MANAGEMENT STRATEGIES FOR REVERSING DECLINES IN LANDBIRDS OF CONSERVATION CONCERN ON MILITARY INSTALLATIONS:

A REPORT TO THE

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PREDICTIVE MODELING OF LANDBIRD POPULATIONS OF CONSERVATION CONCERN ON MILITARY INSTALLATIONS

UPDATING PREDICTIVE MODELS OF LAND MANAGEMENT

BACKGROUND

The Institute for Bird Populations, through its Monitoring Avian Productivity and Survivorship (MAPS) program (1994-2002), effectively monitored 34 landbird species on 13 U.S. Department of Defense installations (or groups of installations) across the eastern and central United States. Of these 34 species, ten are nationally or regionally listed (as of December, 2002) by the US Fish and Wildlife Service as "*Birds of Conservation Concern.*" In 2006, the 1994-2005 bird banding data was used to track species of conservation concern on each installation and the local populations that had declined (i.e. species of management concern). By 2006 we had reorganized the network of monitoring stations by replacing eight stations on five of eight installations in 2003 (3), 2004 (3), and 2005 (2). The eight new stations were located to a) monitor the effects of land management intended to sustain military range activities (i.e., range sustainment), and b) better monitor birds of conservation concern on each of a subset of eight installations.

The initial objective of the MAPS Program on DoD installations such as Fort Bragg was to identify generalized management guidelines and formulate specific management actions that could be implemented on military installations and elsewhere to reverse the population declines of target landbird species and to maintain the populations of stable or increasing species. The identification and formulation of these management guidelines and actions was achieved by modeling the vital rates (productivity and survivorship) of the various landbird species as a function of landscape-level habitat characteristics and spatially-explicit weather variables. The goal was to identify relationships between adult population size, numbers of young produced, productivity (ratio of young to adults), and trends in those parameters and these habitat and weather variables. The resultant management strategies were designed to involve efforts that modify the habitat from

characteristics associated with low population size, population trend, or productivity to characteristics associated with high population size, population trend, or productivity (especially for species for which low productivity is found to be driving the population decline).

The overall goal of this work is to evaluate the efficacy of on-going management practices (or cessation thereof) aimed at reversing declining populations and maintaining stable or increasing populations of target landbird species; and to modify those management practices in an adaptive management framework. The results of the first three years of this effort indicate that we are well on our way to achieving success in this endeavor.

METHODS

To provide management guidelines intended to maintain healthy populations or reverse local declines in Neotropical migratory birds and other landbirds, we constructed species-landscape models. To achieve this we explored the relationships between demographic parameters calculated from banding data and landscape metrics calculated from the National Land Cover Dataset (NLCD; 1992). These models were used to predict the effects of landscape change (i.e. management) on adults, trends in adults, numbers of young, and reproductive success.

In 2005, we reconstructed a new set of species-landscape models using the longer 1994-2002 dataset and intended to improve the predictive power of the models. We used a 2.5 kilometer radius around each station to provide the local spatial statistics. A unique edge combination model (UCEM), developed by the Institute, detects and quantifies unique edge types such as forest-grassland.

For species of conservation concern, we used both the newer and original species-landscape models to predict the annual mean numbers of adults expected to be banded at the six new stations. We then compared these predictions to data collected in the field from those stations. The new species-landscape models were designed to include appropriate transformation of each landscape parameter including estimates of the amount of ecologically important edge habitat. These models were in most cases statistically weaker, or made less biological sense, than those originally constructed. Consequently, with the exception of the new prairie warbler model, they performed less accurately. Thus we used the original models to validate the predictions.

RESULTS

Here we report on the validations of the species-landscape models by including all of the 2003-2005 data. We validated 10 models (original models) representing six of ten species among eight stations located on six installations (Table 1). In three cases the observed numbers are within four individuals of those expected. In six cases, the models underestimated the numbers of individuals. A regression analysis of observed against expected was significant ($P<0.05$). As was the case with validations using the incomplete 2005 data previously reported, most models underestimate the observed numbers. This may be due to recent environmental patterns that have benefited these species. Although the results are encouraging, we need more years of banding data to reduce the potential bias of temporal variability and allow for lag effects, and increase the number of data points by making predictions for more species at more stations. Overall, however, we are showing that the models are useful in predicting the numbers of individuals captured.

Table 1. Species of management concern and identities of MAPS station where species-landscape models have been used to predict the expected mean annual numbers of individual adults (Expected) that would be banded at those stations (Observed) averaged over the years of operation.

Species	Station/Installation	Expected	Observed
Prairie warbler	Sandhill, Fort Bragg, NC	8.54	12.16
Kentucky warbler	Area 03, Jefferson PG, IN	11.55	6.77
Wood thrush	Area 03, Jefferson PG, IN	7.18	10.40
Prairie warbler	Cowley Cemetery, Fort Knox, KY	18.87	23.72
Acadian flycatcher	Area 14, NWSC Crane, IN	13.14	10.84
Wood thrush	Area 14, NWSC Crane, IN	12.90	6.50
Blue-winged warbler	Tilley Bottom, Fort Leonard Wood , MO	15.79	24.59
Prairie warbler	Tilley Bottom, Fort Leonard Wood , MO	10.62	5.40
Prairie warbler	Bradford Cemetery, Fort Leonard Wood , MO	6.84	19.90
Painted bunting	Dropzone, Camp Swift, TX	8.63	13.30

DISCUSSION

Here we discuss the management actions taken at six DoD Installations and the response of populations from analyses of 2005 MAPS banding data.

Fort Bragg, NC

At Fort Bragg Prairie Warbler and Field Sparrow were identified as management species of concern. Following the recommendations of Nott et al. (2003), the I102 station was discontinued in 2003 to reduce the probability of capturing endangered Red-cockaded Woodpeckers that breed within the boundaries of that station. The I102 station was replaced by the Sandstone Hill station in a mosaic of upland patchy forest, shrubland, and grasslands that are frequently managed to reduce fire risks. The primary goal of the new station is monitor Prairie Warblers in a regularly fire-managed area, compare demographic performance with other sites, and thus assess the value of the existing 2-3 year fire cycle on survival (site persistence) and reproductive success.

Prior to the 2004 season the area around Sandstone Hill was burned, and in 2004 a single Prairie Warbler was captured. But in 2005 the capture rates of adult and young Prairie Warblers had increased to 15.5 and 4.8 individuals per 600 net-hours, respectively. Bachman's Sparrow, a USFWS Bird of Conservation Concern with IUCN Red List near threatened status, also showed increased capture rates at Sandstone Hill, from only 2.3 adults in 2004, to 4.8 adults and 2.4 young in 2005.

In summary, our data suggest that few Prairie Warbler or Bachman's Sparrow will occupy potential habitat immediately following a springtime burn but that breeding individuals will recruit into the habitat the second year after fire. As this fire-managed "disclimax" community succeeds towards forest, we predict that continued effectiveness monitoring of these populations will detect the onset of a decline in reproductive success or population size. Based on this timing we can adjust the prescribed fire frequency to maximize gross productivity of Prairie Warbler populations while meeting the management goals associated with Readiness and Range Sustainment. Through such adaptive management cycles, we are confident that we can achieve the long-term goal of reversing declining populations and

maintaining stable or increasing source populations of target landbird species at Fort Bragg and other military installations.

Jefferson Proving Grounds, IN (now managed by FWS as Big Oaks NWR)
Six species were identified as management species of concern for Big Oaks NWR. Following the recommendations of Nott et al. (2003), one station was discontinued in 2004 to reduce the probability of capturing endangered Red-cockaded Woodpeckers that breed within the boundaries of that station. The station was replaced by the Area 03 station in an area of patchy forest, shrubland, and grassland that is frequently managed to reduce fire risks. The primary goal of the new station is to assess the value of the existing fire cycle on survival (site persistence) and reproductive success among all the species that are captured. The area also contains permanent plots that are monitored with point counts and nest searches. Another station, Also, the Area 54 monitoring station, at which successional-scrub species are declining, specifically Prairie Warbler and Field Sparrow, will be subjected to a frequent prescribed burn regime. We expect such management will reverse the declines after an initial drop in the first few years. Thus, a prescribed springtime burn was set in Area 54 management area, adjacent to the established MAPS station AR54, with three management goals, a) to reduce fuel loads in forested habitat that is adjacent to national forest property, b) to reverse Prairie Warbler and Field Sparrow populations of in the vicinity, and c) to encourage native plant growth. At the start of the 2004 breeding season, AR27 was discontinued and replaced by a new station in management Area 03 (AR03). This was placed to better monitor forest dwelling species of conservation concern more typical of those breeding in the vicinity of MAPS station AR07 (i.e., Wood Thrush, Worm-eating Warbler, and Kentucky warbler). In an attempt to increase monitoring levels of shrub/successional species, AR16 was discontinued at the beginning of the 2005 breeding season and a new station (AR46) was established in management area Area 46.

Fort Knox, KY
Following the recommendations of Nott et al. (2003), the Lower Douglas Lake stations was replaced in 2004 by the Ordinance Lake station featuring mid-successional oak-

hickory forest and managed grassy meadowland. This station captures Kentucky Warbler and Wood Thrush. Although the McCracken Springs site was recommended for closure more urgent logistical problems concerning the Duck Lake station necessitated the establishment of a new station, Cowley Cemetery, which captured effort-adjusted numbers of Prairie Warblers (24) in excess of those predicted (19).

Crane NWSC, IN

No stations have been moved at Crane NWSC, however two stations have been recently managed, Sulphur Creek and Area 14. Existing management plans include creating mixed age regeneration openings in the vicinity of Sulphur Creek. Although our initial intent was to move Area 14 (AR14) to an area represented by a mosaic of different aged regeneration openings, recent timber harvesting (Fall 2004) has resulted in just such a mosaic. Alarmingly, an immediate effect was increased captures of Brown-headed cowbirds. During the period 1994-2004 only five cowbirds (four females, one unknown) were captured. In 2005, three males and three females were captured. One female and one male were captured twice on different visits. We expect to see a decrease in reproductive success for cowbird sensitive birds breeding in the vicinity of Area 14.

For both Acadian Flycatcher and Wood Thrush the observed numbers of adults were ~20% and ~50% lower than expected. We look forward with interest to examining a few more years of data from this station. We expect that after the initial "ecological trauma" of the logging disturbance that the shrub layer will become more developed and initial variation in bird populations will relax. Also, we need to repeat the predictive analyses using more recent land cover data to populate the species-landscape model of a 5-kilometer radius surrounding Area 14. The current predictions were made from adjusting the parameter values based on planning documents for the partial clearcut. In reality it is likely that access roads associated with this logging operation have opened up more forest than the planning documents show.

Fort Leonard Wood, MO

Following the recommendations of Nott et al. (2003), the Smith Ridge and Miller Ridge stations were discontinued in 2003 due to low capture rates associated with mature closed canopy forest. They were replaced in 2004 by the Tilley Bottoms station (to act as a replicate for the Big Piney station), featuring managed bottomland forest and the Bradford Cemetery station, a grassland area that is no longer fire-managed and is presently undergoing succession towards pine forest. The Big Piney and Laughlin Bottoms stations were maintained as controls. Fire management of open scrubby habitat around the Miller Pond and Macedonia stations occurred during the spring of 2004.

Nott et al. (2003) predicted that fire management practices, implemented in the vicinity of certain stations, should result in increased populations and productivity among Field Sparrows at those stations. Fire management has occurred at Fort Leonard Wood at various times: during spring 2000 at Laughlin Bottoms, spring 2002 at Miller Pond and Bradford Cemetery, and spring 2003 at Macedonia; no fire management has occurred at the remaining two stations, Big Piney and Tilley Bottoms. Examination of Field Sparrow data indicate that adult populations at each of the four stations having fire management showed increases which peaked during the year or two following that of the managed burns: 2002 at Laughlin Bottoms (10.2 adults/600 net hours), 2003 at Miller Pond (29.3), 2003 at Bradford Cemetery (36.0), and 2004 at Macedonia (4.3). In each case, these totals were the highest recorded during the 4-year period 2001-2004. Interestingly, breeding populations declined in each case during the following two-year period, including 2005, suggesting that the positive effects of burn management on Field Sparrow populations last only 2-3 years. Field Sparrow productivity appeared to be fairly stable at the burn-managed stations since the burns took place.

Increased breeding populations often reflect higher recruitment of first-time breeders into an area, which might also be expected to show decreased productivity. Thus, relatively stable productivity in the face of increased population sizes may be interpreted as a relative increase in production of young. At the very least, increased breeding populations without a concomitant decrease in productivity means that, overall, more

young are being produced and are available to be recruited in the local breeding populations.

For successional species, such as Field Sparrow, the conservation goal is to consistently provide enough primary breeding habitat to annually support a target number of territories (dependent on installation or management zone) and level of productivity consistent with that of a source population in which breeding individuals are able to replace their own numbers. This requires maintaining a mosaic of habitat patches in various stages of post-fire succession such that every year there is an adequate area of primary breeding habitat. The ability to maintain an abundant "source" population might be considered an adequate performance measure by which to evaluate landbird conservation efforts and habitat management techniques.

Nott et al. (2003) also predicted that the establishment of the two new stations, Tilley Bottoms and Bradford Cemetery, should shed further light on landbird population dynamics at Fort Leonard Wood, including those of the other four target species, Acadian Flycatcher, Worm-eating Warbler, Louisiana Waterthrush, and Kentucky Warbler. In 2005 all of these species except the waterthrush were captured at these two stations, including excellent capture rates of Kentucky Warbler. Excellent capture rates of two other target species (with increasing populations), Blue-winged and Prairie warblers, were also obtained at the two new stations. Yellow-breasted Chats were also commonly captured. Unfortunately, we expect the numbers and reproductive success of both of these species to decline in coming years as Bradford Cemetery is managed to allow succession of the currently managed shrub-grassland complex towards the pine forest community currently surrounding it. Although this will eventually represent a loss of productive field sparrow habitat, "disclimax" management on other parts of the installation could replace such habitat. Thus, it appears that the addition of these two stations will help us resolve the population dynamics of target species of management concern at Fort Leonard Wood.

Camp Swift, TX

At Camp Swift in 2004, we replaced the McLaughlin Creek station with a new station, Dropzone, aimed at better monitoring Painted Buntings, a declining species at Camp Swift. We achieved this by looking for habitat patterns that, according to our models, should support healthy bunting populations (e.g., oak prairie). We also hypothesized that, by implementing warm season burns, we would be able to enhance the restoration of native grasses and forbs in the oak prairie habitat, and that this should further increase population sizes and reproductive success of Painted Buntings. Unfortunately, such controlled burns as part of a warm-season fire regime could not be implemented during 2004 due to unfavorable weather conditions, but further attempts to affect this regime are planned for the spring of 2005.

In 2004 we captured 7.6 adult Painted Buntings per 600 net-hours at Dropzone, and this increased to 20.7 adults per 600 net-hours in 2005 (Table 3). Reproductive Index was 0.49 and 0.27, respectively, indicating reasonable but reduced productivity. This provides evidence that the species/landscape models developed through our analyses of MAPS data have substantial predictive power, and that the prescribed burn appears to have resulted in increased recruitment of this species (which, predictably, would show lower productivity due to a surplus of first-time breeders).

Painted Bunting requires the right mix of forest, shrub and grassland to breed successfully which must be maintained by fire or physical means. The conservation goal is to consistently provide enough primary breeding habitat to annually support a target number of territories (dependent on installation or management zone) level of productivity consistent with that of a “source” population in which breeding individuals replace their own numbers. This requires maintaining a mosaic of habitat patches in various stages of post-fire succession such that every year there is an adequate area of primary breeding habitat.

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