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RESOURCE MANAGEMENT PLAN FOR THE OAK RIDGE RESERVATION

VOLUME 27: WILDLIFE MANAGEMENT PLAN

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Environmental Sciences Division
Publication No. 3909



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ENVIRONMENTAL SCIENCES DIVISION

RESOURCE MANAGEMENT PLAN FOR THE OAK RIDGE RESERVATION

VOLUME 27: WILDLIFE MANAGEMENT PLAN

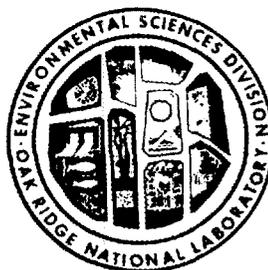
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Date Published -- June 1992

This volume replaces Volume 16 of the Resource Management Plan.



Prepared for the
Oak Ridge National Environmental Research Park
Office of Health and Environmental Research
(Activity No. 26 45 01 00 1)

Environmental Sciences Division Publication No. 3909

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400



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ABSTRACT

A plan for management of the wildlife resources on the U.S. Department of Energy's Oak Ridge Reservation is outlined in this document. Management includes wildlife population control (hunts, trapping, and removal), handling specific problems with wildlife, restoration of species, coordination with researchers on wildlife studies, preservation and management of habitats, and law enforcement. Wildlife resources are divided into five categories, each with a specific set of objectives and procedures for obtaining these objectives. These categories are (1) species-richness management to ensure that all resident wildlife species exist on the Reservation in viable numbers; (2) featured species management to produce selected species in desired numbers on designated land units; (3) management of game species for research, education, recreation, and public safety; (4) endangered species management designed to preserve and protect both the species and habitats critical to the survival of those species; and (5) pest management. Achievement of the objectives is a joint effort between the Tennessee Wildlife Resources Agency and the Oak Ridge National Laboratory's Environmental Sciences Division.

1. INTRODUCTION AND OBJECTIVES

The 35,252 acre (14,100 ha) Oak Ridge Reservation (ORR) was designated a wildlife management area on November 30, 1984, in a 5-year cooperative agreement between the Tennessee Wildlife Resources Agency (TWRA) and the Department of Energy--Oak Ridge Operations (DOE-ORO). The cooperative agreement was renewed for an additional 5 years on December 1, 1989. This management plan will (1) define wildlife management on the Reservation and (2) establish long-term wildlife goals, with specific objectives for the period FY 1991 through FY 1995.

Management objectives are divided into five categories that are discussed in greater detail under the actual planning portion of this document. These are (1) species-richness management, (2) management of featured species, (3) game species management, (4) management of threatened or endangered species, and (5) pest management. This document updates the 1984 Resource Management Plan for Wildlife (Kitchings and Story), which was prepared prior to designation of the ORR as a wildlife management area.

Management of wildlife on an area as large as the ORR is necessary in order to ensure public safety (i.e., by reducing the number of deer/vehicle collisions) and maximize wildlife health and diversity. Maintaining critical habitats is essential in the preservation of listed (state or federal) rare species. Characterizing habitats and understanding wildlife requirements are necessary for making decisions regarding the species or community and evaluating potential impacts. Information on the types of habitats present, on wildlife diversity, and on protected habitat locations is necessary in land use planning and decision making. Additionally, information collected through the wildlife program will be used in regional forest and wildlife management through the TWRA.

2. LEGISLATIVE BACKGROUND FOR MANAGEMENT OF WILDLIFE ON FEDERAL LANDS

A number of federal laws were enacted during the 1970s to address the need for management of natural resources on federally owned lands. These included the National Environmental Policy Act of 1969; the Endangered Species Act of 1973, which mandates the conservation of endangered and threatened species and of the habitats supporting them; the Sikes Act (1974), which calls for new directions and cooperation with the states in planning and management of wildlife habitat on federal lands; and the Federal Land Policy and Management Act of 1976, which directs that federal lands be inventoried, that their uses be planned on a multiple-use and sustained-yield basis, and that they be managed on a sound ecological basis. Of these, the Sikes Act applies directly to ORR. It states that the "Secretary of the Interior shall develop, with the prior written approval of the Atomic Energy Commission (AEC), a comprehensive plan for conservation and rehabilitation programs to be implemented on public land under the jurisdiction of the Chairman of the AEC." It further states that "each comprehensive plan developed...shall be consistent with any overall land-use and management plans for the lands involved." The term "public land" includes all lands under the jurisdiction of DOE. The term "conservation and rehabilitation programs" means to "...utilize those methods and procedures which are necessary to protect, conserve, and enhance wildlife, fish, and game resources to the maximum extent practicable ...consistent with any overall land-use and management plans for the lands involved." These legislative acts laid the groundwork for establishing a wildlife management plan for the ORR in cooperation with TWRA.

In November 1984, DOE-OR and TRWA entered into a cooperative agreement for the establishment of a wildlife management area at ORR (Cooperative Agreement 1984) for a 5-year period. This agreement was extended for an additional 5 years on December 1, 1989 (Cooperative Agreement 1989). A copy of the current agreement is in the appendix. In the cooperative agreement, TWRA accepts the responsibility to provide wildlife protectors for enforcing Tennessee game and fish laws, rules, and regulations. TWRA also agrees, "consistent with the Government's programmatic use of lands, to develop the area for wildlife species by the application of scientific management techniques that are compatible with good land use, and to carry out other wildlife oriented projects as specified" in the wildlife management plan. This document is the wildlife management plan referred to.

3. DEFINITION OF WILDLIFE MANAGEMENT

Wildlife management is the "science and art of changing the characteristics and interactions of habitats, wild animal populations, and men in order to achieve specific human goals by means of the wildlife resource" (Giles 1969). Wildlife management is an interdisciplinary science, with management decisions based on ecological principles. The diversity of wildlife species and quantity of particular species are usually a result of the types of habitat available. Habitat may be managed for a particular goal or may be the result of other land uses (waste management sites, security clearing, powerlines, etc.).

The "Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974" (1974) defines "management" as meaning "the collection and application of biological information for the purposes of increasing the number of individuals within species and populations of wildlife up to the optimum carrying capacity of their habitat and maintaining such levels. The term includes the entire range of activities that constitute a modern scientific resource program including, but not limited to, research, census, law enforcement, habitat acquisition and improvement, and education. Also included within the term, when and where appropriate, is the periodic or total protection of species or populations as well as regulated taking."

Historically, at least through the 1960s, wildlife management was production-oriented, that is, land management was directed toward a goal of producing the highest yield of game species for recreational harvesting. In the southeastern United States, these species usually were quail, wild turkey, and white-tail deer. Wildlife management and research in the 1970s grew rapidly and diversified. The Endangered Species Act of 1973 was indicative of public concern and an appreciation for nongame animals in general, and, as a result, most state wildlife agencies embarked on nongame research programs that supplemented more traditional efforts toward the maintenance and expansion of game species.

Songbird and small mammal species were studied in a variety of forest types, and the community became the unit of study, with diversity being the major indicator of habitat quality (Landers and Johnson 1980). Habitat analysis was conducted at all levels of resolution. Microscale habitat data were used to determine the physical characteristics of forests that influenced the structure of avian communities, and the same techniques were applied to small mammal communities.

Wildlife management in its present form ranges from single species management, to management of communities consisting of many species, to management of ecoregions, each consisting of many different communities distributed over a region. In state wildlife agencies, there is a trend to expend more effort on nongame species, mostly in response to public demands for greater equity of management for game and nongame species on public lands. The demand for greater nongame research has also resulted in a tendency to depart from single-species management. The large number of nongame species has caused nongame management to focus on the community and bioregion levels. Responsible agencies are searching for

management techniques that will maximize the diversity of nongame communities and benefit as many game species as possible. Nevertheless, single-species management remains important to game species and to those species that are rare or endangered.

4. OAK RIDGE RESERVATION WILDLIFE

The diverse vegetational communities on the Oak Ridge Reservation create favorable habitats for a wide variety of animal species typical of eastern Tennessee. The nature of the habitat of an area greatly influences the animal species that can occupy it. Small mammals such as mice or rats may be limited to a single habitat type, while the larger mammals, such as fox or deer, may range over and be dependent on several habitats. As a result, the boundaries of animal communities are not as clearly demarcated as those of plants. Most of the birds and mammals found on the Oak Ridge Reservation have the capability of tolerating and adapting to a variety of habitats and therefore may be found in habitats other than those which are considered typical for the respective species (USDOE 1980).

Species checklists for the Oak Ridge Reservation vertebrates (fishes, amphibians, reptiles, birds, and mammals) are provided in Tables 1-5, respectively. These checklists represent a compilation of information from a variety of sources: (Kitchings and Mann 1976, Johnson 1964, USDOE 1987, Dahlman et al. 1977, Meyers 1987, Ryon and Loar 1988, Klein 1987). Of the biota, only vertebrates have been included; however, information is available from various sources on the terrestrial and aquatic invertebrate population (Kitchings and Mann 1976; Loar 1981a, 1981b, 1985, 1986a, 1986b, 1987; Morton 1962). Additional information on the rare fauna on the ORR is found in the Resource Management Plan for Threatened and Endangered Animal Species (Kroodsma 1987).

Information on the small mammals of the ORR has been obtained by studies of populations in varied habitats and through collections for laboratory experiments. Data for the large mammals have been accrued by sighting, trapping, road kills, track studies, radiocollar studies, and deer hunts. Information on birds was acquired mainly by field observations. Data for amphibians and reptiles were obtained by field studies and collections. Fish were collected or observed by netting, electrofishing and seining.

On the checklists, the common name of the animal is listed along with genus, species, and authority (in some cases). The species are broken down by order (suborder) and family.

Figure 1 depicts representative habitat types on the ORR. Most of the small mammals have home ranges of only a few acres, and some species are restricted to certain habitats. However, some species, such as the southeastern shrew (smallest mammal on the ORR), occur in practically every habitat. At least nine species of bats (all small) feed on insects over all the habitats. During the day, the bats roost in caves, hollow trees, under leaves, and in buildings. The long-tailed weasel, although small, ranges over a square mile or more in most habitats in searches for prey. The striped skunk is less mobile but is found in varied habitats. Larger mammals, such as raccoon, red and gray foxes, coyote, bobcat, cougar, and white-tailed, deer travel for miles through most habitats.

Table 1. Fish of the Oak Ridge Reservation

		<u>TWRA Status</u>
Paddlefish	<i>Polyodon spathula</i>	
Spotted gar	<i>Lepisosteus oculatus</i>	
Longnose gar	<i>L. osseus</i>	
Skipjack herring	<i>Alosa chrysochloris</i>	
Gizzard shad	<i>Dorosoma cepedianum</i>	
Threadfin shad	<i>D. petenense</i>	
Mooneye	<i>Hiodon tergisus</i>	
Northern pike	<i>Esox lucius</i>	
Stoneroller	<i>Campostoma anomalum</i>	
Goldfish	<i>Carassius auratus</i>	
Grass carp	<i>Ctenopharyngodon idella</i>	
Carp	<i>Cyprinus carpio</i>	
Golden shiner	<i>Notemigonus crysoleucas</i>	
Rosefin shiner	<i>Lythrurns ardens</i>	
Emerald shiner	<i>Notropis atherinoides</i>	
Striped shiner	<i>Luxilus chrysocephalus</i>	
Spotfin shiner	<i>Cyprinella spiloptera</i>	
Tennessee dace	<i>Phoxinus tennesseensis</i>	NM ^a
Bluntnose minnow	<i>Pimephales notatus</i>	
Fathead minnow	<i>P. promelas</i>	
Blacknose dace	<i>Rhinichthys atratulus</i>	
Creek chub	<i>Semotilus atromaculatus</i>	
River carpsucker	<i>Carpionodes carpio</i>	
Quillback	<i>C. cyprinus</i>	
White sucker	<i>Catostomus commersoni</i>	
Northern hogsucker	<i>Hypentelium nigricans</i>	
Smallmouth buffalo	<i>Ictiobus bubalus</i>	
Black buffalo	<i>I. niger</i>	
Spotted sucker	<i>Minytrema melanops</i>	
Silver redhorse	<i>Moxostoma anisurum</i>	
Black redhorse	<i>M. duquesnei</i>	
Golden redhorse	<i>M. erythrurum</i>	
Blue catfish	<i>Ictalurus furcatus</i>	
Channel catfish	<i>Ictalurus furcatus</i>	
Black bullhead	<i>Ameiurus melas</i>	
Yellow bullhead	<i>A. natalis</i>	
Flathead catfish	<i>Pylodictis olivaris</i>	
Mosquito fish	<i>Gambusia affinis</i>	
Brook silverside	<i>Labidesthes sicculus</i>	
Brook stickleback	<i>Culaea inconstans</i>	
White bass	<i>Morone chrysops</i>	
Yellow bass	<i>M. mississippiensis</i>	
Striped bass	<i>M. saxatilis</i>	
Rock bass	<i>Ambloplites rupestris</i>	
Redbreast sunfish	<i>Lepomis auritus</i>	
Green sunfish	<i>L. cyanellus</i>	
Warmouth	<i>L. gulosus</i>	
Bluegill	<i>L. macrochirus</i>	

Table 1. Fish of the Oak Ridge Reservation (continued)

		<u>TWRA Status</u>
Longear sunfish	<i>L. megalotis</i>	
Redear sunfish	<i>L. microlophus</i>	
Smallmouth bass	<i>Micropterus dolomieu</i>	
Spotted bass	<i>M. punctulatus</i>	
Largemouth bass	<i>M. salmoides</i>	
White crappie	<i>Pomoxis annularis</i>	
Greenside darter	<i>Etheostoma blennioides</i>	
Black darter	<i>E. duryi</i>	
Stripetail darter	<i>E. kennicotti</i>	
Snubnose darter	<i>E. simoterum</i>	
Yellow perch	<i>Perca flavescens</i>	
Logperch	<i>Percina caprodes</i>	
Sauger	<i>Stizostedion canadense</i>	
Freshwater drum	<i>Aplodinotus grunniens</i>	
Banded sculpin	<i>Cottus carolinae</i>	

^aNM = in need of management.

Source: From Ryon, M. G., and J. M. Loar. 1988. A checklist of fishes on the Department of Energy Oak Ridge Reservation. J. Tenn. Acad. Sci. 63(4):97-102.

Table 2. Amphibians of the Oak Ridge Reservation

Class Amphibia—Amphibians		<u>TWRA Status</u>
<u>Order Urodela—Salamanders</u>		
Family Ambystomatidae		
Spotted salamander	<i>Ambystoma maculatum</i> (Shaw)	
Marbled salamander	<i>Ambystoma opacum</i> (Garvenhorst)	
Family Cryptobranchidae		
Hellbender	<i>Cryptobranchus alleganiensis</i> (Daudin)	NM ^a
Family Salamandridae		
Eastern newt	<i>Notophthalmus viridescens</i> (Rafinesque)	NM ^a
Family Plethodontidae		
Green salamander	<i>Aneides aeneus</i> (Cope & Packard)	
Dusky salamander	<i>Desmognathus fuscus</i> (Rafinesque)	
Two-lined salamander	<i>Eurycea bislineata</i> (Green)	
Long-tailed salamander	<i>Eurycea longicauda</i> (Green)	
Cave salamander	<i>Eurycea lucifuga</i> (Rafinesque)	
Spring salamander	<i>Gyrinophilus porphyriticus</i> (Green)	
Redbacked salamander	<i>Plethodon cinereus</i> (Green)	
Slimy salamander	<i>Plethodon glutinosus</i> (Green)	
Mud salamander	<i>Pseudotriton montanus</i> (Baird)	
Red salamander	<i>Pseudotriton ruber</i> (Sonnini)	
<u>Order Anura—Frogs and Toads</u>		
Family Pelobatidae		
Eastern spadefoot toad	<i>Scaphiopus holbrooki</i> (Harlan)	

Table 2. Amphibians of the Oak Ridge Reservation (continued)

Class Amphibia—Amphibians		<u>TWRA Status</u>
<u>Order Anura—Frogs and Toads (continued)</u>		
Family Bufonidae		
American toad	<i>Bufo americanus</i> (Holbrook)	
Fowler's toad	<i>Bufo woodhousei</i> (Hinckley)	
Family Hylidae		
Northern cricket frog	<i>Acris crepitans</i> (Baird)	
Spring peeper	<i>Hyla crucifer</i> (Wied)	
Gray treefrog	<i>Hyla versicolor</i> (Le Conte)	
Upland chorus frog	<i>Pseudacris triseriata</i> (Wied)	
Family Microhylidae		
Eastern narrowmouth toad	<i>Gastrophryne carolinensis</i> (Holbrook)	
Family Ranidae		
Bullfrog	<i>Rana catesbeiana</i> (Shaw)	
Green frog	<i>Rana clamitans</i> (Latrielle)	
Pickerel frog	<i>Rana palustris</i> (Le Conte)	
Southern leopard frog	<i>Rana sphenoccephala</i> (Cope)	

^aNM = in need of management.

Source: From Klein, J. A. 1989. A checklist of the reptiles and amphibians on the Oak Ridge Reservation, Anderson and Roane Counties, Tennessee. J. Tenn. Acad. Sci. 64(4):228-30.

Table 3. Reptiles of the Oak Ridge Reservation

Class Reptilia-Reptiles		<u>TWRA Status</u>
<u>Order Testudinata-Turtles</u>		
Family Chelydridae		
Snapping turtle	<i>Chelydra serpentina</i> (Linnaeus)	
Family Kinosternidae		
Eastern musk turtle	<i>Sternotherus odoratus</i> (Latrielle)	
Stripenecked musk turtle	<i>Sternotherus minor</i> (Smith & Glass)	
Family Emydidae		
Eastern box turtle	<i>Terrapene carolina</i> (Linnaeus)	
Map turtle	<i>Graptemys geographica</i> (Le Sueur)	
False map turtle	<i>Graptemys pseudogeographica</i> (Cagle)	
Painted turtle	<i>Chrysemys picta</i> (Schneider)	
River cooter	<i>Pseudemys concinna</i> (Le Conte)	
Pond slider	<i>Trachemys scripta</i> (Schoepff)	NM ^a
Family Trionychidae		
Spiny softshell turtle	<i>Trionyx spiniferus</i> (Le Sueur)	
<u>Order Squamata (Lacertilia)-Lizards</u>		
Family Iguanidae		
Eastern fence lizard	<i>Sceloporus undulatus</i> (Green)	
Family Teiidae		
Six-lined racerunner	<i>Cnemidophorus sexlineatus</i> (Linnaeus)	NM ^a
Family Scincidae		
Ground skink	<i>Scincella lateralis</i> (Say)	
Five-lined skink	<i>Eumeces fasciatus</i> (Linnaeus)	
Broadheaded skink	<i>Eumeces laticeps</i> (Schneider)	

Table 3. Reptiles of the Oak Ridge Reservation (continued)

Class Reptilia—Reptiles		<u>TWRA Status</u>
<u>Order Squamata (Serpentes)—Snakes</u>		
Family Colubridae		
Worm snake	<i>Carphophis amoenus</i> (Say)	
Scarlet snake	<i>Cemophora coccinea</i> (Blumenbach)	
Black racer	<i>Coluber constrictor</i> (Linnaeus)	
Ringneck snake	<i>Diadophis punctatus</i> (Linnaeus)	
Corn snake	<i>Elaphe guttata</i> (Linnaeus)	
Rat snake	<i>Elaphe obsoleta</i> (Say)	
Eastern hognose snake	<i>Heterodon platyrhinos</i> (Latrielle)	
Mole snake	<i>Lampropeltis calligaster</i> (Holbrook)	
Milk snake	<i>Lampropeltis triangulum</i> (Lacepede)	
Common kingsnake	<i>Lampropeltis getulus</i> (Yarrow)	
Common water snake	<i>Nerodia sipedon</i> (Linnaeus)	
Rough green snake	<i>Opheodrys aestivus</i> (Linnaeus)	
Queen snake	<i>Regina septemvittata</i> (Say)	
Brown snake	<i>Storeria dekayi</i> (Holbrook)	
Redbelly snake	<i>Storeria occipitomaculata</i> (Storer)	
Eastern garter snake	<i>Thamnophis sirtalis</i> (Linnaeus)	
Smooth earth snake	<i>Virginia valeriae</i> (Baird & Girard)	
Family Viperidae		
Copperhead	<i>Agkistrodon contortrix</i> (Daudin)	

^aNM = in need of management.

Source: From Klein, J. A. 1989. A checklist of the reptiles and amphibians on the Oak Ridge Reservation, Anderson and Roane Counties, Tennessee. J. Tenn. Acad. Sci. 64(4):228-30.

Table 4. Birds of the Oak Ridge Reservation

		<u>TWRA Status</u>
Common loon	<i>Gavia immer</i>	
Pied-billed grebe	<i>Podilymbus podiceps</i>	
Double-crested cormorant	<i>Phalacrocorax auritus</i>	NM ^a
Great blue heron	<i>Ardea herodias</i>	
Great egret	<i>Casmerodius albus</i>	NM ^a
Cattle egret	<i>Bubulcus ibis</i>	
Green-backed heron	<i>Butorides striatus</i>	
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	NM ^a
Yellow-crowned night-heron	<i>Nycticorax violacea</i>	
Tundra swan	<i>Cygnus columbianus</i>	
Canada goose	<i>Branta canadensis</i>	
Wood duck	<i>Aix sponsa</i>	
Green-winged teal	<i>Anas crecca</i>	
American black duck	<i>Anas rubripes</i>	
Mallard	<i>Anas platyrhynchos</i>	
Northern pintail	<i>Anas acuta</i>	
Blue-winged teal	<i>Anas discors</i>	
Gadwall	<i>Anas strepera</i>	
American wigeon	<i>Anas americana</i>	
Canvasback	<i>Aythya valisineria</i>	
Redhead	<i>Aythya americana</i>	
Ring-necked duck	<i>Aythya collaris</i>	
Lesser scaup	<i>Aythya affinis</i>	
Common goldeneye	<i>Bucephala clangula</i>	
Bufflehead	<i>Bucephala albeola</i>	
Hooded merganser	<i>Lophodytes cucullatus</i>	
Common merganser	<i>Mergus merganser</i>	
Red-breasted merganser	<i>Mergus serrator</i>	
Ruddy duck	<i>Oxyura jamaicensis</i>	
Black vulture	<i>Coragyps atratus</i>	NM ^a
Turkey vulture	<i>Cathartes aura</i>	
Osprey	<i>Pandion haliaetus</i>	E ^b
Bald eagle	<i>Haliaeetus leucocephalus</i>	E ^b
Northern harrier	<i>Circus cyaneus</i>	T ^c
Sharp-shinned hawk	<i>Accipiter striatus</i>	T ^c
Cooper's hawk	<i>Accipiter cooperii</i>	T ^c
Red-shouldered hawk	<i>Buteo lineatus</i>	NM ^a
Broad-winged hawk	<i>Buteo platypterus</i>	
Red-tailed hawk	<i>Buteo jamaicensis</i>	
American kestrel	<i>Falco sparverius</i>	
Ruffed grouse	<i>Bonasa umbellus</i>	
Wild turkey	<i>Meleagris gallopavo</i>	
Northern bobwhite	<i>Colinus virginianus</i>	
Common moorhen	<i>Gallinula chloropus</i>	
American coot	<i>Fulica americana</i>	
Killdeer	<i>Charadrius vociferus</i>	
Common snipe	<i>Gallinago gallinago</i>	
American woodcock	<i>Scolopax minor</i>	

Table 4. Birds of the Oak Ridge Reservation (continued)

		<u>TWRA Status</u>
Spotted sandpiper	<i>Actitis macularia</i>	
Ring-billed gull	<i>Larus delawarensis</i>	
Herring gull	<i>Larus argentatus</i>	
Black tern	<i>Chlidonias niger</i>	
Rock dove	<i>Columba livia</i>	
Mourning dove	<i>Zenaida macroura</i>	
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	
Common barn-owl	<i>Tyto alba</i>	NM ^a
Eastern screech-owl	<i>Otus asio</i>	
Barred owl	<i>Strix varia</i>	
Common nighthawk	<i>Chordeiles minor</i>	
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	
Whip-poor-will	<i>Caprimulgus vociferus</i>	
Chimney swift	<i>Chaetura pelagica</i>	
Ruby-throated hummingbird	<i>Archilochus colubris</i>	
Belted kingfisher	<i>Ceryle alcyon</i>	
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	NM ^a
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	NM ^a
Downy woodpecker	<i>Picoides pubescens</i>	
Hairy woodpecker	<i>Picoides villosus</i>	
Northern flicker	<i>Colaptes auratus</i>	
Pileated woodpecker	<i>Dryocopus pileatus</i>	
Eastern wood-pewee	<i>Contopus virens</i>	
Acadian flycatcher	<i>Empidonax virescens</i>	
Least flycatcher	<i>Empidonax minimus</i>	
Eastern phoebe	<i>Sayornis phoebe</i>	
Great crested flycatcher	<i>Myiarchus crinitus</i>	
Eastern kingbird	<i>Tyrannus tyrannus</i>	
Horned lark	<i>Eremophila alpestris</i>	
Purple martin	<i>Progne subis</i>	
N. Rough-winged swallow	<i>Stelgidopteryx serripennis</i>	
Bank swallow	<i>Riparia riparia</i>	
Cliff swallow	<i>Hirundo pyrrhonota</i>	
Barn swallow	<i>Hirundo rustica</i>	
Blue jay	<i>Cyanocitta cristata</i>	
American crow	<i>Corvus brachyrhynchos</i>	
Carolina chickadee	<i>Parus carolinensis</i>	
Tufted titmouse	<i>Parus bicolor</i>	
Red-breasted nuthatch	<i>Sitta canadensis</i>	
White-breasted nuthatch	<i>Sitta carolinensis</i>	
Brown creeper	<i>Certhia americana</i>	
Carolina wren	<i>Thryothorus ludovicianus</i>	
Bewick's wren	<i>Thryomanes bewickii</i>	T ^c
House wren	<i>Troglodytes aedon</i>	
Winter wren	<i>Troglodytes troglodytes</i>	
Golden-crowned kinglet	<i>Regulus satrapa</i>	

Table 4. Birds of the Oak Ridge Reservation (continued)

		<u>TWRA Status</u>
Ruby-crowned kinglet	<i>Regulus calendula</i>	
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>	
Eastern bluebird	<i>Sialia sialis</i>	
Gray-cheeked thrush	<i>Catharus minimus</i>	
Swainson's thrush	<i>Catharus ustulatus</i>	
Hermit thrush	<i>Catharus guttatus</i>	
Wood thrush	<i>Hylocichla mustelina</i>	
American robin	<i>Turdus migratorius</i>	
Gray catbird	<i>Dumetella carolinensis</i>	
Northern mockingbird	<i>Mimus polyglottos</i>	
Brown thrasher	<i>Toxostoma rufum</i>	
Cedar waxwing	<i>Bombycilla cedrorum</i>	
Loggerhead shrike	<i>Lanius ludovicianus</i>	
European starling	<i>Sturnus vulgaris</i>	
White-eyed vireo	<i>Vireo griseus</i>	
Yellow-throated vireo	<i>Vireo flavifrons</i>	
Red-eyed vireo	<i>Vireo olivaceus</i>	
Blue-winged warbler	<i>Vermivora pinus</i>	
Golden-winged warbler	<i>Vermivora chrysoptera</i>	
Tennessee warbler	<i>Vermivora peregrina</i>	
Northern parula warbler	<i>Parula americana</i>	
Yellow warbler	<i>Dendroica petechia</i>	
Chestnut-sided warbler	<i>Dendroica pensylvanica</i>	
Magnolia warbler	<i>Dendroica magnolia</i>	
Cape May warbler	<i>Dendroica tigrina</i>	
Yellow-rumped warbler	<i>Dendroica coronata</i>	
Black-throated green warbler	<i>Dendroica virens</i>	
Yellow-throated warbler	<i>Dendroica dominica</i>	
Pine warbler	<i>Dendroica pinus</i>	
Prairie warbler	<i>Dendroica discolor</i>	
Bay-breasted warbler	<i>Dendroica castanea</i>	
Blackpoll warbler	<i>Dendroica striata</i>	
Cerulean warbler	<i>Dendroica cerulea</i>	
Black-and-white warbler	<i>Mniotilta varia</i>	
American redstart	<i>Setophaga ruticilla</i>	
Prothonotary warbler	<i>Protonotaria citrea</i>	
Worm-eating warbler	<i>Helminthos vermivorus</i>	
Swainson's warbler	<i>Limothlypis swainsonii</i>	NM ^a
Ovenbird	<i>Seiurus aurocapillus</i>	
Louisiana waterthrush	<i>Seiurus motacilla</i>	
Kentucky warbler	<i>Oporornis formosus</i>	
Common yellowthroat	<i>Geothlypis trichas</i>	
Hooded warbler	<i>Wilsonia citrina</i>	
Yellow-breasted chat	<i>Icteria virens</i>	
Summer tanager	<i>Piranga rubra</i>	
Scarlet tanager	<i>Piranga olivacea</i>	
Northern cardinal	<i>Cardinalis cardinalis</i>	
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	

Table 4. Birds of the Oak Ridge Reservation (continued)

		<u>TWRA Status</u>
Blue grosbeak	<i>Guiraca caerulea</i>	
Indigo bunting	<i>Passerina cyanea</i>	
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	
Bachman's sparrow	<i>Aimophila aestivalis</i>	E ^b
Chipping sparrow	<i>Spizella passerina</i>	
Field sparrow	<i>Spizella pusilla</i>	
Grasshopper sparrow	<i>Ammodramus savannarum</i>	T ^c
Henslow's sparrow	<i>Ammodramus henslowii</i>	
Fox sparrow	<i>Passerella iliaca</i>	
Song sparrow	<i>Melospiza melodia</i>	
White-throated sparrow	<i>Zonotrichia albicollis</i>	
Dark-eyed junco	<i>Junco hyemalis</i>	
Red-winged blackbird	<i>Agelaius phoeniceus</i>	
Eastern meadowlark	<i>Sturnella magna</i>	
Common grackle	<i>Quiscalus quiscula</i>	
Brown-headed cowbird	<i>Molothrus ater</i>	
Orchard oriole	<i>Icterus spurius</i>	
Nothorn oriole	<i>Icterus galbula</i>	
Purple finch	<i>Carpodacus purpureus</i>	
Red crossbill	<i>Loxia curvirostra</i>	
Pine siskin	<i>Carduelis pinus</i>	
American goldfinch	<i>Carduelis tristis</i>	
Evening grosbeak	<i>Coccothraustes vespertinus</i>	
House sparrow	<i>Passer domesticus</i>	
House finch	<i>Carpodacus mexicanus</i>	

^aNM = in need of management.

^bE = endangered.

^cT = threatened.

Source: Kroodsmas, R. L. Environmental Sciences Division, Martin Marietta Energy Systems, Inc., personal communication, November 27, 1991.

Table 5. Mammals of the Oak Ridge Reservation

		<u>TWRA Status</u>
Opossum	<i>Didelphis virginian</i>	
Southeastern shrew	<i>Sorex longirostris</i>	NM ^b
Short-tailed shrew	<i>Blarina brevicauda</i>	
Least shrew	<i>Cryptotis parva</i>	
Eastern mole	<i>Scalopus aquaticus</i>	
Little brown bat	<i>Myotis lucifugus</i>	
Keen's bat	<i>Myotis keenii</i>	
Silver-haired bat	<i>Lasionycteris noctivagans</i>	
Eastern pipstrelle	<i>Pipistrellus subflavus</i>	
Big brown bat	<i>Eptesicus fuscus</i>	
Red bat	<i>Lasiurus borealis</i>	
Hoary bat	<i>Lasiurus cinereus</i>	
Evening bat	<i>Nycticeius humeralis</i>	
Eastern cottontail	<i>Sylvilagus floridanus</i>	
Eastern chipmunk	<i>Tamias striatus</i>	
Groundhog	<i>Marmota monax</i>	
Eastern gray squirrel	<i>Sciurus carolinensis</i>	
Southern flying squirrel	<i>Glaucomys volans</i>	
Beaver	<i>Castor canadensis</i>	
Rice rat	<i>Oryzomys palustris</i>	
Eastern harvest mouse	<i>Reithrodontomys humulis</i>	
White-footed mouse	<i>Peromyscus leucopus</i>	
Golden mouse	<i>Ochrotomys nuttalli</i>	
Cotton rat	<i>Sigmodon hispidus</i>	
Pine vole	<i>Microtus pinetorum</i>	
Muskrat	<i>Ondatra zibethica</i>	
Norway rat	<i>Rattus norvegicus</i>	
House mouse	<i>Mus musculus</i>	
Coyote	<i>Canis latrans</i>	
Red fox	<i>Vulpes vulpes</i>	
Gray fox	<i>Urocyon cinereoargenteus</i>	
Raccoon	<i>Procyon lotor</i>	
Long-tailed weasel	<i>Mustela frenata</i>	
Mink	<i>Mustela vison</i>	
Striped skunk	<i>Mephitis mephitis</i>	
Eastern spotted skunk	<i>Spilogale putorius</i>	
Bobcat	<i>Lynx rufus</i>	
Cougar ^a	<i>Felis concolor</i>	E ^c
White-tailed deer	<i>Odocoileus virginianus</i>	

^aMay be accidental or intentional releases from captivity.

^bNM = in need of management.

^cE = endangered.

GENERAL WILDLIFE HABITATS

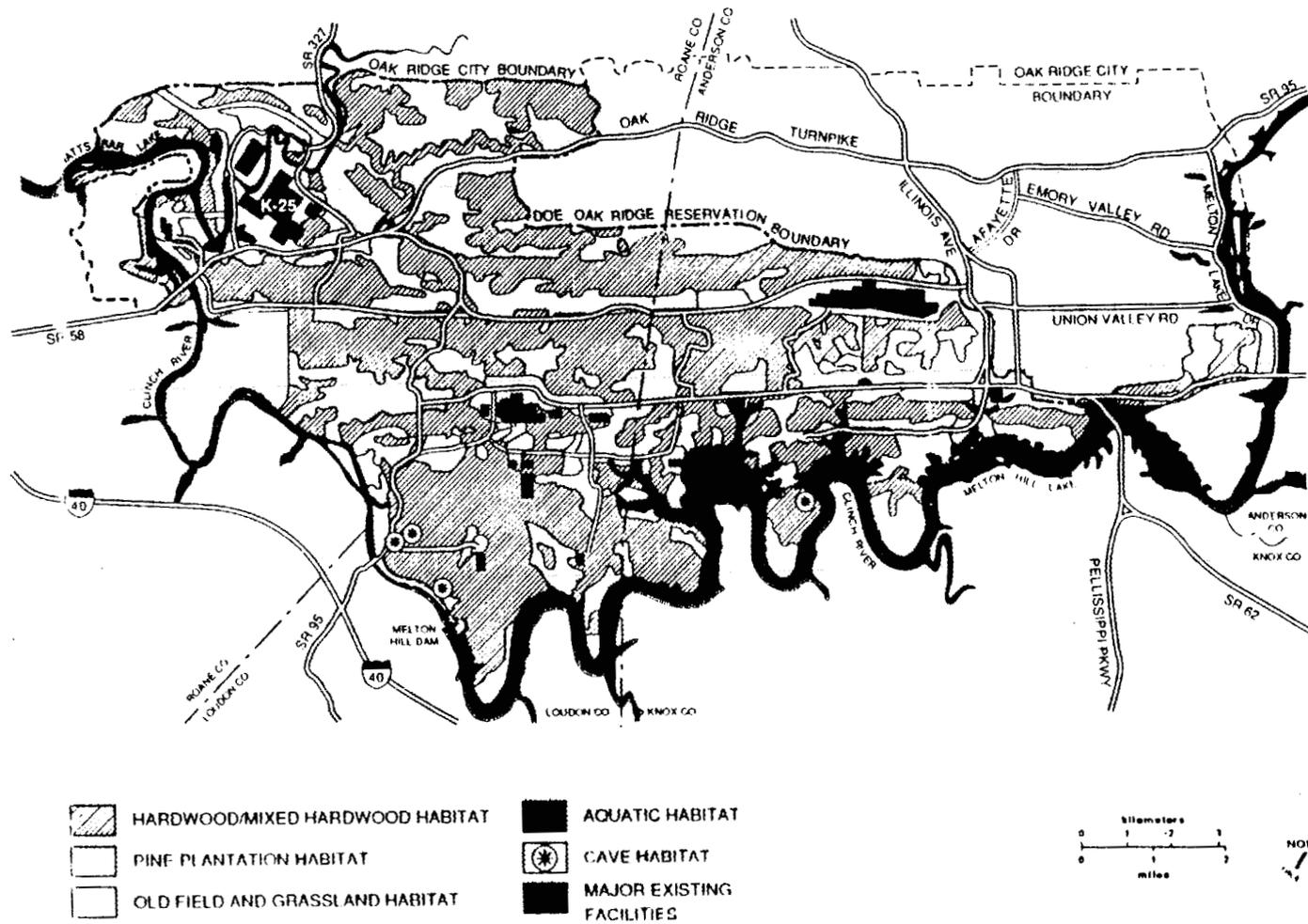


Fig. 1. Map of wildlife habitats on the Oak Ridge Reservation.

In the grassland/forb stage of vegetational succession, the principal species of small mammals are the southeastern shrew, least shrew, short-tailed shrew, eastern harvest mouse, hispid cotton rat, pine mouse, and the eastern cottontail rabbit. The eastern mole occurs in areas of loose soil. Closely mowed or grazed areas and dense kudzu growths near soil surfaces are preferred by the groundhog. Otherwise, the closely mowed or grazed areas are virtual deserts for mammals except for the cottontails, striped skunks, coyotes, red foxes, and deer that feed there, especially at night. As vegetation succession proceeds into brush, small trees, and vines, the white-footed mouse occurs. The golden mouse is found in sites with heavy vine growth (Japanese honeysuckle) and in dense thickets of cane. The opossum becomes a more common resident. Large mammals may range through both early and late stages of this habitat. The coyote, in particular, seems to prefer grassy and shrubby areas. Brush, small trees, and vines are heavily browsed by the deer. Bird species found in this habitat include bobwhite, red-tailed hawk, field sparrow, towhee, blue grosbeak, meadowlark, and red-winged blackbird. The eastern bluebird population has increased with the placement of nesting boxes. Numerous frog, toad, lizard, and snake species are found in the old field areas.

Hardwood and mixed hardwood/conifer habitats occur as the trees begin to mature and canopies begin to close. Eastern gray and southern flying squirrels become inhabitants. The southeastern shrew, eastern mole, short-tailed shrew, white-footed mouse, and eastern chipmunk continue to live in such areas. Among the predators, the weasel and bobcat, in particular, become more numerous. Relatively little food is available for deer, and they utilize the mature forests mainly for cover and protection against weather extremes. The hardwood forests and mixed forests provide habitat for a large number of avian species including the yellow-shafted flicker, red-bellied woodpecker, hairy woodpecker, downy woodpecker, blue jay, Kentucky warbler, pine warbler, yellow-breasted chat, ovenbird, Carolina chickadee, tufted titmouse, and scarlet tanager. A large number of raptorial birds use the woodlands on the ORR for nesting and hunting. The red-tailed and broad-winged hawks are common throughout the area. Wild turkey have been re-introduced to the area and utilize these habitats (Minser 1990). Amphibians and reptiles found in these habitats include the dusky salamander, American toad, eastern box turtle, ground skink, worm snake, black racer, rat snake, black kingsnake, milk snake, and copperhead.

Pine plantations, which grow rapidly in comparison to the hardwoods, form a dense canopy that shades out most undergrowth. Such areas become essentially barren of both small and large mammals except around the edges, where sunlight can penetrate and the lower growing plants and ascending vines provide suitable habitat for some species. Some large mammals may use the stands for protection. When the trees are thinned and fewer, but larger trees are present, the canopies open, undergrowth appears, and small mammals such as those characteristic of early to mid-stage hardwood or mixed hardwood/conifer forests occur. Avian species have a low preference for pure pine areas bordering the transmission line corridors compared to other habitat types. The pine warbler and the white-throated sparrow are common, but few other species have been heard in early morning surveys. In surveys comparing avian

species, there was significantly lower diversity in pine plantations than in hardwood forests (Hardy 1990). The dense pine plantations on the ORR are little utilized as habitat by reptiles or amphibians (Johnson 1964). Older, more open pine forests contain species similar to those in deciduous forests.

Aquatic habitats on the ORR range from undisturbed small streams, to liquid-waste disposal ponds, to the Clinch River. A comprehensive survey of the main creeks and tributaries has been initiated with information collected on the fish and invertebrate populations of these areas (Loar 1986a, 1986b, 1987; Ryon and Loar 1989). Predominant species of the Clinch River in the vicinity of the ORR are gizzard shad, threadfin shad, skipjack herring, carp, smallmouth buffalo, white bass, white crappie, sauger, and freshwater drum (Kitchings and Mann 1976). Many reptiles and amphibians, including turtles, queen snakes, water snakes, salamanders, and frogs, occur in the various aquatic and wetland areas. The muskrat and beaver are bound closely to aquatic habitats and seldom travel far from the protection of bodies of water. The muskrat prefers open areas where aquatic vegetation and dense growths of riparian grasses, sedges, and rushes grow. Beavers rely heavily on trees for food, dams, and lodges. Rice rats seldom occur in dense growths of sedges, cattails, rushes, and grasses in and around streams, ponds, and lakes. Minks frequent aquatic habitats but also hunt in surrounding fields and forests. Raccoons are common in aquatic habitats but also range into other environments. Depending on habitat (old fields, forests, etc.), various small species are present to the water's edge. Many large mammals come frequently to this habitat to drink. The American bald eagle occurs occasionally as a transient and nests near the ORR. Osprey nesting platforms have been successful on the ORR and on other parts of Watts Bar Lake. The Canada goose has become well established. Great blue herons and green-backed herons nest on the ORR and frequent streams, rivers, and lakes in the area. Marsh birds are not frequent on the ORR as their habitat is very limited in acreage.

Caves are common in the limestone of east Tennessee, and there are several on the ORR. Several species of bats are the only mammals to live (roosting or hibernating) deep in the caves. Other species of bats (red, hoary, and silver-haired) occasionally roost in the light zones near the mouths of caves. A few species of small mammals (white-footed mouse, short-tailed shrew, and weasel) may include cave openings in their range. Tracks of raccoon, bobcat, mink, and foxes may be seen in wet soil inside cave mouths. No sampling has been done of animal species indigenous to caves on the ORR, but, in addition to bats, many species of invertebrates, fish, and amphibians are known to occur in east Tennessee caves. The caves are the only known habitat of the green salamander on the ORR.

Groundhogs frequently burrow under buildings surrounded by lawn or pastures. A few species of bats "hang up" during the day in buildings. The striped skunk, bobcat, opossum, raccoon, foxes, and the gray and flying squirrels often den in or under isolated, abandoned buildings. The English sparrow and the starling often are found in buildings. The barn owl roosts and nests in buildings, particularly abandoned ones. Other birds, such as wrens, woodpeckers, swallows, the phoebe, eastern

bluebird, tufted titmouse, black-capped chickadee, and buzzards, may nest in abandoned buildings.

5. RECENT WILDLIFE STUDIES ON THE OAK RIDGE RESERVATION

Wildlife studies on the ORR have been aimed toward a better understanding of the ecological relationships of a species with the habitat, information on population sizes and vigor, and baseline data, and remediation activity impacts. These studies have been done through the Environmental Sciences Division and coordinated with the TWRA. Wildlife-related projects over the last five years have included:

1. white-tailed deer:
 - statistics on deer/vehicle collisions (Alicea et al. in preparation);
 - aging techniques to determine structure of population (Tennessee Tech graduate student project) (Mitchell 1990);
 - hunt data for sex, age, location killed, liver, bone, radioactivity levels; and
 - abosomal parasite counts (Alicea et al. in preparation);
2. wild turkey:
 - release for re-introduction;
 - radio-tracking to determine habitat preferences (with University of Tennessee researcher) (Minser in review);
 - recording of poult sightings and deaths; and
 - trapping and removal for re-introduction at other Tennessee sites;
3. nongame species:
 - radio-tracking coyote (Whitlock 1987);
 - coyotes history, abundance, distribution (Ashwood and Lindahl 1990);
 - comparison of songbirds in different pine plantations (Hardy 1990); and
 - ecology of gray foxes (Greenberg, Pelton, and Parr 1988);
4. remediation-effects-related research:
 - turtle, fish, benthos invertebrates;
5. contaminant-transport-related research:
 - deer (Garten and Lomax 1987); and
 - waterfowl (Loar 1991).

6. ORGANIZATIONAL STRUCTURE

The Wildlife Management Program on the Oak Ridge Reservation is coordinated by the Environmental Sciences Division (ESD) at Oak Ridge National Laboratory. A breakdown of the responsibilities associated with the management of wildlife on the ORR by TWRA is shown in Fig. 2. Within ESD the program is coordinated with the TWRA site manager through the Oak Ridge National Environmental Research Park manager.

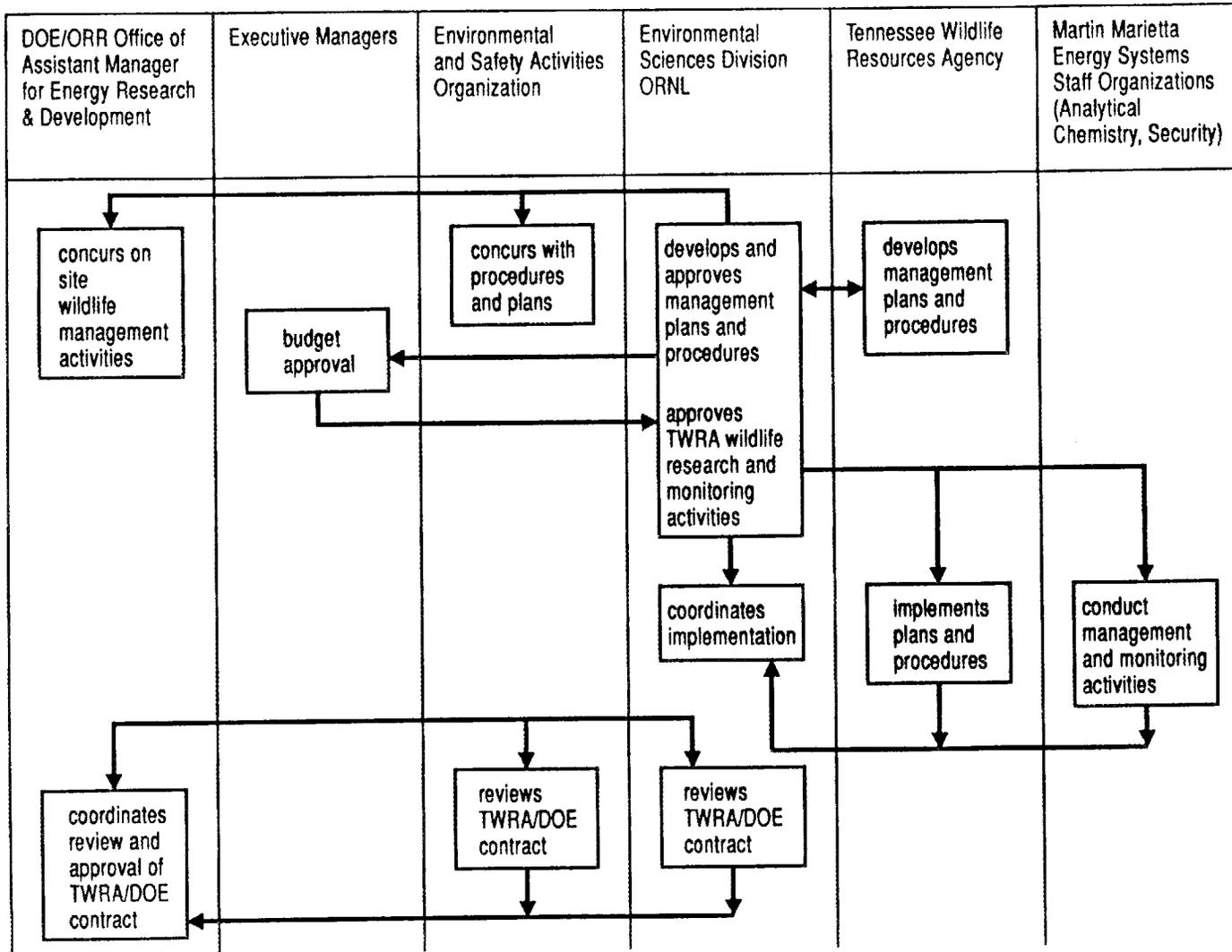


Fig. 2. Responsibility matrix for wildlife management on the Oak Ridge Reservation.

7. MANAGEMENT PLAN

Wildlife on the ORR can be grouped into five management categories: (1) species richness, (2) featured species, (3) game species, (4) threatened and endangered species, and (5) pest species. Each of these categories has an objective, with particular actions necessary for accomplishment of the objective (Table 6). Section 7 contains discussion of the long-term objectives of each category and outlines of specific projects for the FY 1991-1995 period as they relate to the overall objectives. Not surprisingly, the categories will overlap.

7.1 SPECIES RICHNESS MANAGEMENT

Managing for species richness ensures that all wildlife species currently found on the ORR are maintained as residents in viable numbers. Each species is important. Preservation, development, and maintenance of a broad spectrum of habitats are long-term goals. Short-term goals include evaluation of habitats available on the ORR, evaluation of the impact of the discontinuation of the forestry program and other recent land use modifications on the diversity of habitats, more detailed characterization of species occurring in various habitats, and initiation of habitat management for areas that are determined to need it.

7.2 FEATURED SPECIES MANAGEMENT

The featured species concept allows the introduction, restoration, or research of a wildlife species of particular interest. Management of the species may involve forestry manipulation, creation of "artificial niches" (platforms, nesting boxes) within an appropriate habitat, or simply maintenance of suitable habitat already present. Features of the habitat that might limit the species' use of that habitat may be restructured so that conditions will favor the species. This method is applicable to any species whether it is a game or nongame species or an endangered species.

The long-term goals of featured species management are to restore, re-introduce, or research species and to learn more about these species and their needs. Short-term goals include establishment and follow-up studies of wild turkey, osprey, wood ducks, and bald eagles on the ORR.

There are four steps involved in establishing the featured species program: (1) selection of the species, (2) establishment of the habitat requirements of the species, (3) determination of management needs to create the desired habitat, and (4) follow-up studies on the survival and establishment of the selected species. The featured species concept can be expanded to consider species at a community level as well as single species.

Table 6. Categories of wildlife management on the Oak Ridge Reservation

Management categories	Long-term objectives	Short-term objectives
Species richness	Ensure that all current resident species occur in viable numbers. Preservation, development, and maintenance of diverse habitats.	<ol style="list-style-type: none"> 1. Evaluate habitats available and impact of recent land modifications, 2. Characterize in detail species occurring in various habitats, and 3. Initiate habitat maintenance where need is determined.
Featured species	Introduction, restoration, of research of selected species in designated area.	<ol style="list-style-type: none"> 1. Select species, 2. Determine habitat needs, 3. Create or maintain appropriate habitat, and 4. Perform follow-up studies.
Game species	Combine population control with public recreation.	<ol style="list-style-type: none"> 1. Reduce deer/vehicle collisions by decreasing deer population, and 2. Maintain population level through deer hunts.
Threatened and endangered species	Identification, protection, and preservation of individual rare species and their critical habitats.	<ol style="list-style-type: none"> 1. Maintain and update lists of wildlife on ORR, 2. Identify rare wildlife that occurs on ORR, 3. Determine habitat needs, 4. Provide habitat protection, and 5. Evaluate and provide habitat maintenance.

Table 6. Categories of wildlife management on the Oak Ridge Reservation
(continued)

Management categories	Long-term objectives	Short-term objectives
Pest management	Evaluate current land-use and proposed changes for potential wildlife problems.	<ol style="list-style-type: none"> 1. Work on case-by-case basis to alleviate wildlife problems, and 2. Trap and remove nuisance species.

7.3 GAME SPECIES MANAGEMENT

In 1985, the Oak Ridge Reservation was designated a Wildlife Management Area. The long-term goal of game species management is to effectively combine population control of game species (e.g., deer) with public recreation. The short-term objective in this designation was to reduce and continue to control or manage the quickly growing white-tailed deer population on the Oak Ridge Reservation. Collisions of deer and vehicles had risen sharply (Fig. 3) and the potential for injuries was increasing as a result. Public deer hunts were initiated in the winter of 1985. Since public hunting began, the number of deer/vehicle collisions has decreased (Alicea et al. 1991). Management will be continued to maintain the population at this level.

7.4 THREATENED AND ENDANGERED SPECIES MANAGEMENT

The long-term objective of threatened and endangered species management is to identify, protect, and preserve not only individual species but also the habitat critical to that species' survival. The status of the various threatened and endangered plant species and the process by which they are identified and their habitats protected have been addressed in various ORR reports (Parr 1984, Parr and Pounds 1987, Cunningham et al. 1991). Animals that are endangered, threatened, or deemed in need of management (Tennessee Wildlife Resources Agency) are discussed by Kroodsma (1987). Short-term objectives for management of threatened and endangered species are to continue to maintain and update lists of all wildlife on ORR, to identify the rare wildlife that occurs on the Reservation, to determine habitat needs of listed or rare species, to provide protection of habitat through special protected area designation (e.g. Research Park Natural Area, State Natural Area), and to evaluate the need for active habitat management and initiate it when necessary.

7.5 PEST MANAGEMENT

Pest management includes a wide range of wildlife problems: deer-vehicle collisions, animals trapped in buildings, territorial and messy Canada geese, beavers building dams in retention ponds, etc. The long-term objective is evaluation of current land uses and proposed land-use changes as regards the potential for wildlife problems. Short-term objectives include determining the best solution to alleviate the problem and possibly trapping and relocating animals that are nuisances or safety problems in workplaces or field sites. This is being done periodically for Canada geese, beavers, skunks, and groundhogs. Personnel from other agencies are consulted as they are needed for specific problems.

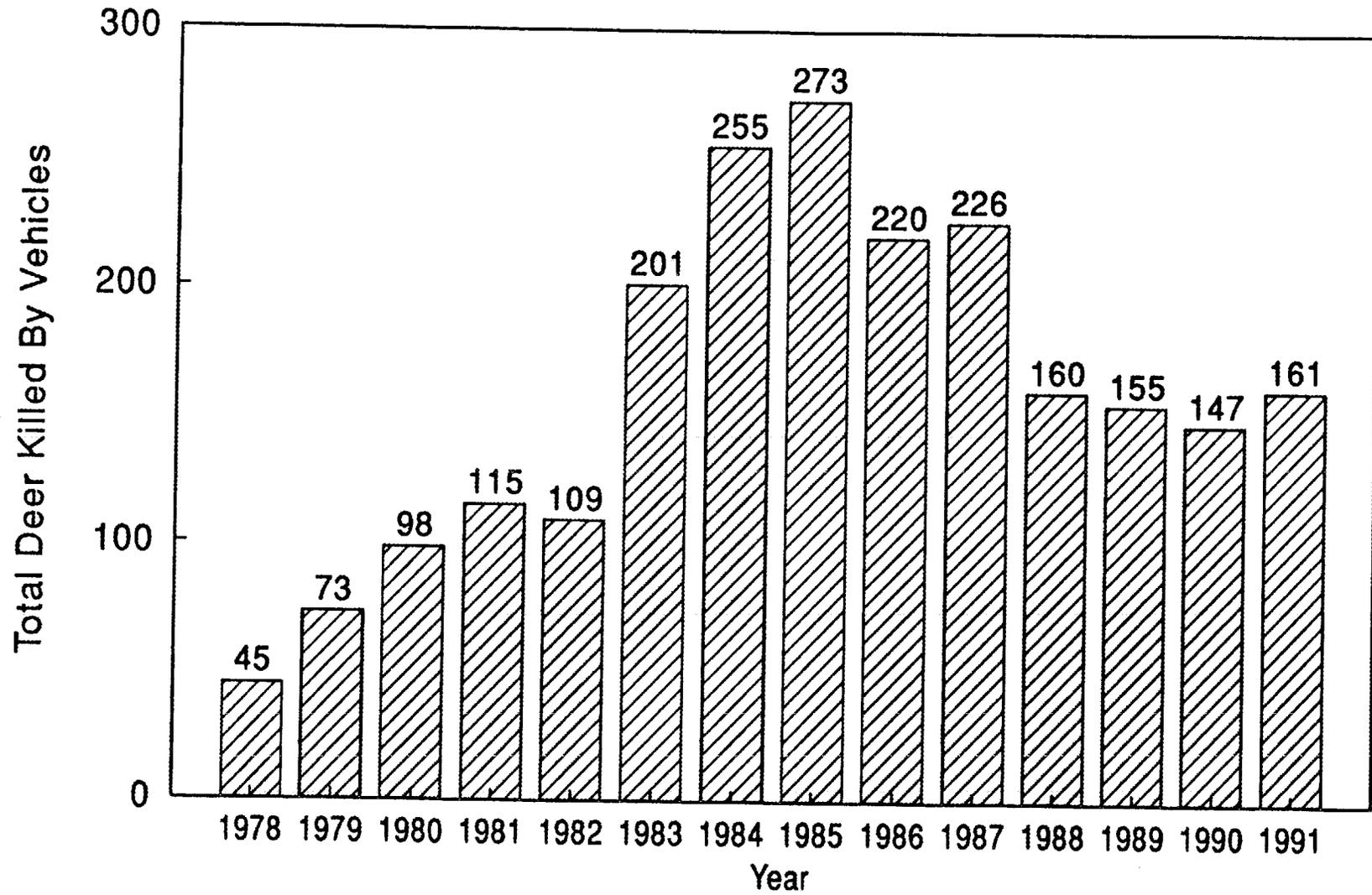


Fig. 3. Number of deer killed in vehicle collisions on the Oak Ridge Reservation from 1978 through 1991 (hunting began 1985).

8. SUMMARY OF MANAGEMENT ACTIVITIES: FY 1983 TO FY 1990

Specific projects to be implemented during the FY 1983 to FY 1987 period were summarized in the Wildlife Management Plan (Kitchings and Story 1984). Many of these activities were indeed initiated, while some were not, due to changes of direction or priorities of the program. This summary highlights the activities of the wildlife program from FY 1983 to FY 1990 to cover the years of management up to this update. Projected and planned activities of the wildlife management program will be summarized for a 5-year period, FY 1991 through FY 1995.

The fiscal year begins October 1 and continues through September 30.

- FY 1983:
 - Evaluation of wildlife management needs and development of plan for the Oak Ridge Reservation.
- FY 1984:
 - Publication of original wildlife management plan for the ORR.
- FY 1985:
 - Cooperative Agreement between DOE and TWRA designating ORR as Wildlife Management Area (November 30, 1984).
 - TWRA area manager locates on-site.
 - Mast surveys done for ORR (data used in regional statistics).
 - Removal of geese from contaminated ponds.
- FY 1986:
 - Public deer hunting is initiated (winter 1985).
 - First wild turkeys are released on ORR.
 - Study of deer age structure on ORR from hunt data by Tennessee Technological University student.
 - Mast surveys on ORR.
- FY 1987:
 - Second release of wild turkeys on ORR.
 - Initiation of turkey radio-tracking for habitat preference information.
 - Placement of wood duck nesting boxes on ORR.
 - Work with ESD on study identifying sources of contamination for deer.
 - Continuation of mast surveys.
 - Continuation of study on deer age structure from hunt data.
 - Annual public deer hunt (first effect of hunts reflected in lower deer/vehicle collision data for year).

- FY 1988:
 - Radio-tracking of turkeys released in 1987.
 - Placement of wood duck nesting boxes on ORR.
 - Establishment of osprey nesting platforms.
 - Work with ESD in waterfowl contamination/transport studies.
 - Canada geese round-up and banding for identification.
 - Annual mast survey on ORR.
 - Annual public deer hunt.
 - Trapping and removal of wild turkeys to stock other east Tennessee areas.

- FY 1989:
 - Placement of wood duck nesting boxes on ORR.
 - Establishment of additional osprey nesting platforms.
 - Continuation of waterfowl contamination study with ESD.
 - Canada geese round-up with banding and collaring.
 - Annual mast survey.
 - Annual public deer hunt.
 - Implementation of plans to keep waterfowl off contaminated ponds.
 - Trapping and removal of wild turkeys to stock other areas.

- FY 1990:
 - Extension of cooperative agreement between DOE and TWRA for wildlife management on the ORR.
 - Re-evaluation of areas on ORR open for hunters with respect to safety.
 - Banding of first osprey young on ORR.
 - Placement of wood duck boxes on ORR.
 - Continuation of osprey restoration program.
 - Canada geese round-up.
 - Annual mast survey.
 - Annual public deer hunt.
 - Trapping and removal of wild turkeys to stock other areas.

9. PROPOSED MANAGEMENT ACTIVITIES: FY 1991 TO FY 1995

The initiation of new management activities that have been proposed is dependent upon funding and, in certain cases, obtaining the appropriate permits and approvals. Additional management activities that have not been included at this time may need to be incorporated.

- FY 1991:
 - Computerization of historical white-tail deer information on database (20 years of data).
 - Preparation of updated document on ORR deer statistics.
 - Annual public deer hunts.
 - Feasibility study for re-introduction of bald eagle on ORR.
 - Canada geese round-up.
 - Annual mast survey.
 - Continuation of osprey restoration program.
 - Trapping and removal of wild turkeys to stock other areas.
 - Placement of additional wood duck boxes.
- FY 1992:
 - Update of wildlife management plan.
 - Evaluation of eagle hacking program for restoration on the ORR.
 - Annual public deer hunts.
 - Canada geese round-up.
 - Annual mast survey.
 - Continuation of osprey restoration program.
 - Trapping and removal of wild turkeys to stock other areas.
 - Continuation of wood duck habitat establishment program.
 - Evaluation of impacts of discontinuation of forest management program on species and habitat diversity.
 - Great Blue Heron contamination studies.
- FY 1993:
 - Initiation of bald eagle hacking and research.
 - Annual public deer hunts.
 - Canada geese round-up.
 - Annual mast survey.
 - Continuation of osprey restoration program.
 - Trapping and removal of wild turkeys to stock other areas.
 - Continuation of wood duck establishment program.
 - Evaluation of need for selective forest management and recommendations.
 - Evaluation of the impact of forest fragmentation on wildlife species.

- FY 1994:
 - Continuation of bald eagle hacking and research.
 - Annual public deer hunts.
 - Canada geese round-up.
 - Annual mast survey.
 - Continuation of osprey restoration program.
 - Removal of wild turkeys to stock other areas.
 - Continuation of wood duck establishment program.
 - Implementation of recommendations from selective forest management study and forest fragmentation study to increase species diversity.

- FY 1995:
 - Continuation of bald eagle hacking and research.
 - Annual public deer hunts.
 - Canada geese round-up.
 - Annual mast survey.
 - Continuation of osprey restoration program.
 - Removal of wild turkeys to stock other areas.
 - Continuation of wood duck establishment program.
 - Selective forest management for species diversity.

LITERATURE CITED

- Alicea, C. R., J. G. Haynes, J. W. Evans, and P. D. Parr. White-tailed deer on the Department of Energy Oak Ridge Reservation: Status summary for 1969-1990 (in preparation).
- Ashwood, T. L., and S. E. Lindahl. 1990. Immigration of coyotes into a forested wildlife management area of east Tennessee (unpublished report).
- Cooperative Agreement between the Department of Energy and the Tennessee Wildlife Resources Agency for the Establishment of a Wildlife Management Area. November 30, 1984.
- Cooperative Agreement between the Department of Energy and the Tennessee Wildlife Resources Agency for the Establishment of a Wildlife Management Area. December 1, 1989.
- Cunningham, M., L. R. Pounds, P. D. Parr, and L. Edwards. 1991. Resource Management Plan for the Oak Ridge Reservation: Rare Plants (in review).
- Dahlman, R. C., J. T. Kitchings, and J. W. Elwood. 1977. Land and water resources for environmental research on the Oak Ridge Reservation. ORNL/TM-5352. Oak Ridge National Laboratory.
- Garten, C. T., Jr., and R. D. Lomax. 1987. Strontium-90 contamination in vegetation from radioactive waste seepage areas at ORNL, and theoretical calculations of Sr-90 accumulation by deer. ORNL/TM-10453. Oak Ridge National Laboratory.
- Greenberg, C. H., M. R. Pelton, and P. D. Parr. 1988. Gray fox ecology in the Oak Ridge National Environmental Research Park: food habits, home range and habitat use. ORNL/NERP-3. Oak Ridge National Laboratory.
- Giles, R. H., Jr. (ed.). 1969. Wildlife Management Techniques. The Wildlife Society, Washington, D.C.
- Hardy, Carol. 1991. A comparison of bird communities in loblolly vs. white pine plantations on the Oak Ridge National Environmental Research Park. Thesis. The University of Tennessee, Knoxville.
- Johnson, R. M. 1964. The herpetofauna of the Oak Ridge area. ORNL-3653. Oak Ridge National Laboratory.
- Kitchings, J. T., and L. K. Mann. 1976. A description of the terrestrial ecology of the Oak Ridge Environmental Research Park. ORNL/TM-5073. Oak Ridge National Laboratory.

- Kitchings, J. T., and J. D. Story. 1984. Resource management plan for the Oak Ridge Reservation, volume 16: wildlife management. ORNL/TM-6026. Oak Ridge National Laboratory.
- Klein, J. A. 1989. A checklist of the reptiles and amphibians on the Oak Ridge Reservation, Anderson and Roane Counties, Tennessee. J. Tenn. Acad. Sci. 64(4):228-30.
- Kroodsma, R. L. 1987. Resource management plan for the Oak Ridge Reservation, volume 24: threatened and endangered animal species. ORNL/ESH-1. Oak Ridge National Laboratory.
- Landers, J. L., and A. S. Johnson. 1980. Trends in wildlife habitat research. pp. 536-44. In Proceedings, Annual Conference Southeastern Association Fish & Wildlife Agencies. Wildlife Resources Agency, Ellington Agricultural Center, Nashville, Tennessee.
- Loar, J. M. 1991. ORNL biological monitoring and abatement program for White Oak Creek/Clinch River. ORNL/TM-10370. Oak Ridge National Laboratory.
- Minser, W. G., S. G. Seibert, and J. C. Cole. Wild turkey use of oak hickory forests and associated pine plantations in eastern Tennessee (in review).
- Mitchell, C. J. 1989. Influence of either-sex harvest on the age and sex structure of white-tailed deer on Oak Ridge Wildlife Management Area, Tennessee. Thesis. Tennessee Technological University, Cookeville.
- Parr, P. D. 1984. Resource management plan for the Oak Ridge Reservation, volume 4: endangered and threatened plant species. ORNL-6026/V4. Oak Ridge National Laboratory.
- Parr, P. D., and L. R. Pounds. 1987. Resource management plan for the Oak Ridge Reservation, volume 23: Oak Ridge National Environmental Research Park, research sites, and state natural areas. ORNL/ESH-1/V23. Oak Ridge National Laboratory.
- Ryon, M. G., and J. M. Loar. 1988. A checklist of fishes on the Department of Energy Oak Ridge Reservation. J. Tenn. Acad. Sci. 63(4):97-102.
- Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974. 1974. Title 70-8-103.
- U.S. Department of Energy. 1980. Oak Ridge Reservation Land-Use Plan. DOE/ORO-748 (Rev. 1). Technical Information Center, Oak Ridge, Tennessee.

Whitlock, S. 1987. Radio-tracking of a pair of coyotes in Oak Ridge, Tennessee. Report for Special Problems WFS 4500, The University of Tennessee, Knoxville (unpublished report).

APPENDIX

A.1 TENNESSEE WILDLIFE RESOURCES AGENCY/DEPARTMENT OF ENERGY
COOPERATIVE AGREEMENT

MARTIN MARIETTA

MARTIN MARIETTA ENERGY SYSTEMS, INC.

POST OFFICE BOX 2003
OAK RIDGE, TENNESSEE 37831

November 13, 1989

Mr. J. R. Newman, Director
Procurement and Contracts Division
Department of Energy - Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37831

Dear Mr. Newman:

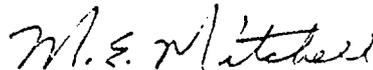
Succeeding Cooperative Agreement Between the Department of Energy (DOE) and the Tennessee Wildlife Resources Agency (TWRA) for the Establishment of a Wildlife Management Area

Attached are three copies of the Cooperative Agreement which will succeed the existing November 30, 1984, Cooperative Agreement between the Department of Energy and the Tennessee Wildlife Resources Agency (TWRA) for the management of the Oak Ridge Reservation as a Wildlife Management Area. The existing agreement which expires on November 30, 1989, will be extended for an additional five years by the attached succeeding agreement.

Per your request, the attached agreement has been signed by appropriate TWRA officials and returned to J. G. Rogers, Energy Systems. The three attached copies are being forwarded to you for appropriate signature and execution on behalf of the DOE. After appropriate signatures are affixed at the DOE, our office will provide an original signed copy to the TWRA.

If you have any questions, please contact J. G. Rogers at 4-8982.

Sincerely,



M. E. Mitchell, Director
Environmental and Safety Activities

MEM:JGRogers:jh

Attachments

cc w/o att: L. W. Long
P. D. Parr
J. G. Rogers

AD424/JRNewman

gm
11/17/89

AD424/ 11-17-89
RPNicholson

AD42 *Ref*
RElynch 11-21-89
DP-84
K. Atchley

11-21-89
DP-85

LRadcliffe *DR*
11-26-89

Mr. M. E. Mitchell, Director
Environmental and Safety Activities
Oak Ridge National Laboratory
Martin Marietta Energy Systems, Inc.
Post Office Box 2003
Oak Ridge, TN 37831-7155

Dear Mr. Mitchell:

SUCCEEDING COOPERATIVE AGREEMENT BETWEEN THE DEPARTMENT OF ENERGY
(DOE) AND THE TENNESSEE WILDLIFE RESOURCES AGENCY (TWRA) FOR THE
ESTABLISHMENT OF A WILDLIFE MANAGEMENT AREA

In response to your letter of November 13, 1989, enclosed is a signed
original and two reproduced copies of the subject agreement. Please
provide the signed original to the Tennessee Wildlife Resources Agency.

We greatly appreciate the efforts that you and your staff have given in
coordinating the management of the Oak Ridge Reservation's wildlife
resources with the TWRA.

Sincerely,

for *LS/Douglas Underwood*

Larry L. Radcliffe, Acting Director
Waste Management Division

AD-424:JRNewman

Enclosure

cc: James G. Rogers, Energy Systems,
MS 7155, w/o encl.

bcc: Larry L. Radcliffe, WMD, w/encl.
R. E. Lynch, AD-42, w/o encl.
R. P. Nicholson, AD-42, w/encl.
D. Cook, DP-82, w/encl.
D. Howard, SE-33, w/encl.

COOPERATIVE AGREEMENT
BETWEEN THE
DEPARTMENT OF ENERGY
AND THE
TENNESSEE WILDLIFE RESOURCES AGENCY
FOR THE
ESTABLISHMENT OF A WILDLIFE MANAGEMENT AREA

THIS AGREEMENT is made and entered into this 13th day of December, 1989, by and between the parties whose names are hereinafter subscribed, their successors and assigns, the UNITED STATES OF AMERICA (hereinafter referred to as the "Government"), acting through the Secretary of Energy, the statutory head of the U.S. Department of Energy (hereinafter referred to as "DOE"), and the STATE OF TENNESSEE, WILDLIFE RESOURCES AGENCY, acting through Gary T. Myers, Executive Director of the Tennessee Wildlife Resources Agency (hereinafter called the "Agency").

WHEREAS, the Government owns a tract of approximately 35,200 acres of land, commonly known as the Oak Ridge Reservation, on which DOE maintains nuclear and energy related research and development and production programs; and,

WHEREAS, the DOE and the Agency entered into a Cooperative Agreement on November 30, 1984, for the establishment of a wildlife management area on said Oak Ridge Reservation; and,

WHEREAS, the term of said Agreement expires on November 30, 1989; and,

WHEREAS, both the Agency and the DOE mutually desire to enter into a succeeding Agreement which will extend said term for an additional five (5) years; and,

WHEREAS, the mission of the DOE continues to include in its research and development programs emphasis on multiple-use of natural resources; and,

WHEREAS, by Tennessee Code Annotated Section 70-1-302(b), authority is given to the Tennessee Wildlife Resources Agency to enter into cooperative agreements for the purpose of regulating fishing, hunting or trapping in the area under jurisdiction of federal agencies; and Section 70-5-101(a), Tennessee Code Annotated, specifically authorizes the Wildlife Resources Agency to establish a wildlife management area with the consent of property owners; and,

WHEREAS, it is to the mutual benefit of the Oak Ridge Operations and the Agency that this succeeding Agreement be consummated;

NOW, THEREFORE, this Agreement witnesseth: That for and in consideration of the mutual promises contained herein, and subject to the premises and conditions set forth herein, the Government does consent and agree to permit the Agency to establish a wildlife management area on that tract of land in Anderson and Roane counties, Tennessee, known as the Oak Ridge Reservation, consisting of 35,200 acres more or less, and the Agency agrees to establish said wildlife management area on said land. This land is described in deeds of record in the respective County Registrar's Offices.

FIRST, THEREFORE, the Agency agrees:

1. To provide adequate wildlife protectors for the proper enforcement of the game and fish laws, rules, and regulations made pursuant to the game and fish laws of the State of Tennessee.

2. To post the area with "Wildlife Management" signs.
3. Consistent with the Government's programmatic use of lands, to develop the area for wildlife species by the application of scientific management techniques that are compatible with good land use, and to carry out other wildlife oriented projects as specified in Appendix Q, Wildlife Management, Resource Management Plan for the DOE Oak Ridge Reservation, a copy of which is attached hereto and incorporated herein by reference. The Wildlife Management Plan shall be revised in 1990 and thereafter as appropriate upon agreement of the parties.
4. To provide a resident TWRA Manager II and other Wildlife officials as appropriate to oversee operation of the Oak Ridge Reservation as a Wildlife Management Area. While, subject to the availability of appropriated funds, costs associated with these positions will be reimbursed to TWRA by the DOE, or its contractor, individuals occupying these positions shall be and remain employees of the Agency, and shall not be considered employees of DOE or its contractor for any purpose.
5. That all mineral and timber rights are retained by the Government, and that the Government retains the right of ingress, egress, and regress to develop, manage, and utilize same, provided, however, that the Government will coordinate such activities with the Agency to maximize consistency with the agreed upon Wildlife Management Plan attached hereto.

6. That the provisions of Tennessee Code Annotated Section 70-4-117 shall not be applicable to those employees of Government or its contractors who are armed under the authority of the Atomic Energy Act of 1954, as amended.
7. That the Agency assumes all responsibility with regard to any hunts, or hunting, conducted within the Wildlife Management Area established hereunder.

SECOND, the Government agrees:

1. That the Agency shall have the rights of ingress, egress, and regress upon the lands of the Government at any and all times for the protection and propagation of wildlife, except for areas to which access is limited by the Government for programmatic, health and safety, or national security reasons.
2. To designate the entire undeveloped area as a Wildlife Management Area.
3. To grant the Agency complete control as regards to harvest of wildlife, as mutually agreed upon by both the Agency and the Government. Such harvest of wildlife shall be consistent with the Wildlife Management Plan attached hereto.

IT IS MUTUALLY AGREED:

1. That this tract shall be known as the Oak Ridge Wildlife Management Area of the United States Department of Energy, and that it shall be open to use as specified by mutual Agreement of both the Agency and the Government, subject to the laws and regulations of both the State of Tennessee and regulation by said Wildlife Resources Agency,

pursuant thereto, and by the United States Department of Energy/Oak Ridge Operations.

2. That the Government or the Agency may close the area to outside users during the period of significant fire hazard, and either may close or prohibit outside use in any area where timber cutting is in progress.
3. That this Agreement shall become effective as soon as signed by the parties hereto and shall continue in force until five (5) years from the date thereof.
4. That this Agreement is for a minimum term of five (5) years.
5. That this Agreement may be extended for such additional periods as may be agreed upon by the Government and the Agency.
6. This Agreement may be cancelled at any time by either party giving ninety (90) days written notice.
7. That Amendments to this Agreement may be proposed by either party upon thirty (30) days written notice to the other, and such amendments shall become effective as soon as signed by both parties hereto.
8. That an annual review will be held, as needed, regarding all ongoing programs and projects under this Agreement and of any unique or one-time projects completed during the year.
9. That nothing in this Agreement shall be construed as obligating the Government or the Agency in any contract or other obligation, except as specifically stipulated in this Agreement.
10. That the exercise of privileges hereby granted shall be without cost or expense to the Government, except as herein specifically provided.

and subject to such regulations as may be prescribed by it from time to time.

11. The Government and the Agency shall each be liable only for claims, demands, damages, actions, costs, or charges which are caused by the negligence, acts and/or omissions of their respective agents, assigns, officers or employees. The Agency and its employees shall not be considered agents, assigns, officers or employees of the Government.
12. The United States Department of Energy, its contractor, their agents and employees assume no liability to the Agency or any third person for personal injury, including death, or damage to property, both real and personal, which might arise out of or be in any way connected with any act or omission of the Agency. The Agency, its agents and employees assume no liability to the United States Department of Energy, its contractor, their agents and employees or any third person for personal injury, including death, or damage to property, both real or personal, which might arise out of or be in any way connected with any act or omission of the United States Department of Energy, its contractor, their agents and employees.
13. That the use of the Oak Ridge Reservation by the Agency shall not interfere with the primary right of the Department of Energy to use the Oak Ridge Reservation, and shall not restrict the Government's right to convey portions of said reservation to third parties. The Government reserves the right to use the property, or permit the use by others, for such purposes and upon conditions as may be determined necessary by the Manager, Oak Ridge Operations.

14. That all communications directed to the Government relative to this Agreement or the terms hereof shall be addressed to Realty Officer, Oak Ridge Operations, U.S. Department of Energy, Post Office Box 2001, Oak Ridge, Tennessee 37831-8755.

IN WITNESS WHEREOF, the duly authorized official of the United States Department of Energy/Oak Ridge Operations and the duly authorized official of the State of Tennessee, acting in their official capacities but not otherwise, have hereunto set their hands as of the date first above written.

STATE OF TENNESSEE
WILDLIFE RESOURCES AGENCY

BY: *Gary T. Myers*

Gary T. Myers
Executive Director

UNITED STATES DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS

BY: *Richard P. Nicholson*

Richard P. Nicholson
Realty Officer

Appendix Q: Wildlife Management, to
Resource Management Plan
for the DOE Oak Ridge Reservation

INTERNAL DISTRIBUTION

- | | |
|----------------------|---------------------------------|
| 1. T. L. Ashwood | 32. D. R. Matt |
| 2. L. D. Bates | 33. L. J. Mezga |
| 3. H. P. Benefield | 34. J. B. Murphy |
| 4. D. M. Bradburn | 35. J. R. Newman |
| 5. J. B. Cannon | 36-60. P. D. Parr |
| 6. W. W. Chance | 61. A. L. Rackstraw |
| 7. R. B. Clapp | 62. J. W. Ranney |
| 8. G. K. Clifton | 63. D. E. Reichle |
| 9. J. H. Cushman | 64. B. G. Roach |
| 10. R. B. Dreier | 65. J. G. Rogers |
| 11-15. J. W. Evans | 66. B. A. Rosensteel |
| 16. M. P. Farrell | 67. F. E. Sharples |
| 17. D. E. Fowler | 68. D. S. Shriner |
| 18. C. W. Gehrs | 69. S. H. Stow |
| 19. R. L. Graham | 70. N. A. Teasley |
| 20. L. B. Hall | 71. R. I. Van Hook |
| 21. S. G. Hildebrand | 72. L. D. Voorhees |
| 22. C. C. Hill | 73. G. E. Ward |
| 23. M. A. Huston | 74. M. C. Wiest |
| 24. P. Kanciruk | 75. C. J. Williams |
| 25. M. W. Knazovich | 76. W. G. Woods |
| 26. F. C. Kornegay | 77. Central Research Library |
| 27. R. L. Kroodsma | 78-92. ESD Library |
| 28. S. Y. Lee | 93-94. Laboratory Records Dept. |
| 29. L. W. Little | 95. Laboratory Records, ORNL-RC |
| 30. J. M. Loar | 96. ORNL Patent Section |
| 31. L. W. Long | 97. ORNL Y-12 Technical Library |

EXTERNAL DISTRIBUTION

98. J. F. Franklin, Bloedel Professor of Ecosystem Analysis, College of Forest Resources, University of Washington, Anderson Hall (AR-10), Seattle, WA 98195
99. R. C. Harriss, Institute for the Study of Earth, Oceans, and Space, Science and Engineering Research Building, University of New Hampshire, Durham, NH 03824
100. C. R. Hickey, U.S. Department of Energy, Office of Energy Research, Washington, DC 20585
101. G. M. Hornberger, Professor, Department of Environmental Sciences, University of Virginia, Charlottesville, VA 22903
102. G. Y. Jordy, Director, Office of Program Analysis, Office of Energy Research, ER-30, G-226, U.S. Department of Energy, Washington, DC 20545

103. C. D. Jorgensen, Ecological Research Division, Office of Health and Environmental Research, ER-75, U.S. Department of Energy, Washington, DC 20545
104. R. H. Olsen, Professor, Microbiology and Immunology Department, University of Michigan, Medical Science II, #5605, 1301 East Catherine Street, Ann Arbor, MI 48109-0620
105. A. Patrinos, Acting Director, Environmental Sciences Division, Office of Health and Environmental Research, ER-74, U.S. Department of Energy, Washington, DC 20585
106. F. J. Wobber, Environmental Sciences Division, Office of Health and Environmental Research, ER-74, U.S. Department of Energy, Washington, DC 20585
107. Office of Assistant Manager for Energy Research and Development, U.S. Department of Energy Oak Ridge Field Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
- 108-117. Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831