Appendix D5

Terrestrial Ecology

This page intentionally left blank.

This page intentionally left blank.

D5.1 Introduction

This appendix supports the description in the main document of the affected environment (Section 4.10) and environmental consequences (Section 5.10) for terrestrial ecology.

The area of the Tennessee River system within 0.25 mile of reservoir shorelines was the study area for terrestrial ecology, since this zone contains several plant and animal communities that depend on or are otherwise associated with current reservoir conditions.

The Tennessee Valley Authority (TVA) has identified a number of terrestrial plant and animal communities that occur in the study area. Several of these communities that depend on current reservoir conditions or are otherwise associated with the Tennessee River system could be affected by changes in TVA's reservoir operations policy. Direct impacts on habitats for these resources could result from manipulation of reservoir levels. In addition, some TVA lands are vulnerable because of their proximity to lands desirable for residential or industrial development. Habitats in these areas could be indirectly affected by changes in land use resulting from changes in the reservoir operation policy.

This technical appendix describes the vegetation communities and wildlife communities associated with habitats that could be affected by changes in the reservoir operations policy.

D5.2 Vegetation Communities

Vegetation communities in the Tennessee River Valley (Valley) can be grouped into two broad categories: lowland and upland. The following qualitative descriptions of plant communities in the study area emphasize uncommon plant communities because potential impacts on these communities were considered potentially more harmful than impacts on more regionally abundant plant communities. The plant communities influenced by reservoir levels and river flows were considered to have the greatest potential to be affected by changes in reservoir operations. Consequently, plant communities associated with wetlands and other lowland habitats form the majority of the discussion. However, some uncommon upland plant communities that are not directly influenced by reservoir levels were also addressed, because changes in reservoir operations could affect these resources indirectly (e.g., through changes in land use).

D5.2.1 Lowland Plant Communities

Lowland plant communities include those communities that are most likely to be directly influenced by changes in reservoir operations and habitats associated with creeks, streams, rivers, and reservoirs in the study area. Examples of communities associated with these habitats include bottomland hardwood forests, scrub/shrub wetlands, and flats vegetation. Plant communities occurring in riparian habitats adjacent to floodplain areas (e.g., streambank forests situated on terraces or levees) are also included in this category. The majority of globally imperiled communities identified from the wetlands subset of the NatureServe Explorer

database (2001) fall in this category (see Tables 4.10-01 and 4.10-02 in Section 4.10, Terrestrial Ecology).

Bottomland hardwood forests occur in the floodplains of streams and rivers and in remnant floodplains and other low-elevation sites adjacent to reservoirs. These forests can also extend along terraces, natural levees, and back-lying sloughs. In the Valley, species commonly observed in these forests include black gum (*Nyssa sylvatica*); black willow (*Salix nigra*); water (*Quercus nigra*), willow (*Q. phellos*), and white (*Q. alba*) oaks; sweet-gum (*Liquidambar styraciflua*); hackberry (*Celtis occidentalis*); sugarberry (*C. laevigata*); sycamore (*Platanus occidentalis*); red (*Acer rubrum*) and silver (*A. saccharinum*) maples; box elder (*A. negundo*); cottonwood (*Populus deltoides*); green ash (*Fraxinus pennsylvanica*); river birch (*Betula nigra*); sycamore; and, in extremely wet areas, water tupelo (*Nyssa aquatica*) and bald cypress (*Taxodium distichum*). Five globally imperiled floodplain forest communities reported from the seven-state TVA region are known from the study area. The Appalachian montane alluvial forest and the swamp forest-bog complex are known from portions of the study area in the Blue Ridge Physiographic Region, the eastern Highland Rim rich floodplain terrace forest and the maple-hickory mesic floodplain forest are known from portions of the study area in the Highland Rim Physiographic Region, and the beech-mixed hardwood floodplain forest is known from portions of the study area in the Coastal Plain Physiographic Region. (Figure 4.1-02 in the main document illustrates the physiographic regions in the study area.)

Although not known to correspond with any of the globally imperiled wetland plant communities recognized by NatureServe, noteworthy stands of water tupelo forested wetlands have been described from Guntersville Reservoir along Dry Creek and inland on Bellefonte Island (TVA 2001). Several water tupelo stands also exist on portions of Wheeler Reservoir near Huntsville and Decatur, Alabama. In addition, a globally imperiled plant community dominated by giant cane (*Arundinaria gigantea*) (the giant cane shrubland) occurs in association with floodplain forests at scattered locations throughout the study area.

Four other globally imperiled floodplain forest communities reported from the seven-state TVA region have potential to occur in the study area, although specific locations of these communities have not been identified. The montane floodplain slough forest and the southern Appalachian bog (rhododendron type) could occur in portions of the study area in the Blue Ridge Physiographic Region, the pin oak–post oak lowland flatwoods could occur in portions of the study area in the Highland Rim and Coastal Plain Physiographic Regions, and the interior forested acid seep could occur in portions of the study area in the Coastal Plain Physiographic Region.

Scrub/shrub communities are often associated with bottomland hardwood forests but lack a well-defined forest canopy. In the study area, woody species commonly observed in scrub/shrub communities include black willow, buttonbush (*Cephalanthus occidentalis*), silky dogwood (*Cornus amomum*), river alder (*Alnus* sp.), Virginia willow (*Salix* sp.), swamp loosestrife (*Decodon verticillatus*), red and silver maples, box elder, sycamore, and green ash. One globally imperiled scrub/shrub plant community, Hiwassee/Ocoee bedrock scour vegetation, occurs in the study area along the Hiwassee and Ocoee Rivers in the Blue Ridge

Physiographic Region. The great rhododendron/peatmoss species shrubland could occur in portions of the study area in the Blue Ridge, but specific locations have not been identified.

Two globally imperiled herbaceous wetland communities that often occur in association with scrub/shrub wetlands could occur in the study area, although specific locations of these communities are not currently known from the area. The floodplain pool community could occur in portions of the study area in the Blue Ridge Physiographic Region, and the Kentucky prairie cordgrass marsh community could occur in portions of the study area in the Highland Rim Physiographic Region.

Reservoir flats occur in the drawdown zone between maximum summer and minimum winter pool elevations. As with other wetlands associated with the reservoir system, the cycle of flooding and soil exposure experienced by these flats communities is reversed from the natural pattern of summer drawdown and winter flooding that typifies most freshwater wetlands. Webb et al. (1988) reported on the flats flora and vegetation of six mainstem reservoirs. Amundsen (1994) reported on the ecology and dynamics of flats and riparian communities on Watts Bar Reservoir. These studies found these flats communities to be dominated by annual plant species, several of which complete their life cycle between the start of each annual winter drawdown and frost. These species include lowland rotala (*Rotala ramosior*), grasslike fimbry (*Fimbristylis miliacea*), yellow false pimpernel (*Lindernia dubia*), and both variable (*Cyperus difformis*) and white-edge (*C. flavicomus*) flatsedge. None of the globally imperiled wetland plant communities reported from the seven-state TVA region are known to be associated with reservoir flats in the study area.

Islands that are exposed at maximum summer pool typically support remnant upland plant communities toward the interior while being surrounded by a fringe of mesic- to hydrophytic- (and often early successional) woody species such as willow, sycamore, and yellow poplar (*Liriodendron tulipifera*) toward the water's edge. In contrast, if vegetated at all, islands exposed during winter drawdown are fringed by an emergent aquatic plant community (see Section 4.9, Aquatic Plants). None of the globally imperiled wetland plant communities reported from the seven-state TVA region are known to be associated with islands in the study area.

Springs, seeps, and vernal pools occur in lowland and upland habitats throughout the study area. They exhibit a range of connectivity to the reservoir system that depends on the underlying geology as well as the topographic setting. In the lowland habitats, species associated with springs include watercress (*Nasturtium officinale*), speedwell (*Veronica* sp.), loosestrife, and duckweed (*Limna minor)*. Lowland seeps tend to be associated with the terraces or floodplains of small ravines and are often characterized by herbaceous wetland vegetation, such as sedges, rushes, jewel weed (*Impatiens capensis*), knotweed (*Polygonum* sp.), and royal (*Osmunda regalis*) and cinnamon (*O. cinnamomea*) ferns.

None of the globally imperiled wetland plant communities reported from the seven-state TVA region are known to be associated with lowland seeps, springs, or vernal pools in the study area. However, four globally imperiled plant communities for which specific locations have not been identified in the study area could be associated with these habitats in the area. The

floodplain pool could occur in portions of the study area in the Blue Ridge Physiographic Region, the Kentucky prairie cordgrass marsh could occur in portions of the study area in the Highland Rim Physiographic Region, the midwest acid seep could occur in portions of the study area in the Highland Rim or Coastal Plain Physiographic Region, and the interior forested acid seep could occur in portions of the study area in the Coastal Plain Physiographic Region.

D5.2.2 Upland Plant Communities

Upland plant communities include all other terrestrial habitats lacking an aboveground hydrologic connection to a waterbody. These areas are typically situated at or above maximum summer pool levels. For the most part, the upland plant communities addressed in this appendix are located on, or immediately adjacent to, TVA reservoirs.

This category includes plant communities ranging from mountain ridge tops and valley slopes to glades, barrens, and bluffs that may occur along reservoir shorelines but are situated above maximum summer pool. The category also includes plant communities exhibiting a range of variation in seasonal moisture, such as wet prairies and meadows, upland ponds or other depressions, and rock shelters associated with seasonal precipitation. Some of these latter communities appear in the wetlands subset of the NatureServe Explorer database because they are characterized by species with high moisture requirements. In the majority of cases, these communities are not likely to be directly influenced by changes in reservoir operations; however, they could be subject to indirect impacts that might result from changes in reservoir operations.

Construction of reservoirs in the Valley raised water levels into areas that were formerly upland sites. In general, reservoir margins that remain predominately characterized by upland vegetation indicate that the adjacent reservoir exerts minimal influence on the composition of the shoreline vegetation. Although located immediately adjacent to the reservoir, these communities are unlikely to be directly affected by changes in reservoir levels. In contrast, areas formerly supporting upland vegetation that now consist of riparian vegetation indicate at least some reservoir influence on plant community composition (see the preceding discussion of lowland communities).

Glades and barrens are upland habitats that have been, in some cases, flooded or encroached on by reservoirs. Consequently, these upland communities often occur immediately adjacent to a waterbody. They may occur on sandstone or limestone and are less common in the Blue Ridge and Coastal Plain Physiographic Regions than in other regions. Limestone cedar glades support several regional endemics that are restricted to these habitats, many of which are federally or state-listed (see Section 4.13, Threatened and Endangered Species). Two globally imperiled wetland plant communities reported from the seven-state TVA region are known from limestone glade habitats in the study area. Both the limestone seep glade and the limestone glade streamside meadow occur along the Duck River in the Nashville Basin. The Cumberland sandstone flatrock glade could also occur along the Duck River in the Nashville Basin, but specific locations are not currently known from the area.

Rock shelters are also widely distributed through the Valley, particularly on the Cumberland Plateau. Like glades and barrens, these habitats tend to support regional endemics, many of which are either federally or state-listed (see Section 4.13, Threatened and Endangered Species). Bluffs are abundant on most reservoirs and stream reaches in the Valley; many of their lower reaches have been flooded or partly flooded by impoundment. Seepage areas associated with these rock shelters, cliff faces, or bluffs often support uncommon plant communities. Three globally imperiled wetland plant communities (the Cumberland Plateau rockhouse; the Cumberland Plateau wet sandstone cliff; and the Cumberland River limestone seep cliff) are known to occur in association with such habitats along Bear Creek and Upper Bear Creek Reservoirs.

Upland depressions, including those associated with seeps, springs, and vernal ponds, may lack an aboveground hydrologic connection to a waterbody but can be connected to these water sources via groundwater systems. None of the globally imperiled wetland plant communities reported from the seven-state TVA region are currently known from upland seeps, springs, or vernal pools in the study area. However, five globally imperiled plant communities for which specific locations are not currently known from the study area could be associated with these habitats in this area. The southern Appalachian acid seep, the southern Appalachian bog (rhododendron type), and the upland sweetgum–red maple pond could occur in portions of the study area in the Blue Ridge Physiographic Region; the white oak sandstone ridgetop depression forest could occur in portions of the study area in the Cumberland Plateau Physiographic Region; and the water tupelo sinkhole pond swamp could occur in portions of the study area in the Highland Rim Physiographic Region.

In addition, the globally imperiled Cumberland Plateau mesic hemlock-hardwood forest occurs in the study area along Bear Creek and Upper Bear Creek Reservoirs. This community is found along steep, mesic sandstone ravines.

D5.3 Associated Wildlife Communities

Ecological data on the terrestrial animals and their habitats that occur along TVA reservoirs were gathered from field interviews with subject matter experts, published reports, TVA land use plans and environmental assessments, and biological data collection centers. After a review of the broad context of the terrestrial ecology of TVA's reservoirs, the scope of the terrestrial ecology analysis was narrowed to focus on those animals and habitats closest to the reservoirs and most likely to be affected by operational changes. For the most part, these affected habitats consisted of lowland communities; therefore, these communities make up the majority of the discussion that follows.

The Tennessee River and its associated riparian zone provide habitat for a diversity of wildlife. Approximately 60 species of reptiles, 70 species of amphibians, 180 species of breeding birds, and 60 species of mammals occur in the Tennessee Valley region (modified from Ricketts et al. 1999). In addition, a variety of species of terrestrial invertebrates, such as spiders, insects, and land snails, occur in the region.

Factors such as habitat type and size, food availability, surrounding land use, and other constraints, determine the diversity and abundance of wildlife that occur in the vicinity of the reservoir system. Habitats types include emergent, scrub/shrub, and forested wetlands; upland and riparian forests; and early successional habitats. Shoreline features occurring in these habitats include caves and sinkholes, vernal ponds, river islands, and flats. In many cases, the highest diversity of species in an area occurs at the interface of high-quality wildlife habitats and the river.

Wildlife of the Tennessee River can be grouped into two broad categories: those that occur in upland communities and those that occur in lowland communities. Within each of these divisions, the following animal groups occur: migratory birds, game mammals, and non-game wildlife—including small mammals, reptiles, and amphibians. The dependence of each of these animal groups on habitats and changes in reservoir levels and river flow is discussed in the following sections. Although there is no clear distinction between plants and animals that occur in either upland or lowland communities, the following discussion groups species of animals into the habitat categories they are most closely associated with.

D5.3.1 Associated Wildlife in Lowland Areas

Wildlife habitats in lowland areas include bottomland hardwood forests, riparian forests, wetlands, shorelines, river islands, and flats. Riparian forests and other terrestrial habitats associated with aquatic resources, such as vernal ponds, rivers, and wetlands, are often the most productive habitats in a given area.

Wading birds of the Valley include great blue heron (*Ardea herodias*), great egret (*Ardea alba*), little blue heron (*Egretta caerulea*), black-crowned night-heron (*Nycticorax nycticorax*) and snowy egret (*Egretta thula*). While the larger colonies of breeding herons occur along the mainstem river system, tributary reservoirs also contain heron colonies. In addition to their importance to breeding wading birds, TVA reservoirs are important in late summer when juvenile birds in the region begin to disperse. Exposed flats and pockets of shallow water created by drawdowns afford foraging areas for these birds (Nicholson pers. comm.). Wetlands and river islands provide nesting, foraging, and roosting opportunities for wading birds and other species, such as the double-crested cormorant (*Phalacrocoras auritus*) and green heron (*Butorides virescens*).

During annual reservoir drawdowns, thousands of acres of flats are exposed along TVA reservoirs. Migrating and resident waterfowl, shorebirds, terns, and herons use flats for resting and foraging, primarily during the spring and fall migration periods. These birds prefer areas ranging from moist flats to shallow water (0 to 4 inches) and moist soils in the drawdown zone. Shorebirds found on inland shores concentrate on flooded fields, muddy freshwater ponds, river flats, and shallow-water areas along the shoreline with limited vegetation that provide invertebrate prey. Numbers of these birds vary by reservoir and largely depend on weather patterns and reservoir levels.

The most extensive flats are located on Kentucky Reservoir. These flats begin to appear as the water levels on Kentucky Reservoir drop to the 356.5-foot elevation. The larger flats on the reservoir are located at the mouth of the Duck River and in Birdsong, Blood River, Big Sandy, and Jonathan Creek embayments. Additional flats occur on Pickwick, Wheeler, Chickamauga, and Douglas Reservoirs.

The largest concentrations of shorebirds in the Valley typically occur during the fall migration period. In contrast to spring migration, agricultural fields are typically dry in fall due to seasonally low precipitation. Shorebirds that migrate through the Valley include spotted sandpiper (*Actitis macularia*), solitary sandpiper (*Tringa solitaria*), least sandpiper (*Calidris minutilla*), pectoral sandpiper (*C. melanotos*), semipalmated plover (*C. pusilla*), and greater (*T. melanoleuca*) and lesser (*T. flavipes*) yellowlegs. Some of these species, such as dunlin (*C. alpina*) and some sandpipers, often winter on TVA reservoirs (Simbeck pers. comm.).

In general, shorebirds need moist flats exposed by early August. These areas are important foraging areas during fall migration. The best conditions occur when the drawdown is slow and continuous. The prevalence of a continuous amount of moist soil conditions supports a prey base by not allowing all of the flats to dry out at the same time (Nicholson pers. comm.). Several reservoirs, such as Kentucky and Douglas, are currently operated at levels that are favorable to shorebirds. Pickwick and Wheeler Reservoirs also attract shorebirds but to a lesser extent, as flats on these reservoirs become exposed later in the migratory season.

Ring-billed (*Larus delawarensis*), herring (*L. argentatus*), and other gulls roost and feed in the immediate vicinity of several TVA hydroelectric dams. Although some gulls use these areas during summer, the highest abundance of gulls is during winter (December to March). These birds have become accustomed to feeding on shad and other forage fish that are killed or are otherwise stunned by dam releases (Simbeck pers. comm.). Gull feeding activity therefore may depend on the timing and duration of dam spillage.

Most waterfowl in the Valley are migratory and usually are present during fall and winter. While dabbling ducks (such as mallard [*Anas platyrhynchos*], gadwall [*Anas strepera*], American black duck [*Anas rubripes*], and blue-winged teal [*Anas discors*]) prefer more shallow waters, diving ducks (such as scaup [*Aythya* sp.], redhead [*Aythya americana*], and canvasback [*Aythya valisineria*]) forage in deeper waters. Depending on the species, the following conditions along reservoirs provide habitat for a favorable diversity of waterfowl: a mixture of water depths, wetlands, riparian vegetation, aquatic macrophytes, shallow-flooded overbank, vegetated flats, and agricultural fields.

Migrating waterfowl of the Valley include blue-winged teal, northern pintail (*Anas acuta*), ring-necked duck (*Aythya collaris*), American widgeon (*Anas americana*), common loon (*Gavia immer*), Northern shoveler (*Anas clypeata*), and gadwall. Nesting waterfowl in the Valley includes wood duck (*Aix sponsa*), Canada goose (*Branta canadensis*), mallard, and occasionally pied-billed grebe (*Podilymbus podiceps*), blue-winged teal, and hooded merganser (*Lophodytes cucullatus*). Numbers of migrating and wintering waterfowl vary in the region, depending on weather conditions, flyway populations, and other factors. Waterfowl tend to

favor reservoirs with a mixture of vegetated flats and abundant emergent vegetation that provides cover and foraging opportunities. The majority of the waterfowl use on the Tennessee River occurs on the mainstem. The largest concentrations of waterfowl are observed on Kentucky, Wheeler, and Guntersville Reservoirs.

Game birds found in lowland communities include Common snipe (*Gallinago gallinago*), American woodcock (*Scolopax minor*), and eastern wild turkey (*Meleagris gallopavo* spp.). Raptors that use these habitats and nearby reservoirs include osprey (*Pandion haliaetus*), red-shouldered hawk (*Buteo lineatus*), barred owl (*Tyto alba*), and screech owl (*Otus asio*). Bottomland hardwood forests have been ranked among the highest priority of areas that provide optimal habitat for Neotropical songbirds (Hunter et al. 1993). Neotropical songbirds found in lowland habitats in the study area include prothonotary warbler (*Protonotaria citrea*), red-eyed vireo (*Vireo olivaceus*), wood thrush (*Hylocichla mustelina*), northern parula (*Parula americana*), yellow-throated warbler (*Dendroica dominica*), Louisiana waterthrush (*Seiurus motacilla*), and Baltimore oriole (*Icterus galbula*). Species such as the common yellowthroat (*Geothlypis trichas*), indigo bunting (*Passerina cyanea*) and belted kingfisher (*Ceryle alcyon*) use river islands in the study area.

Furbearers, such as muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), river otter (*Lontra canadensis*), beaver (*Castor canadensis*), and raccoon (*Procyon lotor*), use wetlands, river islands, and shoreline habitats in the study area for foraging and shelter. Beaver are prevalent in the Valley; their dams, which often create wetland habitats, can be found along the tributaries to TVA reservoirs. Beaver may be associated with changes in reservoir levels, especially in areas where low-gradient streams are influenced by a reservoir (Atkins pers. comm.). Areas influenced by beaver flooding often contain standing dead trees, which provide habitat for cavity-nesting birds and den sites for mammals, and serve as perches for foraging birds. Larger mammals (such as white-tailed deer [*Odocoileus virginianus*] and black bear [*Ursus americanus*]) also depend on lowland communities (such as riparian forests, vegetated shorelines, and wetlands) for food and cover.

Both game and non-game wildlife species found along the reservoirs depend on riparian forests as travel corridors. Dead wood from these forests provides floating logs along the shorelines. Wood accumulation creates basking sites and cover for turtles, snakes, and other species of wildlife (NAS 2002). Small mammals, birds, turtles, and snakes may also find foraging opportunities on these logs.

Some non-game species, such as frogs, toads, and salamanders, are highly dependent on habitats that support moist conditions. Non-game wildlife commonly occurring in lowland communities associated with reservoirs include small mammals, such as little brown bat (*Myotis lucifugus*), least shrew (*Cryptotis parva*), southern flying squirrel (*Glaucomys volans*), and white-footed mouse (*Peromyscus leucopus*). Amphibians found in lowland communities associated with reservoirs include bullfrog (*Rana catesbiana*), green frog (*Rana clamitans*), southern leopard frog (*Rana utricularia*), gray treefrog (*Hyla versicolor*), eastern newt (*Notophthalmus viridescens*), southern two-lined salamander (*Eurycea bislineata*), and several species in the mole salamander group—including mole (*Ambystoma talpoideum*), spotted (*Ambystoma maculatum*), and marbled

(*Ambystoma opacum*) salamanders. Reptiles found in lowland communities associated with reservoirs include common snapping turtle (*Chelydra serpentina*), red-eared slider (*Trachemys scripta*), painted turtle (*Chrysemys picta*), Ouachita map turtle (*Trachemys scripta*), common musk turtle (*Sternotherus odoratus*), spiny softshell (*Apalone spnifera*), northern water snake (*Nerodia sipedon*), eastern worm snake (*Carphophis amoenus*), and eastern cottonmouth (*Agkistrodon piscivorus*).

Like other species of wildlife, aquatic turtles have adapted to the dynamic conditions of the reservoir system. Most species of turtles in the Valley are highly aquatic; however, they depend on riparian habitats for nesting. Features such as shallow water with emergent vegetation, overhanging banks, expose sandbars, muskrat lodges, and rotting stumps along the shoreline provide nesting and basking habitat for turtles. The food habitats of aquatic turtles vary by species, but aquatic invertebrates, aquatic plants, and small fish are important components of their diet.

Important habitats in lowland communities in the study area that are used by non-game wildlife include vernal ponds, waterholes, and caves. Vernal ponds are temporary shallow pools, often found in woodlands. These areas are seasonally to semi-permanently flooded by rainfall, groundwater movement or reservoir overflow. Vernal ponds are often used as breeding sites for insects, salamanders, turtles, frogs, and toads.

Caves are sensitive ecological communities that are strongly influenced by conditions that limit light and nutrients and also maintain somewhat stable temperature and humidity levels. Many terrestrial animals depend on caves during all or part of their life cycle. These animals include birds, bats, rodents, salamanders, and insects. While caves are not restricted to lowland communities, the microclimate of many caves along the Tennessee River is influenced by reservoir levels. Numerous caves and rock shelters are located at the reservoir water level; therefore, water fluctuations within caves often determine the extent of wildlife use of a particular cave. Caves are habitats that are used by rare animals as well as more common species. Many caves in the Valley are threatened by recreational activities and uninformed human activities that cause disturbance to these environments. For the most part, cave-dwelling species have adapted to the dynamic changes in reservoir levels as a result of periodic flooding, and raising and lowering reservoir levels.

Water resources with subsurface connections to the reservoir, such as sinkholes, ponds, and quarries, are also used by wildlife. For example, bats often occupy crevices in sinkholes, and vultures can be found nesting around abandoned rock quarries.

D5.3.2 Associated Wildlife in Upland Areas

Upland communities include deciduous and coniferous woodlands, agricultural lands, old fields, and other early successional habitats. These areas may have an aquatic component, such as a wetland or a stream; however, they are generally located on dry sites and are not affected by periodic flooding. Seeps, springs, and streams that occur within upland communities provide a source of water for terrestrial animals that live there and may provide the very component that

creates breeding and foraging habitat for invertebrates, reptiles, amphibians, birds, and mammals of the area. In many cases, drier upland habitats contain a lower diversity of wildlife species and are less productive from a wildlife standpoint than are lowland moist habitats. However, distinctive animal species are associated with upland communities, and it is important to note that many upland species regularly rely on lowland habitats for food, refuge, reproduction, and migration. Important habitat features found in upland communities include bluffs, rock outcrops, rock shelters, caves, and rock debris.

Migratory birds typically associated with uplands fall into the category of game birds, raptors, and neotropical songbirds. Game birds found in upland fields and forests include northern bobwhite (*Colinus virginianus*), mourning dove (*Zenaida macroura*), ruffed grouse (*Bonasa umbellus*), and American crow (*Corvus brachyrhynchos*). Raptors associated with fields and forests include red-tailed hawk (*Buteo jamaicensis*), broad winged hawk (*Buteo platypterus*), great horned owl (*Bubo virginianus*), Cooper's hawk (*Accipiter cooperii*), and American kestrel (*Falco sparverius*).

Southern Appalachian forests support some of the richest bird diversity in North America (Simons et al. 1998). Neotropical songbirds found in upland forests include summer tanager (*Piranga olivacea*), scarlet tanager (*Piranga rubra*), ovenbird (*Seiurus aurocapillus*), Kentucky warbler (*Oporornis formosus*), hooded warbler (*Wilsonia citrina*), black-and-white warbler (*Mniotilta varia*), and worm-eating warbler (*Helmitheros vermivorus*). Neotropical songbirds found in field communities include barn swallow (*Hirundo rustica*), prairie warbler (*Dendroica discolor*), common yellowthroat, white-eyed vireo (*Vireo griseus*), and field sparrow (*Spizella pusilla*).

Game mammals that occur in fields and forest of the Valley include elk (*Cervus elaphus*), black bear, white-tailed deer, bobcat (*Lynx rufus*), coyote (*Canis latrans*), and gray (*Urocyon cinereoargenteus*) and red (*Vulpes vulpes*) fox. Smaller game animals include woodchuck (*Marmota monax*), eastern gray squirrel (*Sciurus carolinensis*), and eastern cottontail (*Sylvilagus floridana*). Fox squirrel (*Sciurus niger*), coyote, and striped skunk (*Mephitis mephitis*) are found in both wet and drier habitats.

As with lowland communities, habitat features such as caves, vernal ponds, and waterholes are important in producing habitat diversity in upland communities in the study area. Non-game wildlife found in upland communities of the Valley includes small mammals such as eastern mole (*Scalopus aquaticus*), eastern chipmunk (*Tamias striatus*), eastern pipestrille (*Pipistrellus subflavus*), red bat (*Lasiurus borealis*), short-tailed shrew (*Blarina brevicauda*), deer mouse (*Peromyscus maniculatus*), and cotton rat (*Sigmodon hispidus*).

Reptiles and amphibians found in upland communities include spring peeper (*Pseudacris crucifer*), eastern narrowmouth toad (*Gastrophryne carolinensis*), eastern spadefoot (*Scaphiopus holbrookii*), American toad (*Bufo americanus*), upland chorus frog (*Pseudacris triseriata*), fence lizard (*Sceloporus undulatus*), eastern box turtle (*Terrapene carolina*), slimy salamander (*Plethodon glutinosus*), ringneck snake (*Diadophis punctatus*), black racer (*Coluber*

constrictor), northern copperhead (*Agkistrodon contortix*), gray rat snake (*Elaphe obsoleta*), and eastern hognose snake (*Heterodon platirhinos*).

D5.3.3 Terrestrial Animal Resources Unique to the Physiographic Regions in the Tennessee River Watershed

Because of their size, the mainstem reservoirs contain more wildlife habitat than tributary reservoirs. Mainstream reservoirs contain more flats, wintering waterfowl and gulls, heron colonies and wetlands than the tributary reservoirs. Several noteworthy terrestrial resources are associated with the physiographic regions in the study area.

In the Blue Ridge Physiograhic Region, the isolated and riverine conditions of Wilbur Reservoir attract large numbers of waterfowl, such as bufflehead (*Bucephala albeola*), hooded merganser, common golden-eye (*Bucephala clangula*), and white-winged scoter (*Melanitta fusca*) (Cottrell pers. comm.).

A population of green anoles (*Anolis carolinensis*), a lizard species that reaches its northernmost distribution in the Ridge and Valley Physiographic Region, occurs along Tellico Reservoir. Douglas Reservoir provides extensive flats and shallow-water habitats that are used heavily by migrating shorebirds and wading birds. Agricultural areas along Chickamauga Reservoir provide valuable habitat for migrating sandhill cranes (*Grus canadensis*). Watts Bar Reservoir is known to support large numbers of osprey.

In the Cumberland Plateau Physiographic Region, large stands of bottomland hardwoods/ forested wetlands occur on Guntersville Reservoir. Guntersville supports a large number of wintering ducks, and particularly large beaver impoundments are found on this reservoir. Guntersville Reservoir also supports an extensive network of caves and sandstone shelters and a large number of islands that are critical breeding areas for wading birds and amphibians. Upper Bear Creek Reservoir contains unique habitats, such as sandstone outcrops and remnant cove hardwood habitats, which are extremely rare in northwest Alabama. These communities provide habitat for a variety of amphibians, birds, and mammals.

Large tracts of bottomland hardwoods occur on Kentucky Reservoir in the Highland Rim and Coastal Plain Physiographic Regions. Kentucky Reservoir supports more waterfowl than any other impoundment in the Tennessee River system. Large numbers of gulls are known to congregate at Kentucky Dam during winter. Beaver impoundments on Kentucky Reservoir play an important role in wildlife habitat diversity there.

On Pickwick Reservoir, in the Coastal Plain Physiographic Region, gravel bars provide foraging areas for gulls and bald eagles (*Haliaeetus leucocephalus*) during fall and winter. A large number of gulls spend the winter foraging near Pickwick Dam. Numerous flooded sinkholes adjacent to Pickwick Reservoir provide habitat for wading birds and amphibians.

Wheeler Dam, in the Highland Rim Physiographic Region, supports a large wintering gull population. Large numbers of waterfowl winter on Wheeler Reservoir. American alligators

(*Alligator mississippiensis*) use waterholes near Wheeler Reservoir in winter (Atkins pers. comm.).

D5.4 Literature Cited

D5.4.1 References

Amundsen, C. C. 1994. Reservoir Riparian Zone Characteristics in the Upper Tennessee River Valley. Water, Air and Soil Pollution 77:460-593.

Hunter, W. C., D. N. Pashly, and R. E. F. Escano. 1993. Neotropical Migratory Landbird Species and Their Habitats of Special Concern within the Southeast Region. In: Finch, D. M., P. W. Stangel (eds.). Status and Management of Neotropical Migratory Birds: Proceedings of Workshop; 1992 September 21-25; Estes Park, CO. Gen. Tech. Rep. RM-229. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 159-171.

NAS. See National Academy of Sciences.

National Academy of Sciences. 2002. Riparian Areas: Functions and Strategies for Management**.** 2002. Washington, D.C. National Academy Press

NatureServe Explorer: An Online Encyclopedia of life [web application]. 2001. Version 1.6 Arlington, VA, USA: NatureServe. Available: http://www.natureserve.org/explorer. (Accessed: December 12, 2002).

Ricketts, T. H., E. Dinerstein, D. M. Olson, C. J. Loucks, et al. 1999. Terrestrial Ecoregions of North America: A Conservation Assessment**.** Washington, D.C. Island Press. 485 pages.

Simons, T. R., K. N. Rabenold, D. A. Buehler, J. Collazo, and K. E. Franzreb. 1998. The Role of Indicator Species: Neotropical Migrant Songbirds. Pp. 187-208 in J. Peine (ed.). Ecosystem Management for Sustainability: Principles and Practices Illustrated by a Regional Biosphere Cooperative. Lewis Publ., Boca Raton, FL.

Tennessee Valley Authority. 2001. Final Environmental Impact Statement – Guntersville Reservoir Land Management Plan, Volume 1. Guntersville, AL.

TVA. See Tennessee Valley Authority.

Webb, D. H., W. M. Dennis and A. L. Bates, 1988. An Analysis of the Plant Community of Flats of TVA Mainstream Reservoirs. Pp. 177-198 in Snyder, D. H. (ed.). Proceedings of the First Annual Symposium on the Natural History of Lower Tennessee and Cumberland River Valleys. The Center for Field Biology of Land between the Lakes, Austin Peay State University, Clarksville, TN.

D5.4.2 Personal Communications

Atkins, S. 2002. Personal communication. TVA Regional Wildlife Biologist. Guntersville, AL.

Cottrell, S. 2002. Personal communication. TVA Regional Wildlife Biologist. Norris, TN.

Nicholson, C. P. 2002. Personal communication, TVA Senior NEPA Specialist. Knoxville, TN.

Simbeck, D. 2002. Personal communication. TVA Biologist. Muscle Shoals, AL.

D5.4.3 Additional Sources Consulted

Brinson, M. M., B. L. Swift, R. C. Plantico, and J. S. Barclay. 1981. Riparian Ecosystems: Their Ecology and Status. U. S. Fish and Wildlife Service, Biological Services Program. (FWS/OBS-81/17.) Washington, D.C.

Chester, E. W. and W. H. Ellis. 1989. Plant Communities of Northwestern Middle Tennessee. Journal of the Tennessee Academy of Science. 64(3):75-78.

Clebsch, E. E. C. 1989. Vegetation of the Appalachian Mountains of Tennessee East of the Great Valley. Journal of the Tennessee Academy of Science. 64(3):79-83.

DeSelm, H. R. 1989. The Barrens of Tennessee. Journal of the Tennessee Academy of Science. 64(3):89-93.

Ellis, W. H. and E. W. Chester. 1989. Upland Swamps of the Highland Rim of Tennessee. Journal of the Tennessee Academy of Science. 64(3):97-101.

Fralish, J. S. and F. B. Crooks. 1989. Forest Composition, Environment and Dynamics at Land Between the Lakes in Northwest Middle Tennessee. Journal of the Tennessee Academy of Science. 64(3):107-111.

Hinkle, C. R. 1978. The Relationship of Forest Communities and Selected Species to Edaphic and Topographic Factors on the Cumberland Plateau of Tennessee. Ph. D. Dissertation, The University of Tennessee, Knoxville, TN. 262 pages.

_____. 1989. Forest Communities of the Cumberland Plateau of Tennessee. Journal of the Tennessee Academy of Science. 64(3):123-129.

Jones, R. L. 1989. A Floristic Study of Wetlands on the Cumberland Plateau of Tennessee. Journal of the Tennessee Academy of Science. 64(3):131-134.

Küchler, A. W. 1964. Potential Natural Vegetation of the Conterminous United States. American Geographical Society, NY. Map.

Martin, W. H. 1989. Forest Patterns in the Great Valley of Tennessee. Journal of the Tennessee Academy of Science. 64(3):137-143.

Martin, W. H., S. G. Boyce, and A. C. Echternacht (eds.). 1993. Biodiversity of the Southeastern United States: Upland Terrestrial Communities. John Wiley and Sons, NY. 373 pages.

Mitsch, W. J. and J. G. Gosselink. 1992. Wetlands, Edition 2. Van Nostrand Reinhold, NY. 722 pages.

Sharitz, R. R. and W. J. Mitsch. 1993. Southern Floodplain Forests. Pages 311-372 in Martin, W. H., S. G. Boyce, and A. C. Echternacht (eds.). Biodiversity of the Southeastern United States: Lowland Terrestrial Communities. John Wiley and Sons, Inc. NY.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Terrestrial Technical Report. Report 5 of 5. Atlanta: U.S. Department of Agriculture, Forest Service, Southern Region.

Tennessee Valley Authority. 1941. Areas Characterized by Principal Forest Types in the Tennessee Valley (map). Department of Forest Relations.

_____. 1998. Shoreline Management Initiative: An Assessment of Residential Shoreline Development Impacts in the Tennessee Valley—Final Environmental Impact Statement. Knoxville, TN.

_____. 1999. Draft Environmental Impact Statement, Tims Ford Reservoir: Land Management and Disposition Plan. Knoxville, TN.

Weaver, J. E. and F. E. Clements. 1938. Plant Ecology. McGraw-Hill Publishing Company, NY. 601 pages.

Webb, D. H. and A. L. Bates. 1989. The Aquatic Vascular Flora and Plant Communities along Rivers and Reservoirs of the Tennessee River System. Journal of the Tennessee Academy of Science. 64(3): 197-203.