

Sustainable Forest Management: Opportunities for bird conservation on private timberlands in the Klamath Mountains, Oregon



Table of Contents

Introduction	2
Focal Geography and Forest Habitats	3
Focal and Priority Bird Species	4
Desired Habitat Conditions and Potential Management Actions	10
Opportunities for Future Collaboration: Integrating Bird Conservation and Sustainable Forestry on Private Timberlands in the Klamath Mountains Focal Geography	14
Conclusion	16
Literature Cited	17
Appendix 1. Desired Habitat Conditions and Recommended Management Actions	20

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Introduction

This scoping document supports partnership efforts by American Bird Conservancy (ABC); Sustainable Forestry Initiative, Inc. (SFI); SFI Program Participant partners including Weyerhaeuser, Plum Creek Timber Company, and Hancock Timber Resources Group; and key technical partners including Klamath Bird Observatory, National Council for Air and Stream Improvement (NCASI), and Partners in Flight. These efforts are designed to support the SFI Program Participants' commitment to SFI standards and enhance management practices on private forests to benefit birds of conservation concern. The immediate purpose is to use this information to design one or more pilot projects that will, in turn, guide the design and implementation of larger efforts across significant portions of the more than 250 million acres of land that are managed by SFI member companies in the U.S. and Canada. The identification of SFI Focal Geographies in the Southeast and Pacific Northwest regions of the U.S. resulted from collaborative discussions as part of the SFI-supported project, *Bringing Back the Forest Birds*. The partner companies have committed to the SFI Standards as described in the SFI 2015-2019 Standards and Rules (<http://www.sfiprogram.org/sfi-standard/guide-to-2015-2019-standards/>). This scoping document will serve to inform efforts among SFI, the partner companies, ABC, and the technical partners to characterize the conservation contributions of their current sustainable forestry management practices and identify opportunities for contributing additionally to conservation of priority birds in the Klamath Mountains Focal Geography of Oregon.

The contribution to bird conservation made by managed forests cannot be underestimated. Indeed, the abundance and diversity of birds we enjoy today is significantly dependent on these habitats. The *State of the Birds 2013 Report on Private Lands* lists opportunities to maintain working forests on private lands that offer economic benefits associated with managing for timber products while providing important habitat for priority birds (NABCI 2013). Such opportunities include integrating bird habitat conservation objectives into forest certification programs. Within the Klamath Mountains Ecoregion (EPA 1996), where private timberlands are distributed within a patchwork of public lands, such certification programs can encourage habitat management in early- and mid-seral forests that will benefit some of the region's most at-risk species. Managing private timberlands for priority birds that depend on specific early- and mid-seral forest conditions could complement public lands management focused on late-seral forest restoration and protection on adjacent lands.

This scoping document is designed to serve as a decision support tool (Alexander et al. 2009) that synthesizes information about bird conservation objectives that are specific to private timberlands in the Klamath Mountains SFI Focal Geography, the Oregon portion of the Klamath Mountains Ecoregion, and that are linked to management decisions regarding early- and mid-seral forests. We use specific habitat objectives outlined in regional conservation plans (Altman and Alexander 2012, Altman and Hagar 2007). These objectives can be used to identify opportunities for contributing to the conservation of priority bird species and the restoration and maintenance of forest conditions associated with the fire-dependent ecosystems that characterize the Klamath Mountains Ecoregion. Management that considers these conservation objectives can improve ecosystem health in forests that have been degraded due to centuries of fire suppression and other factors. Further, identifying and filling an appropriate niche for commercial timber companies to contribute to bird conservation goals will benefit individual

companies. Such benefits include incentives, such as SFI certification, and improvements to forest health on private timberlands. This document provides a foundation for further development and implementation of compatible practices in the Klamath Mountain Focal Geography.

Focal Geography and Forest Habitats

The Klamath Mountains Ecoregion is a physically and biologically diverse area covering the Klamath and Siskiyou mountains and including parts of the Klamath, Rogue, and Umpqua river watersheds (EPA 1996). The region's geology is characterized by a mix of granitic, sedimentary, metamorphic, and extrusive rocks. The area remained unglaciated during the Pleistocene epoch serving as a refuge for northern plant species. The climate is mild and sub-humid, with lengthy summer droughts. This geology, geologic history, and climate have resulted in a diverse flora with a mix of northern Californian and Pacific Northwestern conifers and hardwoods and many endemic and relic species (EPA 1996).

This scoping document focuses on bird conservation objectives associated with early- and mid-seral forest habitats in the mixed-conifer, mixed-conifer hardwood, pine, and Douglas fir forests prevalent on private timberlands in the Klamath Mountains Ecoregion. The forest vegetation is diverse and includes both conifer and hardwood species (Alexander 1999, Alexander et al. 2006, Huff et al. 2005). Dominant conifers include Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), incense-cedar (*Calocedrus decurrens*), and white fir (*Abies concolor*). Dominant hardwoods include tanoak (*Lithocarpus densiflorus*), Pacific madrone (*Arbutus menziesii*), canyon live oak (*Quercus chrysolepis*), California black oak (*Q. Kelloggii*), Oregon white oak (*Q. garryana*), and big-leaf maple (*Acer macrophyllum*). Shrub species include ceanothus (*Ceanothus* spp.), manzanita (*Arctostaphylos* spp.), western hazel (*Colylus cornuta*), ocean spray (*Holodiscus discolor*), Pacific serviceberry (*Amelanchier alnifolia*), snowberry (*Symphoricarpos albus*), currant (*Ribes* spp.), and poison oak (*Toxicodendron diversilobum*). The herb layer consists of various grasses, forbs and bryophytes, and mosses and lichens cover various ground and vegetation surfaces.

The relative composition of these species varies with elevation, aspect, and soils. Generally, these forests correspond to the Douglas-fir, Mixed Evergreen Hardwood, or White Fir Zones described by Franklin and Dyrness (1973) or Types described by Huff et al. (2005). Fire-related studies in these vegetation types show a mix of fire severities, frequencies, and sizes typically characteristic of low- and moderate-severity fire regimes (Agee 1991; Wills and Stuart 1994; Taylor and Skinner 1998, 2003). Over time, such mixed-severity fires create forests with multiple age classes, often with Douglas-fir or ponderosa pine as an emergent canopy above various hardwoods.

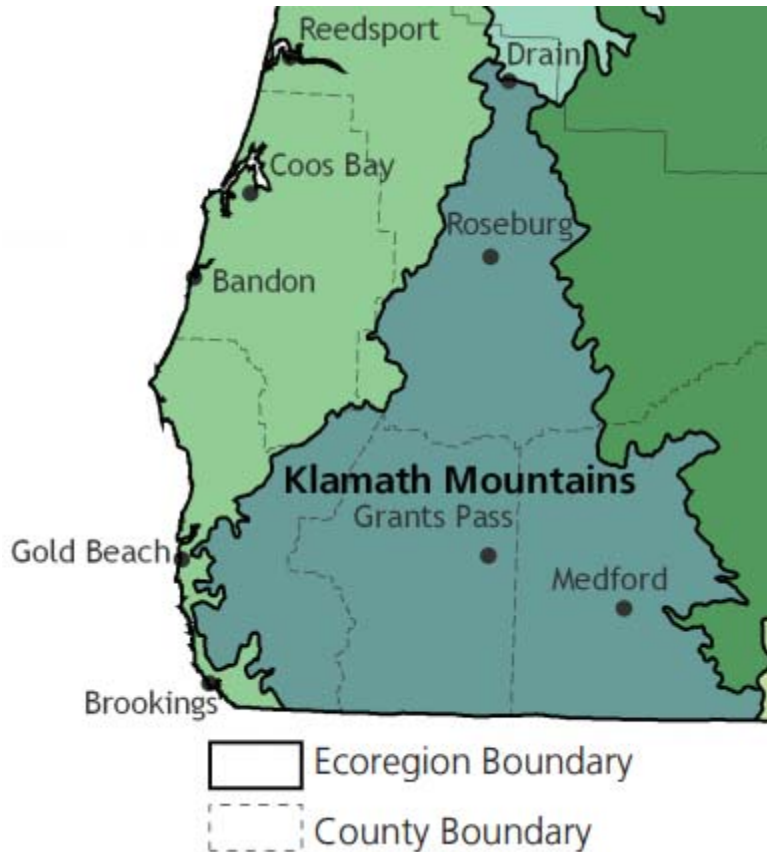


Figure 1. The Oregon portion of the Klamath Mountains Ecoregion (EPA 1996) defines the Focal Geography for this scoping document. Map from ODFW (2005).

Focal and Priority Bird Species

Because birds occupy a wide diversity of ecological niches, they serve as useful tools in the design of conservation efforts (Martin 1995, Askins 2000). Birds are relatively easy to monitor in comparison with other taxa and can serve as focal species, whose requirements define different spatial attributes, habitat characteristics, and management regimes representative of a healthy system. Under the “focal species” approach, managing landscapes to meet the focal species’ needs (e.g., for minimum forest area or for certain structural conditions) is assumed to encompass the requirements of other species (Lambeck 1997).

In assessing the bird species in this decision support tool, we relied on the Partners in Flight (PIF) approach to Focal and Priority Species as described in Altman and Hagar (2007). This approach integrates a focus on habitat objectives associated with Focal Species with the assumed outcome of Priority Species that benefit from management for these objectives (Altman and Alexander 2012). The habitat requirements for a group of Focal Species are used to develop a strategy to achieve functioning forest ecosystems that conserve land birds, many other species, and additional elements of biodiversity. Priority species are typically identified based solely on factors related to each species’ vulnerability or at-risk status or dependence on the geographic area being considered. The most widely used source for scoring and prioritizing species for

conservation is the PIF Species Assessment Database (Panjabi et al. 2012; www.rmbo.org/pif/pifdb.html).

For purposes of our scoping effort we developed a list of bird species characteristic of early- to mid-seral mixed-conifer hardwood, pine, and Douglas fir forests prevalent on private timberlands in the Klamath Mountains Focal Geography (Table 1). The list includes focal species and priority species identified by the North American Bird Conservation Initiative (NABCI 2014; Rosenberg et al. 2014a, 2014b), Partners in Flight (Rich et al. 2004; Altman and Alexander 2012), the U.S. Fish and Wildlife Service (USFWS 2008), and the Oregon Department of Fish and Wildlife (ODFW 2005).

Landbird species that inhabit early- and mid-seral mixed-conifer, mixed-conifer hardwood, pine, and Douglas fir forests can benefit from retention and creation of specific habitat components within those forests. Generally, maintaining or creating diverse tree and shrub species composition, coupled with complex structures that include diverse age classes, snags, and downed wood, will benefit suites of landbird species. These habitat conditions are particularly beneficial when applied to create heterogeneous stands at multiple spatial scales (i.e., across a stand, planning unit, and landscape).

While this document outlines habitat characteristics associated with birds in early- and mid-seral stages, considering the landscape context of other seral stages and habitat types is important. In the Klamath Mountains Focal Geography, where private timberlands are distributed within a mosaic of public lands, habitat management in early- and mid-seral forests designed to benefit a suite of bird species will complement public lands management on adjacent lands focused on late-seral forest protection and restoration. Late-successional forests and lands designated as late-successional forest reserves (i.e., areas managed for the development of late successional forest) cover approximately 50% of the region. Recommendations for the remaining conifer forest landscape (at the ecoregion scale) are to maintain > 25% in each of three successional stages: young forest (understory re-initiation), pole forest (stem exclusion), and early and mid-successional forest (stand initiation) managed for a range of variability consistent with natural regeneration (Altman and Alexander 2012). The specific composition and structural components needed to meet landbird richness goals are described in detail below.

In addition to achieving desired habitat characteristics, timing of management is an important consideration. Management activities occurring outside of the bird breeding season will minimize or eliminate direct impacts on reproduction. Activities that alter habitat during the breeding season can result in a loss of productivity for some individuals in that year, potentially reducing the overall population numbers. The breeding season varies broadly for individual species. For landbirds in this region, residents begin breeding in April, before many migrants that begin breeding in May, have even arrived on their breeding grounds. Generally, management that occurs outside of the primary breeding season of April 15th and July 31st will ensure minimal negative impacts on both resident and migrant birds (Altman and Hagar 2007). Although minimizing impacts to breeding birds is an important consideration, management activities conducted during the breeding season may have long term habitat benefits to priority species that outweigh the temporary loss in productivity.

Table 1. Bird species associated with early- and mid-seral mixed-conifer, mixed-conifer hardwood, pine, and Douglas fir forests prevalent on private timberlands in Klamath Mountains Focal Geography and their conservation status as identified by Partners in Flight, the U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, and the North American Bird Conservation Initiative.

Common Name	State of the Birds ¹		Partners in Flight ²			USFWS ⁴	ODFW ⁴
	Watch List	Common Birds in Decline	Stewardship Species	Focal Species	Priority Species	Conservation Species	Strategy Species
Band-tailed Pigeon	X		X	X	X		X
Black-backed Woodpecker							X
Black-throated Gray Warbler			X	X	X		
Cassin's Finch	X						
Cassin's Vireo					X		
Chestnut-backed Chickadee			X		X		
Chipping Sparrow							X
Cooper's Hawk					X		
Dusky Flycatcher					X		
Flammulated Owl	X		X		X		X
Fox Sparrow			X	X	X		
Gray Flycatcher							
Hammond's Flycatcher				X	X		
Hermit Thrush				X	X		
Hermit Warbler			X	X	X		
Hutton's Vireo					X		
Lazuli Bunting				X	X		
MacGillivray's Warbler					X		
Mountain Quail			X		X		X
Nashville Warbler				X			
Northern Flicker				X			
Northern Goshawk					X	X	X
Northern Pygmy Owl					X		
Northern Saw-whet Owl					X		
Olive-sided Flycatcher	X		X	X	X	X	X
Orange-crowned Warbler				X	X		

Bird conservation on private timberlands in the Klamath Mountains Ecoregion

	State of the Birds ¹		Partners in Flight ²			USFWS ⁴	ODFW ⁴
	Watch List	Common Birds in Decline	Stewardship Species	Focal Species	Priority Species	Conservation Species	Strategy Species
Common Name							
Pacific Wren			X	X	X		
Purple Finch				X	X	X	
Purple Martin					X		X
Red-breasted Sapsucker			X		X		
Ruffed Grouse					X		
Rufous Hummingbird	X		X	X	X	X	
Sooty Grouse	X		X	X	X		
Spotted Towhee					X		
Steller's Jay			X		X		
Townsend's Warbler				X	X		
Western Bluebird					X		X
Western Tanager				X			
Wilson's Warbler		X		X			

1 - Yellow Watch List species (Watch List) and common birds in steep decline (Common Birds in Decline) from *State of the Birds 2014 Report* (NABCI 2014; Rosenberg et al. 2014a, 2014b); 2- Species of continental importance in the Pacific Avifaunal Biome (Stewardship Species) from *Partners in Flight North American Landbird Conservation Plan* (Rich et al. 2004) and focal and priority species (Focal Species and Priority Species respectively) from *Habitat Conservation for Landbirds in Coniferous Forests of Western Oregon and Washington* (Altman and Alexander 2012); 3- Birds of conservation concern in the U.S. portions of the Northern Pacific Forest Bird Conservation Region (Conservation Species) from *Birds of Conservation Concern 2008* (USFWS 2008); 4- Strategy Species from *The Oregon Conservation Strategy* (ODFW 2005).

Table 2. Partners in Flight focal species associated with early- and mid-seral mixed-conifer, mixed-conifer hardwood, pine, and Douglas fir forests prevalent on private timber lands in Klamath Mountains Ecoregion and their habitat associations from Altman and Alexander (2012) and Altman and Hagar (2007).

Species	Forest Type	Seral Stage and Habitat Condition	Habitat Characteristics	Fine Scale Habitat Association/Condition
Black-throated Gray Warbler	Young/Pole	Mid - SE/YS, CP/ST, Rip	Deciduous canopy trees	Broad-leaf canopy and subcanopy trees; Moderate canopy cover
Fox Sparrow	Klamath Mtns. Mixed Forest	Early - SS/PT; Mid - CP/ST, Rip	Montane brushfields	Dense shrub layer; Forest edges and openings
Hammond's Flycatcher	Mature/Young	Mid - SE/YS	Open mid-story	Open mid-story with high conifer canopy cover
Hermit Thrush	Klamath Mtns. Mixed Forest	Mid - CP/ST, SE/YS; <i>Early - SS/PT</i>	Shrub-herbaceous interspersions	Dense shrub patches with open ground cover; Forest edges and openings
Hermit Warbler	Mature/Young	Mid - SE/YS, CP/ST	Closed canopy	High percent conifer canopy cover and foliage volume
Lazuli Bunting	Klamath Mtns. Mixed Forest	Early - GF/SI, SS/PT	Post-fire	Shrub/small tree patches with extensive herbaceous; Drier forest types
Nashville Warbler	Klamath Mtns. Mixed Forest	Early - SS/PT; Mid - CP/ST	Dense shrub understory	Dense shrub layer, especially broad-leaf vegetation; Drier forest types
Northern Flicker	Sapling/Seedling	Early - GF/SI; <i>Mid - SE/YS</i>	Snags	Snags or dying trees for cavity excavation; Forest edges and openings
Olive-sided Flycatcher	Sapling/Seedling	Early - GF/SI, SS/PT; Rip	Residual canopy trees	Forest edges and openings with large residual trees and snags
Orange-crowned Warbler	Sapling/Seedling	Early - SS/PT, Mid - SP/ST; Rip; Early - GF/SI	Deciduous vegetation	Dense shrub layer, especially deciduous vegetation and mesic sites
Pacific Wren	Mature/Young	Mid - SE/YS; Rip; <i>Mid - CP/ST</i>	Forest floor complexity	Low understory complexity, especially stumps, down logs, root wads
Purple Finch	Klamath Mtns. Mixed Forest	Mid - CP/ST, SE/YS; <i>Early - SS/PT</i>	Pine-oak canopy/sub-canopy	Open to semi-open mixed coniferous/deciduous forest and edges

Species	Forest Type	Seral Stage and Habitat Condition	Habitat Characteristics	Fine Scale Habitat Association/Condition
Rufous Hummingbird	Unique	Early - SS/PT , GF/SI; Rip; <i>Mid - CP/ST, SE/YS</i>	Nectar-producing plants	Dense shrub layer with nectar vegetation; Forest openings and interior
Sooty Grouse	Unique	Early - SS/PT, GF/SI; Rip; <i>Mid - CP/ST, SE/YS</i> ; Rip	Landscape mosaic forest	Mesic sites with deciduous cover; Open and closed forests
Western Tanager	Klamath Mtns. Mixed Forest	Mid - SE/SY, <i>CP/SY</i>	Forest canopy edges	Large conifer trees; Forest edges and retention trees in forest openings
Wilson's Warbler	Mature/Young	Early - SS/PT ; Mid - CP/ST, SE/YS; Rip	Deciduous understory	Dense shrub layer, especially wetter sites

1 - Species categorized by use of seral stages and related breeding season habitat conditions [Early - GF/SI = Early-seral, Grass-forb, Stand initiation (0-5 years); Early - SS/PT = Early-seral Shrub-seedling, Shrub Sapling, Pioneer tree (5-20 years); Mid - CP/ST = Mid-seral, Closed-canopy pole, Small tree (14-30 years); Mid - SE/YS = Mid-seral, Stem exclusion, Young sawtimber (25-60 years); Rip= Riparian]. Successional stages and habitat conditions listed in order of the degree of association with bolded text indicating a high degree of association and therefore greater conservation importance, plain text indicating a moderate association, and italicized text indicating a lower association.

Desired Habitat Conditions and Potential Management Actions

Often, desired conditions can be achieved using multiple management techniques. The effect of management techniques on landbirds should also be considered. For example, if a management objective is to promote the growth of conifer seedlings, there are several plausible management techniques. Generally, management techniques that enhance desired habitat characteristics while minimizing the potential for invasive species establishment and limiting insect control measures (e.g. pesticides) are favorable.

1) Large conifer trees

- a. **Significance:** Select landbird species will use large green trees within early-successional forests, primarily for foraging (e.g., flycatchers will forage from a perch on a large tree) and for dispersal between older forest habitat patches. Additionally, large conifer trees retained within a timber harvest will provide the future snags and downed wood important for maintaining bird habitat throughout future harvest rotations. Short rotations may not be sufficient for conifers to become large, thus, forethought is necessary to ensure sufficient retention to achieve long-term goals for live trees, snags, and large downed wood throughout future harvest rotations.
- b. **Conservation Opportunity:** Timber harvest practices often call for the retention of leave trees. In such scenarios harvest prescriptions can be designed to achieve habitat conditions that result from the retention of larger conifer trees in desired configurations.
- c. **Practical Considerations:** Retention of large conifer trees may directly conflict with other management goals presenting potential tradeoffs between timber yield and habitat for species dependent on larger conifer structure. Scattered retention trees may be susceptible to windfall, based on site specific considerations; patch retention may be a good alternative.
- d. **Potential Management Actions:**
 - i. **Harvest** – Where feasible, retain existing large trees;
 - ii. **Regeneration** – Establish stands at low densities to promote large tree recruitment;
 - iii. **Intermediate** – Thin to maintain growth rates and recruit large trees
 - iv. **Landscape** – Provide >30% of the area as early successional forest with large green tree retention scattered or in residual clumps.
- e. **Focal and Priority Species:** Olive-sided Flycatcher, Pileated Woodpecker, Brown Creeper.

2) Large snags and other wildlife structures

- a. **Significance:** Snags provide a critical habitat component within conifer forests for both cavity nesting and bark foraging bird species.
- b. **Conservation Opportunity:** Timber harvest can reduce availability of large snags and some other structural features in intensively managed stands by reducing the source, as well as the natural competition that provides tree mortality. Because

snags are inevitably being lost and degraded through decay, recruitment is an on-going process that requires planning for green tree retention to create future snags.

- c. Practical Considerations: Retention of larger conifer trees for future snag recruitment may directly conflict with other management goals resulting in potential tradeoffs between timber yield and habitat for species dependent on larger snags. Large snags may pose a safety risk based on site specific considerations; patch retention around large snags may be a good alternative.
 - d. Potential Management Actions:
 - i. Harvest – Where feasible, retain existing large snags and/or create snags through topping or girdling green trees; retain trees with wildlife characteristics (e.g., cavities, nest platforms, granary trees);
 - ii. Regeneration – Consider using nest boxes to provide cavities in the interim if snags are lacking;
 - iii. Intermediate – Thin to maintain growth rates and recruit large trees as future potential snags.
 - e. Focal and Priority Species: Northern Flicker.
- 3) Deciduous trees and riparian vegetation
- a. Significance: Deciduous trees, including common plants in riparian areas, increase landbird species richness and abundance in young conifer stands because they provide abundant nest sites (e.g., cavities in oak and Pacific madrone) and food resources (e.g., prey availability on deciduous leaves, hard mast in oak, berries in Pacific madrone).
 - b. Conservation Opportunity: Lacking natural or anthropogenic disturbance, conifer trees will typically outcompete shade intolerant deciduous vegetation. In forests managed for timber, deciduous trees outside of riparian buffers have been traditionally managed against because of competition with commercially planted conifers or inadvertently degraded as a result of management actions.
 - c. Practical Considerations: In commercially managed forests, deciduous trees may compete with commercially planted conifers presenting a trade-off between habitat for broadleaf associated wildlife and timber yield.
 - d. Potential Management Actions:
 - i. Harvest – Retain existing deciduous trees and deciduous vegetation along perennial and intermittent streams; retain and manage for mature pine and oak canopy trees when present;
 - ii. Regeneration – Plant and foster development of deciduous trees;
 - iii. Intermediate – Promote understory growth through management that breaks up the forest canopy while maintaining mid-successional forest; thin competing conifers to open the canopy for deciduous tree development and survival;
 - iv. Landscape – Provide >30% of the area as young/pole forest with >20% canopy cover of deciduous trees.
 - e. Focal and Priority Species: Black-throated Gray Warbler, Nashville Warbler, Purple Finch, Wilson’s Warbler.
- 4) Native shrub patches and mature shrubs

- a. **Significance:** Many landbird species are positively associated with deciduous shrubs in early and mid-successional forests. Shrubs provide an important component of structural heterogeneity and plant species diversity, increasing bird richness.
 - b. **Conservation Opportunity:** Lacking natural or anthropogenic disturbance, conifer forests of this region can have reduced shrub cover as a result of canopy shading. Shrubs have been managed against in reducing fuels and wildfire risk, as well as in intensively managed forests where they may compete with conifer seedlings.
 - c. **Practical Considerations:** In intensively managed forests, shrubs may compete with commercially planted conifers presenting a trade-off for between habitat for broadleaf associated wildlife and timber yield.
 - d. **Potential Management Actions:**
 - i. **Harvest** – Retain shrub patches and old shrubs;
 - ii. **Regeneration** – Allow understory development along with conifer regeneration following harvest or wildfire; lengthen time in early-successional condition by planting a lower density of conifers in conjunction with limited or no competing vegetation management;
 - iii. **Intermediate** – Thin to encourage understory development, if hardwoods are prevalent cut some to encourage sprouting.
 - e. **Focal and Priority Species:** Fox Sparrow, Hermit Thrush, Lazuli Bunting, Orange-crowned Warbler.
- 5) **Berry and nectar producing trees and shrubs**
- a. **Significance:** Berry and nectar producing trees and shrubs provide a unique source of food for birds and are important during both breeding and migration. With changes in phenology as a result of climate change, retention and diversity of fruiting and flowering vegetation is of the utmost importance.
 - b. **Conservation Opportunity:** In conifer forests, a lack of disturbance can reduce canopy gaps that favor berry and nectar producing plants. Shrubs have been managed against in reducing fuels and wildfire risk, as well as in intensively managed forests where they may compete with conifer seedlings.
 - c. **Practical Considerations:** In commercially managed forests, shrubs may compete with commercially planted conifers presenting a trade-off between habitat for broadleaf associated wildlife and timber yield.
 - d. **Potential Management Actions:**
 - i. **Harvest** – Retain existing berry and nectar producing trees and shrubs and allow early-successional habitat to regenerate naturally;
 - ii. **Regeneration** – Plant and manage for berry and nectar producing trees and shrubs; lengthen time in early-successional condition by planting a lower density of conifers in conjunction with limited or no competing vegetation management;
 - iii. **Intermediate** – Maintain or create open canopy cover patches around berry and nectar producing trees and shrubs
 - e. **Focal and Priority Species:** Rufous Hummingbird.

- 6) Diverse tree species and multi-layered structure
 - a. Significance: Multi-layered structure and a mix of tree species will increase bird richness and abundance substantially compared to a homogenous conifer stand. The increased habitat diversity will support a number of species associated with mid-story canopy that provides vertical connectivity and increased nest site and prey availability.
 - b. Conservation Opportunity: As a result of fire suppression and forest management, conifer forests of this region can be more homogeneous in composition and structure compared with the historic range of variability.
 - c. Practical Considerations: Developing and maintaining multi-layered forest structures may involve repeated management actions (e.g., thinning) that would not otherwise be implemented in some commercially managed forests.
 - d. Potential Management Actions:
 - i. Harvest – Retain a diversity of tree and shrub species, protect patches of regeneration;
 - ii. Regeneration – Plant a mixture of tree and shrub species, if hardwoods are prevalent cut some to encourage sprouting;
 - iii. Intermediate – Thin from below to encourage development of mid-story hardwoods and other under-represented species;
 - iv. Landscape: Intersperse late seral and young forest
 - e. Focal and Priority Species: Black-throated Gray Warbler, Hammond’s Flycatcher, Western Tanager.

- 7) Heterogeneous cover
 - a. Significance: Select landbird species are associated with the juxtaposition of habitat type and seral stage and will benefit from heterogeneous canopy, shrub, and herbaceous cover.
 - b. Conservation Opportunity: Fire suppression and forest management can result in homogenous stands at both the patch and landscape scales.
 - c. Practical Considerations: In commercially managed forests the growth of crop species is often emphasized over cover heterogeneity, presenting a possible trade-off for species dependent on non-crop species overstory vegetation.
 - d. Potential Management Action:
 - i. Harvest – Conduct both single tree and group selection harvests; implement variable density thinning;
 - ii. Regeneration – Conduct variable density planting of conifer and hardwood trees and shrubs;
 - iii. Intermediate – Thin to encourage diversity of overstory and understory cover;
 - iv. Landscape– Ensure a diversity of habitat types and conditions
 - e. Focal and Priority Species: Sooty Grouse.

- 8) Complex forest floor structure
 - a. Significance: Landbirds that forage or nest on the forest floor will benefit from large downed wood that provides a unique cover type in early and mid-seral conifer forests.

- b. Conservation Opportunity: Timber harvest can negatively affect availability of large down wood on the forest floor by decreasing the source of snags and the natural competition that provides tree mortality. Because large down logs are inevitably lost and degraded through decay, recruitment is an on-going process that requires planning for green tree retention to create future forest floor complexity.
- c. Practical Considerations: In commercially managed forests, complex vegetation growth on the forest floor may compete with commercially planted conifers, especially during initiation, presenting a trade-off for providing wildlife habitat.
- d. Potential Management Action:
 - i. Harvest – Where feasible, retain and protect existing large down logs; if large down wood is not present fell and leave trees as logs;
 - ii. Regeneration – Establish stands at low densities to promote large tree recruitment for future downed wood;
 - iii. Intermediate – Thin to accelerate growth and down log recruitment
- e. Focal and Priority Species: Pacific Wren.

Opportunities for Future Collaboration: Integrating Bird Conservation and Sustainable Forestry on Private Timberlands in the Klamath Mountains Focal Geography

A great number of options for collaboration exist, and additional work is needed to identify specific opportunities for showcasing and advancing bird conservation objectives on commercially managed forests in the Klamath Mountains Focal Geography. There are two primary information needs essential to that effort:

1. Current practices that are believed to provide desired habitat conditions for birds, many of which are already occurring as part of the SFI certification program, should be identified and quantified.
2. Gaps between existing forest management and desired conditions need to be recognized. A better understanding of the operational constraints or management restrictions that are obstacles to achieving desired habitat conditions for birds on commercial timber lands should be described, and where possible, solutions for overcoming them developed.

Once these two tasks are completed, specific projects should be designed, implemented, and evaluated to both test the hypotheses of compatibility of existing practices and bird conservation, and new hypotheses of modifications/enhancements of those practices to achieve additional bird conservation benefits. Evaluation using standard bird population and habitat metrics should be a central component to these efforts.

In the Klamath Mountains Focal Geography, there is a unique opportunity to inventory existing conditions that have resulted from forestry practices on private timberlands, test new forestry practices, and use an ongoing monitoring and research network, robust datasets, and novel modeling approaches to evaluate the benefits to priority birds. The Klamath Bird Monitoring Network is a broad partnership that maintains theoretical and applied monitoring and research

efforts in this region (Alexander 2011, Alexander et al. 2004). These efforts have resulted in large data sets that are available through the northwest regional node of the Avian Knowledge Network (Iloff et al. 2009). Bird conservation partners have been using these data and novel modeling approaches to better understand bird and habitat distributions and use this understanding to evaluate habitat conditions at fine scales across landscapes inclusive of the Klamath Mountains Ecoregion (Alexander et al. 2015; Betts et al. 2013, 2014; Shirley et al. 2013; Halstead 2013; Veloz et al. 2015).

With a comprehensive monitoring network in place, robust datasets readily available, and state of the art modeling approaches, there is an opportunity to achieve shared goals through future work. The next steps, Phase 1 and Phase 2 described below, could facilitate collaboration among the SFI and partner companies, ABC, and the technical partners (i.e., Klamath Bird Observatory and NCASI). The phases focus on characterizing the conservation contributions of current sustainable forest management practices and identifying opportunities and implementing new efforts to meet conservation objectives for priority birds in the Klamath Mountains Focal Geography.

Phase 1: Fill information gaps to identify opportunities for showcasing and advancing private timberland forestry and bird conservation objectives in the Klamath Mountains Focal Geography.

Exchange information through both meetings and conference calls with staff from SFI and partner companies, ABC, and the technical partners (i.e., Klamath Bird Observatory and NCASI) to identify and fill information gaps. We will identify forest management practices being implemented on private timberlands in the Klamath Mountains Ecoregion, as well as SFI certification criteria that overlap or complement the habitat-based bird conservation objectives and management strategies outlined in regional bird conservation plans and summarized in this scoping document. Gaps between existing forest management and desired habitat conditions will be identified as well. We will work collectively to better understand obstacles, such as operational constraints and management restrictions, and identify opportunities for achieving additional desired habitat conditions within those sidebars.

Building on that information, we can inventory private timberlands in the Klamath Mountains Focal Geography where management practices that overlap or complement habitat-based bird conservation objectives have occurred. Species-centered habitat models, as described by Alexander et al. (2015), Betts et al (2014), Halstead (2014), and Shirley et al. (2013) can be developed using existing bird monitoring data. The modeling approach uses unclassified remote sensing imagery data and large bird monitoring datasets to produce species distribution models that offer high-resolution predictions, avoid uncertainties relating to habitat misclassification, and allow the annual mapping of subtle on-the-ground habitat characteristics at local and landscape scales. These models will result in maps of desired habitat conditions associated with the conservation objectives and management strategies outlined in this scoping document. Additional bird monitoring on private timberlands can be used to validate and improve the species-centered habitat models. The private timberlands inventory and model-based habitat

maps will be cross-walked to identify where current forest conditions on private timberlands and desired habitat conditions for priority birds overlap, as well as where opportunities to improve habitat conditions exist. This analysis will quantify the existing and potential benefits of conservation practices on private lands to priority bird populations. A synthesis of the information exchange with results from the modeling exercise will serve as a decision support tool and will quantify existing contributions and identify opportunities to advance private lands forestry and bird conservation objectives in the Klamath Mountains Focal Geography.

Phase 2: Designing, implementing, and evaluating sustainable forest management practices that result in desired habitat conditions for priority birds on private lands

Building on the groundwork established in Phase 1, this phase will involve the design of management prescriptions that meet specific private forest management and bird conservation objectives simultaneously. Forest management can integrate both existing practices and novel approaches identified collaboratively during Phase 1 to overcome previous obstacles. These practices may relate to existing SFI certification criteria, or be used to inform the development of new criteria. These management prescriptions can be replicated on private timberlands in the Klamath Mountains Ecoregion. Monitoring and modeling efforts will be used to evaluate the effectiveness of these management practices with regards to both forest management and bird conservation objectives. The implementation will provide a better understanding of how operational constraints or management restrictions challenge the integration of private lands forest management and bird conservation. A primary objective of this project will be to test management strategies that are designed to overcome these obstacles. This project will also further quantify the benefits of conservation practices on private timberlands to priority bird populations.

Conclusion

The desired habitat objectives and related management strategies taken from regional bird conservation plans and outlined in this scoping document offer the building blocks for integrating bird conservation and sustainable forestry practices on private timberlands in the Klamath Mountains Focal Geography in Oregon. The information herein is intended to support the SFI Program Participant partners' commitment to SFI standards and enhance management practices on commercially managed forests to benefit birds of conservation concern. The next steps outlined above have been conceptualized to guide the design and implementation of larger efforts across lands that are managed by SFI Program Participants in the U.S. and Canada. When implemented, this demonstration will provide a model for working forests on private lands that offer economic benefits associated with managing for industrial timber products while providing important habitat for priority birds.

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Appendix 1. Desired Habitat Conditions and Recommended Management Actions

Here we present site and landscape scale conservation objectives for early- and mid-seral mixed-conifer, mixed-conifer hardwood, pine, and Douglas fir forests prevalent on private timberlands in the Klamath Mountains Focal Geography. These objectives are based on the habitat associations of the Partners in Flight focal species listed in Table 1. The associations include forest types, seral stages and related habitat conditions, broad habitat characteristics, and more specific fine scale habitat features as outlined by Altman and Alexander (2012) and Altman and Hagar (2007) and presented in Table 2. Altman and Alexander (2012) used these habitat associations, and the best available science to develop and describe more prescriptive, landscape- and site-level habitat objectives, along with management strategies, for each focal and priority species. These objectives and strategies are presented to guide further investigation on commercially managed forests that validates and informs these relationships.

With these details we outline specific desired habitat conditions, along with the focal and priority species to benefit from forest management designed to achieve these conditions across multiple stands and landscapes. Forest management companies operate under a number of significant constraints that govern their ability to adapt habitat management to further enhance bird conservation specifically, including commitments to manage for other wildlife, watershed issues, and various local, state, and federal ordinances and laws. Thus, we present a wide range of options to allow for flexibility in developing objectives and implementing management practices designed to integrate forest management and bird conservation.

As presented below, these associations and strategies, taken from Altman and Alexander (2012) and Altman and Hagar (2007), could be reframed as hypothesis for field investigations involving site specific data collection and detailed analyses that relate the habitat conditions with existing and future management approaches that advance bird conservation on commercially managed timberlands.

Species	Habitat Objectives	Management Strategies
Black-throated Gray Warbler	<p>Landscapes: At watersheds or townships/sections scales provide >30% of the area as young/pole forest with site-level habitat conditions as described below.</p> <p>Sites: In forests >30 years old provide >20% canopy cover of deciduous trees. Riparian buffer zones should be >55 m (180 ft) wide to provide suitable habitat.</p>	<p>Where deciduous trees occur, ensure persistence by thinning of conifers. If deciduous trees are not present, conduct thinning to allow for development of deciduous trees. Thinning should occur in patches and be variable spaced to maintaining some areas with high canopy closure. Under long rotations, conduct repeat thinning as necessary to maintain a deciduous canopy component and lengthen time that habitat is suitable.</p>
Fox Sparrow	<p>Sites: Maintain shrub cover >60% within a forest with canopy cover <30% cover.</p>	<p>Discontinue use of herbicides for deciduous tree and shrub control for species associated with deciduous shrub and small tree cover. Minimize or discontinue grazing in naturally occurring montane brushfields to maintain shrub cover levels and the herbaceous understory and interspersed that protects the soils from erosion, especially on steeper slopes.</p>
Hammond's Flycatcher	<p>Landscapes: At watershed or townships/sections scales provide ≥6 blocks of late-seral and young forest >20 ha (50 ac) or one block >120 ha (300 ac) per square mile. At >1,000 ha scale (2,500 ac) maintain large core areas of fragmented coniferous forest including 80–90% of the area with i.e., >80% conifer cover in canopy, 0–20% of area in early seral habitat, and <1% cover of deciduous habitat in drier uplands.</p> <p>Sites: In forests >40 provide forest patches >15 ha (42 ac), canopy closure >50%, and a relative stem density of 0.2 to 0.3 to maintain an open mid-story. Riparian buffer zones >70 m (230 ft) wide.</p>	<p>Conduct light to moderate single-layered thinning from below avoiding layered understory development. Conduct habitat management in areas without an extensive riparian or deciduous tree component.</p>
Hermit Thrush	<p>Landscapes: Within 1,000 ha (2,500 ac) blocks, provide patch sizes according to the following forest cover amounts:</p> <ul style="list-style-type: none"> >90% forest cover = >8 ha (20 ac) patch size >80% forest cover = >26 ha (64 ac) patch size >70% forest cover = >66 ha (163 ac) patch size >60% forest cover = >156 ha (385 ac) patch size >50% forest cover = >353 ha (873 ac) patch size 	<p>Remove or explicitly control the timing and intensity of grazing to develop and promote the long-term persistence and balance of shrub and herbaceous communities. Promote understory growth through natural disturbance or management that breaks up the forest canopy yet still maintains the dominance of a mid- or late-successional forest. Maintain large</p>

Species	Habitat Objectives	Management Strategies
	<p>Sites: Maintain an understory ratio of shrub-herbaceous (includes bare ground) cover within a range of 30–70% for each parameter.</p>	<p>forest tracts (i.e., minimize fragmentation) for highly suitable habitat.</p>
Hermit Warbler	<p>Landscapes: At watershed or townships/sections scales provide >55% of the area as suitable nesting habitat (forest >40 years old with adequate canopy cover as described below), and >25% of suitable habitat should be young forest.</p> <p>Sites: In forests >30 years old provide average tree dbh >30 cm (12 in), >90% canopy closure, and a dominance of Douglas-fir. Riparian buffer zones >70 m (230 ft) wide.</p>	<p>Extend rotation ages. Light to moderate thinning early in forest development (<30 years-old).</p>
Lazuli Bunting	<p>Sites: Maintain post-wildfire vegetation, especially deciduous shrub/tree vegetation, where opportunities exist or can be managed for with <20% live tree cover and a shrub-herbaceous (includes bare ground) cover ratio that is within a range of 30-70% for each parameter.</p>	<p>Discontinue use of herbicides for deciduous tree and shrub control for species associated with deciduous vegetation in post-fire habitat. Restore fire as a management tool. Maintain areas of unaltered post-fire habitat where regeneration can occur naturally. Retain and encourage the development of shrubs within post-fire habitat. Minimize the impact to shrubs during management activities in post-fire habitat.</p>
Nashville Warbler	<p>Sites: Where ecologically appropriate (e.g., wetter sites), maintain or provide >40% understory shrub layer cover.</p>	<p>Promote understory growth through natural disturbance or management that breaks up the forest canopy yet still maintains the dominance of a mid- or late-successional forest. Discontinue use of herbicides for deciduous tree and shrub control.</p>
Northern Flicker	<p>Landscapes: At watershed or townships/sections scales provide >30% of area as early successional forest.</p> <p>Sites: In early successional forests provide u >3 snags/ha (1 snag/ac) ≥61 cm (24 in) dbh and >12 m (40 ft) in height and in decay classes 2–3 (soft with moderate bark remaining), >7 snags/ha (3 snags/ac) 40–61 cm (16–24 in) dbh and >12 m (40 ft) in height, and >10 snags/ha (4 snags/ac) 10–30 cm (4–12 in) dbh.</p>	<p>Retain large dying and defective trees (e.g., broken tops, fungal conks, insect infestations). If snags have not been retained, create snags within the existing forest through blasting tops, inoculation with heart rot, or other suitable methods if size of trees meets species requirements. Retain known or suitable nesting snags from all harvest and salvage activities and restrict access for fuelwood cutters. Clearings and snags created from forest fires should be left to succeed naturally where possible. In</p>

Species	Habitat Objectives	Management Strategies
Olive-sided Flycatcher	<p>Landscapes: At watersheds and townships/sections scales provide >30% of the area as early successional forest.</p> <p>Sites: In early successional forests >20 ha (50 ac) provide >3 1-ha (2.5 ac) areas (aggregate clumps) with 10–30 trees/ha (4–12/ac) >12 m (40 ft) high, and within the early successional habitat, not adjacent to the forest edge. Remainder of the harvest unit should average 3–5 trees/ha (1–2/ac) >12 m (40 ft) high, dispersed relatively equally. Retained large trees should be >50% hemlocks or true firs to provide and have ≥25% foliage volume. Retain suppressed or understory plantation trees in the harvest unit (>13 ha [5/ac]) 3–12 m (10–40 ft) high. In thinned sites, maintain 10–50% canopy cover with some areas 10–20% canopy cover. In post-fire habitat, maintain >40% as unsalvaged, and where salvage is occurring, retain all trees and snags >51 cm (21 in) dbh and >50% of those 27–50 cm (12–20in) dbh.</p>	<p>harvest units, implement green-tree retention for long term.</p> <p>In addition to green-tree retention, seed tree, shelterwood, or group selection cuts may be used to meet the biological objectives. In reforestation areas, include at least 10% hemlock or true fir seedlings, and retain these trees through thinning and harvest. Retain residual clumps of older forest in association with retained green-trees to increase edge and protect retained trees. Retain maintain, and recruit large trees in association with retained large snags.</p>
Orange-crowned Warbler	<p>Landscapes: At watersheds and townships/sections scales provide >30% of the area as early successional forest described below.</p> <p>Sites: In early successional forest provide >30% cover of the area in deciduous shrubs and small trees (<15 ft tall).</p>	<p>Allow early-successional habitat to regenerate naturally where there is the potential for structurally complex and well-developed deciduous component of shrubs and trees. Maintain deciduous vegetation in areas where conifer seedlings are not planted or difficult to establish. Where vegetation management is conducted, use selective control of deciduous vegetation (e.g., immediately adjacent to conifer seedlings) by manual thinning or limited herbicide application and retain small, untreated patchily distributed plots (e.g., 0.1 ha, 10 X 20 m) of deciduous vegetation throughout conifer plantations. Lengthen time in early-successional condition by planting a lower density of conifers in conjunction with limited or no competing vegetation management. Conduct non-uniform (i.e., patchily)</p>

Species	Habitat Objectives	Management Strategies
		<p>thinning and pruning of conifers in later stages of early-successional and into the pole stage to maintain a deciduous shrub component.</p> <p>Discontinue use of herbicides for deciduous tree and shrub control. Design and tailor harvest entries and logging to minimize ground disturbance and site productivity.</p>
Pacific Wren	<p>Landscapes: At watershed, township/section scales provide ≥ 2 blocks of late-successional forest > 30 ha (75 ac) or one block > 60 ha (150 ac) per square mile. Within landscapes > 150 ha (375 ac), maintain $> 10\%$ of the area as mixed forest or deciduous forest (includes riparian areas).</p> <p>Sites: In forests > 60 years old provide an average of 10 down logs/ha (4/ac) with a dbh > 61 cm (24 in) in decay classes 3–5 (i.e., softer down logs) and > 15.2 m (50 ft) long (decay class 3–5), shrub cover (woody or ferns) $> 60\%$ and fern cover $> 20\%$ within 3 m (9 ft) of the ground, and tree trunk surface area for foraging with a mean dbh > 40 cm (16 in). Riparian buffer zones should be > 40 m (130 ft) wide.</p>	<p>Maintain forests in the largest possible tracts. Retain down woody debris during forest management, and supplement where necessary. Retain root wads. Create and retain slash piles of varying sizes. Conduct light, variable-spaced thinning to enhance understory development. Tailor entries to minimize understory disturbance and site productivity. Provide site-level habitat conditions within or adjacent to riparian areas.</p>
Purple Finch	<p>Sites: Maintain $> 60\%$ canopy/subcanopy closure, especially where pine and oak are part of the canopy. Maintain $> 25\%$ canopy cover of pine and oak trees.</p>	<p>Retain all mature pine-oak canopy trees. Conduct thinning or other forest management to select for mature pine and oak trees. Where managed regeneration is occurring, plant pine and oak trees.</p>
Rufous Hummingbird	<p>Sites: In any forest stage or condition provide $> 20\%$ of the shrub/herbaceous understory cover as nectar-producing plants (e.g., salmonberry, rhododendron, currant).</p>	<p>Allow unmanaged early-successional habitat to regenerate naturally, particularly where there is the potential for a well-developed deciduous component of flower (nectar) producing plants. Retain and/or plant flower (nectar) producing shrubs and trees such as salmonberry, currant, and snowbrush, and herbaceous plants such as penstemon, columbine, and paintbrush. Maintain deciduous vegetation in areas where conifer seedlings are not planted or difficult to establish. Use selective control of deciduous vegetation (e.g., immediately adjacent to conifer seedlings) by manual thinning or limited herbicide application and retain small, untreated</p>

Species	Habitat Objectives	Management Strategies
		<p>patchily distributed plots (e.g., 0.1 ha or 10 x 20 m) of deciduous vegetation throughout the conifer plantation. Discontinue use of herbicides for deciduous tree and shrub control for species associated with early-successional deciduous shrub-layer vegetation. Lengthen time in early-successional condition by planting a lower density of conifers in conjunction with limited or no competing vegetation management. Design and tailor harvest entries and logging to minimize ground disturbance and site productivity. Selectively retain flower and nectar producing shrubs and trees beneath transmission powerlines.</p>
Sooty Grouse	<p>Sites: Maintain an interspersion of tree cover (20–50%), shrub cover (10–40%), and herbaceous cover (30–60%) within a 0.8 km (0.5 mi) radius.</p>	<p>Ensure diversity of habitat types and conditions.</p>
Western Tanager	<p>Sites: Maintain a dispersed or patchy forest canopy with cover between 40–70%.</p>	<p>Promote forest edges through natural disturbance or management that breaks up the forest canopy yet still maintains the dominance of a mid- or late-successional forest. Conduct variable density thinning with some small openings to create more edge habitat.</p>
Wilson's Warbler	<p>Landscapes: Within landscapes >1,000 ha (2,500 ac) maintain a complex heterogeneity of habitat types and conditions including >60% of the area in contiguous deciduous or mixed deciduous-coniferous forest and >4% of the area in early successional habitat in corridor-type strips or complex shapes that to maximize edge.</p> <p>Sites: In forests >40 years old provide >40% understory deciduous shrubs and small trees (<10 ft) cover with >25% of the shrub cover as western sword fern or bracken fern. Riparian buffer zones >30 m (100 ft).</p>	<p>Extend rotation age to >60 years in conjunction with thinning to lengthen suitability of the habitat for a longer time. If understory deciduous vegetation is lacking conduct moderate to heavy variable-density thinning for canopy openings and small gaps (<1 ha [2 ac]). Small patch (0.2 ha [0.5 ac]) group selection cuts to provide result in patches of understory deciduous vegetation. Such vegetation can be maintained thinning to prevent conifers from shading out deciduous understory. Repeated thinnings to advance understory development. During thinning minimize understory disturbance and site productivity. Retain intact patches of forest with understories. Discontinue use of herbicides for deciduous tree and shrub control.</p>