Umatilla National Forest

Terrestrial Wildlife Inventory

Final Report

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Objectives

Overview

The National Forest Management Act (1976) addresses the importance of maintaining species and community diversity on National Forest System lands as a critical component of ecosystem function. Inventory and monitoring is the means of measuring and evaluating the effectiveness of the Forest Plan implementation, including sustaining populations of native and desired non-native species. The Terrestrial Wildlife Inventory (TWI) protocol is intended to serve as a consistent and efficient method for obtaining basic occurrence data and associated habitat condition data for a number of wildlife species at sites that represent a relative sample. The inventory will be implemented in association with Current Vegetation Surveys (CVS) grid points on the Umatilla National Forest. Data generated by the protocol can be used to make inferences about species diversity, distribution, abundance and habitat suitability at a range of scales. The TWI protocol is not intended nor designed to obtain more detailed population data (e.g. reproductive status), determine "absence" with a high degree of statistical confidence, or detect all species that could occur on the site. However, possible benefits of the survey effort could include improved habitat relationships, composition and abundance data, and relative densities.

Background and history

There are potentially 295 terrestrial wildlife species on the Umatilla NF (Forest Plan 1990). This includes 7 amphibians, 14 reptiles, 73 mammals, and 201 birds (Forest Plan 1990). The list was derived primarily from Wildlife Habitats in Managed Forest, the Blue Mountains of Oregon and Washington (Thomas 1979) and secondarily from observations, range maps, species habitat relationships, and/or professional experience. The Interior Columbia Basin Ecosystem Management Project (ICBEMP) provided updated range maps for terrestrial species in the area (Marcot et al. 2003). A list of species can be derived from these range maps and is provided in Appendix B. While many of the species on the Forest list are common and frequently seen, others are seldom seen or have never been documented as occurring on the Umatilla National Forest. In addition, there may be some species not currently on the list that may actually occur on the Forest. Essentially, the species list for the Forest is unverified and potentially incomplete. Documentation of occurrence on the Forest and periodic, systematic wildlife inventories are needed to confirm the presence of most species on the Forest.

Some occurrence and population data is collected periodically by state agencies like the Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW). However, these inventories are primarily limited to selected game species (elk, deer, cougar, bear, bighorn sheep, grouse, turkey, etc.) or furbearers. Occurrence data is collected through herd composition surveys, harvest and/or trapping records that could provide basic population trends for those species. The State fish and wildlife agencies seldom conduct inventories for non-game species.

Over the last 10-15 years some species-specific and/or "species-group" surveys have occurred on the Umatilla NF. The following table lists most of the wildlife inventories that have occurred on the Forest over the last fifteen years. Many of these inventories are limited in extent and duration or designed to assess impacts to a particular project. Some of the past efforts have been inconsistent, limited in coverage and duration and tended to

focus on only the species of interest at the time. With out baseline wildlife inventories, analysis and evaluation of effects on species is limited to speculation, based on the occurrence of habitat in the project area and probable presence of the species.

Inventory/Survey	Extent	Frequency
MIS Monitoring	C1/C2 areas across the Forest	1992
Northern Goshawk	Potential habitat in timber sale planning areas.	1992-present
Pileated woodpecker	Kelsay Timber Sale units, NFJD Database of incidental observations	2002 1988 - present
White-headed woodpecker	Selected sites, NF John Day District	1999
Bald Eagle Wintering	Established routes on south end of Forest	1990-present
Bald Eagle Nest	One nest monitored yearly	1994-present
Peregrine Falcon	Habitat identification and reconnaissance flight, NFJD and Heppner	1997
Flammulated Owl	Selected routes across the Forest	1990s, 2006
Lynx Survey - FWS	Selected locations across the Forest	1999
Lynx Survey – National FS	3 year survey, NF John Day District	1999-2001
Wolverine	Region 6 Denning habitat identification and reconnaissance flights; NFJD	1998
Forest Carnivores Snow Routes	Selected locations across the Forest	1992-1995
Riparian birds	One site, Heppner District	1994
Post-harvest landbirds	Selected harvest units, WW District	1992-1996
Landbird Monitoring in Old Growth Grand fir (Level 2)	Selected sites, Walla Walla District	1992-2001
Monitoring Avian Production and Survivorship (MAPS)	Selected sites, Walla Walla District	1992-Present
Spotted frog, amphibians	Selected sites, NFJD, Heppner & WW Districts	1997, 2000, 2006
Preble's shrew	Selected sites across the Forest	1990-1993

Rationale for survey (Goals)

- The intent is to provide data on the presence of terrestrial wildlife, for use in project analysis and broad sale analysis and assessments.
- Establish baseline information for monitoring presence and distribution of management indicator species and sensitive species at the Forest or unit scale.

Measurable objectives

- Provide a standardized process to inventory terrestrial wildlife species across a large area.
- Conduct terrestrial wildlife surveys across the Forest for a wide variety of species.
- Provide evidence of the presence and relative distribution of management indicator species and sensitive species.
- Populate the NRIS-FAUNA database.
- Repeat surveys every 10 years to establish trends and assess changes in species occurrence, composition, distribution, and habitat condition.
- Integrate the Terrestrial Wildlife Inventory with Current Vegetative Survey (CVS) data.
- Identify habitat relationships for species on the Forest.

Design

Design rationale

The Terrestrial Wildlife Inventory (TWI) is designed to link with the Current Vegetative Survey (CVS) grid system. The CVS program was designed to assess vegetative changes at a broad-scale. A sample grid was established across National Forest System lands and permanent markers were installed. The basic design of CVS sampling includes a 1-hectare (2.47 acres) plot on a 3.4-mile grid, with additional plots occurring at 1.7-mile intervals.

CVS provides estimates of current vegetative condition, data for National Forests and sub state analysis, and a defensible database of ground resource estimates that can be use to periodically assess vegetation and monitor change in vegetation over time. The CVS data is similar to and overlaps the Forest Inventory Assessment (FIA), a nationwide inventory across all ownerships. The CVS program has been in use on the Umatilla Forest since 1993, with re-measurements occurring in 1997, 1999, 2002, and 2006. The CVS data is more readily available for us to use than FIA, however due to funding cutbacks the CVS data may eventually be absorbed into the FIA database (Dolly Robison, Umatilla National Forest, pers. comm.).

Our intent is to inventory for terrestrial wildlife species at each CVS point on the forest. In doing so, we can monitor changes in the proportion of sites occupied by individual species with repeat surveys. Logically, the larger the proportion of all species represented in a sample, the greater the likelihood that the sample accurately reflects the sum total of all species and therefore the condition of the ecosystem. In addition, linking our survey to the CVS vegetation data provides an efficient source of information about vegetative conditions that can be used to interpret trends in habitat condition.

Site selection

The wildlife inventory will be conducted on all 3.4 and 1.7-mile CVS plots within the designated area. CVS point locations are readily available in GIS and can be overlaid on topographic maps (USGS quads) and aerial imagery such as the NAIP (National Agricultural Imagery Program). A spreadsheet of CVS locations can also be obtained from the database which provides UTM locations, directions to each site, and general descriptive comments about each site.

Each CVS point is systematically numbered and marked on the ground. The sample unit is a fixed radius of 185 feet (56.4 m) around the point which equates to a 1 hectare plot (2.5 acres).

Number and location of sample sites

A sample area will consist of a group of CVS plots, generally based on a watershed or multiple watershed boundaries. There are approximately 2,965 CVS plots on National Forest System lands in the Blue Mountain Province. About 630 plots occur on the Umatilla National Forest, with approximately 45 of those plots occurring in wilderness areas.

Ideally, all survey plots would be completed within five years. Assuming that a 2-person crew could complete 50 plots in a season, it would take 2 to 3 crews per year to complete all of the Umatilla surveys within 5 years.

Sampling frequency and replication

The survey period generally occurs from May 15th through August 31 each year. Each terrestrial wildlife survey will be conducted once on each plot within the designated area during the survey period. Ideally, surveys will be repeated within 10 years after the initial survey. Discussion on frequency and timing of individual survey samples can be found in the Field Methods section below.

Field Methods

Field season preparation and equipment

- Determine crew size and vehicle needs for the season.
- Select and group CVS points that will surveyed during the field season. Groupings should not be less than a 5th field HUC (watershed) (HUC 5).

- Prepare and generate field maps for areas to be surveyed. Topographic maps or ortho-quads maybe used as the base layers. CVS points (labeled with number) can be added, along with forest roads and other features if desired.
- Extract data for the CVS points of interest, including point number, UTM coordinates, comments and driving/walking directions to reach the point.
- Prepare/update job hazard analysis.
- Prepare plan for hiring personnel and obtaining vehicles.
- Gather equipment and supplies: hand-held radio, GPS unit, binoculars, camera, satellite phone, compass, flagging, district and forest maps, field forms, collection containers/bags, species identification guides, Sherman live traps, deep coffee cans (pit traps), reptile tongs, and field gear (hardhat, canteens, first aid kit, etc.).
- Gather camping gear if necessary. Make arrangements for overnight stays at remote locations.

Sequence of field season events

1. Hire personnel and obtain vehicles to conduct survey
2. Obtain materials and supplies.
3. Prepare maps for area to be surveyed.
4. Provide for new employee/seasonal orientation
5. Train personnel in various survey techniques.
6. Collect and record data at each CVS plot.
7. Enter data into electronic format (Microsoft Excel)

Details of measurements

The center survey point and plot area consists of 2.47 acres (1 ha) with a radius of 185 feet (56.4 m). Most of the data collected will occur within the plot area, however, bird data will also collect information outside the plot.

Observation data will be collected on a survey form (paper) in the field. Primary data attributes for each survey include; CVS point number, date, observer(s), observation method (visual, aural, capture, etc) gender, and age (adult/juvenile). Secondary attributes include; sex, age, reproductive status, activity, and comments. Observation attribute definitions will be consistent with the NRIS-Fauna data dictionary. Observations outside the plot radius/area are not considered within the sample area but should be recorded and the location noted.

General Search

A general survey can occur anytime during the survey period (May 15 – August 31). Observers will locate the center point of the 1 hectare plot, and search the area for individual animals and sign. Sign is indicated by a range of items including: tracks, scat, scratches, marks, nests and burrows, plucking perches, whitewash and regurgitated pellets. Observers search surfaces, vegetation, logs and rocks. Riparian or mesic habitat is searched extensively for any burrow systems, focusing under riparian vegetation for burrow opening. If nests are discovered, nest characteristics are noted. Particular attention is paid to wildlife trails and other areas showing sign of animal activity.

The objective of the survey is not to quantify the amount of use, but rather to detect species presence. A generalized note on the quantity of sign can be included in the comments sections (e.g. many elk pellets, numerous burrows, etc.). Animals are captured only as necessary to confirm identification. Information recorded on the pre-designed field form will include the CVS point number, date, observer(s), species, and observation method (visual, aural, capture, etc). Secondary information can be recorded when available including age class, gender, reproductive status, activity, and other comments.

Surveyors will become proficient at identification of animal sign.

Amphibians and Reptiles

Amphibian and reptile surveys can occur anytime during the survey period (May 15 – August 31). This survey can be conducted at the same time as the General Search survey.

Observers will systematically survey the 1 hectare plot area (2.47 acres) for individuals. Observers will search surfaces and vegetation, carefully turn over objects such as logs and rocks, look in rock and bark crevices. All disturbed items will be put back in place as they were found. Logs and other substrate should not be torn apart to minimize disturbance to important habitat elements in the plot area. Close attention will be paid to aquatic, wetland, or riparian habitats. Streams and ponds in close proximity to each CVS point may also be searched.

All reptiles or amphibians captured, seen, or heard are recorded, including species, life stage (eggs, tadpoles, juvenile/adult), and the estimated number of individuals (or egg masses). Animals are captured only as necessary to confirm identification and immediately released. Poisonous snakes will not be handled.

Surveyors will become proficient at amphibian and reptile identification. The surveyor will also be trained in safe practices when handling amphibian and reptiles.

Landbirds

Point-count surveys for birds will be conducted in the spring, beginning when the majority of migrants have arrived and are exhibiting territorial behavior, generally after May 15th. Bird point counts should not be conducted after July 15th. One point-count station will be located at the CVS center point and last for about 10 minutes. Surveys will start no earlier then 30 minutes before dawn and conclude no later than 10 a.m. Counts are not conducted if precipitation is occurring or if the wind is greater than a gentle breeze.

The surveyor must be skillful in detecting bird species in the Blue Mountains by sight and sound (species vocalizations). Typically, one visit to a point-count station will detect between 80-90% of the birds occurring in the area (Pers. comm. Rex Sallabanks).

The observer records all birds detected either visually or aurally. Other species (squirrels, amphibians, etc.) observed or heard should also be recorded at this time. Birds may be recorded as occurring within the plot (185 foot radius from plot center), outside the plot (> 185 feet), and fly-over. All individuals detected at the count station are recorded on the data form. Additional information to record includes the following: observer, date, start time. When possible collect individual information like, age (adult/juvenile) and sex, activity (breeding, foraging, etc.).

Nocturnal Birds

A survey for nocturnal birds (primarily owls and nighthawks) will be conducted in the CVS plot between May 15 and July 15. Broadcast calling may be used to elicit responses from raptors in the area. Surveys will start no earlier than sunset and end when the desired number of plots is surveyed. The count period lasts for 30 minutes and one visit is conducted for each CVS plot. Counts are not conducted if precipitation is occurring or if the wind is greater than a gentle breeze.

The surveyor must be skillful in detecting nocturnal bird species in the Blue Mountains by sight and sound (species vocalizations). Watch for birds that fly silently into the area. The observer records all birds detected either visually or aurally.

Small Mammals

Live trapping can take place from early June through mid August. Sherman traps are deployed along two transects, 328 feet (100m) long, within the CVS plot perimeter, and arranged in a cross-pattern centered on the plot center. Transects are generally aligned with the four cardinal compass directions (north-south, east-west). Transects may not be a direct line in order to allow for traps to be placed at habitat features such as logs, burrows, the base of trees, runways, and areas that provide cover from weather (under shrubs, grass, etc.). Traps are placed at 10 meter intervals, for a total of 11 traps per transect or 22 traps per plot.

Vented, large, folding Sherman live traps are recommended. Traps are baited with a dollop of peanut butter rolled in quick oats and/or birdseed. Bait can be prepared ahead of time and stored in small containers.

Preferably traps will be set and baited in the afternoon, checked the following morning, and removed from the plot. Assure that no traps are missing or left unaccounted for. Captured animals are identified to species, sex, and age (juveniles or adults), and then released. If there is uncertainty as to the species, additional information can be recorded such as head/body length, tail length, ear length, and hind foot length. Unidentified species may also be photographed for expert identification.

Occasionally animals will be found dead or lethargic due to an inability to keep warm or cool in the trap. The smallest mammals are not likely to recover and should be euthanized; however, we did have a case where a chipmunk was presumed dead and brought in, only to revive and flee it's captor in the office. In cold weather, nesting material such as cotton balls can be provided in each trap. In warm weather, traps should be placed in locations that will have shade in the afternoon and checked as early in the day as possible.

All traps are to be cleaned and disinfected weekly. Traps are emptied of all bait and organic material before being placed in a mild bleach/water solution (approx. 2 cups of bleach to 30 gallons water) where they remain for a minimum of 5 minutes. Any traps that remain soiled after soaking are scrubbed with brushes using the mild bleach solution until traps are clean. Traps are then rinsed with water and allowed to dry fully before being put away.

Surveys will become familiar with the small mammal trapping protocol, and become proficient at identification of small mammals. The surveyor will also be trained in safe practices when handling small mammals and traps.

Shrews and Moles

Pitfall traps can be placed on the plot anytime during the survey period (May 15 – August 31). One trap should be placed in each quadrant of the hectare for a minimum of 4 pitfall traps for each CVS plot. Additional traps may be placed within the plot at randomly selected locations. Pitfalls traps can be connected to drift fences or placed at the end of runways. Pitfall traps consist of 1.5-gallon plastic buckets or deep coffee cans, sunk in the ground so the top of the bucket is at ground level. Plastic buckets may improve survival over metal cans because plastic does not conduct heat as easily as metal. Covers consist of large pieces of bark or limbs placed over the top of the trap during sampling to entice individuals to crawl under the cover and fall in the trap. Place a handful of duff/litter into each bucket to provide some warmth to captured animals.

Pitfall traps are placed on the plot in the late afternoon and checked the following morning and then removed from the plot. Traps with cover boards should be lifted slowly and with caution. Captured animals are identified to species and released. Unidentified species may be photographed or collected for expert identification. Some shrew species can only be identified by examining the teeth under a dissecting scope.

Surveyors will become familiar with the pit rapping protocol, and become proficient at identification. The surveyor will also be trained in safe practices when handling small mammals and traps.

Data handling, analysis and reporting

Data storage

- Enter completed forms on to an electronic spreadsheet (Excel) for summary and analysis.
- Analyze data and write report on findings.
- Data from spreadsheets will be migrated into the NRIS FAUNA observation.
- Data may be tied to the CVS vegetation data for further analysis.

Personnel requirements and training

Roles/responsibilities

The forest biologist or other designated individual will direct the overall program and track the data collection and data entry progress. District project managers will supervise survey crews.

Qualifications

Surveyors should be comfortable with working in remote areas and be skilled in backcountry navigation using a GPS receiver and map. A background in biology and/or forestry is

recommended. They should be familiar with local forest types and common wildlife species. At least one crew member should have the ability to recognize birds by ear.

Training

If necessary, employees will be trained to recognize tree species and wildlife species and/or their sign. Other important skills include field navigation, aerial photo and/or map interpretation, use of GPS and other equipment, and safety procedures.

Operational requirements

Annual workload, field schedule

By early spring of each year, estimate the personnel and equipment needs for the coming field season.

Startup costs, budget considerations

Survey planning and preparation are essentially donated wildlife program funds. The survey itself is currently funded with timber, fuels, inventory/monitoring, and wildlife program contributions.

A two-person crew is the smallest unit to efficiently conduct TWI on CVS plots. The estimated cost for a two-person crew, travel per diem, supplies, and a vehicle is about $16,000.

Ideally two or three crews would be hired each summer, in order to complete the Terrestrial Wildlife Inventory within 5 years on all 630 CVS points on the Umatilla Forest. The total cost to complete the forest-wide baseline survey is estimated at $ 200,000.

Results 2003-2006

Survey points completed

A general map of CVS points selected for the Terrestrial Wildlife Inventory is shown in Figure 1. Targeted areas contained a total of 272 CVS points, or 43% of all CVS points on the forest. Funding was provided to hire seasonal personnel beginning in 2003 and continued through 2006. Total funds approximated $90,000 for 6 survey crews over 4 years. Additional overhead costs were absorbed with wildlife program funds.

Wildlife detections were recorded at 224 CVS points (Table1). The average number of completed plots was about 37 plots per crew year, lower than the expected 50 per crew year. This number is difficult to quantify because surveys were staggered from 2003 to 2005, such that partial surveys were completed the first year, and bird surveys were 'caught up' the next spring. Generally, 30 to 40 plots could be accomplished by a single two-person crew depending on terrain and travel.

Table 1. Completed Terrestrial Wildlife Inventory at Umatilla National Forest CVS points.

Year	Watershed	Plots planned	Partially completed	Fully completed	Total plots visited	Percent fully completed
2003/2004	Potamus	64	6	56	62	88 %
2004/2005	Grande Ronde	106	2	86	88	81 %
2005	Granite / Desolation	35	3	30	33	86 %
2006	Wall / John Day	67	2	39	41	58 %
total	6 crews	272	13	211	**224**	**78%**

Species Detected

One hundred fifty species were detected, or about one half of the 295 species expected to occur on the Umatilla Forest (Forest Plan 1990). About 45% of the mammal species were recorded, 53% of the bird species, 57% of the reptiles, and 43% of the amphibians. Of these 150 species[1], 6,008 individuals were recorded (Table 2).

Since this figure includes hundreds of larval amphibians, which overly inflates the numbers, plot occurrence figures are also given (Table 2 and Figure 4. Each species on a plot was counted as one plot occurrence, no matter how many individuals were observed. There were 3,855 plot occurrences on 224 plots, therefore the average as 17 species per CVS plot.

[1] The following 6 were not tallied because they were not identified to species: woodpecker spp., hummingbird spp., deer spp., ground squirrel spp., rodent spp., and 'microtine run'.

On most plots the majority of data is of birds heard during point counts and of mammal sign. In 2003 and 2004, the method of detection was not consistently recorded, as it was in 2005 and 2006. Our best estimate is that about 23% (873) of all plot occurrences were based on sign.

Table 2. Total number of wildlife species and individuals recorded.

	Mammals	Bird	Reptile	Amphibian	Total
Species	33	106	8	3	**150**
Plot Occurrences	1333	2493	21	8	**3855**
Total individuals	1728	3877	35	367	6008

General Search

Typical records included snowshoe hare pellets, deer excrement, coyote excrement, and logs torn up by bears. There was an occasional unusual find such as: a barred owl feather, bats roosting in the crack of a rock, one rattlesnake, and newly hatched but dead nighthawk chicks. Results of general searches are discussed further below by groups of animals.

Amphibians and Reptiles

Three species of amphibians were detected (Figure 5). The relatively common chorus frog and long-toed salamander were found as expected. A rarely observed species, the tailed frog, was found under a rock in upper Charley Creek. The Columbia spotted frog was not detected with these surveys, but its presence is well documented on the forest. Although there were rumors of tiger salamanders in several areas, the evidence suggests that these were in fact long-toed salamanders. None of these questionable salamanders were within the survey plots.

Long-Toed Salamander

Tailed Frog

Thirty-five reptiles were noted on 15 different plots (Table 2 and Figure 5). Western fence lizards were detected on 11 plots. Other reptile species more rarely seen included: gophersnake, rattlesnake, garter snake, racer, rubber boa, sagebrush lizard, and southern alligator lizard. The southern alligator lizard was noted as a first for the forest, but was not confirmed by capture or photograph. Not detected on plots were: western skink, painted turtle, and striped whipsnake.

Landbirds

Birds made up the largest group, with 2,493 plot occurrences and 106 different species. Roughly 90 of the bird species expected on the forest were not detected with these surveys. One birder (Mike Denny) performed all of the bird surveys except for the Granite – Desolation survey. He detected 101 bird species over 4 seasons and in four distinct watersheds with a broad range of habitats. About 47% of the species plot occurrences were detected 'by ear' (Figure 6). Birds of prey were seen infrequently, but the following were reported on or near plots: 1 osprey, 7 red-tailed hawks, 2 turkey vultures, 2 prairie falcons, 6 northern goshawks, 6 Cooper's hawks, and 3 sharp-shinned hawks.

Western Tanager

Nocturnal Birds

Nocturnal bird surveys were not completed, however a few owls were detected. Three plots had great gray owls; one detection was visual, one was heard, and one was based on a pellet. A family of 6 long-eared owls was seen, 1 northern pygmy owl was heard, and 1 barred owl feather was found.

A flammulated owl survey was completed via line transects at 3 locations. This survey was not specifically tied to any CVS points, but was done within the Wall – Lower John Day River watershed where CVS surveys were ongoing. Flammulated owls were heard on all three routes, with a total of 50 owls detected (Denny and Harris 2006).

Mammals

Thirty-three species of mammals were recorded. The majority of mammal occurrences (64%) were based on observations of sign such as tracks or scat (Figure 7). Elk and deer were most commonly recorded when pellets and tracks were observed. Coyote and bear scat was also readily recognized. Other sign included antler rubs, squirrel and pack rat middens, torn up logs, gopher and mole burrows, and ground squirrel mounds.

Very few mammal species were observed visually. Squirrels and chipmunks were the most commonly seen and heard mammal. Other mammal detections by ear included one elk, one coyote, one bat, and 2 bears.

Most captures in Sherman live traps were of voles, mice, and chipmunks, and accounted for 20% of all mammals recorded.

Pitfall traps were generally not completed 2003-2006. A few pitfalls established in 2005 on the NFJD district but resulted in no captures.

Forty-four sooted track plates were placed on the Walla Walla Ranger District. Four of the 44 were at CVS plots, but most were placed in other areas. No target species were detected in the CVS plots. Five target species were detected in other areas: marten, coyote, bear, skunk, and bobcat. We also picked up tracks of flying squirrel and several other rodents.

Boxed track plate

Discussion

This project was modeled after early draft versions of the Multiple Species Inventory and Monitoring guide (MSIM) (Manley et al. 2006), with similar objectives and strategy. The MSIM is intended to serve as a consistent and efficient method for obtaining basic presence/absence data and associated habitat condition data for a large number of individual species at sites that represent a probabilistic sample.

The MSIM guide provides analysis methods to determine the number of locations each species is detected, whether you have enough data to estimate detection probabilities, and if your point samples can represent other areas of the forest.

Manley (2004) determined that by using the MSIM protocol, a majority species would be adequately detected except for rare species and species of concern. MSIM has 3 key differences from our Terrestrial Wildlife Inventory project: the use of animal sign, funding levels, and the intensity of surveys.

1. Use of animal sign

In our surveys, 23% (873) of all plot occurrences were based on sign. Some of these are more reliable than others. For example, coyote, bear, and elk scat is relatively easy to identify. On the other hand, a vast majority of our bear detections are based on torn up logs. There is some question as to how recent the sign is, and does it matter? These records are easy to weed out of the data because they were marked as sign to be consistent with the Fauna database.

The MSIM guide does not include using 'sign' as evidence of species presence; nor does it recommend an area search for mammals. Visual records of mammals are collected as incidental detections during other surveys and as visual encounters at aquatic site surveys. In the Tahoe project, such detections of mammals at bird point count surveys included: deer, bear, coyote, ground squirrel, marmot, pika, and Douglas squirrel. Presumably the use of sign was discussed at some point for the MSIM, and a decision was made to keep it clean by requiring visual observation, capture, photo, or tracks on a track plate for that species to be considered 'detected'. However, Roth et al (2004) recommends including gopher and mole sign because they were frequently present but not detected by trapping.

2. Funding levels

Assuming Roth's costs are additive, the total estimated cost for the Tahoe Basin survey was $370,000 for the first year (Table 3). These figures represent maximum costs; including personnel, per diem, oversight, office space, housing, vehicles, and first year supplies (traps, cameras, etc). We expected to complete a similar number of survey points (30) each year, however our budget was much smaller and therefore our sampling was much less intensive.

3. Intensity of surveys

The MSIM design expects to provide a way for each Forest Service Region to monitor populations and habitats of hundreds of species, including many species of concern. It provides a means to determine species richness, proportion of points occupied by a species,

and probabilities of detection. The MSIM guide calls for much more intensive sampling than ours, hence our survey data is not nearly as statistically robust.

To complete the 6 core group surveys at 33 sites in one season, the MSIM guide suggests that a staff of 8 to 10 people would be required from April through August. The core surveys are birds, owls, small mammals (live traps), midsize mammals (track plates), amphibians and reptiles, and habitat. If additional surveys are planned, such as for bats or aquatic sites, 2 to 4 more people would be required.

Since the MSIM procedures are based on a regional effort, the costs are spread between forests. The MSIM guide recommends that each region of the Forest Service complete the 6 core surveys. Each selected Forest would complete 50% of the plots on that forest. For example, if a forest has 200 FIA points, 100 MSIM survey sites would be completed within 3 years. In addition to core requirements, surveys for bats, aquatic-associated vertebrates, plants, and other specific species of interest would be placed strategically on some forests.

The MSIM guide was implemented in the Tahoe Basin in 2002 (Roth et al 2004). Three of the six core group surveys were completed on 40 sites: live trapping, bird point counts, and habitat surveys (Table 3). Two core surveys were completed on a subset of these points (track plates and pit traps for amphibians and reptiles). Bat mist netting, a secondary survey, was also completed at a subset of the 40 FIA points.

Non core surveys were also completed at 46 aquatic sites for aquatic birds, amphibians and reptiles, and habitat. They hope to complete 3 years of surveys by 2006.

Table 3. MSIM survey design used in Tahoe Basin.

Taxonomic group	MSIM priority	Number of sites	Survey method	Number of visits	Cost per site	Total cost
Landbird	Core	40	6 point counts visual / audio	2 visits	1100	44000
Small Mammals trapping	Core	40	103 traps per site	3 trap nights, checking twice per day	1700	68000
Medium/large Mammals	Core	22	6 track plates and 4 cameras	10 days, 4-5 visits	2980	65560
Amphibians/Reptiles	Core	9	12 pits and 6 cover boards	60 days, checking every 3-4 days, avg. 17 visits	1000	9000
Habitat & plants	Core	40	Several inventory methods tried		1325	53000
Bats	Primary	22	3 mist nets 2 acoustic surveys	2 visits	4600	101200
Aquatic vertebrates (birds, fish, reptiles, amphibians)	Primary	46	visual surveys of lentic sites, netting, snorkeling	2 visits	650	29900
total						$370,660

Land Birds

Their analysis suggests that 3 visits to 7 point count stations at each FIA survey point were required to detect 84% of the bird assemblage; therefore the repeat visits are recommended. They detected 44% of the 217 bird species possible or 98 species. Only 10% of 60 bird species associated with aquatic habitats were detected using the point count survey.

During the aquatic visual encounter surveys, 20 bird species were detected, 14 of which are aquatic associated. Species richness was higher at lakes. They recommend point count bird surveys at lentic sites, rather than the strictly visual encounter survey for aquatic associated birds.

Owls were not specifically surveyed because of other ongoing owl monitoring. They also recognized that many other raptors were missed because broadcast calling is not part of the survey.

We detected fewer bird species each year (70-80 species) with single visits, but the 4 year total is comparable to the first year of the Tahoe effort at 106 species.

Amphibians and Reptiles

The aquatic based visual encounter surveys at 46 lentic sites provided a highly representative sample of aquatic herpetofauna in the Tahoe survey. They detected 4 amphibian and 6 reptile species. Where second visits were made, additional species were frequently added, so they recommend at least 2 survey visits per site.

Pitfall traps and cover boards were also used but only five herpetofauna species were found. They recommend eliminating the pit trapping and using area searches instead, because only two lizard species were detected uniquely by pit trapping. A total of 22 individuals were found at 9 points by pit trapping and this resulted in low probabilities of detection.

Our surveys yielded the same number of species (11), but again their more intensive efforts yielded more individuals observed.

Small Mammals

Our live trapping detected 39% of all small mammal species expected on the Umatilla National Forest (11 of 28 species). However a total of 68% of all small mammal species expected were detected by live trapping, visual observations, sound observations, and sign. Our trapping consisted of 22 traps per site left out for one night and checked in the morning.

The Tahoe survey used 103 Sherman live traps per site, which were checked twice per day for 5 days. Live trapping detected 79% of all small mammal species potentially occurring in the area (18 of 23 species). Based on their results, they recommend reducing the number of traps from 103 to 79, but adding an additional night. Only 16 species were detected sufficiently across the 40 monitoring points to estimate proportion of points occupied.

Pit trapping is not a core survey in the MSIM guide because of high animal mortality (namely shrews), but is optional. After trying out this method, Roth (2004) determined that

it was too labor intensive. The mountain pocket gopher was the only mammal detected uniquely by pit trapping. Other species found in pits included ground squirrels, chipmunks, voles, mice, and shrews. Thirty individuals died, of which 17 were shrews.

Several mammals were also detected during the aquatic site visual encounter survey: long-tailed weasel, broad-footed mole, white-footed mouse, and pika.

Medium and Large mammals

Detections of target species in the Tahoe Basin were made at 16 of the 22 survey sites, with marten being the most common species. Track plates detected 5 target species: marten, coyote, raccoon, black bear, and spotted skunk. Cameras detected 4 target species: marten, coyote, bear, and skunk. The following were not detected: bobcat, mountain lion, ermine, and long-tailed weasel. Conducting this survey at more sites would probably result in detections of some of these missed species. Three stations appeared to be the most efficient effort level when cameras and track plates were paired at each survey site.

Our track plate surveys also detected 5 target species: marten, coyote, bear, skunk, and bobcat. We also picked up tracks of flying squirrel and several other rodents.

Bats
Mist nets detected 9 species of bats, and acoustic equipment detected 8 of the same species.

Evaluation and Recommendations

The objectives of the Umatilla TWI project are repeated here with an evaluation as to how well they were met.

Objective	Accomplishment
Provide a standardized process to inventory terrestrial wildlife species across a large area.	Completed and implemented the Umatilla Terrestrial Wildlife Inventory (TWI) protocol.
Conduct terrestrial wildlife surveys across the Forest for a wide variety of species.	Completed 43% of Umatilla sites.
Provide evidence of the presence and relative distribution of management indicator species (MIS) and sensitive species.	**MIS**: presence was documented for elk, pileated woodpecker, northern three-toed woodpecker, and 12 other primary cavity excavators; no detections were made of downy woodpecker and pine marten. **Sensitive**: Of the currently listed 12 species, only one was detected. The gray flycatcher was found on 4 different plots.
Populate the NRIS-FAUNA database.	Data not yet transferred.
Repeat surveys every 10 years to establish trends and assess changes in species occurrence, composition, distribution, and habitat condition.	Yet to be determined.
Integrate the TWI data with Current Vegetative Survey (CVS) data and identify habitat relationships for species on the Forest.	Data not yet combined.

The TWI protocol is not intended nor designed to obtain population data, determine absence, or detect all species that could occur on the site. The goal of the TWI project was to confirm the presence of species assumed to be on the forest and provide distribution information. This information is valuable when evaluating broad scale trends and project level effects.

The TWI project has not provided enough data on the presence and distribution of most management indicator species and sensitive species. The MSIM guide also recognizes this insufficiency and recommends additional surveys designed to key in on those species.

It is clear that it is not feasible to get all of the Umatilla Forest plots surveyed in a 5 year period as hoped. The goal was to complete all 630 CVS plots in 5 years. At our current funding level and completion rates, it will take closer to 10 years. To complete all plots within 5 years, three to four 2-person crews would have had to have been working for all 5 years at a cost of about $70,000 per year. Our funding allowed us to hire only one or two crews per year.

After a review of the data, funding availability, accomplishments and challenges, as well as the comparison of this project to the national Multiple Species Inventory and Monitoring protocol (Manley et al. 2006), I recommend that the Terrestrial Wildlife Inventory be discontinued at this time. Current funding does not allow sufficient information to be collected. As the MSIM guide suggests, collaboration among the forests in the Region is key because of limited funds and staff.

I believe our limited forest funding would be better spent on surveys for specific species that play a greater role in the way we manage the national forest. A new emphasis on focal species is emerging in the revision of our forest plan. We know very little about many of these species because they are rare and/or hard to detect. The Terrestrial Wildlife Inventory is missing most of these species. Future funding would be well spent surveying for species that are at high risk of habitat loss in the managed forest, such as northern goshawk, owls, woodpeckers, marten and lynx.

The number of species recorded is impressive and all those who worked on this project should be commended. A number of challenges were overcome to the best of our abilities. The baseline data we have collected thus far can be used in ongoing and future evaluations of species presence and habitat use. Some or all of the data can be migrated into the FAUNA database and thus retained in the national repository of wildlife observations. I am unclear whether it would be useful to tie the TWI data to the CVS vegetation data. Further data analysis could be done as suggested in the MSIM guide, such as proportion of all plots occupied by a species, probability of presence, and detection probabilities.

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