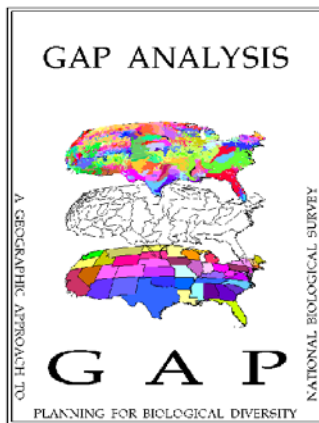# Field Methodologies and Training Manual for Nevada Field Crews

Southwest Regional Gap Analysis Project (SW ReGAP)

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Abstract

This is the training manual for Nevada's field crews who will undertake the data collection in support of the land cover mapping segment of the Southwest Regional Gap Analysis Project, SW ReGAP. It provides overview information regarding the National GAP Program, the SW ReGAP Project and its land cover mapping methodologies, field crew duties and expectations, field equipment, contacts list, and software tutorials. This manual is intended to serve as an aid during field crew training and as a reference in the field should question arise.

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Section 1.0: Introduction

1.1 - Introduction to the Gap Analysis Program: Past national focus on threatened and endangered species has drawn attention to the relatively small number of taxa in the most desperate condition and away from the importance of maintaining healthy conditions for biological communities and systems. Thus, conservation efforts have become reactive, difficult, and expensive in attempting to recover species from the most desperate of conditions. In contrast, directing conservation attention toward maintaining relatively intact biological systems and communities is proactive, potentially less expensive, and capable of minimizing disputes among land use interests by identifying in advance significant areas for planning.

The Gap Analysis Program (GAP) is a national program of the USGS Biological Resources Division (USGS-BRD) that maps the distribution of plant communities and selected animal species and compares these distributions with land stewardship to identify biotic elements at potential risk of endangerment. These analyses provide a landscape-level process for assessing conservation of biological diversity. By necessity, the effort is multidisciplinary, involving ecologists, geographers, zoologists, botanists, statisticians, sociologists, and others.

The main goal of the GAP program is to prevent additional species from being listed as threatened or endangered. A secondary goal is to provide focus and direction for proactive, rather than reactive, land management activities at the community and landscape levels. For example, GAP provides an ecological context for a hierarchical approach to land management and more detailed ecological studies in the future. It needs to be stressed, though, that Gap Analysis is intended to complement, not replace, the species-by-species approach to preserving biodiversity that is so critical to the survival of species now nearing extinction.

The primary products of the Gap Analysis Project are digital thematic maps of existing landcover habitat types and distributions for each vertebrate species at a scale of 1:100,000. GAP analysis uses Geographic Information System (GIS) technology to assemble and view large amounts of biological and land management data to identify areas where conservation efforts may not be sufficient to maintain diversity of living natural resources. As such, this process provides a tool for assessing how the presence of significant biological diversity may need to be incorporated into land use planning. Thus, agriculturalists, business park developers, conservation interests, and many others alike can use GAP analysis information to determine how and where their actions most relate to maintaining natural diversity.

Gap Analysis products have many different uses. One of the most important uses is to provide an overview of the distribution and management status of selected components of biodiversity (i.e., landcover types and terrestrial vertebrate distributions). The GAP program seeks to identify vegetation types and species that are not adequately represented in the current network of special management areas. These are the "gaps" in the present-

day overall mix of conservation lands and conservation activities. This information is intended to be used by decision makers for proactive land management planning which will hopefully lead to fewer species becoming endangered, and thus reduce the number of future conflicts regarding natural resource issues.

1.2 - Introduction to Southwest Regional Gap Analysis Program: While the first generation of western GAP projects were highly innovative for their time, there were unforeseen problems associated with the state-by-state model used to generate maps of landcover and vertebrate species distributions. As the various western state GAP projects were completed and stitched together, it was apparent that vegetation maps exhibited abrupt changes in their classification systems and community distributions at state boundaries. Animal species distribution maps, modeled largely from vegetation maps, also revealed abrupt changes at state boundaries. Three main problems were identified: 1) separate vegetation classification systems for each state, 2) unique methodologies for constructing predictive maps of plant communities, and 3) the use of non-natural boundaries to determine the project's extent. These problems, and the need to examine biodiversity at larger, ecoregional scales, led to the initiation of a second generation of GAP projects.

The Southwest Regional GAP Project (SW ReGAP) is a multi-year project that covers the five southwestern states of Arizona, Colorado, Nevada, New Mexico, and Utah. The three basic elements of the SW ReGAP project are:

> *Land Cover Mapping:* The SW ReGAP project will use recent Landsat 7 Thematic Mapper Data composited into biogeographically unique mapping units ("mapzones") that span political boundaries. These mapping units use a combination of topography and soils information to identify relatively large geographic areas that have similar topographic and biologic characteristics. Ancillary data layers will include a 30-meter digital elevation model, NOAA-AVHRR 10-day composites, DAYMET climatological data, and the STATSGO soils database.

> *Wildlife Habitat Relationships:* The project will model the predicted distribution of each vertebrate species that resides, breeds, or uses habitat in each state for a substantial part of its life history, including important migration stopovers. The distribution maps will indicate predicted species presence for known, probable, and possible areas of its geographic range. This effort will include production and review of wildlife habitat relation models, production and review of range maps, and possible cooperation on the production and publication of species atlases and/or field guides.

> *Land Stewardship:* The project will produce a land stewardship map of the state that indicates individual management units of public land and for private conservation lands when voluntarily provided. Each tract will be attributed for land ownership, managing institution, and management status. A substantial effort will be made to identify and contact all potential conservation landowners and/or managers holding tracts at least as large as the GAP minimum resolution size.

A "gap" analysis will be conducted with the vegetation, animal distribution, and land stewardship maps to identify "gaps" in the protection of biodiversity. This information will then be provided to the public and those entities charged with land use research, policy, planning, and management. By using this broad-scale, ecoregional approach, biologically meaningful conservation strategies may be created.

The SW ReGAP program will rectify the problems of the first generation of GAP products through the use of: 1) a standardized vegetation classification system, the National Vegetation Classification System, 2) an objective, statistical approach to landcover mapping, 3) the use of "mapzones", or ecoregional subunits, as our basic unit for landcover classification, and 4) a standardized set of geospatial data products provided by the EROS Data Center. The use of standardized geospatial data, modeling methodologies, vegetation classification system, and landscape units will lead to the creation of seamless maps of biotic elements and a broad assessment of the status of biodiversity protection in the southwestern US.

1.3 - Introduction to Nevada ReGAP: NERL-ESD-Las Vegas began leading the Nevada portion of the SW ReGAP Project in September 2000. Project responsibilities during the initial year include building a cooperative network, field data acquisition, and providing assistance to the regional laboratory for imagery analysis (RS/GIS Lab at Utah State University). Fifteen mapzones (Figure 1) lie mostly in Nevada and comprise the responsibility of the Nevada team. Landcover will be classified to the vegetation "alliance" level, using the national classification scheme under development by NatureServe and others. Based on land cover mapping and other data sets, models will be developed by the SW ReGAP group for approximately 1000 vertebrate species that inhabit the 5-state area.

Field data collection in support of the landcover mapping component was initiated in 2002. Sampling was completed in five mapzones of southern and eastern Nevada, comprising roughly 40% of the state. One field crew worked from February to June in the Mojave mapzone, and 2-3 field crews working in the eastern Great Basin mapzones (TOAB, DKWT, GSHT, PIOC). This effort resulted in the collection of approximately 8,000 samples, or training sites, that included 45 different "mappable" plant communities. All of the data collected in 2002 was collected via road sampling, our most time- and money-efficient sampling methodology.

During 2003, field data collection for the remainder of Nevada must be completed. Field efforts begin in central Nevada and work westward towards Reno and Lake Tahoe, then moving north and east towards Utah. We will use 4+ field crews during April through October to gather 10,000+ training sites that represent 60+ mappable plant communities. Most of 2003's sampling will be road-based sampling, however we will also employ other forms of sampling such as backpacking and/or horse packing in an effort to sample communities not found near roads (e.g., alpine and riparian communities).

Figure 1: Mapzones of Nevada
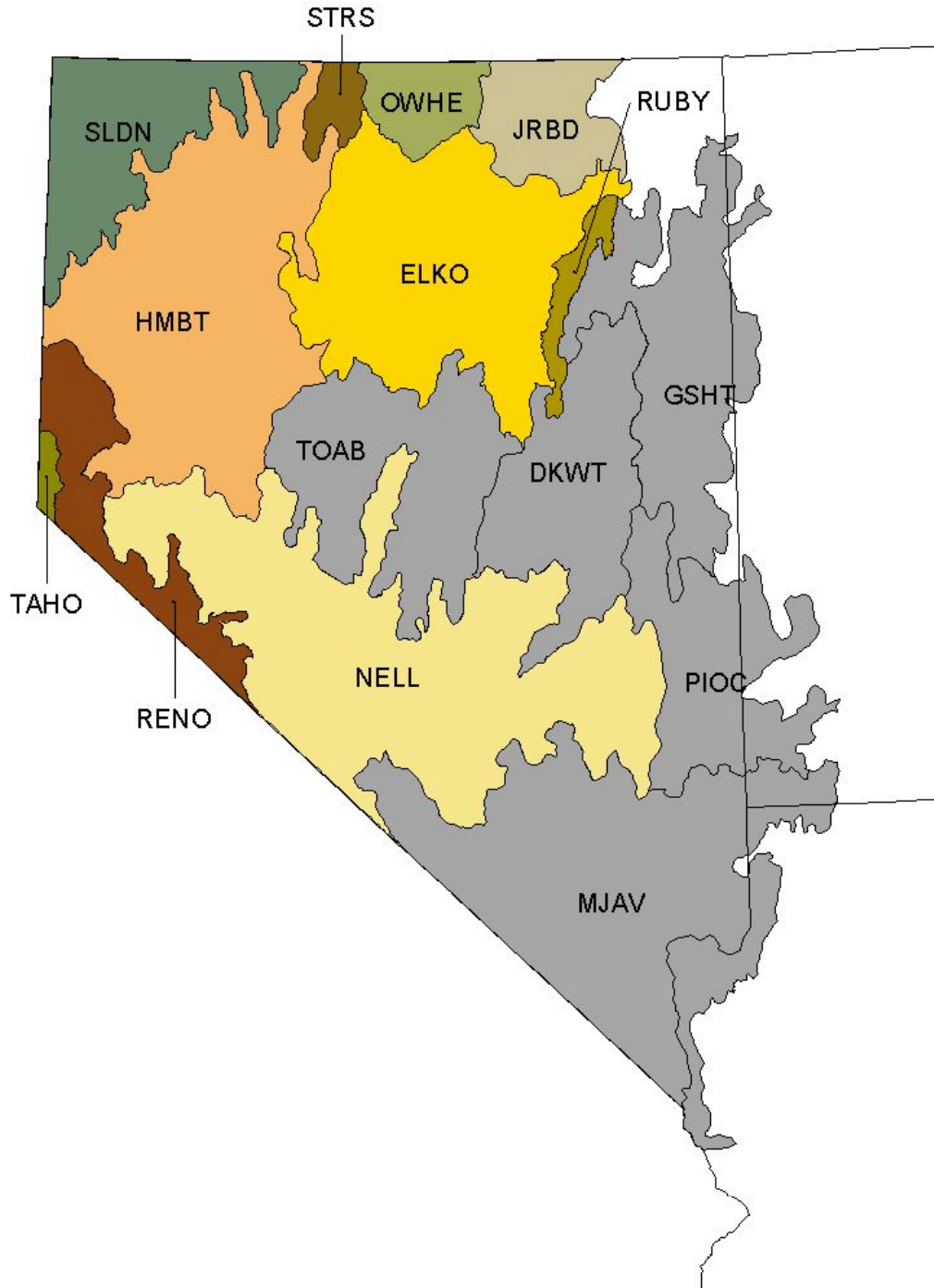
Section 2.0 - Overview of Landcover Mapping Methods

2.1 - Field Data Collection: An ideal dataset for landcover modeling has two critical characteristics: 1) it adequately samples the range of environmental settings in a landscape, and 2) it contains enough data to robustly model each plant community of the classification. To classify the vegetation of a five state region thus requires thousands of training sites. Because of the large volume of data required, only enough time is spent at each site to collect the minimum amount of ecological detail to confidently assign an alliance labels. Field crews select training sites opportunistically based on homogeneity of plant species composition, landform, and spectral characteristics. Three essential steps are performed at each site: plant community characterization, site delineation, and photographic documentation.

> *Plant Community Characterization:* Three basic types of information that are collected for each training site: 1) ocular estimates of vegetative cover subdivided into growth form (e.g., tree, shrub, forb/graminoid) and plant species, 2) visual estimates of abiotic ground cover (e.g., rock fragments, bedrock, water), and 3) measurements and classification of the communities' landscape setting (e.g., landform, topographic attributes).

> *Site Delineation:* With the assistance of a laptop computer, a polygon delineating the training site is hand-digitized in the field. To assist in this task, field crews utilize satellite imagery, digital elevation models (DEMs), and digital raster graphs (DRGs) as guides. Field polygons are a minimum of 90x90 meter areas in most cases though some communities of special concern (e.g., riparian areas) are delineated with smaller dimensions.

> *Photographic Documentation:* To document each training site, a digital photograph is collected as a reference should any questions arise regarding it alliance, ecological system or NLCD label.

2.2 - Plant Community Classification: The National Vegetation Classification System (NVCS), developed by NatureServe, is the basis for plant community classification for the SW ReGAP project. The "alliance" level of the NVCS was the initial goal of the SW ReGAP landcover maps. As landcover mapping has proceeded, it was determined that mapping at the alliance level was infeasible, and alliances had to aggregated. NatureServe developed a modified classification system to be used by the SW ReGAP project. Based on the plant community characterization collected in the field, each site is assigned an alliance, ecological system, and "coarse-level" label.

2.3 - Geospatial Data: Once all of the training site polygons for a mapzone are collected, they are intersected through various digital datalayers. In order to further standardize methodologies throughout the five states, we will use consistent datalayers for modeling. The geospatial data layers include Landsat 7 Enhanced Thematic Mapper Plus (ETM+) imagery from 3 dates, digital elevation model data, and STATSGO soils data.

Multi-date Landsat 7 ETM+ imagery: A spring, summer, and fall scene was selected for each path/row. These scenes were georectified and terrain-corrected by EROS Data Center personnel. From the raw imagery additional data layers (e.g., Tasseled Cap Transformation, geologic indices, etc.) will be derived.

USGS Digital Elevation Models: This elevation model was obtained from USGS and will be used to develop additional datalayers including slope, aspect, elevation, and landform.

Edaphic GIS Layers: These layers include STATSGO soils and state maps of geology and can be used to create numerous layers related to soil texture and chemistry.

DAYMET Climate Data: This dataset was developed by Thornton et al. (1997) using Advanced Very High Resolution Radiometer (AVHRR) and climate station data for the conterminous United States. It provides climatic variables including precipitation and temperature.

2.4 - Land Cover Modeling: The SW ReGAP project is faced with a daunting task, namely constructing predictive vegetation models and subsequent vegetation maps for a diverse region that is almost as large as Alaska, or 530,000 square miles. At the project's outset it was recognized that this large region had to be subdivided, hence our mapzones were developed. Even with a single mapzone, vegetation diversity can be substantial. Classification and regression trees can handle large numbers of predictor variables and are relatively insensitive to "noisy" data. Therefore, the SW ReGAP modeling approach is centered on the use of classification and regression trees.

Classification and Regression Trees: Classification trees recursively partition a dataset into increasingly "pure" subsets based on a multitude of predictor variables. A CART starts with a binary split of a single predictor variable that produces the most homogeneous daughter nodes. Splitting stops when an acceptable level of node "purity" has been reached. CARTs tend to produce over fit models that are revised by a process called "pruning". In the case of SW ReGAP, the pure subsets are groups of field sites that belong to the same alliance or system. The output of a classification tree is a set of decision rules.

Divide-and-Conquer Methodology: Because the variety of plant communities within a mapzone can be considerable, each mapzone will be further subdivided. Two alternate scenarios are possible: 1) using a very coarse vegetation classification,

generate a preliminary classification tree. Each coarse vegetation class (e.g., Tall Shrubland) would then be decomposed into its component Ecological System classes (e.g., Sonora-Mojave Creosote-White Bursage Desert Scrub, Mojave Mid-Elevation Mixed Desert Scrub, etc.) by a second classification tree, or 2) perform a preliminary classification of a predictor variable (e.g., coarse elevation ranges), and construct separate classification trees for all training sites occurring within each elevation range.

2.5 - Accuracy Assessment: As final predictive vegetation maps are completed, it will be subjected to various accuracy assessment procedures. The first method will withhold a proportion of the training dataset (e.g., 20%) and use those data in a conventional accuracy assessment (confusion matrix, errors of omission/commission). The assessment dataset could be supplemented with sites identified from airborne videography. A second qualitative methodology involves review of draft vegetation maps by regional experts; gross inaccuracies could be thus identified and revised by the landcover analyst.

Section 3.0 - Participating Agencies and Personnel

U.S. Environmental Protection Agency – David Bradford and William Kepner are the Primary Investigators for Nevada ReGAP and are responsible for insuring all aspects of Nevada ReGAP are complete. Todd Sajwaj is the Landcover Coordinator, and oversees aspects of data collection, image processing, and the creation of landcover maps.

Nevada Bureau of Land Management – Gary Medlyn is the primary point of contact at the Ely BLM Field Office. Gary and other BLM personnel have arranged for the use of BLM vehicles, access to soil survey data, information on local roads, and assistance with plant identification.

Eastern Nevada Landscape Coalition – Betsy MacFarlan and Mindy Seal represent the ENLC and supervise the day-to-day operations of field data collection. Problems or questions should be directed to them first.

USGS SageMap Project – Steve Knick of the USGS Field Office in Boise ID oversees a project to map the distribution of sagebrush throughout the western US. Steve Knick has generously contributed to GAP by providing money to hire a field crew.

National Gap Analysis Project – Kevin Gergley and Ree Brannon represent the National GAP Analysis Project, and have been instrumental in insuring funding for the landcover mapping component of the project.

Section 4.0 - Field Sampling

4.1 - Philosophy: To construct a vegetation map of Nevada with 50+ plant communities, we need hundreds of examples, or training sites, of each community that represent their distribution across ecological and spectral gradients. We have 6 months to collect 10,000+ training sites distributed across 60% of Nevada. Because we need to collect a large amount of data in a short time, we must use our field time efficiently.

Our field methodology is designed to collect just enough information to classify the training sites according to the National Vegetation Classification System (NVCS). Consequently, we spend 5 minutes or less characterizing each site. We do not have time to collect the amount of ecological and floristic detail characteristic of most vegetation studies. We want to adequately characterize the dominant species and their approximate proportions and delineate the training site as quickly as possible. We cannot afford to spend 30 minutes at one site puzzling over unknown or rare species or precisely locating training site boundaries.

4.2 - Field Crew Base and Composition: All field crews will be based in Ely, NV. It is a central location in Nevada and we have strong logistic and managerial support from the ENLC and Ely BLM Field Office. You will provide for your own lodgings while in Ely; rent is inexpensive, and less so if several people live together.

We will use four field crews each composed of two people: a botanist and a computer operator. The driver/botanist selects and characterizes the training site, while the navigator/computer operator delineates the training site and takes a photo. Miscellaneous data entry is performed en route to the next site or at camp that night. Using this approach, the 2002 field crews collected an average of 40 training sites per day, or 8000 sites spread across 40% of Nevada. The 2003 field crews must achieve this rate of sampling if we are to be successful.

All field personnel will become intimately familiar with both jobs so crews can be re-arranged when necessary. You will spend a great deal of time with your crew partner. Spending so much time with one person sometimes creates difficulties. Field crews will be re-organized periodically to prevent spending too much time with each other. If personality conflicts arise, please get along until the problem can be resolved or the crews can be rearranged.

4.3 - Sampling Areas: Field data collection for the GAP project is subdivided into mega-mapzones, mapzones and work areas. Mega-mapzones and mapzones are ecologically distinctive areas used to facilitate the modeling process, while work areas are logistic constructs to prevent overlap in sampling efforts.

Mega-mapzones: Mega-mapzones are broad regions with similar patterns of climate, phenology, and geology. Coarse vegetation maps will be developed at the mega-mapzone level. Field crews will be concentrated in a single mega-mapzone until it has been thoroughly sampled. The mega-mapzones of Nevada are illustrated in Figure 2.

Mapzones: Each mega-mapzone is sub-divided into mapzones, or sections that are more homogeneous with respect to phenology, plant communities, and spectral characteristics. We will focus most of our field efforts within a single mapzone where possible. Figure 3 depicts the mapzones of Nevada. The mapzones and their abbreviations are:

1) Duckwater (DKWT) – completed 2002
2) Goshute (GSHT) – completed 2002
3) Toiyabe (TOAB) – completed 2002
4) Pioche (PIOC) – completed 2002
5) Mojave (MJAV) – completed 2002
6) Nellis (NELL)
7) Humboldt (HMBT)
8) Sheldon (SLDN)
9) Reno (RENO)
10) Tahoe (TAHO)
11) Santa Rosa (STRS)
12) Owyhee (OWHE)
13) Jarbidge (JRBD)
14) Elko (ELKO)
15) Ruby (RUBY)

We must complete field sampling in mapzones 6 - 10 during 2003.

Work Areas: Each mapzone is parsed into work areas, or an area that one field crew will work in until thoroughly sampled or all roads have been exhausted. A crew should spend no more than 5 days in a single work area. The tentative schedule of work areas for 2003 is shown in Figure 4.

Figure 2: Mega-mapzones of Nevada

MMZ #1 = SLDN

MMZ #2 = NELL + HMBT

MMZ #4 = RENO + TAHO

MMZ #13 = MJAV + AZ mapzones

MMZ #3 = GSHT + DKWT + TOAB + PIOC

MMZ #15 = SRTS + OWHE + JRBD + ELKO + RUBY
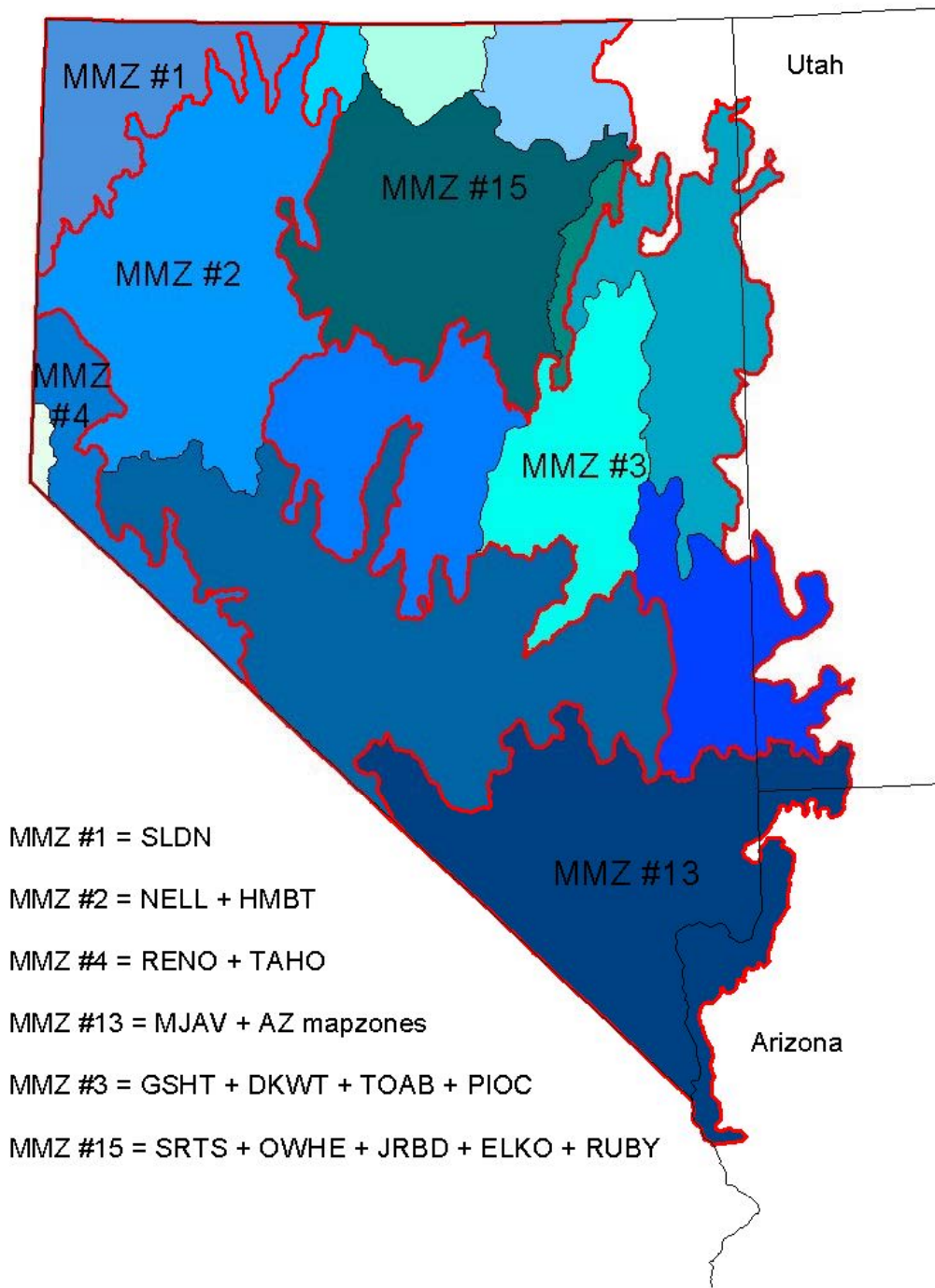
Figure 3: Mapzones of Nevada
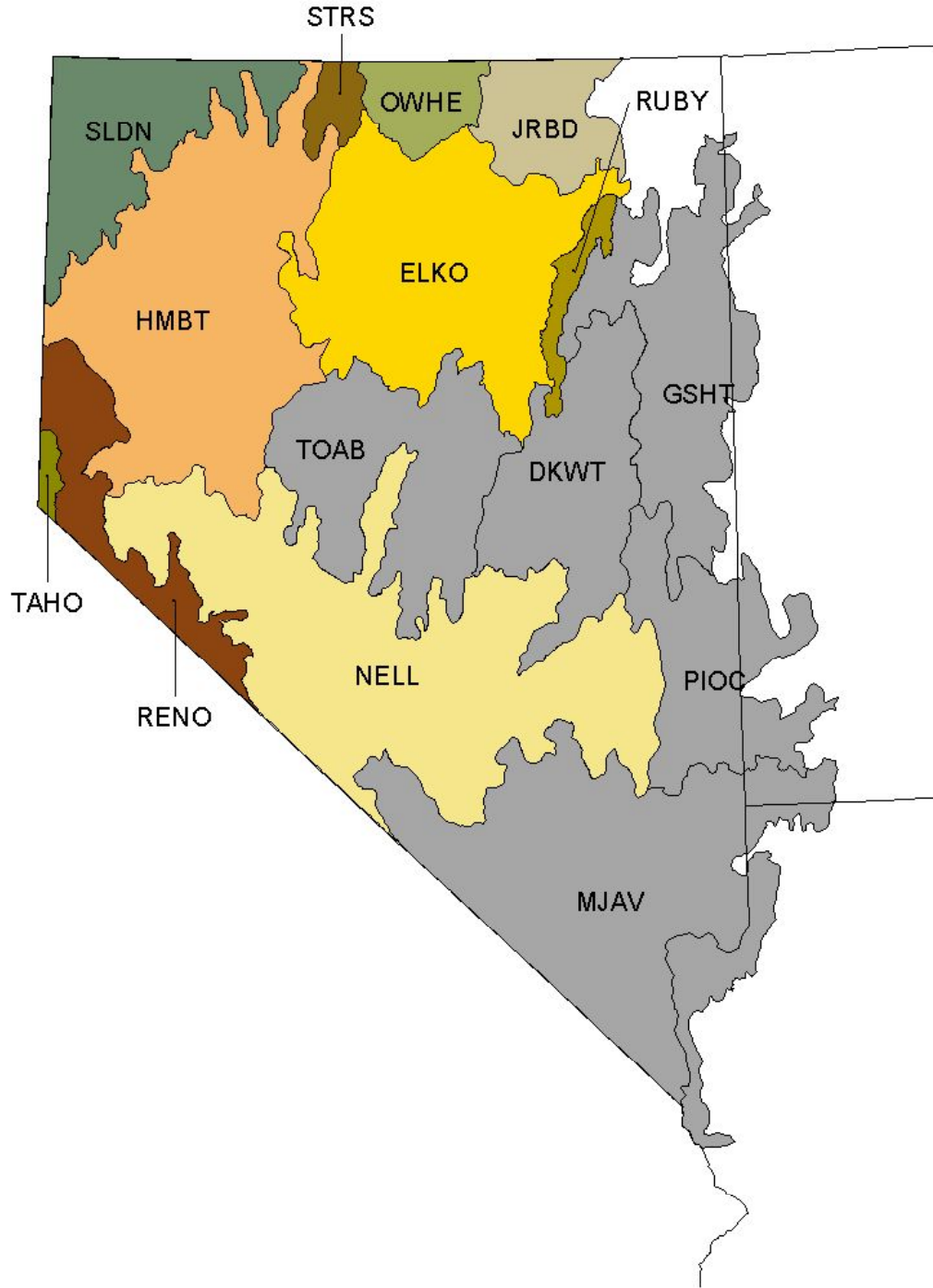
Figure 4: Schedule of Work Areas for 2003

April: Begin Nellis

May: Complete Nellis
Begin Sheldon/Humboldt

June: Continue Sheldon/Humboldt

July: Complete Sheldon/Humboldt/Tahoe
Begin Reno

August: Complete Reno/Santa Rosa/Owyhee/Jarbidge
Begin Elko/Ruby

September: Continue Elko/Ruby

October: Complete Elko/Ruby
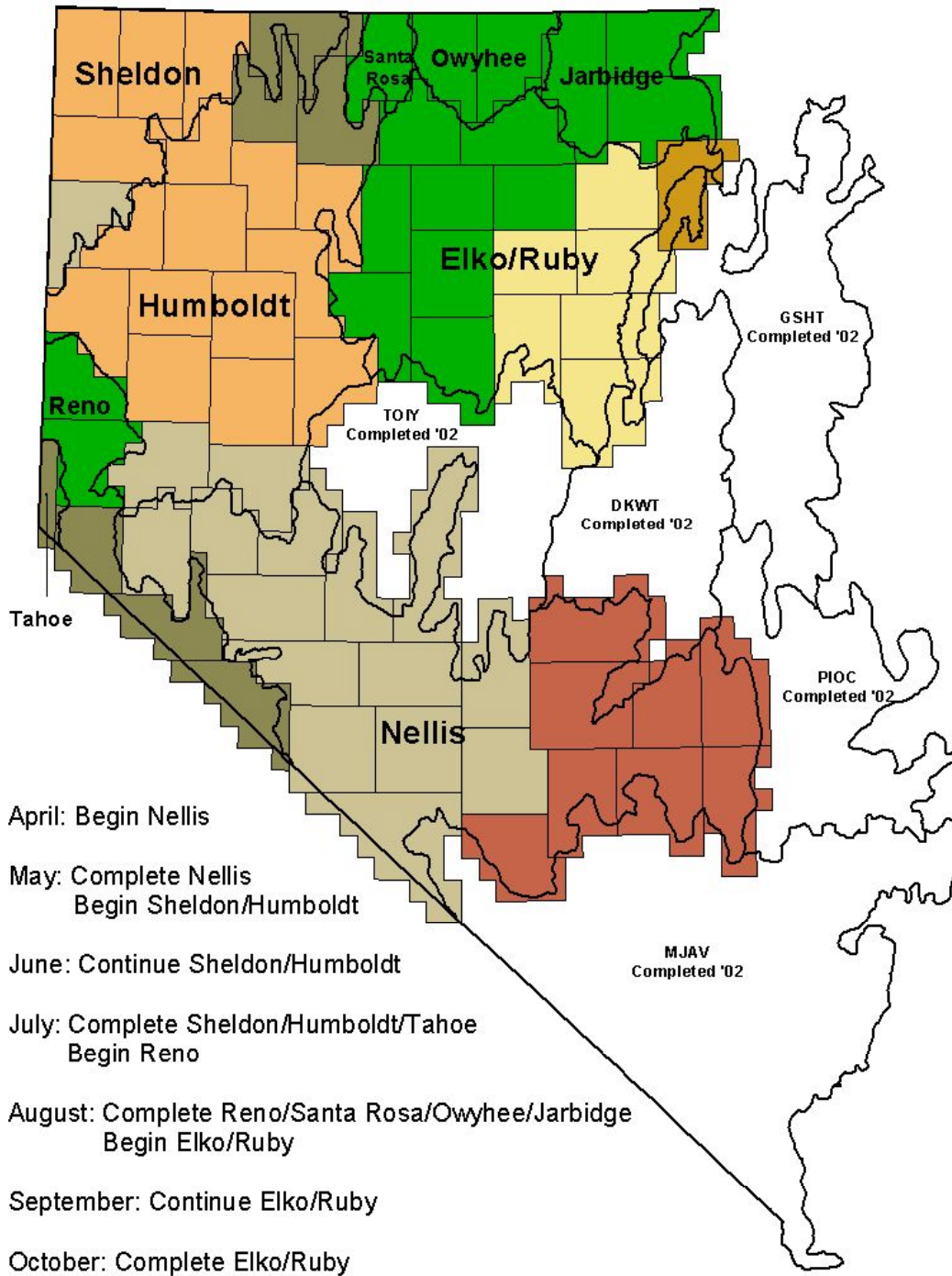
4.4 - Field Trips: We will tentatively use a 10 days on/4 days off schedule in order to maximize sampling efforts and minimize travel time. As field crews range farther from Ely, it becomes more efficient for crews to stay out for longer periods of time rather than taking short trips where most of the time is spent traveling to and from Ely.

Your nightly field accommodations are up to you. You will not be reimbursed for hotel expenses or campground costs. Crews may have access to BLM bunkhouses, but these are few and far between. Since most of Nevada is managed by BLM, it is recommended that you camp while in the field. There are no fees to camp on most BLM lands. While it is expected that crews will spend a night or two in a motel to clean up and re-organize, it is not recommended that you travel long distances to find a place to sleep. It increases travel time and reduces your efficiency.

4.5 - Equipment: GAP field equipment is purchased and owned by the ENLC and/or the Ely BLM Field Office and will only be used in service of the GAP project. Each crew is responsible for its field equipment. It is in your best interest to keep it clean and in good working order. If your equipment is down, you cannot work unless spare equipment is available. Report any equipment problems to Mindy Seal or Betsy MacFarlan immediately.

Before you leave for a field trip, be certain you have all required field equipment. Leaving any gear behind might mean a long trip to pick it up. You will be provided with a large storage container for field gear. Always keep your gear clean and in the container when not in use so you know its location and status for immediate use. When not in the field, field gear should remain in the ENLC office in case other crews have emergency equipment problems. GAP equipment will NOT go on vacation with anyone, lest you suffer the wrath of Betsy MacFarlan and Todd Sajwaj. Your equipment includes:

Field Vehicle: Your vehicle is the most important and expensive piece of equipment you will be issued. The field vehicles for the GAP project are on loan from various BLM districts throughout the state. As such, all crews will receive driving training from BLM and you will adhere to their guidelines. Field crews will be responsible for getting vehicles in for regular maintenance and for keeping the vehicle's log.

Crews will drive thousands of miles on remote 4X4 roads, a situation that is tough on vehicles. You will minimize rough treatment by using common sense and driving sensibly. Rough handling of your vehicle will likely result in accidents or prolonged repairs that put your crew out of commission. Traffic accidents happen occasionally, but if they happen more than once, you will likely lose your job.

Computer: Next to your vehicle, the most important piece of equipment you will be issued is a laptop computer. Our laptops are expensive to repair and the data you collect is irreplaceable, so take VERY good care of them. They do not respond well to being hit, dropped or other forms of abuse. Similarly, Betsy MacFarlan and Todd Sajwaj will not respond well if our computers are hit, dropped or otherwise abused. If your computer is out of commission, you cannot work so it is vital that you treat these

computers with kindness and veneration. It is acceptable to use the laptops for email and web browsing, only so long as it does not interfere with work. Each computer will carry the following software:

- ArcView is a simple Geographic Information System (GIS) that enables you to view satellite imagery, digital models of topography, topographic maps and digital orthophotos, as well as to locate and delineate training sites. It also has specially designed programs, or extensions, developed for the GAP project. This software will be used daily, so learn it well.
- Access is a database program used to enter and store your site characterization data. It has many other capabilities as well, but for our purposes, it will mainly be used for data entry and data sanitation.
- EZ CD Creator is used to save all field data to CD for transmission to ENLC and EPA personnel.
- Thumbs-Plus is used to view digital photographs taken at each training site as well as to properly name photographs so that they can be referenced to their corresponding ArcView polygon and site characterization data.
- Windows XP is our operating system and you should already have some familiarity with it.

Contained in the Appendices (Section 9.0) are simple how-to exercises for the software mentioned above. We will go through all of the software during the 2-3 week training session, so everyone knows how to use the laptop. Unfortunately, we cannot teach you everything there is to know about our software. Todd Sajwaj will always answer questions about software if you have problems. But the best way to learn the software is through using it, making mistakes, and becoming familiar with the Help menus.

Where possible we will provide you with digital copies of the datasheets, NVCS community and landform descriptions, plant keys and lists, and digital imagery to be stored on your computer. This enables you to print them out as needed and refer to them quickly when in the field. Should you identify additional resources that would be useful during field data collection, please bring it to Todd Sajwaj's attention quickly so it can be delivered to you.

GPS: A Global Positioning System (GPS) unit will assist you in locating yourself on the imagery we have provided you. We will instruct you in their basic use for determining your position in terms of latitude, longitude, and elevation as well as the basics of the coordinate system we will use (UTM, Datum NAD27, Zone 11).

Datasheets: We have two basic datasheets that are used in the field: the site characterization datasheet, and the ocular estimate datasheet. The site characterization datasheet will be filled out at each site. These datasheets should be filled out as completely as humanly possible. More about the datasheets will be discussed below in the Data Collection section. You will also use the calibration datasheet once per day to standardize your ocular estimates of vegetative cover to the other crews and to "reality".

Plant Collection Materials: While we do not spend time keying out plants at each site, this does not mean that we avoid it. We will equip each crew with a plant press, Zip-loc bags, field guides, taxonomic keys and a specimen flip book to assist you in identifying unknown plants. Most of the use of this equipment will be done in camp during the evenings or at the office when in town.

Digital Camera: The camera is used to document the vegetation and ecological setting of each training site so that if questions arise in the office regarding species identification or total ground cover, we have a handy reference for each site.

Miscellaneous: Compasses and inclinometers are used to roughly quantify the slope and aspect of our training sites. An optical densiometer is used for calibrating cover estimates of tree canopies. Other minor bits of equipment may also be introduced.
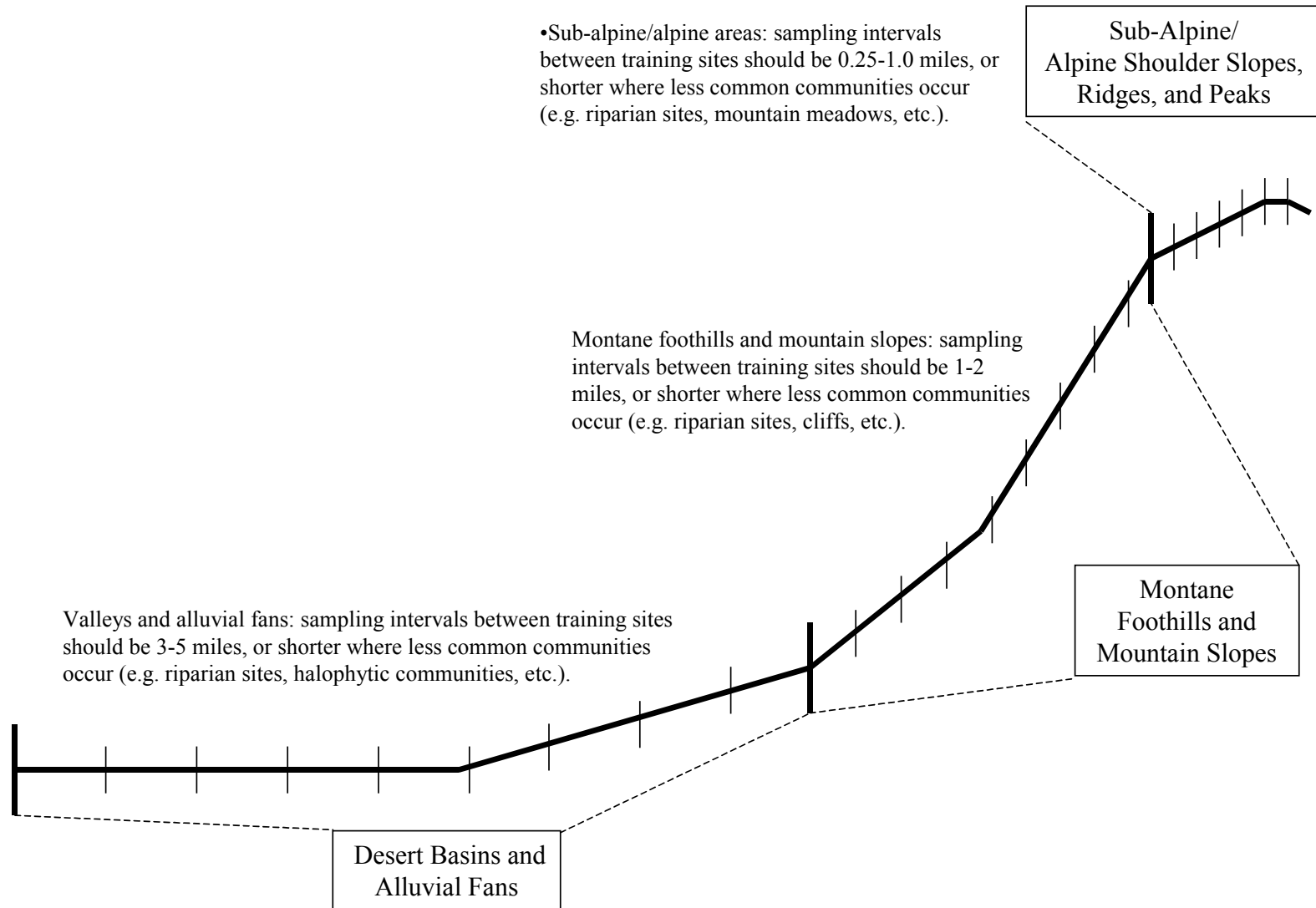
Section 5.0 - Field Methodologies

5.1 - Travel Routes: Field crews must travel through a range of environmental settings in order to collect a diverse sample of plant communities. As noted earlier, we need hundreds of training sites per plant community we attempt to map. Unfortunately, most roads are located in the broad valleys and foothills of the Great Basin. Field crews will identify roads that traverse an elevational gradient, meaning you will start in the valleys, move up as high as you can into the montane, sub-alpine, and alpine zones, and then back down to the foothills and valleys. It is recommended that crews consult with BLM personnel at the regional Field Offices to identify good roads.

5.2 - Site Spacing: Training sites must be well dispersed to capture the spectral and ecological variation of a mapzone, but also to sample the less common riparian, montane and alpine vegetation types. Training sites should be dispersed; we do not want 15 training sites all bunched up along a 1-mile stretch of road. Field crews must take advantage of roads that go into the less common communities such as riparian, montane, sub-alpine, and alpine zones. General rules for distance intervals between training sites are illustrated in Figure 5.

This strategy enables field crews to quickly sample desert valleys and alluvial fans in order to spend relatively more time sampling the montane, sub-alpine and alpine communities. Field crews must use these guidelines judiciously. If a riparian community is found only 0.5 miles from the last site in a broad valley, it should be sampled regardless of minimum spacing guideline. There is another exception to the guideline: when multiple distinct communities can be collected at a single stop. More about this topic will be described below.

Figure 5: Sampling Intervals for Elevation/Landform Strata

•Sub-alpine/alpine areas: sampling intervals between training sites should be 0.25-1.0 miles, or shorter where less common communities occur (e.g. riparian sites, mountain meadows, etc.).

Sub-Alpine/ Alpine Shoulder Slopes, Ridges, and Peaks

Montane foothills and mountain slopes: sampling intervals between training sites should be 1-2 miles, or shorter where less common communities occur (e.g. riparian sites, cliffs, etc.).

Valleys and alluvial fans: sampling intervals between training sites should be 3-5 miles, or shorter where less common communities occur (e.g. riparian sites, halophytic communities, etc.).

Montane Foothills and Mountain Slopes

Desert Basins and Alluvial Fans

5.3 - Site Selection: Training sites are not pre-selected since navigating to pre-determined sites requires more time to locate the site than is needed to characterize the site's vegetation. Rather, GAP field crews select training sites opportunistically in the field. Selecting a training site requires constant attention to a myriad of factors including changes in the dominant canopy vegetation, environmental gradients, and spectral characteristics of the areas that are driven through. Each time a crew stops, you should run through the following questions to be certain the site should be collected:

1) Is the site homogeneous with regard to the plants in the uppermost canopy?
When selecting a site, it should be uniform with regard to the dominant plant species in the canopy. Ideally, you will locate sites where only 1-2 plant species dominate the uppermost canopy. For example, a site that has 60% total cover of mountain big sagebrush and 15% cover in miscellaneous graminoids would be a good site to collect; it will be relatively easy to classify via the NVCS. However, if a potential site contained 10% cover of mountain big sagebrush, 15% cover singleleaf pinyon, 10% cover of limber pine, and 15% cover of mountain mahogany you would avoid it, since it would be difficult to classify.

Field crews should sample "pure" communities whenever possible. In other words you want to avoid ecotones, or sites that lie across an environmental gradient influencing the local vegetation types. You must become familiar with the common plant associations of the region you are working in as quickly as possible. For example, limber pine is commonly observed with bristlecone pine throughout the Great Basin, making these good sites to collect. Limber pine is not observed with mountain mahogany, making this a site to avoid.

2) Can I readily attach a single NVCS alliance label to the site?
Once field crews have become familiar with the NVCS alliances of Nevada, you should be able to assign an alliance label to the potential site without quantifying the vegetative cover. If you can apply 2-3 alliance labels to a potential site, you should probably avoid it.

Unfortunately, the NVCS is a work-in-progress, so you will encounter communities not described in the NVCS. Therefore, field crews must consider if a potential site is a repeated unit across the landscape. This means that the same groups of dominant plants occur together throughout the mapzone and/or mega-mapzone. So even if the plant community is not listed the National Vegetation Classification System, if it is a widespread, repeated community, you will want to collect the site.

Similarly, if a community is uncommon (e.g., riparian or alpine communities) but repeated across a broad area of Nevada, you will want to collect it. Crews should be careful with these uncommon, but repeated communities. They could be legitimate "mappable" communities, but they could also be rare associations that only occur in a localized area. Field crews should always compare notes about the communities encountered whenever possible, and also consult BLM field personnel regarding the

distribution of rare plant communities. If we cannot collect a large number of sites for a rare vegetation type, we will be unable to map it accurately

3) Is the site 100X100 meters (or larger) in size?
This is self-explanatory. Some vegetation types do not meet this requirement even though they are common. For example, riparian communities in the Great Basin are typically long and linear in dimension. Crews will not be able to find many 100x100 meter riparian sites. In these instances, it is acceptable to collect a site that is linear in shape. Most training sites however, should meet the 100x100 meter standard.

4) Is the site homogeneous with regard to topography (e.g., slope, aspect, and elevation) and other elements of its environmental setting?
Training sites should lie within a single environmental setting. This can be visually assessed by examining the site's location with regard to slope, aspect, elevation, and slope shape. To assist in these decisions, field crews will delineate training site boundaries in ArcView using digital topographic data in the form of digital raster graphic (DRGs) and digital elevation models (DEMs).

Potential sites ought to lie on a slope with a single dominant aspect, homogeneous slope, and similar potential for relative soil moisture. For example a potential site that straddles a ridge, located half on a north-facing slope and half on a south-facing slope, is an example of a site to avoid. Similarly, a site in a valley that lies across a dry wash does not contain significant topographic changes, but does straddle a relative soils moisture gradient that could influence the plant community composition and/or the total vegetation cover of the site. Field crews must constantly review the factors that influence the distribution of plant communities (topography, soil texture and chemistry, dominant geology, relative soil moisture availability, etc.) when selecting training sites.

5) Is the site spectrally homogeneous?
The spectral characteristics of the site can only be assessed by examining the satellite imagery in ArcView. Field crews must assess the similarity of pixel colors to one another within the training site's polygon. All field personnel will become adept at interpreting satellite imagery and manipulating the spectral information in the ArcView environment. The various spectral datalayers, or bands, can be arranged in numerous ways to assist in identifying a training site's location. Using the most common combination of spectral bands for Landsat Thematic Mapper imagery, the dense vegetation of riparian corridors can is readily differentiated from the sparser upland vegetation.

Two types of satellite imagery will be provided to each field crew: multispectral, or color imagery, and panchromatic imagery, or black-and-white imagery. The multispectral imagery has 30x30 meter pixels and a wealth of spectral information, while the panchromatic imagery has better spatial resolution, 15x15 meter pixels, but relatively little spectral information. More about the imagery is described in the Section 5.4 called "Field Imagery".

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6) Can I collect multiple sites with a single location?

If possible, try to stop the vehicle in locations where multiple potential sites can be assessed. This strategy will not work well in the valleys and alluvial fans, but will be valuable in more mountainous areas. For example, in montane and alpine areas you can commonly stop and collect a *Cercocarpus ledifolius* site on a south slope, and an *Artemisia tridentata ssp. vaseyana* site on the north-facing slope. Similarly, you can also acquire "remote sites" or sites that are distant, but whose vegetation can be adequately describes with the help of a spotting scope of a good set of binoculars. Remote sites should only be collected when the vegetation species can be POSITIVELY identified from a distance, and POSITIVELY delineated on the imagery.

To summarize:
- Look for sites with relatively simple species composition in the uppermost canopy.
- Select training sites that represent dominant, repeated vegetation units across the landscape.
- Collect sites to which a single alliance label can be quick applied.
- Avoid ecotones.
- Acquire sites that are larger than 100x100 meters in dimension.
- Check for topographic and spectral homogeneity within the training site.
- Collect multiple sites at a single location where possible.

5.4 - Field Imagery: You will use four types of imagery in the field to help you delineate training sites and navigate while in the backcountry: 2 types of imagery from the Landsat 7 Enhanced Thematic Mapper sensor, a landform image, and digital raster graphics. To review the details for setting up each of the imagery type in ArcView, please consult the Appendices.

Landsat TM Multispectral Imagery: The multispectral imagery will be the primary layer upon which training sites are delineated. The Landsat Multispectral sensor detects energy in 6 regions of the electromagnetic spectrum (EMS):

Band	Wavelength Range (micrometers)	Region of EMS
Band 1	0.45 - 0.52	Visible – Blue
Band 2	0.52 - 0.60	Visible – Green
Band 3	0.63 - 0.69	Visible – Red
Band 4	0.76 - 0.90	Near Infrared
Band 5	1.55 – 1.75	Middle Infrared
Band 7	2.08 – 2.35	Middle Infrared

The multispectral imagery used by field crews will contain only the near-infrared, red and green bands from the multispectral imagery. Each pixel is 30x30 meters in size.

When each band is viewed individually, the darkest shades in the image refer to areas that do not strongly reflect radiation in that particular band, while the brightest areas indicate regions that strongly reflect those wavelengths. For example, if you were looking at the red band of the multispectral imagery, dense vegetation would appear to be rather dark since plants strongly absorb (and do not reflect) red light to drive photosynthesis, while bare soil would tend to be very bright since soil reflects red light strongly.

The field imagery is compressed into a format called MrSID that reduces the storage space needed for each image and permits faster displays in ArcView. Each MrSID image requires two files: a *.sid file, containing the image itself, and a *.sdw file which contains geo-referencing information. Both files are essential for the image to be displayed properly. The MrSID file format will require the use of a special extension in ArcView before it can be used, which will be discussed in the Appendices: ArcView-Manipulating Imagery.

Landsat TM Panchromatic Imagery: The panchromatic sensor produces images akin to a black-and-white photograph. Because its pixels are smaller, 15x15 meter, than those of the multispectral imagery, it is better for identifying features whose shapes are important such as agricultural fields. The panchromatic imagery should be used as a secondary aid for training site delineation. These images are also delivered in the MrSID format and also require the MrSID extension to be enabled before viewing in ArcView.

Landform Imagery: The landform image is derived from digital elevation models (DEMs) with pixels that are 30x30 meters in dimension. The original DEM is used to calculate a relative moisture index whose values are classified into 10 categories. We will collapse two of the categories to produce a landform image with eight categories. Field crews will use the landform layer as another secondary aid for delineating training site boundaries. The 10 landform classes and their names are:

Landform Class(es)	Category Description
1 and 4	Valley Flats
2 and 3	Toe Slopes and Alluvial Fans
5	Very Moist Steep Slopes
6	Moist Steep Slopes
7	Dry Steep Slopes
8	Very Dry Steep Slopes
9	Cool Aspect Cliffs and Scarps
10	Hot Aspect Cliffs and Scarps

The landform imagery is in an ARC GRID format that is very sensitive to alterations in its file structure. DO NOT MOVE THE LANFORM FOLDER!! IT WILL SEVER IMPORTANT LINKAGES AND MAKE THE LANDFORM LAYER UNUSABLE.

Digital Raster Graphics (DRGs): These are digital versions of 1:100K topographic maps produced by the US Geological Survey. The topography lines are very useful for examining slope shapes, and locating certain roads and other man-made features. Be wary of the roads on these images since not all roads are on the DRGs, and not all roads on the DRGs are passable. DRGs are in a TIFF file format that will require the use of the TIFF extension in ArcView. The DRGs used for this project require two files to work properly in the ArcView environment: the *.tif and *.tfw files. The *.tif file is the digital image of the topographic map, while the *.tfw file provides geographic reference information.

If for some reason you lose an important DRG, you can download them from the following website: http://keck.library.unr.edu. Navigate to the 1:100K collarless DRGs and then select the appropriate file. They will arrive in a zipped format, so simply unzip the file and copy both files to the appropriate file folder.

5.5 - Site Characterization: Data used in the site characterization will be used chiefly to label training sites with the most appropriate NVCS alliance and ecological system labels. As mentioned earlier, site characterization data will be brief but will identify the primary elements of biotic and abiotic ground cover as well as the ecological setting of the site on the landscape. Please refer to Figures 6 and 7 throughout this section. Fill out every training site record COMPLETELY. Do not leave fields blank; it gives the impression that information is missing. If you do not have any information for a particular field, put a small "/" through it to indicate no information.

Figure 6: Site Characterization Datasheet (3 records per datasheet)

Date:	Community:	Elevation:	Alliance:
Observers:	Plot Size:	Slope:	Confidence: L M H
Mapzone:	X-Coord.:	Aspect:	Alliance Alternate(s):
PlotID:	Y-Coord.:	Photos:	

SITE NOTES:	Ecological System:

Physiognomic Class	Landform - General	Landform - Specific	Hydrology Class
Sparse Herb. Shrub. Dw. Shrub Woodland Forest	1 2 3 4 5 6 7 8 9 10	MOUNTAIN BASIN	Upland Riparian Playa Wetland

Trees Ht. % CC			Shrubs Ht. % CC			Herbaceous % CC	
SP 1			SP 1			SP 1	
SP 2			SP 2			SP 2	
SP 3			SP 3			SP 3	
SP 4			SP 4			SP 4	
SP 5			SP 5			SP 5	

BARE SOIL	LITTER	SURF. ROCK	BEDROCK	CRYPTO	WATER

Date:	Community:	Elevation:	Alliance:
Observers:	Plot Size:	Slope:	Confidence: L M H
Mapzone:	X-Coord.:	Aspect:	Alternate(s):
PlotID:	Y-Coord.:	Photos:	

SITE NOTES:	Ecological System:

Physiognomic Class	Landform - General	Landform - Specific	Hydrology Class
Sparse Herb. Shrub. Dw. Shrub Woodland Forest	1 2 3 4 5 6 7 8 9 10	MOUNTAIN BASIN	Upland Riparian Playa Wetland

Trees Ht. % CC			Shrubs Ht. % CC			Herbaceous % CC	
SP 1			SP 1			SP 1	
SP 2			SP 2			SP 2	
SP 3			SP 3			SP 3	
SP 4			SP 4			SP 4	
SP 5			SP 5			SP 5	

BARE SOIL	LITTER	SURF. ROCK	BEDROCK	CRYPTO	WATER

Date:	Community:	Elevation:	Alliance:
Observers:	Plot Size:	Slope:	Confidence: L M H
Mapzone:	X-Coord.:	Aspect:	Alternate(s):
PlotID:	Y-Coord.:	Photos:	

SITE NOTES:	Ecological System:

Physiognomic Class	Landform - General	Landform - Specific	Hydrology Class
Sparse Herb. Shrub. Dw. Shrub Woodland Forest	1 2 3 4 5 6 7 8 9 10	MOUNTAIN BASIN	Upland Riparian Playa Wetland

Trees Ht. % CC			Shrubs Ht. % CC		Herbaceous % CC	
SP 1			SP 1		SP 1	
SP 2			SP 2		SP 2	
SP 3			SP 3		SP 3	
SP 4			SP 4		SP 4	
SP 5			SP 5		SP 5	

BARE SOIL	LITTER	SURF. ROCK	BEDROCK	CRYPTO	WATER

Figure 7: Site Characterization Record

Section A: General Site and Ecological Setting Data

Date:	**Community:**	**Elevation:**	**Alliance:**
Observers:	**Plot Size:**	**Slope:**	**Confidence:** L M H
Mapzone:	**X-Coord.:**	**Aspect:**	**Alliance Alternate(s):**
PlotID:	**Y-Coord.:**	**Photos:**	
SITE NOTES:			**Ecological System:**

Physiognomic Class				Landform - General					Landform - Specific	Hydrology Class	
Sparse	Herb.	Shrub.	Dw. Shrub	1	2	3	4	5	MOUNTAIN	Upland	Riparian
Woodland		Forest		6	7	8	9	10	BASIN	Playa	Wetland

Trees	Ht.	% CC	Shrubs	Ht.	% CC	Herbaceous	% CC
SP 1			SP 1			SP 1	
SP 2			SP 2			SP 2	
SP 3			SP 3			SP 3	
SP 4			SP 4			SP 4	
SP 5			SP 5			SP 5	

BARE SOIL	LITTER	SURF. ROCK	BEDROCK	CRYPTO	WATER

**Section B: Ground Cover Elements and Cover
Estimates**

5.5.1 - General Site and Ecological Setting Data: Two types of data are found in Section A of Figure 7. The first set of data is related to reference and record-keeping information. They include the date, observers, coarse geographic information, and, most importantly, a unique training site identification:

Date: Enter 2-digit month, 2-digit day, and 2-digit year. EX: 04/02/03

Observer: Enter 2 letter initials of observing crew members.

Mapzone: Enter 4-letter abbreviation of the mapzone.

Mapzone	Abbreviation
Duckwater	DKWT
Elko	ELKO
Humboldt	HMBT
Jarbidge	JRBD
Mojave	MJAV
Nellis	NELL
Owyhee	OWHE
Pioche	PIOC
Reno	RENO
Ruby	RUBY
Santa Rosa	SRTS
Sheldon	SLDN
Tahoe	TAHO
Toiyabe	TOAB

PlotID: This field will be unique for each training site. Enter the 2-letter state abbreviation, 6-digit date, 2-letter initials, and 2-digit sequential number. EX: nv020502ts01. *This field will be used to associate the site characterization data to the training site polygon and photograph. If the plot ID is entered incorrectly, one of two bad scenarios occurs: 1) TDS or the observing field crew must go back into the data and attempt to fix the problem, or 2) the site is lost which equates to wasted effort and money.*

Plot Size: Approximate dimensions of the training site expressed in "X" pixels by "Y" pixels. EX: 3x5 = 3 pixels east/west by 5 pixels north/south. 1 pixel = 30m. x 30m.

X-Coord.: Easting coordinate recorded from GPS where the projection is UTM - nad27 – zone 11
Y-Coord.: Northing coordinate recorded from GPS where the projection is UTM - nad27 – zone 11

Photos: Record the number and orientation of photographs taken for the site, where L=landscape and P=portrait. EX: 1L and 1P

5.5.1 con't - Ecological Setting Data: The second set of information in Section A deals with the ecological setting of the training site, or the site's topography, landform, hydrology, general vegetation, and specific site notes:

Elevation: Elevation from GPS recorded in meters. EX: 1520 meters

Slope: Slope from inclinometer recorded in degrees. EX: 13°

Aspect: General direction of the slope recorded as the 4 cardinal directions. EX: North. SPECIAL NOTE: When slope is less than 3°, aspect is recorded as FLAT.

Community: A general characterization of the vegetation recorded BEFORE an alliance name is assigned. EX: creosote/ambrosia

Site Notes: Any additional information that is deemed significant including how the site was described (i.e., remote sites) and notes on disturbance type and severity.

Physiognomic Class (circle one only)
1. Total woody cover ≥ 10%, **go to #3**
    3. Woody plants ≥ 3m. tall and growing predominantly from a single stem (TREES), **go to #7**
        7. Total tree cover ≥ 65% = **FOREST**
        8. Total tree cover < 65% and ≥ 25% = **WOODLAND**
    4. Woody plants ≤ 3m. tall and growing predominantly from multiple stems (SHRUBS), **go to #9**
        9. Perennial graminoid cover ≥ 25% and total shrub cover ≥ 10% and shrub cover > tree cover = **SHRUB HERBACEOUS**
        10. Perennial graminoid cover < 25% and total shrub cover ≥ 10% and shrub cover > tree cover, **go to #21**
            21. shrubs ≥ 0.5m tall = **SHRUBLAND**
            22. shrubs < 0.5m tall = **DWARF SHRUBLAND**
2. Total woody cover < 10%, **go to #5**
    5. Total vegetative cover < 10% = **SPARSE**
    6. Total vegetative cover > 10%, **go to #13**
        13. Woody cover < 10% and perennial graminoids ≥ 20% = **HERBACEOUS**
        14. Woody cover < 10% and annual graminoids/herbs ≥ 20% = **HERBACEOUS**

Landform - General (circle one only)
This is the majority landform occupied by the training site when it is digitized on the landform imagery.

Landform - Specific: Circle the dominant landform type (mountain or basin) and then select the specific landform from Tables 1 and 2.

Table 1: Specific Basin Landforms

Basin Landform	Slope Range	Description
Alluvial Fan	1 – 15	Deposits of cobbly/gravelly soil materials in convex, fan-shaped patterns at the mouths of canyons or other drainage intercept points, may have incised channels and shallow ravines within the fan.
Bajada	1 – 15	Coalesced alluvial fans flanking the base of mountain ranges, (differentiated from alluvial fan by being an extensive, nearly continuous bench).
Canyon	15 – 45	Very steep slopes in relatively narrow "V" or "notch" valleys.
Cinder Cone	15 – 45	Conical hill formed of volcanic cinders and pyroclasts around vents.
Cliff	>45	Nearly vertical rock face (if the feature is lengthy, continuous, and/or not predominantly hard rock, use escarpment or badland).
Dune	5 – 20	Wind deposited and wind shaped sand hills, with or without vegetation
Draw	5 – 35	Low relief valley as a feature of mountain slopes and dissected plateaus, shallow ravine or gulch
Lake Plain	0 - 2	Nearly flat areas on basin floors associated with ancient lakes or lake shores
Lake Terrace	0 – 2	Similar to lake plains but conspicuously elevated above the level of the basin floor
Marsh	0	Ponded shallow water with emergent and/or aquatic vegetation, often bordering open water
Mesa	< 5	Elevated plateau remnant or tableland, bounded on at least one side (frequently all sides) by an escarpment, synonymous with the flat top of a butte
Playa	0 – 1	Intermittently flooded basin floor (often with salt crust), lacking vegetation, (or ephemeral lakebed).
Plateau	< 10	An extensive, relatively flat, upland surface. "Plain" is considered as low-elevation plateau.
Ridge	<15	Linear, convex drainage divides in hill, mountain, or dissected plateau landscapes.
Wash	0 – 3	Flat-bottomed intermittent stream bottoms typical of desert landscapes, may be vegetated.
Valley Side	15 – 35	The steeper portion of fluvial or glacial valley slopes, extending from the ridge to a foot slope, terrace, bench, or valley floor
Valley Floor	0 – 2	Extensive alluvial surface bounded by valley sides, may be used in place of more specific "flood plain" and "stream terrace"
Bench	0 – 5	Relatively level, long and narrow, terrace or platform, breaking a valley slope. Used to denote a landform resting on solid rock as opposed to a stream terrace or bajada (on un-consolidated alluvium).
Badlands	> 15	Intricately dissected soft rock with sparse or no vegetation
Butte	> 30	Isolated hill with steep slopes and a craggy summit or a narrow flat summit (mesa).
Escarpment	> 15	Long, nearly continuous, steep slope or cliff, separating gently sloping landforms. Generally facing in one direction. Synonymous with scarp or scarp slope (steep side of a cuesta).

Table 2: Specific Mountain Landforms

Mountain Landform	Slope Range	Description
Alluvial Fan	1 – 15	Deposits of cobbly/gravelly soil materials in convex, fan-shaped patterns at the mouths of canyons or other drainage intercept points, may have incised channels and shallow ravines within the fan.
Avalanche Chute	30 – 60	Very steep mountainsides or ravines with evidence of recent slides, sparse, or colonizing vegetation.
Bog	0 – 1	Flat, nearly closed, bottom land saturated to the surface most of the time, having spongy organic soils and wetland vegetation, includes "fen", (differentiated from marsh by lacking standing water for long periods).
Canyon	15 – 45	Very steep slopes in relatively narrow "V" or "notch" valleys.
Cliff	> 45	Nearly vertical rock face (if the feature is lengthy, continuous, and/or not predominantly hard rock, use escarpment or badland).
Cirque	>30	Glacial headwall or semi-circular hollow of steep cliffs (differentiated from headwall by setting: cut into a high alpine or sub-alpine ridge, recognized as shaped by alpine glaciers).
Draw	5 – 35	Low relief valley as a feature of mountain slopes and dissected plateaus, shallow ravine or gulch.
Hill	5 – 30	Convex sloping landforms rising less than roughly 1000 feet above surrounding flatter terrain (used where a more specific term is not apparent).
Head Wall	>30	Very steep slopes at the upper drainage of valleys created by mass wasting.
Lava Flow	2 – 30	Rock formed from lateral outpourings of lava from a vent, barren or sparsely vegetated.
Landslide/Debris Flow	5 – 30	Colluvial/fluvial deposits along valleys below avalanche chutes or mass wasted headwalls.
Mountainside	15 – 60	Steeply sloping portions of mountains (roughly differentiated from hills by relief greater than 1,000 feet). Not an apparent fluvial valley side or more specific type of slope.
Moraine	< 45	Glacially deposited mounds, ridges, or undulating valley fill of unsorted rock and soil debris (can be generally, but not absolutely, differentiated from alluvium by irregular slopes and unsorted sediments).
Mudflow	< 45	Similar to alluvial fans but associated with active or recent mudflows.
Peak	> 10	Steeply sloping summits in mountains or hills, (differentiated from ridge by shape, ridges are linear and relatively even with respect to top slope; peaks are conical or other form besides linear.).
Plateau	< 10	An extensive, relatively flat, upland surface. "Plain" is considered as low-elevation plateau.
Ridge	< 15	Linear, convex drainage divides in hill, mountain, or dissected plateau landscapes.
Saddle	< 15	Low area in summit divides.
Swale	1 – 5	A depressional (concave) landform with closed or impeded drainage, especially in glacial (ground moraine) basins, (differentiated from flood plain by lacking stream channel, less flat and wet than bog).
Slump	1 – 30	Irregularly sloping landforms caused by downslope sliding (and often rotation) of masses of soft rock or unconsolidated materials.
Stream Terrace	0 – 2	A nearly flat, alluvial plain, somewhat elevated from the floodplain, or the relict floodplain of an incised stream. A stream terrace is above the normal flooding level.
Valley Side	15 – 35	The steeper portion of fluvial or glacial valley slopes, extending from the ridge to a foot slope, terrace, bench, or valley floor.
Foot Slope	3 – 30	Convex colluvial slopes at the base of steep valley side slopes or mountainsides (includes talus slopes).
Bench	0 - 5	Relatively level, long and narrow, terrace or platform, breaking a valley slope. Used to denote a landform resting on solid rock as opposed to a stream terrace or bajada (on un-consolidated alluvium). Also called structural bench.

Hydrology Class (circle one only)

Upland - All sites above floodplains and away from them. Alluvial and flooding processes do not strongly influence the vegetation. Overland flow or sheet/rill erosion from precipitation events may be present.

Riparian - Sites occurring along stream or river channels. Flows may be perennial or intermittent. Enough seasonal groundwater or surface water is present that the dominant vegetation is different from the adjacent uplands (may include lakeshore vegetation). In the arid/semi-arid West, there is typically an obvious difference between the upland and riparian vegetation.

Wetland - Sites are saturated for extended periods during the growing season; surface water is often present. Alluvial/fluvial processes are not predominant.

Playa Lakebed - Depressional site where water concentrates intermittently, then evaporates. The high rate of evaporation often results in elevated levels of salts on the surface of the soil profile, which strongly influences the vegetation.

5.5.2 - *Ground Cover Characterization:* Section B of the field form contains all ground cover data. Ground cover is divided into two general cover types, biotic and abiotic cover, which when summed equals 100%. Estimating ground cover components should be done as though the observer were suspended several meters above the training site. A quick walk through the training site will help you with this shift in perception. Looking at the ground from an oblique, or low, angle suggests very different cover numbers than an overhead view. A quick walk through the site will also assure you there are not significant changes in species composition or vegetative cover. It is also recommended that training sites be located at least 30 meters from roads; most roads tend to affect the species composition of nearby plant communities as well as the abundance of species.

<u>Biotic Ground Cover:</u> The following steps will be used in the characterization of the vegetation:

1) Estimate the total vegetative cover for the training site.
An easy way to make this preliminary estimate is to go through the following questions:

> Is the total vegetative cover greater or less than 50%?

> If >50%, is the total vegetation cover greater or less than 75%?
> Or,
> If <50%, is the total vegetation cover greater or less than 25%?

And so on until a total vegetative ground cover estimate is finalized. All ground cover estimates are recorded in 5% increments. It is recommended that you consult with your crew partner on ocular estimates, until your "eye" has been acclimated to the plant communities of Nevada. Field crews will also use perform point transects on a daily basis to calibrate their estimates to "reality" and to the estimates of other field

crews (see section Field Methods: Calibration below). For further refinement of your cover estimate you can refer to Figures 8 - 11.
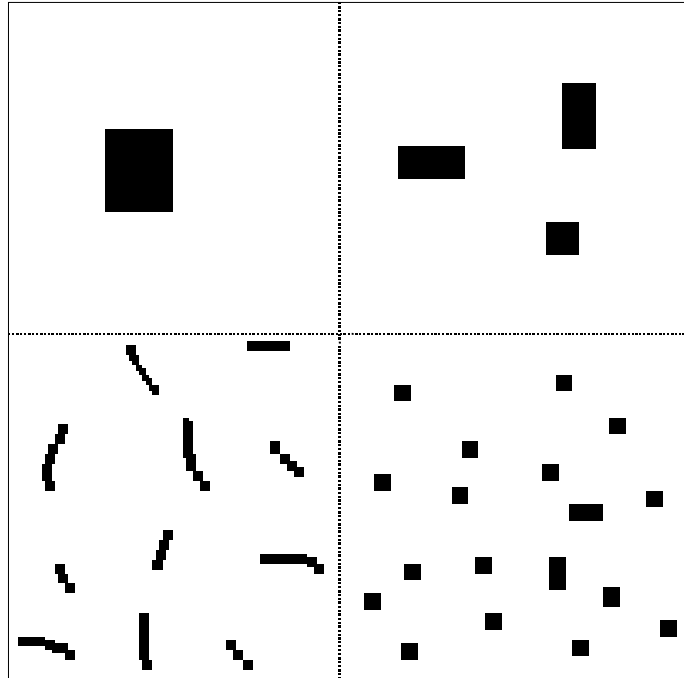
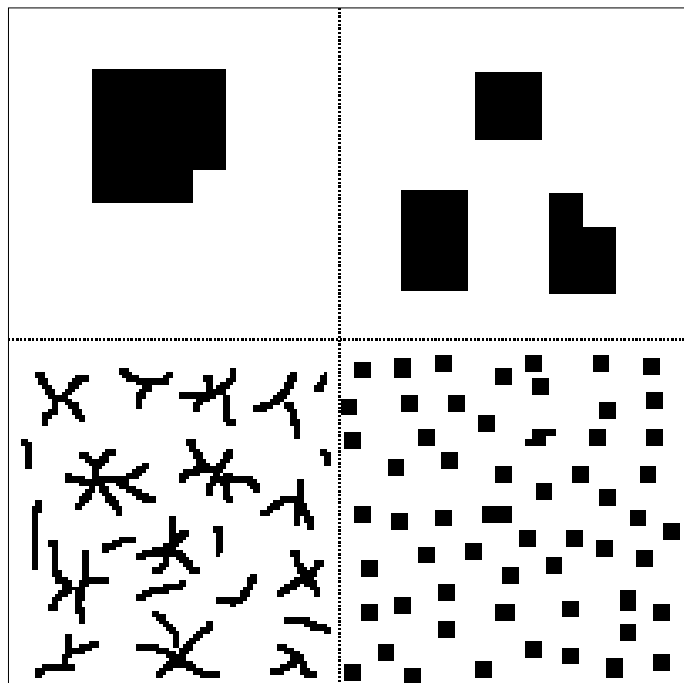## Figure 8: 5% Cover

Figure 9: 15% Cover
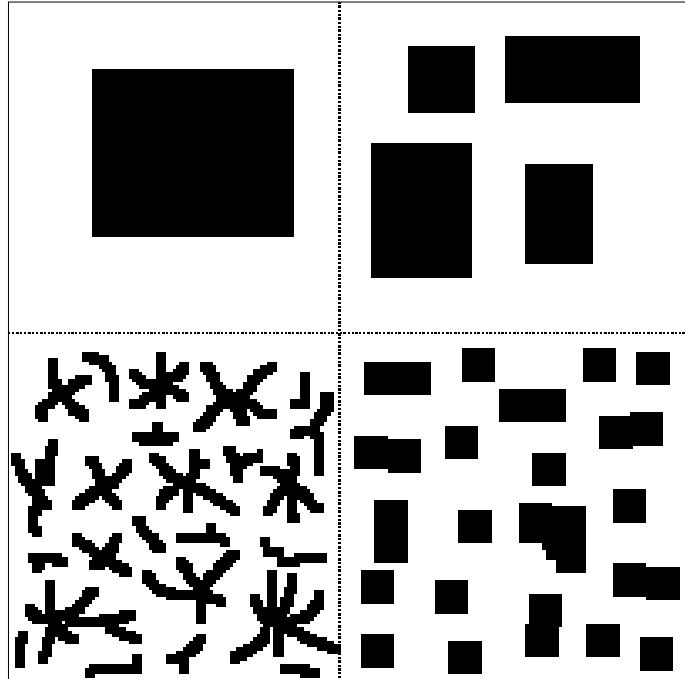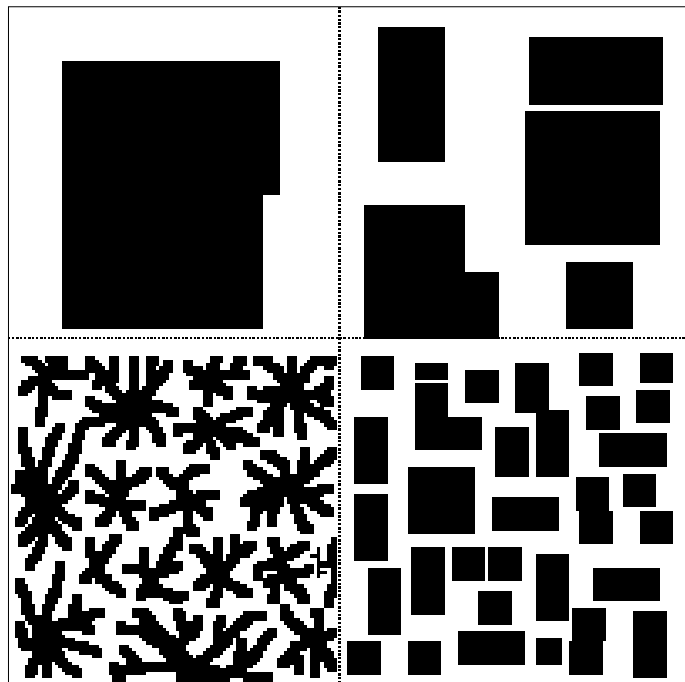
Figure 10: 30% Cover

Figure 11: 50% Cover

2) Record all tree, shrub, and herbaceous species whose total ground cover is 5% or greater.

These species are our "dominant" cover species. They will be recorded on the training site datasheet and in the database by the following naming protocol: the first three letters of the genus and species names. So *Cercocarpus ledifolius* would be recorded as CERLED. Use capital letters and no spaces in the species naming convention. Some species require identification to the sub-species level such as the big sagebrush species. These species will receive a 7-letter abbreviation that uses the first three letters of the genus and species names, and the first letter of the sub-species name. For example, *Artemisia tridentata spp. vaseyana* would be abbreviated as ARTTRIV.

3) Parse up the total vegetative cover estimate into cover estimates (in 5% increments) for each dominant species, also record mean plant heights for trees and shrubs.

The summed cover estimates for each dominant species should equal the total vegetative cover estimate. DO NOT use relative cover estimates for each species.

For example, say a particular site's total vegetation cover is 45%, and you have identified two dominant shrubs (*Artemisia tridentata ssp. vaseyana* and *Symphoricarpus oreophilus*) and two dominant grasses (*Agropyron cristatum* and *Bromus tectorum*). Your cover estimates for the dominant shrubs and grasses should add up to 45%. You would record the following:

ARTTRIV – 25%
SYMORE – 10%
AGRCRI – 5%
BROTEC – 5%

Typically non-dominant species will contribute to the total vegetative cover of a training site. You will need to pretend non-dominant species do not exist on the site. Use the original total vegetation cover estimate and assign the entirety of that estimate only to the dominant species on the training site.

4) Record the presence of non-dominant species if practical and possible.

IF you can quickly assign a species ID to a non-dominant species and there is room on the datasheet after the dominant species have been recorded, then it is acceptable to identify these species on the datasheet, just put a dash in the % cover column to indicate it is a non-dominant plant. Do not spend more than a few seconds attempting to identify non-dominant species.

5) If a dominant species on a site cannot be identified quickly, collect a specimen and assign it a unique label for future identification.

When faced with an unknown dominant species that cannot be positively identified, record the plant on the datasheet and in the database with a unique identification using the following convention:

UF/US/UT – Unknown Forb/Unknown Shrub/Unknown Tree
6-number date
2-letter observer initials
2-number indicator

EX: US040303ts01

Collect a good sample of the plant and place it in a Ziploc bag with a slip of paper bearing the unique ID and any notes regarding the ecological setting of the species. Unknown plants should be identified in camp that night or at the ENLC offices. DO NOT key out plants at each site. This requires time that is better spent acquiring additional training sites.

Once in camp or back at the ENLC offices, you can spend more time with the various plant guides and taxonomic keys that are available. You can also refer to the growing reference collection in the ENLC basement. Once you have positively identified an unknown species, be absolutely CERTAIN that you replace the unknown species ID with the correct species ID on the appropriate data sheet and in the database.

If you have collected a new plant that is not in the collection, it is highly recommended that you press the plant and label it well so we can add it to the collection for use by all field crews.

The fields on the datasheet related to vegetative cover are:

Tree/Shrub/Herb.: Record the 6- or 7-letter species identification of the dominant species (% canopy cover > 5%). Non-dominant plants can be recorded if they can be identified quickly.

% CC: Only dominant species are recorded (% cover > 5%) for % canopy cover. Non-dominant species are denoted by a slash. The % canopy cover for the dominant species should incorporate the cover attributed to non-dominant species. For example if we were describing a site with 25% juniper, 10% pinyon, and 2% ponderosa it would be recorded as:

JUNOST   25%
PINEDU   10%
PINPON   --

Ht.: Record the mean height of the dominant canopy species in meters. Non-dominant species are denoted by a slash. Do not record heights for herbaceous species. Use the following increments:
0.0 meters
0.25 meters
0.5 meters
0.75 meters

<div align="center">

1.00 meters
1.5 meters
2.0 meters
2.5 meters
3.0 meters
4 meters
5 meters
6 meters
Etc.

</div>

Abiotic Characterization: When the total vegetative cover is subtracted from 100%, you are left with the abiotic ground cover that is sub-divided into the following elements:

Bare Soil: The ocular estimate of % ground cover attributable to bare soil, or soil and pebble-sized rocks smaller the 0.5 cm diameter.

Litter: The ocular estimate of % canopy cover attributable to FALLEN dead plant material. STANDING dead plant material is included in estimates of % CC for trees/shrubs. Sometime litter is a judgment that can only be made by the field crew.

Surface Rock: The ocular estimate of % ground cover attributable to surface rock, or loose rock not anchored in the ground, and whose diameter is greater than 1 cm.

Bedrock: The ocular estimate of % ground cover attributable to exposed bedrock, or large rock fragments anchored in the ground.

Cryptobiotic Crust: The ocular estimate of % ground cover attributed to cryptogams, or symbiotic organisms (lichens and algae) that live on the surface of the soil and typically appear as a dark brown or black crust.

Water: The ocular estimate of % ground cover attributed to water.

5.5.3 - *Alliance and Ecological Systems Labeling:* Section C of the datasheet is where alliance and ecological system labels are recorded. This information will receive the greatest scrutiny of anything on the datasheet. The alliance and ecological systems labels are largely dependent upon the most dominant plant species on the training site. The fields of this section include:

Alliance: The preliminary NVCS alliance name assigned to the site.

Alternate Alliances: If more than one alliance label fits the training site characterization, then list any alternate labels that apply.

Confidence: The level of certainty that the alliance name is correct. Use High if only one alliance label is applicable, Medium if two alliance labels are applicable, or Low if three or more alliance labels are applicable.

Ecological System: The NVCS ecological system label assigned to the training site.

Labeling Method #1: There are two methods for labeling a training site. The first is the use the handout entitled "Key to Eastern Great Basin Ecological Systems and Alliances." This document, prepared by NatureServe personnel, can be used to quickly assign an ecological system label, and sometimes, an alliance label to most training sites. This is not a complete list of ecological systems for the entire state of Nevada, as the name implies. As you encounter ecoregional transitions, such as the Mojave region of southern Nevada or the Sierra Nevada region of western Nevada, you will be required to assign labels whose plant communities are not listed on the Eastern Great Basin Key. For these vegetation types, you will use the second method for assigning alliance and ecological system labels.

Labeling Method #2: The second method begins with identifying the single most dominant species on the site. The next step is to review the Table of Contents of the document entitled "Alliance Descriptions for the Great Basin." Then identify those alliances whose name contains the training site's dominant species. Next, read though the Alliance Concepts, paying special attention to the associated species and ecological setting of the alliance in question. Use your best judgment and list the abbreviated alliance name on the datasheet. Occasionally, field crews will encounter a repeated community on the landscape that does not have an alliance description. In these rare cases, create a new alliance name and indicate a possible new alliance in the Site Notes field.

To identify the proper ecological system, begin with the physiognomic class of the training site and select the appropriate list of ecological systems, for example Shrub_ES.xls will contain all of the shrubland ecological systems. Next, focus on the ecological setting and the short list of dominant woody plants that are associated with your training site. Many ecological systems can be eliminated based on their name, for example, it is very unlikely Nevada field crews will see examples of the "Chihuahuan Succulent Desert Scrub" ecological system. As with alliance labels, read through the descriptions of the ecological systems that seem most appropriate. Typically, there will be a single, best label.

Alliance and Ecological System Label Abbreviations: The naming convention for alliances is to use the 6 or 7 letter species abbreviation of the dominant species followed by the abbreviated physiognomic class. There are other modifiers associated with alliance labels such as the flooding frequency that should also be abbreviated. For example, *Artemisia tridentata ssp. vaseyana Shrub Herbaceous Alliance* would be recorded as ARTTRIV SHRUB HERB, or *Scirpus acutus - (Scirpus*

tabernaemontani) Semi-Permanently Flooded Herbaceous Alliance would be abbreviated as SCIACU – (SCITAB) SPF HERB.

The naming convention for ecological systems labels is to capitalize the first letter of each word in the system name with no spaces. For example, "Great Basin Pinyon-Juniper Woodlands" becomes GBPJW.

Confidence Ratings: Most times, the alliance and ecological system labels are easily and confidently identified. Other times, more than one label may be appropriate. Please list other appropriate alliance and/or ecological system labels that are appropriate for the training site, then circle a value in the "Confidence" field. Training sites with a single, best alliance/ecological system label receive a "High" confidence rating. Sites that could have two alliance/ecological system labels receive a "Medium" confidence rating. Sites to which three or more labels can be applied receive a "Low" confidence rating.

All training site labels will be reviewed by TDS, especially those with Medium or Low confidence ratings. Most sites with low confidence ratings represent ecotones and should not have been collected in the first place. Most sites with a Low confidence rating will likely be eliminated from the dataset.

5.6 - Site Delineation: Delineating training site is done with the assistance of the Field Data Collection extension in ArcView. Specific instructions for the Field Data Collection extension are found in the Section 9.0 in the Appendices.

The Field Data Collection extension will orient the field crew to the ground by zooming into the location and indicating a position with a small yellow circle. It is recommended that you orient the top of the computer screen to north to begin reading the imagery. It is then the job of the computer operator to interpret the satellite imagery, landform image, and DRGs in order to delineate the training site.

Figures 12 and 13 illustrate several possible training site polygons against a background of multispectral imagery and landform imagery, respectively. If we assume that the vegetation within each polygon is floristically homogeneous, the next step is to decide which polygons are homogeneous with regard to spectral and topographic attributes.

When viewed against the multispectral imagery polygons 2-6 appear spectrally consistent, while polygon 1 has a patchy appearance. We would not collect information from polygon 1; it would be omitted from consideration because it is not spectrally homogeneous. When polygons 2-6 are viewed against the landform image, polygons 4-6 appear to lie on uniform landforms, so they are still being considered good sites. Polygons 2 and 3 however straddle two or more landforms, making them suspicious. Polygon 3 is likely in a riparian position, which will rarely be homogeneous with regard to landform. And given the rarity of riparian sites, this site should be collected despite the heterogeneity of landform. Polygon 2 is basically within a single aspect (north facing,

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moist slopes), but it encompasses two distinct slope classes (moderately steep, and very steep). This polygon could be modified to include only one of these slope classes, and then the site would be acceptable to collect.

Size is another consideration. All of the polygons in Figures 12 and 13 are 5x5 pixels or larger. This is a typical size for training site polygons. If polygons are much bigger they tend to contain more spectral, topographic, and floristic variability then we are interested in. So, in general, keep your polygons small. Using large polygons also means more area that must be assessed by a quick walk through. You will not have time to walk 0.5 km to make sure the site is floristically homogeneous. Lastly, keep polygons at least one pixel away from roads. Roads not only influence the floristic characteristics of an area but also affect the spectral properties as well.

Figure 12: Training Site Delineation with Multispectral Imagery

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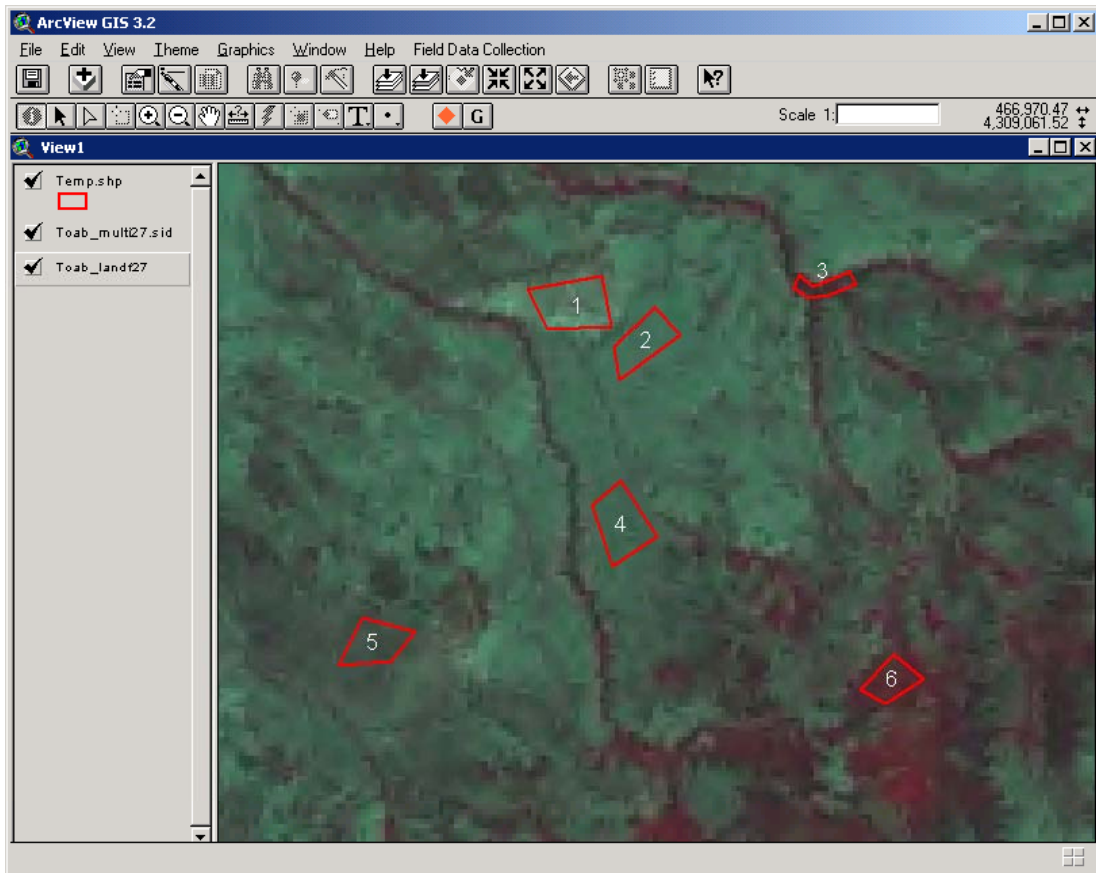
Figure 13: Training Site Delineation with Landform Imagery
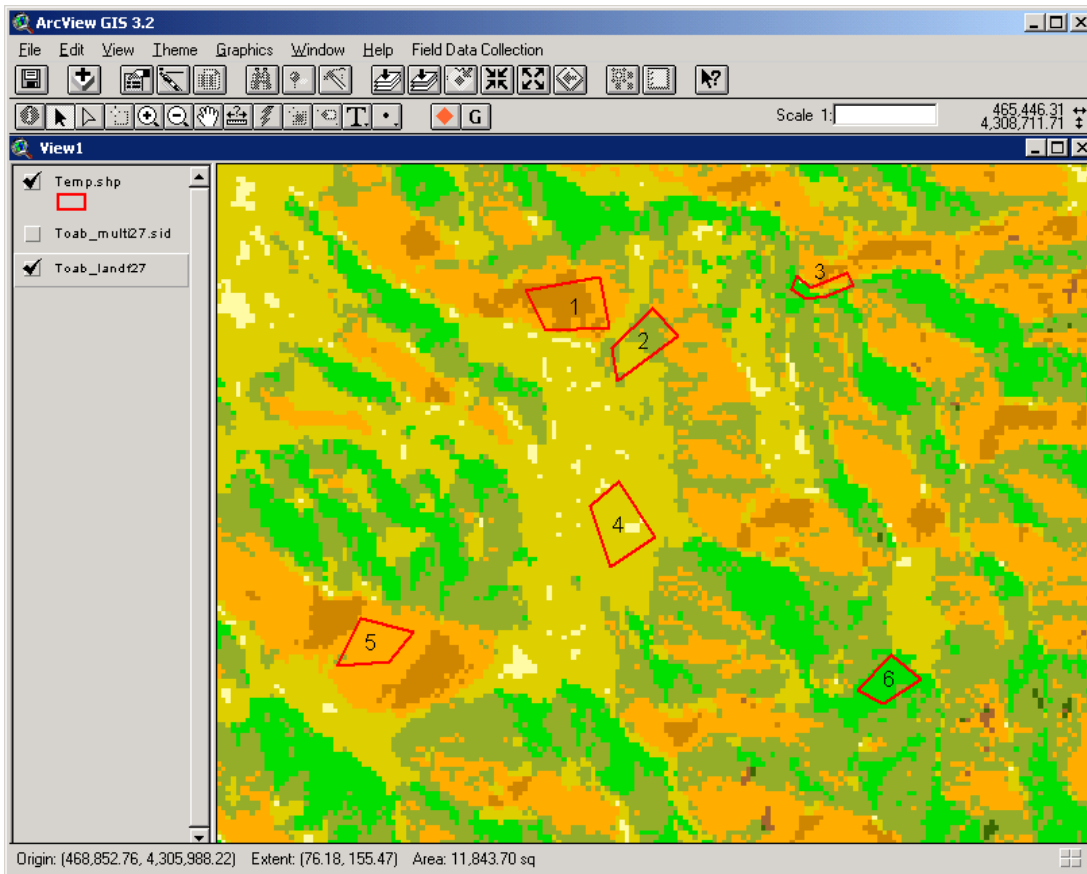
5.7 - Site Documentation: Usually a single photograph is taken at each training site. It should depict as much of the training site as possible, while simultaneously capturing some of the floristic detail. Figure 14 illustrates good examples of site documentation photos. The photos of training sites are commonly used to review and revise the alliance and ecological systems labels that have been assigned to the training site.

Figure 14: Training Site Documentation

5.8 - Site Audits: Reviews of training site data will be conducted by EPA personnel throughout the field season to implement a modest degree of quality control on data collected by field crews. Site audits will involve visits to randomly selected training sites collected earlier by field crews. Audits of field data will be carried out roughly once per month over the course of a few days. At each audit site, the ground cover will be characterized by the protocols described in previous sections. The audit data will be compared against the data collected by field crews to insure that data is being collected properly. Most importantly, the alliance and ecological systems labels listed by the field crews and the auditor will be compared.

5.9 - Ocular Estimate Calibration: Because we use ocular estimates, we need to standardize our estimates between field crews and to "reality". Our methodology uses a 100-meter point transect for shrublands and grasslands, and four measurements of canopy cover from a densiometer for forests and woodlands. Field crews will perform a calibration transect once per day. Since Nevada is dominated by shrublands, your "eye" will quickly become proficient and accurate in assessing percent ground cover for these communities. Infrequently encountered communities, such as grasslands and forests, will require the use of point transects to re-calibrate your estimates. If a crew has not sampled in a particular physiognomic class for three or more days, a calibration transect is strongly recommended. Field crews need not run more than one transect per day, but rather transects should be run to improve the accuracy of ocular estimates.

The use of a point transects is not an absolute measurement of percent cover of the biotic and abiotic ground cover components and the placement of the tape can influence the cover measurements. However, it is fast and reasonably accurate. Ideally we would perform several transects at a site and average the ground cover component numbers, but there is simply not enough time.

Field crews will fill out the training site characterization datasheet BEFORE the calibration transect is performed. Then, a randomly selected bearing will be used to set the transect. The tape should be set as straight as possible to record an unbiased sample. This will not be easy in tall cover, but if the tape is too influenced by walking around objects the transect will be a less reliable indicator of ground cover. Then, recording all information on a calibration datasheet, the tape will be read at every whole meter mark beginning at 1.0 meters. Record the top-most plant species or abiotic element that lies directly under each whole meter interval. Please us the following abbreviations:

- B = bare soil (<0.5 cm)
- L = vegetative litter (include standing dead herbaceous, but not shrubs/trees)
- R = surface rock
- C = cryptogam
- BR = bedrock
- W = water
- Plant species = 6-7 letter species abbreviation

- IF other cover elements are encountered, be sure to specify the cover element and its abbreviation

While the 100-meter transect is effective for shrublands and grasslands, it is difficult to use with forests and woodlands. For these communities we will use a line transect in conjunction with an optical densiometer. A 100-meter tape will again be stretched using a random compass bearing across the training site. Rather than read each meter interval, calibration transects run under tall canopies will only be read every 20 meters beginning at the 20 meter mark, for a total of five measurements of tree cover. Do not attempt to measure shrub and herbaceous cover when running a densiometer transect; the two methodologies are incompatible.

The face of the densiometer is covered with a grid of squares. The number of vertices covered by tree canopy divided by the total number of vertices equals the total ground covered by trees. If possible differentiate the number of vertices covered by individual tree species. Using the calibration datasheet, record the number of vertices covered by each tree species and the total number of vertices on your densiometer for each of the five stops on the 100-meter transect. Do not perform the averages in the field. This will be done in the office.

Section 6.0 - Data Entry

6.1 - File Structure: We will use the following file structure throughout the field season:

C:/field_data/mapzone/database – Access databases created every two weeks
      /shapefiles – Each day's shapefiles
      /photos/day – All photos taken on a given day
      /imagery – All spectral, landform, and DRG imagery
      /mapzone.apr – ArcView project file
    /ancillary_data – Sage keys, alliance descriptions, system keys, etc.

6.2 - Naming Conventions and Abbreviations: It is critical that all field crews adhere to established naming conventions and abbreviations for training sites, shapefiles, species names, etc.

    Training Sites: Each training site will receive a unique 12-character alphanumeric identification in the shapefile. All letter are capitalized.
        2-Letter State Abbreviation
        6-Number Date
        2-Letter Observer Initials
        2-Number Indicator
      EX: NV040203TS01.

    Shapefiles: Shapefiles are given a 6-number label based on the date the data are collected.
      EX: 040203.shp.

    Species Names: Species abbreviation use the following naming protocol: the first three letters of the genus and species names. Use capital letters and no spaces in the species naming convention. Some species require identification to the sub-species level such as the big sagebrush species. These species will receive a 7-letter abbreviation that uses the first three letters of the genus and species names, and the first letter of the sub-species name.
      EX: *Cercocarpus ledifolius* = CERLED.
      EX: *Artemisia tridentata spp. vaseyana* = ARTTRIV.

    Alliances: NVCS alliances are abbreviated with the 6 or 7 letters species abbreviation of the dominant species followed by the abbreviated physiognomic class. All letters are capitalized.
      EX: *Artemisia tridentata ssp. vaseyana Shrub Herbaceous Alliance* = ARTTRIV
        SHRUB HERB.
      EX: *Scirpus acutus - (Scirpus tabernaemontani) Semi-Permanently Flooded*
        Herbaceous Alliance = SCIACU – (SCITAB) SPF HERB.

Ecological Systems: NVCS ecological systems are abbriviated using the first letter of each word in the system name with no spaces. All letters are capitalized.
>   EX: Great Basin Pinyon-Juniper Woodlands = GBPJW.

Unknown Plant Species: Unknown plant species will be given a unique identification using the following convention:
>   UF/US/UT – Unknown Forb/Unknown Shrub/Unknown Tree
>   6-number date
>   2-letter observer initials
>   2-number indicator
>   EX: US040303TS01.

Databases: Access databases will be named as the dates bounding the field trip.
>   EX: 040203_041203.mdb.

Field Photos: Field photographs will be named by their training site.
>   EX: NV040203TS01.jpg.

6.3 - General Data Entry: All of the information that is collected at a training site (site characterization, delineation, documentation, and calibration) is ESSENTIAL information. Collect all data requested on the datasheets. When blank spaces appear on datasheets and in databases, it means crews have neglected to collect the information in the field, or got sloppy with data entry. Be thorough and meticulous with data collection and data entry, otherwise you will end up working on your off days correcting the problems.

Data entry into the database will be performed while at the training site, en route to the next training site, or in camp during the evening. It is understood that not all data entry can be completed in the field, but a large majority can be done IF IT IS DONE REGULARLY. Whenever there is a spare moment, enter a record or three. We do not want to see you bringing huge stacks of un-entered datasheets into the ENLC office. Field crews are paid to gather field data, not sit in the office entering data.

6.4 - Data Cleaning: Data entry is not rocket science, but it is tedious and repetitive. Your mind tends to wander and data records get fouled up. This is why each field crew will review its datasheets and its database, and look for obvious errors: duplicated records, omitted records, incomprehensible spelling, miss-entered site IDs in shapefiles or in the databases. In other words, the data that TDS receives will be sanitized and free of obvious errors. Nothing is more vexing than a database that has copious omissions, duplicated records, and bad site IDs. If TDS receives such databases, the guilty parties will spend their off days fixing them to his satisfaction.

Please make the life of TDS easier: after entering your field data, give it a good once over. Make sure the omissions and duplications and bad site IDs are fixed before TDS ever sees them.

6.5 - Data Submission: Upon the completion of two work areas, or thereabouts, field crews will deliver that data to ENLC and EPA personnel. You will be required to submit TWO copies of all training site datasheets, calibration datasheets, databases, shapefiles and photos. Training site and calibration datasheets will be photocopied. The database, shapefiles, and photos will be burned to a CD. The data will be delivered as follows:

To EPA:
- Original training site and calibration datasheets
- CD with database, shapefiles, and photos

To ENLC:
- Duplicate training site and calibration datasheets
- CD with database, shapefiles, and photos

The CD will use the following file structure:

/WA1&2/Database
Shapefiles
Photos/Day

Section 7.0 - Communications

Daily Check-in: While in the field, all crews will check in with ENLC and/or BLM personnel via radio or cell phone once in the morning and once around 4-5 p.m. These checks are just to be sure that nothing horrible has happened. Failure to check in may result in a search party being sent out to look for the crew's remains. These checks are done to insure the safety of the field crews.

Bi-Weekly ENLC/EPA Meeting: Every two weeks all field crews will meet with ENLC and EPA personnel to discuss problems encountered in the field, data submission schedules, new work area assignments, etc.

Other Communications: The ENLC will provide field crews with cell phones and the BLM will provide radios to be used primarily for daily check-ins. They can also be used to contact TDS if problems regarding protocols are encountered. It also suggested that crews utilize the resources of the other BLM Field Offices in Winnemucca, Carson City, Battle Mountain, and Tonopah. BLM personnel can be valuable sources of information regarding common communities and passable roads in the area.

Emergencies: In the case of an emergency, be sure to contact BLM, ENLC personnel as soon as possible. Emergencies can include vehicle breakdown, traffic accidents, injuries, family emergencies, etc. Make sure to also contact ENLC and BLM personnel after the situation has been resolved.

Section 8.0 - SW ReGAP Contact List

Elko BLM Field Office   3900 East Idaho Street, Elko NV 89801-4611
1. Ray Lister   775/753-0222   ray_lister@blm.gov
2. Karl Scheetz   775/753-0280   karl_scheetz@blm.gov

Winnemucca Field Office   5100 East Winnemucca Blvd., Winnemucca NV 89445
1. Les Boni   775/623-1548   les_boni@blm.gov
2. Terri Barton   775/623-1543   terri_barton@blm.gov

Carson City Field Office   5665 Morgan Mill Rd., Carson City NV 89701
1. Katrina Leavitt   775/885-6130   katrina_leavitt@blm.gov
2. Dan Jacquet   775/885-6116   daniel_jacquet@blm.gov

Ely Field Office   702 North Industrial Way, Ely NV 89301-9408
1. Gary Medlyn   775/289-1847   gary_medlyn@blm.gov
2. Jim Perkins   775/289-1860   james_perkins@blm.gov

Battle Mountain Field Office   50 Bastian Rd., Battle Mountain NV 89820
1. Leonard Brouse   775/635-4020   leonard_brouse@blm.gov
2. Kimberly Conley   775/635-4084   kimberly_conley@blm.gov

Tonopah Field Station   1553 South Main Street, Tonopah NV 89049-0911
1. Bill Fisher   775/482-7801   william_fisher@blm.gov
2. Valerie Metscher   775/482-7843   valerie_metscher@blm.gov

Nevada BLM State Office   1340 Financial Blvd., Reno NV 89502
1. Randy McNatt   775/861-6473   randy_mcnatt@blm.gov

EPA---Office of Research & Development, Landscape Ecology Branch, 944 East Harmon Avenue, Las Vegas NV 89119
1. Todd Sajwaj   702/375-4204   sajwaj.todd@epa.gov
2. Dave Bradford   702/798-2681   bradford.david@epa.gov
3. Bill Kepner   702/798-2193   kepner.william@epa.gov

Eastern Nevada Landscape Coalition   P.O. Box 150266 Ely NV 89315
1. Betsy MacFarlan   775/289-7974   enlrp@idsely.com

Section 9.0 - Appendices

Introduction to ArcView

ArcView Projects: In ArcView, you work within a project. A project is a collection of documents (tables, charts, layouts, etc.), document user interfaces (called DocGUIs), and scripts. Only one project is open at a time.

The project window in ArcView is like the table of contents to your project. The project window displays two lists: a list of available kinds of documents, and a list of existing documents. The types of available documents are: views, tables, charts, layouts, and scripts. When a document type is highlighted, the available documents of this type are displayed. You can customize the appearance of your project window.

Projects are persistent. When you save a project to disk, you are saving a snapshot of the current state of all the objects that project references. The size of the application window is saved with the project. The document that was active when you saved the project is maintained in the project file so when the project is re-opened, the appropriate document resumes its active status. The project file has the extension *.apr.

ArcView Views: With ArcView, you work with geographic data in interactive maps called views. A view is a collection of themes, or geospatial data files. A theme (also called "coverages") represents a distinct set of geographic features in a particular geographic data source. Your themes will consist of multispectral and panchromatic imagery, landforms, and various shapefiles. A view's themes are listed in its Table of Contents.
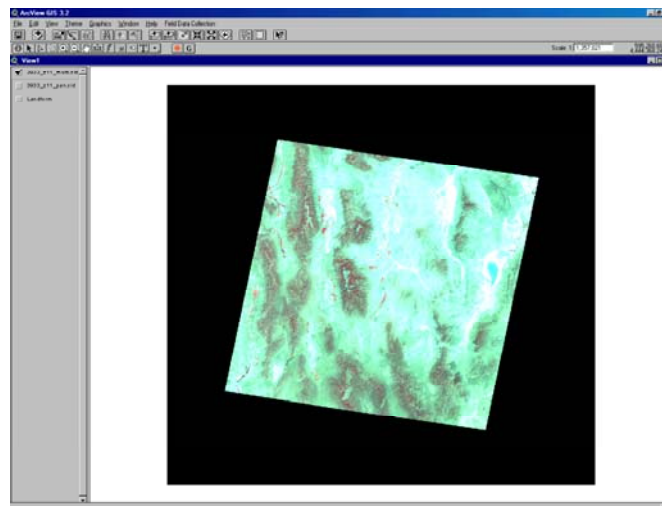
The Table of Contents: Each view has a Table of Contents listing the themes in the view. The Table of Contents shows:

- **Theme Name**: Themes can be given any name. By default, a theme is named after the data source it represents, such as "Landform".
- **Theme Legend**: A theme's legend shows the symbols and colors used to draw the theme.
- **On/Off Status:** Each theme has a check box to its left that indicates whether the theme is currently drawn in the view. If checked, it is on, and, if not, it is off.
- **Theme Overlay Order:** The theme at the top of the Table of Contents is drawn on top of those below it. Themes that form the background to your view are therefore at the bottom of the list. Simply drag themes up and down in the Table of Contents to change the order they are drawn in.
- **Active Themes:** When you make themes active you choose which themes you wish to work with. When a theme is active it is highlighted in the Table of Contents. Simply click a theme's name or legend to make it active.
- **Editable Themes:** A dashed line around the theme's check box indicates a theme is being edited. Only shapefiles can be edited; ARCINFO coverages, GRIDS, and MrSID files cannot be edited in ArcView.

Shapefiles: Shapefiles are a simple, non-topological format for storing the geometric location and attribute information of geographic features. The shapefile format defines the geometry and attributes of geographically referenced features in as many with specific file extensions that must be stored in the same project workspace. They are:

.shp - the file that stores the feature geometry. *Required.*
.shx - the file that stores the index of the feature geometry. *Required.*
.dbf - the dBASE file that stores the attribute information of features. *Required.*
.sbn and .sbx - the files that store the spatial index of the features. *Optional.*
.prj - the file that stores the coordinate system information. *Optional.*

Editing a Shapefile's Appearance in a View:
1. Begin by double clicking on a shapefile; this will start the Legend Editor (see below).
2. Double click on the green rectangle under "symbol" to bring up the Palette menu, containing the Fill Palette, Pen Palette, Marker Palette, Font Palette, and Color Palettes. To switch between these palettes simply click on the buttons immediately below the title bar.

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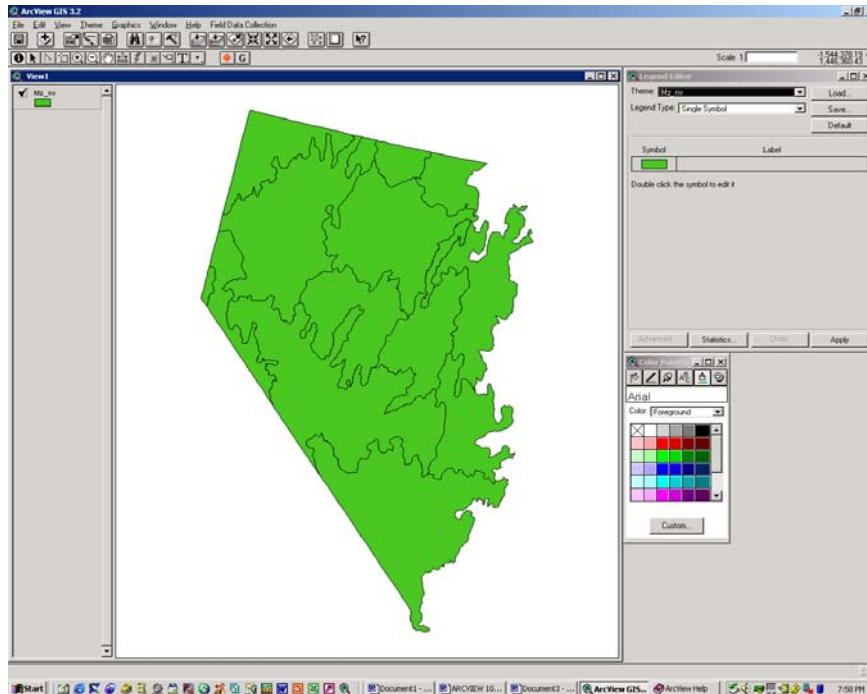
3. Please experiment with different color patterns and fills with your shapefiles. When you save your project, the settings for each shapefile or image file will be saved.

4. Another method for editing a shapefile's appearance is to again open the Legend editor, but this time select "Unique Symbol" in the Legend Type pull-down menu. Then select a value in the "Values Field" pull-down menu:
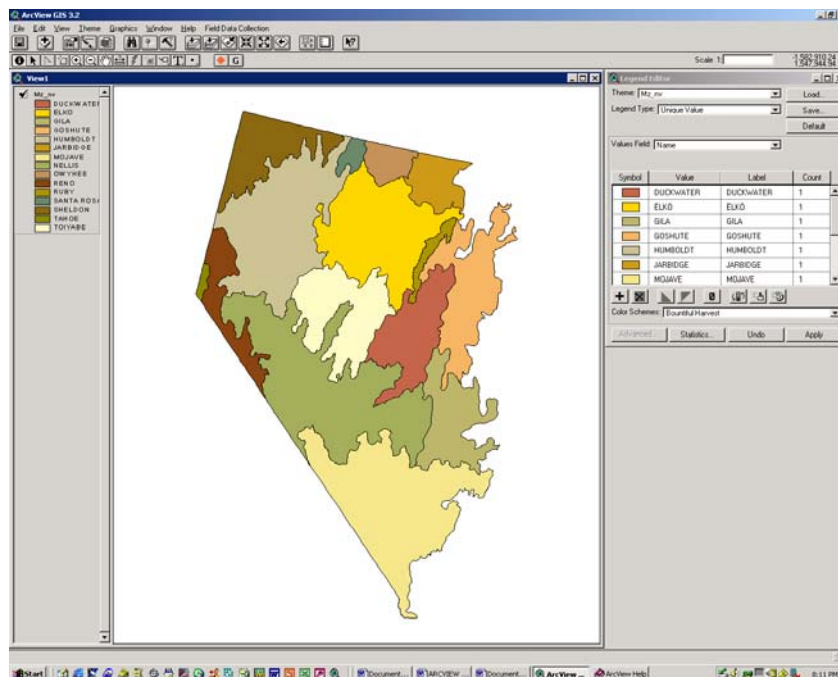
Editing the Appearance of Image Files: Landform and image files (.sid) can also be edited. Double-click on the active theme you would like to change. You will get a dialog box that looks like the following:
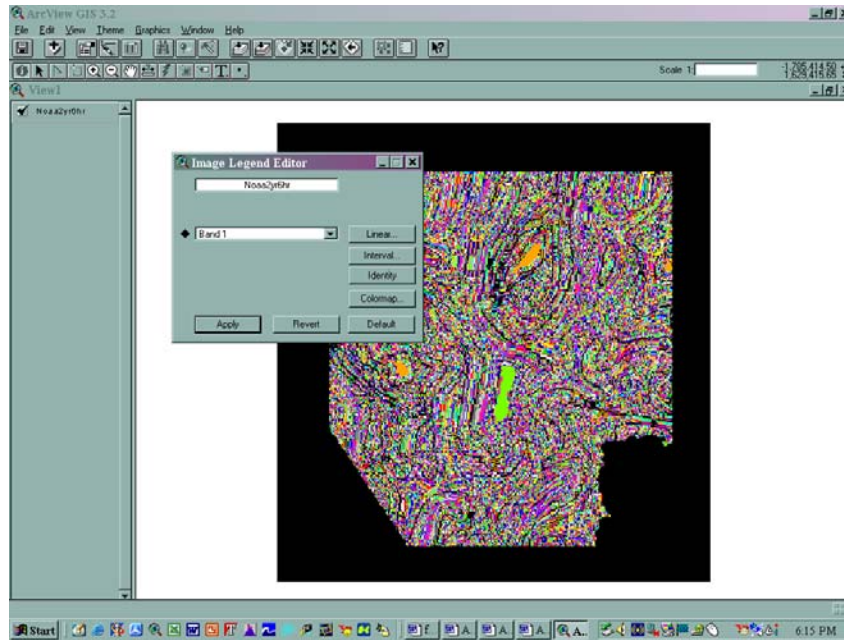
Editing the Landform Image: Select the "colormap" tab and you can now change the color scheme associated with each of the landform categories.

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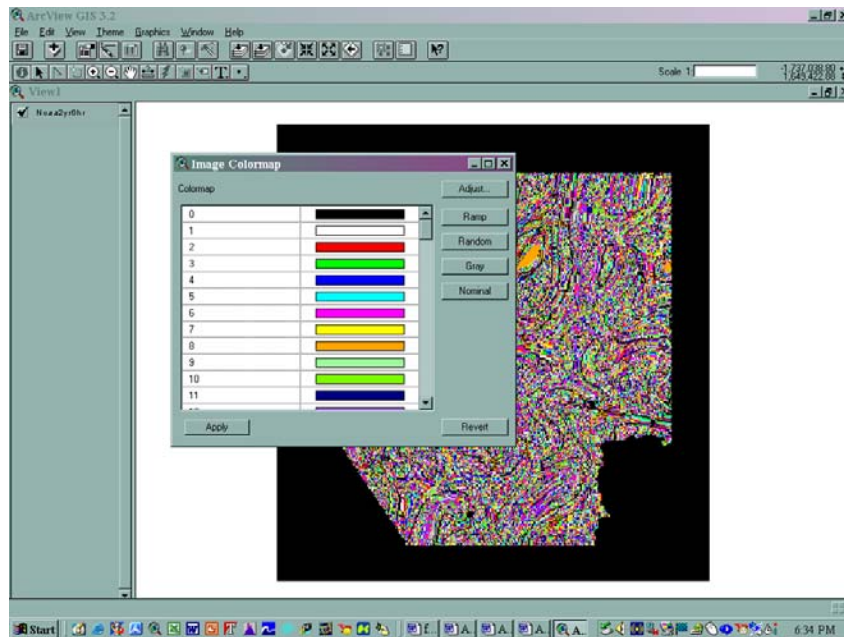
Editing MrSID Imagery: Select the "linear" tab and a series of look-up tables will be displayed. The contrast in each spectral band can be altered by moving the top node/square on the upper bound of the graph.
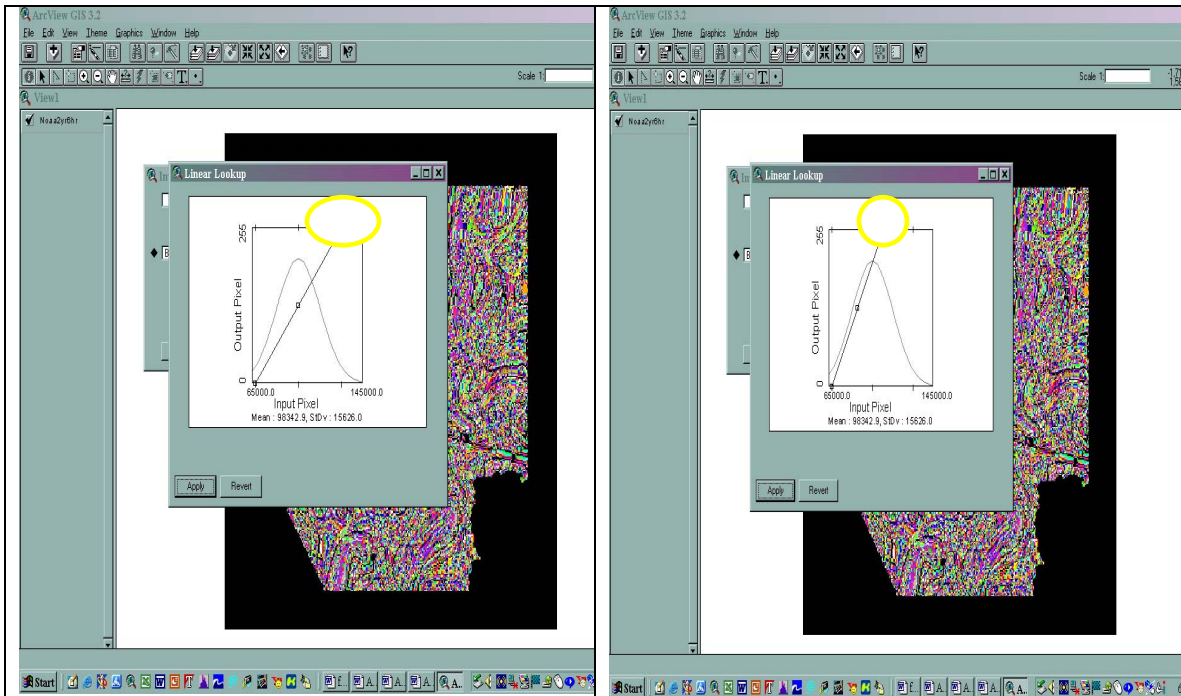
ArcView Tables: Activate a shapefile and then click on the button that resembles a spreadsheet (top row of buttons, fifth from the left) to view all objects in a shapefile and their attributes. Selecting a record in a table will highlight that feature in the view. Viewing tables can help prevent making errors when entering training site IDs.
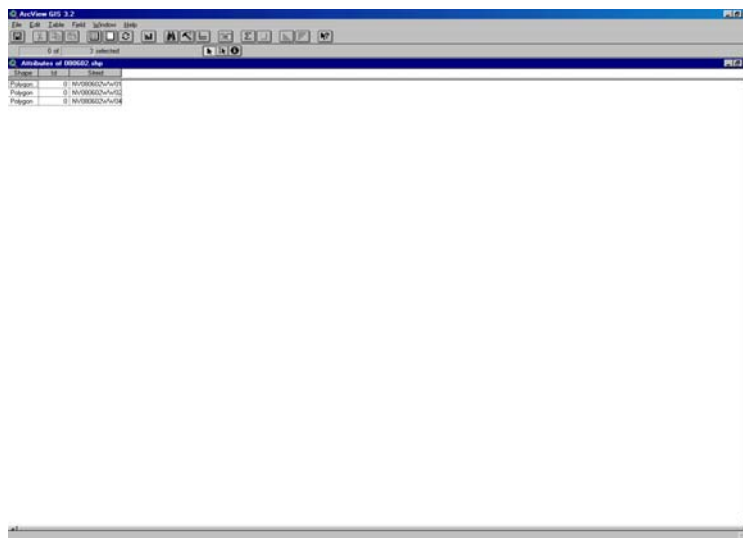
Editing Tables: Once in the attribute table, go under Table, then select, 'Start Editing' to activate the editing mode. Select the "Change cell values" button (second row, second button from the left) to edit the values in a cell, such as an improper training site ID.

Field Data Collection

Each mapzone will have its own project file. Project files will be named based on the 4-letter mapzone abbreviation. For example, nell.apr, elko.apr, etc.

When you open ArcView, it automatically opens you in a new project.
You will either:
      1. Start the new project for a mapzone   OR
      2. Open an existing project you have already created

If you are starting a new project, follow these instructions:

New Project
    1. Open a New View
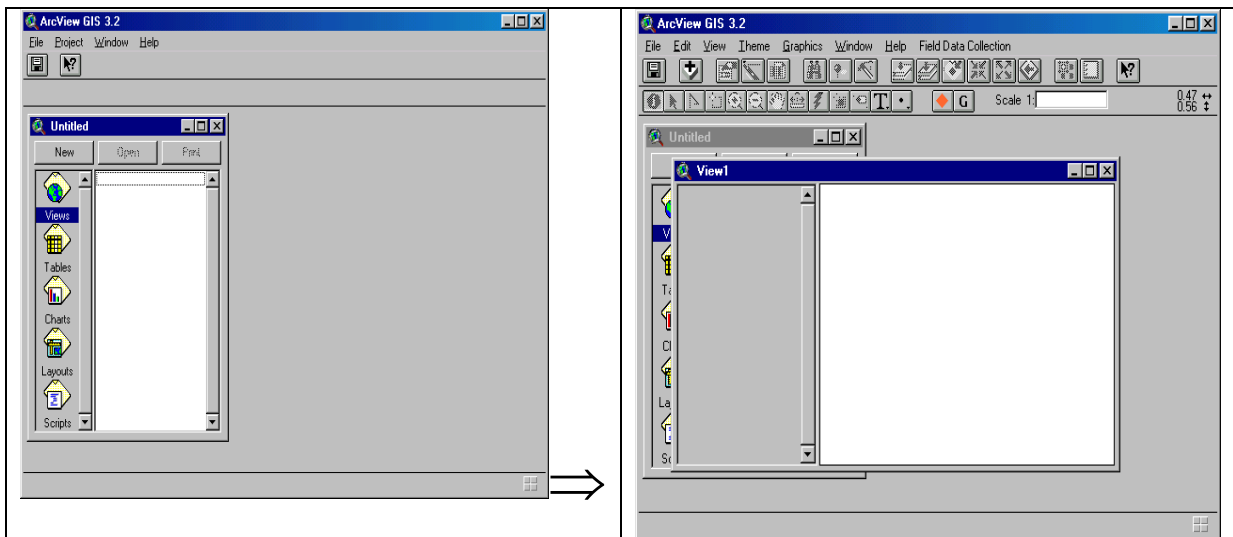
Open the new view by selecting the word 'New.'

    2. In the new view, Set your working folder
         a. Select 'File' then 'Set Working Folder'
         b. Type in the following:

You are specifying the default location for saving files, etc. In this case, everything will go to the c: drive, the swgap folder, the fielddata subfolder, and the subfolder for the mapzone. REMEMBER: WHEN YOU CHANGE MAPZONES, YOUR WORK DIRECTORY WILL READ: c:\swgap\fielddata\NAME OF MAPZONE (you fill in the name). This is important because we DO NOT want any of your changes going into folders where they cannot be found.

3. Turn on your extensions
    a. Select 'File' then 'Extensions'
    b. Select extensions by putting a check mark in the box.
        i. Check Field Collection extension
        ii. Check Mr. Sid Image Support
        iii. Check TIFF extension
    c. Check the box 'Make Default' and click OK
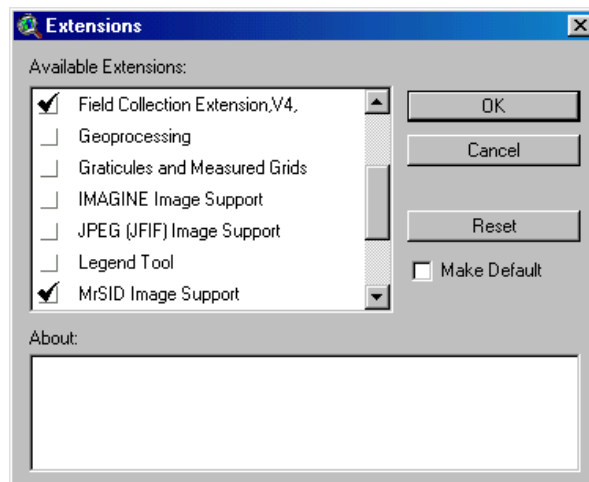
4. Add your themes
    a. Click on the 'Add Theme' icon. (Remember if you can't remember which one it is, just hold the cursor over the icons until you find the one that reads 'Add Theme.'
    b. Load your imagery (Remember, your Data Source MUST read "Image Data Source"
        i. mz_nv: Description: Imagery of all Mapzones
        ii. mapzone name_multi.sid
        iii. mapzone name_pan.sid
        iv. mapzone name_lf.sid
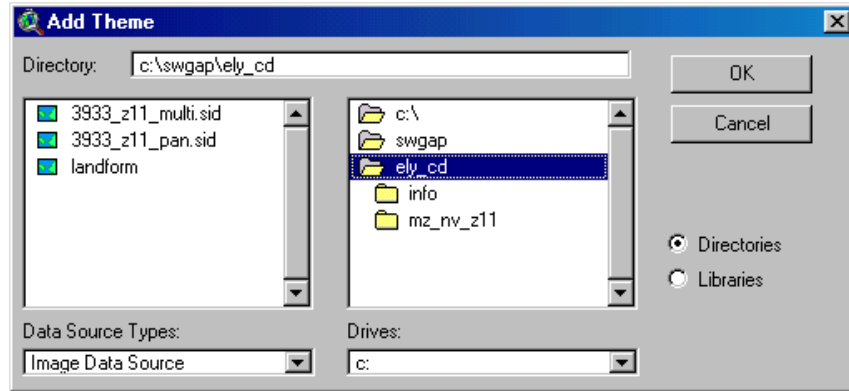
5. Now you are ready to start working on your project. Each day when you pull up your project from a mapzone, the work you did the following day (including the .shp files containing all the polygons) will come up as well. You should always have these themes turned on to ensure you do NOT do the same site twice.
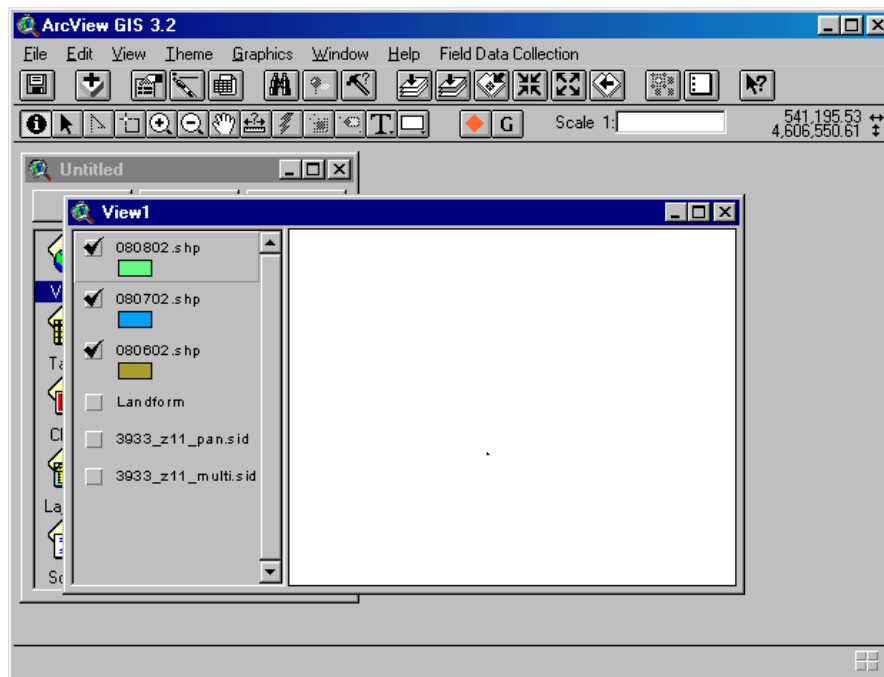
6. Now follow the instructions below to begin collecting sites and entering data.

Opening an Existing Project
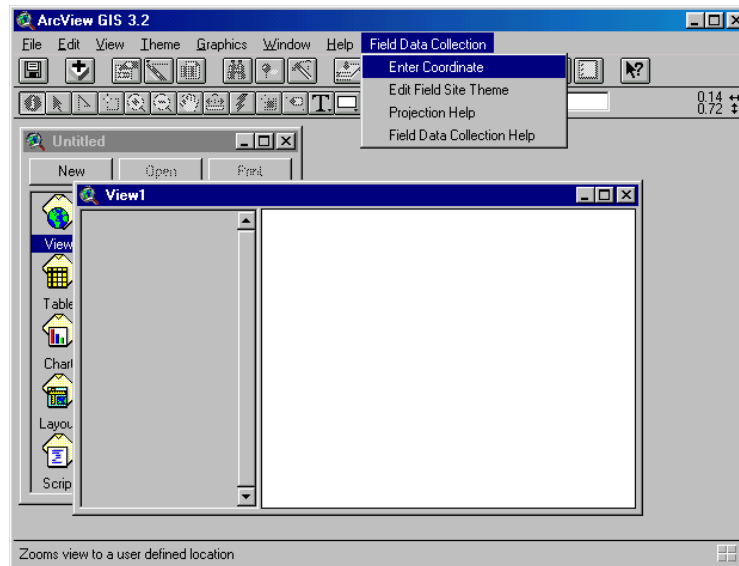1. Upon opening ArcView, you will get a screen that looks like (a).
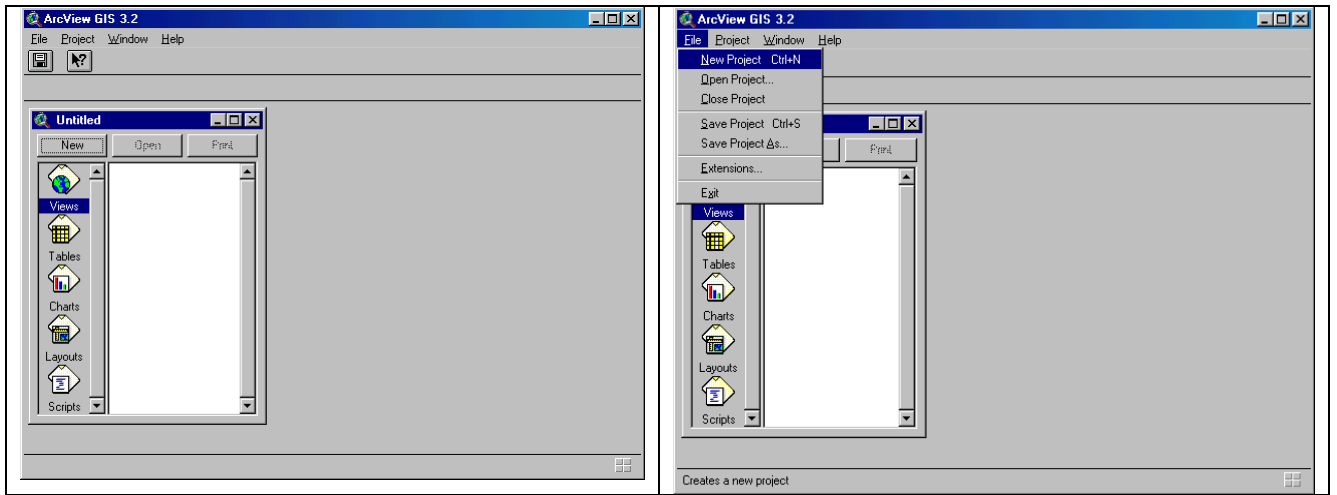
(a)   (b)

2. Select 'File' then 'Open Project.' Open the project associated with that mapzone (b).

Using the Field Data Collection Extension
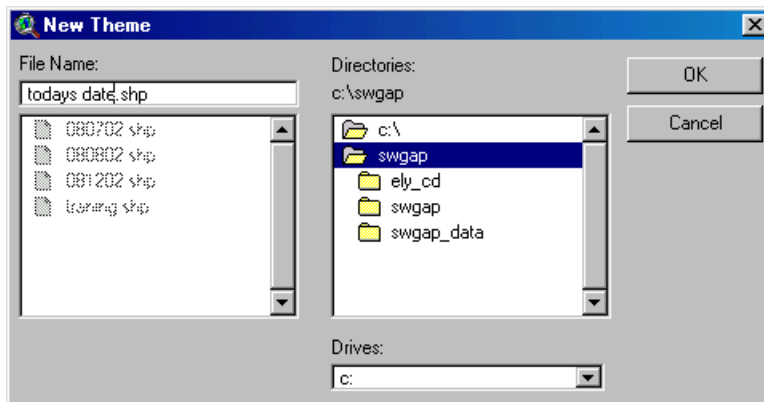1. Select 'Field Data Collection.' and choose 'Enter Coordinates.'

2. Enter your easting and northing.
3. The area you are in will be denoted by a yellow circle. You may want to zoom into this area.
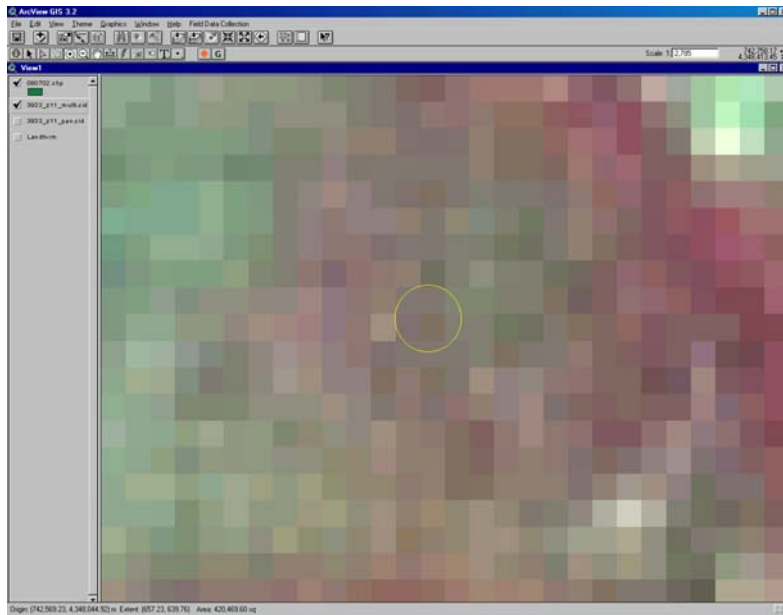
4. Select 'Field Data Collection' and choose 'Edit Field Site Theme.'
5. Select 'New Theme'
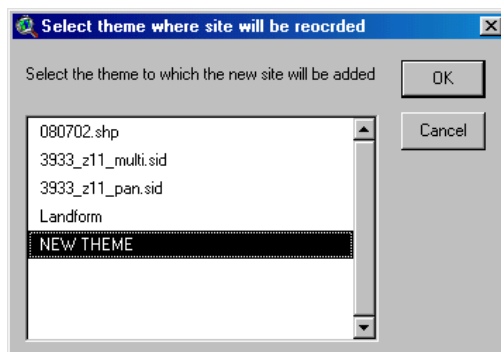
6. Navigate to the appropriate folder and label the shape file today's date and click OK.

7. You are now ready to digitize polygons.
   a. Delineate the training site polygon. Sometimes it is helpful to orient the top of the computer screen to north.
   b. Make the current day's shapefile active, or highlight it in the Table of Contents. If it is NOT highlighted, the extension will NOT work correctly, and you will get an error. You want to make sure you DO NOT put polygons from one day into the .shp file from ANOTHER day.
   c. Digitize your polygon, by taking the cursor down to the pixel you want to begin with. Left click on the mouse and pull the "line" in the direction you want to digitize. When you reach a spot where you want to put a corner in, click the left mouse ONE TIME. Continue this until you have your polygon. At the last corner, you want to DOUBLE CLICK to tell the program you are done making your polygon.
   d. You will be prompted to name the polygon. EX: NV040203TS01
   e. After you enter the id, it will ask if you want to save edits to the shape file. CHOOSE YES!!!

If you don't like the polygon you have created, delete it and start over.
1. Make sure the .shp file theme is active. (It will be "highlighted.")
2. Select 'Theme' and choose 'Start Editing'
3. Take the pointer tool and click to select the polygon.
4. Now click the Delete Key.
5. Now you can start over the same way you made the polygon.

SAVING YOUR PROJECT

Every time you either:
1) Move sites
2) Shut down the computer OR
3) Finish for the day

YOU WANT TO SAVE! SAVE! SAVE!

New Project: Select the 'File' menu, choose 'Save As' and navigate to the appropriate folder. THIS IS IMPORTANT! WE WANT EVERYTHING UNIFORM. The following is an example for the dkwt mapzone.

Previously Saved Project: If the project has been saved before, all you have to do is choose the 'Save' icon. This icon resembles a diskette. Click it and you have saved your changes!

Access Database Tutorial

## *Microsoft Access*

What is Access?

Microsoft Access is a relational database management system. At the most basic level, it is a program that facilitates the storage and retrieval of structured information.

Getting Started

To start Access, you double click the Access icon   Microsoft Access.lnk   from Microsoft Windows.

The following menu will appear, which allows you to open your <u>existing</u> program file. Go ahead and select the *Great Basin* file and click OK .
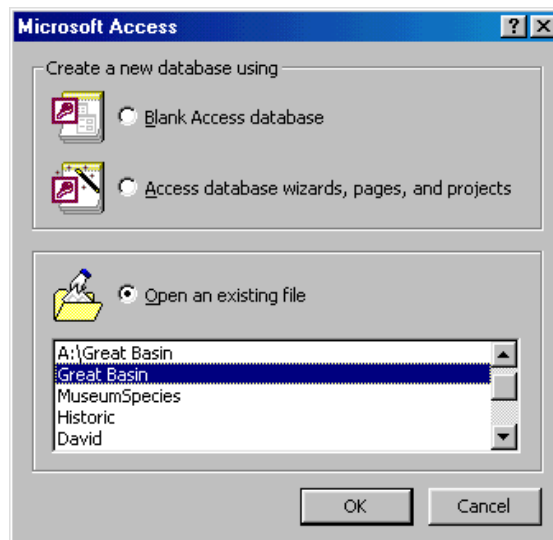
Next, the **Database Windows Toolbar** will appear. This identifies the *Objects* that are available in Access. These Objects include Tables, Queries, Forms, Reports, etc. For this project, you will only be working in **Forms**. The *Forms* object is activated when it is highlighted. Go ahead and double click the *frmDataEntry* file.

Objects
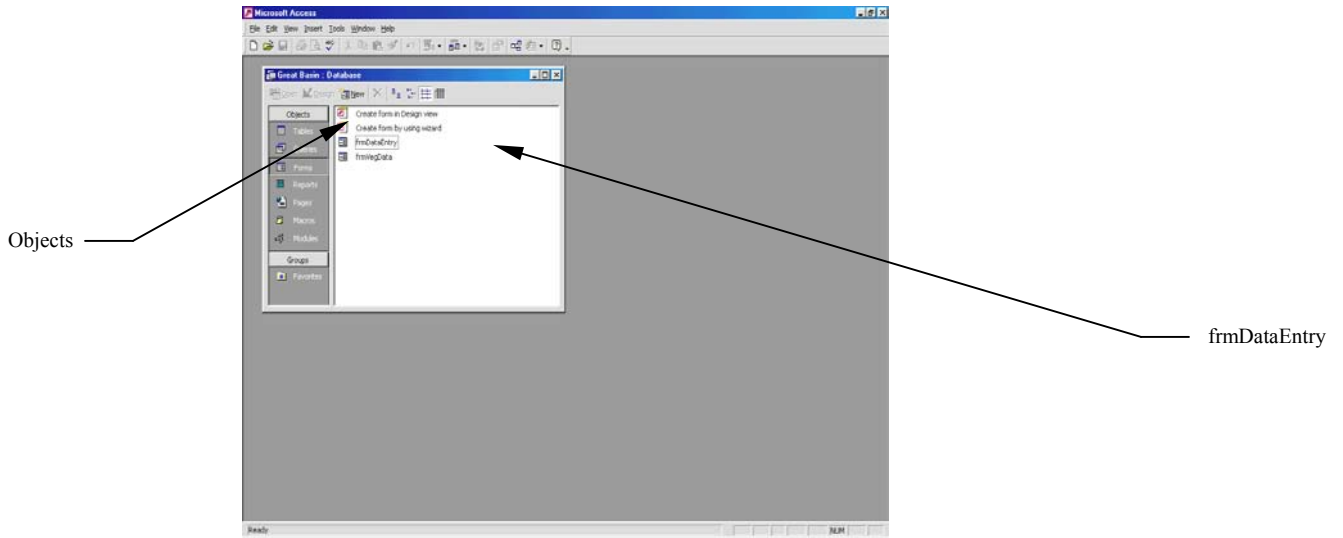
frmDataEntry

You have now launched the *SWReGAP Data Entry Form* (as shown below).

Arrows

Click for blank form
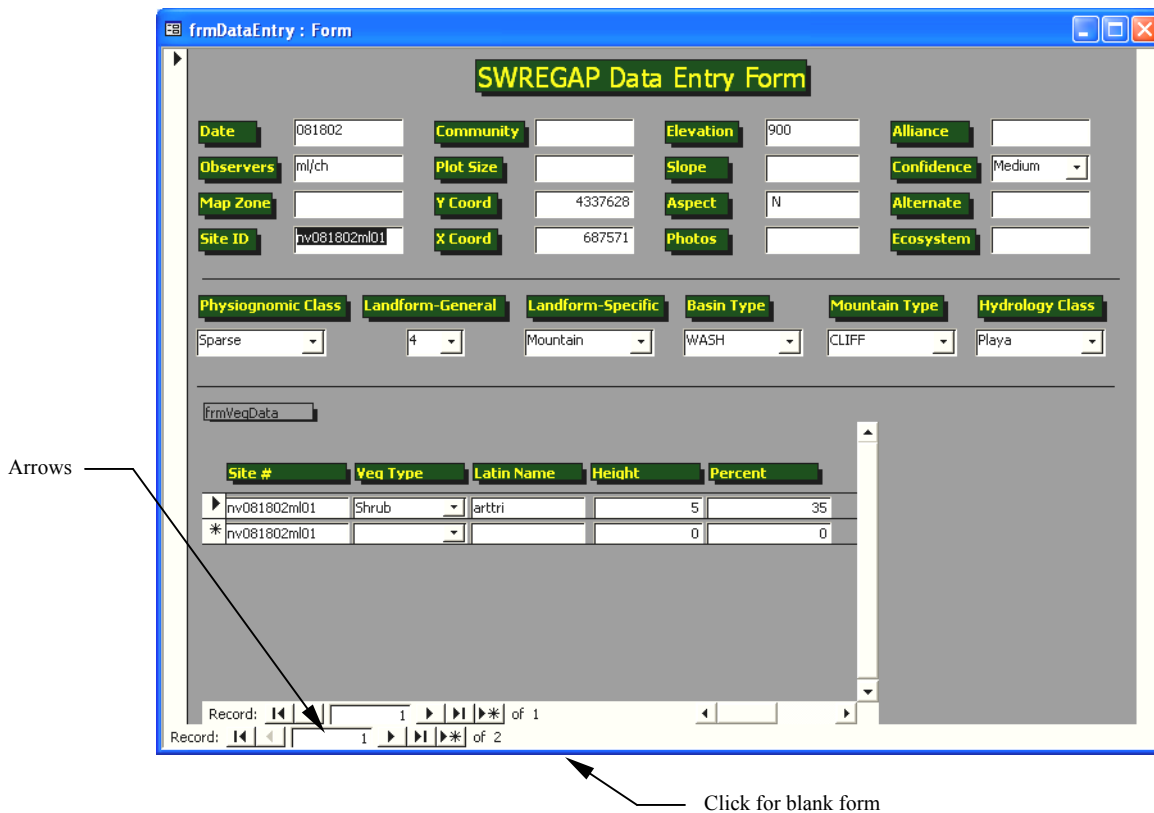
The arrows in the bottom left-hand corner allow you to scroll through the forms either one form at a time or to the very first or very last form. To get a blank form simply click on the arrow with the * symbol. While you are entering your data, use the **Tab** key to advance you one field at a time.

Notice there are some fields with a pull-down field (we will focus on the *Mountain Type* field). These fields have been designed to reduce error and to expedite your data entry. As you become

more familiar with Access, you will notice that by typing the first few letters of a word it will automatically appear in the field.
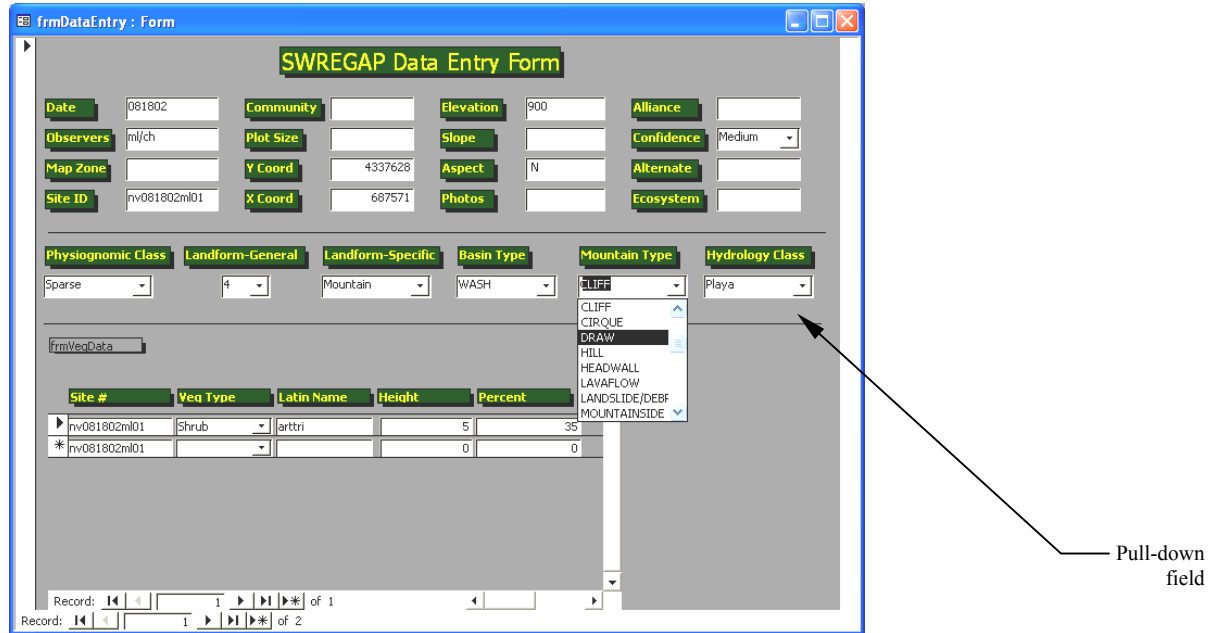
When you finish adding data to the form, select the arrow with the * symbol to automatically advance you to a new blank form.

To close out of the **Data Entry Form**, simply click the ⎡**X**⎤ in the upper right-hand corner. Your data entry will automatically be saved. This will take you back to the **Database Windows Toolbar**, which identifies the *Objects* available in Access. At this time you may go to **File** and select **Exit** to close out of the Access application.
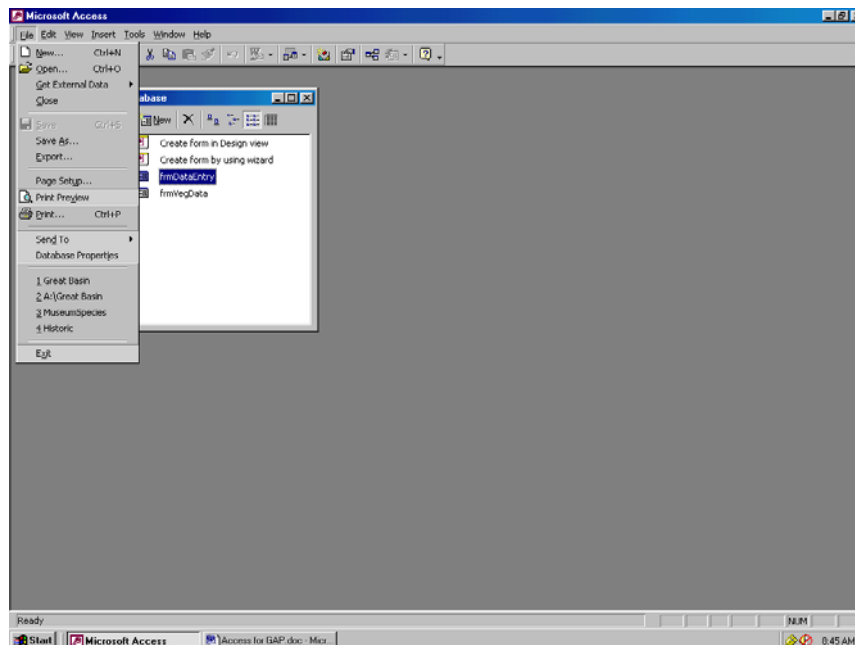
United States Department of the Interior

Bureau of Land Management
Nevada State Office
P.O. Box 12000 (1340 Financial Blvd.)
Reno, Nevada 89520-0006
http//www.nv.blm.gov/

January 8, 2003

EMS TRANSMISSION   01/09/2003
Instruction Memorandum No. NV-2003-021
Expires: 09/30/2004

To: BLM Employees, Nevada

From: State Director, Nevada

Subject: Safety Policy

As we begin the New Year, I want to reemphasize and share with you my commitment to safety.

The purpose of safety is simple -- to accomplish our goals and to provide employees and visitors with a safe and healthy environment. As such, safety is a core value, a management and worker responsibility inherent in everything we do which cannot be deleted for convenience or expediency. Accidents can cause tragic loss of life and suffering; managers and supervisors must also understand that accidents always reduce performance and lower quality of life. While accident investigation and reporting are often the most visible elements in Bureau of Land Management (BLM) safety programs, the emphasis in Nevada will be on accident prevention. Leadership at every level must integrate risk management principles into the planning and execution of everything we do. The success of our diverse missions and the safety of our dedicated employees depend on it.

No mission, no activity, no job is so important that we will knowingly expose any employee to an unacceptable degree of risk. Supervisors at all levels are responsible for accident prevention and employee training and are accountable that personnel under their control observe appropriate safety and occupational health rules and regulations. Management will maintain a safe and healthful environment and promptly evaluate and take actions to correct hazards reported by employees or identified through an inspection or accident investigation.

All employees will comply with established standards and promptly report all hazards to their supervisor or the safety manager for correction. The most nebulous, but probably

the most important, aspect of safety is fostering, nurturing, and maintaining a culture of Safety Awareness. Every person must be aware of what they are doing, the type of environment in which they are operating, and the possible consequences of their actions.

Communication is a critical aspect of any successful endeavor. To this end, each manager and supervisor is responsible to ensure that critical issues involving safety are communicated up, down, and across the organization. These issues include, but are by no means limited to, training initiatives, identified hazards and deficiencies, and adverse environmental conditions.

Finally, I do not believe that accidents "just happen". I challenge each manager, supervisor, and employee throughout Nevada to take those actions necessary to prevent the needless and costly waste of material, time, and human resources that result from mishaps.

Signed By: Authenticated By:
Robert V. Abbey   Patti Webber, Staff Assistant
State Director, Nevada   Division of Support Services

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