

tive Dove Study from 1948 to 1952. The report will be published for the use of administrators and technicians after a review by a committee of the South-eastern Association with Foote and Peters. The need for additional data on breeding populations and production in distinct vegetative habitats was emphasized.

## GENERAL GAME SESSION

### GAME MANAGEMENT PRACTICES ON STRIP MINED LAND

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#### INTRODUCTION

This paper is being presented with the hope that some of the ideas and theories set forth will act as a guide to game technicians who will be confronted with wildlife management on strip mined lands. Several states throughout the southeast have areas that are being affected by strip mining operations, and it is believed that much of this so-called "waste" land can be utilized by game management personnel.

The statistics used in this paper are based almost entirely on conditions that exist in Kentucky coal fields. However, the basic problem of reclaiming this land for wildlife is considered to be universal in nature. The data used in this paper were obtained by the author during the period 1952-1956. This material should be classified as independent investigations, since no formal project or study was set up to gather this information. Prior to 1956 the author was employed as a wildlife biologist in the western coal fields.

For those who are not familiar with mining activities, the term strip mining refers to the recovery of a mineral from an open pit. The open pit (strip mining) method of mining consists of removal of the overlying soil and rock material, and exposing the desired mineral. The exact method in removing this overburden will vary, depending upon the mineral being removed.

The topography of the resulting spoil material is one of a series of ridges and ravines with relatively steep short slopes. The slopes will range from 10 to 60 degrees and about 50 to 80 feet in length. The height of the ridges, measured from the adjoining valleys, will vary from 20 to 50 feet in most areas.

Severity of the reclamation problem will depend upon the physical and chemical nature of the soil and rock which overlays the coal strata. The nature and properties of this spoil material will vary between coal fields. In fact, it can and does vary within a few hundred yards within the same spoil pile. Vegetation on this spoil material will generally be of two types. It will either be volunteer native vegetation, or vegetation created by seeding and planting. Reclamation of these lands by seeding and planting can be regulated to benefit wildlife, produce forest products, or provide recreational areas.

Since 1948, approximately 15,000 acres of spoil material have been formed in Kentucky coal fields. Through the progressive efforts of the strip mine operators, and the Kentucky Reclamation Association, 6,984 acres of this total have been reclaimed. (KRA was formed in 1948.) On these reclaimed acres, approximately 4,290,949 trees and shrubs have been planted and 97,524 pounds of seed sown. As would be expected, the stage of plant succession varies from one-year-old seedlings to eight-year-old trees.

The first concerted use of game food shrubs on Kentucky spoil banks began in 1953. Since that time approximately 270,000 game food and cover plants have been utilized on strip mined lands. This utilization of game food plants on spoil banks was brought about through cooperation with the Kentucky Department of Fish and Wildlife Resources.

## WILDLIFE USAGE OF STRIP MINED LANDS

The degree to which various wildlife species will inhabit strip mined lands depends upon the density and type of plants growing on these lands.

The bobwhite quail (*Colinus v. virginianus*) is a frequent inhabitant of spoil banks especially if these banks are adjacent to areas of farm land or old fields. This extensive "edge effect" provides an abundance of food and adequate cover for the birds.

The mourning dove (*Zenaidura macroura*) has repeatedly been observed feeding on pokeberry (*Phytolacca americana*) seed in spoil bank areas. Pokeberry is frequently one of the first native plants to appear on new spoil material. The numerous small water holes found throughout strip mined lands have been observed to serve as a source of water for doves. Even though much of this water is known to be strongly acid, the birds still utilize it.

The cottontail rabbit (*Sylvilagus floridanus mearnsi*) also has been seen frequenting strip mined lands. Tracks and pellets have been observed far out in sparsely vegetated spoil banks. Both natural and seeded grasses and legumes on spoil banks provide this game species with both food and cover.

Rocky portions of spoil banks, with the resulting cracks and crevices, make ideal denning areas for the woodchuck (*Marmota monax*). Succulent natural vegetation, or seeded grasses and legumes, add the necessary food for the woodchuck, thus completing the requirements for a suitable habitat. The woodchuck and cottontail are apparently the first animals to acquire permanent residence in strip mined lands.

All species of furbearers have been observed utilizing strip mined lands. From evidence at hand the raccoon (*Procyon lotor*) is perhaps the most frequent inhabitant of spoil bank areas. The raccoon forages for food around the numerous ponds and drains where an abundance of semi-aquatic life exist. From signs observed in older stripped areas, it is believed that the raccoon also dens in the rocky portions of the spoil banks.

Both the red fox (*Vulpes fulva*) and the gray fox (*Urocyon cinereoargenteus*) make wide use of strip mined lands. Fox paths can generally be found on the spoil bank ridge tops. This high travel-way gives the fox an excellent vantage point during hunting trips. Fox scats have been observed in and around patches of pokeberry. A family of adult grays (2 adults and 4 kits) were observed in one remote section of strip mine lands.

Mink (*Mustela vison*) and muskrat (*Ondatra z. zibethica*) are perhaps the greatest financial asset coming from wildlife on strip mined lands. The greatest attraction to muskrats is the impounded waters, and the presence of rank growths of cattails (*Typha angustifolia*). This plant will tolerate and grow in extremely acid mine water, and provides both food and cover for the muskrat. Apparently the rocky nature of the spoil material hinders bank den construction; as a result muskrat houses built of cattails can be seen in many strip mine ponds.

In these strip mine ponds and marshes, muskrats and other aquatic and semi-aquatic life serves as a food supply for the mink. Rocky portions of isolated areas of spoil banks provide necessary dens for the mink.

As an example of the usage by these latter mentioned furbearers can be seen in random trapper's reports. One trapper harvested 24 muskrats and one mink from a 50-acre strip mine lake. Based on 1955-56 fur prices, this represents approximately \$1.52 per acre. At least three other trappers also operated on this same lake, but their success is unknown. Another trapper operating in a tract of strip mined land, which contained approximately 10 acres of ponds and marshes, harvested 86 muskrats and 14 mink. This gave an average of \$40.90 per acre of water.

Migratory waterfowl have also been observed utilizing strip mine lakes and ponds. Both the mallard (*Anas p. platyrhynchos*) and black duck (*Anas rubripes*) have been seen on strip mine lakes, especially on blustery winter days. The high steep banks break the winds and provide quiet sheltered waters. Although the relatively steep banks and depth of water in strip mine lakes is not conducive to the production of waterfowl foods, some shallow areas do exhibit as mentioned previously, an abundance of cattail; also pond weed

(*Potamogeton crispus*), bur reed (*Sparganium* spp.) and smart weed (*Polygonum* spp.) are present. Waterfowl have also been observed using extreme acid ponds and lakes as resting areas.

What can be expected from spoil banks in relation to big game? With only a growing deer herd, limited reclaimed acres, and low plant growth, it is really too early to tell. However, in western Kentucky, it has been noted that one major movement of deer from a stocked area has been into reclaimed spoil banks. This area was reclaimed by planting to black locust and pines. These trees, along with native trees and shrubs, are now 10'-15' in height providing good cover and browse. Other states have experienced excellent results with this game animal in reclaimed strip mined lands.

Recently the chukar partridge (*Alectoris graeca*) was introduced as a possible exotic game bird to be stocked on strip mine lands. The use of chukars on spoil banks was proposed by Mr. John Crowl, Executive Director of the Kentucky Reclamation Association. Mr. Crowl had studied the bird in some of the western states, and believed there existed a relatively close similarity between habitat conditions of some reclaimed spoil banks and conditions as noted in the west. A review of available literature on chukar habits revealed that except for rainfall, similar conditions did exist. For example, the chukar seemed to prefer a topography of rocky steep slopes. This condition is matched on many spoil banks. Relatively sparse grass vegetative cover was another condition which appeared to be duplicated on spoil banks which had been seeded to fescue (*Festuca arundinacea*) and Korean lespedeza. The third habit comparison can be made between semi-dense low canopy cover. In the west this element of a successful habitat is filled by bitterbrush and other native species of tall growing shrubs. On spoil banks, the element is duplicated by various native shrubs and planting of black locust (*Robinia pseudoacacia*) and shrub lespedeza (*Lespedeza* spp.).

The first attempt at stocking chukars was more or less of a random nature. Approximately 300 birds (14 to 16 weeks of age) were released in the fall of 1955 on three separate sites. Only random observations were made on these birds since no project was established for extensive study. But many interesting observations were made which gave some encouragement. The chukar quickly adapted itself to the new environment and made extensive use of the rocky areas of spoil banks. When the birds were found they were generally well hidden in the cracks and crevices of the rocky areas. Roost sites were found under overhanging rocks, and when pursued, the birds preferred to run in among the jumbled piles of rock. The latter mentioned habit made pursuit and the use of dogs almost impossible. The birds also showed a tendency to run up the slope then fly to the bottom of the valleys. This flight generally placed several steep narrow ridges between the pursued and the pursuer.

Verbal reports were received of seeing chukar broods and juvenile birds on two of the three areas during the spring of 1956, but here again no concerted effort was made to verify these reports.

Very limited crop analysis revealed the chukar fully utilized the foods at hand. Vegetative parts and seeds of both fescue and Korean lespedeza plus insects were found in the crops.

## MANAGEMENT TECHNIQUES

Management of and development for wildlife on strip mine lands is *New*. New, as the lands on which applied; therefore, the theoretical plans expressed must be considered as such and undoubtedly will need modification as time goes by.

However, the plans and theories can be accepted as somewhat advanced and are all based upon sound, practical experience on strip mined lands. Other scientists more qualified in reclamation and wildlife management have studied and approved these concepts.

Many basic game management techniques can be applied to some degree on strip mined lands, but it is generally conceded that some modification of techniques is needed. Spoil material and topography of the banks make conditions entirely different than those found on agricultural or forest lands.

Plan I is a plan of development and management, not exactly starting at the beginning. This plan is based on using what is left of native vegetation.

The nucleus of vegetation can serve as a beginning for wildlife development. In any strip mine operation there are areas which are ignored by the mine operator, because of the absence of coal, or the coal strata is too deep, or of poor quality.

There are many factors governing the type and amount of reclamation around this nucleus, but the two which will directly affect wildlife will be the type of vegetation within the nucleus and the plantable conditions of the surrounding spoil material. The type of vegetation within the nucleus will govern to a large extent the species of game toward which management is directed.

Plan II is a plan of development and management when reclamation is being started in tracts of strip mined lands which have no nucleus or source of natural vegetation. This type of planting could be considered as a "hollow block" with changes in vegetative types giving the maximum in "edge effect" after several years of growth.

The game species under management would change over the years as the plants grew. The removal of various forest products from the tree planting would aid in manipulating the overall wildlife habit.

Plan III is based on the utilization of impounded water. Development for the improvement of wildlife habitat near these waters is a relatively simple matter. Many of the trees and shrubs now used in reclamation work require moist sites, and are adapted for this type of plan. In many areas the presence of acid in the water may prevent aquatic life, but even such areas can be made more desirable for wildlife if food and cover plants are available around the perimeter of the water.

Plan IV is a development and management plan which can be applied where forest products are the ultimate goal. The plan is based on observed movements of wildlife species in spoil bank areas, and it employs the use of grasses or shrubs in strips through major forest plantings.

The theory behind the use of strips along the gullies and ridges is to make observed natural travel-ways more desirable to game species. With such strips, the essential edge would normally fall slightly below the ridge crest and above the base of the gully. Aside from feeding areas, such edges should give the optimum in nesting site location. This would be especially true in relation to adverse weather conditions.

Plan V is a development plan for contour type of strip mining which is found in eastern Kentucky and other mountainous areas. Thoughts behind the plan are two-fold. The use of shrubs on actual spoil material which has been pushed or flowed over the natural slope, would greatly assist in stabilizing this material. In relation to wildlife, these shrubs could produce food in various forms, especially if the adjacent timber was in the advance stages of growth and offering little in the way of game foods.

Use of grasses on the remainder of the affected areas would serve as essential grassland within otherwise solid forest. Open areas of this nature, with the resulting edge would be of considerable value in big game management of mountainous areas.

#### PLANT SPECIES FOR DEVELOPMENT

Much still needs to be learned about the utilization of plants on strip mined lands. Two important factors to consider in selecting plants is whether or not the plant species will tolerate acid conditions and of what value the plant will be to wildlife. The following is a brief listing of plants being used on strip mined lands in Kentucky:

*Kentucky 31 fescue*—A grass which is widely used in reclamation work. It will tolerate moderately acid conditions and is known to be utilized by the chukar partridge and cottontail.

*Korean Lespedeza (L. stipulacea)*—A plant used in combination with fescue as a standard seeding mixture for strip mined lands with considerable wildlife

food value. This plant will tolerate highly acid conditions and is known to be used extensively by both quail and chukar partridge.

*Secirea Lespedeza (L. cuneata)*—A plant used in reclamation of strip mined lands that will tolerate moderate to highly acid conditions. Dense growths have shown usage by rabbits.

*Shrub Lespedeza (L. bicolor) (L. japonica)*—An exotic game food shrub becoming widely used in reclamation work. Experimental plantings have shown good survival (80% to 90%) on spoil material with a pH of 4.5. Three-year-old plantings on spoil banks have revealed heavy seeding.

*False Indigo (Amorpha fruticosa)*—An exotic shrub being used on an experimental basis on spoil banks. Observations have shown a tolerance to extremely acid conditions. In experimental plots, good survival has been obtained with a pH of 3.8 to 4.0. This plant has been observed to produce seed the second year. Probable use on spoil banks would be as a low canopy cover plant.

*Sweet Clover (Melilotus spp.)*—A biennial plant widely used in reclamation work with apparent value to wildlife. The plant is best used on spoil material of a calcareous nature.

*Kudzu (Pueraria thumbergiana)*—An exotic vine type plant used in many areas to provide fast ground cover. Apparently will tolerate moderate to high acid conditions. Observed usage by rabbits for cover.

*Multiflora Rose (Rosa multiflora)*—An introduced thorny shrub which has been used on spoil banks with good success. Will tolerate only moderately acid conditions. Three-year-old plants have been observed with cane growth of five feet or more. On spoil banks the plant tends to have procumbent growth habits. Plantings will provide excellent escape cover.

Many species of both hardwood and pine trees can and are being used for the development of wildlife habitat. Although the plantings are primarily for the forestry phase of reclamation, they will nevertheless have a direct or indirect value to wildlife.

In developing strip mined lands for wildlife much consideration should be given to native plants. It is surprising to find that many of the native plants which first appear on spoil material are rated high as wildlife food and cover plants. Only a few of many native plants are listed here, and to date no techniques have been perfected for perpetuating these plants.

*Pokeberry*—A native plant which is one of the first to volunteer into fresh spoil. Apparently will tolerate moderate to extremely acid conditions. Observations have been made on usage of the berries by doves, opossum, raccoon and fox.

*Blackberries and Dewberries (Rubus spp.)*—Native plants which provide both food and cover for wildlife and appear on spoil material shortly after it has been deposited. Very tolerant to highly acid conditions. Soil tests taken around the roots have shown a pH of 4.5 to 5.0.

*Partridge Pea (Chamaecrista spp.)*—A native legume which appears on spoil quite readily and exhibits good growth characteristics. Apparently will tolerate moderately high acid conditions.

Many other native plants invade strip mined lands depending on spoil conditions and the nearness of the seed source. Greenbrier (*Smilax* spp.), trumpet vine, (*Campis radicans*), sumac (*Rhus* spp.), and many native grasses are also among the first plants to become established on spoil material. Red bud (*Cercis canadensis*) is one of the first small trees to invade spoil material in eastern Kentucky. Native trees of value to wildlife, which readily invade spoil banks, are sassafras (*Sassafras albidum*), persimmon (*Diospyros virginiana*). Wild blackcherry, wild plums (*Prunus* spp.), hawthorns (*Crataegus* spp.) and mulberry (*Morus rubra*) are other native trees and shrubs found occasionally on spoil banks. Their value to wildlife is well known.

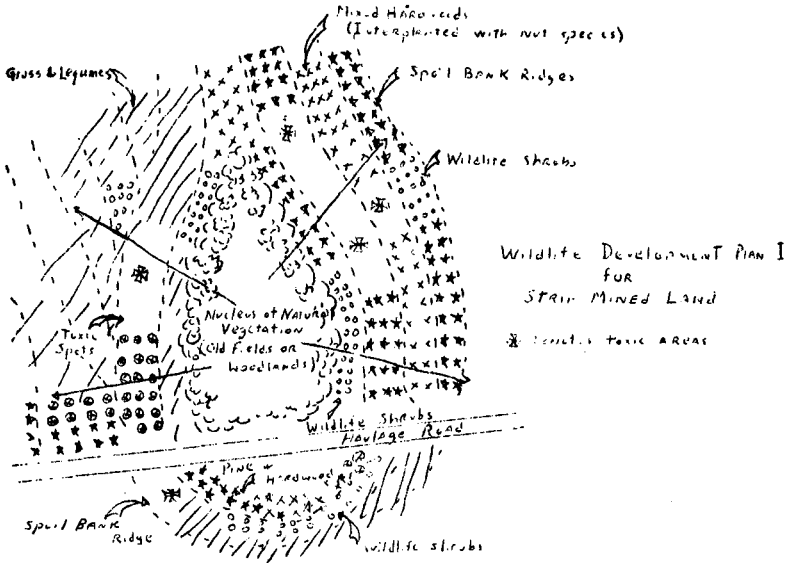
## CONCLUSION

Strip mined lands offer a definite potential for the development of wildlife habitat. To the game manager responsible for areas containing strip mined lands, this potential should not be overlooked or underestimated.

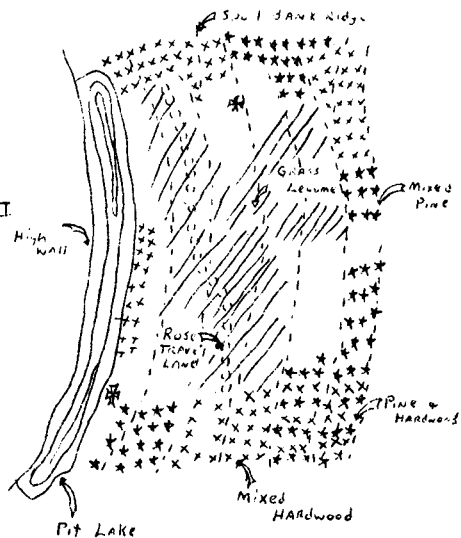
It is true that the very nature and properties of spoil material will create many complex problems; however, by applying common sense, coupled with sound observations, these problems can generally be solved. The material presented in this paper is by no means the final answer since much basic research along these lines needs to be made.

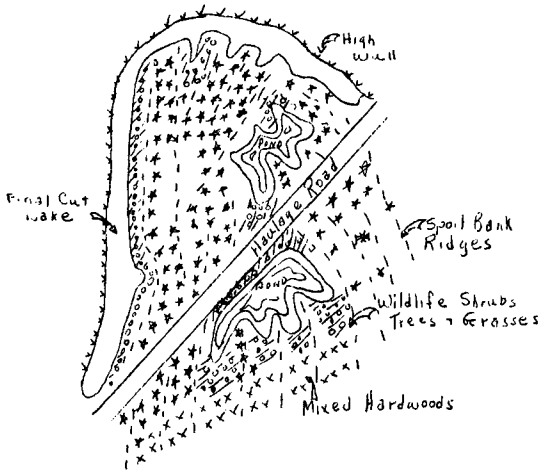
In the minds of the game managers responsible for areas of strip mining the first question to arise is "Where do we start?" The starting point is with the mine operator who either has leased or owns the land. Most operators are more than willing to cooperate in reclaiming strip mined land for wildlife even if no monetary value can be realized.

In strip mined areas where the operators have formed reclamation associations or similar organizations and hired competent trained technicians to handle their reclamation problems, the game manager's job is simplified. Closely coordinated planning between the game manager and reclamation personnel will result in good wildlife management on the strip mined lands.



Wildlife Development Plan II  
 for  
 Strip Mined Land  
 ✱ denotes toxic areas

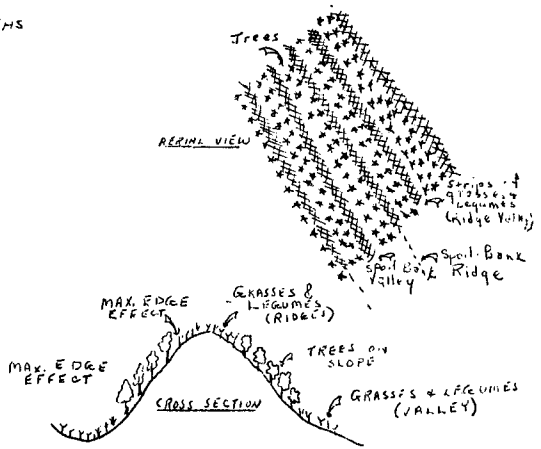




WILDLIFE DEVELOPMENT PLAN III

FOR SPOIL BANK AREAS

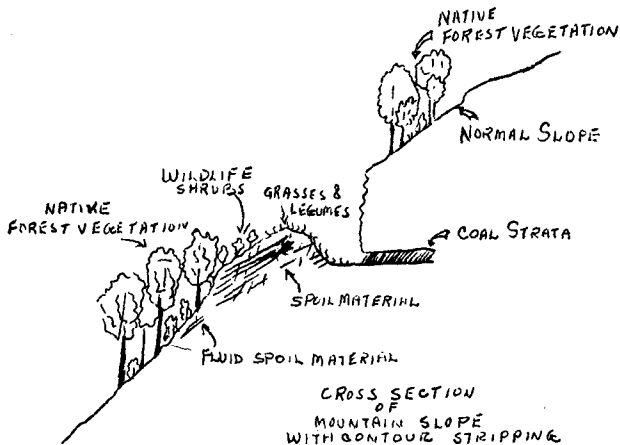
\* DENOTES TOXIC AREAS



WILDLIFE DEVELOPMENT PLAN IV

FOR SPOIL BANK AREAS





----- WILDLIFE DEVELOPMENT PLAN V -----  
 FOR SPOIL BANK AREAS

## CONTROL OF RACCOON PREDATION ON MUSKRATS NEAR CURRITUCK, NORTH CAROLINA

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Raccoon populations have been high for more than a decade in Currituck County in the northeast corner of North Carolina. Small harvests caused by low fur prices have resulted in their steady increase in all parts of the county—from wooded swamp to open marsh. In the marshes, raccoons have been very destructive to nestling muskrat populations. Muskrat yields in the county have dropped about 75 per cent and some marshes are no longer trapped. On the state-owned Northwest River area, muskrats subjected to little or no trapping failed to increase during the six-year period from 1947 to 1952. On the nearby Tice marsh yields dropped 96 per cent from 1947 to 1952.

Experiments in the control of raccoon populations were initiated on the Northwest River area in 1952 and on Tice marsh in 1953. In 1956, control of the raccoon was also attempted on the state-owned marsh near Corolla on the Outer Banks.

### DESCRIPTION OF THE STUDY AREAS

The Northwest River area contains 1,263 acres of which about 700 are marsh. The principal marsh cover types are cattails (*Typha latifolia*, *T. domingensis*, *T. glauca* and *T. angustifolia*), threesquare (*Scirpus olneyi*), needlerush (*Juncus roemerianus*), cordgrass (*Spartina cynosuroides*), and sawgrass (*Cladium jamaicense*). Cattails and threesquare occupy approximately 60 per cent of the marsh area. About 185 acres of the marsh are diked. The remaining 560 acres of the area contain scattered stands of pine (*Pinus regida* and *P. taeda*) and swampy areas of sour gums (*Nyssa aquatica-biflora-sylvatica*), cypress (*Taxodium distichum*), and red maple (*Acer rubrum*), and swamp rose (*Rosa carolina*). Den trees are numerous. Fish, frogs, crayfish, muskrats, small rodents, cottontail rabbits, gray squirrels, gray foxes, birds, turtles and snakes are common. Deer are present, also otter and a few mink.