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# BALANCING COMPETING HABITAT MANAGEMENT NEEDS FOR NORTHERN SPOTTED OWLS AND OTHER BIRD SPECIES IN DRY FOREST LANDSCAPES

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*Abstract*. Dry site forests in the eastern Cascade Range in Washington were historically maintained on the landscape by a combination of low-intensity and mixed-severity fires whose frequent occurrence generally prevented the extensive establishment of high densities of small trees, including fire intolerant species. Fire suppression over the last century has altered tree species composition and forest structure at stand and landscape levels. Prior to the onset of fire suppression, dry forests in the eastern Cascade Range were characterized by the presence of fire refugia embedded within a matrix of dry, open-grown forest often dominated by ponderosa pine (*Pinus ponderosa*); some of these refugia of closed-canopy, mixed coniferous forests likely supported Northern Spotted Owls (*Strix occidentalis caurina*). The effects of fire suppression have resulted in the presence of larger and more contiguous areas of closed-canopy forest, likely increasing the amount of Spotted Owl habitat compared to conditions prior to European settlement. Concomitant with these changes has been a decline in the amount and quality of open ponderosa pine habitat and an increased risk of stand-replacement fire and large-scale insect outbreaks. Consequently, present conditions are not sustainable in the long-term and ecological management objectives are conflicted. Continued fire suppression will further degrade ponderosa pine forest and increase the likelihood that landscape-level fires will eliminate habitat used by both Spotted Owls (associated with closed-canopy forest) and a number of pine-dependent (open-canopy) species. Landscape-level models that address fire risk and forest health in a dry forest landscape should be developed and used to identify best possible configurations of forest patches necessary to reduce fire risk while addressing the divergent habitat needs of Spotted Owls and a suite of species associated with ponderosa pine forests. This strategy can be applied in other dry forest landscapes to address similarly conflicting management objectives. Fire suppression and related issues were recently identified by Partners in Flight as having great importance to bird conservation in forests of the Intermountain West. Partners in Flight can play a crucial role in research and monitoring efforts and in the development and dissemination of information.

*Key Words*: dry forest management, fire risk management, forest health, landscape-level planning, Northern Spotted Owl, *Strix occidentalis caurina.*

## NIVELANDO LAS NECESIDADES DE MANEJO DE HABITAT PARA EL BUHO MANCHADO Y OTRAS ESPECIES DE SELVAS SECAS

*Resumen*. Los bosques con zonas secas, al este de la Cordillera de las Cascadas (Cascade Range) en el Estado de Washington, han persistido debido a la ocurrencia continua de fuegos de baja-intensidad y fuegos severidad-múltiple; estos fuegos contribuyen a la no proliferación o establecimiento de árboles pequeños incluyendo especies intolerantes al fuego. El control de fuegos forestales en los últimos cien años ha ocasionado una modificación en la composición de especies arbóreas, estructura forestal y niveles de campiña. Previamente al inicio del control de incendios forestales, los bosques de zonas secas de esta región, se caracterizaban por la presencia de refugios de fuego rodeados por una mezcla de bosques secos y bosques de crecimiento extenso comúnmente dominados por pinos ponderosa (*Pinus ponderosa*); algunos de estos refugios con pabellón cerrado y con mezcla de bosques de conifera muy probablemente fueron el hábitat de la especie del búho moteado del norte (*Strix occidentalis caurina*). Los efectos del control de incendios han dado como resultado la presencia de áreas más extensas y contiguas de bosques de pabellón cerrado, probablemente incrementando el área de hábitat del búho moteado comparado a las condiciones previas a la colonización Europea. Vinculado con estos cambios ha habido un descenso en la cantidad y calidad del hábitat del pino ponderosa y un incremento en el riesgo de tolerancia a incendios forestales y al brote de plagas a gran escala. En consecuencia, las condiciones forestales actuales no tienen una base a largo plazo y los objetivos del

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manejo ecológico son conflictivos. Una continua extinción de incendios continuara degradando los bosques de pino ponderosa e incrementara la probabilidad que los incendios a nivel de la campiña eliminaran el hábitat usado por los búhos moteados (asociados con los bosques de pabellón cerrado) y un numero de especies dependientes a estos pinos (pabellón abierto). El uso de maquetas para abordar los temas del peligro de incendios y salud forestales con una campiña de bosques secos deberán ser desarrolladas y usadas para identificar las mejores distribuciones de parches forestales necesarias para reducir el riesgo de incendios forestales, teniendo en cuenta el hábitat necesario para los búhos moteados y una serie de especies asociadas con los bosques de pinos ponderosa. Esta estrategia podría ser aplicada a otras campiñas de bosques secos para implantar un manejo de objetivos con peligros similares. La extinción de incendios forestales y otros puntos en cuestión fueron recientemente tratados por la organización Partners in Flight teniendo una gran importancia para la protección de aves en los bosques del occidente Intra-montañoso. Partners in Flight puede jugar un rol decisivo en la labor de investigación, monitoreo, desarrollo y en la difusión de información.

## INTRODUCTION

The Northern Spotted Owl (*Strix occidentalis caurina*; hereafter, Spotted Owl) has been the focus of substantial conservation efforts over the last two decades. A recently completed recovery plan for the subspecies identified habitat loss as one of the key factors contributing to its continued population decline (U.S. Fish and Wildlife Service 2008). In dry forest landscapes of the eastern Cascade Range, the effects of unnatural fires and insect outbreaks have contributed to loss of habitat used by Spotted Owls (Courtney et al. 2008). Ironically, such impacts also affect Flammulated Owl (*Otus flammeolus*), White-headed Woodpecker (*Picoides albolarvatus*) and Pygmy Nuthatch (*Sitta pygmaea*), species which are strongly associated with older, open-grown ponderosa pine (*Pinus ponderosa*) forests (Wisdom et al. 1999), a cover type not used as habitat by the Spotted Owl (Buchanan et al. 1995). Therefore, the challenge for resource managers is to seek a balanced approach to habitat management for Spotted Owls, a species associated with closed-canopy forests, and a suite of species that are closely associated with open-grown forests dominated by ponderosa pines. Here I describe this management dilemma and some strategies to address the situation, and identify opportunities where Partners in Flight can play a role in adaptive management studies and data dissemination.

## THE NORTHERN SPOTTED OWL

In Washington, the range of the Spotted Owl extends from the international border south to the Columbia River, and from the Pacific coast to the lower eastern slope of the Cascade Range (Gutiérrez et al. 1995). As of November 2007 there were 1069 activity centers of territorial Spotted Owls in Washington recognized in the Washington Department of Fish and Wildlife's statewide database for Spotted Owl activity centers. Of these, 346 (32%) were east of the Cascade Range crest. Within the eastern Cascade Range province, Spotted Owls are distributed from the Cascade Range crest nearly to the lower elevation of the dry forest zone (Fig. 1).

The Spotted Owl is associated with mature and old forest habitat throughout most of its distribution (Gutiérrez et al. 1995). Forest conditions vary dramatically within the eastern Cascade Range, generally coincident with a moisture gradient from mesic near the Cascade crest to xeric toward the eastern edge of the forest. Not surprisingly, habitat use by Spotted Owls varies across the region, apparently the result of differing forest growth capability and site history (Buchanan and Irwin 1998, Herter and Hicks 2000). In this region, the median age of forests used for nesting is about 130 years, ranging from 45 years to several hundred years of age; many forests in the easternmost part of the region are approximately 60 to 80 years of age (Buchanan and Irwin 1998, J. Buchanan, unpublished data). Forests used by Spotted Owls in the eastern Cascade Range generally have high densities of Douglas-fir (*Pseudotsuga menziesii*) or grand fir (*Abies grandis*), multiple canopy layers, and high levels of canopy closure (Buchanan et al. 1995).

Because Spotted Owls are associated with many forest types in the region, I used existing land cover data (NatureServe and Washington Natural Heritage Program 2005), and combined ecological systems (Appendix 1) into mesic, mixed conifer and ponderosa pine zones to generalize forest conditions associated with Spotted Owl sites. The distribution of Spotted Owl activity centers in the eastern Cascade Range is strongly associated with the ponderosa pine zone, with comparatively fewer sites in the mixed conifer and mesic zones (Fig. 2). The U.S. Forest Service designated five Fire Management Analysis Zones (FMAZ) for the purposes of fire suppression and management on federal lands in the eastern Cascade Range. The forest

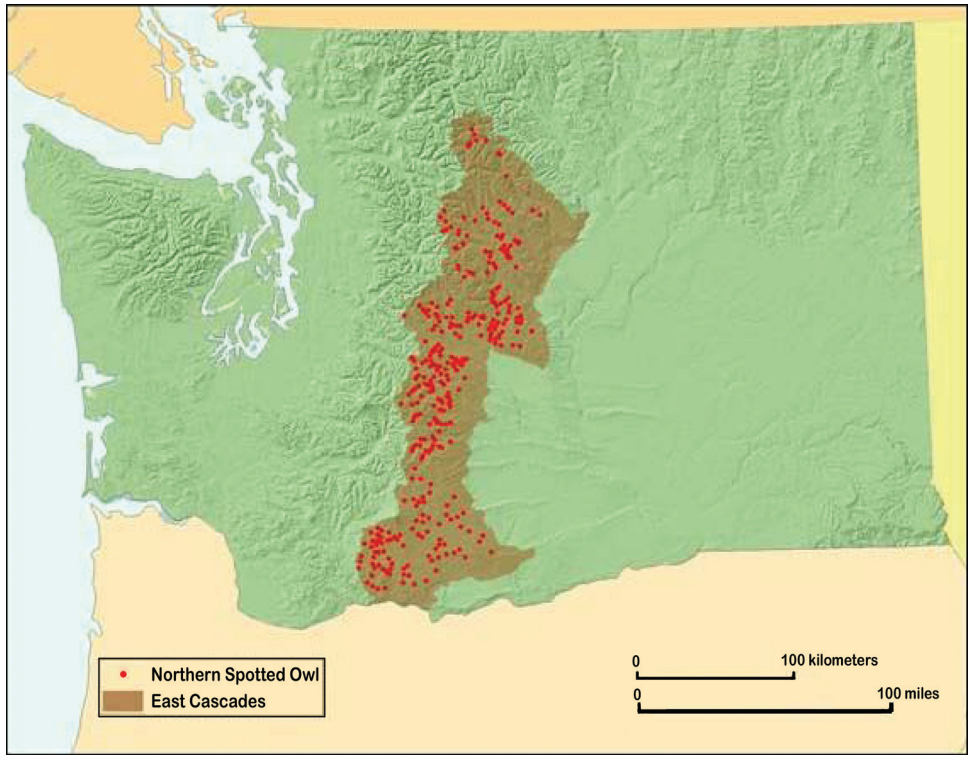


FIGURE 1. Distribution of Spotted Owl activity centers in the eastern Cascade Range Province, Washington (excluding several sites north of Lake Chelan). Location data from Washington Department of Fish and Wildlife.

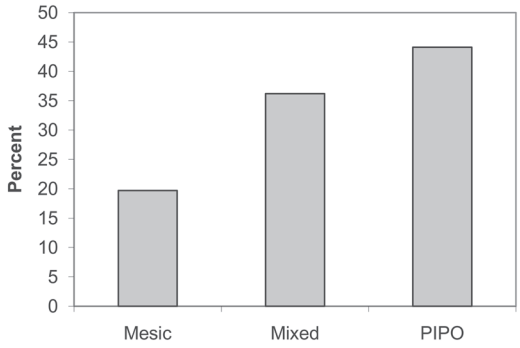


FIGURE 2. Percentage of Spotted Owl activity centers ($n$ = 345) associated with the three general vegetation zones (mesic, mixed conifer, ponderosa pine [PIPO]) found in the eastern Cascade Range Province, Washington. Location data from Washington Department of Fish and Wildlife.

in FMAZ 1 and 2, the easternmost two zones, is characterized as belonging to the ponderosa pine forest association although these forests are no longer dominated by ponderosa pine (Buchanan and Irwin 1998). The relationship between Spotted Owls and dry site conditions is particularly evident in FMAZ 2 (Fig. 3), where nearly one-half of the nest site sampling plots contained large diameter (≥ 76 cm dbh) ponderosa pines embedded within what has become a closed-canopy forest (Buchanan et al. 1995, J. Buchanan, unpublished data).

## THE MANAGEMENT DILEMMA

Fire suppression has long been used as a management tool throughout the Intermountain West (Agee 1993). The intent of fire suppression was to reduce the effects of fires, including low- or mixed-severity fires that were typical of much of the dry forest landscape (Agee 1993, Hessburg and Agee 2003, Murphy et al. 2007). Prior to European settlement, portions of the eastern Cascade Range were dominated by open-grown forests; small patches of more closed-canopy forest occurred within this matrix as fire refugia—areas where fires, for a variety of reasons, did not occur as frequently as in other parts of the landscape (Camp et al. 1997). It is likely that some of these refugia resembled current-day forest used by Spotted Owls.

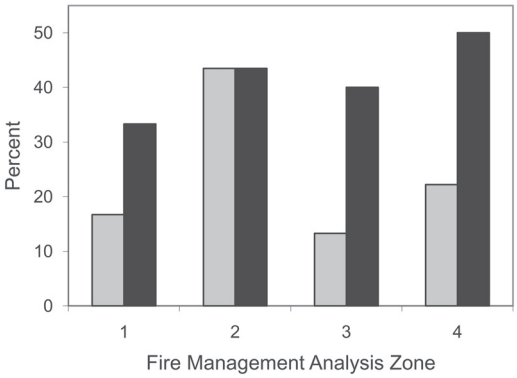


FIGURE 3. Percentage of Spotted Owl site centers with at least one ponderosa pine (gray) or Douglas-fir (black) of ≥76 cm diameter at breast height in a vegetation sampling plot of approximately 0.2 ha centered at the nest tree, according to Fire Management Analysis Zone (J. Buchanan, unpublished data). Zones 1 and 2 are at the eastern edge of the forest, zone 5 (not included due to small sample size) is a narrow area along the length of the Cascade Range crest, and zones 3 and 4 fall in between (see Buchanan and Irwin 1998). Sample size for nest sites in each FMAZ was 1 = 12, 2 = 23, 3 = 15, and 4 = 18.

Based on our current understanding of habitat use by Spotted Owls (e.g., Buchanan et al. 1995), these open-grown forests likely did not, nor do they currently, constitute significant habitat for Spotted Owls. Low-intensity ground fires that burned at intervals of 7 to 38 years (Hessburg and Agee 2003) maintained the generally open structure of the dry site forest matrix, but with the extension of the fire return interval, due to fire suppression, regularly occurring lower-intensity fires were largely eliminated from the landscape. The consequence of this reduction in fire frequency was the invasion of open-grown forests by various tree species, including those not adapted to fire (Agee 1993). In the ensuing decades, these invading trees, largely shade-tolerant species, became established and assumed canopy dominance or co-dominance over large areas of the landscape (Camp 1999) and created conditions suitable for Spotted Owls. Although specific data are lacking on trends in the amount of suitable Spotted Owl habitat on the landscape since European settlement, existing data indicate an increased amount of closed-canopy forest (Hessburg et al. 2000, Hessburg and Agee 2003, Hessburg et al. 2005), suggesting the amount of Spotted Owl habitat has increased over time.

Objectives for managing wildlife resources across large landscapes in the eastern Cascades Range (and elsewhere in the Intermountain West) have become conflicted. Long-term fire suppression has dramatically changed the structure and composition of forests, which are now outside the historic range of variability and not expected to persist (Agee 2003). Consequently, management strategies designed exclusively to retain habitat for species associated with closed-canopy forests, such as the Spotted Owl, are not consistent with management for species associated with open-canopy ponderosa pine forests. This management conflict is a problem for several reasons. First, due to changes in the fire regime (because of fire suppression), fuel loads within stands and across the landscape have increased, thus increasing the likelihood of catastrophic stand replacement fires in more xeric forests, in contrast to the low or mixed severity events that occurred prior to European settlement. This was evident in 1994 when several large fires burned in the eastern Cascade Range and negatively impacted multiple Spotted Owl territories (Bevis et al. 1997, Gaines et al. 1997). Second, diseases and insect outbreaks are more likely to injure or kill trees in larger areas due to continuity in the distribution of suitable hosts, notably Douglas-fir and grand fir trees, and increases in moisture stress due to unusually elevated densities of trees. For example, western spruce budworms (*Choristoneura occidentalis*) are currently epidemic in the eastern Cascade Range of Washington and have degraded or eliminated Spotted Owl habitat (Hummel and Agee 2003, J. Buchanan, personal observation).

The consequences of the management dilemma are significant. Fire suppression effects that create or maintain extensive landscape areas of habitat for Spotted Owls and other species in closed-canopy mesic forest likely pose direct threats to species associated with the dry and open forests that occur in the same landscapes but which have become reduced in area and degraded. Numerous species that occur in mesic closed-canopy forests of the eastern Cascade Range are considered species of conservation concern in Washington (e.g., WDFW 2005), including the Spotted Owl and Northern Goshawk (*Accipiter gentilis*), for example (McGrath et al. 2003). Other species of conservation concern, in contrast, are associated with xeric, open forests: for example, Flammulated Owl, White-headed Woodpecker and Pygmy Nuthatch (e.g., Bull et al. 1990, Buchanan et al. 2003). The latter species are strongly associated with ponderosa pine forests and generally do not occur in other forest types (Wahl et al. 2005). Threats to these species include degradation and loss of habitat due to timber harvest and the effects of fire suppression, including insect outbreaks and fire.

Ponderosa pine forests, and apparently their associated wildlife populations, have been impacted by numerous human activities since European settlement (Sallabanks et al. 2001), and much of the older ponderosa pine forest has been harvested or degraded (Wisdom et al. 1999). Areas of open-grown, old ponderosa pine and other dry forest tree species remain on the landscape but many of these trees are now embedded within extensive (and often contiguous) patches of grand fir and Douglas-fir (Buchanan et al. 1995), and in some cases higher densities of ponderosa pine. Areas of nesting habitat for White-headed Woodpecker, Flammulated Owl and Pygmy Nuthatch now exist predominantly at the margins of, or as small patches within, landscapes of closed-canopy forest (Hessberg et al. 2000, J. Buchanan, personal observation). Consequently, not only has the amount of open-grown dry forest habitat decreased but the increased possibility of stand-replacement fires in such forests would destroy not only Spotted Owl habitat, potentially in large areas, but could also remove these relatively limited areas of habitat for dry forest species. In addition, such fires could destroy elements of substantial restoration value (e.g., large, old ponderosa pines) that are embedded in the closed canopy forest, and therefore delay forest restoration actions that might target the retention of these specific features to benefit dry forest species (Gaines et al. 2007). The latter point is an important conservation issue because some dry forests with large, old ponderosa pines (or other species such as Douglas-fir or western larch [*Larix occidentalis*]), if properly managed to remove invading conifers, represent prime candidates for active management to accelerate restoration of habitat functionality for dry forest bird species (Wisdom et al. 1999).

## MANAGEMENT CONSIDERATIONS

A common perspective expressed by forest ecologists is that the current condition of forests in portions of the eastern Cascade Range province is not stable and is highly unlikely to persist (e.g. Agee 1993). Ecological conditions in many forests in the region are outside the historical range of variability (Agee 2003), and forests are currently at a greater risk of loss due to fire, insects, disease and the effects of competition (e.g., for nutrients, moisture, sunlight). Recent effects of fires and insect outbreaks have the potential to negatively influence large landscapes and alter both the carrying capacity of the landscape for species of conservation concern and the structure of the vertebrate community. Management strategies to protect habitat for high priority species—including the Spotted Owl—in the more mesic forests of western Washington will not likely prove to be useful conservation measures for the drier forests in the eastern Cascade Range (Courtney et al. 2008).

A new approach to forest management is needed in the dry forest landscapes of the eastern Cascade Range, or for other dry forest landscapes in the Intermountain West, where the effects of fire suppression have raised similar ecological concerns (Hessburg et al. 2005). Strategies for actively managing the dry forest landscape have been proposed over the years, and the final recovery plan for the Spotted Owl included recommendations for an active approach to forest management (USFWS 2008).

Because the present forest condition is generally unstable and beyond the historical range of variability, the approach most likely to succeed in sustainable landscape-level forest protection should involve active management that incorporates the shifting mosaic concept (Harris 1984). In general, this approach would involve protecting key areas of closed-canopy forest while managing the remaining landscape to restore and maintain dry site conditions (Agee and Skinner 2005, Lehmkuhl et al. 2007). This ecosystem-based program would create firebreaks, protect Spotted Owl habitat and restore old forest conditions for species such as White-headed Woodpecker, Flammulated Owl and Pygmy Nuthatch. Consequently, management in dry forest landscapes should strive to achieve multiple goals: 1) create areas where dry forest can be restored or recruited, 2) retain areas of closed canopy forest, 3) recruit additional closed-canopy forest to facilitate implementation of the shifting mosaic, and 4) produce timber for harvest. Additional recommendations more specific to Spotted Owls are provided in Courtney et al. (2008).

Implementation of a landscape-level forest management strategy that addresses fire risk, forest health, and wildlife habitat should be based on landscape-level models. Such models should be comprehensive and address a variety of environmental and ecological risk factors and real or potential constraints (e.g., Finney et al. 2006, Lehmkuhl et al. 2007). For example, a planning model might include information on locations of fire ignition sources and risks, patterns of forest type and condition, assessments of forest restoration capacity, and location of Spotted Owl activity centers and habitat. Key uncertainties requiring evaluation in a model, particularly one addressing Spotted Owls, should include responses of Spotted Owl prey to forest management as well as the likely ability of landscapes to support territory occupancy,

reproduction and natal dispersal by Spotted Owls according to differing scenarios of patch size, quality and dispersion (e.g., Lehmkuhl et al. 2004, Lee and Irwin 2005). Similar ecological constraints should be evaluated for dry site species (e.g., White-headed Woodpecker) with ecological requirements—for example, large home range size—that will likely influence model output. The model should account for spatial variability in fire regimes (i.e., low-, mixed- and high severity regimes) such that appropriate data and assumptions are used to characterize fire risk (Hessburg et al. 2007), desired future condition (e.g., Harrod et al. 1999) and the appropriateness of proposed management procedures such as prescribed fire (Tiedemann et al. 2000, Brown et al. 2004). Model output would provide a suite of conceptual options for landscape management to help inform decision-makers of the consequences associated with various sets of assumptions or desired future conditions. Additionally, evaluating whether the desired future condition can be achieved via multiple pathways, as reflected in the model, may result in greater flexibility to address various management issues, thereby minimizing conflict.

There are practical limitations to implementing a landscape-level conservation plan designed to manage for the full suite of species and habitat types in a dry forest landscape. First, the availability of information on the presence of old forest conditions across the landscape may be limited. Inventory information about the specific presence of old forest features (e.g., large, old trees) is lacking in some areas (e.g., Franklin et al. 2007), in some cases perhaps because areas of old trees do not occur in distinct patches (Spies et al. 2006). Sparse data may hinder efforts to identify key landscapes within which old forest conditions can be readily treated through active restoration management. Although identification of valuable resources such as large, old trees can occur during inventory efforts or timber sale planning, this approach to information acquisition is more gradual and is less useful for landscape planning. Planning is clearly a landscape-level activity, but viewing implementation as a site-specific endeavor offers the opportunity to gather essential information and make decisions that result in improved habitat management and protection. Moreover, in the absence of high quality spatially explicit landscape data a strategic model allows for conceptual development of a landscape approach that is then implemented with more detailed site-specific knowledge.

The second limitation involves the need for ongoing management. Management actions designed to substantially reduce the volume of conifers in areas of dry forest while retaining remnant features (e.g., large, old ponderosa pine, Douglas-fir and western larch trees) can be a profitable venture, depending on timber market conditions and the amount of wood extracted. Moreover, such management could place specific forest areas on a trajectory toward historic conditions. On the other hand, in the absence of fire—prescribed or otherwise—as a management tool, the effects of fire suppression will resurface unless other management tools are developed and used to retain open forest structure. Given general market conditions subsequent management activities (e.g., prescribed fire, thinning) necessary to maintain the open forest structure (e.g., by preventing the invasion of additional trees) may not be economically viable because those harvests would primarily involve very small trees and saplings. Although removal of large, old trees may permit an economical harvest, such trees are typically scarce and are important habitat features, making such harvests undesirable from a habitat protection standpoint. In addition, where old or mature trees are absent the volume of merchantable wood may be insufficient to cover the costs of the harvest activity. Consequently, when remnant or recruitment features are to be retained it may be beneficial to view the near-term cost of harvest activities as part of a greater forest management effort that ultimately reduces the longer-term costs of landscape-level fire suppression, or to develop and use new opportunities to offset costs of forest management (Skog et al. 2006). Guidelines for management of dry forests have been developed (Allen et al. 2002, Brown et al. 2004, Agee and Skinner 2005, Kolb et al. 2007).

## ACTION ITEMS FOR PARTNERS IN FLIGHT

The habitat management scenario described here involves the Northern Spotted Owl and other avian species found in dry forests. The retention of habitat for the owl is often inconsistent with optimal conservation measures for other dry forest species. Moreover, passive management (i.e., permanent protection) of closed-canopy forest may result in degradation or loss of habitat for the owl and other species. This rather paradoxical conflict, given the high profile of the Spotted Owl, may result in confusion and concern by stakeholders. Such management conflicts and attendant concerns by the public likely exist throughout the Intermountain West for multiple species. Because effective conservation measures will likely involve active management of the forest landscape, information

and modeling tools must be accessible to all sectors of the public.

There are many opportunities for Partners in Flight to contribute to the exchange of information that will be necessary to adequately inform stakeholders. One of the greatest needs is to make information available that can be used by the general public, resource managers and decision makers. This will require creation and dissemination of a variety of products designed to target these groups. The Western Working Group of Partners in Flight has identified options for facilitating such information development and exchange (see Neel and Sallabanks 2008).

Implementation of a comprehensive program of adaptive ecosystem management in dry forests of western North America will require a new perspective on forest and wildlife management. Because there is no legacy of such management, the amount of uncertainty associated with implementation is great. Not only is information on habitat relationships and population status lacking for many species, predicting how species might respond to drastic changes in forest management practices will be a key component of an ecosystem management program. This will involve adaptive management studies. The Western Working Group of Partners in Flight has identified the Flammulated Owl as a priority for monitoring; this is one of several excellent candidates for evaluating the effectiveness of restoration activities in dry forest landscapes. Partners in Flight should continue to provide technical expertise that can ultimately be used to generate management recommendations of regional relevance. In addition, promotion of collaborative efforts and development of partnerships to seek funding opportunities to implement and evaluate management actions is essential.

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APPENDIX 1. Ecological systems associated with three primary forest types (mesic, mixed conifer, ponderosa pine) used to characterize forests within the range of the Northern Spotted Owl in Washington's eastern Cascade Range Province (data from NatureServe and Washington Natural Heritage Program 2005).

| Forest Types | |
|---|---|
| **Mesic forest** | |
| 5 | North Pacific maritime mesic – wet Douglas-fir – western hemlock |
| 10 | North Pacific coast mountain hemlock |
| 12 | North Pacific dry/mesic silver fir – western hemlock – Douglas-fir |
| 20 | Rocky Mountain subalpine mesic spruce – fir forest woodland |
| 121 | Transitional vegetation evergreen forest |
| 123 | Transitional vegetation short shrub |
| **Mixed conifer forest** | |
| 31 | East Cascades mesic montane mixed conifer forest and woodland |
| 41 | North Pacific avalanche chute shrubland |
| 92 | North Pacific montane riparian woodland and shrubland |
| 121 | Transitional vegetation evergreen forest |
| 123 | Transitional vegetation short shrub |
| 125 | Transitional vegetation herbaceous – woody mix |
| **Ponderosa pine forest** | |
| 25 | Northern Rocky Mountain dry – mesic montane mixed conifer forest |
| 26 | Northern Rocky Mountain ponderosa pine woodland and savannah |
| 92 | North Pacific montane riparian woodland and shrubland |
| 111 | Recently burned |
| 123 | Transitional vegetation short shrub |