RESEARCH REPORT 63

RECOMMENDATIONS FOR A SCATTERED WETLANDS PROGRAM OF PHEASANT HABITAT PRESERVATION IN SOUTHEAST WISCONSIN

By

John M. Gates

Department of Natural Resources

Madison, Wis.

1970

ABSTRACT

This report summarizes results of a 1959-65 field study on the Waupun Study Area in east central Wisconsin undertaken as a year-round appraisal of the significance of wetland habitat to pheasants. Nearly two-thirds of all brood production during the period occurred in wetlands, these being the only cover types in which nest success was consistently high enough from year to year to assure adequate levels of reproductive success for population maintenance. In an average winter, nearly 90 percent of the population was dependent on some form of wetland cover as winter shelter. From this and other Wisconsin research it was concluded that preservation of wetland habitat is essential if pheasant populations and pheasant hunting in southeast Wisconsin are to be maintained in the future.

Recommendations are made for a scattered wetlands program of pheasant habitat preservation and management, its broad aim to preserve both nesting and winter cover in planned management units fulfilling year-round cover requirements of local populations. Specific guidelines are presented on the size and distribution of management units, the optimum spacing of nesting cover in relation to winter cover, the amount and type of wetland cover essential for preservation, and subsequent management to maintain those wetland types of maximum value to pheasants.

Though game management funds available for wetland preservation probably will not be sufficient to maintain current levels of pheasant abundance without complementary forms of private management, a scattered wetlands program along recommended lines will safeguard population nuclei from which pheasants will expand into newly created or improved habitats. Recommendations in this report should eventually be integrated with a broader-based program of wetland acquisition aimed at preserving these areas as part of total resource conservation and management. Considering the overall importance of wetlands to both game and nongame species of wildlife, as well as the ecological diversity these areas add to the landscape, no sounder investment could be made on behalf of preserving environmental quality in southeastern Wisconsin.

1025-18

ACKNOWLEDGMENTS

Many persons took part in the field studies and data analysis on which these recommendations are based, and though space does not permit me to acknowledge each contributor, failure to do so in no way diminishes my debt of gratitude to each. For administrative and technical supervision during field work, I am indebted to F. H. Wagner and C. D. Besadny, former Group Leaders of Farm Game Research in the Department of Natural Resources, and to J. B. Hale, Chief of Wildlife Research, since the project's inception.

In the Bureau of Game Management, F. H. King, Assistant Director, has been among the most active proponents of the scattered wetlands program and whose long-term support of research into pheasant-wetland relationships I deeply appreciate. Also in the Bureau of Game Management, I wish to thank P. K. Dix and D. M. Owen, Assistant Area Game Managers, for stimulating discussion of an earlier draft of these recommendations which has helped make the present set adaptable to a wider spectrum of field conditions.

Finally, to E. J. Frank, formerly of the Farm Game Research Staff, now with the Bureau of Game Management, I am grateful for helpful dialogue clarifying many of the ideas expressed in this report. Review of the present manuscript and editorial assistance was provided by C. D. Besadny, R. A. Hunt, C. Kabat, F. H. King, A. J. Rusch, and D. R. Thompson.

Supported in part by funds from the Federal Aid in Wildlife Restoration Act under Pittman-Robertson Project W-141-R.

The author is a Wildlife Biologist with the Bureau of Research, Madison.

Edited by Ruth L. Hine

CONTENTS

INTRODUCTION

Wisconsin's annual pheasant (Phasianus colchicus) kill has gradually declined since the years of peak pheasant abundance in this state. In the decade between 1938 and 1947, the average annual statewide harvest was nearly 500,000 cocks, compared with 377,000 as the mean between 1960 and 1966 -- a reduction of nearly 25 percent. Many changes in land use and other factors unfavorable to pheasants have contributed to population decline, but none more clearly than wetland drainage. Since the mid-1930's almost 30 percent of the wetland acreage in the major pheasant range of southeast Wisconsin has been drained and converted to cropland or other uses (Wagner et al., 1965:95).

Notwithstanding, the pheasant still ranks as Wisconsin's foremost game bird, if not in total kill then certainly in terms of hunter appeal and man-hours of recreation provided. To stay abreast of future demand for outdoor recreation, maintenance and improvement of pheasant hunting is an important objective of the Department of Natural Resources. An annual harvest of 500,000 cocks has been established as a base-line management goal (Natural Resources Committee of State Agencies, 1964; Wagner et al., 1965:158).

How to restore and maintain former levels of pheasant abundance in the face of land-use changes basically detrimental to pheasants is no small challenge. In spite of a large-scale stocking program, costing roughly $200,000 annually, artifically propagated birds presently comprise no more than 15-20 percent of the statewide kill (Besadny and Wagner, 1963:56). And while the relative importance of pen-reared birds in the bag may increase in proportion to decline of wild populations, stocking is far too costly to bridge the gap between the harvestable surplus of wild-reared pheasants and the desired level of kill. Nor will the management of state-owned lands fill more than part of the need. Though state-owned areas within the major pheasant range will eventually total 100,000 acres, the maximum level of pheasant production possible through highly intensive management would satisfy but a fraction of the overall demand. The upshot is that Wisconsin pheasant hunting in the foreseeable future will continue to depend on the fortunes of wild-reared populations produced on private lands, and that success or failure in meeting management goals will hinge on whether effective management programs can be implemented on private holdings.

Research in this state has clearly demonstrated the need for wetland preservation if present-day pheasant densities are to be maintained. As an ecological principle which seems to apply generally throughout Wisconsin pheasant range, wetlands and their associated frontage with agricultural land represent islands of favorable habitat in an environment in which population maintenance is otherwise impossible. Apart from localized instances in which cover requirements have been temporarily met through Federal land-conversion programs (Gates et al., 1970), pheasants simply do not exist in shootable numbers over extensive units or the range devoid of wetland cover. Other management practices may

eventually contribute to population maintenance, but only insofar as basic habitat requirements have already been fulfilled through wetland preservation.

The purpose of this report is 3-fold: (1) To summarize recent field studies establishing the year-round importance of wetland cover to pheasants; (2) To describe wetland habitat preferences and cover selection which demonstrate those wetland types most essential to pheasant management; and; (3) To suggest guidelines for scattered wetlands preservation and management in southeastern Wisconsin.

Attention in this report is admittedly focussed on but a single aspect of the total need for wetland preservation. Maintenance of these areas should be viewed as part of the larger problem of preserving environmental diversity and natural resource corridors, as well as habitat essential for numerous species of both game and nongame wildlife. Eventually, recommendations in this report, geared largely to pheasants, should be integrated with more comprehensive planning for wetland preservation based on fuller appreciation of the overall ecological value of these areas.

SUMMARY OF RESEARCH ON THE IMPORTANCE OF WETLAND HABITAT TO PHEASANTS

Biologists and game managers in Wisconsin have long recognized the correlation between wetland distribution and pheasant abundance in southeastern Wisconsin, but until recently lacked specific information on the details of the relationship. The early view seemed to be that wetlands were pre-eminently important as winter cover (Leopold and Grimmer, 1946:23; McCabe et al., 1956:281-282), but from indirect evidence Wagner et al., (1965:94) postulated that these vegetation types were equally critical if not more essential as nesting cover. In 1959-65, a year-round investigation of pheasant ecology was conducted on the Waupun Study Area in east central Wisconsin. One of its principal aims was to determine the seasonal habitat requirements of pheasants and to recommend steps for wetland preservation and management based on these findings. Though a final report on this study is in preparation, more immediate need has arisen for a set of management guidelines in a recently expanded program of scattered wetlands acquisition. Emphasis in this report will therefore be placed on conclusions and recommendations of these studies and actual field data will receive only brief mention.

Area and Methods

The Waupun Study Area, 42 square miles in size, is located in southwestern Fond du Lac County and adjoining parts of Dodge and Green Lake counties. Approximately 10 percent of the area consists of wetlands well distributed over the landscape. Cultivated uplands are generally typical of Wisconsin pheasant range. In general, the area supports pheasant densities as high as any which presently occur in the state.

Within this area, two smaller tracts of 7600 acres were established as nesting study areas. All potential nesting cover was searched for pheasant nests according to a randomized sampling plan which allowed calculation of total clutch production by cover type as well as the number of chicks eventually produced in each. Movement studies were conducted on the Waupun Study Area at large; first, to learn the extent of seasonal movement between winter and summer range and secondly to furnish information on daily movement, home-range size, and habitat selection. The importance of wetlands in winter was evaluated by periodic censuses relating the distribution of winter flocks to available types of winter cover. More detailed information on winter use of wetland cover was obtained by sampling individual vegetation types for evidence of pheasant use based on field sign observed after fresh snowfall. In principle, this basic design was beleived to be an adequate foundation for evaluating the year-round role of wetlands in pheasant ecology.

Importance of Wetlands as Nesting Cover

Rates of Hatching Success and Brood Production

In 1959-64, nearly two-thirds of all successful clutches were located in wetland cover. The average rate of hatching success in wetland types was 46 percent, compared with only 19 percent as the combined mean in all upland cover types used by nesting birds. Especially low rates of nest success prevailed in harvested cropland -- 16 percent in hayfields, 31 percent in small grains, and 0 percent in peafields. Combined with heavy rates of nest mortality in upland cover, nearly 20 percent of the adult hen population and 10 percent of the broods produced were destroyed by hay-mowing and other agricultural operations in a normal year.

Nesting studies in Wisconsin and elsewhere suggest as a rule of thumb that roughly 50 percent of the hens alive in spring must succeed in brood production to maintain a stationary population. From population models based on current estimates of nesting hen mortality and capability of unsuccessful hens for renesting, it may be shown that overall rates of nest success of almost 30 percent are required to assure this level of hen success. Any cover type with consistently lower hatching success is therefore a liability as far as pheasant production is concerned.

Aside from retired cropland, present in very limited acreages, wetlands were the only cover type in which nest success consistently topped this figure and which also was sufficiently abundant to attract a large enough number of nesting hens to raise the mean level of nest success to the needed threshold for population stability. On two study areas with contrasting wetland acreages, population density was roughly proportional to the amount of wetland cover available for nesting. At higher population densities on both areas, wetland vicinities were first to become saturated with breeding birds and progressively more hens were forced into less preferred upland habitat where lower rates of reproductive success operated as an important check on population

growth. Portions of the study area without wetland cover depended on ingress of birds produced elsewhere. The basic principle to emerge from these findings was briefly this: That population density tends to be roughly adjusted to the amount and distribution of wetland cover available, and that as wetland habitat progressively disappears from the landscape pheasant numbers must drop accordingly.

Over the years it is clear that wetlands have become increasingly important to pheasant production. Earlier nesting studies in Wisconsin (Leopold, 1937; Buss, 1946), conducted when hay was harvested much later than today, reported close to 40 percent success in hayfields. Hence there must have been little if any disadvantage in hayfield nesting 20 or 30 years ago. With passage of time, pheasant populations appear to have become progressively compressed into areas where adequate wetland cover is available to counterbalance the detrimental effects of heavier mowing mortality on reproductive success. Many areas of the state which once supported reasonably good pheasant densities with little or no wetland cover are today virtually without pheasants (Wagner et al., 1965:97).

Relative Value of Individual Wetland Types for Nesting

For purpose of this study, wetlands were defined as any cover type presently unsuited for cultivation because of excessively high water tables. This included all organic soils once drained and converted to cropland but subsequently abandoned as drainage systems fell into disrepair. Muck or peat soils voluntarily retired from agricultural production under provisions of Federal land-conversion programs were placed in a separate category.

Five vegetation types comprised the bulk of the wetland acreage. Characteristics of each were:

1. Shrub swamps -- More than 30 percent canopy of willow (*Salix* spp.) and/or dogwood (*Cornus* spp.) with understory typically composed of sedges (*Carex* spp.), bluejoint grass (*Calamagrostis canadensis*), and mixed lowland herbs. Shrub layer 6-12 ft. tall; understory 1-2 ft. in height. Water levels variable but frequently with standing water through early May. Classified as Type 6 wetlands - shrub swamps - by Shaw and Fredine (1956), as shrub-carrs by Curtis (1959:352-355).

2. Cattail -- Dominated by cattail (*Typha latifolia*), occasionally with other emergent aquatics. Typically too wet for pheasant nesting.

3. Canary grass -- Principally monotypic stands of canary grass (*Phalaris arundinacea*) originally propagated as marsh hay or lowland pasture on wetland soils with improved drainage. Also apparently originating through invasive spread and replacement of sedge meadow vegetation in response to lowering of water tables and disturbance. Water levels variable but ordinarily dry enough for nesting. Commonly subjected to grazing and occasionally cut for marsh hay but most of the acreage undisturbed throughout the growing season.

4. Herbaceous -- Various stages of secondary succession on drained sites formerly devoted to crop production, typically dominated by heavy stands of aster (Aster spp.) and goldenrod (Solidago spp.) with lesser and highly variable amounts of sunflower (Helianthus spp.), Eupatorium spp., giant ragweed (Ambrosia trifida), nettle (Urtica dioica), and thistles (Cirsium spp.). Unpastured and rarely with standing water at any stage of the nesting season.

5. Sedge meadow -- Plant cover highly variable, but with sedge, principally Carex stricta, sharing dominance with bluegrass (Poa spp.), red-top grass (Agrostis alba), bluejoint grass, canary grass, and/or mixture of lowland forbs. Water levels subject to wide variation, wetter stands grading into emergent aquatic vegetaion, drier stands into wet prairie. Approximately 50 percent of the acreage subject to grazing, but most ungrazed stands also showing evidence of former use as lowland pasture. Ground surface highly irregular due to hummocks, tending to be replaced by shrub cover if succession not periodically interrupted by disturbance. Classed as Type 2 wetlands -- inland fresh meadows -- by Shaw and Fredine (1956), as southern sedge meadows by Curtis (1959:365-373). Constituted 61 percent of the total wetland acreage of the study area.

Nest densities in wetland cover, based on a relative scale of 100 for the most preferred type, were: herbaceous 100, canary grass 49, sedge meadow 24, shrub swamps 15, and cattail 7. Herbaceous cover and canary grass, in particular ungrazed stands of the latter, received proportionally heaviest use for nesting, but neither were present in sufficient acreages to include a major segment of the overall nesting effort. Cattail cover was for the most part too wet for nesting, and shrub swamps, especially stands with complete or near-complete shrub canopies, tended to be avoided by nesting hens.

Sedge meadows, by virtue of their large total acreage, contained 54 percent of all wetland nests. Because of the wide spectrum of plant composition characterizing this type, more detailed analyses were undertaken to reveal which vegetation types were most attractive as nesting cover. Results showed that essentially monotypic stands of sedge, or stands in which dominance was shared with bluegrass or red-top grass, were rarely used for nesting, and that nest densities in the sedge meadow type were directly proportional to the relative amounts of bluejoint grass, canary grass, and/or lowland forbs in the vegetational make-up. Sedge-canary grass or sedge-herbaceous cover was utilized almost as heavily for nesting as stands typed as pure canary grass or herbaceous.

Use of wetland cover for nesting appeared to be determined by the amount and quality of residual cover present in spring. Because most nests were established in wetlands before new growth was adequate for nest concealment, cover types which afforded larger amounts of residual plant material were preferentially sought for nesting. Essentially pure stands of sedge, sedge-bluegrass, or sedge-red-top not only produced lesser amounts of the total plant cover, but residual vegetation tended to become severely flattened by spring. By comparison, the stiffer-stemmed nature of canary grass and most herbaceous plant species was more

Heavy stands of herbaceous wetland cover, typically dominated by aster and other lowland forbs, furnish dense cover of residual plant material in spring and are preferentially selected for nesting.

When left ungrazed, the stiff, upright stems of canary grass provide dense clumps of erect or semi-erect vegetation which also are highl attractive for nesting.

Sedge meadow vegetation, though it receives somewhat lighter nesting use on a per-acre basis, is nevertheless the most important wetland type for nesting by virtue of its large total acreage.

Nest densities in the sedge meadow type are progressively higher in those stands which show increasing amounts of canary grass and lowland forbs in the vegetational make-up.

resistant to flattening and provided greater abundance of semi-upright clumps of cover as potential nest sites. It was concluded that the relative importance of both canary grass and herbaceous vegetation in the sedge meadow type could be relied upon as an indicator of the potential value of a given stand as pheasant nesting cover.

It was also concluded that secondary successions on wetland sites were more valuable as nesting cover than vegetation types closer to undisturbed condition. The herbaceous type, with the highest average density of nests, occurred on sites once cultivated and subsequently abandoned as cropland. Sedge meadows with the largest amount of canary grass and herbaceous cover all showed evidence of having been partially drained, for a time used as lowland pasture, and subsequently relieved of heavy grazing pressure, the nonsedge components of these stands apparently representing "increasers" or "invaders" with disturbance of the original sedge meadow community. From the standpoint of pheasant nesting cover, much of the wetland acreage of the study area probably had benefitted from man's disturbance in the past.

Other Factors Influencing Wetland Use for Nesting

In all wetland types subject to grazing, nest densities were inversely related to current levels of grazing pressure. Though light pasturing was not totally incompatible with pheasant nesting, moderately or heavily grazed stands, presumably from reduction in residual plant material available in spring, were seldom used by nesting birds. Little nest destruction was directly attributable to grazing, since nests in grazed stands were typically situated in elevated positions on hummocks and thus were secure from direct disturbance by cattle.

Nest establishment in wetlands began in mid-April and reached a peak during the first 10 days of May. Over 80 percent of all nesting in wetlands began before June 1. Wetland cover that remained consistently wet underfoot through mid-May was therefore little used for nesting and those stands which contained the highest density of nests on a long-term average were those least subject to flooding or which tended to dry out earliest in spring.

Analysis of nest placement revealed neither avoidance nor preference for peripheral sites. Though nests appeared to be randomly distributed with respect to edge, a slight preference apparently existed for units of cover larger than 20 acres in size. No relationship was observed between nest success and distance from edge, nor between nest success and wetland size, hence it did not appear that nests in smaller pockets of wetland cover tended to be more vulnerable to predation.

Nesting use of all wetland types subject to grazing is inversely related to grazing pressure. The lightly pastured stand of sedge-canary grass on the left still provides adequate nesting cover, but the heavier grazed stand of sedge-bluejoint on the right is an example of excessive cover removal in terms of pheasant nesting. Many such stands would show marked increase in nest density after the first growing season in which cattle were excluded.

Importance of Wetlands as Winter Cover

Population Distribution Related to Winter Cover

In an average winter, nearly 90 percent of the population was concentrated in areas where wetlands furnished the principal source of roosting and/or loafing cover. Thirty-two locations on the Waupun Study Area were designated as traditional wintering areas, sites which held winter flocks throughout the 7-year study. Of these, 29 consisted of some form of wetland cover.

Among the wetland types earlier described, shrub swamps were most important as winter cover. Shrub cover totalled less than 1 percent of the study area, yet sheltered 40 percent of the winter population as a 7-year mean. During two winters of unusually heavy snowfall, nearly 70 percent of the population was dependent on shrub swamps as winter shelter. Other wetland types preferentially used in winter included cattail and herbaceous stands. The sedge meadow and canary grass types were for the most part avoided by winter flocks unless adjacent to other types of winter cover.

Shrub swamps of willow-dogwood are useful as nesting cover provided the shrub canopy is open enough to support sufficiently dense ground cover for nest concealment. Stands with 50 percent or more shrub canopy appear to be of lower value for nesting cover than less shaded stands, but are highly important as winter cover.

Relative Value of Individual Wetland Types in Winter

Patterns of wetland use as both roosting and loafing cover varied with snow depth. Sedge meadow and canary grass were utilized predominantly for roosting, but use was mainly restricted to snowless conditions or snow depths of 6 inches or less. Little use was made of these cover types during daylight hours regardless of the amount of snow present. Herbaceous and cattail cover received proportionally heavier use in winter, both as roosting and loafing cover, but the latter was largely confined to snow depths of 10 inches or less. Night-time use of these types declined sharply as snow cover exceeded 12-15 inches in depth, from which it was concluded that neither cover type could be relied upon as all-round winter shelter with as much as a foot of snow blanketing the ground.

Shrub swamps were preferentially used for loafing under the full gamut of observed snow depths, and though initially avoided for roosting, night-time use of this cover type progressively increased as alternative roosting cover disappeared beneath the snow line. At snow depths of 20

Sedge meadow and canary grass winter cover is used almost exclusively for roosting, but seldom with more than 6 inches of snow on the ground.

Herbaceous wetland cover on the left, sedge meadow cover on the right, the former retaining winter cover value through much deeper snow conditions than the latter.

Cattail and herbaceous wetland types rank second in all-round importance as winter cover, but use of both as daytime loafing cover is largely restricted to snow depths of 10 inches or less.

Shrub cover is the most important wetland type in winter. Shrub swamps are preferentially used for loafing under the full gamut of snow conditions and receive progressively heavier use for roosting as other wetland types are snowed under.

First priority in winter cover preservation should be given to closed-canopy shrub stands of sufficient size to guarantee against filling by wind-driven snow.

Food is no less critical to welfare of wintering pheasants than adequate cover. Wintering areas preserved for pheasants as part of the scattered wetlands program would be greatly enhanced in all-round value to wintering birds if provisions were also made for food patches adjacent to winter cover.

inches or more, shrub swamps received almost exclusive use for loafing and at night sheltered higher densities of roosting birds than all other cover types combined. In summary, it was concluded that shrub swamps were the most essential source of winter cover, especially during emergency conditions when cover was in shortest supply and birds were hardest pressed for winter shelter. Unfortunately, no stands of tamarack (Larix laricina) occurred on the area, but observations in other areas have suggested that heavy tamarack stands may be equally valuable or perhaps even superior to shrub swamps as all-round winter cover.

Other Factors Influencing Wetland Use in Winter

Research did not succeed in demonstrating a minimum or optimum wetland acreage in terms of winter cover use. Though larger tracts of shrub cover consistently held the largest winter flocks from year to year, stands as small as 5-10 acres not infrequently sheltered groups of 50-100 birds with moderate to heavy snow cover. This was particularly true if alternative roosting cover was available and if food supplies nearby were especially favorable. As a subjective estimate, shrub stands of 10 acres in size may be close to the minimum capable of holding flocks of 100 birds or more without undue stress of overcrowding or increased vulnerability to predation. Tracts appreciably smaller than this, depending on shape and topography, frequently become snow traps with heavy drifting and lose much of their value as winter cover.

In general, the spatial distribution of the winter population from year to year depended more intimately on the stable distribution of winter cover than the more variable distribution of winter food. Good winter food supplies, e.g., standing corn, were rarely used when more than ¼ mile from winter cover, whereas traditional wintering areas held flocks year after year even though birds were obliged to subsist on marginal foods or to expose themselves to greater risk in search of food. In two out of seven winters, prolonged food shortages were associated with accelerated winter mortality and serious weight reduction of hens by winter's end. It was concluded that winter food was no less critical to the welfare of wintering pheasants than winter cover, and that the value of a given tract of winter cover was greatly enhanced when adequate winter food was available.

Seasonal Movement in Relation to Annual Cover Requirements

Movement of birds to winter cover averaged 1.3 miles for all sex and age groups combined; spring dispersal from winter cover was of near-comparable magnitude. Roughly 80 percent of all birds concentrating at traditional winter cover originated from, and subsequently returned to, summer range within a 2-mile radius. Hens tended to return each year to the same winter cover provided that the area in which they first bred, and to which they remained faithful throughout the remainder of their lives, was situated within 2 miles of winter cover occupied during the first winter of life. Hens that dispersed greater distances from winter cover in their initial breeding season typically selected new winter quarters in closer proximity to where they bred. Many young

of the year demonstrated random dispersal from fall to winter, yet movement of the majority exhibited strong orientation to traditionally used winter cover to which they were apparently led by returning adults. It was concluded that successive generations of hens from various portions of the summer range tended to have rather well-defined traditions for specific wintering areas, and that family organization was one of the primary mechanisms through which tradition was passed. Young hens that wintered within 2 miles of their birthplaces showed 30 percent return to the natal vicinity, whereas those which ended up in more remote winter locations demonstrated only 7 percent homing the subsequent spring.

From these and other findings it was concluded that the minimum unit of pheasant management should be considered an area of 4 miles in diameter centering on a traditionally used wintering area. Units of approximately this size could be expected to contain the seasonal movements of a large majority of a population associated with specific tract of winter cover and would permit one to manage this population as a more or less self-contained unit. Attempts to carry out pheasant management on appreciably smaller acreages would entail progressively greater risk of egress into unmanaged and presumably less favorable habitat.

These conclusions, of course, applied to the distribution of winter cover present on the Waupun Study Area, and areas with winter cover more or less widely spaced might conceivably show greater or lesser seasonal movement. At present, however, it seems reasonable to proceed on the assumption that fall ingress and spring dispersal from within a 2-mile radius. This suggests that the minimum spacing of winter cover needed to meet annual cover requirements would be one wintering area per 9-section block, a density of 4 wintering areas per township.

RECOMMENDATIONS FOR WETLAND PRESERVATION

General

The preceeding pages have demonstrated the critical importance of wetlands to pheasants on a specific area, a situation which doubtless prevails in broad outline, if not specific detail, across Wisconsin pheasant range. Fortunately, a significant program of habitat maintenance, aimed specifically at wetland preservation, appears to be highly feasible as a game management enterprise. Most wetlands require large outlay of capital for drainage and conversion to cropland, hence the very habitat types most essential to pheasants tend to be of lower-than-average land value on the agricultural scene. Contrast this with other midwestern states, where as high as 90-95 percent of the best pheasant range is frequently under cultivation and where pheasant management must be contemplated on land worth several hundred dollars an acre. At least potentially, the management outlook for this species in Wisconsin is considerably brighter than exists in most other states of the region.

Eventually, several programs may contribute to wetland preservation beneficial to pheasants. The Shore Lands and Flood Plains Zoning Act of 1965 assures wetland protection from certain destructive types of land use within specified distances of navigable streams and lakes. Wetlands may also be included as conservancy areas or greenbelts recommended for preservation by planning agencies such as The Southeast Wisconsin Regional Planning Commission. The Federal Water Bank Program, should it become a reality, may also contain provisions for wetland preservation in Wisconsin. At present, however, the only action program in operation is by the Department of Natural Resources. In the past, the game management aspects of wetland acquisition have been largely concentrated on areas large enough to be managed as public hunting areas, but future attention will be increasingly directed at preservation of smaller units of wetland cover. It is to DNR's scattered wetlands program, specifically to the objective of preserving pheasant habitat, that the present set of recommendations has been tailored.

Two alternative approaches are possible under this program -- preservation through purchase or preservation through easement in which drainage rights are obtained by the state. It is not the province of this report to recommend between alternatives, but certain advantages and disadvantages of each will be pointed out. Actually, judicious combination of the two probably would be most satisfactory, between which there should be sufficient flexibility from area to area to adapt to regional differences in habitat conditions, land values, and perhaps socio-economic factors influencing public acceptance of wetland preservation.

Spatial Distribution of Nesting and Winter Cover

It is patently obvious that not all wetland habitat can be preserved through easement or purchase, though in fact something close to this ideal may be necessary to maintain current levels of pheasant abundance. It is essential therefore to develop acquisition plans for each county that will ensure maximum effectiveness of the acreage protected.* The broad objective of the scattered wetlands program should be to preserve nesting and winter cover in planned management units rather than spreading the effort indiscriminately over the landscape. To meet this objective, the following guidelines should be followed in the initial stages of planning.

* Recommendations apply in principle to the 20 southeastern-most counties of the state comprising the major pheasant range (Wagner, et al. 1965:16): Calumet, Columbia, Dane, Dodge, Fond du Lac, Green, Green Lake, Jefferson, Kenosha, Manitowoc, Marquette, Ozaukee, Racine, Rock, Sheboygan, Walworth, Washington, Waukesha, Waushara, and Winnebago. At time of writing scattered wetland projects have been approved by the Natural Resources Board for all or parts of those counties underlined. Others may be added to the program in the future.

Each Area Game Manager overseeing a scattered wetland program should first prepare a pheasant distribution map showing regions of higher and lower pheasant density. At least at the outset, wetland preservation should be concentrated in areas of better pheasant density where it may be presumed that ecological conditions are basically favorable to pheasants and where protection of wetland habitat will return highest dividends. All existing wetland cover in the area should then be mapped, preferably with some notation as to cover composition and quality, including the location of all areas under state or other types of ownership already assuring protection from drainage.

Attention should then be focussed on individual townships comprising the better pheasant range, at which point some basic decision will be necessary between alternative plans. In townships where wetlands occur as scattered parcels of cover more or less uniformly distributed over the landscape, as illustrated in Figure 1, the scatter plan approach to wetland preservation is recommended. Where wetlands exist as larger, more disjunct blocks of cover (Figure 2), the large area plan should be followed.

Scatter Plan Wetland Preservation

The initial step in implementation of this plan should be to identify the most important tracts of winter cover presently relied upon by wintering birds. At least four such areas per township should be tentatively singled out as first priority for preservation. These should be as widely dispersed as possible, the idealized distribution with an easement or purchase unit at or near the center of each 9-section block. The next step is draw a circle 2 miles in radius around each wintering area and to regard the circumscribed area as a scattered wetlands management unit. In townships with winter cover well distributed, these units will overlap and nesting cover can be preserved throughout the summer range. Where they do not overlap, highest priority should be given to nesting cover within 2 miles of winter cover.

Research has not demonstrated a point of diminishing returns beyond which additional wetland acreages receive progressively less use for nesting, at least not in areas that contain as high as 20 percent of the land area in wetland cover. Though the ideal would be to preserve all the best nesting cover in a given unit, a more reasonable goal is recommended at 5 percent of the land area, between 250 and 300 acres per unit. In areas where wetland cover falls substantially short of this acreage, or for one reason or another cannot be preserved in such amounts, then it is recommended that the area be dropped as a scattered wetlands unit or set aside as lower priority for future development. The purpose of the program should be to insure both nesting and winter cover requirements and it would be illogical to preserve winter cover without adequate amounts of nesting cover also

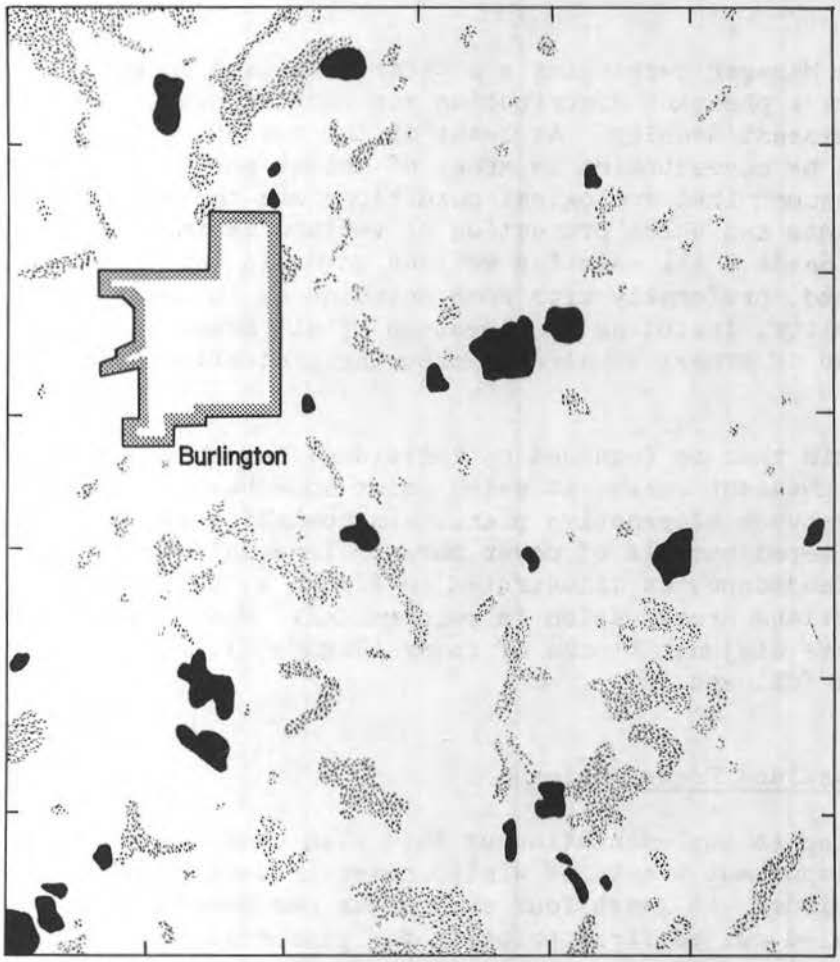

Figure 1. Town of Burlington, Racine County, Wisconsin, an example of wetland distribution to which the scatter plan program of habitat preservation would be ideally suited. Darkened areas represent wetland vegetation types (shrub and timber swamps) of primary value as winter cover; stippled areas represent nonwoody wetland types (principally sedge meadows) of potentially greatest importance as nesting cover. Map based on Wisconsin Wetland Inventory (1960).

provided. If on a township basis it is impossible to preserve at least 5 percent of the land area in high-quality nesting cover, then the number of management units should be reduced so that each will meet minimum standards.

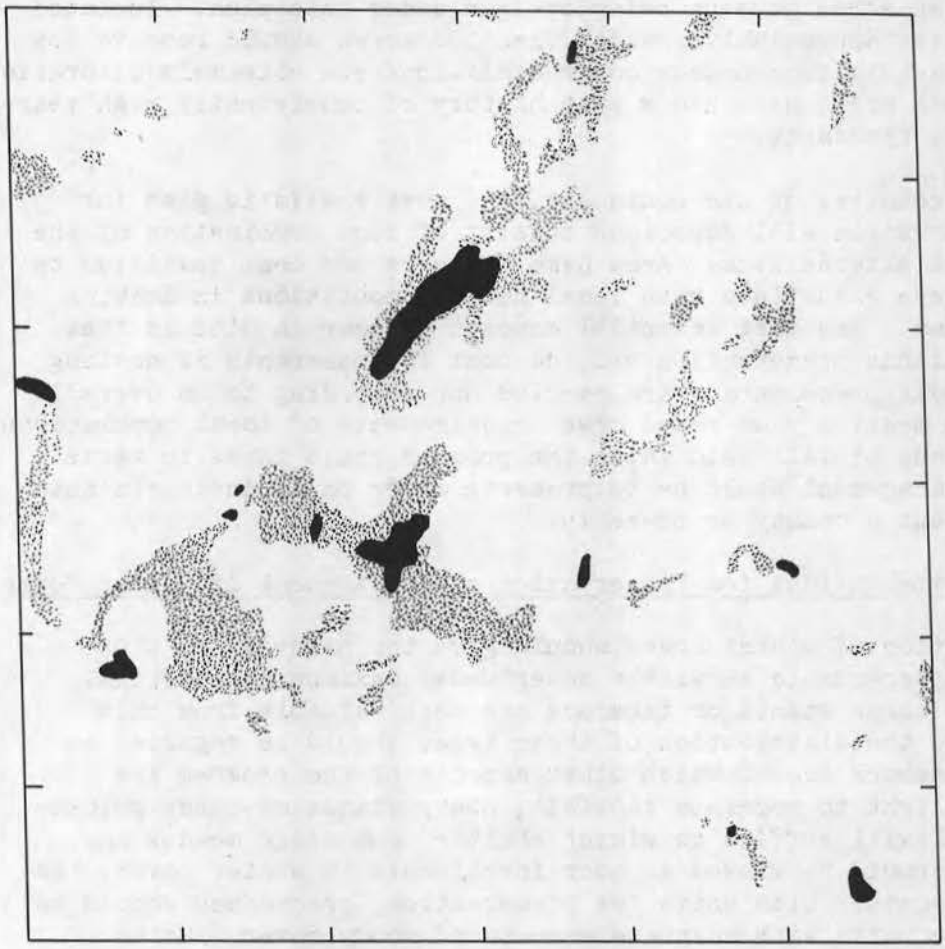

Figure 2. Town of Lima, Rock County, Wisconsin, an example of wetland distribution in which the more ideal form of habitat preservation would be the large area plan concentrating on large blocks of wetland cover combining both nesting and winter cover types. Dark areas represent wetland vegetation types (shrub and timber swamps) of primary value as winter cover; stippled areas represent nonwoody vegetation types (principally sedge meadows) of potentially greatest importance as nesting cover. Map based on Wisconsin Wetland Inventory (1959).

Large Area Plan Wetland Preservation

Under this plan, highest priority should be given to wetland tracts providing both nesting and winter cover, specifically areas that appear to be large enough for population maintenance independent of other areas. As a subjective judgment wetland complexes of at least 100 acres in size probably will hold sufficient numbers of breeding birds each spring to be managed as a scattered wetlands unit.

Larger tracts would be progressively more desirable, with areas up to several hundred acres perhaps being optimum under this plan. Isolated pockets of cover appreciably smaller than 100 acres should receive low priority for acquisition unless cover conditions are extremely favorable or unless these areas have had a past history of consistently high year-round value to pheasants.

In most counties of the southeast, the most realistic plan for wetland preservation will doubtless consist of some combination of the aforementioned alternatives. Area Game Managers are best qualified to intergrate these guidelines with local habitat conditions in drawing up county plans. The most essential concept to bear in mind is that scattered wetlands preservation will do most for pheasants if nesting and winter cover preservation are carried out according to an overall plan aimed at meeting year-round cover requirements of local populations. The most serious pitfall into which the program could lapse in terms of pheasant management would be to preserve cover on an indiscriminate basis throughout a county or township.

Specific Recommendations for Preservation and Management of Winter Cover

Preservation of winter cover should give top priority to those wetland types dependable as winter cover under maximum snow depths. Closed-canopy shrub stands or tamarack are most valuable from this standpoint and the distribution of these types should be regarded as the basic framework around which other aspects of the program are built. With light to moderate snowfall, heavy stands of aster-goldenrod or cattail will suffice as winter shelter, but sedge meadow and canary grass should be viewed as poor investments in winter cover. In establishing scatter plan units for preservation, precedence should be given to those units with adequate amounts of woody cover. Units deficient in this regard should be viewed as second priority unless management steps can be undertaken to encourage woody cover development.

Blocks of shrub or tamarack cover up to 20 acres in size should be preserved intact. If possible, larger acreages should be subdivided for purchase or easement in part. Tracts as small as 5-10 acres may be adequate if larger acreages are unavailable or if scattered pockets of winter cover have been scheduled for preservation within a township. Each wintering area should also provide alternative cover for roosting, e.g., ungrazed sedge meadow, canary grass, or aster-goldenrod. In the scatter plan approach to wetland preservation, the ideal would be 4 wintering areas per township, each 20-30 acres in size, where shrub or tamarack cover is combined with some form of nonwoody vegetation doubling as preferred roosting cover in winter and as nesting cover in summer. Under the large area plan, each unit should contain no less than 5-10 acres of woody cover, but the majority of the acquisition or easement acreage should consist of nesting cover rather than winter cover. Large stands of closed-canopy brush or tamarack, in view of their limited usefulness for nesting, will be of lesser overall value than units with heavy preponderance of nesting cover. Wintering birds tolerate crowding, whereas breeding birds do not, hence the size of the breeding population accommodated will depend to large extent on the amount and quality of nesting cover available.

In general, purchase in fee title rather than easement should be considered the safer approach to winter cover preservation. Drainage easements will not ensure the maintenance of a specific vegetation type; a shrub swamp, for example, might be ruined as winter cover by overgrazing even though drainage rights were held by the state. Such dangers are potentially less critical in terms of nesting cover. Light grazing is not wholly detrimental to pheasant nesting, in addition to which a comparatively wider spectrum of cover composition is satisfactory for this purpose. Most important, secondary succession will not restore winter cover nearly as rapidly as nesting cover once disturbance has been relieved. On such grounds it is recommended that state purchase be relied upon as much as possible to acquire key tracts of winter cover and that easements be broadly aimed at preservation of nesting cover.

Other advantages of fee title over easement in preservation of winter cover may also be noted. Each area in state ownership would presumably include a small acreage of upland needed to "square off" the purchase unit. Winter food patches could be produced on these lands, greatly enhancing the overall value of the area to wintering birds. In times of deep snow, provision of winter food in conjunction with winter cover would improve both survival and nutritional welfare of winter flocks. State ownership would also facilitate management aimed at cover maintenance or cover improvement. In areas where woody cover is absent or in short supply, protection from disturbance might accelerate the normal successional replacement of sedge meadow by lowland shrubs (Curtis, 1959:377; White, 1965). Conversely, in areas where shrub invasion has proceeded beyond the optimum balance between nesting and winter cover, opportunity for shrub control would be considerably improved. Though complete land control would be desirable in managing both nesting and winter cover, advantages of state ownership in the latter instance would appear to clearly outweigh the collective disadvantages of higher costs, tax obligations, and possible need for fencing.

Specific Recommendations for Preservation and Management of Nesting Cover

Wetland types providing the densest and driest residual cover in spring should be given first priority for preservation. Herbaceous cover such as aster-goldenrod or ungrazed stands of canary grass appear to be most attractive for nesting, but typically occupy drier sites where drainage has already been improved and which therefore have the greatest agricultural potential. Costs of acquisition or easement may be prohibitive in view of the larger acreages of sedge meadow that could be preserved at comparable expense. Sedge meadow stands with maximum representation of bluejoint grass, canary grass, and/or mixtures of lowland forbs should be given heavy precedence over monotypes of sedge, sedge-bluegrass or sedge-redtop cover. Shrub swamps with less than 50 percent canopy provide adequate ground cover for nesting, but those with complete or nearly closed shrub layers should be avoided in favor of less shaded stands.

Strict attention must be paid to water levels in setting acquisition priorities. Basin-type wetlands which fail to dry out by early May under normal conditions of spring runoff and spring rainfall should not be acquired as pheasant nesting cover, nor should flood plain wetlands if in most years these are subject to overflow during the major period of pheasant nesting. Ideally, cover conditions should be evaluated by field inspections made between winter breakup and spring greenup -- the month of April in an average year. In summary, the densest and driest cover available at this season will be of greatest value to nesting pheasants.

In the scatter plan approach to wetland preservation, 250-300 acres of nesting cover per 9-section block is the recommended goal. Ideally this should be as well dispersed within the management unit as feasible. Wetland units 20-40 acres in size may be most attractive for nesting on a per-acre basis, but smaller stands should not be rejected on size characteristics alone. Cover composition and dryness should outweigh all other factors in evaluating the potential of individual stands. Wetland tracts larger than 40 acres probably should be subdivided and purchased or leased in part to promote the widest possible dispersion of the acreage to be preserved as nesting cover.

In the large area plan, acreage recommendations are more flexible, but the aggregate easement or purchase unit should not as a rule of thumb be appreciably smaller than 100 acres. The majority of each unit should consist of nesting cover or combination nesting and winter cover. Extensive wetland tracts often exhibit strong elevational differences with considerable variation in cover composition and water levels. Nesting cover preservation should obviously concentrate on the drier perimeters of such areas and should avoid the waterlogged centers whenever possible.

Because much larger acreages are required for nesting, easements deserve much stronger emphasis under this phase of the program than recommended for winter cover. Preliminary experience suggests that easements in perpetuity prohibiting draining and filling may be obtained at roughly half the purchase price in fee title, in addition to which taxes and other disadvantages of state ownership are circumvented. Much larger acreages of nesting cover could be protected from drainage through easement, but this advantage must be balanced against non-prohibited changes in land use, particularly grazing, which could be highly detrimental to cover quality. Seemingly the wisest course of action would be to rely on easements to forestall drainage and to purchase if necessary after the basic distribution of nesting cover has been protected from agricultural exploitation. In areas of the state where drainage rights cannot be obtained through easement, higher costs of purchase and subsequent maintenance will obviously reduce the number of scattered wetland units on which minimum nesting cover requirements can be provided.

It is important to realize that many of the wetland types recommended as nesting cover do not represent stable plant communities and that management may be required to maintain optimum cover conditions.

Sedge meadows protected from disturbance are commonly invaded by shrubs, and management to arrest shrub dominance may eventually become necessary. The herbaceous wetland type represents an early successional stage following abandonment of lowland soils for cultivation and may require disturbance at frequent intervals to retain optimum cover density and composition. Of the preferred wetland types for nesting, canary grass appears to be the most stable. On areas purchased by the state, and which are accessible to farm machinery, the most economical type of management in the long run might be to artificially establish canary grass as nesting cover.

It is also clear that various types of management could be implemented to improve the quality of stands originally acquired as second-rate nesting cover. Exclusion of cattle from heavily grazed sedge meadows would in most instances produce much-improved conditions for pheasant nesting. Shrub control might be used to open up closed-canopy stands as a means of encouraging heavier nesting use. Finally, certain types of mechanical disturbance, for example bulldozing or discing, might be used to initiate secondary succession on sedge meadow lands and provide more attractive nesting cover. Easements, of course, would be less opportune for management than state purchase, though provisions for management access could perhaps be appended to the legal instrument prohibiting drainage. An important research need in this connection is to obtain a clearer understanding of the response of wetland vegetation to various types of disturbance, to ascertain the stability of the various wetland types, and to develop and refine management techniques for maintaining those cover types most favorable to pheasants and other forms of wildlife production.

It should be emphasized, however, that management of wetlands favorable to pheasants might not be in best interest of their preservation as natural areas. In many instances, maintenance in undisturbed condition might considerably outweigh the sole objective of improved pheasant production.

Considerations Involving Other Game Species

Recommendations in this report have been specifically aimed at pheasant management. It is clear, however, that wetland preservation along suggested lines would also benefit other game and nongame species as well. Winter cover use by both cottontail rabbits (*Sylvilagus floridanus*) and white-tailed deer (*Odocoileus virginianus*) tend to overlap pheasants with regard to woody cover preference during heavy snow. Nesting cover recommended for pheasants may be of less critical value to these species, but drier wetland sites would be used to some extent by cottontails for nesting in addition to serving as escape cover throughout snow-free periods of the year. During field studies on the Waupun Study Area, heavy use of wetlands was noted by does and young fawns in the spring of the year. Because woodlots were extremely scarce in the region, wetlands were the only sites secure from agricultural disturbance where fawns could be safely left unattended.

Wetland types recommended for pheasants would not be of particularly high value to breeding waterfowl, one notable exception being the usefulness of residual nesting cover to early nesting mallards (Anas platyrhynchos). While adequate amounts of surface water are present in most springs in southeastern Wisconsin to attract at least modest densities of breeding mallards and blue-winged teal (A. discors), the large majority of the wetland habitat does not retain open water under normal conditions of summer rainfall. Shortage of brood habitat thus appears to be a critical limitation to duck production in the region (Jahn and Hunt, 1964:56-57; Gates, 1965), which may actually constitute a trap for breeding ducks whose reproductive efforts are wasted through excessive brood mortality. On such grounds, high priorty should be given to preservation of those wetland types that afford more dependable sources of brood-rearing habitat, particularly deep fresh marshes -- type 4 wetlands -- in the classification of Shaw and Fredine (1956). Most such areas are rimmed by cattail or other emergent aquatic vegetation, hence would also serve as pheasant winter cover. To be of maximum value to nesting ducks, as well as pheasants, each area should also include a peripheral strip of dry, undisturbed upland nesting cover, 100-200 yards in width (Jahn and Hunt, 1964:142). Marshes of this type comprise only 8 percent of the wetland acreage of southeast Wisconsin (Jahn and Hunt, 1964:22). Because of their relative scarcity in the region and high value to a large variety of game and nongame species of wildlife, preservation of these somewhat unique areas should rate among the foremost objectives of the scattered wetlands program. Purchase, rather than easement, might be better suited for this purpose if undisturbed nesting cover is to be provided and if water level manipulation is desired or necessary as a subsequent form of management.

In much of southeast Wisconsin, duck production appears to be seriously curtailed by shortage of dependable brood-rearing habitat in most years. Areas which retain surface water throughout the summer should accordingly receive high priority for preservation under the scattered wetlands program. Emergent aquatic vegetation associated with these open water marshes also provides pheasant winter cover.

Unlike pheasants, the value of scattered wetlands preservation to waterfowl would not be restricted to southeast Wisconsin. Except for the driftless area of the southwest, a significant program of habitat preservation for waterfowl might extend throughout the southern two-thirds of the state. More specific recommendations along this line will be spelled out in a future report.

CONCLUDING REMARKS

It would be remiss to conclude this report without emphasis that wetland preservation will at best contribute to maintenance of present day levels of pheasant abundance and cannot be expected to put additional birds before the hunter over the number currently available. It would also be misleading to imply that the total amount of wetland habitat that can be preserved exclusively with game management funds will be adequate to insure against further population decline. Neither contingency, however, should lead to disillusionment in the scattered wetlands program. Game management interests should view their role in wetland preservation as part of the broader attempt at total resource management and conservation. Over much of southeastern Wisconsin, wetland areas comprise much of what still remains of more or less natural plant and animal communities in an otherwise man-dominated and ecologically highly simplified environment. On such grounds alone, money invested in wetland preservation would be money well spent.

Granted that some form of scattered wetlands preservation is and ought to be a key objective of the Department of Natural Resources, recommendations in this report will guarantee maximum benefits to pheasants. If management goals for this species are to be realized, however, it is abundantly clear that ancillary types of management must also be instituted on private lands to complement state-sponsored protection of wetlands. Apart from licensed shooting preserves, most of which unfortunately depend largely on pen-reared birds for shooting, private habitat management has yet to assume even token importance on the overall scene. Hopefully this trend will be reversed in the future as demand for outdoor recreation increases. One of the primary values of the scattered wetlands program will be to maintain population nuclei from which populations can expand into newly created or improved habitat niches.

LITERATURE CITED

Besadny, C. D. and F. H. Wagner. 1963. An evaluation of pheasant stocking through the day-old-chick program in Wisconsin. Tech. Bull. No. 28. Wis Conservation Dept., Madison. 84 pp.

Buss, I. O. 1946. Wisconsin pheasant populations. Wis. Conservation Dept., Madison. Publ. 326, A-46. 184 pp.

Curtis, J. T. 1959. The vegetation of Wisconsin/ An ordination of plant communities. Univ. Wisconsin Press, Madison. 657 pp.

Gates, J. M. 1965. Duck nesting and production on Wisconsin farmlands. J. Wildl. Mgmt. 29(3)515-523.

Gates, J. M., E. J. Frank, and E. E. Woehler. 1970. Management of pheasant nesting cover on upland sites in relation to cropland diversion programs. Res. Rept. No. 48. Wis Dept. of Natural Resources, Madison. 22 pp.

Jahn, L. R., and R. A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Tech. Bull. No. 33. Wis. Conservation Dept., Madison. 212 pp.

Leopold, A. 1937. 1936 pheasant nesting study. Wilson Bull. 49(2):91-95.

Leopold, A., and W. F. Grimmer. 1946. The history and future of the pheasant in Wisconsin. Pp. 15-25. In Buss, I. O. 1946 Wisconsin pheasant populations. Wis. Conservation Dept., Madison. Publ. 326, A-46. 184 pp.

McCabe, R. A., R.A. MacMullan, and E. H. Dustman. 1956. Ringneck pheasants in the Great Lakes region. Pp. 264-356. In Allen, D. L. Ed. Pheasants in North America. Stackpole Co., Harrisburg, Pa. and Wildl. Mgmt. Inst., Washington. D.C. 490 pp.

Natural Resources Committee of State Agencies. 1964. The status of farm game in Wisconsin. Natural Resources Committee of State Agencies. Land Subcommittee. Madison. 23 pp.

Shaw, S. P., and C. G. Fredine. 1956. Wetlands of the United States/ Their extent and their value to waterfowl and other wildlife. U.S. Fish and Wildl. Serv. Circ. No. 39. 67 pp.

Wagner, F. H., C. D. Besadny, and C. Kabat. 1965. Population ecology and management of Wisconsin pheasants. Tech. Bull. No. 34. Wis. Conservation Dept. 168 pp.

White, K. L. 1965. Shrub-carrs of southeast Wisconsin. Ecology 49(3):286-304.