Lesson Plan Outline

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Course: Mining and Minerals Management for Natural Resource Trainees

Topic: Developing Baseline Monitoring Systems

Suggested Time: 1 hour and 30 minutes

Objectives: At the end of this session, participants will have:

1. An understanding of the need to establish a solid baseline monitoring system from which projected impacts of proposed mineral development activities can be measured;

2. An understanding of the steps necessary to establish a baseline monitoring system; and

3. An understanding and familiarity with the steps necessary to maintain appropriate records on the monitoring system, and the various uses of the baseline monitoring system.

OUTLINE	NOTES

Purpose of a Baseline Monitoring Program

The preservation of Park Service lands cannot be achieved by the drafting of a boundary line on a map. Sources of human influence (i.e., mineral development), both external and internal, may represent serious threats to the environmental quality and integrity of the natural resources. The values of many units administrated by the National Park Service lies in their continued naturalness, especially as other lands outside the parks become increasingly modified by man. Values are eroded by external and internal sources of human influence which act to alter the very conditions which

initially prompted the NPS designation. At some point conditions may become inconsistent with the original purpose the park was created for. These changes may be subtle at first with rapid changes later on. By the time some changes become noticeable, it may be too late to save some species from being extirpated from a park.

Managers have long recognized and accepted the insuitability of some deterioration in the natural resources of the park, particularly in areas where mineral useage is occurring. Usually managers have lacked a comprehensive system with which they could assess the biophysical limits of acceptable change. These limits should define the critical boundary line below which resides the range of conditions management judges to be acceptable. Areas in which mineral development causes conditions to exceed the established limits, are in danger of losing the ecological qualities that led to define them as a park, recreation area, monument, historic site or preserve.

But what constitutes excessive or unacceptable change and how do managers define these limits? A good baseline monitoring program is the key for analyzing environmental impacts from mineral related activities. The purpose of this section is to provide park managers ideas for gathering reliable information on the natural resources. It is not to say that any one system is the only method to use in long term baseline monitoring. The most important element is not how the data is collected but that it is collected in a consistent, statistically reliable way, it is collected every year and it is analyzed and stored in a format that is useable to a manager.

A good baseline monitoring program should be integrated in that data elements regarding wildlife, vegetation, soils, landform, climate and other ecosystem determinants are considered in relation to each other within geographically defined areas.

This type of monitoring does not draw any conclusions on the condition of the environment or what the potential flora and fauna could be. It does provide the manager a foundation to work from and monitor changes over time. Impacts from mineral development may be assessed from information gathered from this system. Changes to flora and fauna will continue to take place over time from natural processes. A good monitoring system will be able to document naturally occurring changes from human caused changes and could enable the manager to set use limits within the NPS administered land when dealing with development activities.

One of the best ways to develop a longterm monitoring program is with park staff. The cost is less and data collected can be reliable if personnel are properly trained. Many private contracts that are done for baseline inventories are excellent, but are usually done during a one time sampling period. The NPS administered unit often times makes management decisions on these one time contracts for years after the data is collected. There are so many variables in data collection that even a one or two year project cannot tell a manager five years later what is happening to his unit now. Permanent transects need to be established in the unit and data collected every year on vegetation, birds, mammals, reptiles, amphibians, and fish.

The Objectives of a Good Baseline Monitoring Program Is To:

A. Provide standardized procedures and data elements for describing, classifying, and comparing specific habitat sites.

B. Provide an integrated and organized data bank of ecological information to facilitate good habitat analysis.

C. Classify habitat sites according to standard habitat type association, based on current vegetation, aspect, soils and landforms.

D. Provide data interchange with other Federal Agencies, State Agencies, and private or academic institutions.

E. Provide a resource information base to guide park management on the preservation and protection of park resources.

The type of baseline monitoring program explained in this section is based on ecological relationships more easily interpreted as a habitat classification system. This allows the system to consider more than one determinant (e.g., vegetation, soil, and landform), when classifying areas for establishing permanent transects. This type of classification system will permit habitat analysis at less complex classification levels, i.e., the habitat site or standard habitat site.

The habitat site level is the lower level of the classification system. The habitat site is a mappable unit composed of homogenous forms of vegetations, soils, and landform. A standard habitat site is the aggregation of habitat sites having similar vegetation, landform, and soil. An example would be looking at pinyon-juniper woodland in a western park. Pinyon-juniper may occur on

various types of landforms (i.e., mesa top, plateau, valley, hogback, etc.). These various types of landforms would represent habitat sites. However some studies have shown that similar types of wildlife and vegetation are found in pinyon-juniper woodland; regardless if the woodland is on a mesa top, bench or hogback. Therefore, if a manager wanted to establish a permanent transect in pinyon-juniper woodland, all pinyon-juniper might be classified under one standard habitat site and only one or two permanent transects may be necessary to monitor flora and fauna.

Applications of this Baseline Monitoring System.
Habitat data obtained by this system can be used to:

A. Accumulate wildlife habitat inventory data in a standardized manner to support the planning system, to prepare reports, and for other land use management purposes.

B. Coordinate wildlife with vegetation to determine relationships.

C. Monitor condition and trend of wildlife habitats.

D. Verify and/or predict species occurrence and distribution (e.g., endangered animals and plants or small animals) within a particular area.

E. Predict and analyze impacts of land development on resources in and around the parks.

F. Estimate future plant composition and productivity.

G. Delineate and estimate carrying capacity of crucial areas for such species as bighorn sheep, mule deer, bears or elk.

H. Delineate essential habitats for threatened, endangered, sensitive or priority species.

I. Determine the limiting factors to wildlife population expansion.

J. Analyze biological and temporal aspects of plants and animal succession to identify new ecological interrelationships.

K. Provide data on various levels for local, regional, and national assessments of wildlife resources; and,

L. Process and analyze wildlife inventory data more efficiently through automated data processing (ADP).

Steps in Utilizing the Baseline Monitoring Program

The following steps should be used in sequence and will provide the user with the methods that will be used in sampling. These methods are not the only methods available, but do represent good sampling techniques that utilize the least amount of time to provide the area with the best information. It also insures that everyone will collect the same information so that all data is interchangeable.

Mapping the Habitat Sites and Standard Habitat Types. The first project that needs to be done will be to develop a vegetation map with habitat sites mapped out on overlays. Most NPS units have vegetation maps established, but to create a standard habitat site, it requires looking at habitat sites with landform and soils.

A. Description of Habitat Sites. Terrestrial and aquatic habitat sites are the basic field data gathering units. The major function is to provide a procedure for accumulation, storing, and retrieving site data.

1. Terrestrial Habitat Sites. Terrestrial habitat sites include all upland as well as wetland habitats. Riparian habitats are a specialized form of wetland and are referred to as "wetland-riparian." Habitat sites are areas of homogeneous vegetation (existing), landform, soils, and climate. Terrestrial habitat site boundaries are established wherever there is a significant change in vegetation composition, cover, and/or structure, or in local landform. These changes are generally more specific than changes that result in differences between associations. Many terrestrial habitat site boundaries generally correspond to soil series or soil series phase boundaries. These soil differences can be used as an additional aid in delineating habitat sites, if the soil types are known.

2. Aquatic Habitat Sites. Aquatic habitat data are very general in nature and relate only to streams, lakes, and reservoirs and their occupancy and use by amphibious, terrestrial, and flying wildlife. Smaller water bodies

(e.g., ponds, seeps, springs) should be considered special habitat features within terrestrial habitat sites. More detailed data on fisheries, aquatic organisms, water quality, flow rates, pool riffle characteristics, substrate, and thermal conditions should be collected using separately approved inventory methods and forms. To reemphasize, aquatic habitat sites are described to establish their direct relationships to animals other than fishes and aquatic organisms and to identify any juxtapositional effects they may have on nearby terrestrial habitat sites.

3. Terrestrial Habitat Site Names: Each terrestrial habitat site, including wetland riparian habitat sites, is assigned a name. The terrestrial habitat site name consists of the dominant and subdominant plant species and the landform for each habitat site. The last part of the habitat site name should be a three letter code for either standard landform or standard wetland-riparian form. The following examples could be used in filling out the landform.

   a. Standard Landform Codes

      ALF - Alluvial Fan
      ALP - Alluvial Plain
      ARY - Arroyo
      BAA - Bajada
      BAI - Barrier Island
      BAL - Badland
      BAR - Barranca
      BEG - Gravel Beach or Bar
      BES - Sand Beach or Bar
      BFI - Basin Floor Internal Drainage
      BFE - Basin Floor External Drainage
      BNC - Bench
      BTT - Butte
      CAL - Caldera
      CAN - Canyon
      CES - Cuesta
      DOM - Dome
      ENR - Exogenic
      FPL - Flood Plain
      FRD - Fiord
      GCR - Glacial Cirque
      GLA - Glacial Cirque
      GMR - Glacial Moraine
      GOW - Glacial Outwash
      PYA - Playa
      RDG - Ridge

SBS - Subsidence Check
SCL - Sea Cliff
SDL - Saddle
SDN - Sand Dune
SNK - Sinkhole
SPT - Spit
SRP - Scarp
TRC - Terrace
VAL - Valley
SWE - Swell
GTO - Glacial Trough
GUL - Gully
HBK - Hogback
HIL - Hill
ISL - Island
KRS - Sarst
LCP - Lacustrine Plain
MSA - Mesa
MTN - Mountain
PED - Pediment
PEP - Peneplain
PIN - Pingo
PMT - Piedmont

Standard Wetland-Riparian Form Codes

BMR - Bog Marsh Riparian
BPR - Beaver Pond Riparian
IPR - Intermittent Playa Riparian
ISR - Intermittent Stream Riparian
OLR - Lake Riparian
ORR - Reservoir Riparian
OSR - Perennial Stream or River Riparian
SUR - Sub-Riparian
SWR - Salt Water Riparian
WMR - Wet Meadow Riparian

B. Description of Special Habitat Features. Wildlife populations are frequently limited by relatively small anomalies or inconsistencies in the habitat (e.g., the presence of water, a nesting cliff, or salt lick); therefore, this baseline monitoring system includes a procedure for identifying and describing these special habitat features within habitat sites. If a feature is present in the habitat site because of animal use (e.g., raptor nest), it is considered a special habitat feature. If the feature has no effect on any of the animal species present in the habitat site, it is not considered a special habitat feature, for special habitat features may affect wildlife positively or negatively.

FORM 2

PARK

SPECIAL HABITAT FEATURE

DISTRICT

COUNTY

Recorded By:	Date

Feature Description and Location

General Description of Special Habitat Feature (maximum 20 characters)	Code	Special Feature Location							
		UTM Cordinate	Township	Range	Section	¼ Section	¼¼ Section	Elevation	Acres
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									

1. Record Keeping. Form-2, Special Habitat Features, would be filled out whenever a natural or man-made habitat anomaly or structure occurs within or adjacent to a habitat site.

2. Special Habitat Feature Codes. Following are examples of types of special habitat features that could be used for filling out Form 2.

A01 East Facing Cliff
A02 Fin
A03 Sand Dune
A04 Insect Mounds
A05 Overhang
A06 Salting Area
A07 Seep
A08 Cold Spring
A09 Sinkhole
A10 Snag-Group of Snags
A11 Talus Slope
A12 Talus Field
A13 Waterfall
A14 Island
A15 Sandbar
A16 Log Jam
A17 Downed Timber
A18 Beaver Dam
A19 Beaver Burrow
A20 Rapids
A21 Pools
A22 Eddies
A23 Backwater Areas
A24 Cottonwood Groves
A25 Tamarisk Stands
A26 Mud Flow
A27 Temporary Pond
A28 Potholes
A29 Rodent Colony
A30 Snake Den
A31 Raptor Nest Tree Accipiter
A32 Raptor Nest Tree Buteo
A33 Raptor Nest Tree Golden Eagle
A34 Raptor Nest Tree Bald Eagle
A35 Raptor Nest Tree Kestrel
A36 Nest Tree Raven
A37 Raptor Nest Cliff Accipiter
A38 Raptor Nest Cliff Buteo
A39 Raptor Nest Cliff Golden Eagle
A40 Raptor Nest Cliff Bald Eagle
A41 Raptor Eyrie Cliff Peregrine Falcon
A42 Raptor Eyrie Cliff Prairie Falcon
A43 Nest Cliff Raven
A44 Owl Nest Tree

A45 Owl Nest Cliff
A46 Bald Eagle Roost
A47 Hawk-Owl Roost
A48 Raven Roost
A49 Other Bird Roosts
A50 Hanging Garden
A51 Other Bird Nest
A52 Bat Roost
B01 Bridge
B02 Under Pass
B03 Reseeding Areas
B04 Buildings
B05 Culvert
B06 Exclosure Study Areas
B07 Gauging Station
B08 Fish Migration Barrier
B09 Mining Activity
B10 Livestock Grazing
B11 Poles
B12 Perches
B13 Road
B14 Trail
B15 Stream Crossing
B16 Shelter
B17 Stock Water Pond-Tank
B18 Old Airstrip
B19 Old Roads
B20 Weather Station
B21 Gravel Pit
B22 Landfill
B23 Sewage Lagoon or Pit
B24 Oil and Gas Operations
B25 Pipelines, Powerline or Other Right of Way

C. Description of Standard Habitat Types. Habitat sites having similar existing dominant and subdominant plants, landform, and other ecosystems determinants such as small species of birds should be aggregated into standard habitat types to predict occurrence of sedentary animals on unsampled sites. The technique is also useful for analyzing wildlife data. For example aggregating similar habitat sites into a single standard category allows comparison of the total acreage of the standard habitat site to the amount affected by a particular land action or decision. With this type of monitoring system, a land manager could accurately predict the total number of species of plant and animals, and what plant density and per cent cover that would be lost when any amount of land is lost to development. Before a standard habitat site can be designated, the habitat site

must be delineated using landform, soil, and vegetation inventory data.

Delineation and Classification of Habitat Sites

A. Delineation of Habitat Sites. Habitat sites are the basic field data gathering units and lowest classification level. Every piece of land in an area should be delineated as a habitat site even if it will not be inventoried. Habitat sites are delineated according to biological and physical factors including: vegetational characteristics (species, structure, composition, percentage of cover, and vigor); local landform (slope, aspect, elevation); soil factors affecting vegetation and/or wildlife; local water form; animal occurrence (abundance, seasonal use); and habitat anomalies affecting animal occurrence (special habitat features). They are mappable, geographical units of land on which inventories are conducted. After habitat sites are mapped, they are aggregated into categories called standard habitat sites based on similar existing dominant and subdominant vegetation and landform. Some representative habitat sites within the standard habitat site category are selected for conducting inventories for wildlife species occurrence. This data is then extrapolated to other habitat sites within the standard habitat site category for use in predicting animal occurrence.

As previously, mentioned, this system is designed to use existing information, thereby minimizing time on field inventories. Key ecosystem determinants including existing homogenous vegetation and local landforms can sometimes be identified in the office by using aerial photography, various mapping techniques, and prior inventory and vegetation survey data. Keep in mind that the primary factors used in delineating habitat site boundaries are existing vegetation (homogenous for composition, structure, and cover) and local landform. Habitat sites are delineated to a minimum size of 2 acres on 7.5 minute USGS orthophotoquads or on overlays of aerial photographs approaching the scale of 7.5 minute USGS quadrangle maps (1:24,000). Aerial photographs at the scale 1:24,000 are most desirable, as they correspond to the most common scale. Color infrared, black-and-white, or color positive photographs may all be used, provided resolution is sufficient to distinguish most habitat site boundaries. Without suitable aerial photographs, more field reconnaissance is necessary for accurate habitat site delineation.

Inventory of Habitat Sites. Once habitat site boundaries have been established, each habitat site is aggregated to a standard habitat site classification. Inventories are not conducted on all habitat sites within the standard habitat type category. At least two habitat sites within a standard habitat site should be inventoried for groups of animals and vegetation communities occurring there. The number of sites inventoried may vary depending on time constraints and evaluation of the data as it is collected and analyzed.

Techniques used for sampling animal species may vary from unit to unit but the methods used should be statistically reliable. Following is some recommendations for collecting data:

A. Birds. Habitat sites should be inventoried for a two-season period with a minimum field time of 1 day per season and a maximum time of 3 consecutive days per season. Nesting and wintering seasons are generally the most important inventory time. For western parks the Emlen Strip Census may be the best technique, and for eastern parks the Circular Plot Method may be the best.

B. Reptiles and Amphibians. Survey's should be conducted during the peak of their activities. For most species the breeding season and the spring and early summer are the peak activity periods. Strip censuses, road censuses and pit arrays would be good sampling techniques for herps.

C. Small Mammals. At a minimum, small mammals endemic to sites should be inventoried during the season of highest activity, normally spring or early summer. Some type of a web or grid pattern would be good with a mark and recapture method. Not all small mammals are susceptible to live traps and in some cases it may be necessary to use snap traps. Snap traps should not be used every year because of its unnatural impact to the population in the area.

D. Ungulates and Large Carnivores. Crucial habitats or areas of seasonal use should be designated on an overlay. These may be supplemented with ground or aerial examination or sites for actual large mammal occupancy.

Record animal sighting dates and site locations on a form such as Form 1 or on Wildlife Observation Forms. After completing site delineation, examine the site to verify that it is a seasonal habitat, a crucial area, or other important area from examination of browse species, pellet droppings, tracks,

beds, or other field observations. Verification should be documented. Examine all sites in presently occupied or potential large mammal ranges to determine key forage areas, cover, and waters. In addition to ungulates, occupancy by other large mammals such as badgers, coyotes, and beavers can be determined at this time by locating dens, tracks, feeding areas, and droppings.

E. Vegetation Collection by Standard Habitat Type. There should be at least two vegetation transects within a standard habitat type. All transects should be permanently marked with some type of a witness post and accurately described and photographed. Vegetation should be sampled during the peak of the flowering period for most of the species. It may be desirable to sample a transect twice in a year to catch different plants when they are flowering or fully developed. However, because of a limitation in time this is rarely done. Information should be collected on density, frequency, percent canopy cover, percent litter, percent bareground, percent cryptogamic cover, percent rocks, percent gravel, shrub volume, and productivity.

F. New Verifications of Animals Should Be Recorded and Dated. If significant species are found in a habitat site they should be recorded with as much information as possible. Significant species include:

1. Federal or State endangered or threatened species.

2. NPS sensitive species (defined in the units Resource Management Plan).

3. Designated priority management species. This designation could change from time to time based on managements needs.

4. Ungulates on crucial or important seasonal ranges.

5. Animals having a high viewing potential such as bighorn sheep.

6. Species limited in number due to restricted habitat, or position in the food chain, such as mountain lions, bears or other predators.

Even though the techniques used to develop this type of baseline monitoring sound complex, it can be done with

Form 1

ANIMAL SPECIES OCCURRENCE

DISTRICT

COUNTY

ELEVATION IN METERS

Standard Habitat Site Name _____ Recorded By: _____

Habitat Site Identification

Date _____ _____ _____
mm dd yr

Habitat Site Name

Dominant Spp. _____

Sub - Dominant Spp. _____

Land Form _____

Structrual Height

Slope _____

Acres _____

Aspect _____

Special Habitat Features in Habitat Site _____
(use codes)

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Animal Species

Animal Occurrence Data

Common Name	Status	Crucial Time Period				Method of Verification	Occurrence				Comments limit 40 characters
		WI	SP	SU	FA		WI	SP	SU	FA	

park staff. By collecting data on flora and fauna in standard habitat sites, a manager can determine exactly what species could be affected by mineral-related activities. For example, a manager would be able to predict the number of a species of bird that would lose breeding bird habitat by the building of a 4 acre oil drill pad, the percent canopy cover lost from road building, or species of animals that may be lost from development along the units boundaries. Managers could have sound data to enable them to determine what the limits of acceptable change would be from mineral extraction. One of the goals of park management should be maintaining biotic associations. Maintenance of suitable habitat is the key to sustaining animal populations, and that protection, though it is important, is not of itself a substitute for good baseline monitoring.