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White-headed Woodpecker Monitoring Strategy and Protocols

USDA Forest Service, Region 6 & Rocky Mountain Research Station
USDI Bureau of Land Management, Oregon and Washington

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1. Overview

1.0 Overview and Purpose

The purpose of this strategy is to provide guidelines and protocols for inventory and monitoring of white-headed woodpeckers (WHWO) on USDA Forest Service (FS) and USDI Bureau of Land Management (BLM) lands in Oregon and Washington. The strategy is designed to ensure consistent and scientifically credible sampling, data collection, and analysis protocols are used by the agencies in WHWO inventorying and monitoring activities. The strategy and protocol are designed to meet standards required under the Data Quality Act.

1.1 Background and Business Needs

This monitoring strategy is a companion to a Conservation Assessment (CA) developed under the Interagency Special Status and Sensitive Species Program (ISSSSP). The CA provides detailed information on life history and habitat of the WHWO. The reader should become familiar with the life history traits and habitat components important to WHWO in order to understand how they influence the inventory and monitoring approaches in this strategy.

This strategy addresses the business needs identified in Table 1.1 below.

Table 1.1. *Inventory and monitoring business needs pertaining to white-headed woodpeckers.*

Business need	Target group	Type of information needed
To avoid Federal listing of plant and animal species (FSM 2670) and To initiate proactive conservation measures that reduce or eliminate threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA (BLM 6840 policy)	Plant and animal species designated as Sensitive by the FS and BLM	Distribution, status, and trend of species and their habitats
To provide information for Forest Plan Revision (FS) or Resource Management Plans (BLM)	Species identified as needed	Distribution, status, and trend of species and their habitats in planning area
To provide information for the environmental analysis of proposed projects (NEPA)	Primarily TES and MIS (FS) species and Birds of Conservation Concern (BLM)	Availability of suitable habitat and species' presence in project area and larger landscape context

In addition, this strategy addresses several high priority tasks identified by the Woodpecker Workgroup as identified in Table 1.2 below.

Table 1.2. *High priority tasks identified by the Woodpecker Workgroup in 2008.*

Task	Description	Type of information needed	Type of monitoring protocol
H5-Task 2	Validate core areas with monitoring.	Distribution, occupancy rate (presence or absence of individuals within stratified habitats), and trend of WHWO and their habitats in core areas	Broad-scale occupancy and distribution
H6-Task 1	Monitor trends of WHWO in emphasis areas	Population trend of WHWO and their habitats in emphasis areas	Broad-scale occupancy and distribution
H7-Task 1b	Habitat model calibration and validation for WHWO in un-burned forest	Nest Occurrence , habitat occupancy rate (i.e. presence or absence of individuals), and reproductive success (nest survival and no. fledged) of WHWO, and vegetation characteristics, in areas identified as high, moderate and low quality habitat by model	Model validation
H7-Task 1c	Effectiveness monitoring to evaluate response of WHWO to stand and landscape level treatments including fuels reduction treatments	Nest Occurrence, habitat occupancy rate, and reproductive success (nest survival and no. fledged) of WHWO, and vegetation characteristics, in treated and untreated areas - pre- and post-treatment monitoring desired	Effectiveness monitoring

1.2 Roles and Responsibilities

The following list of roles and responsibilities apply to all aspects of the monitoring strategy and protocol development and implementation.

1.2.1 National Responsibilities

- Facilitate information sharing and collaboration across USFS administrative regions and BLM State Offices, with other Federal and State agencies, and with Forest Service Research and Development efforts to avoid development of duplicate protocols.
- Provide adequate funding for protocol development at USFS regional and BLM State Office levels and for collaboration with other agencies.
- Provide timely technical and administrative review of protocols developed for multiregional and interagency use.

- Assist regions in providing training for data management and analysis.

1.2.2 Regional Responsibilities (USFS R6, BLM OR/WA State Office)

- Develop inventory and monitoring protocols and strategies for species and species groups with inventory and monitoring needs shared by several forests and grasslands, and BLM districts.
- Ensure the use of the Species Protocol Technical Guide (Vesely et al. 2006) during the development of inventory and/or monitoring technical guides at regional and local scales.
- Facilitate information sharing and collaboration within the region, with adjacent regions, with other Federal and State agencies, and with Forest Service Research and Development efforts.
- Avoid development of duplicate protocols for the same species.
- Obtain technical and administrative review of protocols developed by the USFS region or BLM State Office.
- Identify emphasis areas for monitoring across the region to ensure monitoring and inventory efforts are most efficient and meaningful.
- Coordinate data collection at the regional and state office level, with direct involvement of the field units, to maximize efficiency, consistency, and data quality.
- Develop, coordinate, and conduct training for field data collection.
- Analyze and report on status and change in populations and habitat conditions, and their implications for viability of the species.
- Evaluate sampling efficiency and statistical power and update protocol and strategy as needed.
- Apply data and results as needed to inform regional and ecoregional assessments.
- Work with national offices and regional partners (internal and external) to procure funding for implementation of the monitoring strategy and protocols.

1.2.3 Field Unit Responsibilities

- Participate in regional or bioregional monitoring efforts as described in applicable protocols.
- Ensure the use of established protocols identified in the monitoring strategy when conducting inventory and monitoring on the forest, grassland, or BLM district.
- Facilitate information sharing with adjacent forests/grasslands/BLM districts and regions to avoid duplication of efforts.
- Ensure that survey, visit, and occurrence data are entered into National Resource Information System (NRIS) Wildlife database for FS, and the Geographic Biotic Observations (GeoBob) database for BLM, and that data meet quality control standards.
- Use results in management plans, project planning, and assessments.
- Work with Regional/State office and local partners (internal and external) to procure funding for implementation of the monitoring strategy and protocols.
- Ensure that funding provided for monitoring are allocated to the monitoring project.

1.3 Relationship to Other Federal Inventory and Monitoring Programs

This monitoring strategy is consistent with the Forest Service Technical Guide for *Development of Protocols to Inventory or Monitor Wildlife, Fish or Rare Plants* (Vesely et al. 2006). The *Multiple Species Inventory and Monitoring Guide* (Manley et al. 2006) was also used in development of this strategy.

The FS Region 6 and OR/WA BLM Land Bird Program lead, Barb Bresson, is co-author of both the CA and this Monitoring Strategy. Partners in Flight (PIF) is major partner in the Land Bird Program. The PIF Conservation Strategies for Landbirds of the East-slope of the Cascade Mountains and Northern Rocky Mountains in Oregon and Washington (Altman 2000a , Altman 2000b) identify the WHWO as a focal species. Monitoring of the species is identified as a need in the Strategies and it has been identified as a high priority species for monitoring in Oregon and Washington by PIF (Altman and Bart 2001).

WHWOs occur in densities too low to use USGS Breeding Bird Survey (BBS) data to credibly monitor trends. The "credibility measure" for this species in the BBS is either red or yellow indicating results are "very imprecise" due to "very low abundance" of birds, low numbers of routes, or both; the results are so imprecise that a 5% or 3% per year change, respectively, would not be detected over the long-term (Sauer et al. 2008). Because habitat for the WHWO is rare on the landscape (Wisdom et al. 2000); the BBS is a road-based approach there are some difficulties in getting adequate sample sizes for assessing habitat relationships and habitat trends using BBS data in rare or uncommon habitats (Manley et al. 2006).

Integrated Landscape and Assessment Project (ILAP) - (http://oregonstate.edu/inr/ilap) – Source habitat data will be queried from the ILAP data. Vegetation data in ILAP is derived using Gradient Nearest Neighbor (GNN) methods (Ohmann and Gregory 2002). The process uses FIA/CVS plots and imputes plot data to each pixel on a map (http://www.fsl.orst.edu/lemma/gnnpac). Habitat data in ILAP meet Interagency Regional and USDA FS national standards.

ILAP pixel-level data will be used to identify pixels of nesting habitat that will be used as the population from which to generate a stratified random sample of locations. The center of selected pixels will be used as the starting point for survey transects.

National Resource Information System (NRIS) Wildlife – Data from inventory and monitoring of WHWO will be entered into the NRIS Wildlife database as basic surveys with visits and as basic observation data for work conducted on Forest Service lands.

Geographic Biotic Observations (GeoBOB) - Data from inventory and monitoring of WHWO will be entered into the GeoBOB database as basic surveys with visits and as basic observation data for work conducted on BLM lands.

1.4 Quality Control and Assurance

This monitoring strategy and the protocols were developed using peer reviewed guides and protocols (Dudley and Saab 2003, Manley et al. 2006, Vesely et al. 2006, Wightman and Saab

2008). The guides and protocols used were developed by experts in ecological principles and biostatistics. This strategy was developed in consultation with WHWO species experts, research scientists, and biostatisticians.

1.5 Change Management

The WHWO monitoring strategy and protocols will be updated as needed to keep current with the latest scientific information, laws and regulations. The protocols have been field tested for at least 2 seasons. The following may trigger a need to update this strategy:

- New Federal regulations to guide planning on National Forests or BLM Districts.
- New developments in biostatistical approaches to monitoring
- Changes to corporate data storage and analysis tools
- Development of new technologies that may be applicable to answering monitoring questions (e.g., genetic tools)
- Validation of habitat models indicate a new approach is needed to monitor the species or habitat

2. Broad-Scale Occupancy and Distribution Monitoring

This protocol is designed to provide reliable, standardized data on the distribution and site occupancy for WHWO across their range in Oregon and Washington. The data can be used to better define habitat associations of WHWO at the stand and landscape scales in the 2 states. Once base data are obtained, this protocol can be used to monitor change in the distribution and occupancy of WHWO. The sampling design assumed the monitoring would occur for a minimum of 6 years.

2.0 Objectives

This protocol is designed to answer the following inventory and status questions:

- What is the status of the population of WHWO across Oregon and Washington?
    - Proportion of monitoring points/transects occupied (presence or absence of individuals)
    - Spatial distribution of occupancy (presence or absence of individuals) – current distribution can be compared to anecdotal historical records
- What is the direction and magnitude of change of proportion of monitoring transects occupied by WHWO across Oregon and Washington?
    - Change in proportion of monitoring points/transects occupied
    - Change in the spatial distribution of occupancy rates
- What environmental factors are associated with WHWO presence/absence across Oregon and Washington?
    - Vegetation structure and composition at monitoring points and at the landscape scale
    - Site attributes (slope, aspect, etc.) at monitoring points
- What is the direction and magnitude of change in habitat availability for WHWO across Oregon and Washington? Other data will be included to assess statistical significance of change in vegetation.

2.1 Planning and Design

The protocols for the occupancy and distribution monitoring are based on Management Indicator Species (MIS) survey protocols for WHWOs developed for the Payette NF in Idaho (Wightman and Saab 2008).

2.1.1 Selected Measures of Population and Habitat

- The target population measure is the proportion of monitoring points which are occupied (presence/absence); target data are detection/nondetection.
- The target habitat measures are:
    - A summary of habitat conditions that describe plant species composition and vegetation structure at monitoring points.
    - A summary of landscape level parameters (e.g., percent of landscape in habitat) surrounding both occupied and unoccupied monitoring points.
    - A summary of physical attributes (e.g., slope, aspect, topographic position).

2.1.2 Sampling Design

The basic sample design will be point count/playback response surveys along transects established within potential habitat for WHWO as described in Table 2.1. The basic design is outlined in Table 2.2.

Table 2.1. *White-headed woodpecker habitat definitions.*

Habitat type	Forest Type
potential habitat	Ponderosa Pine/Douglas-fir or Dry Grand Fir Vegetation Types - PIPO (ponderosa pine, PILA (sugar pine), PIMO3 (western white pine) listed as dominant species (1st or 2nd species listed) –derived from GNN
non habitat	Any other forest type or non-forest type

Table 2.2. *Summary of sampling design for broad-scale occupancy and distribution monitoring*

estimate determined	occupancy – detection/non-detection
number transects	30 for region
transect length	2,700 m
transect width	0-50, 50 – 150, and >150 m
points	10/transect
distance between points	300 m
transect location	WHWO potential habitat
distance between transects	10 km or more
playback survey	yes
time per point	4.5 min
survey period	May 1 – June 30
repeat visits	2, minimum of 2 weeks apart
vegetation plot @ points	yes

Point counts used for monitoring songbirds during the breeding season are problematic for surveying woodpeckers. Woodpeckers have larger territories and vocalize infrequently, thus

detection by point count alone can be difficult. Most woodpeckers will respond to playback calls during courtship and early in the breeding season. For this reason playback calls are incorporated into the sampling design for this species. Even with playbacks, however, some individuals that are present will go undetected. Thus it is important to get an estimation of detection probabilities for these birds. (Wightman and Saab 2008)

Data collection of population and habitat measures will be at the regional scale (OR & WA). The region will be stratified into potential habitat, and non-habitat categories (Table 2.1). ILAP/GNN vegetation data will be used to map habitat at the regional scale. Digital National Agriculture Imagery Program (NAIP) imagery will be used to identify actual areas of habitat available to survey.

Sample size and intensity

Based on 2010 Pilot Data, 30 transects will be monitored across the region. As more data become available, the number of transects may need to be increased or decreased to meet the desired level of precision as stated below.

Transects receive 2 repeat visits per year, based on detection probabilities calculated from 2010 Pilot data.

Precision

Statistical confidence and power varies among species depending on risk and detectability (Manley et al. 2006). The initial standards for precision for WHWO are set at the ability to detect 20% change in occupancy with a statistical confidence and power of 80%. Higher statistical confidence would reduce power to detect change. The worst-case scenario of failure to detect change could be failure to intervene which could ultimately result in species extirpation.

Sample selection

Survey locations are identified at the regional scale by randomly selecting points for survey locations from center points of GNN pixels determined to be in potential habitat (Table 2.1) based on tree list data assigned to each pixel. Pixels are validated as meeting habitat criteria using NAIP Imagery. For feasibility and efficiency, random points should be within 500 m of a road or trail. See Appendix IV for details of transect selection.

Transect establishment

In the field, aerial photos and a GPS are used to establish a 2700 m transect as identified for survey. Starting and ending points, along with azimuth are provided by the Regional Office. The starting point of the transect should be a tree at least 150 m within the stand, and as close as possible to the generated random point. Follow azimuth and establish 10 points, 300 m apart on each transect. See Appendix I for detailed protocol.

Timing of surveys

Surveys should be conducted beginning no earlier than May 1with the 2 visits completed by June 30 (Wightman et al. 2010, Latif et al. 2012). At least one of the surveys should occur between May 15 and June 15. Surveys should start just after dawn and be completed by 11 am.

Control of biases

- Survey transects should be run by a different surveyor than used in the previous survey(s) to account for observer bias.
- Transects should be run in the opposite direction from the previous survey to account for potential differences in time of day.

2.2 Data Collection Protocols

2.2.1 Data Collection Methods

Population data

Protocols for collecting population data are from Wightman and Saab (2008), Hollenbeck and Saab (2010), and Latif et al. (2015). Survey protocols are designed for 2 person teams.

Before conducting a survey:

1. Practice estimating distances and pacing using a rangefinder and measuring tapes.
2. Practice distinguishing between woodpecker species. Listen for calls or drumming, make your best educated guess, and then go find the bird to make a positive visual identification. Continue practicing until you repeatedly identify birds by sound correctly.

Establish transects in the field.

1. Walk the survey route **prior to** conducting a survey and mark each survey point with a metal tag (transect number and point number) and flagging. Mark flagging color on the data sheet. Record GPS locations on the route description data sheets provided and mark in your GPS unit. Make sure your GPS is recording the location with relatively high accuracy (± 10m) before marking and recording the point.
2. Use GPS coordinates and maps provided to navigate to the first point. Establish the first point, as described below, if ponderosa pine, sugar pine or white pine is dominant in the stand. If not present, do not establish the transect and report the misclassification immediately.
3. If the first point is in a non-target forest type (e.g., a meadow), relocate the point to the closest stand of the target forest type. If there is no target forest type in the vicinity (~500m), do not establish the transect. Report this immediately to project coordinators so a substitute transect can be identified, if appropriate.
4. When establishing a point, select a tree (representative of stand) within a 10m radius of the GPS coordinates as the point center. Mark the tree with a metal tag and flagging and record GPS coordinates at the base of the point center tree. The accuracy of the GPS coordinates is ±10 m or better if possible before recording.
5. Following transect instructions, travel to next point. Repeat the steps above for locating the point center.

The survey protocol consists of a 4.5 minute playback survey at each point along the transect.

To conduct a playback survey:

1. Note any WHWO observed when you approach a survey point. Record these birds on your point count data sheet [*PlaybackSurveyForms.xls*]. Note "observed prior to the starting the survey" in comments field. Do not mark a distance column. Continue with the survey as if the bird was not present.
2. Fill out the location, date, visit #, and observer information on the data sheet header. Record start time, time remaining (i.e. time remaining on stopwatch when woodpecker was first detected), starting wind and weather using the categories listed on the data sheet. Record starting temperature in degrees Fahrenheit.
3. Broadcast a WHWO call at 60° from the transect line, turning clockwise and continuing in the same direction during subsequent turns. Listen and watch for 30 seconds. Turn 120° and repeat the procedure. Then turn another 120° and repeat the procedure.
4. Broadcast call distance objective is 150 m. Adjust volume accordingly.
5. Playbacks will consist of 20 seconds of calling/drumming followed by a 30 second break. This is conducted 3 times in the 3 directions for a total of 2.5 minutes. Then pause and observe for 2 minutes. So, each sampling period is a total of 4.5 minutes.
6. Immediately **discontinue the survey if a WHWO is detected within 50m** of the survey station (e.g., the 0-50m distance category). Otherwise, continue with call broadcasting & record the time remaining when a WHWO is detected for each distance category (e.g., 50-150m , >150m) until 4.5 minutes has expired before moving to the next station.
7. If WHWO are detected, record each WHWO seen or heard with the species code (e.g., WHWO). If no woodpeckers are detected, write "NONE" under species code. Record sex as M (male), F (female), or U (unknown). If a pair of woodpeckers (a male and a female) is detected, record P (pair) for both birds.
8. Record your detection method as either V (visual) or A (auditory) in the DET (detection) column. If you hear and see a woodpecker, record the method that first allowed you to detect the bird.
9. Record bird behavior using categories provided on the data sheet. Record the dominant behavior, e.g., if a bird is foraging it might fly from tree to tree. You would record foraging, not flying. Reserve flying and perched categories when none of the other behaviors are appropriate. If the Other category is used, explain in comments section.
10. Place an X in the appropriate column to record the bird's location from the point (0-50, 50-150, or >150m).
11. Again, **be sure to fill in all columns for each row of data** unless you have recorded "none" under the species code column.
12. End the survey, approximately 5 minutes after starting the broadcast surveys (allows for changing playback direction).
13. If a WHWO is detected, the second crew member can search for nests, while the surveyor continues along the transect.
14. Move to the next point on the transect and start over.
15. Record individuals once. This will require keeping track of recorded birds to make sure you do not record individuals again at the next point.
16. Record notes, observations or birds detected outside the sampling period (e.g., while walking between points). Record these birds on your playback survey data sheet. Put NA in Point ID column and note "observed outside sampling period" in comments field.

Immediately after completing a transect:

1. Review data sheets or data entered electronically and make sure that all data is recorded accurately and clearly. Fill in any blank columns. Have another member of the survey crew check data sheets for completeness and legibility at the end of each day.
2. Download electronic files, or file data sheets in travel storage folder or office, at the end of the day.
3. If using hard copy data sheets, make copies of all data sheets as soon as possible. For remotely-stationed field crews, this may mean copying the week's worth of data sheets in the office on Friday afternoon before the weekend.

If a nest is located:

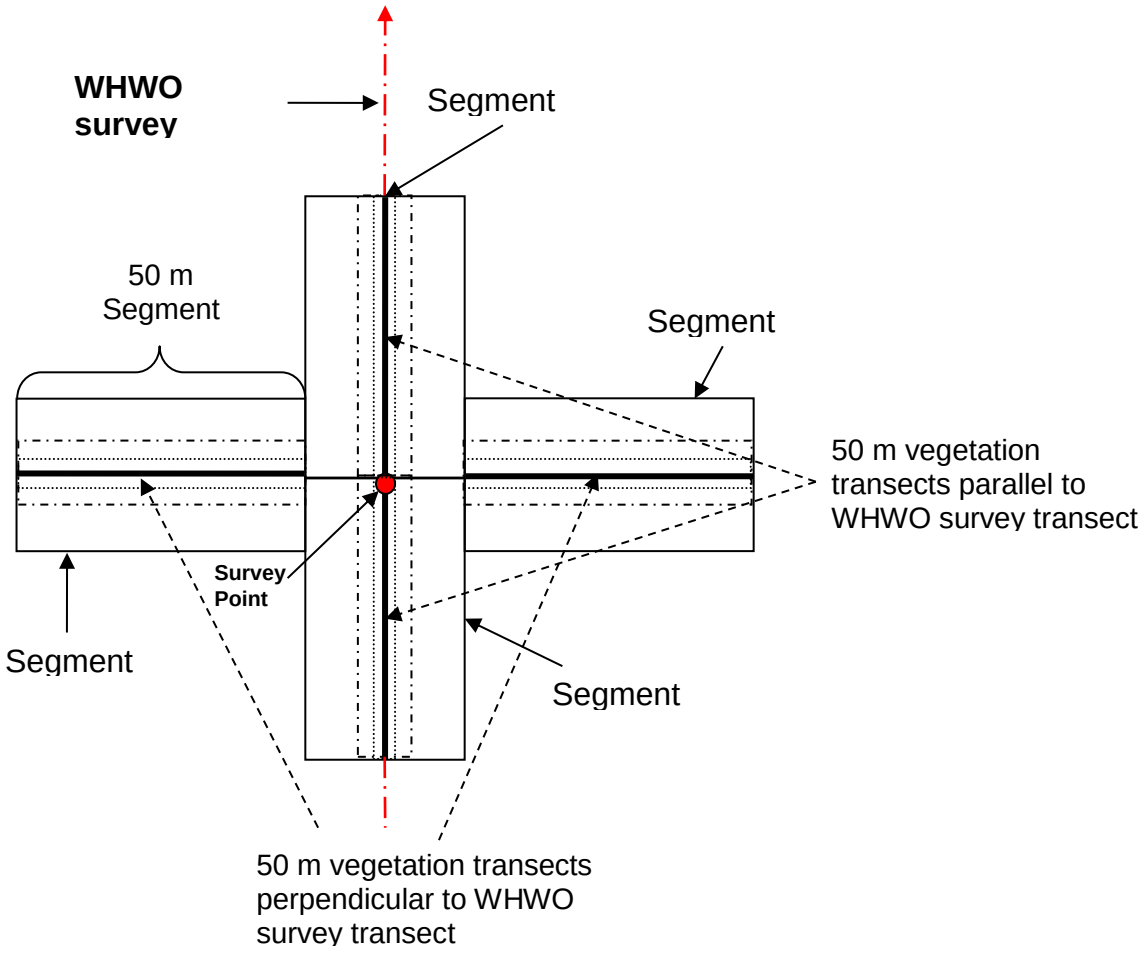
1. Mark nearby tree with flagging and take GPS location and record azimuth and distance to nest.
2. Complete a **nest data form** following instructions in Appendix V and Dudley and Saab (2003).

Habitat data

Vegetation data will be collected at each WHWO survey station along the transect. One third of the transects will be sampled for vegetation each year, resulting in each transect being monitored 2 times during the 6 years of monitoring. Vegetation data is collected 2 times in order to detect change in vegetation conditions. The complete set of vegetation variables will be measured during the first sampling period. During the second sampling period a reduced set of variables will be measure unless the plot has been disturbed between visits due to treatment, fire, etc.

Vegetation sampling protocols are modified from those used for the Birds and Burns project (Saab et al. 2006), from Bate et al. (2008a, 2008b), and Keane and Dickinson (2007). The sample design uses variable radius rectangular plots, and/or transects to sample trees, snags, down wood, and shrubs. Canopy cover, slope, aspect, and topographic position are derived from GIS. Figure 2.1 illustrates the basic design of the vegetation plot. Complete protocols are in Appendix II.

Figure 2.1. *Sample design surrounding WHWO survey plots*.



2.2.2 Personnel Qualifications and Training

Trained technicians will work under well-qualified biologist/ecologist at the Forest level. All surveyors will be trained in the protocol by qualified biologists with survey experience. Surveyors with previous point count experience are desirable.

2.2.3 Quality Control and Assurance

- Surveys should not be conducted during heavy rains or fog, or when wind speed exceeds 8-12 miles per hour (estimate using Beaufort scale) (Frenzel and Popper 1998) due to difficulty in hearing birds. If weather become inclement during the survey, stop surveying and continue the transect within 1 or 2 days.
- Drumming alone should not be used to identify WHWO; their drumming is very difficult to distinguish from that of other woodpeckers (Bate 1995).

- At the end of each day data sheets should be reviewed by another surveyor to make sure data and header information are recorded completely and legibly.

2.2.4 Data Forms

The data form for ***Transect Establishment*** to record information on transects is in Excel spreadsheet: TransectEstablishmentForm.xlsx
The data form for ***Population Data*** for playback surveys is in Excel spreadsheet: PlaybackSurveyForms.xls
Data forms for ***Habitat Data*** are in Excel spreadsheets: WHWOVegFieldForms.xls.
Data forms for ***Nest Data*** are in Excel spreadsheet: NestDataForm_Occupancy.xlsx

2.2.5 Logistics

Population Data Equipment List:

- day pack
- binoculars
- range finder
- compass
- thermometer
- GPS unit
- 2-way radio and/or satellite phone
- maps and aerial photos of transect and points
- tape or digital file of WHWO calls
- broadcast amplifier - FoxPro
- field data recorder
- For back-up to field data recorder also have available:
    - data sheets on write-in-the rain paper (transect establishment, population data, nest data)
    - clipboard
    - mechanical pencils – several (work best on write-in-the rain paper)
- flagging
- metal tags
- Sharpie or other permanent marker pen

Habitat Data Equipment List:

- day pack
- range finder
- compass
- DBH Tape or Biltmore stick
- Clinometers or Hypsometer
- tape measure – metric –50 to 100 m long
- Sampling frame (1 x 1 m square; PVC)
- Photoload plot photo sequence
- Fuel model photo sequence

- Go/No-go gauge
- Trowel
- Small ruler (cm)
- GPS unit
- 2-way radio and/or satellite phone
- maps and aerial photos of transect and points
- field data recorder
- For back-up to field data recorder also have available:
    - data sheets on write-in-the rain paper (vegetation data)
    - clipboard
    - mechanical pencils – several (work best on write-in-the rain paper)
- mechanical pencils – several (work best on write-in-the rain paper)
- flagging
- metal tags
- Sharpie or other permanent marker pen

Safety

Walk transects at a safe pace and be aware of weather conditions, topography, vegetation, down wood, etc.

Crew members need to wear sturdy hiking boots and appropriate clothing, including long pants, long sleeved shirts, and a hard hat. Crews should carry a reliable radio or satellite phone, GPS unit, compass and appropriate maps. It is usually a good practice for **everyone** to mark the GPS location of the vehicle so that if they get turned around, they can always head for the vehicle coordinates. Make sure that each member of the team has the UTM coordinates of the other members' survey sites and that everyone knows the scheduled meeting time and place. Have an **emergency action plan** if a team member fails to arrive at the meeting location on time (e.g., radios should remain on if the scheduled time is missed, pre-arranged contact times, leave notes on vehicle).

Snags often fall under windy conditions, so stay away from snags during winds. Also, avoid passing downslope from, or standing near, snags that are heavily charred at the base or otherwise look unstable.

Lightning can be dangerous. Do not take chances if storms are approaching. Stay away from lone or tall trees and ridges. If in an exposed area and a storm is approaching, get to a safe place before the storm hits.

The crew leader should be responsible for knowing crew members location each day. A daily sign-in/sign out sheet or other check in/out process is recommended.

A Job Hazard Analysis (JHA) should be prepared by each unit using the information in Appendix III. Safety issues to consider include, but are not limited to: vehicle/traffic hazards, inclement weather or lightning activity, poison oak, insects (bees, wasps, ticks), wild animals, physical conditions (hypothermia, heat stroke), falling debris (cones, branches, rocks), falling

snags, walking hazards (trips and falls, uneven terrain), cultivation or manufacturing of illegal substances, toxic waste.

2.3 Data Storage

Data from field recorders should be downloaded to a PC at the end of each day, and backed up on a shared drive, such as the Forest Service O drive, or external hard drive each week. If hard copy data sheets are used, a copy of data sheets should be photocopied each week and stored in a separate location than the originals.

Data will be entered and stored in NRIS Wildlife (FS) or GeoBOB (BLM). The ISSSSP will work with developers to make sure data will fit in to the structure. Additional data needed for analysis purposes will be entered into the spreadsheets provided by the ISSSSP. The field crew supervisors will be responsible for ensuring that data are entered in to the appropriate database(s) in a timely manner, at a minimum within 3 months after data are collected.

2.4 Data Analysis

Data analysis will be conducted in coordination with Rocky Mountain Research Station (RMRS).

At the end of each field season, a sample size analysis will be conducted to ensure sample size is adequate to give the confidence and power desired for estimating occupancy and change in status.

Detection probabilities will be determined using occupancy estimation and modeling (MacKenzie et al. 2006) in the R Statistical Package.

2.5 Cost Estimate (at 2013 costs to government)

***Data collection*– $126,000 per year**

For occupancy monitoring on 30 transects and vegetation data collection on 10 transects/year – 2 1/2 field crews for 8 pay periods (includes vehicles and per diem at the camping rate)

***Data entry* – $2,000 per year**

***Data analysis and write-up* - $16,000 per year**

Rocky Mountain Research Station

3. Effectiveness Monitoring

This protocol is designed to provide reliable, standardized data on the effectiveness of treatments to restore or enhance habitat and populations of WHWO, and the impacts of treatments with other objectives (e.g., fuels reduction, salvage logging) on WHWO across their range in Oregon and Washington. The data can be used to better define habitat associations of WHWO, and to design treatments at the stand and landscape scales in the 2 states, and potentially Idaho.

3.0 Objective

This protocol is designed to answer the following questions:

- Do WHWOs utilize treated stands in the same proportion to untreated (control) stands?
    - Occupancy, in the form of proportion of monitoring points which are occupied (presence/absence), in pre- and post-treatment units and control units
- Do WHWOs use treated stands for nesting in the same proportion to untreated (control) stands?
    - Densities of WHWO nests in pre- and post-treatment units and control units
- Is the reproductive success of WHWO in treated stands higher than those using untreated stands?
    - Nest survival in pre- and post-treatment units and control units
    - Egg success (% of eggs laid resulting in fledged young) and fledging rate (# fledglings/successful nest) in pre- and post-treatment units and control units
- What are stand and landscape attributes of areas used by successfully reproducing WHWOs versus unsuccessful sites?
    - Vegetation structure and composition at nest sites in pre- and post-treatment units and control units
    - Site attributes (slope, aspect, etc.) at nest sites in pre- and post-treatment units and control units
- What are the best treatments to maintain or enhance those attributes (mature ponderosa pine, large snags, low canopy cover) associated with successfully reproducing WHWOs?
    - Survival rate of large ponderosa pine trees in pre- and post-treatment units and control units
    - Survival rate of large snags in pre- and post-treatment units and control units
    - Canopy cover in pre- and post-treatment units and control units

3.1 Planning and Design

The protocol for determining occupancy is similar to the population data protocols in the Broad-Scale Occupancy and Distribution Monitoring section above. The protocol for locating and monitoring nests is based on protocols for monitoring cavity-nesting birds described in Dudley and Saab (2003).

3.1.1 Selected Measures of Population and Habitat

- The target population measures are:
    - Occupancy, in terms of the proportion of monitoring points which are occupied (presence/absence) by WHWO using the standardized protocol.
    - The density of nests located using the standardized protocol.

    - Apparent nest success – percentage of nests that successfully fledge at least 1 young
    - Daily nest survival
    - Clutch size (# of eggs)
    - Number of young fledged per successful nest
- The target habitat measures are:
    - A summary of habitat conditions that describe plant species composition and vegetation structure at occupied and unoccupied points
    - A summary of habitat conditions that describe plant species composition and vegetation structure at nest sites and non-nest sites
    - A summary of landscape level parameters (e.g., percent of landscape in habitat) surrounding nests and non-nest sites
    - A summary of physical attributes (e.g., slope, aspect, topographic position) at nests and non-nest sites

3.1.2 Sampling Design

A BACI (before-after/control-impact) study design is the preferred monitoring design. In this design, units are sampled before and after a treatment in both treatment and control units. A BACI approach is not always possible. In those cases a retrospective monitoring design can be implemented in which treatment and control units are monitored only after the treatment has occurred. Priority funding and effort should be given to monitoring projects that can implement the BACI design.

Nest searching and nest monitoring are important to determine if treatments are having the desired effect on WHWO reproductive success. If funds are not available to conduct nest searches and monitoring, occupancy monitoring alone will at least give information on use of treated areas.

Study unit selection

Random selection of units is usually the preferred method to select units to monitor. However, logistical issues often limit this approach; managers rarely randomly select units for treatment. Control units should be a unit nearby that will not receive treatment. The vegetation, topography, and abundance of WHWOs pre-treatment should be similar between treatment and control units.

For large landscape treatment projects (e.g., CFLRPs), strive to identify a **minimum** of 15 units in treatment areas and an equal number (15) of controls for each "study". Units should be large enough to place a transect of 10 points spaced 300 m apart. For smaller-scale treatments, identify a minimum of 500 ha (1200 acres) within 2 or more planned treatment units and an equal number of controls.

We recommend a first year, pilot study to gather data for a power analysis to determine an adequate sample size of transects, which will be based on WHWO detection rates. Control units should be at least 1 km from treatment units in similar forest composition and structure and similar in size to treatment units if possible.

Sample and re-sample frequency

Transects should be surveyed 2 times per season. Active nests should be revisited ever 3-4 days until young have fledged or the nest has failed.

Monitoring of treatment and control units should continue for at least 3 years post-treatment. Pre-treatment monitoring should occur for at least 1 year prior to treatment. Post-treatment monitoring should occur for at least 2 consecutive years post treatment, but then could be monitored every other year, or another interval, thereafter.

Precision

Statistical confidence and power varies among species depending on risk and detectability (Manly et al. 2006). The initial standards for precision for WHWO will be set at the ability to detect 20% difference in nest density and nest success with a statistical confidence and power of 80 percent. Higher statistical confidence would reduce power to detect important differences. Standards may be adjusted if necessary after analysis of data from the first sampling 3-year sampling period.

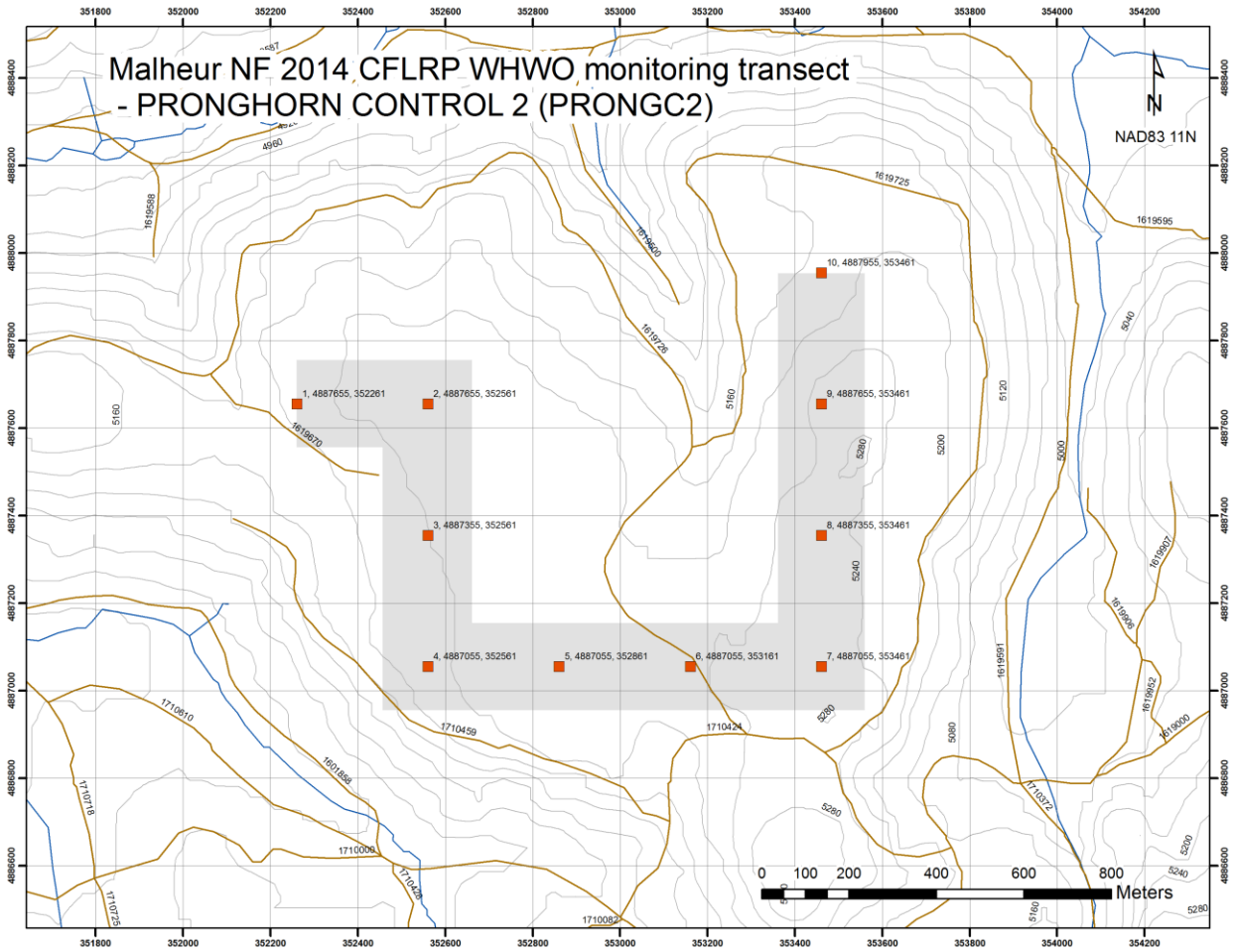
3.1.3 Occupancy Monitoring

Establish survey transects (or cluster of points)

Follow protocols in section 2.2.1 Data Collection Methods with the exception point count/playback response station locations.

First, identify a minimum of 500 ha (1200 acres) within 2 or more planned treatment units. Second, identify a set of control units of similar size, topography, vegetation composition and structure, and at least 1 km from any other treatment unit. Establish a grid of points spaced 300 m apart generated by GIS to overlay the "study area" (i.e. restoration project area). Survey points at 300-m spacing are assumed independent based on WHWO home range sizes (67±704 ha; Garrett et al. 1996). From the grid of points, select subsets of approximately 10 points to constitute one transect. Points do not need to be randomly selected from the study area grid, but instead should be selected to facilitate logistics and efficiency of field data collection. Transects can consist of a single, contiguous, linear row of 10 points or a cluster of adjacent points depending on the size of control or treatment units, unit configurations, and composition and structure of vegetation (Figure 3.1). Strive to survey at least 40 points (4 transects of 10 points) over 500 ha (1200 acres) of treatment areas and an equivalent amount (≥ 40 points over 500 ha [1200 acres]) over control units. Although 8 transects total is a relatively small sample size for one study area, this sampling scheme should be adequate across time and space (other forests in the Pacific Northwest Region). If monitoring is being conducted in a Collaborative Forest Landscape Restoration Project (CFLRP), strive to identify a minimum of 15 units in treatment areas and an equal number of controls. Transects should be distributed throughout an area of interest to represent the sampled landscape (e.g., across a CFLRP). Survey points should only sample pine-dominated vegetation and structure types scheduled for treatment. The objective is to have an equal number of transects surveyed within treatment units and within control units placed at least 1 km apart.

Figure *3.1.* *Example of a survey transect for monitoring occupancy and conducting nest searches. Shaded area is the superimposed belt transect (200 m wide) for nest searching.*



Timing of surveys

Surveys should be conducted beginning no earlier than May 1 with the 2 visits completed by June 30 (Wightman et al. 2010, Latif et al. 2012). At least one of the surveys should occur between May 15 and June 15. Surveys should start just after dawn and be completed by 11 am.

3.1.4 Nest Searches

Establish belt transects

Treatment and control transects are searched systematically for nests using belt transects superimposed over occupancy transects (Figure 3.1). Typically, belt transects are 2700 m (8,858 ft) long and 200 m (656 ft) wide. Transects do not always form a straight line, i.e. point arrangement is based on treatment and control unit configurations, vegetation type, and habitat suitability. Consequently, belt transects for nest searching may not form one linear, narrow rectangle. In these cases, nest searchers simply reorient the belt transect, changing directions to coincide with the point arrangement of the survey transect, always searching within 100 m of the

transect line (Figure 3.1). If woodpeckers move outside of the belt transect, individuals are followed up to 1 km in hopes of finding their nest cavity.

Timing of surveys

Surveys should be conducted between May 15 and June 21 in Oregon (Frenzel 2004) and July 1 in Washington (Kozma, pers. comm.). Surveys should start a half hour after sunrise and be completed by noon each day (Dudley and Saab 2003).

Control of biases

- Observers should be changed or rotated between transects and units to minimize observer bias.
- Study units should not be searched in the same order in subsequent years to account for bias associated with probability of woodpecker detections related to nesting stage (Russell et al. 2009). For example, if block A is one of the first areas searched in 2010, it should be searched in the middle or late in the search period in 2011.
- Surveys should not be conducted during heavy rains or fog, or when wind speed exceeds 8-12 miles per hour (estimate using Beaufort scale) (Frenzel and Popper 1998) due to difficulty in hearing birds.

3.1.5 Pilot Studies

This monitoring protocol is based on published field protocols (Dudley and Saab 2003) and previous studies of WHWO in Oregon (Forristal et al. 2007, Frenzel and Popper 1998, Frenzel 2004, Wightman et al. 2010, Hollenbeck et al. 2011, Latif et al. 2015). However, we still consider the first year of effectiveness monitoring as a pilot study. Power analyses should be completed on the first year data to determine the most efficient and adequate sampling effort.

3.2 Data Collection

3.2.1 Data Collection Methods

Occupancy monitoring

Conduct surveys at point count/playback response surveys at point count stations as per the protocols in 2.2.1 Data Collection Methods.

Systematic nest searches

Protocols for locating nests are based on Dudley and Saab (2003) and protocols used by Sisters Ranger District, Deschutes National Forest, which were developed with assistance from Richard Frenzel. Field personnel should become familiar with the publication by Dudley and Saab (2003).

Before conducting a survey:

- Establish belt transects on a map as per Establishing Belt Transects procedures as described above.
- Randomly select the order for surveying transects, and assign transects to each field biologist.

Establish belt transects in the field:

- Navigate to transect endpoints by using a GPS unit; locations of both ends of the transect should be recorded using GPS.
- Find a nearby tree (or tall stump if necessary) to mark as a permanent transect end-point or "transect tree". Transect trees should be large and/or highly visible so that they can easily be relocated.
- Wrap the tree with three individual bands of flagging at a visible height and mark each band with the unit name and transect letter (e.g., TRANS A). Identify, mark and label a transect tree at each end of each transect.
- Use a GPS (or compass) and the unit map to follow the belt transect. Periodically check the unit map while conducting the survey to stay on course.

Conduct systematic nest search:

- Begin the survey at the transect endpoint approximately a half hour after sunrise. Record the start time on the datasheet. Fill out a new systematic nest search datasheet during each visit.
- Proceed along the transect at a comfortable, safe pace. Meander as necessary to focus attention on key habitat features within the 200-m belt transect.
    - Move freely off the transect but within the belt width, checking snags for cavities and watching and listening for birds.
    - Always return to the transect center line before proceeding along the transect.
    - When walking a belt transect the person with the compass should choose a distant landmark as a reference to limit the amount of time spent checking the bearing with the compass or GPS unit.
    - With more than one person searching, it's usually easiest for one person to maintain the direction of travel by occasionally checking the GPS unit or compass bearing while the other person keeps the person with the compass in view.
    - Before straying from the transect to check snags within the belt width, make a mental note of the spot or leave a temporary flag so you can easily return to in the transect center line before continuing to move in the general direction of travel determined by the GPS unit or compass bearing.
    - With more than one person try to stay aware of the whereabouts of the other searcher(s) and don't get too far ahead of another searcher. Whistles and pre-arranged signals can be helpful.
- If a potential nest snag is located (nest-size cavity observed) but nesting activity is not immediately observed (e.g., young seen or heard, adult entering or leaving cavity) look for fresh wood chips on the ground and knock on the snag with a stick or knuckles to see if a bird looks out the cavity or flushes. Snags with fresh chip piles at unoccupied cavities that are located prior to 1 June should be mapped and the possible nest should be re-visited every 4 days until June 1 or until the occupant or activity of the nest is determined.
- Record GPS coordinates for all active nests of cavity nesters you find and record pertinent data on the Nest Survey data sheet. For nests of WHWO place a red dot on the map approximating the location of the nest and start a nest monitoring data sheet. Use a GPS unit to record the digital location of the nest. Assign a unique alpha-numeric

identification to the nest using transect letter and nest number (e.g, A3 is the 3rd nest located on transect A). Locate a bearing tree at least 5-10 m from the cavity tree, with a view of the cavity. Flag the bearing tree with 2 bands of flagging, label the bands with the nest identification, and take a compass bearing to the cavity tree from the bearing tree.

- If you see a WHWO but no nest is found within approximately 400 m, mark the approximate location of the sighting on the map in blue.
- At the end of the transect, identify, mark and label an endpoint transect tree.

Nest monitoring

Protocols for monitoring nests are based on Dudley and Saab (2003) and protocols used by Sisters RD which were developed with assistance from Richard Frenzel. Field personnel should become familiar with the publication by Dudley and Saab (2003).

Nests are monitored until it is determined if the nest was a Failure or a Success. A successful nest is one where at least 1 young fledges from the cavity (i.e. a feathered nestling leaves the nest cavity on its own). Methods for checking status of the nests vary with the stage of development during the breeding season. These methods aim to increase efficiency and limit disturbance during early nesting and incubation when the birds are most prone to disturbance.

- Each active nest of WHWO located during the systematic nest searches should be re-visited every 3-4 days until the outcome of the nesting attempt is determined. As fledging nears visits should increase to daily visits.
- At each visit remain long enough to determine the nesting stage as per Dudley and Saab (2003). If there is no evidence that the nest is still active after 30 minutes, use a cavity peeper or mirror to check the cavity for young or evidence of predation (e.g., feathers or body parts in the cavity).
    - **Visits from May 15 to June 1** - Approach known nests no closer than 75 m and quietly wait in an inconspicuous spot either 30 minutes or until activity at the nest is observed. If at any time a WHWO looks out of the cavity or enters or leaves the cavity, record the nest as *Active* and leave the area. If no activity is observed after the 30 minute wait, approach the nest noisily (breaking sticks, talking) while watching the cavity. If a WHWO looks out of the cavity at any time during the approach, try to quietly leave without flushing the bird from the nest and record the nest as active. If no bird is seen, tap on the snag. If no activity is observed, tap closer to the cavity entrance with a stick or pole. In some cases the nest may still be occupied by an incubating or brooding adult even though no bird looks out or flushes; so if possible examine the contents of a cavity that appears inactive with a cavity peeper or inspection mirror to confirm that the cavity is no longer occupied. If the cavity is not occupied by a WHWO but contains intact eggs, the clutch may be incomplete and the pair may not have started full-time incubation yet. Record the status, and revisit the nest in 4 days to determine activity. All aborted nesting attempts during the period are recorded as *Failures*.
    - **Visits from June 1 to June 14** - Start by first quietly walking up to the cavity, listening for sounds of begging young. If no young are heard and nestlings have not previously been heard at the cavity, then use the protocol from the previous time period. If nestlings are not heard but were previously heard at the cavity

then approach the cavity as described for the previous time period. All aborted nesting attempts during the period are recorded as *Failures*.

- **Visits from June 15 to July 15 -** Walk quietly up to the cavity and listening for sounds of young from the cavity. If no young are heard, gently tap on the snag to try and get the young to respond. If no young are heard, examine the cavity with a cavity peeper or inspection mirror to confirm that the cavity is no longer occupied. If a nest is no longer occupied the nesting attempt is recorded as a success if a fully feathered nestling with its head outside the entrance of the cavity was seen during a previous visit and there is no evidence of predation of fully feathered young in the cavity.

- When determining nest fate, look for evidence of a failed (e.g., feathers at the base of the snag or in the cavity) or successful nest (e.g., perched or calling fledglings nearby).
- Each nest should have a separate Nest Monitoring data sheet. Record data for each visit on the Nest Monitoring data sheet for that nest. It is important to report all observations of bird behavior and cavity condition as per Dudley and Saab (2003).

Habitat data

Habitat data are collected at each nest site in both treatment and control units. Habitat data should also be collected at 2 random plots associated with each nest site. Random plots are located by taking a random compass direction (0-359 degrees) and measuring out 250 m. The second random plot is located by measuring 250 m out from the nest the opposite direction (180 degrees) from the first random plot. For each random plot, use the nearest tree, snag or tall stump as the plot center.

Vegetation sampling protocols are based on those used for the Birds and Burns project (Saab et al. 2006) and from Bate et al. (2008a, 2008b). The sample design uses variable radius rectangular plots, circular sub-plots, and/or transects to sample trees, snags, down wood, and shrub cover. Canopy cover, slope, aspect, and topographic position are derived from GIS. Figure 2.1 illustrates the basic design of the vegetation plot. Complete protocols are in Appendix I.

3.2.2 Personnel Qualifications and Training

Trained technicians will work under well-qualified biologists at the Forest or BLM District. All surveyors will be trained in the protocol by qualified biologists with survey experience. Surveyors with previous cavity nesting bird survey experience are desirable.

3.2.3 Quality Control and Assurance

- Surveys should not be conducted during heavy rains or fog, or when wind speed exceeds 8-12 miles per hour (estimate using Beaufort scale) (Frenzel and Popper 1998) due to difficulty in hearing birds.
- Drumming alone should not be used to identify WHWO; their drumming is very difficult to distinguish from that of other woodpeckers (Bate 1995).
- At the end of each day data sheets should be reviewed by another surveyor to make sure data and header information are recorded completely and legibly.

3.2.4 Data Forms

The data form for ***Population Data*** for playback surveys is in Excel spreadsheet: PlaybackSurveyForms.xls
Data forms for ***Systematic Nest Searches*** are in Excel spreadsheets: NestSearchSurveyForms.xls
Data forms for ***Nest Monitoring*** are in Excel spreadsheets: NestDataForms.xls
Data forms for ***Habitat Data*** are in Excel spreadsheets: WHWO_veg_field_forms.xls.

3.2.5 Logistics

Occupancy Monitoring Equipment List:

See section 2.2.5 Logistics section above.

Systematic Nest Search and Monitoring Equipment List:

- day pack
- binoculars
- range finder – for belt width
- compass
- GPS unit – accuracy of 3 m or less
- thermometer
- 2-way radio and/or satellite phone
- cavity peeper or inspection mirror, flashlight and extension ladder
- maps and aerial photos of units marked with belt transect locations
- data sheets on write-in-the rain paper
- clipboard
- red and blue fine-tipped markers
- mechanical pencils – several (work best on write-in-the rain paper)
- flagging
- Sharpie or other permanent marker pen

Habitat Data Equipment List:

- day pack
- range finder
- compass
- DBH Tape
- clinometer
- tape measure – metric – at least 50 m long
- 1 meter long, thin, rigid dowel
- GPS unit
- 2-way radio and/or satellite phone
- maps and aerial photos of transect and points
- data sheets on write-in-the rain paper
- clipboard
- mechanical pencils – several (work best on write-in-the rain paper)
- flagging

- Sharpee or other permanent marker pen

Safety

Walk transects at a safe pace and be aware of weather conditions, topography, vegetation, down wood, etc.

Crew members need to wear sturdy hiking boots and appropriate clothing, including long pants, long sleeved shirts, and a hard hat. Crews should carry a reliable radio or satellite phone, GPS unit, compass and appropriate maps. It is usually a good practice for **everyone** to mark the GPS location of the vehicle so that if they get turned around, they can always head for the vehicle coordinates. Make sure that each member of the team has the UTM coordinates of the other members' survey sites and that everyone knows the scheduled meeting time and place. Have an **emergency action plan** if a team member fails to arrive at the meeting location on time (e.g., radios should remain on if the scheduled time is missed, pre-arranged contact times, leave notes on vehicle).

Snags often fall under windy conditions, so stay away from snags during winds. Also, avoid passing downslope from, or standing near, snags that are heavily charred at the base or otherwise look unstable.

Lightning can be dangerous. Do not take chances if storms are approaching. Stay away from lone or tall trees and ridges. If in an exposed area and a storm is approaching, get to a safe place before the storm hits.

The crew leader should be responsible for knowing crew members location each day. A daily sign-in/sign out sheet or other check in/out process is recommended.

A Job Hazard Analysis (JHA) should be prepared by each unit using the information in Appendix III. Safety issues to consider include, but are not limited to: vehicle/traffic hazards, inclement weather or lightning activity, poison oak, insects (bees, wasps, ticks), wild animals, physical conditions (hypothermia, heat stroke), falling debris (cones, branches, rocks), falling snags, walking hazards (trips and falls, uneven terrain), cultivation or manufacturing of illegal substances, toxic waste.

3.3 Data Storage

A copy of data sheets should be photocopied each week and stored in a separate location than the originals.

Data will be entered and stored in NRIS Wildlife or GeoBOB. The ISSSSP will work with developers to make sure data will fit in to the structure. Additional data needed for analysis purposes will be entered into the spreadsheets provided by the ISSSSP. The FS forest biologist or BLM District biologist will be responsible for ensuring that data are entered in to the appropriate database(s) in a timely manner, at a minimum prior to the next field season.

3.4 Data Analysis

Nest density and nest success will be compared between treatment units and control units to determine if statistically significant differences occur. Data analysis will be conducted in coordination with RMRS.

3.5 Reporting

Information on effectiveness monitoring projects will be included annual monitoring report, which will be submitted to the ISSSSP. An interim report will be prepared at the end of the 3 to 4-year monitoring period for each set of effectiveness monitoring projects. The report will be jointly prepared by Region 6 and RMRS personnel.

3.6 Cost Estimate based on FY15 costs

Cost estimates below are for large-landscape projects. Costs are broken out by different levels of monitoring objectives. At the very basic level is the occupancy monitoring to determine presence/absence of WHWO before and after treatment. Each additional task adds value to the data collected and more monitoring questions can be answered with the additional data. Each task identifies the workforce and time required for that task. Some of this can be accomplished with the same individuals or by hiring a larger crew.

***Occupancy Monitoring** (playback surveys)& systematic **Nest Searching** -* **$42,700 per year (with 2 visits to 30 transects x 10 points = 300 point counts over 10 week period, ~ 6 transects completed/week)**

Per paired units (10-15 treatment transects, 10-15 control transects):

- 4 people (1 GS-6 and 3 GS-5) for 6 pay periods - $35,400 (field biologists work in pairs; 1 biologist conducts playback surveys while the other biologist searches for nests). Field work includes 10 weeks for conducting playback surveys [monitoring for occupancy], nest searching, and nest vegetation measurements, 1 week for training, and 1 week for bad weather and unknown obstacles.
- 2 vehicle - $5,000
- Per diem - $2,000 (if needed for logistical purposes)
- equipment - $300

Additional cost to Occupancy Monitoring & Nest Searching: Monitoring Nest Success **– $35,800 first year; $28,800 per year subsequent years**

Per paired units (10-15 treatment transects, 10-15 control transects):

- 4 people (1 GS-6 and 3 GS-5) for additional 1 pay period (7 pay periods total) - $5,700 (includes vegetation measurements at about half [150] survey points and all nest locations.
- 2 people (2 GS-5) for 7 pay periods - $19,600
- 1 vehicle - $2,500
- Per diem - $1,000 (if needed for logistical purposes)
- Equipment - $7,000 (includes cavity peepers first year only)

***Additional cost to <u>Occupancy Monitoring</u> & <u>Nest Searching but no monitoring of Nest Success</u>: Habitat data collection* – $22,410 first year; $21,410 per year subsequent years**

Per paired units (10-15 treatment transects, 10-15 control transects):

- 6 people (1 GS-6 and 5 GS-5) for additional 2 pay periods (8 pay periods total) - $16,910 (includes vegetation measurements at another 150 points [total of 300 points] and at all nest locations)
- 1 vehicle - $2,500
- Per diem - $2,000 (if needed for logistical purposes)
- equipment - $1,000 (first year only)

***Data entry & data management* – $3,200 per year**

1 person for 2 pay periods - $3,200

***Data analysis& write-up* -$15,000 per year**

Rocky Mountain Research Station

4. Model Validation

Preliminary habitat models were developed for WHWO in post-fire and un-burned forest by the Rocky Mountain Research Station (Wightman et al. 2010, Hollenbeck et al. 2011). However, the predictive ability of models are expected to be lower in landscapes outside of the model origin area. Therefore, field validation and refinement using independent data were needed to verify the predictive value of these models. To date, the un-burned forest model has been evaluated and refined using additional nest location and point count survey data, as well as alternate modeling techniques, for informing management planning in Oregon (Latif et al. 2015). Preliminary work has also been conducted to evaluate the post-fire model using nest locations from a recent fire (2012 Barry Point Fire, Fremont-Winema National Forest). Results from this analysis suggest models developed for any one fire are unlikely to provide useful predictions at new post-fire locations (Latif and Saab unpublished data). Therefore, new WHWO nest location data are needed from a range of post-fire locations to evaluate and generalize HSI models for post-fire nesting habitat. Additional data are also needed to develop and validate a habitat model for un-burned forests in the North Cascade Mountains of Washington, because these forests represent a range of conditions outside of those represented by models developed in Oregon.

4.0 Objective

- Assess and refine applicability of current models to post-fire landscapes across Oregon and Washington.
- Develop and evaluate a model for unburned forests with known WHWO nesting locations in the North Cascade Mountains, Washington.

Validation and refinement of the un-burned forest model in Washington is a priority due to the applicability to assessing and prescribing fuels reduction activities. Further development and evaluation of a post-fire model is a lower priority at this time.

4.1 Data Collection

Broad-Scale Occupancy and Distribution Monitoring protocols do not include locating and monitoring WHWO nests, thus, additional field work will be necessary to obtain the nest location data needed to evaluate and refine habitat suitability models. Data collected using Effectiveness Monitoring protocols can also be used to develop, evaluate, and refine habitat suitability models for un-burned forests. Monitoring of salvage logging operations in recent post-fire habitats could yield data useful for further development and evaluation of post-fire habitat models. Generally, at least 20 WHWO nest locations will be necessary from any given study area along with requisite remotely-sensed environmental data to allow model evaluation and refinement. More data are likely needed for development of a completely new model for a new landscape (e.g., North Cascades, Washington). Given results from preliminary analyses, we anticipate at least 20 locations from each of 4 post-fire study areas will be needed to develop a robust model for nesting WHWO in burned forest.

Nest Searches

Locate nests of WHWOs encountered during transect/point count surveys by returning to the location after the transect has been completed. Or if there are two observers per transect, second observer could search for the nest while first observer completes the transect survey.

- Nest searches should be conducted within a 200 m radius of any WHWO detection and up to 1-km when following adults. Snags should be systematically searched for signs of fresh cavity excavations.
- If a potential nest snag is located (nest-sized cavity found) but nesting activity is not immediately observed (e.g., young seen or heard, adult entering or leaving cavity), look for fresh wood chips on the ground and knock on the snag with a stick or knuckles to see if a bird looks out of the cavity or flushes. Snags with fresh chip piles at unoccupied cavities that are located prior to mid-June should be mapped and the potential nest cavity should be re-visited every week until July 1 or until the occupant or activity of the nest is determined.
- Record GPS coordinates for all active nests of WHWO found and record pertinent data on the Nest Survey data sheet. For nests of WHWO place a red dot on the map approximating the location of the nest and start a nest monitoring data sheet. Use a GPS unit to record the digital location of the nest. Assign a unique alpha-numeric identification to the nest using transect letter and nest number (e.g, A3 is the 3rd nest located on transect A). Locate a bearing tree at least 5-10 m from the cavity tree, with a view of the cavity. Flag the bearing tree with 2 bands of flagging, label the bands with the nest identification, and take a compass bearing to the cavity tree from the bearing tree.

Nest monitoring

Use the nest monitoring protocols described for Effectiveness Monitoring.

Habitat data

Habitat data are collected at each nest site. Vegetation sampling protocols are based on those used for the Birds and Burns project (Saab et al. 2006) and from Bate et al. (2008a, 2008b). The sample design uses variable radius rectangular plots, circular sub-plots, and/or transects to sample trees, snags, down wood, and shrub cover. Canopy cover, slope, aspect, and topographic

position are derived from GIS. Figure 2.1 illustrates the basic design of the vegetation plot. Complete protocols are in Appendix I.

4.2.2 Personnel Qualifications and Training

Trained technicians will work under well-qualified biologists at the Forest or BLM District. All surveyors will be trained in the protocol by qualified biologists with survey experience. Surveyors with previous cavity nesting bird survey experience are desirable.

4.2.3 Quality Control and Assurance

- At the end of each day data sheets should be reviewed by another surveyor to make sure data and header information are recorded completely and legibly.

4.2.4 Data Forms

Data forms for ***Nest Monitoring*** are in Excel spreadsheets: NestDataForms.xls
Data forms for ***Habitat Data*** are in Excel spreadsheets: WHWO_veg_field_forms.xls.

4.2.5 Logistics

Nest Search and Monitoring Equipment List:

- day pack
- binoculars
- range finder – for belt width
- compass
- GPS unit
- 2-way radio and/or satellite phone
- cavity peeper or inspection mirror, flashlight and extension ladder
- maps and aerial photos of units marked with belt transect locations
- data sheets on write-in-the rain paper
- clipboard
- red and blue fine-tipped markers
- mechanical pencils – several (work best on write-in-the rain paper)
- flagging
- Sharpie or other permanent marker pen

Habitat Data Equipment List:

- day pack
- range finder
- compass
- DBH Tape
- clinometer
- tape measure – metric – at least 50 m long
- 1 meter long, thin, rigid dowel
- GPS unit
- 2-way radio and/or satellite phone
- maps and aerial photos of transect and points

- data sheets on write-in-the rain paper
- clipboard
- mechanical pencils – several (work best on write-in-the rain paper)
- flagging
- Sharpie or other permanent marker pen

Safety

Walk transects at a safe pace and be aware of weather conditions, topography, vegetation, down wood, etc.

Crew members need to wear sturdy hiking boots and appropriate clothing, including long pants, long sleeved shirts, and a hard hat. Crews should carry a reliable radio or satellite phone, GPS unit, compass and appropriate maps. It is usually a good practice for **everyone** to mark the GPS location of the vehicle so that if they get turned around, they can always head for the vehicle coordinates. Make sure that each member of the team has the UTM coordinates of the other members' survey sites and that everyone knows the scheduled meeting time and place. Have an **emergency action plan** if a team member fails to arrive at the meeting location on time (e.g., radios should remain on if the scheduled time is missed, pre-arranged contact times, leave notes on vehicle).

Snags often fall under windy conditions, so stay away from snags during winds. Also, avoid passing downslope from, or standing near, snags that are heavily charred at the base or otherwise look unstable.

Lightning can be dangerous. Do not take chances if storms are approaching. Stay away from lone or tall trees and ridges. If in an exposed area and a storm is approaching, get to a safe place before the storm hits.

The crew leader should be responsible for knowing crew members location each day. A daily sign-in/sign out sheet or other check in/out process is recommended.

A Job Hazard Analysis (JHA) should be prepared by each unit using the information in Appendix III. Safety issues to consider include, but are not limited to: vehicle/traffic hazards, inclement weather or lightning activity, poison oak, insects (bees, wasps, ticks), wild animals, physical conditions (hypothermia, heat stroke), falling debris (cones, branches, rocks), falling snags, walking hazards (trips and falls, uneven terrain), cultivation or manufacturing of illegal substances, toxic waste.

4.3 Data Storage

A copy of data sheets should be photocopied each week and the copy stored in a separate location than the originals.

Data will be entered and stored in NRIS Wildlife or GeoBOB. The ISSSSP will work with developers to make sure data will fit in to the structure. Additional data needed for analysis purposes will be entered into the spreadsheets provided by the ISSSSP. The FS forest biologist or

BLM District biologist will be responsible for ensuring that data are entered in to the appropriate database(s) in a timely manner, at a minimum prior to the next field season.

4.4 Data Analysis

Model Refinement, Calibration, Validation

The Rocky Mountain Research Station will complete analysis necessary to validate the habitat models. Existing models will also need to be calibrated for each new ecoregion before they can be applied in those ecoregions with statistical rigor. At least 20 new WHWO nests per ecoregion, and associated vegetation information at nests and random sites, will be necessary before model refinement and validation can occur.

4.5 Reporting

Rocky Mountain Research Station will prepare and submit reports on the results of model validation and refinement.

4.6 Cost Estimate

Data collected through Broad-Scale Occupancy and Distribution Monitoring and Treatment Effectiveness monitoring will be used to model habitat, thus data analysis is the only additional cost for model validation.

***Data analysis and modeling* – $15,000 per year**
Rocky Mountain Research Station

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7. Appendices

7.1 Appendix I

Instructions for survey forms: Point Count Surveys, Nest Search Surveys, Nest Data

7.2 Appendix II

Instructions for Vegetation Measurements at WHWO nests, random sites and point count stations

7.3 Appendix III

Safety information for developing a Job Hazard Analysis

7.4 Appendix IV

Regional transect establishment methodology

7.5 Appendix V

Instructions for completing nest card