Modeling Gray Vireo Habitat – General Considerations

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Introduction

The development of robust models of Gray Vireo (*Vireo vicinior*) habitat would permit management agencies to better assess population health and conservation status. Construction of a Geographic Information System (GIS) habitat model for a species appears relatively straight forward: determine the consistent characteristics of known habitat and, through manipulation of those characteristics, predict habitat in known and unknown areas. To develop site specific models for the Gray Vireo, we reviewed nest locations and habitat at four Department of Defense (DoD) installations in New Mexico: the New Mexico Army National Guard Camel Tracks Training Site, Kirtland Air Force Base, White Sands Missile Range, and Fort Bliss Military Range (Arbetan et al. 2006, Johnson et. al. 2007, Natural Heritage New Mexico unpubl. data). These sites cover diverse geographic areas of the Caja del Rio Plateau west of Santa Fe, the west slope of the Manzano Mountains, and the San Andres and Organ mountains. At these locations, Gray Vireos seem to prefer a specific range of juniper (*Juniperus* spp.) or piñon (*Pinus* spp.)-juniper nesting tree densities that are dominant over competing tree species and that are found in the vicinity of moderate slopes that form open bowl or drainage topographies.

Methods

For the four New Mexico DoD installation sites, modeling Gray Vireo habitat requires GIS layers of vegetation type, vegetation density, bowls, and drainages. Our methods were generally to use current GIS layers with these characteristics and construct new layers of habitat quality. Locations with juniper or juniper and piñon at specific densities found in rolling hills with bowl or shallow drainage topographies are classified as habitat. Other combinations, such as low tree densities found outside of rolling topographies, are classified as non-habitat. However, automated and interactive modeling techniques rely on GIS layers that are surrogates of biophysical landscape characteristics. Thus, modeling Gray Vireo habitat employs GIS layers that are themselves models of vegetation type, vegetation density, bowls, and drainages. When these models do not exist at the appropriate scale, they must be made from GIS layers that do exist. For example, Kirtland Air Force Base had high-precision field-survey data, but no vegetation map for distinguishing plant communities. At Kirtland, we used 10-m digital elevation models to delineate topographic features and photo interpreted 1-m color infra-red orthophotography to delineate plant community characteristics (Fig. 1). At larger sites, such as the San Andres Mountains, a lack of specific site locations together with the large extent of the area of interest required us to scale up spatially to derive the model using existing vegetation maps (Muldavin et al. 2000).

Results and Discussion

The consistent habitat characteristics at the four DoD installations suggest a general model with wide applicability, perhaps across the Gray Vireo breeding range, is possible. However, there are nesting sites on flat mesa tops in northern New Mexico (Reeves pers. comm.) and in areas dominated by other tree species in southern New Mexico. This suggests that, at the four installations, nest tree density and topography are indicators of a more fundamental characteristic.

Thermoregulation is a critical physiological and behavioral feature of organisms, and birds have evolved a host of features to regulate both their own body temperature and that of their eggs and nestlings. We postulate that Gray Vireos establish nests in areas that have a particular thermal zone. At the New Mexico Army National Guard's Camel

FIGURE 1. Potential Gray Vireo (*Vireo vicinior*) habitat on Kirtland Air Force Base, New Mexico shown in black. White circles are use sites.

Tracks Training Site, where we have seven years of Gray Vireo monitoring data, we quantified solar radiation over the time of nest establishment and used these data as indicator metrics. These metrics correlate well with attempted nesting (Fig. 2). We hope to use these metrics, together with tree species metrics, to test nest location data across New Mexico. Also, protocols for measuring solar radiation in the field are needed to understand what the model-derived metrics are explaining, other than demonstrating a positive correlation with known and currently unknown breeding sites and negative correlation with poor habitat.

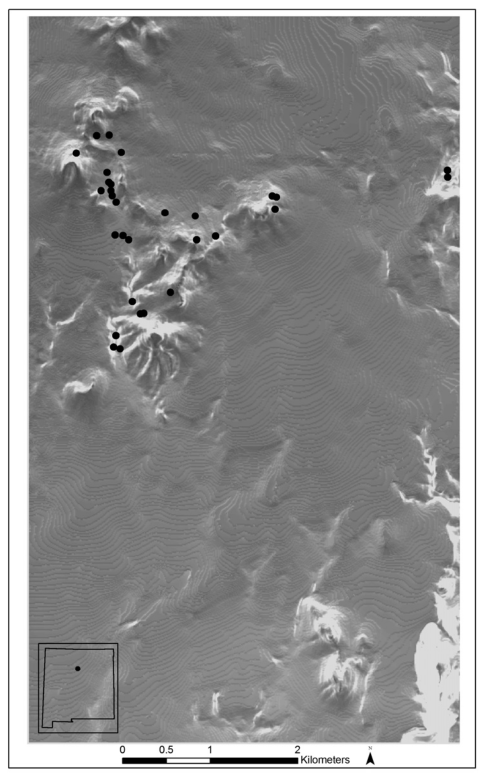

FIGURE 2. Gray Vireo (*Vireo vicinior*) solar radiation model for Camel Tracks Training Site, New Mexico. White areas identify potential solar suitability. Black circles are nest sites.

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