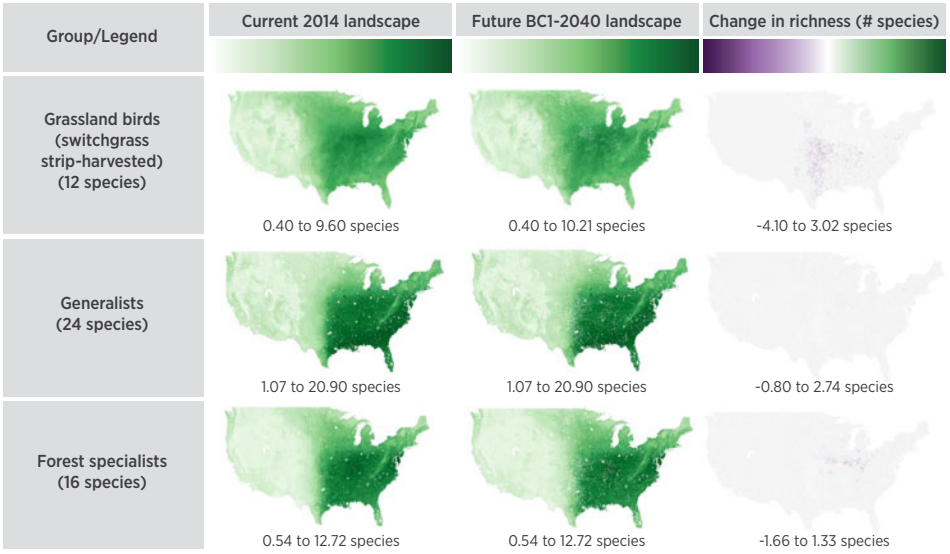
# Effects on Biodiversity under *BT16* Scenarios

The *2016 Billion-Ton Report (BT16) Volume 2: Environmental Sustainability Effects of Select Scenarios from Volume 1* is a pioneering effort to analyze a range of potential environmental effects associated with illustrative near-term and long-term biomass production scenarios. Key environmental effects studied include effects on avian biodiversity as a result of biomass crop production, as well as effects on biodiversity in forest ecosystems as a result of woody biomass harvesting.[1] Results summarized here pertain to the 2017 and 2040 scenarios analyzed in volume 2.[2]




Projected richness under the 2014 landscape (left column) and under a landscape consistent with the 2040 base-case yield (BC1) future agricultural scenario (middle column), as well as differences in richness (right column) for three groups of species. Rows display distributions for grassland, generalist, and forest specialist species. The range for differences in richness displayed by the legend row (below headers) is indicated below each map.

## Summary

One of the objectives of this study was to quantify projected changes in suitable habitat (i.e., ranges) of avian species. Overall changes in richness were zero for the majority (greater than 98%) of areas, with no difference between richness under the 2040 base case (BC1) scenario and under the 2014 reference case. In the remaining areas, forest generalists species had higher richness under BC1, whereas forest and grassland specialist species had higher richness in the 2014 scenario. The analysis suggests that grassland birds in agricultural landscapes dominated by corn and other rowcrops will respond positively to switchgrass. In addition, field studies are needed to quantify responses of the native bird community to growing miscanthus in the United States.

[1] The information in this fact sheet is further discussed in *BT16* volume 2 chapters 10 and 11.

[2] Scenarios are specific to *BT16* and are further elaborated in chapter 2.

Woody-biomass harvest in the examined scenarios would primarily affect biodiversity through changes in forest structure, both at the stand (e.g., loss of canopy cover and residues) and landscape scales (e.g., distribution of stand ages from clearcutting smaller-diameter trees). Species could be negatively or positively affected at the ecoregion scale based on the primary forest habitat type sourcing the feedstock, and at the local scale based on species distributions, specific habitat requirements, and the proportion of forest types affected by biomass harvest.

## Insights and Implications

Because many avian species are affected by the type and timing of management activities, as well as by land cover, guidelines for managing bioenergy crops may be needed to maintain biodiversity of grassland birds and other species as biomass production increases. This analysis is useful in showing where energy crops could be grown with potential benefits to bird species and where more research is needed to understand the wildlife consequences of adopting particular energy crops and management practices.

Conservation of species amidst an increasing national demand for woody biomass will require taking a multi-scale planning approach and continually monitoring species that are functionally dependent on the material to fulfill their life-history requirements. Case studies of taxonomic groups or single species with life-history traits that rely functionally on dead and downed wood or changing canopy cover are discussed in *BT16* (an example case study is shown in the text box). This information may be used in conjunction with other finer-scale biodiversity assessments (e.g., state wildlife action plans, county project planning, etc.) to identify species that may be vulnerable to changes.

## Background

As estimated in *BT16* volume 1, 0.8 billion dry tons of biomass are potentially available annually by 2040 at $60 per dry

ton or less[3] under a base-case production scenario.[4] Scenarios from 2040 were selected to examine effects of a large increase in biomass production with an emphasis on cellulosic biomass in the future.

Bird species habitat and species richness in agricultural landscapes were modeled as a way to investigate questions about potential effects of increased energy crop production on biodiversity. The approach used species-distribution modeling to model bird probabilities of occurrence in different geographic locations as a function of climate and land use/land cover. This includes highly valued game species (e.g., bobwhite quail), species with special conservation status (e.g., Henslow's sparrow, upland sandpiper) on the 2008 List of Birds of Conservation Concern,[5] as well as more common species (e.g., American robin).

Using harvest acres generated from the Forest Sustainable and Economic Analysis Model in volume 1 of *BT16*, volume 2 assesses and compares implications for biodiversity of potential forest biomass produced in specific near-term (2017) and long-term (2040) scenarios.[6] A coarse-filter approach was taken to assess effects of woody-biomass harvesting on biodiversity, placing forest change in habitat context. The study describes changes in forest types producing feedstocks and forest age based on harvest type (i.e., thinning and clearcut) within ecoregion units that had the greatest projected harvest intensities compared to other ecoregions. This approach examined forest changes within a habitat and ecological context to help identify species and areas that may be most affected by spatial variability in biomass sourcing.

Further detail on the approaches taken can be found in *BT16* volume 2 chapters 10 and 11.

## Case Study: Golden-Winged Warbler—Species of Concern

This example is one of several additional case studies included in chapter 11 of *BT16* volume 2.

Young forests are an important habitat for the golden-winged warbler (*Vermivora chrysoptera*), a migratory bird found throughout the north-central and eastern United States. The golden-winged warbler population has declined range-wide, and the warbler is currently under consideration for listing under the Endangered Species Act. This decline has been attributed to loss of preferred breeding habitat caused by maturing forests. Regenerating upland and lowland habitat is used for breeding as dense foliage and shrubs provide cover for ground nests. Scattered trees or edges of forests provide singing perches. Dense foliage also lowers negative interactions with blue-winged warblers (*Vermivora cyanoptera*) and cowbirds (*Molothrus* spp.). Given the influx of young forests expected from clearcuts of mature lowland hardwoods under both 2040 scenarios, and from the same relative acreage in 2017 from whole-tree biomass harvesting, there may be opportunities in this ecoregion to contribute to the conservation of this warbler and other species that rely on young forests. Other birds associated with young forests showing range-wide declines are the chestnut-sided warbler (*Setophaga pensylvanica*), Bell's vireo (*Vireo belli*), alder flycatcher (*Empidonax alnorum*), American redstart (*Setophaga ruticilla*), and blue-winged warbler (*Vermivora cyanoptera*).

[3] This price is at farmgate or roadside, marginal cost. In GHG-emissions analyses and air-emissions analyses, supplies delivered to the biorefinery (up to a price of $100 per dry ton at the reactor throat) are included.

[4] Base case refers to a 1% annual yield increase.

[5] U.S. Fish and Wildlife Service, *Birds of Conservation Concern 2008* (Arlington, VA: U.S. Department of the Interior, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 2008), https://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf.

[6] Scenarios include a 2017 and 2040 baseline (moderate housing, low wood energy demand, referred to as "ML") and a 2040 high housing–high wood energy scenario (referred to as "HH"). In the forestry assessment, biomass availability decreases from 2017 to 2040. Furthermore, biomass is lower in the HH 2040 scenario than in the ML 2040 scenario because of the high demand assumed for housing.

This fact sheet refers to the following documents:

U.S. Department of Energy. 2017. *2016 Billion-Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy, Volume 2: Environmental Sustainability Effects of Select Scenarios from Volume 1*. R. A. Efroymson, M. H. Langholtz, K.E. Johnson, and B. J. Stokes (Eds.), ORNL/TM-2016/727. Oak Ridge National Laboratory, Oak Ridge, TN. 640p.

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