

ORIENTATION IN PRAIRIE CHICKENS

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THIS paper describes the use of natural features as reference points to territorial boundaries by cock Prairie Chickens (*Tympanuchus cupido pinnatus*) and the birds' response to experimental creation and movement of mowed edges on booming grounds.

Hamerstrom and Hamerstrom (1960) suggest that such natural features as wheel tracks, dead furrows, tussocks, and droppings may serve as reference points to Prairie Chicken territorial boundaries. I found similar features in apparent use for the same purposes on 23 booming grounds in Grant, Linwood, Carson, and Plover Townships, Portage County; and in Sherry and Sigel Townships, Wood County, Wisconsin during 1962, 1963, and 1964. Also cocks relocated territories in response to uncontrolled midseason changes in surface features. Experimental changes in booming ground cover were implemented by mowing to study cock responses in greater detail.

METHODS

Most of this study was conducted during spring booming seasons and largely during the morning display periods. Booming grounds were watched daily between 1 April and 10 June of each booming season in 1962, 1963, and 1964 from blinds on the edges of booming grounds. Individual cocks were identified by colored leg bands (Hamerstrom and Mattson, 1964), or by distinctive variations in plumage, usually the pattern of undertail coverts. Territorial boundaries of cocks were mapped by noting points of contact between adjacent cocks and orienting those points to natural topographic features and/or inconspicuous markers placed on the booming ground in a 25-foot grid. Thus, it was readily apparent when cocks were orienting to some recognizable feature on the booming ground for territorial boundaries.

New grass growth late in the booming season made it possible to create a noticeable edge on two booming grounds by mowing, and then to move the edge periodically by additional mowing. A 2-foot strip was first mowed in the general vicinity of the existing territorial boundaries after a morning display period. If adjacent cocks accepted the line between mowed and unmowed cover as a territorial boundary, another 4-foot strip was mowed beside the existing strip after the display period on that day. Cock responses were again watched and recorded on the following morning. Additional 4-foot strips were mowed daily until cocks no longer responded or until the study was ended. I developed this technique in 1962 after five cocks responded to experimental mowing of part of a booming ground and successfully applied it on booming ground A in 1963 and 1964, and on booming ground B in 1963. A total of 24 individual cocks was tested in the three experiments in 1963 and 1964. All cocks were not identified as individuals during the developmental trials in 1962, thus, except for the interior cock 3 mentioned below, the 1962 data are not included in this paper.

RESULTS AND DISCUSSION

Natural reference points to territorial boundaries included a fenceline, a shallow drainage ditch, a grass waterway, and edges of depressions and swales. In addition, midseason agricultural practices created changes in surface features that birds promptly adopted as territorial boundaries on two booming grounds. One was partially plowed on 25 April 1963, leaving a strip of sod 13 feet wide through the middle of the booming ground. A 1-foot difference in elevation existed from the bottom to the top of the furrow on the edge of the sod; this edge became the boundary for three cocks. Another booming ground was disked and dragged, and a portion graded smooth on 10 May 1963 in preparation for seeding; the junction of graded and dragged surface immediately became the boundary for four cocks.

The birds also used major differences in vegetation height and composition as boundaries. This was apparent in a natural situation on another booming ground where two cocks used the edge of a swale with coarse vegetation as a boundary. Cocks whose booming grounds were on partially mowed meadows often used the edge between mowed and unmowed cover as a territorial boundary.

Of the 24 cocks exposed to edges newly created by experimental mowing, 21 adopted the mowed edge as a territorial boundary and reacted to changes in its position by moving with the edge as additional strips were mowed (Table 1). All cocks did not respond with every shift of the edge; this may have been a result of the variation in density and height of new grass growth, which in turn caused a variation in the distinctiveness of the edge. Six cocks responded every time to as many as nine successive mowings of 4 feet each. In 1964 every one of the 10 cocks on booming ground A and the 6 cocks on booming ground B accepted the initially mowed edges as territorial boundaries as well as the subsequent moves of 4 feet on the following day. On both grounds the mowed strips were very close to the original territorial boundaries and the vegetation density and height made a sharp edge along a mowed strip. Three cocks did not respond to initial mowing on booming ground A in 1963, perhaps because the mowed strips were not close enough to established boundaries. Altogether 24 cocks were exposed to experimentally created edge by mowing new grass growth in 135 trials; 21 cocks accepted mowed edge as territorial boundary when exposed to it the first time. Edge was shifted 111 times by sequential mowing and accepted as a new boundary 92 times. In 19 trials where the new edge was not immediately accepted, four cocks eventually accepted the edge as a boundary.

Lashley (1915) reports that Sooty Terns (*Sterna fuscata*) use visual objects in the immediate neighborhood of their nest as visual stimuli for

TABLE 1
 ORIENTATION OF PRAIRIE CHICKEN COCKS TO EDGE
 BETWEEN MOWED AND UNMOWED GRASS

Booming ground	Date	A:B ¹
A	2 June 1963	5:8
	3	4:5
	4	5:5
	5	2:5
	6	3:3
	7	2:3
	A	13 May 1964
14		10:10
15		9:10
20		9:9
21		9:9
26		8:9
28		8:9
2 June		7:10
4		4:6
B		31 May 1963
	1 June	6:6
	2	4:6
	3	2:6
TOTALS		113:135

¹A, Number of acceptances of initially mowed edge and subsequently moved edge by mowing; B, number of trials. The first (top) figure for each set of trials gives the number of individual cocks involved: 8, 10, and 6 respectively.

nest recognition; the terns sometimes accepted a moved nest if it were accompanied by two visual objects from the vicinity of the nest. Nero and Emlen (1951) show how Red-winged Blackbird (*Agelaius phoeniceus*) females promptly accepted experimental displacement of their nests, with its supporting vegetation, in moves of 10 to 15 feet for distances of up to 40 feet. My experiments show that Prairie Chicken cocks learn to use natural objects and features as visual clues to territorial boundaries and that they are strongly attached to them.

In two instances (booming ground A in 1962 and 1964) an interior cock (one with territories on all sides) used the mowed edges in such a way that the successive mowing of 4-foot strips reduced the size of his territory each day. In 1962 cock 3 retreated with five successive mowings, relinquishing approximately 75 per cent of his territory before he abandoned the mowed edge as a boundary and reclaimed most of his original territory. In 1964 cock 4 reacted similarly to repeated mowing. This cock also relinquished approximately 75 per cent of his original territory by adhering to the mowed edge as its location changed. When the last unmowed portion of his territory was mowed on 2 June 1964, cock 4 began

reclaiming "lost" area and by 11 June had reoccupied his original territory as it existed on 12 May.

Braestrup (1966) reviews the selective advantages of lek display, Brown (1964) discusses diversity in avian territorial systems, and Robel (1966) presents quantitative data on mating success of the Greater Prairie Chicken relative to territory size. There probably is an optimum size for an individual cock territory but, as Nice (1941) shows for Song Sparrows (*Melospiza melodia*), the size claimed is probably larger than needed as evidenced by the two cocks above that relinquished territorial area. Both these cocks copulated successfully when their territories had been reduced by approximately one-half. Other cocks subsequently copulated after their territories had been reduced still further. By now the interior cocks were noticeably involved in vigorous territorial defense much of the time. Thus relinquishing territory in favor of mating may be of selective value, at least up to point, for both cocks finally resisted further constriction of their territories through intensified aggression at the expense of mating. Here aggressiveness may suppress their reproductive activity.

Eliot Howard (*in* Huxley, 1934), while observing the territorial behavior of Coots (*Fulica atra*) mechanically limited by ice, notes that "There seems to be a minimum size of territory. If a bird owns more than the minimum he yields readily to encroachment; if he has not the minimum he is a more persistent fighter." Huxley (1934) compares the territories of Coots to elastic disks in that they are partially compressible, but their compressibility is not complete, and he adds "As the edge of the territory is pushed nearer the center, the violence of the impulse to defend it increases." The interior cocks in the two cases described above retreated because of their strong attachment to the physical features of their territorial boundary. They stopped retreating when they reached a compression threshold, and then not only resisted further compression but recouped much of their former territory.

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SUMMARY

For territorial boundaries on booming grounds in central Wisconsin Prairie Chicken cocks oriented to such natural features as fencelines, shallow drainage ditches, grass waterways, edges of depressions and

swales, between plowed and unplowed ground, between graded and dragged soil surfaces, and between vegetation of differing height and composition. Of 24 cocks exposed in 135 trials to edge experimentally created by mowing, 21 accepted mowed edge as territorial boundary when first exposed to it. Edge was shifted 111 times by sequential mowing and was accepted as a new boundary 92 times. In 19 trials where the new edge was not immediately accepted, four cocks eventually accepted the edge as a boundary. In two different tests, two interior cocks relinquished approximately 75 per cent of their territories to adjacent cocks when their territories were reduced by mowing; on reaching an apparent compression threshold, they stopped retreating and reoccupied much of their former territory.

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