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BASELINE STUDIES ON AVIFAUNA POPULATIONS
ABRAMS CREEK FLOODPLAIN AND BEECH GAP SPECIAL PROTECTION SITES
GREAT SMOKY MOUNTAINS NATIONAL PARK

by Roland H. Wauer
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Great Smoky Mountains National Park
Gatlinburg, TN 37738

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As part of an expanded program to mitigate the impacts of non-native hogs (Sus scrofa) on Great Smoky Mountains National Park resources, especially vulnerable natural sites were identified for special protection and long-term monitoring. All sites possessed either (1) unique, rare or endangered species and/or habitats or geology, (2) certain significant undisturbed habitats, (3) large intact natural systems, or (4) especially fragile flora and/or fauna and required special attention if they were to be perpetuated. The park staff listed approximately 20 of these locations as "Special Protection Sites" in 1983 (National Park Service, 1983).

Three of the Special Protection Sites (Abrams Creek Floodplain and Gum Swamp in Cades Cove and a Beech Gap near Indian Gap along the Clingmans Dome Road) were considered "severely" threatened by wild hogs and fenced in fall 1984. Thirty-nine-inch "hog-fencing" was utilized so as to permit small wildlife, such as birds, rabbits, foxes and rodents, to pass through the mesh, and larger wildlife, such as deer and bears, to go over the top.

The three fenced sites also were designed to demonstrate habitat changes that were expected to occur within the sites after hogs were

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Great Smoky Mountains National Park, Gatlinburg, TN 37738

excluded. All three sites are accessible to the public, and interpretive signs were installed at strategic places along the fence. The Beech Gap fence was installed so that it crossed the Appalachian Trail (Fig. 1), forcing hikers to walk through one end of the enclosure itself.

Prior to fencing, baseline data on vegetation and small mammal and bird populations were gathered within two of the Special Protection Sites, Abrams Creek Floodplain and Beech Gap. An adjacent Beech Gap, that was later left unfenced, was also studied. This paper documents the avian baselines for the three sites.

Site Descriptions

Abrams Creek Floodplain study site (1715' or 520 m elev.) is a wooded area located at the western end of Cades Cove below the loop road bridge on the north side of the creek. The area supports a mesic second growth forest of red maple (Acer rubrum), boxelder (Acer negundo), tuliptree (Liriodendron tulipifera), ash (Fraxinus americana and F. pennsylvanica), alder (Alnus serrulata), and other species. There are some drainageways that remain swampy through much of the summer. In places, alder thickets dominate.

Rare plant species recorded in the area include fringeless purple orchid (Platanthera peramoena) which is listed as threatened in both North Carolina and Tennessee and is known from only two records in the park; this population appears to be the remnant of one of those early records. Other rare plants include blue flag (Iris virginiana) and weak-stemmed buttercup (Ranunculus laxicaulis).

Figure 1. West Beech Gap fence, interpretive sign, and trail (along fence on left) that crosses the Appalachian Trail just east of Indian Gap on the Clingmans Dome Road.



Five 0.1 ha vegetation plots were established within the greater floodplain area in 1978 and 1979: one in the marsh adjacent to the woods, one in an alder thicket, one on the forested floodplain, one in mixed successional thicket, and one on the upland immediately above the alder thicket. In 1984 and 1985, six additional 0.1 ha plots were established within the fenced area and three outside the fenced area (Peter White, pers. comm.).

Beech Gap study site (5200 - 5500' or 1573 - 1667 m elev.) is comprised of dual sites (only one was fenced) within the two south-facing gaps, located along and above the Clingmans Dome Road, just east of Indian Gap parking lot. The Beech Gap community type is endemic to the southern Appalachians and possess very abrupt boundaries with the adjacent spruce-fir forest. Both gaps are dominated by beech (Fagus grandifolia), with minor amounts of yellow birch (Betula lutea), yellow buckeye (Aesculus octandra), and several other species.

Rare plant species recorded on the sites include: Rugel's ragwort (Cacalia rugelia), bluebeard lily (Clintonia borealis), Clingman's hedge-nettle (Stachys clingmanii), and rose twisted-stalk (Streptopus roseus). Several other species of concern, such as turk's cap (Lilium superbum) and fringed phacelia (Phacelia fimriata), occur within the beech gap community.

One 0.1 ha vegetation plot was established in the unfenced gap in 1977, and six additional 0.1 ha plots (3 inside the fenced exlosure and 3 in the non-fenced site) were established in 1984 and 1985 (Peter White, pers. comm.). Baseline vegetation data will be reported

elsewhere.

Methods

Plots were laid out and marked with flagging in each of the study sites prior to the 1984 breeding bird season. Abrams Creek Floodplain (ACF) provided room for a matrix of 52 31 m² blocks, 13 in length and 4 in width. This unit of 403 x 124 meters equaled five (5) hectares. Fencing later encompassed all five hectares. In the Beech Gap sites, 4 by 4 matrices of 31 m² blocks conformed to the available space; each unit of 124 x 124 meters equaled 1.54 ha. The entire West Beech Gap (WBG) site was later fenced; the East Beech Gap (EBG) site remained unfenced.

Birds were censused on ACF nine times for two hours duration (total of 18 on-site hours) between April 10 and June 10, and on eleven occasions on the two Beech Gaps for one and one-half hour duration (totals of 16.5 on-site hours each) between June 2 and July 29. All censuses were undertaken between 0600 and 0930 hours, by slowly walking the center lines and back and forth to the sides of the units with occasional stops for better bird identification as necessary. All avian species (by two or three-letter abbreviations) and their activities (by circles for flight, rockers for nests, and comments in the margin) detected were recorded in representative blocks on field sampling forms (Appendix A). All of those data were later transferred to permanent summary sheets (compilations in Appendix B, C and D) to illustrate the number of individuals detected within the study sites.

All recorded avifauna were classified as "breeds" (in the study area), "breeds nearby," or "transient." "Breeds nearby" birds were

those known or suspected to nest nearby. Transients were those species known to be migrants or to nest several miles from the study site. Birds detected flying overhead only and not utilizing the habitat (between the highest point of vegetation and ground level), such as swifts, redwings, and crossbills, were not recorded.

All recorded species also were classified into one of ten feeding and one of four nesting guilds. Classification of species to nesting guilds was determined by direct observations, known behavioral patterns, and descriptions in Chapman (1966). Feeding guilds were derived from those developed by Wauer and Dennis (1980) and required placing all species into specific categories of primary consumers (grainivores/nectarivores) or secondary consumers (insectivores/ carnivores). Each species was assigned a category according to which food types formed the largest part of its diet during the breeding season. Food preferences were derived from prior knowledge or from Bent (1963, 1964).

Guild descriptions and abbreviations include:

<u>Feeding Guilds</u>	<u>Nesting Guilds</u>
FS = Foliage-Seed	FN = Foliage Nesters
GS = Ground-Seed	CD = Cavity and Depression Nesters
FN = Foliage-Nectar	GN = Ground Nesters
ASI = Air-Soaring-Insect	P = Parasitic
API = Air-Perching-Insect	
FI = Foliage-Insect	
TDI = Timber-Drilling-Insect	
TSI = Timber-Searching-Insect	
GI = Ground-Insect	
GP = Ground-Predator	

Use values for all species and study sites were calculated to "adjusted densities," the number of individuals per 40 ha (100

acres), a standard-sized unit utilized in avian population analysis. Relative abundance values were derived from calculating the percent of individual species relative to the total number of individuals per 40 ha. Species diversity (H') was computed as $H' = -\sum P_i \log P_i$ (Shannon and Weaver, 1963), and evenness (J'), a measure of relative abundance, was calculated as $J' = H'/\ln(s)$ where the natural logarithmic system is used to obtain the log of base e (Pielou, 1975). This value "represents the ratio of the observed diversity to the maximum diversity possible for the same number of species," ranging from 0 to 1.0.

Biomass figures were derived from mean weights and numbers of individuals per 40 ha. Weights for each species were obtained from the literature (Roberts, 1955; Salt, 1957; Wauer and Johnson, 1984) and F.J. Alsop (pers. comm.). Standing crop biomass (SCB) was calculated by multiplying the weight of each species times the number of individuals. Consuming biomass (CB) was calculated by raising the mean weight of each species to the .633 power and then multiplying that figure by the number of individuals per species (Karr, 1968).

All methods utilized were designed so that they could easily be repeated. Therefore, unit size and methods must remain constant. Changes in the avifaunal use of the fenced units should be evident by 1988. Each site should be recensused in the exact same manner described above after four or five years and every four or five years thereafter.

Table 1. Abrams Creek Floodplain, April 6 - June 10, 1984

<u>Species (41)</u>	<u>Breeds</u>	<u>Breeds nearby</u>	<u>Tran-sient</u>	<u>Use Value</u>	<u>Feeding Guild</u>	<u>Nesting Guild</u>
Green-backed Heron (<u>Butorides striatus</u>)		x		.56	GP	FN
Broad-winged Hawk (<u>Buteo platypterus</u>)			x	.11	GP	FN
Wild Turkey (<u>Meleagris gallopavo</u>)		x		.67	GI	GN
Yellow-billed Cuckoo (<u>Coccyzus americanus</u>)	x			1.00	FI	FN
Eastern Screech-Owl (<u>Otus asio</u>)		x		.11	GP	CD
Whip-poor-will (<u>Caprimulgus vociferus</u>)		x		.11	GI	GN
Ruby-throated Hummingbird (<u>Archilochus colubris</u>)		x		.11	FN	FN
Belted Kingfisher (<u>Ceryle alcyon</u>)		x		.11	GP	CD
Red-bellied Woodpecker (<u>Melanerpes carolinus</u>)		x		.33	TDI	CD
Yellow-bellied Sapsucker (<u>Sphyrapicus varius</u>)			x	.11	TDI	CD
Downy Woodpecker (<u>Picoides pubescens</u>)	x			.78	TDI	CD
Northern Flicker (<u>Colaptes auratus</u>)			x	.11	GI	CD
Pileated Woodpecker (<u>Dryocopus pileatus</u>)	x			.89	TDI	CD
Eastern Wood-Pewee (<u>Contopus virens</u>)		x		.11	API	FN
Acadian Flycatcher (<u>Empidonax virescens</u>)	x			1.44	API	FN
Eastern Phoebe (<u>Sayornis phoebe</u>)		x		.78	API	CD

Table 1, con't.

Great Crested Flycatcher (<u>Myiarchus crinitus</u>)	x		2.78	API	CD
Blue Jay (<u>Cyanocitta crisata</u>)	x		2.00	FS	FN
American Crow (<u>Corvus brachyrhynchos</u>)		x	.78	GP	FN
Carolina Chickadee (<u>Parus carolinensis</u>)	x		2.78	FI	CD
Tufted Titmouse (<u>Parus bicolor</u>)	x		1.11	FI	CD
White-breasted Nuthatch (<u>Sitta carolinensis</u>)	x		.78	TSI	CD
Carolina Wren (<u>Thryothorus ludovicianus</u>)		x	.22	GI	CD
Blue-gray Gnatcatcher (<u>Poliophtila caerulea</u>)	x		.89	FI	FN
Wood Thrush (<u>Hylocichla mustelina</u>)		x	.11	GI	FN
American Robin (<u>Turdus migratorius</u>)		x	.22	GI	FN
Gray Catbird (<u>Dumetella carolinensis</u>)		x	.11	FI	FN
Brown Thrasher (<u>Toxostoma rufum</u>)		x	.22	GI	FN
Yellow-throated Vireo (<u>Vireo flavifrons</u>)		x	.11	FI	FN
Red-eyed Vireo (<u>Vireo olivaceus</u>)	x		2.00	FI	FN
Northern Parula (<u>Parula americana</u>)		x	.44	FI	FN
Ovenbird (<u>Seiurus aurocapillus</u>)		x	.22	GI	GN
Louisiana Waterthrush (<u>Seiurus motacilla</u>)		x	.11	GI	GN

Table 1, con't.

Indigo Bunting (<u>Passerina cyanea</u>)	x		.22	FI	FN
Song Sparrow (<u>Melospiza melodia</u>)	x		.22	GI	FN
Rusty Blackbird (<u>Euphagus carolinus</u>)		x	.22	GI	FN
Common Grackle (<u>Quiscalus quiscula</u>)	x		.22	GS	FN
Brown-headed Cowbird (<u>Molothrus ater</u>)	x		.22	GS	P
Orchard Oriole (<u>Icterus spurius</u>)	x		.11	FI	FN
Purple Finch (<u>Carpodacus purpureus</u>)		x	.22	FS	FN
American Goldfinch (<u>Carduelis tristis</u>)	x		.44	FS	FN
Totals	(12)	(23)	(6) 24.08		

Results

Table 1 includes 41 bird species that were recorded within the Abrams Creek Floodplain study site between April 6 and June 10, 1984. Only 12 of these were found to breed on site: Yellow-billed Cuckoo, Downy and Pileated Woodpeckers, Acadian and Great Crested Flycatchers, Blue Jay, Carolina Chickadee, Tufted Titmouse, White-breasted Nuthatch, Blue-gray Gnatcatcher, Red-eyed Vireo, and Brown-headed Cowbird. An additional 23 species were considered to breed nearby, and six species were considered to be transients. The actual mean population of the 41 species recorded on nine censuses on the five hectare study site was 24.08. The adjusted density (Table 4) for ACF amounted to 191.5.

Table 1 also includes feeding and nesting guilds for all the species recorded. The vast majority of the 41 species utilizing the ACF woodland habitat were secondary consumers. Ground-insect feeders were most numerous (11), followed by foliage-insect gleaners (10), ground-predators (5), air-perching-insect and timber-drilling-insect (4 each), and timber-searching-insect feeder (1). Only six of the 41 species were primary consumers: three foliage-seed, two ground-seed feeder, and one foliage-nectar feeder.

Table 2 includes 15 species that were recorded within the West Beech Gap study site between June 2 and July 29, 1984. Six of these were found to be breeding: Hairy Woodpecker, Black-capped Chickadee, Red-breasted Nuthatch, Solitary Vireo, Black-throated Green Warbler, and Dark-eyed Junco. An additional six species were considered to breed nearby, and three species were transients. The actual mean population of the 15 species recorded on the 1.54 ha study site on

11 censuses was 23.46. The adjusted density (Table 4) for WBG was 610.2.

All but one of the 15 bird species utilizing WBG study site were secondary consumers; Dark-eyed Junco is a ground-seed feeder. Six of these were foliage-insect gleaners, three were ground-insect feeders, the ground-predator and timber-searching-insect guilds were represented by two species each. There was one timber-drilling-insect feeder.

Table 3 includes 16 species that were recorded within the East Beech Gap study site between June 2 and July 29, 1984. Seven of these were found breeding on site: Hairy Woodpecker, Black-capped Chickadee, Red-breasted Nuthatch, American Robin, Solitary Vireo, Black-throated Green Warbler, and Dark-eyed Junco. Six additional species were considered nearby breeders, and three species were transients. The actual mean population of the 16 species recorded on the 1.54 ha study site was 18.72. The adjusted density (Table 4) for WBG was 486.6.

The East Beech Gap study site, like WBG, was heavily utilized by secondary consumers, and only one primary consumer. Eight of the 16 species were foliage-insect feeders; two guilds had two representatives (ground-insect and timber-searching-insect feeders); the air-perching-insect, timber-drilling-insect, and ground-predator guilds were represented by one species each.

Discussion

Avian populations can be assessed in a number of ways. The most

Table 2. West Beech Gap, June 2 - July 29, 1984

<u>Species (15)</u>	<u>Breeds</u>	<u>Breeds Tran- nearby sient</u>	<u>Use Value</u>	<u>Feeding Guild</u>	<u>Nesting Guild</u>
Broad-winged Hawk (<u>Buteo platypterus</u>)		x	.09	GP	FN
Hairy Woodpecker (<u>Picoides villosus</u>)	x		1.18	TDI	CD
American Crow (<u>Corvus brachyrhynchos</u>)		x	.18	GP	FN
Black-capped Chickadee (<u>Parus atricapillus</u>)	x		.64	FI	CD
Red-breasted Nuthatch (<u>Sitta canadensis</u>)	x		1.73	TSI	CD
Brown Creeper (<u>Certhia americana</u>)		x	.64	TSI	CD
Winter Wren (<u>Troglodytes troglodytes</u>)		x	.36	GI	CD
Golden-crowned Kinglet (<u>Regulus satrapa</u>)		x	1.55	FI	FN
Veery (<u>Catharus fuscescens</u>)		x	.09	GI	FN
American Robin (<u>Turdus migratorius</u>)		x	.09	GI	FN
Solitary Vireo (<u>Vireo solitarius</u>)	x		2.82	FI	FN
Black-throated Blue Warbler (<u>Dendroica caerulescens</u>)		x	.18	FI	FN
Black-throated Green Warbler (<u>Dendroica virens</u>)	x		2.09	FI	FN
Indigo Bunting (<u>Passerina cyanea</u>)		x	.18	FI	FN
Dark-eyed Junco (<u>Junco hyemalis</u>)	x		11.64	GS	GN
Totals	(6)	(6)	(3) 23.46		

Table 3. East Beech Gap, June 2 - July 29, 1984

<u>Species (16)</u>	<u>Breeds</u>	<u>Breeds</u> <u>Nearby</u>	<u>Tran-</u> <u>sient</u>	<u>Use</u> <u>Value</u>	<u>Feeding</u> <u>Guild</u>	<u>Nesting</u> <u>Guild</u>
Hairy Woodpecker (<u>Picoides villosus</u>)	x			1.22	TDI	CD
Eastern Wood-Pewee (<u>Contopus virens</u>)			x	.09	API	FN
American Crow (<u>Corvus brachyrhynchos</u>)			x	.18	GP	FN
Black-capped Chickadee (<u>Parus atricapillus</u>)	x			1.09	FI	CD
Red-breasted Nuthatch (<u>Sitta canadensis</u>)	x			1.00	TSI	CD
Brown Creeper (<u>Certhia americana</u>)		x		.55	TSI	CD
Golden-crowned Kinglet (<u>Regulus satrapa</u>)		x		.18	FI	FN
Veery (<u>Catharus fuscescens</u>)			x	.27	GI	FN
American Robin (<u>Turdus migratorius</u>)	x			.91	GI	FN
Solitary Vireo (<u>Vireo solitarius</u>)	x			2.64	FI	FN
Chestnut-sided Warbler (<u>Dendroica pensylvania</u>)		x		.09	FI	FN
Black-throated Blue Warbler (<u>Dendroica caerulescens</u>)		x		.55	FI	FN
Black-throated Green Warbler (<u>Dendroica virens</u>)	x			1.18	FI	FN
Blackburnian Warbler (<u>Dendroica fusca</u>)		x		.18	FI	FN
Canada Warbler (<u>Wilsonia canadensis</u>)		x		.09	FI	FN
Dark-eyed Junco (<u>Junco hyemalis</u>)	x			8.45	GS	GN
Totals	(7)	(6)	(3)	18.72		

common and useful of these, because they best represent community dynamics, are species diversity and bioenergetics. All baseline data represent the mean avian density of each study site for censuses taken during the avian breeding season.

Species Diversity. Two components of the diversity index (H') are species richness (S) and evenness (J'). Richness, or the mean number of avian species, provides the simplest and most convenient measure of organic diversity of a particular habitat or locality. Nine Abrams Creek Floodplain censuses produced a total of 41 bird species, but only 12 (about 20% of the population) were found to utilize the site for nesting. And four of the 12 made up 40% of the avian population; Great Crested Flycatcher, Blue Jay, Carolina Chickadee and Red-eyed Vireo. All 12 breeding species made up 69% of the total population.

A considerable higher percentage (>40%) of the recorded avifauna of the Beech Gaps was found nesting; 6 of 15 species on WBG and 7 of 16 on EBG. One species, the Dark-eyed Junco, dominated both highland study sites, making up 50% of the WBG population and 45% of the EBG population.

The number of species in the "breeds nearby" category was surprisingly high for ACF (23), especially compared with nearby breeders detected on WBG (6) and EBG (7). The high ACF number can probably be explained by the larger number of breeding species that occur within the general area of Cades Cove, compared with the number of breeding birds that occur within the high elevation spruce-fir community that surrounds the two Beech Gaps.

Transient species were twice the number on ACF (6) compared with WBG and EBG (3 each), probably due to the earlier time period when the ACF site was censused, to best correspond with the lower elevation nesting season, but allowed for many more migrants. In the Beech Gaps, the presence of Broad-winged Hawk, Eastern Wood-Pewee and Veery in July suggests an upward movement of these species from lower elevations nesting sites to the highland sites where suitable feeding sites are available.

Examination of avifauna present within the three study sites reveals few surprises. None of the 55 total species were found breeding in all three study sites, although two species (American Crow and American Robin) were recorded in some capacity within all three sites. The highest population on all three study sites occurred toward the later part of the breeding season at a time when the greatest number of fledged birds were present.

Adjusted densities (Table 4) of the avifauna to 40 ha units provide more meaningful data. Examination of these data reveal some striking comparisons. Population totals suggest that, in spite of the greater number of birds recorded on ACF study site, the Beech Gaps possessed a much higher avian density; WBG was approximately three times greater than ACF. This type of data provides valuable insight on the significance of the Beech Gap communities within the Southern Appalachians.

Population differentials can be further analyzed by comparing relative abundance and diversity values (Table 4). The general concept of species diversity implies the diversity indices are

higher where the communities are more stable. Each species occupies a unique niche within the community, and so the number of species present or absent is indicative of the ecological diversity of the habitat.

The diversity index permits comparative measurements of community complexity. Species diversity (H') is derived from the number of species and their abundance within the community. Higher diversity means longer food chains, more cases of symbiosis and greater possibilities for negative feedback, which reduce oscillations and hence increase stability (Margalef, 1968).

Table 4 includes the H' values for the three study sites. Species diversity values for ACF was a very high .960, while that of the two Beech Gaps was .657 and .701 for WBG and EBG sites, respectively. These three values should not be compared with species diversity values of other studies because the majority of those studies consider breeding populations only and result in lower H' values. This study provides a more realistic perspective of the entire ecosystem. It considers all the avifauna present throughout the study period. The presence of the non-breeding species in addition to the breeding bird population must be considered together if the full value of the ecosystem is to be appreciated.

Evenness (J') provide an additional value for trend comparisons. Tramer (1969) stated that birds are "equalibrium" species whose requirements and characteristics are relatively stable from one generation to the next. Avian species "partition the breeding space in a characteristic way, and a series of samples from the same or

different localities (within like habitats) will yield similar distributions and species abundance." The higher evenness values reflects the importance of additional species in the communities.

Bioenergetics. Salt (1975) pointed out that avifaunal composition expressed in numbers is not always clear; that is, it implies that "three horned owls and one hummingbird are equal to four sparrows." More meaningful measurements can be expressed in terms of standing crop (SCB) and consuming biomass (CB) values. SCB is the total weight (in grams) of the avifauna present at the time of the census. CB is existent energy and is a measurement more closely related to community metabolism. It is indicative of the rate of food consumption or energy intake by the avifauna, and represents the total stored energy present as birds. These measurements can further be related to feeding guilds that reflect on the relative stability of the community. Biomass measurements for the three study sites are illustrated in Table 5.

SCB values provide a considerably different perspective on the three sites because it incorporates the additional factor of weight into the multidimensional ecosystem. The Abrams Creek Floodplain suddenly becomes more highly productive than the two Beech Gap sites, 3.9% greater than WBG and 4.3% greater than EBG. The bioenergetic importance of ACF is easily explained by the presence of a few large species, such as Green-backed Heron and Wild Turkey that were not present within the Beech Gap communities.

Salt (1957) pointed out that species efficiency is proportional to its size, and that "the efficiency of an avifauna is indicated by

Table 5. Foraging Diversity of Avifauna

Species by Category	No. of birds/40ha			Mean wt/ bird(g)	Biomass			(g/40 ha)		
					Standing Crop (g)			Consuming (g)		
	ACF	WBG	EBG		ACF	WBG	EBG	ACF	WBG	EBG
Primary Consumers										
Foliage-Seed (FS)										
Blue Jay	16.0	0	0	85.5	1368.0	0	0	267.3	0	0
Purple Finch	.9	0	0	25.4	22.4	0	0	7.0	0	0
American Goldfinch	3.5	0	0	13.4	46.9	0	0	18.1	0	0
Totals	20.4	0	0		1437.8	0	0	292.4	0	0
Ground-Seed (GS)										
Common Grackle	1.8	0	0	112.5	202.5	0	0	35.8	0	0
Brown-headed Cowbird	1.8	0	0	41.5	74.4	0	0	27.5	0	0
Dark-eyed Junco	0	302.6	219.7	21.0	0	6354.6	4613.7	0	2078.9	1509.4
Totals	3.6	302.6	219.7		276.9	6354.6	4613.7	63.3	2078.9	1509.4
Foliage-Nectar (FN)										
Ruby-throated Hummer.	.9	0	0	3.0	2.7	0	0	1.8	0	0
Totals	.9	0	0		2.7	0	0	1.8	0	0
Secondary Consumers										
Air-Soaring-Insect (ASI)										
	0	0	0		0	0	0	0	0	0
Air-Perch.-Insect (API)										
Eastern Wood-Pewee	.9	0	2.3	13.0	11.7	0	29.9	4.6	0	11.7
Acadian Flycatcher	11.9	0	0	10.6	121.9	0	0	51.3	0	0
Eastern Phoebe	6.2	0	0	20.0	124.0	0	0	41.3	0	0
Great Crested Flyc.	22.2	0	0	30.9	686.0	0	0	194.8	0	0
Totals	40.8	0	2.3		943.6	0	29.9	292.0	0	11.7
Foliage-Insect (FI)										
Yellow-billed Cuckoo	8.0	0	0	57.5	460.0	0	0	104.0	0	0
Black-capped Chickadee	0	16.6	28.3	11.1	0	184.3	314.6	0	76.2	129.9
Carolina Chickadee	22.2	0	0	10.6	235.3	0	0	98.9	0	0

Table 5, con't.

Tufted Titmouse	8.9	0	0	22.4	199.4	0	0	63.7	0	0
Blue-gray Gnatcatcher	7.1	0	0	5.0	35.5	0	0	19.7	0	0
Golden-crowned Kinglet	0	40.3	4.7	5.0	0	201.5	23.5	0	111.6	13.0
Gray Catbird	.9	0	0	38.5	34.7	0	0	9.1	0	0
Solitary Vireo	0	73.3	68.6	17.4	0	1260.8	1179.9	0	443.8	415.3
Yellow-throated Vireo	.9	0	0	19.3	17.4	0	0	5.9	0	0
Red-eyed Vireo	16.0	0	0	22.4	358.4	0	0	114.5	0	0
Northern Parula	3.5	0	0	7.9	27.7	0	0	12.9	0	0
Chestnut-sided Warbler	0	0	2.3	9.8	0	0	22.5	0	0	9.8
Black-th. Blue Warbler	0	4.9	14.3	10.2	0	50.0	145.9	0	21.3	62.2
Black-th. Green Warbler	0	54.3	30.7	9.9	0	537.6	303.9	0	231.8	131.0
Blackburnian Warbler	0	0	4.7	10.0	0	0	47.0	0	0	20.2
Canada Warbler	0	0	2.3	10.2	0	0	23.5	0	0	10.0
Indigo Bunting	1.8	4.9	0	18.6	33.5	91.1	0	11.5	31.2	0
Orchard Oriole	.9	0	0	13.7	12.3	0	0	4.7	0	0
Totals	70.2	194.3	155.9		1414.2	2325.3	2060.3	444.9	915.9	791.4

Timber-Drilling-
Insect (TDI)

Red-bellied Woodpecker	2.6	0	0	67.5	175.5	0	0	37.4	0	0
Yell-bellied Sapsucker	.9	0	0	45.0	40.5	0	0	10.0	0	0
Downy Woodpecker	6.2	0	0	28.2	174.8	0	0	51.3	0	0
Hairy Woodpecker	0	30.7	33.0	63.2	0	1940.2	2085.6	0	423.6	455.4
Pileated Woodpecker	7.1	0	0	308.0	2168.8	0	0	267.0	0	0
Totals	16.8	30.7	33.0		2577.6	1940.2	2085.6	365.7	423.6	455.4

Timber-Searching-
Insect (TSI)

Red-breasted Nutcatch	0	45.0	26.0	12.3	0	553.5	319.8	0	220.4	127.3
White-breasted Nuthatch	6.2	0	0	20.4	126.5	0	0	41.8	0	0
Brown Creeper	0	16.6	14.3	8.5	0	141.1	121.6	0	64.3	55.4
Totals	6.2	61.6	40.3		126.5	694.6	441.4	41.8	284.7	182.7

Ground-Insect (GI)

Wild Turkey	5.4	0	0	6720.0	36288.0	0	0	1429.3	0	0
Whip-poor-will	.9	0	0	63.0	56.7	0	0	12.4	0	0
Northern Flicker	.9	0	0	123.6	111.2	0	0	19.0	0	0

Table 5, con't.

Carolina Wren	1.8	0	0	13.9	25.0	0	0	9.5	0	0
Winter Wren	0	9.4	0	9.3	0	87.4	0	0	38.6	0
Veery	0	2.3	7.0	33.6	0	77.3	235.2	0	21.3	64.8
Wood Thrush	.9	0	0	48.8	43.9	0	0	10.5	0	0
American Robin	1.8	2.3	23.7	73.3	131.9	168.6	1737.2	27.3	34.9	359.2
Brown Thrasher	1.8	0	0	68.6	123.5	0	0	26.2	0	0
Ovenbird	1.8	0	0	18.6	33.5	0	0	16.6	0	0
La. Waterthrush	.9	0	0	20.5	18.5	0	0	6.1	0	0
Song Sparrow	1.8	0	0	21.4	38.5	0	0	12.5	0	0
Rusty Blackbird	1.8	0	0	65.5	117.9	0	0	25.4	0	0
Totals	19.8	14.0	30.7		36988.6	333.3	1972.4	1594.8	94.8	424.0
<u>Ground-Predator (GP)</u>										
Green-backed Heron	4.5	0	0	2229.0	10030.5	0	0	592.3	0	0
Broad-winged Hawk	.9	2.3	0	363.5	327.2	836.1	0	37.6	96.1	0
Eastern Screech-Owl	.9	0	0	216.8	195.1	0	0	27.1	0	0
Belted Kingfisher	.9	0	0	236.2	212.6	0	0	28.6	0	0
American Crow	5.6	4.7	4.7	479.9	2687.4	2255.5	2255.5	278.9	234.0	234.0
Totals	12.8	7.0	4.7		13452.8	3091.6	2255.5	964.4	330.1	234.0
Total Prim.Consumers:	24.9	302.6	219.7		1717.4	6354.6	4613.7	357.5	2078.9	1509.4
Total Second.Consum.:	166.6	307.6	266.9		55503.3	8385.0	8845.1	3703.6	2049.1	2099.2
Totals	191.5	610.2	486.6		57220.7	14739.6	13458.8	4061.1	4128.0	3608.6

the proportion of its biomass made up of large birds." Larger birds are more efficient because of their ability to store food for longer periods. However, only small birds are capable of foraging in the upper stratum of more complex vegetative environments.

Analysis of the sizes of birds on the three units (Table 6) shows a relatively balanced ratio of small, medium and large species in the ACF study site, but an extremely high preference for small species in the two Beech Gap units. Size relationships play an important role in determining avifaunal community structure.

Table 6. Bird Size Differentials

	<u>ACF</u> <u>Pop./Sps.</u>	<u>WBG</u> <u>Pop./Sps.</u>	<u>EBG</u> <u>Pop./Sps.^a</u>
Large (>150g)	7/25.3	2/7.0	1/4.7
Medium (45-149g)	12/38.8	2/33.0	2/56.7
Small (<44.9g)	22/127.7	11/570.2	13/425.2
Totals	41/191.5	15/610.2	16/486.6

a Pop. = Total population /40 ha, and Sps. = total # of species /40 ha

Bird size may be extremely significant in long-term assessments of avian communities relative to low level (ground and lower vegetation) impacts such as would be expected from wild hogs.

Foraging diversity provides further insight into the stratigraphic feeding niches of the community. Ecological requirements of the various species often are so restrictive that some species can not utilize the habitat. Hilden (1965) stated that the distinctive feeding and nesting niches of each species are among the most important factors in the differential selection of habitat. In

fact, one can predict that a certain species will utilize a particular habitat according to whether it feeds in the tops of trees, in bushes, in flight, or on the ground.

Fourteen of the 41 ACF bird species were either seed or insect ground feeders, representing 65% of total SCB. Eleven species were either seed or insect foliage feeders, representing a 5% of the total SCB. Five ground-predators represented 23%, and five species utilized timber-drilling or searching guilds for 5% of the total SCB. There were four aerial feeders that accounted for 2%, and the one nectar feeder accounting for only a fraction of the total SCB on the Abrams Creek Floodplain study site.

The Beech Gaps supported many more foliage feeders (6 for 15% in the WBG, and 8 for 15% of the total SCB in the EBG) than any other guild, but the ground feeders (4 for 46% in the WBG, and 3 for 49% in the EBG) completely dominated the SCB ratios. The abundant Dark-eyed Junco represented 43% of WBG and 34% of EBG standing crop biomass values. Timber-drilling and timber-searching feeding guilds were represented by three species in each study site, accounting for 18% of the total SCB on WBG and 19% on EBG. There were two predators recorded on WBG for 21%, and one predator for 17% on EBG. A single aerial feeder was recorded on EBG for 2% of the total SCB. These data, like bird size, illustrate the importance of the ground level, in spite of the greater number of birds with upper foliage gleaning preferences, and may prove the most useful in a long-term indices of ecological conditions of avian communities.

It is obvious that habitat selection operates most strongly for

birds during the breeding season. That is the time that habitat requirements, particularly those relating to nesting, are most essential. Upon examination of only the nesting species (Tables 1, 2 and 3), 48% of the total 25 nesting species utilized cavity or depression sites; 50% of the 12 nesting species in AFC, 50% of the six nesting species in WBG, and 43% of the seven nesting species in EBG. Next in importance was the foliage nesters with a 40% total use; 42% of AFC, 33% of WBG, and 43% of EBG. Only one ground nesting species (Dark-eyed Junco) occurred in each Beech Gap sites, and one parasitic nesting bird (Brown-headed Cowbird) was detected in AFC.

Conclusions

The avifauna of three communities have been analyzed on the basis of species diversity and bioenergetics relative to both feeding and nesting guilds. This report is designed to provide for easy replication of baseline data for future comparisons. The differences between the current baseline and that obtained by future field studies will provide insight into the avian community dynamics that can be contributed to the presence or absence of wild hogs. That difference may help to explain or justify continuance of hog control in the short- and long-term resource management programs at Great Smoky Mountains National Park.

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Appendix A

Recorder R. W. Anderson

Weather Overcast, heavy rain at 6:45-7:15

1	crow		WRL	
2	WRL		Hum	
3	TIT	GBg		
4	BTA		Cyb	
5	WC			
6		Cyb		
7			Ch	
8	FHC			
9		Ule	ch2	WPL
10		Jac1		
11		FHC		GBg
12		NW4		
13		Jac2		

Titan head

Overcast

Date 5/26/84 7:45-9:45 Study Site ACF

Appendix B. Abrams Creek Floodplain Avian Data - 1984

Species (41)	Individuals Recorded per Census									Totals
	April		May			June				
	16	26	16	19	26	27	31	05	10	
Green-backed Heron								1	4	5
Broad-winged Hawk									1	1
Wild Turkey						2		4		6
Yellow-billed Cuckoo		1	1	2	2			1	2	9
Eastern Screech-Owl							1			1
Whip-poor-will				1						1
Ruby-throated Hummingbird					1					1
Belted Kingfisher								1		1
Red-bellied Woodpecker		1		1	1					3
Yellow-bellied Sapsucker	1									1
Downy Woodpecker	1	1	1	1		1	1	1		7
Northern Flicker								1		1
Pileated Woodpecker		2	1	1	1	1	1		1	8
Eastern Wood-Pewee							1			1
Acadian Flycatcher				1	2	1	1	1	1	7
Eastern Phoebe	2	1					5	2		10
Great Crested Flycatcher				1		1	2	2	7	13
Blue Jay		3	3	1	2		2	3	4	18
American Crow		2	2	1	1			1		7
Carolina Chickadee	4	3	2	3	3	3	4		3	25
Tufted Titmouse		1		1	1	1	5	1		10
White-breasted Nuthatch	1			1	1		4			7
Carolina Wren				1	1					2
Blue-gray Gnatcatcher	1	1			2	1		2	1	8
Wood Thrush	1									1
American Robin				2						2
Gray Catbird			1							1
Brown Thrasher		2								2
Yellow-throated Vireo						1				1
Red-eyed Vireo		2	1	3	1	3	3	3	2	18
Northern Parula		1				1	1	1		4
Ovenbird		2								2
Louisiana Waterthrush		1								1
Indigo Bunting					1	1				2
Song Sparrow				2						2
Rusty Blackbird		2								2
Common Grackle		1					1			2
Brown-headed Cowbird		1		1						2
Orchard Oriole		1								1
Purple Finch	2									2
American Goldfinch	1	1						2		4
Totals	14	30	12	24	20	17	32	27	26	202

Appendix C. West Beech Gap Avian Data - 1984

Species (15)	Individuals Recorded						per		Census			Totals
	June						July					
	2	9	12	21	23	26	3	8	11	19	29	
Broad-winged Hawk									1			1
Hairy Woodpecker	1	1	1	2		1	3	1	2	1		13
American Crow								1	1			2
Black-capped Chickadee	1	2	1	1		1			1			7
Red-breasted Nuthatch	2	2	3	1	1		1	1		7	1	19
Brown Creeper							1	5		2	1	9
Winter Wren										2	2	4
Golden-crowned Kinglet					1	1	4	3	1	7		17
Veery										1		1
American Robin							1					1
Solitary Vireo	1		4	2	3	4	6	4	3	2	2	31
Black-throated Blue W.								1	1			2
Black-throated Green W.				1	2	1	2	3	7	7		23
Dark-eyed Junco	3	1	3	3	5	5	15	31	8	15	39	128
Indigo Bunting						1		1				2
Totals	8	6	12	10	12	14	33	51	25	43	46	260

Appendix D. East Beech Gap Avian Data - 1984

Species (16)	Individuals Recorded						per Census					Totals
	June						July					
	2	9	12	21	23	26	3	8	11	19	29	
Hairy Woodpecker	2	2		3	1	2	1	1	1	1		14
Eastern Wood-Pewee							1					1
American Crow	1				1							2
Black-capped Chickadee	2	1	2	2	1	4						12
Red-breasted Nuthatch	3	1	1	1	1			1	2		1	11
Brown Creeper		1					2	1	1		1	1
Golden-crowned Kinglet								2				2
Veery				1		1	1					3
American Robin					1	1	2	1	2	3		10
Solitary Vireo	2	1	2	4	1	4	8	4	1	2		29
Chestnut-sided Warbl.						1						1
Black-throated Blue W.	1			1				2	2			6
Black-throated Green W.					1	1	3	6	1	1		13
Blackburnian Warbler		1						1				2
Canada Warbler										1		1
Dark-eyed Junco	4		1	2	1	4	11	13	8	14	35	93
Totals	15	7	6	14	8	18	29	32	18	22	37	206

Table 4, con't.

Gray Catbird	.9	0	0	.005	0	0			
Brown Thrasher	1.8	0	0	.009	0	0			
Solitary Vireo	0	73.3	68.6	0	.120	.141			
Yellow-throated Vireo	.9	0	0	.005	0	0			
Red-eyed Vireo	16.0	0	0	.084	0	0			
Northern Parula	3.5	0	0	.018	0	0			
Chestnut-sided Warbler	0	0	2.3	0	0	.005			
Black-throated Blue Warbler	0	4.9	14.3	0	.008	.029			
Black-throated Green Warbler	0	54.3	30.7	0	.089	.063			
Blackburnian Warbler	0	0	4.7	0	0	.010			
Ovenbird	1.8	0	0	.009	0	0			
Louisiana Waterthrush	.9	0	0	.005	0	0			
Canada Warbler	0	0	2.3	0	0	.005			
Indigo Bunting	1.8	4.9	0	.009	.008	0			
Song Sparrow	1.8	0	0	.009	0	0			
Dark-eyed Junco	0	302.6	219.7	0	.496	.451			
Rusty Blackbird	1.8	0	0	.009	0	0			
Common Grackle	1.8	0	0	.009	0	0			
Brown-headed Cowbird	1.8	0	0	.009	0	0			
Orchard Oriole	.9	0	0	.005	0	0			
Purple Finch	.9	0	0	.005	0	0			
American Goldfinch	3.5	0	0	.018	0	0			
Totals (55)	191.5	610.2	486.6	.999	1.005	1.000	3.566	1.780	1.944
J' Totals							.960	.657	.701

* ACF = Abrams Creek Floodplain; WBG = West Beech Gap; EBG = East Beech Gap

Table 4. Adjusted Densities, Relative Abundance and Species Diversity Values

Species	Adjusted Densities (# of birds / 40 ha)			Relative Abundance			Species Diversity		
	ACF	WBG	EBG	ACF	WBG	EBG	ACF	WBG	EBG*
Green-backed Heron	4.5	0	0	.023	0	0			
Broad-winged Hawk	.9	2.3	0	.005	.004	0			
Wild Turkey	5.4	0	0	.028	0	0			
Yellow-billed Cuckoo	8.0	0	0	.042	0	0			
Eastern Screech-Owl	.9	0	0	.005	0	0			
Whip-poor-will	.9	0	0	.005	0	0			
Ruby-throated Hummingbird	.9	0	0	.005	0	0			
Belted Kingfisher	.9	0	0	.005	0	0			
Red-bellied Woodpecker	2.6	0	0	.014	0	0			
Yellow-bellied Sapsucker	.9	0	0	.005	0	0			
Downy Woodpecker	6.2	0	0	.032	0	0			
Hairy Woodpecker	0	30.7	33.0	0	.050	.068			
Northern Flicker	.9	0	0	.005	0	0			
Pileated Woodpecker	7.1	0	0	.037	0	0			
Eastern Wood-Pewee	.9	0	2.3	.005	0	.005			
Acadian Flycatcher	11.5	0	0	.060	0	0			
Eastern Phoebe	6.2	0	0	.032	0	0			
Great Crested Flycatcher	22.2	0	0	.116	0	0			
Blue Jay	16.0	0	0	.084	0	0			
American Crow	5.6	4.7	4.7	.029	.008	.010			
Black-capped Chickadee	0	16.6	28.3	0	.027	.058			
Carolina Chickadee	22.2	0	0	.116	0	0			
Tufted Titmouse	8.9	0	0	.046	0	0			
Red-breasted Nuthatch	0	45.0	26.0	0	.074	.053			
White-breasted Nuthatch	6.2	0	0	.032	0	0			
Brown Creeper	0	16.6	14.3	0	.027	.029			
Carolina Wren	1.8	0	0	.009	0	0			
Winter Wren	0	9.4	0	0	.015	0			
Blue-gray Gnatcatcher	7.1	0	0	.037	0	0			
Golden-crowned Kinglet	0	40.3	4.7	0	.066	.010			
Veery	0	2.3	7.0	0	.004	.014			
Wood Thrush	.9	0	0	.005	0	0			
American Robin	1.8	2.3	23.7	.009	.004	.049			