RESPONSE OF BOBWHITE QUAIL TO MANAGEMENT ON SOME ILLINOIS STRIP-MINED LANDS

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Population changes of bobwhite quail, *Colinus virginianus*, in response to habitat development on strip-mined lands have been studied in southern Illinois since 1954. This has been conducted as a part of a cooperative research project to evaluate the potential of spoil banks as recreational areas with primary emphasis on hunting and fishing. Initially, population levels of bobwhites precluded productive hunting on stripmine lands and it was considered important to determine the feasibility of developing such areas to increase resident game populations. Earlier efforts toward reclamation on strip-mined lands have most often been directed toward forestry, horticultural and grazing practices (Klimstra, 1959).

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Description of Area

A 920-acre tract, located 6 miles south of Pinckneyville and 3 miles west of Pyatts, Perry County, Illinois was deeded to Southern Illinois University for research purposes by the Truax-Traer Coal Company. Small agricultural fields interspersed with woods border on the west and partially on the south; similar strip-lands lie adjacent to all other boundaries.

The spoilbanks on the research area, formed from 1932 through 1941 (excluding 1934), vary in direction, length and height. Erosion has rounded the crests and deposited alluvial materials in the valleys between the ridges. Soils, at or near the surface, generally have sufficient quantities of available phosphorus and potash; nitrogen is available at the rate of 30 to 40 pounds per acre (Birkenholz, 1958). Except for shale and gob deposits, soils are neutral or basic. Analysis of soils and vegetation indicate that soil fertility is better than adjacent farm lands not under proper management (Klimstra, 1959).

Approximately one-half of the total area, including the south and western portions, was planted to trees in 1942 and 1943. Pine planta-

tions contain short-leaf pine (*Pinus echinata*) and jack pine (*Pinus banksiana*); deciduous species include black locust, osage-orange (*Maclura pomifera*), catalpa (*Catalpa speciosa*), silver maple (*Acer saccharinum*) and oaks (*Quercus* spp.). Excluding the black locust plantings, these plantations, characterized by a dense stand of trees and sparse understory, are of little value to upland game and require extensive management to produce suitable habitat.

The main herbaceous species (scientific nomenclature after Jones, 1950) on naturally revegetated spoilbanks include sweetclover (*Melilotus alba* and *M. Officinalis*), goldenrod (*Solidago* spp.), woody aster (*Aster pilosus*) and cheat (*Bromus secalinus*). Interspersed widely with these herbs are clumps of sumac (*Rhus glabra* and *R. copallina*), poison ivy (*Rhus radicans*) and blackberry (*Rubus frondosus*). Cottonwood (*Populus deltoides*), sycamore (*Plantanus occidentalis*), willow (*Salix interior*), elm, (*Ulmus rubra*), box elder (*Acer negundo*) and persimmon (*Diospyros virginiana*) are common trees.

Previous studies (Brewer and Triner, 1956; Verts, 1957) showed that the vegetation in the naturally revegetated areas is similar in each age group of spoils; species composition, number of stems, average height of vegetation, and percentage of bare ground varies little from areas mined in 1932 to spoilbanks formed in 1941. The only significant difference in the vegetation on the oldest spoils as compared with those more recently formed is the increase in diameter and height of the trees.

Typical of many Southern Illinois strip-mined areas, there are two unmined tracts on this research area. A 51-acre plot near the center and a smaller one along the west border provide about 60 acres of tillable land though the clay soils are of low fertility and poorly drained.

On the basis of initial studies (Brewer and Triner, 1956; Verts, 1956) it was believed that spoilbank habitat could be improved for upland game. The uniformity of vegetative cover as well as the lack of it in some areas, the absence of plant species which provide food, and the lack of openings or breaks in plant distribution were considered major limiting factors.

Techniques

Roads, totaling 4.2 miles in length, were constructed. A total of 12.1 miles of spoil crests were leveled; 0.9 mile of spoil valley was graded and widened. Selected areas of spoilbanks were leveled to provide plots ranging from 0.25 acre to 1.5 acres in size. These developments not only created critically needed "edge" but also bare ground for establishing plant species which would benefit bobwhites.

Korean lespedeza (*Lespedeza stipulacea*) was broadcasted on roadsides, leveled areas, non-mined lands and spoilbanks lacking in ground cover each winter after 1955. Establishment has been successful on over 100 acres of the research area; natural reseeding occurs each year.

Sericea and bicolor lespedezas (*Lespedeza sericea* and *bicolor*) were planted on spoils, roadsides and in prepared food plots. Food patches

containing combinations of Korean lespedeza, German millet (*Setaria italica*), sorghum (*Sorghum vulgare*), soybeans (*Glycine max*), corn (*Zea mays*) and buckwheat (*Fagopyrum esculentum*) were established on the unmined areas and in spoilbanks on leveled areas. Row crops were planted most years on the interior and perimeter areas that were not mined.

Since 1954, quail populations have been censused each year just prior to the hunting season (Table 1); in addition, daily observations of coveys have been maintained. Except for 1958, censuses were accomplished in 2 or 3 days by 5 to 12 persons walking abreast along the crests of adjacent spoilbanks. Dogs were utilized where possible, but dense patches of briars and the undulating terrain restricted their effectiveness. The fall population in 1958 was estimated on the basis of the number of quail present the following spring.

Crops were obtained from 49 quail harvested from November 14 to December 23, 1959, on the research area. Food items from the crops were identified and compared with contents from crops of six quail collected during the fall of 1955.

TABLE 1.—Bobwhite Quail Populations on the Pyatts Striplands Research Area, November, 1954-59.

Year	Number of Coveys	Mean Covey Size	Total Number of Quail
1954...	4	11.5	46
1955...	7	12.0	84
1956...	10	16.3	163
1957...	12	13.9	167
1958...	16*	13.5*	216*
1959...	20	13.9	279

* Estimated on basis of prenesting population and routine field observations.

Presentation and Analysis of Data

The number of bobwhites on the research area (Table 1) increased from 46 birds in 1954 to 279 in the fall of 1959. The population nearly doubled from 1954 to 1955 and from 1955 to 1956; increase was more gradual in subsequent years. The population buildup continued on the research area through 1958 and 1959 despite decreases in regional populations (Klimstra, 1958, 1959).

Excluding the pine and hardwood plantations not used by quail, the population density was about one bird per 2.3 acres of habitat after 4 years of management; nearly 250% more than on unmanaged farm lands in southern Illinois (Klimstra, 1959). This increase in population, when compared with adjacent unmanaged, but similar, spoilbank areas, is striking. The high population level afforded hunting in 1959 even though the terrain was more difficult to traverse than nonmined areas.

Roads and leveled crests of spoils were important in both management and hunting of quail. The roads were valuable to quail as loafing sites when vegetation was wet and in providing edge. Food plots were developed adjacent to roads and leveled crests of spoils to facilitate access for management and hunting. Quail did not include in their ranges areas where there had been extensive leveling of spoils or the isolated

leveled plots when no food producing plants were provided. Regrowth of sweetclover, briars, cottonwoods, and cheat was more rapid on these cleared and unplanted areas than on areas planted to favorable plant species following disturbance of the natural vegetation.

With the exception of black locust plantings, tree plantations were of little value as quail habitat at any time during the year. The open canopy resulting from destruction by the locust borer on the trees produced an understory vegetation. With food available from the locust and cover from the tangled understory, quail utilized segments of the locust plantations; however, hunting was next to impossible because of the dense growth. Large plantation plantings (exceeding 5 acres in size) are not recommended for spoilbanks which are managed for wildlife. Limited pine plantings may be used to enhance aesthetic qualities of striplands and to provide edge, but large block plantings offer little food or protection for bobwhites.

TABLE 2.—Food Items Identified from Crops of Bobwhite Quail Collected on the Pyatts Stripland Research Area, Fall, 1959.

Food Item	1959		
	Per cent occurrence	49 crops Rank	Per cent volume
Korean lespedeza (*Lespedeza stipulaceae*)	94.0	1	73.0
Common lespedeza (*Lespedeza striata*)	26.0	2	trace
German millet (*Setaria italica*)	24.0	3	17.4
Sweet clover (*Melilotus* spp.)	20.0	4	trace
Small wild bean (*Strophostyles leiosperma*)	18.0	5	trace
Common ragweed (*Ambrosia elatior*)	16.0	6	trace
Tick-clover (*Desmodium* spp.)	16.0	6	1.2
Lance-leafed ragweed (*Ambrosia bidentata*)	14.0	7	trace
Dwarf sumac (*Rhus copallina*)	12.0	8	1.2
Trailing wild bean (*Strophostyles helvola*)	8.0	9	trace
Beggar-ticks (*Bidens* spp.)	8.0	9	trace
Wild black cherry (*Prunus serotina*)	8.0	9	1.2
Grit	8.0	9	trace
Short horned grasshopper (*Locustidae*)	6.0	10	trace
Cheat (*Bromus secalinus*)	6.0	10	trace

TABLE 2.—Continued.

Food Item	1959		
	Per cent occurrence	49 crops Rank	Per cent volume
Pennsylvania smartweed (*Polygonum pennsylvanicum*)	6.0	10	trace
Leafy material	6.0	10	trace
Hemiptera (*Redviidae*)	6.0	10	trace
Sorghum (*Sorghum vulgare*)	4.0	11	trace
Partridge-pea (*Cassia fasciculata*)	4.0	11	trace
Leaf beetles (*Chrysomelidae*)	4.0	11	trace
Soybeans (*Glycine max*)	2.0	12	trace
Smooth sumac (*Rhus glabra*)	2.0	12	trace
Black locust (*Robina pseudoacacia*)	2.0	12	2.5
Rough buttonweed (*Dioda teres*)	2.0	12	trace
Panic grass (*Panicum* spp.)	2.0	12	trace
Paspalum spp.	2.0	12	trace
Yellow foxtail (*Setaria lutescens*)	2.0	12	trace
Spiders (Arachnidae)	2.0	12	trace
Total Number of Food Items	29		

Thinning and block cutting (or using chemical herbicides) within plantations might enhance their wildlife values, but are expensive and time consuming. Management efforts on older striplands may be more profitably directed toward retarding succession on naturally revegetated areas and establishing food producing plants.

The importance of providing food was evident in the analysis of crops of bobwhites collected on the research area (Table 2). Crops of quail collected in 1959 contained Korean lespedeza, German millet, black locust, tickclover, dwarf sumac, and wild black cherry in amounts in excess of 1% of the total volume. Korean lespedeza was the most important single food, occurring in 94% of the crops and yielding 73% of the total volume.

Though a small sample for comparative purposes, the crops of six bobwhites collected on the area in 1955 contained seeds of corn (available in a food plot), trailing wild bean (*Strophostyles helvola*), small wild bean (*S. leiosperma*), rushfoil (*Crotonopsis elliptica*), lance-leafed ragweed (*Ambrosia bidentata*), beg-

gar-ticks (*Bidens* spp.) and grasshoppers in amounts exceeding 1% of the total volume (Verts 1956). Davison (1958) classified trailing and small wild beans and rushfoil as inferior quail foods. Even though available in very limited amounts, cultivated species comprised 50% of the volume of the crops (primarily corn). Korean lespedeza was not recorded in any of the crops.

The establishment of several covey ranges could be correlated with the development of food plots in the spoilbanks, especially where Korean lespedeza had been planted. A total of 227 observations of coveys was recorded during the winters of 1957-58 and 1959-60; 70% of these occurred in or immediately adjacent to patches of Korean lespedeza. Quail began using this lespedeza as the seeds matured in late September and early October. Continued and intensive use of lespedeza plantings was recorded until other foods became available in late March and early April even when harassed by hunters during the legal season.

Broods of quail utilized food patches on the unmined areas during the summer; this use continued until the hunting season in November, indicating the importance of managing unmined areas associated with stripped lands. Following the initial exposure to hunting, however, the birds could only infrequently be located near the food patches or even on the unmined tracts. Stoddard (1931) reported that dog handlers spoke highly of small food patches as being a great help in locating coveys when they started to train their dogs in the fall. In Stoddard's study, general use of the food patches ceased soon after work with the dogs began. Utilization of the food plots on the unmined areas followed a similar pattern, but continued use of introduced foods within the spoilbanks was noted even after constant harassment by hunters.

One of two coveys utilizing a food patch in 1959-60 was completely annihilated after being located on six separate occasions during the hunting season in the same food patch; the other covey was reduced to one-half of the original number, but continued to utilize the food plot. The food plots within the spoils served as starting points for hunters with dogs and high success was recorded in locating coveys during 1959-60. Quail were not always present within the plots, but were often trailed from the plots by dogs. Though Stoddard (1931) warned against localization of coveys during the hunting season to prevent over harvest unless shooting is controlled, localization is necessary for management of quail on strip-mined lands.

A few of the coveys on the entire area may bear the brunt of the hunting pressure, but the terrain and availability of escape cover generally makes the hunting of singles unprofitable. Careful observation of flushed birds sometimes makes a second contact with a segment of a covey possible. The distribution of the coveys throughout the research area in 1959-60 was such that a number of coveys were not located by hunters during the season. The danger of over harvest is considered to be very minor.

Summary

Responses of bobwhite quail to

management practices applied on 920 acres of strip-mined land in southern Illinois have been studied since 1954. Practices employed included road construction, grading of spoils and widening of spoil valleys, manipulation of cover and introducing plant species which produce food for quail. An increase of bobwhites from 46 prior to incorporation of management to 279 in 1959-60 was recorded. An analysis of the crops of 49 quail obtained in 1959-60 indicated a dependence of the birds on plant species introduced through management.

Huntable populations of quail on naturally revegetated spoilbanks depends largely on the establishment of a suitable food supply and to a lesser extent upon altering the vegetative pattern to provide diversity. Large tracts with extremely homogeneous vegetative cover are as detrimental to quail populations as are farmlands where cover is wanting. Efforts should be directed toward retarding or disrupting the natural plant establishment by bulldozing, burning or application of herbicides. The selection of specific spoilbanks to manage would depend upon the topography and the accessibility for hunting. Less expense would be incurred if management practices were initiated as soon after mining as possible. This would result in less competition as pioneer species would not have become firmly established.

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