Global Ecology and Conservation 4 (2015) 658–665

Contents lists available at ScienceDirect

Global Ecology and Conservation

journal homepage: www.elsevier.com/locate/gecco

Original research article

Measuring the effectiveness of conservation programs for shrubland birds

Scott Schlossberg [a], David I. King [b,*]

[a] Department of Environmental Conservation, University of Massachusetts — Amherst, 201 Holdsworth Hall, Amherst, MA 01003, United States
[b] Northern Research Station, USDA Forest Service, 201 Holdsworth Hall, Amherst, MA 01003, United States

HIGHLIGHTS

- We measured the amount of shrubland habitat in a typical eastern US state.
- Most shrubland habitat resulted from commercial logging.
- For 15 priority species an average of 20% were supported by deliberate conservation.
- Conservation efforts supported 47% of field sparrows and 49% indigo buntings.
- Deliberate shrubland management is an important supplement to commercial activities.

ARTICLE INFO

Article history:
Received 4 September 2015
Received in revised form 9 November 2015
Accepted 10 November 2015
Available online 1 December 2015

Keywords:
Shrubland birds
Disturbance
Conservation effectiveness
Management
Geographic information systems

ABSTRACT

Disturbance-dependent habitats such as grasslands and shrublands are declining in many regions. To mitigate these declines, government agencies are using anthropogenic disturbances like logging and mowing to mimic natural ones. Because these programs can be costly or controversial, measuring their effectiveness is important. Here, we evaluate the conservation effectiveness of shrubland management for 15 bird species in Massachusetts, USA. Because shrublands are constantly changing in extent and location, we suggest that the key measure of conservation effectiveness should be how managed areas contribute to habitat availability. We used remotely-sensed data to assess the total area of shrublands in Massachusetts and consulted managers and a timber-harvest database to determine contributions of management by government agencies and non-governmental conservation organizations. We calculated species-specific habitat availability based on the habitat relationships of individual bird species. The area of potential habitat for shrubland birds in Massachusetts averaged 35,000 ± SD of 11,300 ha. Of this total, an average of 20% ± 15% exists because of management by government and NGOs. Management was most important for birds that nest primarily in uplands and avoid wetlands. We conclude that active management by government agencies and NGOs provides a substantial proportion of shrubland habitat in Massachusetts. With habitat on private property being lost to development or succession, active management will be even more important in the future.

1. Introduction

Disturbance-dependent habitats and their constituent plants and animals are increasingly imperiled (Litvaitis, 1993; Askins, 2000, 2001; Brawn et al., 2001). Seven of the 11 endangered songbirds in the contiguous U.S. require disturbed

* Corresponding author.
E-mail addresses: xanthocephalus@gmail.com (S. Schlossberg), dking@fs.fed.us (D.I. King).

http://dx.doi.org/10.1016/j.gecco.2015.11.003

habitats, and 79% of the most endangered ecosystems nationwide are disturbance-dependent (Noss et al., 1995; U.S. Fish and Wildlife Service, 2006). Historically, floods, wildfires, beavers, and insect outbreaks maintained disturbance-dependent habitats (DeGraaf and Miller, 1996; Askins, 2000). Today, these disturbances are often suppressed because they threaten human health or property. As a result, state and federal land-management agencies and non-governmental conservation organizations (hereafter "NGOs") are using anthropogenic disturbances such as logging, prescribed fire, and mowing to replace natural disturbance regimes. Managers using these techniques now treat thousands of hectares each year in the eastern U.S. (Oehler, 2003).

Habitat management can be costly because of the specialized equipment and personnel needed. For example, mechanically removing woody plants in old fields costs \$80 to \$486 ha^{-1} (Oehler, 2003). Because disturbance-dependent habitats are ephemeral, they require frequent treatment to maintain their distinctive ecological characteristics (Thompson and DeGraaf, 2001; DeGraaf and Yamasaki, 2003). Using disturbance as a management tool can be controversial because of concerns about aesthetics, forest fragmentation, and fires (Askins, 2001). The increasing scarcity of conservation funds and public concerns about management activities necessitate that we evaluate the effectiveness of management for early-successional habitats.

For disturbance-dependent organisms, however, evaluating the conservation benefits of managed areas can be complicated. Early-seral patches are in constant flux because of succession, and the locations and total area of habitat are always changing (Bormann and Likens, 1979; Askins, 2000). Despite criticisms (Soule and Sanjayan, 1998), conservation targets are often based on the *proportion* of a habitat under protection (Svancara et al., 2005; Tear et al., 2009). However, this approach does not lend itself to managed habitats. Proportional targets do not make sense if the overall area of habitat available is declining, as shrublands are in this area (e.g. Bradshaw and Hannon, 1992; Litvaitis, 1993; Swetnam, 1993). In the northeastern U.S., for instance, disturbance-dependent grasslands and shrublands are currently declining (Askins, 2000). Proportional targets would dictate, nonsensically, that the area of habitat needing protection is becoming smaller as a result. Alternatively, the area protected per se can be used to judge conservation effectiveness (Brooks et al., 2004; Chape et al., 2005). This measure can be problematic because of the difficulty in objectively determining how much habitat is necessary to preserve biodiversity (Fahrig, 2001; Wilhere, 2008).

We suggest that, for disturbance-dependent organisms, the criterion for the effectiveness of management efforts should be how habitat availability would change in the absence of management (Ferraro and Pattanayak, 2006). This criterion is suitable regardless of current habitat extent. When the habitat is abundant, managed areas may make little contribution to habitat availability, and management will be less necessary. When the habitat is rare, even a small managed area can provide substantial benefits. Thus, one can only evaluate benefits of managed areas in light of regional habitat availability (e.g. Buffum et al., 2011).

Here, we conduct a conservation evaluation of management efforts for shrubland-breeding birds in Massachusetts. We focus on Massachusetts because it, like other parts of the northeastern U.S., has suffered significant losses of shrublands to forest regeneration and suburban development in recent decades (Litvaitis, 1993; Askins, 2000; Trani et al., 2001; DeNormandie et al., 2009). In this region, the area of early-successional forest has decreased by 89% since the 1950's (Schlossberg and King, 2007). As a result, populations of most shrubland birds are declining as well (Hagan et al., 1992; Hunter et al., 2001). To stem these declines, government agencies and conservation organizations are actively creating and maintaining shrublands, which we define as open-canopied habitats with varying amounts of woody cover. We collected data from a variety of sources to determine the extent of shrubland management by government agencies and NGOs in Massachusetts. Our goal was to determine, for several bird species, how shrubland availability would change in the absence of government and NGO management programs.

2. Methods

We conducted a conservation assessment for 15 bird species common in Massachusetts shrublands (Table 1). Our assessment had three steps: (1) We estimated the total area of shrublands in Massachusetts; (2) We collected data on areas managed as shrublands by state and federal government agencies and NGOs; (3) For each species, we compared the area of shrubland habitat in the state with the area created through management to determine the contribution of managed areas to that species' conservation.

2.1. Estimating total shrubland cover in Massachusetts

Our study area was mainland Massachusetts, which excludes Dukes and Nantucket Counties. To estimate total cover of shrublands, including natural and anthropogenic shrublands owned by private landowners, government, and NGOs, we used geographic information system (GIS) data from the Commonwealth of Massachusetts. The 2005 Land Use layer is based on aerial photos captured in 2005 and classified into 33 categories indicating natural habitat or type of development (MassGIS, 2009). Four land use categories potentially included shrublands: (1) "Brushland/successional" included several types of shrublands; (2) "Open land" included abandoned agricultural fields among other open habitats; (3) "Powerline/utility" comprised rights-of-way where shrubby vegetation is often encouraged over trees that could interfere with power lines (Confer and Pascoe, 2003; King et al., 2009a); (4) "Non-forested wetlands" included two types of shrubby habitat: shrub swamps and bogs (see Brewer, 1967; Van Velzen, 1980; Ewert, 1982).