A PATTERN TO POPULATION OSCILLATIONS OF THE BOBWHITE QUAIL IN THE LOWER PLAINS GRAZING RANGES OF NORTHWEST TEXAS *

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The Lower or Rolling Red Plains comprise an area of nearly 23 million acres. Approximately two-thirds of the area are used for cattle raising. Mesquite brush has spread throughout the area since the establishment of ranching, and these former prairies now make one of the important quail hunting areas in Texas.

Geographically, the Lower Plains area represents an eastern extension of the Great Plains in northwest Texas. It lies west of the North Central and Grand Prairies, and extends from the edge of the Edwards Plateau in Tom Green County northward to Red River. It is bounded on the west by the High Plains escarpment.

The Lower Plains have a generally rolling surface, as the alternate name Rolling Red Plains implies. However, there are extensive level areas which are mostly devoted to field crops. The forks of several rivers originate west of the Lower Plains and traverse them in a generally west to east direction.

The soils have developed mainly from red bed clays and sandy and clayey outwash parent materials. Where developed on gentle slopes from red beds, the deeper soils are mainly of the Tillman, Hollister, and Foard series. Very shallow and shallow soils on moderate to steep slopes are mainly Vernon soils over red beds, Potter and Mansker over outwash materials, or frequently, thick beds of caliche. Soils developed from outwash materials on flat to moderately sloping surfaces are Abilene, Miles, and Roscoe series. These range from light brown loamy fine sand to dark grayish brown clay in the surface layers, and have subsoils ranging from reddish sandy clay loam to dark grayish brown clay.

The average annual rainfall in the Lower Plains varies from 29 inches at the eastern edge to 20 inches at the western margin. However, average or "normal" rainfall seldom occurs. From existing records it appears that for different reporting stations, 52 to 64 per cent of the years have less than average rainfall. Reporting stations have records showing annual totals varying from approximately 7 inches to nearly 60 inches.

Average rainfall is low during the winter and peaks in April and May. Another peak is reached during September and October. The Lower Plains have cool winters and hot summers. June and July are commonly hot and dry. The average growing season is 231 days, but like the rainfall, has wide extremes. The severest part of the winter usually arrives after the first of January.

The more important range grasses are the various gramas, the bluestems, curly mesquite, buffalo grass, and sand dropseed. Locally, depending on seasonal conditions, other species are quite often as important.

The mesquite tree is the dominant woody plant, occupying as it does most of the grazing range. It reaches greatest size and density in the better watered east half of the Lower Plains.

The ecology of the bobwhite quail in the mesquite brush habitat of the Lower Plains is of particular interest because, 1) the area lies on the western perimeter of the bobwhite's range, and 2) the habitat is an ephemeral one, depending upon phases of plant succession induced by drouth and overgrazing alternating with seasons of excessive rainfall.

Twice during the last 25 years, bobwhite numbers have risen to fantastic levels in the Lower Plains mesquite brush grazing ranges and then

* A contribution from Pittman-Robertson Projects Nos. W-1-R, W-45-R, and W-88-R (Texas).

undergone sharp declines. These peaks occurred during 1942 and 1958. Almost as high populations existed during 1950. In between these years there have been continuous fluctuations, with minor peaks providing good to excellent hunting, and a few seasons during which hunting virtually ceased.

For a continuous record of these oscillations in bobwhite numbers, the writer is indebted to Mr. Fred Forman, rancher-sportsman of Throckmorton County, who made available his hunting diary detailing each season's quail harvest by his parties on certain Lower Plains ranches. The records are complete and cover quail bagged per man-day, per ranch, and per season. An 18-year period is spanned, beginning with 1941 and ending with the hunting season of 1958. Rainfall data for the county were included (Figure 1).

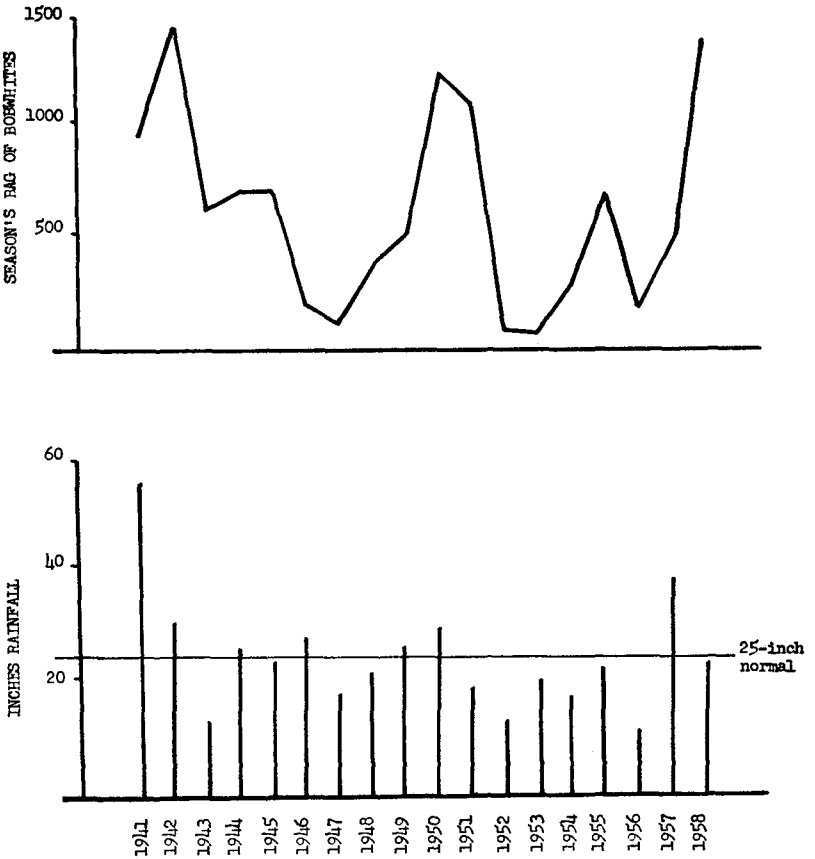

Figure 1. Annual rainfall and seasonal bobwhite harvest on certain Lower Plains ranches */

*/ from hunting diary of Fred Forman

The eruptive population of 1942 was studied through its peak and crash decline (Jackson, 1947). Lehmann (1953) reported an eruptive crop of bobwhites as having literally vanished throughout southwest Texas in the winter of 1950-51. He attributed die-off, desultory breeding, and

perhaps heavy infestations of parasites, to the same thing—inadequate nutrition.

The 1958 situation in the Lower Plains seemed to be of a pattern with that of 1942 in that the eruption occurred simultaneously with a population explosion of range rodents, under similar sequences of rainfall and plant successions. Accordingly, permission was obtained to broaden the scope of the Panhandle Regulatory Survey [2] to allow a more intensive survey in those counties where according to warden reports as well as press and radio publicity, bobwhites were in trouble. The counties were those extending from the base or southeast corner of the Panhandle eastward through Wichita County, and south from the Red River to Jones, Shackleford, and Stephens Counties. The counties in the western part of the Lower Plains held the same irruptive population of bobwhites, but habitats had not changed so abruptly, and the effects of rodents were not as pronounced.

The following few examples serve to show the magnitude of the quail population and harvest during 1958.

During November, Conservation Officer C. T. Pittman censused a two-square-mile study area near Seymour, Texas, using excellent pointer dogs. A total of 75 coveys of bobwhite and scaled quail was counted, for a conservative estimate of 1,125 quail. When the hunting season opened, the two sections were subjected to heavy hunting, and the harvest carefully determined. The harvest on the 1,280 acres was 1,030 quail, of which number approximately 65 per cent was bobwhites. As the season progressed, influx from overcrowded surrounding range filled the gaps created by hunting, and the end of the season found quail still present.

It is generally conceded in Texas that shooting preserve record books fall short of revealing the actual game kill. Nevertheless, the record books of nine Motley County shooting preserves, totaling 30,000 acres, showed a total kill of 12,000 quail, or a bird per two and one-half acres.

The diary of Fred Forman's hunting parties has been mentioned above. These expert hunters are in the field almost every day of suitable weather during the season. Twenty-seven hunts were made during the 1958-59 season, with an average bag of 52.48 bobwhites per trip; the average kill per man-day was 11.42 quail, barely under the 12-bird daily bag limit. Forman's 18-year journal shows only one year, 1942, affording equivalent hunting success.

Ammunition sales provided a measure of the seasonal harvest of bobwhites, notwithstanding the fact that the army of non-resident hunters would have in the main brought supplies of shells with them. A Lubbock sporting goods company sold four carloads, or 2,400 cases of shells, with a retail value of approximately 120,000 dollars. In one town of 4,000 population, a small store retailed 225 cases of shot shells, another sold 120 cases, and there were eight other suppliers in town. The story was repeated in every Lower Plains town. All the retailers in Wheeler County kept records for a game biologist. The total was 376 cases of shotshells, despite the fact that nearly all the hunting done in this county was by non-resident sportsmen who would have presumably brought stocks of ammunition with them.

Thus was the status of the bobwhite population in the opening weeks of the hunting season beginning December 1, 1958. Almost at once the hunters in the central and eastern Lower Plains counties began to encounter coveys of quail too poor for the table. Such birds were discarded by the hunters, who adopted the practice of first shooting a sample bird from the coveys; if the specimen proved too thin for keeping, another covey in better condition was sought.

Such were the number of bobwhites and so uniform their distribution that the above conditions did not deter hunting; neither were the proportions of the ensuing die-off noted by most hunters. However, from the records of the wardens working the area and interviews with a

2 Pittman-Robertson Project W-45-R-9 (Texas).

great many hunters, it seems clear that, beginning about the first of January, the decline in bobwhite numbers was accelerated by a series of nights with sub-zero temperatures. Each such night would have left its toll of thin weak bobwhites dead on the roost site. Also, the feeble power of flight of such quail, limited in many observed instances to one short flight, would have made them easy prey to almost any kind of predator.

During a period February 18-March 4, a reconnaissance was made in the following counties: Archer, Baylor, Foard, Hardeman, Stephens, Throckmorton, Wichita, and Wilbarger. Seven ranches in the respective warden districts were selected for intensive checks on bobwhite numbers and the condition of the habitat. The selected ranches were ones for which information was available regarding fall populations and the season's harvest.

At the close of the first day in the field it was evident that the decline in quail numbers had leveled off, and that enough bobwhites survived for stocking the *surviving* habitat.

In contrast to the great fall crop of bobwhites, only 33 coveys were found during the entire survey, which included counts with dogs. This was about the number which one could depend on finding with dogs in a half-day of hunting during the fall months. On one ranch only was a fragment of range found which held a quail population comparable to fall numbers. This was on a part of the ranch which by every accepted standard was without quail food and cover. In general, the bobwhite population was found to be gone from the great tracts of deep soils and bottomlands which normally provides the best habitat. Thin gravelly and rocky soils having less pure stands of rank grasses and a minimum of cover had held fewer rodents, and the small amount of cover which had been produced was still standing. Of the 33 coveys which were found, 27 were on these thinly covered soils.

Distribution of surviving bobwhites showed almost complete reversal in character of recognizable bobwhite habitat. The upland loam and clay soils were covered with a mat of fallen annual grasses now cut at ground level by hordes of range rodents. This sterile and useless mass was identified as being composed of rescue grass *(Bromus unioloides)*, Japanese brome *(Bromus japonicus)*, Canada wildrye *(Elymus canadensis)*, and Texas winter grass *(Stipa* sp.*)*. Vast areas had been covered with a stand of these grasses which had stood several feet high before falling. No forbs of use to quail were identified in the association, and if forbs had previously been present they had long since been consumed by rodents and quail. Low areas and bottomlands were no better habitats; the ground cover was now either a decaying litter or had been completely destroyed by grazing.

Seven bobwhites which were collected from as many coveys in widely separated locations showed remarkable uniformity in the contents of their crops. The weathered and spineless seeds of Texas heronbill *(Eronium texanum)* made up 80 per cent of the total volume of food, and were present in every crop. The presence of heronbill in so large amounts is significant: it grows on soils generally barren of other vegetation and possesses an adaptation which enables its seeds to bury themselves by mechanical action. Thin stands of snakeweed *(Amphiachyris dracunculoides)* stood in areas which had not supported rodents, and the tiny seeds of this plant ranked second in the bobwhite's food, in volume and occurrence. A small amount of green plant material ranked third.

The weights and physical condition of 50 bobwhites proved normal for the season, despite the fact that they were trapped from what appeared to be 100 per cent deficient habitat. No weak or light birds were found, and no evidence of predation was seen. In short, the spring population was in physically better shape than had been the huge fall crop.

The habitat described here had origin in the drouth seared and grazed out soils of the dry years beginning in 1951 and culminating with low

rainfall totals of 7 to 12 inches over most of the area in 1956. Conversely, rainfall for 1957 totaled up to 40 inches at some of the same stations. The results were about the same as if the entire range had been plowed during the winter or early spring of 1957. There were tremendous pastures of forbs in which such key quail-food species as Texas croton (**Croton** *texensis), pigweed (Amaranthus retroflexus),* lesser western ragweed *(Ambrosia psilostachya)* and others predominated. The ground cover grew well up into the lower branches of the mesquite shrubs.

The spring months were cool and wet with the result that in 1958 an association of annual grasses described earlier supplanted the forbs throughout the eastern part of the Lower Plains. The range must have lacked in quail foods of current production, and the assumption seems justified that the bobwhite population must have been living on carried over reserves of food before the crisis became evident. In that case, the high rodent population would have hastened depletion of food stores and brought about their own decline as well. During the spring survey, it appeared that the rodents had disappeared with the bobwhites from most of the range.

The enormous bobwhite populations of 1942 and 1958 in the Lower Plains have too much in common in their histories to be accounted for as coincidence. Both peak populations followed the breaking of major drouths in the region during which mesquite brush ranges were reduced to bare soils and bobwhite quail seemingly disappeared from the land. Both peak quail productions occurred during similar phases of range recovery and were both preceded by a year of rainfall excessive for the region. The rainfall at Throckmorton, for instance, was 55.96 inches during 1941 and 39.54 inches during 1957. Finally, the maximum production of bobwhites failed to synchronize with the plant successions which might have carried such populations through the winter. In each case, adjustment of populations was inevitable. This was brought about in January and February of 1943 when the ground cover failed and predation toppled the bobwhite population. During the winter of 1958-59 the starvation of quail in the eastern Lower Plains was hastened by rodent competition for food, but the determining factor was the successional change-over to stands of annual grasses.

Fortunately, it has been possible to continue investigation of bobwhite populations in the western part of the Lower Plains where there had been no abrupt decline of bobwhites.[3] It is also fortunate that since 1958, annual rainfall totals have been very much on the wet side of the normal. After the crash of bobwhites in 1943, drouth set in again and it was not possible to determine reaction of the surviving population to continued "favorable" rainfall. The word "favorable" has been set in quotation marks, for it now appears that despite three years of above-average rainfall since 1958, the bobwhite population of the west Lower Plains has steadily declined to a level common with that of the eastern part. This decline has accompanied a trend in range vegetation toward almost pure stands of grasses over vast areas.

This is a situation which characteristically results from the ranching practice in northwest Texas of stocking the range at rates suited for average rainfall years. As has been said, years of average rainfall seldom occur. When the annual rainfall drops below the illusory normal the ranges are soon depleted, in which case the rancher feeds his stock and hopes for rain. On the other hand, stocking rates are seldom increased to match the forage production resulting from the wet years. During a series of these, grasses increase to the exclusion of the narrow range of forb species upon which the quail must depend for food. In such times, the exceptions to the above conditions comprise the "spotty" quail habitat. In the Lower Plains, grasses contribute little to the food of bobwhites.

3 Pittman-Robertson Project W-88-R. Dynamics of Bobwhite Quail in the West Texas Rolling Plains.

The mechanics of bobwhite quail fluctuations in the Lower or Rolling Red Plains of northwest Texas may be generalized as following the sequence outlined below:

a. Start with a drouth of several years duration, grazed out and barren ranges, and minimum bobwhite populations. The relic population survives in niches of stable habitat along brushy water courses, about ranch buildings and feed lots where livestock is fed, and field edges where tillage successions of weeds and waste grain exists. These bobwhites are in a sense selected stock and to a degree adapted to lack of cover. Before the advent of grazing, low grounds and water courses must have held the woody cover requisite to bobwhite habitat in the Lower Plains. The prairies were open antelope range and before the mesquite invasion would have been lacking in winter cover for bobwhites.
b. As the drouth progresses, soils on which the grassy turf has been destroyed give rise to weedy plant successions with each spring's limited rainfall. The first year of increased rainfall will bring about thousands of acres of crotons, sunflowers, ragweeds, pigweeds, and other good bobwhite winter foods. This herbaceous ground cover affords functional if unstable winter cover when supplemented by the lower branches of mesquite shrubs. The nutritional situation is good, the predator population has lagged during the dry years, and bobwhite has advantage in capacity to extend his range and occupy it rapidly. This occurs. Call it a lateral increase.
c. A year of excessive rainfall breaks the drouth. A great deal of the mesquite brush grazing range is canopied with snakeweed (broomweed to the rancher) which provides excellent winter ground cover yet is open beneath for quail travel and feeding. Now the range is all bobwhite habitat as regards cover. Bobwhite colonizes the old prairie grassland and begins his increase in density. The food picture is still fairly good and the quail increase is rapid. Call this a vertical increase.
d. Another year of normal or excessive rainfall occurs, with good moisture carry-over from the previous season. Bobwhite has a big hatch on the mesquite brush range and the population explodes. Coveys occupy all marginal habitat, and even overflow into roadsides and Lower Plains towns. Meanwhile, the current range plant succession represents a step away from the previous several ones composed of weedy associations to one composed principally of grasses. Bobwhite is out on a limb, far from stable habitat, and very probably competing with an eruptive rodent population for a diminishing food supply. For the same conditions have quite probably brought about high rodent populations.
e. The bobwhite population crashes if food or cover fails before spring. Otherwise the numbers may not show immediate decline, as example, in the western half of the Lower Plains during the winter of 1958-59. The spring shuffle will spread bobwhites over much of the range, but thinly. When fall comes the hunter will find his birds in niches of habitat which are exceptions to general range conditions. If annual rainfalls hover about the normal this continues to be the situation for several seasons, and results in the minor population peaks and depressions shown in the graph of Fred Forman's hunting success.
f. Dry years set in and continue. Conditions revert again to the ones described under item a.

In summary, the interactions of drouth, range depletion, and subsequent heavy rainfall from time to time converts vast acreages of marginal mesquite brush range to quail habitat in the Lower Plains. This is an ephemeral phase which emphasizes the need to harvest heavily the resulting bonus crop of bobwhites if it is not to be wasted. Neither the quail, nor the weather and plant successions responsible are likely to last more than a year or two.

By now it should be possible to recognize the signs of an approaching buildup of peak populations of bobwhites in the Lower Plains, and to adjust hunting regulations to permit harvesting a greater portion of the surplus. When eruptive populations of bobwhites occur again in the Lower Plains, it would be wise management to open the season much earlier, perhaps October 1, and to liberalize bag and possession limits.

With a greater part of the Lower Plains now under regulatory management of the Texas Game and Fish Commission, the above presents no great problem in itself. The bigger problem is to persuade ranch owners to allow more than the present token amount of hunting permitted on a vast aggregate acreage where the great waste of surplus quail occurs.

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COTURNIX QUAIL INVESTIGATIONS IN KENTUCKY *

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INTRODUCTION

In 1955 a new exotic game bird exploded on the midwestern scene with a terrific bang. It was the Japanese subspecies of the coturnix quail (*Coturnix coturnix japonica*), also known as the Old World quail or the Japanese quail, a migrating bird in its native range. Accompanying publicity, largely because of its amazing prolificness under penned conditions, heralded it as the answer to the wildlife manager's and gunner's problem. The need for increased targets for sportsmen would be solved by this bird, we were informed. Grossly exaggerated and misleading publicity provided fuel for demanding sportsmen to besiege state conservation agencies with requests to obtain breeding stock and begin mass releases as soon as possible.

Following the precedent established by investigations of two other exotics, the ring-neck pheasant and the chukar partridge, Kentucky's work with this new bird was placed in a research study. Here, releases were kept to a minimum and confined to selected habitat types with intensive follow-up studies by trained personnel.

Breeding stock was obtained from the Missouri Conservation Commission in the spring of 1956. Originally, Missouri obtained 70 pairs from a California importer in the spring of 1955. These birds were three generations removed from stock originally shipped from Japan. During the summer of 1955 the Missouri Commission reared four generations of young and it was from these progeny that Kentucky's stock was procured. Birds were also distributed to Tennessee, Oklahoma, Alabama, Ohio, Nevada, Virginia, Georgia, Illinois and Indiana.

Kentucky's study was initiated on May 1, 1957 as a phase of Pittman-Robertson Project W-34-R, Exotic Game Bird Investigations. A reorganization of P-R projects resulted in the termination of W-34-R on July 1, 1959, at which time the study was incorporated as a phase in Project W-38-R, Special Problems Investigations, which embodied all game research.

The objectives of the study were to determine the survival rates and influencing factors of released pen-reared Japanese coturnix quail in Kentucky. The findings were to be used in the formulation of coturnix management meas-

* A Contribution of Kentucky Federal Aid Projects W-34-R and W-38-R.