Wildlife Monitoring for the Collaborative Forest Restoration Program

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WILDLIFE MONITORING FOR THE COLLABORATIVE FOREST RESTORATION PROGRAM

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Introduction

Wildlife responds to changes in the natural landscape. Changes resulting from restoration treatments on Collaborative Forest Restoration Program (CFRP) projects may improve habitats for some species and degrade habitats for others, causing changes in the composition and abundance of wildlife on the treated site. Monitoring can help determine how forest treatments affect wildlife by determining if diversity or abundance of species increases or decreases following a treatment, and if wildlife species benefit from or are adversely affected by these treatments. This information can then be used to improve forest restoration techniques to better support wildlife communities.

This handbook provides information and protocols for monitoring the following species or species groups: birds, red squirrels, butterflies, mule deer, elk, wild turkey and other wildlife that are detectable by sign (such as Abert's squirrel, bear and coyote). While other species may also be good indicators of environmental change, these species were chosen because they are relatively easy to monitor, are typically sensitive to change or respond rapidly to change, and are applicable across the state.

These methods are designed for use by CFRP grant recipients, collaborators, contractors, or community groups involved with multiparty monitoring. Because these methods were developed to be practical for use by a wide range of people with varying expertise, they have been simplified from the rigor normally required for more in-depth scientific research. Despite this simplification, this monitoring can yield reliable information, useful for collaborative learning and adaptive management.

Wildlife indicators are animals that often respond quickly to restoration efforts and show if these efforts have been successful at improving wildlife abundance or diversity

This document offers a number of wildlife monitoring methods that enable each project to customize their monitoring efforts to suit their goals, available resources and conditions. These protocols may be used separately or together as a set. The greater the number of species included in monitoring, the greater our understanding of effects on the entire wildlife community. To determine which wildlife species to monitor, each project should examine the local wildlife community and evaluate available monitoring resources as well as local wildlife concerns or issues.

Section 1. Designing a Wildlife Monitoring Program

A wildlife monitoring plan must be developed with a project's multiparty stakeholder team prior to restoration treatments and preferably during the proposal development stage. Projects with wildlife monitoring should include a person with wildlife monitoring expertise, such as a wildlife biologist or agency representative. The wildlife monitoring plan should be developed in conjunction with other ecological monitoring efforts as well as socioeconomic monitoring to increase efficiency and avoid conflicts.

In general, monitoring several wildlife species will provide a better understanding of restoration treatments on the entire wildlife community. When possible, the methods in this handbook have been designed so that data collection can be combined so as to reduce the number of trips necessary to the field and to allow a greater number of species to be monitored for a given project.

Pre-treatment or baseline *data provide critical information about the conditions in an area* before *a project begins and allow comparisons after project completion*

It is very important to begin monitoring before any treatment occurs in order to establish the baseline conditions at a project site. The baseline data on species composition and abundance in the untreated forest are critical to understanding the effects of forest restoration. Long-term (15+ years) monitoring is necessary to really show wildlife responses to restoration. Baseline data and short-term monitoring conducted during the 3-4 years of a CFRP project will offer some insights on immediate changes and set a strong foundation for long-term monitoring should it become possible.

During the planning stage, it is important to identify the number and boundaries of treatment areas (also called management units) in order to accurately plan the monitoring effort and budget required.

Choosing Which Species or Species Groups to Monitor

Monitoring birds and butterflies provides important ecological information about forest restoration treatments so should be a priority in monitoring efforts

One of the first steps in designing a wildlife monitoring plan will be to select which wildlife indicators to monitor. Some wildlife species, such as birds and butterflies, are particularly useful in indicating changes in forest conditions, such as the amount of light or temperature. For example, the number of butterflies should increase with greater numbers of flowering plants and openings that could result from a restoration treatment. Other species, such as red and Abert's squirrels can indicate changes in forest structure. Monitoring of other species, such as turkey or deer and elk can indicate whether forest restoration changes are desirable for these culturally important species. For more information on monitoring each species, please refer to the monitoring protocols for each species in Section 2.

In selecting wildlife indicators to monitor, your multiparty team should consider the forest type, the restoration treatment, and if there are any species of concern (Table 1). Species of concern are animals that are declining in numbers and may require special conservation or attention during restoration. For more information on current species of concern and monitoring methods for them, please consult with the applicable land management agency for your project and with the New Mexico Department of Game and Fish Conservation Services Division.

Feasibility and timing of monitoring each species should be considered when developing the monitoring plan (see below). If you plan to only monitor one or two species or species groups, we recommend selecting birds and butterflies, as these indicators are most sensitive to forest restoration changes, and monitoring these groups provides information about species diversity as well as abundance of any single species. If you are working in mixed conifer forests, we also recommend selecting the red squirrel, which can be monitored at the same time as birds and may be adversely affected by thinning treatments.

Table 1. Wildlife Indicators by Forest Type

	Ponderosa Pine	Piñon-Juniper	Mixed Conifer	Bosque
Butterflies	X	X	X	X
Birds	X	X	X	X
Red squirrel			X	
Abert's squirrel	X			
Turkey	X	X	X	X
Deer/Elk	X	X	X	X
General Wildlife	X	X	X	X
Species of Concern	Northern Goshawk	Gray Vireo	Northern Goshawk & Spotted Owl	Southwestern Willow Flycatcher

Who will do the Monitoring

As with all monitoring, a person trained and experienced in wildlife monitoring should be a part of a monitoring team. There are a number of options and resources available for training or partnership in CFRP monitoring, as shown in Table 2. This team should be developed early on, preferably in the proposal development stage, of any CFRP project.

Table 2. Potential partners or resources for wildlife monitoring

Role	Potential Sources
Training in setting up monitoring plan, data collection or analysis, contractor recommendations	CFRP Technical Assistance through New Mexico Forest and Watershed Restoration Institute, wildlife biologists
Oversight of monitoring, training, field data collection and analysis	Wildlife biologists, independent contractors, land management agencies, conservation organizations, NM Department of Game and Fish
Field data collection, data entry and analysis	Local community organizations, universities, YCC crews, high schools, wildlife biologists
Conducting bird or butterfly surveys	Local chapters of Audubon Society, Wildbirds Unlimited, Natural Resource Institute
Conducting deer, elk and general wildlife surveys	Rocky Mountain Elk Foundation, National Wild Turkey Federation

Determining a Monitoring Timeline

Baseline monitoring should begin prior to any forest treatment and would ideally involve the optimal survey time periods that are recommended below (Table 3). Follow-up monitoring should not occur until the treatment is completed.[1] If follow-up monitoring begins immediately after treatment, results may not show responses to the recovering stand but may be more reflective of the disturbance.

Typically, it is important to monitor wildlife during specific time periods in order to best detect each species or species group during critical or peak periods of activity. For example, many birds are migratory and use forest habitats in the Southwest for breeding and nesting during the spring and summer months. It is critical to monitor during these months in order to collect data for these birds. Also, birds are generally more vocal hence, more detectable during the breeding season. Tables 3 and 4 outline key monitoring time periods by season and day for each species or species group. The monitoring schedule also allows time for vegetative sampling during the monthly butterfly surveys. This schedule will need to be followed prior to treatment and repeated at least one year post-treatment during CFRP project implementation.

Table 3. Optimal survey times for each species or species group.

Species Group	Optimal Survey Time	Time of Day (if applicable)
Birds	Three times from May 15 to June 30 (breeding birds) (critical) Three times from September 15 to October 30 (fall birds, also picks up migrants)	½ hour before to 4 hours after sunrise
Butterflies	A minimum of once a month from May to August	10:00 a.m. – 3:00 p.m.
Deer/Elk	Season of use (summer, fall, winter, or year-round)	
Red Squirrel	Three times in September and October	
General Wildlife Sign	Spring, summer, or fall; if done in autumn do before leaf and snow fall	

[1] Additional data collection should occur after any prescribed broadcast burning.

Table 4. Sample Monitoring Schedule for one unit in a Mixed Conifer Forest before and after treatment

Date	Indicator	Monitoring Schedule
May 15	Birds	6:00-10:00
	Butterflies	10:00-12:00
June 1	Birds	5:30-9:30
	Butterflies	10:00-12:00
June 20	Birds	5:30-9:30
	Butterflies	10:00-12:00
July 20	Butterflies	10:00-12:00
August 20	Butterflies	10:00-12:00
September 20	Birds	7:00-10:00
	Red Squirrels	7:00-10:00 (with birds)
	General Wildlife Sign	10:00-12:00
October 12	Birds	7:00-10:00
	Red Squirrels	7:00-10:00 (with birds)
October 30	Birds	7:00-10:00
	Red Squirrels	7:00-10:00

Developing a Monitoring Budget

Ideally, you should develop a monitoring budget that includes which wildlife species or species groups will be monitored during the proposal development stage. If wildlife indicators are added after a project has been funded, a budget revision may be needed to cover all monitoring expenses. Wildlife monitoring budgets should include:

- Time for coordination and planning with collaborators, including multiparty meetings (a minimum of 2 meetings and 1 planning day)
- Time and costs for wildlife monitoring training, including time and travel to attend trainings and fees for attending workshops
- Time and travel to and from the field site for collecting monitoring data. The number of trips required will depend on the actual species or groups to be monitored, but will require a minimum of 4 hours (for wildlife sign search) and more likely 6 or more days (for birds, butterflies, and red squirrel)
- Time required for field surveys (see Table 5)
- Time and resources for data entry, analysis, interpretation, and report writing (generally 50-75% of the time necessary to collect field data).
- Time and travel for a final multiparty meeting to discuss and potentially revise the monitoring report.

To help with this planning, Table 5 provides estimates of the effort involved in conducting the field surveys.

Table 5. Estimated field effort (does not include travel time to and from the site) required to monitor each species or species group per 100 acre management unit.

Species Group	Recommended Sample size per 100 acre unit	Hours per person	Sampling Frequency	Total Survey Time (hrs) per year
Birds Spring	10 points	4 hrs. per 10 points	3 visits per field season (i.e., 30 points)	12
Birds Fall	10 points	4 hrs. per 10 points	3 visits per field season (i.e., 30 points)	12
Butterflies	10 transects	2 hrs. per 10 transects (depends on abundance of butterflies)	5 visits	10
Deer/Elk	5 transects	5-10 hrs. per 5 transects (depends on abundance of pellets and number of people)	1 visit per year minimum	5-10
Red Squirrels	10 points	4 hrs. per 10 points	3 visits per year (i.e., 30 points)	12 (can be done concurrently with bird survey with no additional time)
Wildlife Sign	2 search hours	2 hrs.	1 visit per year	2 hours

Special Considerations in Monitoring Design

Small or narrow treatment areas may have more edge effects *from boundaries that will influence wildlife behavior and monitoring data*

Sampling varies by species groups. Some species require repeated field visits in a season. In general, we recommend sample sizes of either 10 points for birds (repeated 3 times per season), 10 transects for butterflies (repeated 5 times per season) or 5 transects for deer and elk for every 100 acres of project area (Table 5). Some projects may be less than 100 acres or long and narrow in shape. In these cases, there will be potential for *edge effects* to impact monitoring data. Edges are boundaries in a forest, such as where a road, project boundary, or change in habitat type exists (such as an edge between meadow and forest, ponderosa pine and mixed conifer forests, or thinned and unthinned areas). These edges tend to have greater sun and wind exposure and greater habitat diversity. Some species concentrate at edges, while others avoid such edges. For example, many butterflies will seek out edges for the sunlight they provide, while some birds that prefer closed canopy, such as brown creepers, will avoid these edges, and may leave a small treated project area with many edges. For these reasons, in small or narrow project areas, we recommend that as many points and transects be located within the project area as possible (to reach the minimum target), as long as these sampling areas are located at least 300 feet from any edge or boundary (Figure 1).

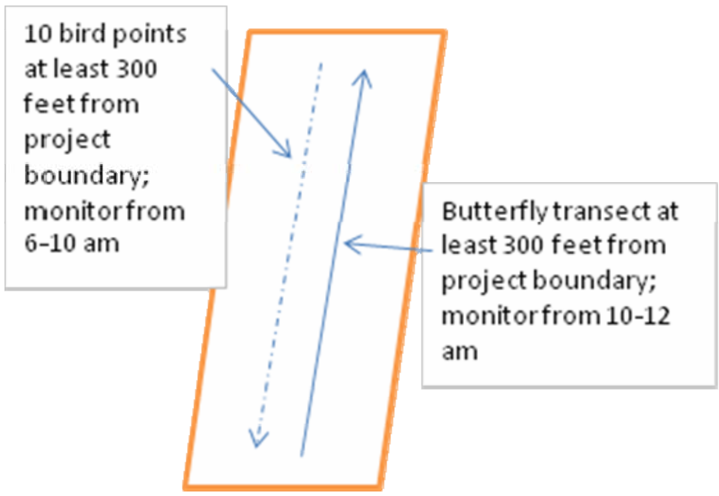

Figure 1. Sample monitoring design for narrow project areas

Projects that occur in areas of less than 50 acres are not good candidates for wildlife monitoring; the edge effects are so great that it is difficult to detect the effects of the treatment itself. This must be taken into consideration when developing a monitoring plan.

Wildlife monitoring typically requires repeated visits to the field during the season(s) of monitoring. For example, birds must be monitored 3 times in the breeding season and 3 times in the fall.

Many times, treatment begins during the first full breeding season or in the first fall of a CFRP project. This timing may not allow a complete survey of wildlife indicators. For example, if a CFRP project begins in August, and treatment begins in October, there would not be time to collect baseline data for any of the breeding season or some of the fall bird surveys. In these cases, we recommend installing a control adjacent to the project area where a complete survey can take place.

A control site is an area that is similar to the project area but where no project activities take place

A control site is an area similar to the project site but where no project activities occur. Control sites should be chosen to reflect as closely as possible the sites that will be treated. Data from control sites help show changes that result from outside influences, and in this case, also serve as a proxy for incomplete pre-treatment data. Data in the control area should be collected in the exact same way as data collected within the project area, both before and after treatment. Post-treatment data should also be collected in the project area, even if pre-treatment data were not completely collected.

Data Analysis and Reporting

Data analysis is an essential, but frequently neglected, component of monitoring. **The time and money spent in field data collection will be wasted without adequate data analysis**

and reporting. Reports should include maps and GPS coordinates of the project area, ideally with sketches of transect or point locations for each of the wildlife indicators. Make sure to budget for data entry, analysis, interpretation, and reporting. Some tools to help with data entry and analysis include:

- Cybertracker, a free software program that can be used with a hand-held device to directly enter data into a computer in the field (see Appendix B),
- CFRP wildlife monitoring spreadsheets for data entry and analysis (downloadable at www.nmfwri.org/collaborative-forest-restoration-program), and
- Free technical assistance for data entry, analysis and reporting (go to www.nmfwri.org/collaborative-forest-restoration-program for contact information).
- Data entry and analysis tutorials are available at www.nmfwri.org/collaborative-forest-restoration-program

Section 2. Wildlife Monitoring Protocols

Bird Diversity and Relative Abundance

Birds are a good ecological indicator of the effects of forest treatments because:

1. Most bird species occupy a well-defined habitat niche; their use or non-use of an area can offer information regarding changes in available resources.
2. They are fairly mobile and can respond quickly to changes in resource availability and serve as a relatively rapid indicator of change.
3. A single bird survey includes multiple species simultaneously and provides information on species diversity as well as overall abundance.

> ***Birds***
>
> —
>
> *Use in any ecosystem*
>
> —
>
> *Sample before, after, and every 3-5 years after*
>
> —
>
> *Sample 3x from May 15-June 30 and 3x from Sept 15 to Oct 30*
>
> —
>
> *Survey between ½ hour before to 4 hours after sunrise*
>
> —
>
> *Sample a minimum of 10 points per visit*
>
> —
>
> *Use data sheet A*

Many birds eat insects and thus help to control insect populations or outbreaks. Some bird species also disseminate plant seeds and can play an important role in forest recovery after treatment.

Training of monitoring personnel
Birds can be difficult to identify. Anyone conducting bird surveys should be skilled in bird identification by sight, call and song. Training should focus on identification of the birds expected to occur in the area to be monitored. Training should address bird identification by both sight and sound, sampling methods, field methods for bird monitoring and methods of recording data.

If possible, the same observers should conduct each survey. This will improve the consistency of data collected.

Materials needed
Binoculars, watch, bird identification guide (see Appendix A), portable playback devise with bird songs (optional), paper data forms (see Appendix D) or handheld computer.

Monitoring protocol
Birds are monitored by recording all birds seen or heard for a specific time period at specific points within a project area. This is called a point count and can provide information on the relative abundance of specific species as well as overall composition of birds in a project area.

Bird surveys should be conducted in each management unit three times per season: between May 15 and June 30 for breeding birds and between September 15 and October 30 for a fall survey. Each survey should be conducted between ½ hour before sunrise and completed no later than 4 hours after sunrise. This is the optimal activity time for most birds. Surveys should not be conducted if it is raining or if the wind is strong enough to keep the leaves and twigs of trees in constant motion (8-12 mph) or if other conditions occur which hinder the observers hearing or bird activity (e.g., chainsaw or excessive human activity).

The recommended sample size varies with different unit sizes. A minimum of 10 points should be surveyed. This number is appropriate for a unit approximately 100 acres in size; sample sizes would ideally be determined with that ratio (10 points: 100 acres). However, if budget or time is limited, a target sample size of 10 points can be used regardless of unit size. It is more important that the site be visited 3 times per season than more than 10 points be added.

It is valuable to have a reconnaissance birding day in the area prior to the initial survey. This enables the observers to become familiar with local birds so sampling time can be focused on counting birds rather than on determining species identification. This is particularly important if novice birders are conducting the survey.

Point Sampling Method
A point is a place where an observer stops to record the presence of birds. Points are established by the following method:

- Prior to entering the field, plan a general route for the survey that will meet the following three conditions:

    1. placement of 10 survey points separated by a 5 minute walk (approximately 300-375 yards);
    2. points are set a minimum of 300 feet from the unit perimeter; and
    3. points are well distributed throughout the unit (Figure 2).

    This route may be circular, linear or irregular depending on the shape of the unit and providing the above three requirements are met (Figure 2). Points are randomly located within the walk and are not re-visited in the same field season.

- When entering a unit, follow the planned route and move to the interior of the unit, approximately 300 feet, and establish the first point.

- Set each following point by walking for 5 minutes, generally along the planned survey route. If the unit is too small to set a minimum of 10 points 5 minutes apart, the distance between points can be reduced by a one minute walk but not less.

- Upon arriving at each counting point, one trained observer will identify all different individuals of bird species seen or heard within a period of 10 minutes. A portable playback device can be used to aid in call and song identification. It should not be used to "call in" or attract birds during the survey. Care should be taken to avoid recording the same bird more than once. Birds outside the management unit should *not* be recorded. Other people may be present to record data, keep time or learn the procedure, but for the sake of consistency, should not contribute to the bird counting.

Birds whose specific identification is unknown may be recorded as specifically as possible (e.g. raptor species, warbler species, passerine species) or simply recorded as unknown. Those birds can be included in the Overall Abundance summary but not the Species Richness or Species Composition summaries, unless no other related species exists (e.g. no other raptor species was included in the survey).

- The starting point for each subsequent survey should vary to allow more complete coverage of the unit and to vary the time that each area is sampled (Figure 2). Birds tend to be more vocal in the early part of the morning.

Paper data should be copied after returning from the field and electronic data transferred to a computer.

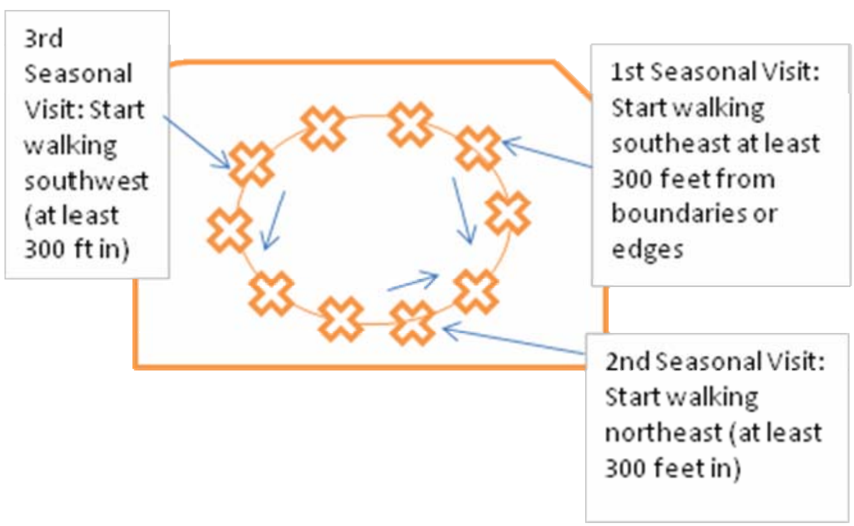

Figure 2. Example of sampling within a single unit, showing 10 points with different starting location and direction of walking with each seasonal visit. Note that sampling points should not be exactly the same each time, but should follow this general pattern. The arrangement of these points will vary by size and shape of each unit.

Analysis
You will generate three types of data from your bird surveys:

1. Species richness: the total number of different species observed
2. Species composition: the average number of individuals of each species per point
3. Overall abundance: the average number of birds of all species observed per point

For example, to calculate species richness if you had at total of 4 mountain chickadees, 2 white-breasted nuthatches, 1 brown creeper, 1 hairy woodpecker, 2 flickers, and 3 western bluebirds, and 1 yellow-rumped warbler, you would have a species richness of:

mountain chickadee + white-breasted nuthatch + brown creeper + hairy woodpecker + Northern flicker + western bluebird + yellow-rumped warbler = 7.

To calculate species composition for each of these species, you would total the number counted at each point and divide by the total number of points sampled. Using the above example, let's say you sampled a total of 10 points. Your species abundance for mountain chickadees would be 4 divided by 10 or 0.4 birds per point.

To calculate the overall abundance, you would add the total number of all birds counted and divide by the total number of points sampled for an overall abundance. In this example, you would add 4+2+1+1+2+3+1 = 14 birds sampled. Then divide 14 by the total number of points sampled (10), for an overall abundance of 1.4 birds per point.

For more assistance with data entry and analysis, consult the NMFWRI website for the CFRP Wildlife Monitoring Tutorial at www.nmfwri.org/collaborative-forest-restoration-program.

Interpretation

In general, you should expect an increase in the number of native birds that were historically found in the particular forest type in the years after forest restoration. However, it is expected that within a few years after forest treatment, species abundance and composition will likely yield results that are more reflective of the disturbance and creation of more open habitat than of the longer term restored conditions of the stand. Species that prefer open forest structure (e.g., western bluebird) will be the first to move into a restored forest, while species that prefer a more closed canopy (e.g., brown creeper) may take many years to return. Results in these early years following treatment should be examined in this context. You may also need to pay attention to the abundance of exotic or invading birds that may enter a stand after treatment, such as the brown-headed cowbird, a brood parasite which favors open areas and edges and is detrimental to other native bird species.

Red Squirrel Abundance

Red Squirrel

—

Use in mixed conifer forests

—

Sample before, after, and every 3-5 years after

—

Sample 3x in the fall (at the same time as bird surveys)

—

Sample 10 points per 100 acres

—

Use data sheet B

Red squirrels (*Tamiasciurus hudsonicus*) are found in mixed conifer and spruce-fir forests throughout New Mexico. Red squirrels play an important role in forest ecology and restoration:

- They disseminate conifer seeds and many key forest fungi;
- They are food for forest raptors and other predators and rely on clumps of trees for cover from these predators;
- They have specific habitat requirements in terms of tree age, abundance and spacing and so are sensitive to changes in forest structure; and
- They represent a guild of species that may be similarly affected by changes in forest structure and canopy reduction.

For these reasons, red squirrels are excellent indicators of changes as a result of forest treatment. Red squirrels require a forest structure that provides (i) large areas of closed canopy, (ii) specific temperature and moisture conditions associated with closed canopies; and (iii) large trees that produce an abundant cone crop. Because most forest restoration treatments involve thinning, red squirrels may not always favor thinned forests if thinning does not retain their needed habitat structure.

Red squirrels are fairly easy to monitor and can be monitored concurrently with fall bird surveys with little additional effort. Either red squirrels (in mixed conifer) or Abert's squirrels (in ponderosa pine) also can be surveyed at the same time as other species during a Wildlife Sign Search (see page 22)[2].

Training of Monitoring Personnel

Training should focus on identification of red squirrels by sight and sound. Red squirrel vocalizations are easy to detect and identify, even for people with limited training.

[2] A method for assessing the habitat for Abert's squirrel is also available on-line at www.nmfwri.org/collaborative-forest-restoration-institute.

Materials needed
Paper data forms (Appendix D) or hand-held computer.

Monitoring protocol
A survey of red squirrels can be conducted as a part of a fall bird survey with little additional effort. This survey can only be done in the fall because red squirrels are most vocal at that time.

To add red squirrels to a fall bird survey, simply record the number of red squirrel vocal or visual observations at each bird survey point. As with birds, care must be taken to ensure that a squirrel is not counted more than once. This is typically simple as squirrels are often in different trees separated by some distance. If no fall bird survey occurs, the same sampling methods can be used to conduct a red squirrel only survey.

Paper data should be copied after returning from the field and electronic data transferred to a computer.

Analysis
You will calculate relative abundance from your squirrel surveys (or the average number of red squirrels for all points). To calculate relative abundance for squirrels, you would total the number of squirrels for all points and divide by the total number of points counted. Let's say you sampled a total of 28 squirrels over 10 points. Your relative abundance for red squirrels would be 28 divided by 10 or 2.8 squirrels per point.

Interpretation
Red squirrel populations are sensitive to changes in forest structure. If you find decreases in a population after treatment, this may be because there are fewer high quality tree clumps at a site to provide food or cover for the squirrel. If an adequate number of larger trees, and clumps of interlocking canopy maintained, squirrel abundance may remain constant. If you find significant decreases (greater than 50%) in red squirrel populations, you should discuss this with your multiparty group to determine if future treatment prescriptions should be modified to retain forest structure characteristics that favor red squirrels.

Butterfly Diversity and Relative Abundance

Like birds, butterflies are a good indicator of changes that result from forest restoration:

- Because of their mobility, butterflies can respond quickly to environmental changes and changes in available resources.
- Butterflies are directly tied to specific host plants, and these associations are often known. The presence of particular butterflies also indicates a healthy community of plants associated with that species.
- Because butterflies forage on a diversity of flowering plants, species richness and overall abundance of butterflies can indicate how the understory is responding to forest restoration.

Butterflies also are important pollinators of many plants and can facilitate the re-vegetation of treated stands. A butterfly survey can provide information on species diversity as well as individual species.

A difficulty with monitoring butterflies is that their population numbers and use in a particular area are affected by many variables beyond habitat condition, including weather, time of year, and population dynamics of predators and parasites. To minimize this variability, the timing of surveys and attention to optimal weather conditions must be consistent.

Training of monitoring personnel
This protocol offers two different methods for butterfly data collection, so that people with a range of identification skills can monitor butterflies. The simplest method involves identifying butterflies only by color and size. The second method involves identifying species to family, genus, or species when possible. More in depth training is required if species identification is desired.

Training should focus on identification of the butterflies commonly found in the area to be monitored and on distinguishing moths from butterflies. With very minimal training, anyone can identify species to color and size and obtain an indication of species diversity and overall abundance for a site.

Materials needed
Binoculars, butterfly guide (Appendix A), butterfly net, paper data sheets (Appendix D) and/or hand-held computer, list of common butterflies for the appropriate forest type (Appendix C).

Butterflies

—

Use in any ecosystem

—

Sample before, after, and every 3-5 years after

—

Sample monthly, 4-6 times between May and August

—

Survey between 10:00 am and 3:00 pm

—

Sample a minimum of 10 transects per visit

—

Sample after completing morning bird surveys

—

Use data sheet C or D

Monitoring protocol
Because the identification of butterflies can be difficult, it is acceptable to identify butterflies at two different levels of accuracy:

1. Butterflies can be identified on the basis of color (white, yellow, orange, blue, green, gray, brown, black) and relative size (small, medium, large).

2. Identification also can be to the family, subfamily or genus/species level. Identification to the species level provides the best information and should be done whenever possible. It is most likely that some combination of the above levels will be possible because some butterflies are easier to identify than others.

Butterflies should be sampled between 4 and 6 times between May and August and surveys should be evenly spread during that time period (e.g., one sample per month). Surveys should only occur on sunny, calm days between 10 am and 3 pm when winds are calm to mild and temperatures are above 70 degrees. Cloud cover, precipitation, cold and wind discourages butterfly activity. If weather conditions change during a field visit, butterflies should not be surveyed, as the data will be invalid.

Butterflies will be sampled along transects that are 300 feet in length. Transects should be located at least 150 feet away from any boundaries. A minimum of 10 transects should be established in each unit; more is preferable in units larger than 100 acres. Transects should be placed at least 300 feet apart to avoid duplicate counts. Transects can be established prior to fieldwork in a random manner or they can be established in the field along a route that best covers the unit area (Figure 3). Transects need not be fixed locations; they can vary with each repeat sampling.

At each transect, a trained observer should walk at a steady pace, scanning the area within 30 feet on both sides of the midline, focusing on butterflies alone. *It is important to walk at a consistent pace along all transects to ensure comparable data per each transect*. Observed butterflies should be recorded either to size and color (level 1) or to family or species (level 2). Care must be taken to correctly differentiate between moths and butterflies. Small or medium sized white, brown or gray moths are abundant in many forests and can be easily confused with hairstreaks, elfins, skippers, etc.[3]

Many butterflies can be identified with the use of binoculars or the naked eye; this is preferable to catching them if at all possible. A net can be used to catch butterflies of questionable identity. Butterflies should be carefully handled or placed in a glass container, identified, and promptly released, but none should be killed or collected. Photographs can be taken for later identification; photograph both the top and underside of wings if possible. Appendix C provides a list of common New Mexico butterflies by forest type.

In surveys attempting to identify butterflies to the family/species level and when specific identification is unknown, butterflies should be recorded as specifically as possible (e.g. hairstreak species, fritillary species) or simply recorded as unknown. Those butterflies can be included in the Overall Abundance summary but not the Species Richness summary unless no other related species exists (e.g. no other hairstreak species were included in the survey).

[3] The most obvious difference is in the feelers, or antennae. Most butterflies have thin slender filamentous antennae which are club shaped at the end. Moths, on the other hand, often have comb-like or feathery antennae, or filamentous and un-clubbed.

Paper data should be copied after returning from the field and electronic data transferred to a computer.

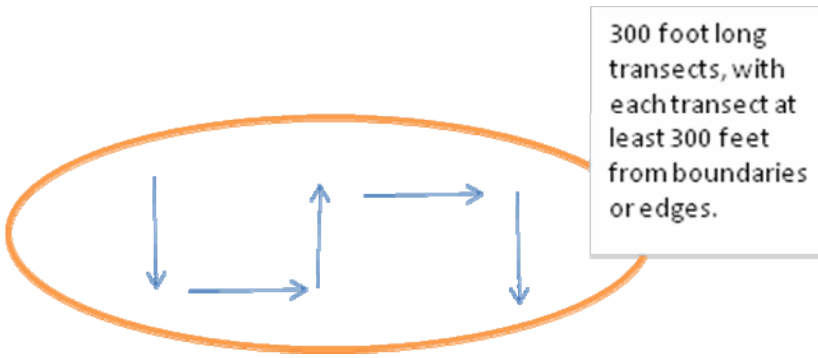

Figure 3. Sample arrangement of butterfly monitoring transects.

Analysis
You will generate three types of data from your butterfly surveys:

1. Species richness: the total number of different species observed
2. Species composition: the average number of individuals of each species per transect
3. Overall abundance: the average number of individuals observed per transect

For example, to calculate the species richness: if you had 2 cabbage whites, 1 monarch, 1 Arizona sister, 1 western pine elfin, 2 clouded sulphurs, and 1 common checkered skipper, you would add:

> Cabbage white + monarch + Arizona sister + western pine elfin + clouded sulphur + common checkered skipper = 6.

To calculate species abundance for each of these species, you would total the number of a single species counted for all transects and divide by the total number of transects sampled. Using the above example, let's say you sampled a total of 10 transects. Your average species abundance for cabbage whites would be 2 divided by 10 or 0.2 per transect.

To calculate the overall abundance, you would take the total number of all butterflies counted (in this case 8), and divide by the total number of transects sampled (in this case, 10), for an overall abundance of 0.8 per transect.

If you collect butterfly data by size and color only, you can also calculate richness and overall abundance.

For richness, if you had 2 small whites, 1 large white, 1 large orange, 2 small yellows, and 1 medium blue, you would add small white + large white +large orange + small yellow + medium blue = 5.

To calculate overall abundance, you would take the total number of all butterflies counted (in this case, 7), and divide by the total number of transects (in this case, 10), to get 0.7 per transect.

Interpretation

Butterflies are expected to respond positively to forest restoration efforts due to increased sunlight, warmth and herbaceous plant growth, especially flowering plants. An abundance of adult butterflies can indicate an abundance and diversity of nectar producing plants. Each butterfly species requires a particular host plant to provide food for larvae (for example, aspen is a host plant for western tiger swallowtails and Weidemeyer's admirals, while violets are host plants for the fritillaries); the presence of a particular species indicates an abundance of its host plant. The natural variability in butterfly populations, however, should be considered in data interpretation. Variation in weather patterns (wet and dry years), parasite loads, and population trends in predators may affect butterfly population trends. Because each species of butterfly emerges at a different time and may only persist as an adult for a short period of time (1-2 weeks), variation in sampling time can also have significant effects on results.

Mule Deer and Elk Population Trends

Deer and elk are considered an umbrella species: they require large areas that if protected will provide habitat for many other species as well. However, deer and elk are not the strongest indicators of ecological change because:

- They are wide-ranging and therefore not contained to smaller project areas for their resource use;
- They are generalists in their resource use and so are fairly adaptable and can do well in disturbed areas.

However, deer and elk are an important resource of public interest, and many communities are interested in monitoring these species for socio-cultural reasons. This handbook provides two methods for monitoring deer and elk; a more rigorous technique using transects, and a general wildlife sign search.

Deer and Elk

—

Use in any ecosystem

—

Sample before, after, and every 3-5 years after

—

Sample yearly, during season of use

—

Survey any time of day

—

Sample 4-6 transects per unit

—

Use data sheet E

Training of monitoring personnel
Training should include establishing transects, clearing transects, identifying pellets (scat) for mule deer and elk, field methods for pellet counting, and methods of data recording and analysis.

Materials needed
300 foot measuring tape, 2 foot long rebar stakes (4 for each transect to be established), 2 foot long PVC pipe (4 for each transect to be established), 10 foot measuring pole (1 for each person doing the monitoring count), permanent marker, hammer, flagging ribbon, GPS unit, pin flags, and paper data forms (Appendix D) or hand-held computer.

Establishment of transects
Deer and elk pellets are monitored along 300-foot long transects, as with vegetative sampling. However, separate transects need to be established in order to avoid trampling of understory vegetation and pellets, which would affect data.

Permanent transects for monitoring deer and elk populations should be established as soon as possible after the start of a project. A minimum of four, and ideally six, transects should be established in each management unit. The method for establishing these transects is the same as for creating vegetative transects:

- Starting at the edge of the management unit, walk at least 300 feet into the project area and randomly locate the first stake. Transect locations can be established prior to fieldwork in a random, yet well distributed manner and located in the field with GPS coordinates.
- Deer and elk transects should be at least 20 feet from vegetation transects.
- Record the GPS coordinates of this location, stake the location (rebar driven into the ground with a PVC pipe cover), mark the stake with the transect number and mark a nearby tree with flagging ribbon. Record visual landmarks, such as unique trees, ravines, or roads that are nearby the transect start.
- Follow a compass bearing into the project area, setting stakes at 100, 200, and 300 feet from the starting stake. Because the exact area must be relocated to survey post-treatment, it is important that transects be laid out in a straight line.
- Record the compass bearing on the data sheet.
- At 300 feet, record the GPS coordinates and mark a nearby tree with flagging.

Monitoring protocol
Deer and elk are monitored by counting the number of pellet groupings along a transect that is 20 feet wide and 300 feet long. Deer and elk pellets should be counted during the primary season of use (summer, fall, winter or year-round), and should be consistently monitored during this period both before and after treatment. **It is important to schedule pellet counts before leaf or snow fall so all pellet groups can be easily seen.**

Each transect must be cleared of pellets before collecting any data, as follows:

- Summer range: clear transects in late spring or early summer and read in the fall.
- Fall range: clear transects in summer and read in late winter.
- Winter range: clear transects in the fall and read in late spring or early summer.
- Year-round: clear transects one year (or as long as possible) prior to counting pellets.

For pellet clearing, make sure to choose an interval that can be consistently maintained throughout the life of the project.

To clear the pellets, walk within the sample area, which is 10 feet on either side of the 300-foot transect, and remove any pellets found within this area. Or alternatively, spray each pellet group with paint and leave in place to mark the group as "old." Record the date of plot clearing on the monitoring data sheet.

To conduct a pellet count:

- Temporarily mark the transect connecting end and middle stakes with a straight line. This can be done with pin flags or by laying the 300' measuring tape on the ground.
- Walk the transect, scanning for pellets in a 10' area on either side of the transect line. This is best done with two people (one on each side). The 10' distance can be measured with a 10' pole (or dowel) or estimated after some practice.
- Record each pellet group encountered and record whether it is a deer or elk pellet group. A group is a cluster of 5 or more pellets not connected to another group. If clusters of pellets are connected by scattered pellets, then count as one group unless the shape and age (level of desiccation) are clearly different. If a pellet group is on the outer edge of the transect, count the group if more than half of the pellets are within 10 feet of the center line.
- After counting a pellet group, it must be cleared (thrown out of the transect area).

Paper data should be copied after returning from the field and electronic data transferred to a computer.

Analysis
Deer and elk monitoring provides a number of pellet groups for each species. To calculate this number:

- Tally the total number of pellet groups recorded for deer and for elk for each transect.
- If pellet counts were not conducted on exactly the same day for pre- and post-treatment readings, you will divide the number of pellet groups by the number of days from clearing the plot to the pellet count. This will yield a number of pellet groups/day and will give more consistent data for comparison between pre- and post-data.

    For example, if for pre-treatment monitoring, you cleared the transects on March 20th and read the transect on July 1, you would divide the total number of pellet groups (for example, 20 pellet groups) by 102 (or the number of days between March 20 and July 1). You will have 0.2 pellet groups per day.

    For post-treatment monitoring, if you cleared on April 1 and read the transect on July 15, you would divide the number of pellet groups (15) by 106 (or the number of days between April 1 and July 15). You will have 0.14 pellet groups per day.

- Next, you will need to know the number of acres sampled:
    - Multiply the total number of transects by the total area sampled on each transect (20 feet by 300 feet = 6000 square feet). If you sampled 6 transects, you would multiply 6 times 6000 to get 36,000.
    - To convert to the area sampled to the acreage sampled, you will divide the area sampled by the number of square feet in an acre (43,560). In this example, you would divide 36,000 by 43,560 to get 0.83 acres sampled.

- Finally, you will convert the number of pellet groups to a per acre number. If you sampled 0.2 deer pellet groups per day (as above), then you would divide 0.2 by 0.83. This would give you 0.24 deer pellet groups per day per acre.

Interpretation
Both deer and elk populations can be expected to increase as the understory vegetation (providing both forage and cover) becomes more abundant over time. If deer and elk populations do not increase over time, this may indicate a lack of understory recovery, and you might compare the deer and elk data with the understory data to investigate. You should discuss this with your multiparty group to determine if future treatment prescriptions should be modified. Other possible reasons to explore may be an increase in roads (which deer and elk tend to avoid) or a drastic reduction in hiding cover.

General Wildlife Sign

A general wildlife sign search is a relatively simple method for monitoring the use of an area by a number of species, including deer, elk, turkey, tree squirrels, bear, or large carnivores. This method is not as rigorous as other wildlife monitoring methods, but provides a good opportunity to determine presence and relative abundance of many species. A wildlife sign search is also an excellent opportunity to teach the general public about wildlife in a project area.

This survey can be used in lieu of the previously discussed Deer and Elk transect survey and the Red Squirrel survey if less rigorous data is sufficient to accomplish the project goals. During the project planning phase, the multiparty team should determine if all species encountered will be recorded or if specific species (such as red squirrel, deer, and elk) will be monitored.

General Wildlife Sign

—

Use in any ecosystem

—

Sample before, after, and every 3-5 years after

—

Sample yearly, preferably in early fall

—

Survey any time of day for approximately 2 hours

—

Use data sheet F

Materials needed
Tracking field guide (Appendix A), paper data forms (Appendix D) or hand-held computer.

Training of monitoring personnel
Training should include identification of scat, tracks and other signs (such as squirrel middens, foraging sites, or bear scratches) of wild turkeys, bear, deer, elk, red squirrel, Abert's squirrel[4], and large carnivores (such as bobcat and coyote). Other species can be added if their sign is easily recognizable and they are of local significance. Aging of wildlife signs should be covered. Training should also cover methods of data recording, entry and analysis.

Monitoring protocol
A timed search method will be used to monitor changes in wildlife use of the treated area. Timing of the search is not critical but should be done at roughly the same date each year. An early fall search (before leaf and snow fall), will best capture the heavy use of the summer season. The type, species, frequency and age of signs observed are recorded on data sheets.

It is useful to distinguish between old and fresh sign. This information can help with better understanding how animals are using the site. Because it can be difficult to accurately determine sign age (environmental conditions affect aging rates), two simple categories can be used: fresh and old. If expertise is available, more specific categories can be developed. For our purposes, fresh sign is generally that which was produced or was used within the last few months. For tracks, typically all tracks will be considered fresh, given their rapid rate of disintegration. Scat that has not gone through substantial weathering (that is not gray) would be considered fresh. Fresh middens will have

[4] A method for assessing habitat for Abert's squirrel is also available on-line at www.nmfwri.org/collaborative-forest-restoration-institute.

distinct holes or burrows and fresh (bright colored) cone scales. Fresh foraging sites will have newly churned soil, bright cone scales or green clippings. Judgment calls will be necessary to make a determination of old versus fresh signs. It is important to be consistent in making these judgment calls so that data can be comparable.

*A **midden** is a pile of discarded cone scales at the base of a conifer and often contains underground caches of cones or underground winter burrows. **Middens** can become quite large (6+ feet in diameter) as they are commonly used for many years. A **cache** can be associated with middens or may simply be a collection of green cones in or under a log or its loosened bark.*

The searching method can be done in one of two ways depending on the size of the group conducting the survey. Using either approach, sign to be recorded will include scat, tracks, other types of sign (e.g. rubbings, middens, foraging sites), and actual animals. In order to ensure accurate comparisons from year to year it is critical to record the number of observers and the total time searched (i.e., search time multiplied by the number of observers).

<u>Small group method</u>
If there are 1 or 2 observers, each observer should follow a path of their choosing through the heart of the project area for a minimum of 2 hours and record all wildlife sign they encounter. More time may be required to cover the unit, depending on its size. With this approach, the observers must be careful to cover areas only once so as not to duplicate observations.

<u>Large group method</u>
An alternative approach for larger groups is to cover the area in a systematic manner. This method will alleviate the possibility of covering a particular area more than once and ensure careful coverage of the area. A team can line up with about 20 foot spacing between observers. The area to be covered should be decided upon in advance and should cover the central area of the unit at least 300 feet from the unit boundary. The area covered can be linear – the team travels in a line across the unit and then turns and travels along an adjacent area on the return pass. Pin flags can be used to mark the end line to prevent double coverage. Alternatively, the area covered could be more circular, following a path parallel to the unit perimeter but 300 feet to the interior (Figure 4).

The actual time spent searching with either method can vary provided the search time and number of observers is recorded. The emphasis should be placed on the quality of the search rather than speed; observers should travel slowly to well cover their search area, stopping as necessary to identify signs.

Paper data should be copied after returning from the field and electronic data transferred to a computer.

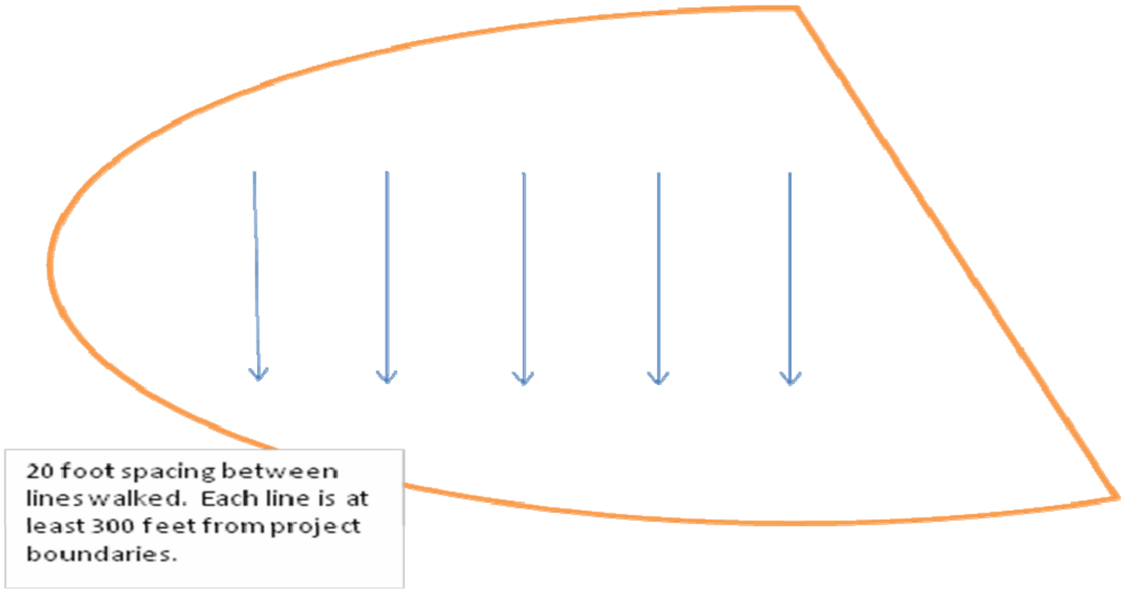

Figure 4. Sample wildlife sign search for a large group, showing parallel transects walked with 20 foot spacing between each line.

Analysis

For the general wildlife sign search, you will calculate three types of data for each management unit:

- Number of signs observed for each species per hour of search time.
- Species richness (total number of different species)
- Overall abundance (total number of signs observed)

If you conducted a group search, the first step would be to combine all the data from each data sheet into one, as in the example below, or have one person record data for the entire group.

Species	Sign Type	Number of Signs	Comments
Deer	Pellet group	3	
Abert's squirrel	Foraging Site (clippings)	2	
Bear	Tracks	1	
Coyote	Scat	1	
Turkey	Individual animal	6	1 adult plus 5 young

You will also need to calculate the total number of hours spent searching. To do this, you will take the total search time for each person and multiply it by the number of observers. For example, if you had 7 individuals searching for 30 minutes each, you would have a total search time of 210 minutes, or 3.5 hours.

Next, calculate the number of signs observed for each species per hour of search time. In the above example for deer, you would take the number of signs (3) and divide by the number of search hours (3.5) to get 0.86 signs per hour. You would repeat this for each species to arrive at the following data:

Species	Number of Signs/Search Hour
Deer	0.86
Abert's squirrel	0.57
Bear	0.29
Coyote	0.29
Turkey	1.7

For species richness, you would add up the total number of different species observed, in this case, you would add: deer + Abert's squirrel + bear + coyote + turkey = 5.

To calculate overall abundance, you would take the total number of signs counted for each species (in this case, 3+2+1+1+6 = 13) and divide by the total number of search hours (3.5) to get 3.7.

Interpretation
As treated stands recover from initial thinning, it is expected that habitat diversity will improve in the form of forest openings, increases in grass, forb and shrub cover, increases in availability of woody debris (which also provide cover), and a diversity of tree sizes. It is expected that wildlife populations will increase in response to these habitat changes. Long-term population trends will indicate whether or not the restoration project has met this expectation.

Appendix A: Recommended Resources and References for Wildlife Identification

Birds

Sibley, David A. 2000. The Sibley Guide to Birds of Western North America. National Audubon Society. Alfred A. Knopf, N.Y.

National Geographic Society. 2002. Field Guide to the Birds of North America.

Species names and codes for frequently encountered birds can be found at www.nmfwri.edu/collaborative-forest-restoration-program.

Butterflies

Brock, Jim P. and Kenn Kaufman. 2003. Kaufman Field Guide to Butterflies of North America. Houghton Mifflin Company.

Cary, Steven J. 2009. Butterfly Landscapes of New Mexico. New Mexico Magazine.

Glassberg, Jeffrey. 2001. Butterflies through Binoculars.

Bailowitz, Richard A. and Doug Danforth. 1997. 70 Common Butterflies of the Southwest. Western National Parks Association.

The publication *Butterflies as Indicators of Restoration Progress* from the Ecological Restoration Institute provides further information (see www.eri.nau.edu).

All species names and codes for butterflies listed in Appendix C can be found at www.nmfwri.edu/collaborative-forest-restoration-program.

Software that can help analyze data collected is available at www.urbanwildlands.org/INCA/ and an example of volunteer butterfly monitoring can be found at: www.mchenry.cc.il.us/faculty_pgs/mgarriso/butterflyproject/aBMG.html#TableofContents

Deer and Elk Pellet Identification and Wildlife Sign

Murie, Olaus J. 1974. A Field Guide to Animal Tracks. The Peterson Field Guide Series. Houghton Mifflin Company.

Halfpenny, James C. 2001. Scats and Tracks of the Rocky Mountains. A Falcon Guide.

A method for assessing Abert's squirrel habitat is also available on-line at www.nmfwri.org/collaborative-forest-restoration-institute.

Appendix B: CyberTracker Software

CyberTracker is a tool to help increase the efficiency and reliability of monitoring. It is a free software program that allows you to directly enter data in the field onto a handheld computer or GPS. The advantages of CyberTracker include:

1. By entering data directly into a hand-held computer in the field, you save the time it normally takes to transfer data from paper data sheets to a computer.
2. You also reduce the amount of human error that can occur when transferring data from paper forms (especially when frequently the person collecting the data is not the same person transferring it to the computer).
3. There are also a number of potential education opportunities available with CyberTracker. It is an internationally used program, and the website provides easily referenced case examples of how the program is being used around the world for different types of wildlife monitoring. There is a world map showing locations of CyberTracker users and descriptions of select projects.
4. The CyberTracker program comes with some helpful tools, such as a species identification filter, which helps select features and characteristics of species.
5. The CyberTracker program also allows you to geographically place data to create a map showing the spatial distribution of wildlife, which would be particularly interesting in larger or disbursed project areas.

The disadvantages of using CyberTracker include the potential cost of acquiring a device to support the free software, and the time and effort required to learn the program.

There are a number of compatible computer and hardware devices that support the CyberTracker software, including:

- Microsoft Windows 2000/XP/2003/Vista operating systems,
- Most handheld devices purchased within the last 5 years,
- Any GPS device that can output NMEA sentences or Trimble, and
- Field computers.

To learn more about CyberTracker, visit the website at http://www.cybertracker.co.za.

Appendix C: Common Butterflies of New Mexico by Forest Type

Butterflies Common to Ponderosa Pine Forests

Ubiquitous Residents	Ubiquitous Transients	Ponderosa Pine
Black Swallowtail	Pipevine Swallowtail	Pale Swallowtail (North-Central NM only)
Cabbage White	Dogface Sulphur	Pine White
Checkered White	Sleepy Orange	Coral Hairstreak (not Gila)
Clouded Sulphur	Mexican Yellow	Western Pine Elfin
Orange Sulphur	Cloudless Sulphur	Colorado Hairstreak
Dainty Sulphur	Marine Blue	Bramble Hairstreak
Gray Hairstreak	Common Buckeye	Thicket Hairstreak
Reakirt's Blue	American Snout	Western Tailed Blue
Melissa's Blue	Monarch	Square spotted Blue
Variegated Fritillary	Queen	Nais Metalmark (not Sacramentos)
Mourning Cloak	Funeral Duskywing	Mexican Metalmark
Red Admiral	Sachem	Nokomis Fritillary
American Lady		Field Crescent
Painted Lady		Arachne Checkerspot
Common Checkered Skipper		Satyr Comma
		California Tortoiseshell
		Arizona Sister
		Canyonland Satyr
		Common Ringlet (not Sacramentos)
		Riding's Satyr
		Silver spotted Skipper
		Northern Cloudywing Short-tailed Skipper
		Pacuvius Duskywing
		Afranius Duskywing
		Rocky Mountain Duskywing
		Edwards' Skipperling
		Morrison's Skipper
		Taxiles Skipper
		Python Skipper
		Cassus Roadside Skipper
		Orange-headed Roadside Skipper

Butterflies Common to Piñon Juniper Woodlands

Ubiquitous Residents	Ubiquitous Transients	Piñon Juniper Woodlands
Black Swallowtail	Pipevine Swallowtail	Two-tailed Swallowtail
Cabbage White	Dogface Sulphur	Spring White
Checkered White	Sleepy Orange	Sara Orangetip
Clouded Sulphur	Mexican Yellow	Juniper Hairstreak
Orange Sulphur	Cloudless Sulphur	Acmon Blue
Dainty Sulphur	Marine Blue	Mylitta Crescent
Gray Hairstreak	Common Buckeye	Painted Crescent
Reakirt's Blue	American Snout	Fulvia Checkerspot
Melissa Blue	Monarch	Sleepy Duskywing
Variegated Fritillary	Queen	Common Sootywing
Mourning Cloak	Funeral Duskywing	Green Skipper
Red Admiral	Sachem	Apache Skipper (not Sacramentos)
American Lady		Uncas Skipper
Painted Lady		Dun Skipper
Common Checkered Skipper		

Butterflies Common to Mixed Conifer Forests

Ubiquitous Residents	Ubiquitous Transients	Mixed Conifer Forests
Black Swallowtail	Pipevine Swallowtail	Western Tiger Swallowtail
Cabbage White	Dogface Sulphur	Margined White
Checkered White	Sleepy Orange	Queen Alexandra's Sulphur
Clouded Sulphur	Mexican Yellow	(not Sacramentos)
Orange Sulphur	Cloudless Sulphur	Sheridan's Hairstreak
Dainty Sulphur	Marine Blue	Silvery Blue
Gray Hairstreak	Common Buckeye	Spring Azure
Reakirt's Blue	American Snout	Boisduval's Blue
Melissa Blue	Monarch	Arctic Blue
Variegated Fritillary	Queen	(not Sacramentos)
Mourning Cloak	Funeral Duskywing	Northwestern Fritillary
Red Admiral	Sachem	Silvery Checkerspot
American Lady		Milbert's Tortoiseshell
Painted Lady		West Coast Lady
Common Checkered Skipper		Weidemeyer's Admiral
		Small Wood Nymph
		Mexican Cloudywing
		Dreamy Duskywing
		Persius Duskywing
		Garita Skipperling
		Tawny-edged Skipper

Butterflies Common to Cottonwood Bosque

Ubiquitous Residents	Ubiquitous Transients	Cottonwood Bosque
Black Swallowtail	Pipevine Swallowtail	Sylvan Hairstreak
Cabbage White	Dogface Sulphur	Mourning Cloak
Checkered Whit	Sleepy Orange	Viceroy
Clouded Sulphur	Mexican Yellow	Common Wood Nymph
Orange Sulphur	Cloudless Sulphur	
Melissa Blue	Marine Blue	
Variegated Fritillary	Common Buckeye	
Mourning Cloak	American Snout	
Red Admiral	Monarch	
Painted Lady	Queen	
Common Checkered Skipper	Funeral Duskywing	
	Sachem	

Appendix D: Data Sheets

Data Sheet A: Birds
Data Sheet B: Red Squirrels
Data Sheet C and D: Butterflies
Data Sheet E: Deer and Elk
Data Sheet F: General Wildlife Sign

Data Sheet A: Bird Data Sheet

Page #: _________

Site name: ______________________________________ Elevation: ___________________

Location or Unit:_________________________________ Date: _______________________

Breeding Season or Fall (circle one) Seasonal visit 1, 2, 3 (circle one)

Observer(s): ____

◯ Control site ◯ Treatment site
Number of years since treatment: _____

◯ Before treatment ◯ After treatment

Weather Conditions (cloud cover, avg. temp., wind speed): ______________________

Point #	**Start time**	**Species Name or Code***	**Number of Individuals**	**Mode of Detection (Song, Call, Visual)**	**Comments**

Weather Codes: Clear = 1; Partly Cloudy = 2; Mostly Cloudy = 3; Light/Intermittent Rain = 4
Wind Codes: Calm = 0; Light (1-3 mph) = 1; Leaves rustle (4-7 mph) = 2; *Leaves and twigs in constant motion (8-12 mph) = 3*

*You may download species codes from www.nmfwri.org/collaborative-forest-restoration-program

- Make copies of this sheet as necessary-

Data Sheet B: Red Squirrel Data Sheet Page #: ________

Site name: ______________________________ Elevation: ________________

Location or Unit: ___________________________ Date: ____________________

Visit # 1, 2, 3 (circle one) Observer(s): ______________________________

○ Control site ○ Treatment site
Number of years since treatment: _____

○ Before treatment ○ After treatment

Point #	Number of Squirrels	Mode of Detection or Sign	Comments

Modes of Detection: Visual or Sound
Types of Sign: Foraging Site, Midden, Cache, Live animal

- Make copies of this sheet as needed-

Data Sheet C: Butterfly Data Sheet (To Species) Page #: __________

Site name: ____ Elevation: ______________________

GPS Location:______________________________ GPS Datum: ____________________________

Date: ______________________ Seasonal visit 1, 2, 3 (circle one)

Observer(s): ____

◯ Control site ◯ Treatment site
Number of years since treatment: _____

◯ Before treatment ◯ After treatment

Weather and Wind Conditions (use codes at bottom) ______________________________

Transect #	**Species Name or Code***	**Number of Individuals**	**Comments**

Weather Codes: Clear = 1; Partly Cloudy = 2; Mostly Cloudy = 3; Light/Intermittent Rain = 4
Wind Codes: Calm = 0; Light (1-3 mph) = 1; Leaves rustle (4-7 mph) = 2; Leaves and twigs in constant motion (8-12 mph) = 3

*You may download species codes from www.nmfwri.org/collaborative-forest-restoration-program

- Make copies of this sheet as needed -

Data Sheet D: Butterfly Data Sheet (By Size and Color) Page #: __

(Use one sheet for all transects in a management unit)

Site name: ____________________________ Elevation: __________________

GPS Location:________________________ GPS Datum: ______________________

Date and Time: ___________________________ Seasonal visit 1, 2, 3 (circle one)

Observer(s): ____

◯ Control site ◯ Treatment site

Number of years since treatment: _____

◯ Before treatment ◯ After treatment

Weather and Wind Conditions (use codes at bottom): ________________________

Butterfly Wingspan		Butterfly Dominant Color							
		orange	white	yellow	blue	green	gray	brown	black
	Small (< 1")	skippers		small sulphurs	blues hair-streaks	hair-streaks	hair-streaks	hair-streaks skippers elfins	skippers
	Medium (1-2")	checker-spots crescents commas coppers ladies	whites	sulphurs			satyrs	wood-nymps alpines metal-marks skippers	
	Large (>2")	greater-fritillaries monarchs		swallow-tails				distinctive brushfoots	admirals swallow-tails

Weather Codes: Clear = 1; Partly Cloudy = 2; Mostly Cloudy = 3; Light/Intermittent Rain = 4

Wind Codes: Calm = 0; Light (1-3 mph) = 1; Leaves rustle (4-7 mph) = 2; Leaves and twigs in constant motion (8-12 mph) = 3

\- Make copies of this sheet for additional transects -

Data Sheet E: Mule Deer and Elk Data Sheet Page #: __________

Site name: ______________________________________ Elevation: ______________________

Unit name: ___________________________ GPS Datum: ________________________________

Observer(s):_____________________________ Date: _________________________________

○ Control site ○ Treatment site

Number of years since treatment: _____

○ Before treatment ○ After treatment

Transect #	GPS Location	Slope	Aspect	Number of Pellet Groups		Comments
				Mule Deer	Elk	

Note: Refer to CFRP Short Guide for Monitoring for how to record slope and aspect along a transect.

- Make copies of this sheet as needed -

Data Sheet F: Wildlife Sign Data Sheet Page #: __________

Site name: ____ Elevation: _______________________

GPS Location:______________________________ GPS Datum: _____________________________

Observer Names:_ ___________________________ Number of Observer(s):__________________

Date: ______________________________Start Time: ____________ End Time: ______________

Amount of Time Searching (Number of Observers x total time searched): __________

○ Control site ○ Treatment site
Number of years since treatment: _____

○ Before treatment ○ After treatment

Species	Sign Type	Relative Age of Sign (old or fresh)	Number of Signs	Comments

Examples of Sign Types:
Scat, Tracks, Rubbings (deer/elk, bear, etc.), Scratching (bear), Foraging Site (Abert's squirrel, red squirrel, bear, turkey), Roost Tree (turkey), Feather (turkey), Midden (red squirrel), Cache (red squirrel), Den/Nest (coyote, bear, squirrels), Live animal

New Mexico Forest and Watershed Restoration Institute

The New Mexico Forest and Watershed Restoration Institute at New Mexico Highlands University is dedicated to providing state-of-the-art information about forest and watershed restoration to the public, federal and state agencies, tribes, and private landowners in New Mexico. To accomplish this, the Institute collaborates with citizen stakeholders, academic institutions, NGOs, and professional natural resources managers to establish a consensus concerning prescriptions and monitoring protocols for use in the restoration of forests and watersheds in an ecologically, socially, and economically sound manner. Through research and collaboration, the Institute promotes ecological restoration and forest management efforts in ways that 1) will keep New Mexican homes and property safe from wildfire, 2) will lead to a more efficient recharge of New Mexican watersheds, and 3) will provide local communities with employment and educational opportunities.