OF 34 VEGETATION PLOTS

oaks and mesic hardwoods are found together in so many combinations that classification by presence or absence is next to impossible. The average number of tree species per plot was 13. With diversity and species overlap so high, the classification of communities was almost arbitrary. The types that are defined can be placed along a gradient, the extremes of which blend into other types. The similarity of codominants was the criterion used to discriminate types.

Most of the land in the watersheds is forested, although about 10 hectares of lowland marshes and fields still remain (in Indian Creek Drainage and in Cooper Creek Drainage). There are low shrubs in them now, and they will probably support tulip tree forests within twenty years.

Before the establishment of the park, there were farms and logging operations on the watersheds. Much of the forest dates from the time when these areas were abandoned to natural succession. Approximately one-third of the area in the watershed, however, is covered by mature, if not virgin forest (see acetate overlay map). Along Thomas Divide and Mingus Ridge there are scattered dead chestnut snags and logs, and although young chestnut suckers can still be seen, no mature trees remain. This relatively dry section of the park was once covered by extensive chestnut-dominated forests. Chestnut blight destroyed the trees by 1940 and *Quercus spp.* (oak), *Acer rubrum* (red maple) and *Oxydendrum arboreum* (sourwood) are filling in. According

to Woods and Shanks (1959), *Quercus prinus* and *Quercus rubra* had the greatest proportion of chestnut replacements.

Wetter mature forests occur on the north face of Mt. Noble, and in the coves at the upper end of Indian Creek. Some of the trees near the end of the jeep trail are very large (130cm dbh). A white oak was cored there and found to be 281 years old.

Cove Rhododendron

Cove-rhododendron is the most mesic of the vegetation types found. It was always found along stream banks at low to medium elevations (2300' to 2900'). Slopes varied with the steepness of the particular stream bed. Where the stream valley was wide and flat, the cove forest would be wide and well-developed. Where the stream had cut a narrow, rocky channel, the cove forest would be narrow, and change quickly into the surrounding drier forest types; 250 hectares of this type were found.

The most important species in this vegetation type is *Rhododendron maximum*. It dominates the shrub layer, determines what herbs will survive, and influences the canopy to some extent because of its shading effect on seedlings. The relative basal areas of *R. maximum* were not very large, due to the small diameters of the stems. An importance value, computed from numbers of stems, density of stems and basal areas, was consistently around 30 (out of a total 100).

Acer saccharum, Betula lenta, Tsuga canadensis and *Liriodendron tulipifera* were common tree species. There was an average of 16 tree species per plot.

The number of shrub and sapling species varied from a low of 6 to 20 in one plot. Percent cover also varied from 16 percent to 65 percent. As in the tree class, *Rhododendron maximum* dominated the shrubs and saplings. *Euonymus americanus* and *Pyrularia pubera* were among the shrubs present.

In one of the cove-rhododendron plots there was one herb: *Chimaphila maculata*. The average cover was 0.05 percent. In another sample, however, 28 species were found per-square-meter, and the average cover was 20 percent. The species found in this type of environment are the same as those commonly growing under dry oak and pine forests. This suggests a similarity in micro-environment. *Galax aphylla, Dryopteris spinulosa, D. marginalis* and *Polystichum acrostichoides* are common.

Upper Cove Deciduous

Upper cove deciduous forests were found on slopes with a westerly aspect in the middle elevations (2500' to 3800'). These areas were generally mesic and sheltered from winds and strong sunlight. Slopes were uniformly steep (31 to 37 degrees); 650 hectares of this vegetation type were found.

Three tree species characterize the upper cove deciduous forest:

Quercus rubra, *Halesia carolina*, and *Tilia heterophylla*. The co-dominance of these species varied with the four plots sampled. At times all three were present; in other areas *Quercus rubra* and one of the other two would dominate. The relative basal area in the three species combined was never less than 50 percent, and in one plot was as high as 82 percent of the total tree species. Many other trees were common, among them *Tsuga canadensis*, *Betula lenta*, *B. lutea*, *Acer saccharum*, *Liriodendron tulipifera*, *Aesculus octandra* and *Cornus florida*. Twenty-three tree species were found in association with the three dominants (see appendix for complete list).

Upper cove deciduous forests were found on slopes which had been logged. Some opening of the canopy may have been caused by the chestnut blight. Evidence of the blight was present in three of the sample plots. The largest trees in each plot were aged and found to be fairly young. The oldest was an 81-year-old *Halesia carolina* at the upper end of Indian Creek. The average age of the cored trees was 52.7 years.

Quercus rubra, **(red oak)**, *Halesia carolina* (silverbell) and *Tilia heterophylla* (basswood) were well represented in the sapling and shrub layer in the sample plots. This has led to the conclusion that the species composition of upper cove deciduous is relatively stable, barring unnatural stress. Other shrubs were largely ericaceous. *Hydrangea arborescens*, *Vaccinium vacillans*, *V. stamineum*, *Morus rubra*

and *Leucothoe editorum* were shrubs present. The shrub layer was high in total ground cover. Forty-three percent cover was the lowest figure encountered; 135 percent was the highest.

The average number of herb species was 33 per plot. H-prime values were very high; they ranged from 2.6 to 2.9. This forest type is among the most diverse in the eastern United States. Wildflowers are very abundant, with up to 60 species per hectare. Many orchids, *Panax quinquefolia, Clintonia umbellulata, Trillium spp., Hepatica acutiloba* and other showy monocots were found, as well as *Caulophyllum thalictroides, Podophyllum peltatum, Diphylleia cymosa* and other dicots. The percent cover of herb plots ranged from 25 percent to 75 percent.

Hemlock

Hemlock forests were found on low, north-facing slopes and cove floors. Abundant moisture and shelter from winds and sunlight seemed to be required. Fifty hectares of this vegetation type were found; (this figure excludes those second-growth tulip tree forests which will eventually reach a hemlock climax).

In the two plots sampled, it was found that greater than 45 percent of the total basal area was hemlock. Other common trees were *Quercus rubra, Q. alba, Betula lutea*, and *B. lenta*. Only 11 other tree species were found in association with hemlock (see appendix for lists).

Four hemlocks were cored and aged. They were found to be 69, 74, 108 and 124 years old. One *Quercus alba* was aged at 281 years. *Tsuga canadensis* is a shade-tolerant, sensitive tree that enters a forest only after successional trees have provided shelter. Hemlock forest plots are a stable, self-reproducing vegetation type. The two plots sampled were mature; one was definitely virgin, having trees aged at greater than 250 years.

The shrub and sapling layer had an average cover of 45 percent. Shurbs were non-ericaceous and sparse. *Euonymus americana, Lindera benzoin,* and *Pyrularia pubera* were common. *Tsuga canadensis* was well represented (4 individuals and a 6 percent average cover), confirming stability of the stand. Herb species averaged 20 per plot. The average cover ranged from 13.6 percent to 50.9 percent (see herb lists).

Tulip Tree - Second-Growth

Five plots were taken of the tulip tree (*Liriodendron tulipifera*) second-growth forest. These areas were found at the lower elevations (below 3200') on moist, disturbed land. Evidence of farming or logging was present in all plots. Slopes were flat to moderately steep (28 degrees). Fifty hectares of this forest type were found.

As the name suggests, these forests are not a climax type. *Liriodendron tulipifera* is a sun-loving tree that seeds profusely and grows rapidly. It is one of the first trees to invade open land.

The average age of those trees cored was 43.1 years. This age corresponds to the abandoment of farmlands and homesites in this part of the park.

The relative basal area of tulip tree in this vegetation type is greater than 30 percent. Fourteen other tree species were found in association with tulip trees (see appendix for lists). While *Liriodendron tulipfera* is the dominant species now, it will not remain so. Mesic cove hardwoods will grow to overtake the tulip trees that are now there, changing the forest structure. Where tulip tree was the dominant, it will become merely a component of the overall canopy. In the understory now, we find *Acer saccharum, Betula lutea, Halesia carolina* and *Quercus rubra.*

Lindera benzoin and *Hydrangea arborescens* were common shrubs. Total shrub cover varied greatly with the plot. The lowest value was 6 percent, the highest value was 40 percent.

The number of herb species per plot varied from 20 to 39. Percent cover was high in all plots (lowest value was 35 percent; highest was 160 percent). In the youngest tulip tree second-growth plot the herbs were characteristically light-tolerant, successional species. Up to 30 percent were exotics.

White Oak

Three areas dominated by white oak were sampled. The habitats were sub-mesic and not exposed. The plots were on 25 to 30 degree

slopes facing west to southwest in the middle elevations (2500' to 3600'). White oak was often found on sheltered, low knolls. Three-hundred-and-fifty hectares total of this type were found.

Quercus alba (white oak) was dominant, making up more than 40 percent of the total basal area. Other oaks were always present, primarily *Quercus rubra* and *Q. prinus*. *Carya tomentosa* and *C. glabra* were usually associated, as well as *Acer rubrum* and *Oxydendrum arboreum*. *Cornus florida* was always present, often as second in dominance. *Ilex opaca* was another small tree. *Castanea dentata* used to be an important component - chestnut suckers and dead snags are abundant.

Shrub and sapling cover was between 25 percent and 75 percent. The trees mentioned above were all present as saplings and will perpetuate the canopy. *Euonymus americanus*, *Rhododendron calendulaceum* and several species of *Vaccinium* were common shrubs.

There were about 20 species of herbs present in each plot. Average cover under the white oak type was between 15 percent and 25 percent. *Smilax glauca* and *S. rotundifolia* were common, as well as *Chimaphila maculata* and other xeric to sub-xeric species.

Trees were aged and found to be younger than expected. The oldest tree cored was a 97-year-old white oak. There were larger trees in these plots, but most had heart-rot and could not be aged. The average age of those non-oak species cored was 60 years.

Oak-Hickory

There were 950 hectares of oak-hickory forests in the area. This vegetation type is found on all aspects and all elevations, from 2200 to 4000 feet. Slopes were between 20 and 35 degrees, and the moisture gradient was sub-mesic to sub-xeric.

This vegetation type is characterized by the presence of *Quercus rubra*, *Q. alba*, *Q. prinus*, *Carya tomentosa* and *C. glabra*. Their combined relative basal area was greater than 50 percent. Other tree species common to these forests were *Oxydendrum arboreum*, *Nyssa sylvatica*, *Acer rubrum* and *Sassafras albidum*.

The understory was not ericaceous. *Pyrularia pubera* and young sassafras were present in the shrub layer. *Rhododendron maximum* was an important shrub member in some plots, but not in others. Percent cover of shrubs was high, usually greater than 35 percent.

The average cover of herbs varied with the samples. In some plots it was greater than 40 percent of the plots. In others, it ran as low as 3 percent cover. *Polystichum acrostichoides* was a frequent fern. *Smilax rotundifolia* was common. *Chimaphila maculata* and *Galax aphylla* were nearly always present.

Dry Oak - Heath

Most of the forest in the three watersheds was of the dry oak/heath type. The aspects of most were in a general southeast direction, and two were on a northwest-facing slope. Dry, low elevation slopes

and ridges describe the environment where this type was found; 1800 hectares of dry oak/heath forest are found in the area.

The type is characterized by three tree species: *Quercus prinus*, *Q. coccinea* and *Oxydendrum arboreum*. The heath understory is a combination of *Kalmia latifolia* with or without *Rhododendron maximum*. *Quercus prinus* had a relative basal area always greater than 15 percent, and once, as high as 80 percent. *Quercus coccinea* wasn't present in all sample plots. In others its relative basal area ran as high as 50 percent. *Oxydendrum arboreum* was always present with a relative basal area of about 10 percent.

Other tree species commonly associated with this type are *Quercus rubra*, *Q. alba*, *Nyssa sylvatica*, *Acer rubrum*, *Carya tomentosa* and *Robinia pseudo-acacia*. The average number of tree species in this type is 13.

The shrubs and saplings were dominated by ericads. *Kalmia latifolia*, *Rhododendron maximum*, *R. calendulaceum*, *Vaccinium stamineum* and *V. vacillans* cover the ground. *Sassafras albidum* and *Pyrularia pubera* were also common shrubs.

The herb cover under this type of canopy is not extensive; percent cover varied between 2 percent and 25 percent. The herbs present are those commonly associated with a low light environment: *Epigea repens*, *Goodyera pubescens*, *Chimaphila maculata*, *Polystchum acrostichoides*, plus others that are appendixed.

Pine Type

Areas covered with a pine forest were found on exposed ridgetops. One-hundred hectares in the three watersheds were of this vegetation type. Two sample plots were taken at elevations between 2000' to 3000'. Both were on southwest-facing slopes.

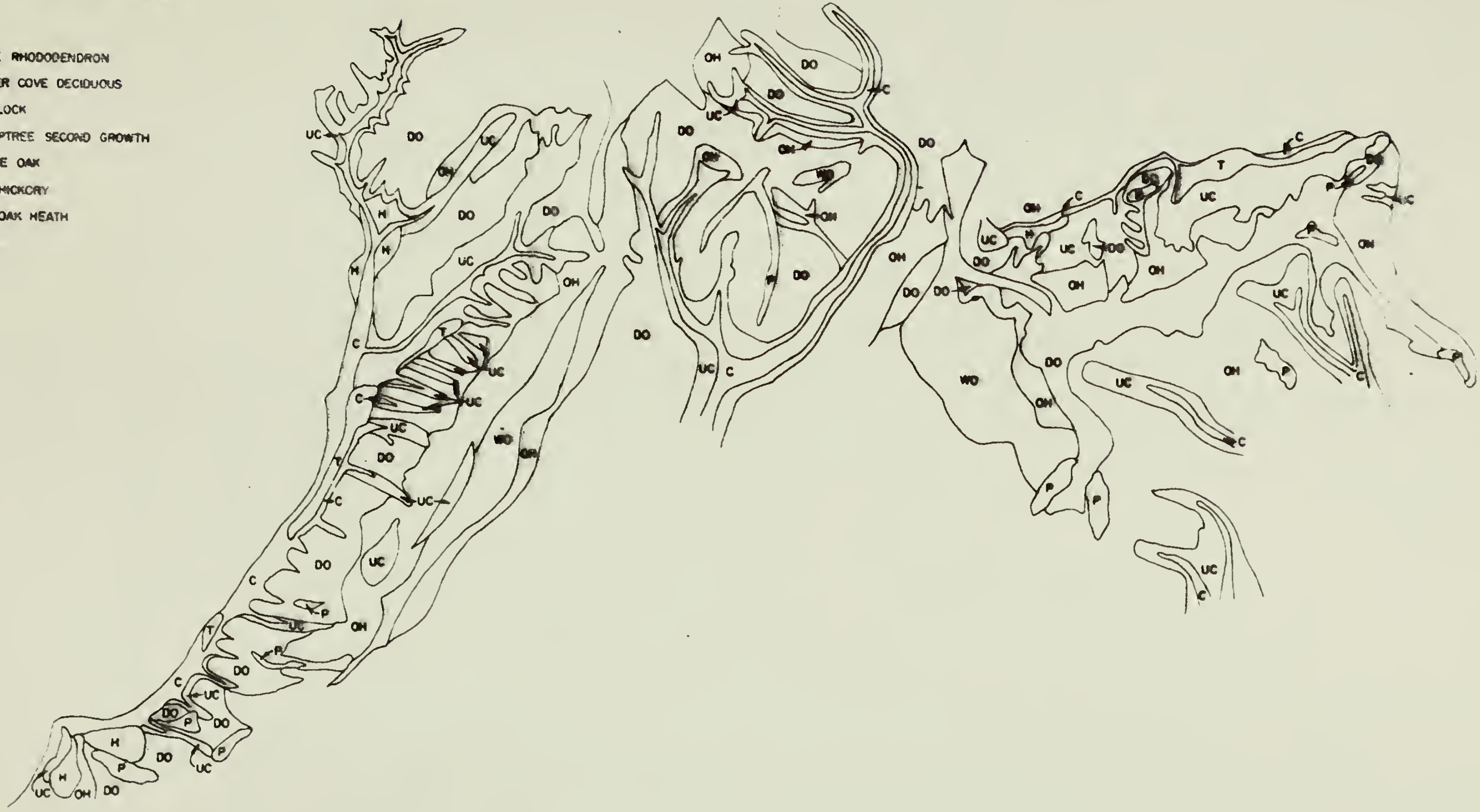
Pinus rigida (and occasionally *Pinus pungens*) is the dominant tree in these plots. Its relative basal area is greater than 45 percent. Other tree species commonly found in association with pitch pine are *Quercus coccinea*, *Q. prinus*, *Sassafras albidum*, *Oxydendrum arboreum*, and *Nyssa sylvatica*. Common trees in the sapling and shrub category were *Quercus coccinea*, *Q. prinus*, *Acer rubrum* and *Sassafras albidum*. Ericaceous shrubs were common. Pines were not found in this layer. This indicates that the pine type is not self-sustaining. Pine trees grow on disturbed, exposed land, and seem to be successional to more shade-tolerant species.

Herb cover was slight. Only seven species were found in one-tenth hectare plot: *Epigea repens*, *Galax aphylla*, *Gaultheria procumbens*, *Lysimachia quadrifolia*, *Pteridium aquilinum*, *Smilax tamnoides* and *Streptopus roseus*. The average cover of the 1m x 1m plots was 5 percent.

The other sample plot had 15 herb species, and the average cover of 1m x 1m quadrats was 15 percent. Seven trees were cored and aged. Three pines were found to be 93, 83 and 35 years old. A *Quercus stellata* was much younger, only 36 years old.

vegetation map

C- COVE RHODODENDRON
UC- UPPER COVE DECIDUOUS
H- HEMLOCK
T- TULIPTREE SECOND GROWTH
WO- WHITE OAK
OH- OAK HICKORY
DO- DRY OAK HEATH
P- PINE



map of

mature forests

base map:

proposed

blue ridge parkway extension area

VEGETATION DISCUSSION

A hypothetical drive along each of the routes would allow exposure to each of the forest types, as well as assessment of scenic values and potential environmental problems associated with vegetation. Alternatives 1, 2 and 3, travel together for the first mile parallel to U.S. 441. The forest is second-growth oak-hickory on land that was once agricultural. The diversity of species is low for this part of the country. The forests change as the road turns north above Mingus Mill. This wet, steep slope supports second-growth deciduous trees. In contrast to oak-hickory forests, these are extremely rich in species number. Trilliums, dutchman's britches, wild ginger, spring-beauty, blood-root, hepatica, violets and may-apple are just a few of the early spring herbs one would see. Silver-bell, buckeye, basswood, tuliptree and dogwood are trees with equally showy flower displays. Later in the spring, lady-slipper, doll's eyes, foam flower, speckled wood lily, black cohosh adorn the slopes. Umbrella-leaf flowers later, as does bee-balm and purple flowering raspberry. In the fall, composites continue the display.

The upper cove deciduous forest peculiar to the Southern Appalachians is a very diverse forest type with a sensitive understory. Alternatives 1 and 3 would cause the most destruction to this area. Alternative 2 would be less severe as it covers less of the cove before it swings over to the south, more xeric slope. The slopes of Mingus

are steep, necessitating wide road cuts. Road cuts, shoulders, the road itself, and careless construction activities would result in the loss of many hectares of upper cove deciduous forest. Careful construction supervision would reduce the impact to some extent. Drainage changes, exhaust, and social trails from roadside pulloffs may cause more damage.

Alternative 4 avoids the mesic slopes entirely, by travelling the drier slopes of the Cherokee Indian Reservation. From the present Blue Ridge Parkway terminus it makes its way through second-growth oak-hickory communities to Mingus Ridge.

Mingus Ridge supports a mature oak forest, with many trees greater than 100 years old. There will be no way to avoid removing some of them, if construction involves going over the ridge. Care should be taken to damage as few as possible.

Alternative 5, crossing the Cooper Creek Drainage, passes through forests that have been previously lumbered; nothing pristine would be destroyed. The motorist would see a variety of forest types. The route crosses creeks three times, each time descending from oak-hickory, to dry-oak/heath, to a small band of upper cove deciduous, to cove rhododendron, and ascending in the same order. Blooming mountain laurel and rhododendron would provide a showy display.

The floral composition of Deeplow Gap, and all of Thomas Divide is an unusual one. Mature oak forests, including areas which are

dominated by white oak, compose the canopy. Its uniqueness lies in the lack of an ericaceous understory. Herbs are abundant, particularly in the late spring. Extremely large populations of speckled wood lily, columbines, and *Thalictrum* spp. are found. These plants, which are uncommon nationally and in the Southern Appalachians, are common on Thomas Divide.

Driving west on Alternative 6 would pass through mature dry oak forests. A dense understory of mountain laurel provides a showy display of blossoms in June. Near Indian Creek the vegetation changes. Mature oaks are replaced by mature cove species. Large, old, basswoods, hemlocks, tulip trees, buckeyes and red oaks have escaped the ax. The understory is typical of hardwood coves. At present, the road passes very near the proposed special protection site for *Gleocantherellus purpurescens*. A minimum buffer-zone of 220m around the area should be considered. This distance is needed in order to prevent any differences in drainage patterns caused by the road from affecting the site. Fungi are fragile enough that any change in micro-environment may affect them adversely. Construction activities will also need to be carefully supervised.

Alternative 6 passes from the mushroom site into an impressive stand of virgin hemlocks, many of which will have to be removed for the road cut. The route then travels parallel to Indian Creek for 5 miles in second-growth cove rhododendron, tulip tree second

and upper cove deciduous forests. It passes through a second proposed special protection area, which contains the type localities of 12 or more endemic fungi. In order to preserve this site, the route will have to be relocated a safe distance away.

Alternative 7 passes directly through the middle of the unusual white oak herb communities peculiar to Thomas Divide. There is already a foot path and an unused motor nature trail traversing the ridge. The combined impact of these three on the native vegetation would be great. To the motorist, this alternative would offer little variation in forest type. With the exception of some pines, the route is lined by oaks, hickories, and sourwood.

The most aesthetically appealing alternatives, to the visitor-motorist, are either 1 or 3, 5 and 6. These would allow maximum exposure to different forest communities, and showy floral displays. Alternatives 1 and 3, however, would cause much more damage to unusual ecological communities than Alternatives 2 or 4. Corridor 4 would cause the least amount of such damage. Alternative 6, if it were rerouted to save the special protection areas and the hemlock stand, would cause less damage than Alternative 7. In the stream valley, much of the forest has already been disturbed by logging and farming. This is not the case along Thomas Divide.

CONCLUSION

The route alternatives are listed below, with their negative aspects. A reasonable choice for the Blue Ridge Parkway Extension should be made with these environmental considerations in mind.

Alternative 1:

1. Vistas are local only.
2. This alternative would be visible from Mingus Mill, Oconaluftee Visitor Center, U.S. 441 and points on the Blue Ridge Parkway.
3. Some trails, including the Appalachian Trail, are within hearing or sight distance.
4. A tunnel under Mingus Ridge would be expensive.
5. Enloe Cemetery, and possibly other archeological sites would be harmed by roadbuilding activities.
6. Water supplies for the town of Cherokee might be in danger of contamination from siltation and other contamination sources.
7. Siltation may cause a lowering of aquatic faunal diversity.
8. Many hectares of upper cove deciduous forest, an unusual plant community, will be disturbed.
9. Large populations of showy orchis and several other wild-flower species will be destroyed.

Alternative 2:

1. The road would be visible from Mingus Mill, Oconaluftee Visitor Center, U.S. 441 and points on the Blue Ridge Parkway.
2. Some trails, including the Appalachian Trail, will be within sight or hearing distance.
3. Enloe Cemetery, and possibly other archeological sites will be damaged by construction activities.
4. Siltation may cause a lowering of the number of aquatic invertebrate species, and damage to the trout population.
5. Many hectares of upper cove deciduous forest will be disturbed and removed.
6. The large populations of showy orchis and several other wildflower species will be destroyed.
7. Mature oaks on top of Fox Knob will be disturbed.

Alternative 3:

1. Vistas are local only.
2. The road would be visible from Mingus Mill, Oconaluftee Visitor Center, Clingman's Dome and its parking lot, U.S. 441, and points on the Blue Ridge Parkway.
3. The road will be seen from some foot trails including parts of the Appalachian Trail, and will be heard from several nearby trails.

4. Enloe Cemetery and other archeological sites may be damaged by construction activities.

5. Water supplies for the town of Cherokee might be in danger of contamination.

6. Siltation from road cuts may cause a lowering of aquatic invertebrate diversity, and damage to the trout population.

7. Steep slopes on the side of Mt. Noble will necessitate wide road cuts.

8. Many hectares of upper cove deciduous forest will be disturbed and destroyed.

9. The large population of showy orchis and several other wildflower species will be destroyed.

10. Mature oaks on Mingus Ridge will be in danger of removal.

Alternative 4:

1. Road cuts will be visible from points on the Blue Ridge Parkway, Clingman's Dome and U.S. 441.

2. Mature oaks on Mingus Ridge will need to be removed.

Alternative 5:

1. One-half mile on Deeplow Gap and Mingus Ridge will be visible from Clingman's Dome, points on the Newfound Gap Road, and the Blue Ridge Parkway.

2. Siltation may cause a lowering of stream faunal diversity, and may damage the trout population in the park and the private trout-rearing operation located just outside the park.

Alternative 6:

1. One-half mile of road cuts will be visible from Clingman's Dome and its parking lot, Newfound Gap and points on U.S. 441.
2. Many trails will be crossed by the road. Some will also be within hearing distance for their entire length; Sunkota Ridge Trail, Indian Creek Trail, and Thomas Divide south of Newton Bald.
3. Several archeological sites, both native American and settler, will be destroyed.
4. Approximately 5 miles of cove forests and upper cove deciduous forests will be disturbed, including some mature areas.
5. The two proposed special protection areas may be disturbed or destroyed.
6. A virgin hemlock stand will be heavily distrubed.
7. An increase in stream silt load could detrimentally affect stream fauna. This route is the closest to a creek and

careless construction activity could be extremely detrimental to water quality and to aquatic life.

Alternative 7:

1. The road will be the third man-made slash across Thomas Divide.
2. Road cuts could be seen from Clingman's Dome and its parking lot, Newfound Gap and the highway near it, and other points on U.S. 441.
3. Foot trails, including the Appalachian Trail, would be within sight of the road. Some trails, including Thomas Divide, Sunkota Ridge, and Indian Creek, would be within sight and hearing distance along their entire length.
4. Road cuts will have to be severe (or extensive), due to the steepness of the slopes.
5. The archeological site at Deeplow Gap will be covered over.
6. The route passes through, and will disturb, mature white oak forests.
7. Unusual floral communities will be disturbed.

The construction of a road anywhere is bound to cause some environmental damage. Should the decision be made to construct the

Blue Ridge Parkway Extension, a course must be followed which will allow for the least environmental damage coupled with the most aesthetic appeal. The least damaging alternative, relative to the physical and biological environment, is a combination of Alternatives 4, 5 and 6 (rerouted to avoid the proposed special protection areas).

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