

# Wildlife Values and Management of Gravel Pits in Forest Ecosystems

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Gravel pits in forest ecosystems provide unique habitats for a variety of wildlife species due to features such as steep banks, storage piles of excavated material, exposed mineral soil, and surface water. In north central Minnesota there are 51 species associated with these characteristics. Gravel-pit management and rehabilitation can be coordinated to meet wildlife management objectives by providing dead and dying trees for cavity-nesting species, shallow areas of surface water, and downed logs and by maintaining vertical banks and areas of bare ground.

An open area in a forested ecosystem is recognized as a vitally important habitat that contributes to faunal diversity and to the welfare of many wildlife species (1-5; 6, pp. 189-197). Most forest habitat management programs emphasize the significance and management of these habitats, often referred to as wildlife or permanent openings (2,7).

Due to their structural characteristics, gravel pits--both operational and abandoned--provide opening types differing in wildlife values from those originating from homesteads, old fields, or frost pockets. The purpose of this paper is to assess the value of gravel-pit openings to those wildlife species who use them for feeding and breeding and to provide recommendations that land managers can use to enhance and manage these habitats in a forest ecosystem.

## CHARACTERISTICS OF GRAVEL PITS

Gravel pits occur throughout the forested area of the Lake States in relatively small land units ranging in size from an acre or less to 20 acres or more. On the Chippewa National Forest in north central Minnesota, they account for about 10 percent of the opening type of community and vary from 1 to 10 acres in size (8). Most of these pits originate when relatively small quantities of gravel are extracted for local road construction or for timber-sale haul roads. Abandoned sites, unless totally depleted, are often reopened after many years of inactivity.

The diversity of vegetation and structure of gravel pits depend on activity status, age, soil conditions, and rehabilitation treatment. Unfortunately, from a wildlife-habitat perspective, abandoned sites are often degraded by leveling and reforestation practices. A typical abandoned pit consists of a mixture of grasses, shrubs, and forbs interspersed with bare ground. A steep slope or bank (usually occurring from excavation) is a typical structural feature. Occasionally water resulting from excavation below the water table will be present.

Although gravel-pit openings proceed through vegetative succession very slowly after abandonment, they will eventually disappear, if unmanaged, due to the encroachment of the forest.

## ORIENTATION OF WILDLIFE TO PERMANENT OPENINGS

Although the data presented here apply specifically to the Chippewa National Forest, the concepts and values are generally applicable throughout the forested region of the Lake States.

To provide a systematic way of simultaneously displaying the effects of habitat alteration on all

species of wildlife, a habitat association data base was assembled (9). The data base also facilitates the ranking and assessment of various vegetative communities in terms of richness of vertebrate species. Used to evaluate gravel pits in terms of the wildlife community, these data will also provide a rationale for management.

## Description of Data Base

The data base consists of 9 interrelated elements correlating 310 vertebrate species with habitat, season of use, and status. The habitat types (communities) described by Niemi and Pfanmuller (10, pp. 154-177) were modified to accommodate the conditions and vertebrate species on the Chippewa National Forest. These 24 communities reflect a combination of vegetation, successional stage, and structure. The permanent opening is one of these communities.

Each species was categorized by the communities it uses for feeding, breeding, or both. Because most species are oriented to more than one community, an attempt was made to designate one of these communities as particularly important. This was termed the critical community for the species. It was impossible to assign a critical community to the more ubiquitous species.

The 310 vertebrates were also classified into 16 life forms, adapted from work by Thomas and others (11, pp. 60-77).

Eight categories were used to relate special habitat requirements to each species (man-made structure, edge, decaying log, snag, riparian area, mast, and bank or bare ground). Those species having a special requirement of a bank or bare ground are particularly germane to the subject of this paper. Each species was also categorized as to season of use (migration, summer, winter, permanent resident) and status (threatened, endangered, sensitive, game or fur, indicator). The data were entered on an IBM OS/6 word processor for storage and manipulation and to facilitate updating.

A gravel pit is a type of permanent opening, so the information in the data base concerning the species associated with openings can be generally applied to this assessment. A more specific and detailed analysis can then be made based on the unique habitat features of gravel pits and their relation to the special requirements of the associated vertebrate fauna.

Although permanent openings account for less than 5 percent of the upland communities on the Chippewa National Forest, there are 158 vertebrate species (51 percent of 310) that have a primary orientation to them; i.e., they feed, breed, or both in permanent openings:

Group	No. of Species			
	Feed	Breed	Both	Total
Birds	71	6	34	111
Mammals	15	0	21	36
Herps (reptiles and amphibians)	3	2	6	11
Total	89	8	61	158

Among the 158 species associated with permanent openings, 22 are game or fur species, 7 are classified as sensitive, 2 are considered by the federal government to be endangered or threatened, and 5 are management indicator species.

A further refinement of these data can be displayed by considering only those species that have the opening community designated as their critical community:

Group	No. of Species	Total Species in Class (%)
Birds (N = 233)	38	17
Mammals (N = 57)	15	26
Herps (N = 20)	8	40
Total (N = 310)	61	

#### Unique Qualities of Gravel Pits

Gravel pits, considered as a type of permanent opening, could potentially accommodate all of the species listed above. The animal community associated with specific gravel pits will depend on characteristics of the vegetation, presence of water, and structural features.

The uniqueness of gravel pits as compared with other openings in a forest ecosystem is due to the presence of steep banks, storage piles of excavated material, and exposed mineral soil. There are 21 species (13 percent of the 168) oriented to openings that have these features (Table 1). This group of vertebrates includes bank-nesting birds, such as the belted kingfisher and bank swallow; fossorial mammals such as the badger and woodchuck; and reptiles such as the snapping turtle that require bare ground for excavating a nest.

Unvegetated banks and mounds of surplus material created by excavation are favored rendezvous sites for the threatened gray wolf (12,13) and are frequently used by other canids (personal communication from Bill Berg, Minnesota Department of Natural Resources). Deer and other mammals are also attracted to exposed soil typical of gravel pits, possibly for mineral content.

Clearly, gravel pits are important and valuable components of wildlife habitat, and if species di-

versity is a management goal, land managers should be aware that they deserve thoughtful and careful consideration.

#### MANAGEMENT OPPORTUNITIES

Of the 158 species associated with openings, 132 have one or more special requirements considered in the data base. These special requirements are directly related to habitat management strategies for gravel pits. Again, the wildlife habitat association data base provides information (Table 1) and focuses on the importance of various structural features to vertebrates associated with gravel-pit habitat.

#### Snags

Thirty-four (22 percent) of the species associated with openings also require snags or cavities for nesting, roosting, hibernation, or perching. Examples are American kestrel, eastern bluebird, red-headed woodpecker, big brown bat, and white-footed mouse. Three are primary excavators (14, pp. 214-225) that initiate holes for secondary users.

Normal gravel-pit operations will generally preclude the presence of snags within the clearing, although this may be possible in some instances by reserving islands, or clumps of trees, at the time of land clearing. Snags, however, can be provided along the edges of the clearing to accommodate the 34 species that require them. By using the method of Thomas and others (11, pp. 60-77) for determining snag densities by community type, a density of about two hard snags per acre [diameter at breast height (dbh), 16 in. or larger] will accommodate the primary excavators and the associated secondary users at the 100 percent management level (Table 2). Nesting boxes for secondary users may be substituted for snags if trees of suitable size are not present.

#### Water

Clearly, surface water or wetland habitat within or adjacent to a gravel pit enhances its value to wildlife. If a gravel pit contains surface water due to excavation below the water table, an additional community (pond) is established. Depending on depth and permanency of the water and whether fish are present, animal diversity is significantly affected. The presence of a pond within a gravel pit will potentially accommodate 30 additional species, consisting of 18 birds, 6 mammals, and 6 reptiles and amphibians. Fifty-eight (37 percent) of the species associated with gravel pits are also associated with riparian environments. Examples are spotted sandpiper, eastern kingbird, killdeer, coyote, little brown bat, and eastern garter snake.

When possible, excavation procedures should provide for digging below the water table to produce permanent or temporary aquatic habitats. Water-filled excavations should not be filled in as part of the reclamation activity. In order to produce a varied and productive aquatic plant community, excavations should produce gently sloping and shallow edges and should not exceed 3 ft in depth unless a

Table 1. Special requirements of species associated with openings.

Group	No. of Species <sup>a</sup>						
	Snag	Edge	Riparian	Log	Mast	Bank	Bare Ground
Birds	23	60	34	8	9	5	6
Mammals	11	24	16	21	8	6	0
Herps	0	0	8	7	0	0	4
Total	34	84	58	36	17	11	10
Percentage of total	22	53	37	23	11	7	6

<sup>a</sup>Total number of species = 158.

Table 2. Hard snags required to support various percentages of maximum populations of primary excavators associated with openings.

Species	Minimum Dbh (in.)	Snags/100 Acres by Management Level				
		100 Percent	80 Percent	60 Percent	40 Percent	20 Percent
Common flicker	12	50	40	32	20	10
Red-headed woodpecker	16	200	160	120	80	40
Yellow-bellied sapsucker	10	100	80	60	40	20

fishery is planned. The pond habitat can be further enhanced by planting willows along the edges.

#### Downed Logs

Downed, decaying trees are used as cover or foraging sites by 36 (23 percent) of the species associated with openings. Examples are common flicker, red fox, masked shrew, and red-bellied snake.

Prescriptions for gravel-pit rehabilitation or management should provide for this structural feature by dropping trees into the pit area along the edge or hauling logs into the interior. At least two logs per acre are recommended (15, pp. 78-95). Logs should also be placed on the periphery of ponds to provide waterfowl roosting sites and places for amphibians and reptiles to sun and hide.

#### Mast

Seventeen (11 percent) of the vertebrates associated with openings also use mast, such as acorns and nuts. Examples are white-tailed deer, black bear, and eastern chipmunk.

Managers should strive to perpetuate oak adjacent to gravel pits and promote mast-producing shrubs such as American hazel within the clearing.

#### Banks and Bare Ground

Unvegetated banks and mounds of surplus material created by excavations should be retained and not leveled as a rehabilitation technique. Rehabilitation plans should also provide for patches of bare ground on at least 50 percent of the area to benefit species such as nighthawks, killdeer, snapping turtles, and green snakes.

The open character of depleted or abandoned gravel pits should be maintained, and vegetation plans should not provide for reforestation. Seeding and fertilizing to restore vegetative cover on portions of the area should be done with grasses and legumes suitable to the soil and site. In some situations, planting of native shrubs may be appropriate to enhance habitat structure, although natural invasion may accomplish the same objective over time. In order to control the invasion of trees, maintenance treatments with herbicide, hand cutting, or burning may be required.

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Publication of this paper sponsored by Committee on Landscape and Environmental Design.