Vegetation Mapping Project,

Craters of the Moon National Monument and Preserve

Natural Resource Technical Report
November 2006

Craters of the Moon National Monument and Preserve – Northern Wapi Flow

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EXECUTIVE SUMMARY

In 1994, The United States Geological Survey (USGS) and the National Park Service (NPS) began the process of mapping the vegetation found in the National Parks throughout the United States. In cooperation with the National Park Service (NPS) the Vegetation Mapping Program began with an emphasis on the parks found in the upper Midwest. In 2006, funding became available for the vegetation mapping of Craters of the Moon National Monument and Preserve (CRMO). Northwest, Management, Inc. (NMI) was contracted to collect vegetation survey information in April 2006. During May-July 2006, NMI collected field data information for the 753,222 acres across the monument and preserve.

The vegetation mapping survey project at CRMO follows the standards and procedures of the National Parks Service Vegetation Mapping program. National Agricultural Imagery Program (NAIP) was utilized for the CRMO project. Preliminary Vegetation Classification was provided by Steven K. Rust, Lead Ecologist, Idaho Conservation Data Center. Some unique conditions were considered when developing the field data forms for the CRMO project.

NAIP imagery was utilized for the delineation of the vegetative signatures for Craters of the Moon. The resolution of the photography allowed us to identify unique features and the associated vegetative signatures necessary to identify sampling points. A target of 3 Vegetation Plots and 1 Observation Point were identified as the minimum number of data points for each dominant plant association found in the monument and preserve.

A total of 398 Vegetation Plots and 108 Observation Points were placed across the monument and preserve. Due to limited existing information, these data points were placed primarily on NPS property; however, a limited number of data points were placed on the adjacent BLM lands to achieve the desired number of points for each plant association. Where pre-existing vegetation information was limited or lacking on the adjoining BLM properties, additional points were placed.

INTRODUCTION

In 1994, The United States Geological Survey (USGS) and the National Park Service (NPS) began the process of mapping the vegetation found in the National Parks throughout the United States. In cooperation with the National Park Service (NPS) the Vegetation Mapping Program began with the goal of developing good quality vegetation maps for the more then 250 properties managed by the National Park Service. A set of guidelines and protocols were developed for the National Vegetation Mapping Program, which then established the standards for the vegetation-mapping program.

These standards comply with all guidelines set forth in the Federal Geographic Data Commission of thematic consistency, spatial accuracy, and data production. The National Vegetation Classification is used for vegetation classification. The minimum accuracy for each map unit is 80% at a 90% level of confidence.

The vegetation-mapping project for Craters of the Moon National Monument and Preserve was initiated in the spring of 2006. Northwest Management, Inc. was contracted to complete the field data collection during May-July of 2006. The Conservation Data Center provided the initial preliminary vegetation associations for CRMO.

Project Area

Craters of the Moon National Monument and Preserve is a national monument and national preserve located between Rupert and Arco, Idaho. The volcanic features found on CRMO are representive of one of the best preserved flood basalt areas in the continental United States.

The Monument was established on May 2, 1924. In November 2000, a Presidential proclamation greatly expanded the Monument area. The National Park Service portions of the expanded Monument were designated as Craters of the Moon National Preserve in August 2002. The National Park Service and the Bureau of Land Management (BLM) cooperate in the management of the NPS Monument and Preserve and the BLM Monument.

The Monument and Preserve encompasses 753,222 acres in three major lava fields and about 400 mi² (1,000 km²) of sagebrush-steppe grasslands to cover a total area of 1117 mi² (2,892 km²). All three lava fields lie along the Great Rift of Idaho, with some of the best examples of open rift cracks in the world, including the deepest known on Earth at 800 feet (240 m). There are excellent examples of almost every variety of basaltic lava as well as tree molds (cavities left by lava-incinerated trees), lava tubes (a type of cave), and many other volcanic features.

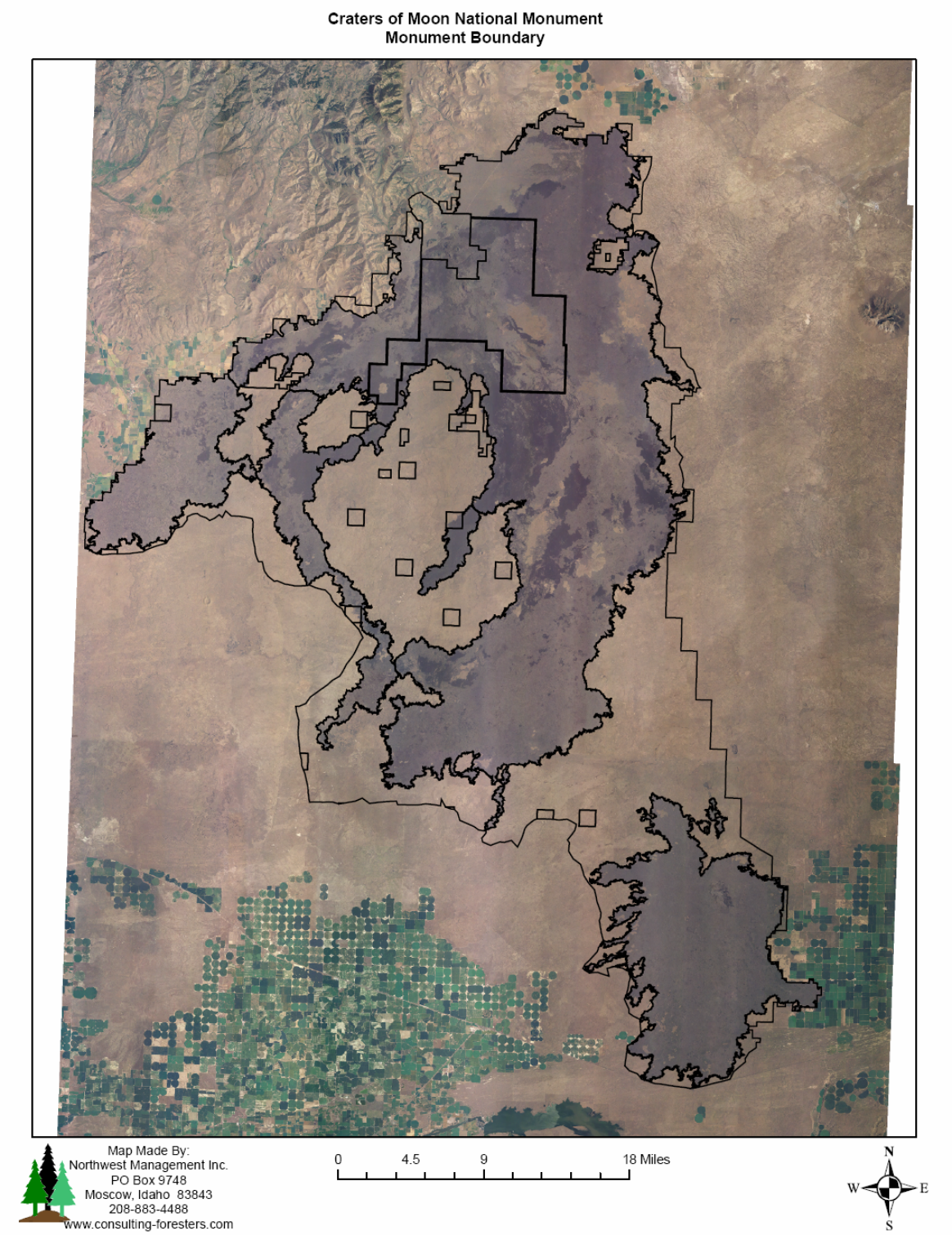


Figure 1. Project Area Map

METHODS

Timeline of Activities

Table 1. Timeline of Activities

Timeline of Activities	
April 2006	RFP released for CRMO
May 2006	Scoping and kickoff meeting at Park Headquarters
May 3 – July 15, 2006	Field data collection

The vegetation-mapping project for CRMO follows the standards and general procedures of the NPS Vegetation Mapping Program. The same standards, type of photography and field data collection procedures were followed. Due to the unique qualities of the monument and preserve some changes in sampling and techniques were employed. Electronic data recorders were employed throughout the field data season.

Planning and Scoping Meeting

The Planning and Scoping meeting was held at the Park Headquarters on May 3, 2006. The following cooperators were in attendence:

- Lisa Garrett – NPS Upper Columbia Basin Network, 208-885-3084, lisa_garrett@nps.gov
- Leona Svancara – NPS UCBN, 208-885-3774, leona_svancara@nps.gov
- John Apel – NPS CRMO, 208-527-3257x501, john_apel@nps.gov
- Paige Wolken – NPS CRMO, 208-527-3257x505, pagie_wolken@nps.gov
- Gwen Kittel – NatureServe, 303-541-0364,
- Dan Cogan – CTI, 815-858-3483, dancogan@cogantech.com
- John Erixson – Northwest Management Inc (NMI), 208-883-4488, erixson@consulting-foresters.com
- Jim VonLoh – e^2M, 303-754-4216, jvonloh@e2m.net
- Matt Smith – e^2M, 303-754-4200, msmith@e2m.net
- Pete Williams – e^2M, 970-374-2504, williapa@toast.net
- Klara Varga – NPS Grand Teton Natural Resources, 208-652-3239, klara@ida.net
- Julie Hilty – BLM Shoshone Botanist (julie_hilty@blm.gov)
- Kasey Prestwich – BLM, 208-732-7204
- Steve Rust – Idaho Conservation Data Center, 208-883-4488, srust@idfg.idaho.gov
- Roger Blew – Idaho National Lab, S.M. Stoller Corp., 208-525-9358, Rblew@stoller.com

- Amy Forman – Idaho National Lab, 208-525-9358, aforman@stoller.com
- Tom Richards – NMI, 208-883-4488, richards@consulting-foresters.com
- Drake Barton – NMI, 406-449-6586, montana-moods@hughes.net
- Jim Cancroft – NMI, 406-442-7550, nwimanage@montana.com
- Jack Gunderman, NMI, 208-667-1553
- Fran Gruchy – NPS HAFE/MIIN, 208-0837-4793x5233, fran_gruchy@nps.gov
- Bob Lorkowski – HAFE, 208-837-4793x5228, robert_lorkowski@nps.gov
- Tess O'Sullivan, Ecologist tess@lavalake.net

The facilitator for the Planning and Scoping Meeeting was Dan Cogan, CTI Project Coordinator.

Preliminary Data Collection and Review of Existing Data

Prior to and following the scoping and kickoff meeting, NPS and Upper Columbia Basin Network (UCBN) staff began to review and collect existing data of the monument and preserve as well as adjacent ownerships. These data sets include GIS data layers, existing vegetation mapping data sets and fuels data. The information collected during this process was provided to the cooperators. These data sets were used in the mission planning for the field collection crews.

From the initial survey of existing data, the NPS and Upper Columbia staff determined that there was significant data collected on the BLM parcels, which include Laidlaw Park, Little Park and Paddleford Flats. After investigation the data appeared to be incompatible with the planned surveys. This was due in part to the design of the surveys where the BLM collected line transect data focusing in on determining range condition and trends. One part of the surveys that was useful for this project was the weed surveys that were conducted in these same areas.

Current maps of vegetation and geology existed in many areas for the monument and the preserve. These maps were used as initial surrogates for field data collection and mission planning. Another source utilized by field crews was the herbarium records maintained at the park headquarters near Arco, Idaho.

Aerial Photography

There is not a complete set of existing 9 X 9 inch aerial photography available for the monument and preserve. The NAIP imagery was available for all areas of the monument and preserve. After evaluation of the NAIP Imagery by the cooperators, the imagery was determined adequate for this initial phase of the project.

Development of Special Mapping and Data Collection Criteria

The minimum mapping unit for this project was 0.50 hectare for the field collection criteria. This unit size was selected to sample some of the unique features found in this monument and preserve. The primary park features of special interest for the NPS staff

are kipukas. These unique features were sampled to determine the current health of these isolated pockets of old vegetation found on more recent lava flows. The primary concern in the Kipukas was the presence or absence of Cheatgrass (*Bromus tectorum*). The other area of specific interest to the NPS staff was the presence of invasive weeds. The major weed of concern that was observed in or near the monument and preserve boundaries was rush skeleton weed (***Chondrilla juncea*)**. This weed is spreading rapidly across the adjacent BLM administered properties.

Attempts were made to sample other invasive weeds and unique vegetative features in this monument and preserve. Two vegetative plots were placed in Curl-leaf Mountain Mahogany (*Cercocarpus ledifolius*) stands previously not recorded in the monument and preserve. No additional plots were recorded in this plant association due to the rareness of this association.

Field Data Collection and Classification

Development of Preliminary Classification

Steve Rust of the Idaho Conservation Data Center provided the preliminary plant classification for Craters of the Moon National Monument and Preserve. This initial list of potential plant associations was based on the vegetative types that are common to the habitat and environment that were likely to occur within the boundaries of the monument and preserve.

Field Reconnaissance

On May 3, 2006, NMI field staff along with NPS staff and other cooperators visited sites on CRMO to familiarize field crews with the data collection protocol and the monument and preserve. This field reconnaissance also allowed field staff to become familiar with vegetative signatures identifiable on the NAIP imagery.

Field crews continued the reconnaissance for the first week of the field season. This again allowed crews to become more familiar with the signatures found on the imagery. This field reconnaissance was used to identify the areas of interest for site visits and build consistency amongst the field survey crews. The final vegetation classification is not defined until after the field vegetative plots are established and the data collection is complete. This final classification is scheduled for the winter months of 2006-2007.

Field Collection Strategy

Field data collection was completed utilizing two basic plot types. The first was the vegetation plot and the second the observation point (each type of data point is further defined in the following section). Two two-person field crews collected plot data of both types. Each team consisted of a Botanist and a Field Ecologist. Plots were

systematically placed throughout the monument and preserve in the areas with the greatest diversity.

Field staff collected the information for each of the observation points and the vegetation plots. Data collection points were identified on the NAIP imagery where a field crew would navigate to the specific photo signatures. Additional data points were collected for under represented vegetation associations when identified by field crews in their travels to and from points of interest. GPS coordinates were collected for each data point and representative photographs were taken. All field data was collected with Archer Field PCs utilizing Microsoft Windows Mobile 5.0 operating systems. Crews typically found the vegetation on the monument and preserve in distinct polygons; edges of vegetation types/associations were recognizable in the field.

The goal of this fieldwork was to maximize the contribution of each data collection point for the next phase of this project as performed by the photo interpreters. All GPS points are available for the photo interpreters with the associate plot data. The estimated accuracy of each GPS point is included with the database and is typically within 5 meters. This will allow for the data points to be attached to a particular polygon.

Field Data Collection

The plot sampling methodology follows the standards set forth by the Federal Geographic Data Commission of thematic consistency, spatial accuracy, and data production. The National Vegetation Classification is used for vegetation classification. Prior to the fieldwork NAIP imagery was reviewed to identify the areas of interest for field visits by the field crews. The survey areas focused on capturing the natural variability in the vegetation across the landscape. The National Vegetation Classification was used to provide a first approximation of the plant associations that were present in the monument and preserve. There were 84 preliminary plant associations identified for CRMO. A goal of 3 to 5 vegetation plots and 1 to 2 observation points were set as the targeted output from the field data collection period.

For each field day, each team would review the mission plan with the lead project ecologist. Teams would identify areas of interest with a significant number of different photo signatures. The teams traveled to those sites using USGS Topographic maps and NAIP imagery to locate the points. Plots were placed at each location. When field teams would discover a new or unique plant association in their travel to a specific point, the crews would place a data point at that location.

In the scoping and the kickoff meeting, the specific methodology was discussed and modified for conditions and to collect useful data at Craters of the Moon. The Upper Columbia Basin Plot Collection Data Form was modified accordingly, and the appropriate plot size was determined. The typical plot was a 20 by 20 meter square; however, in some instances a rectangular plot was utilized in order to capture the uniqueness of the vegetation or due to topographic limitations. Most plots were set up

on cardinal directions (2 perpendicular 20 m tapes aligned to the cardinal directions); however, on a few occasions it was necessary to set plots up on a bearing in order to capture the representative vegetation. In all cases, the plot size was 400 square meters. While all data was collected using Archer Field PCs utilizing Data Plus software, the Upper Columbia Basin Plot Collection Data Form was utilized to set the protocols for the field PCs.

Utilizing field data recorders provided several advantages over the more traditional method for recording field data on paper. These advantages include: 1) less opportunity for transcription error in data entry; 2) a weather resistant platform for recording data; and 3) efficiency of data entry. Each handheld data recorder was downloaded onto a laptop computer where the field crews audited data.

Plot data collected for each vegetation plot included Plot Header Information (Identifiers/Locators), Environmental Descriptions, Vegetation Descriptions, Species List, and Fuels Information. For observation points, the species list and fuels data were not required; all other components listed above were collected. The presence of invasive weeds was recorded for all data collection points as well as any observations of noxious weeds noted during the field season. All plots were geo-referenced typically within 5 meters using Garmin Map 76 GPS units. A digital photograph of each vegetation plot was taken from the midpoint of the outside perimeter of each side of the plot in cardinal direction; the representative photo was noted in the electronic data recorders. One representative photo was taken for each observation point.

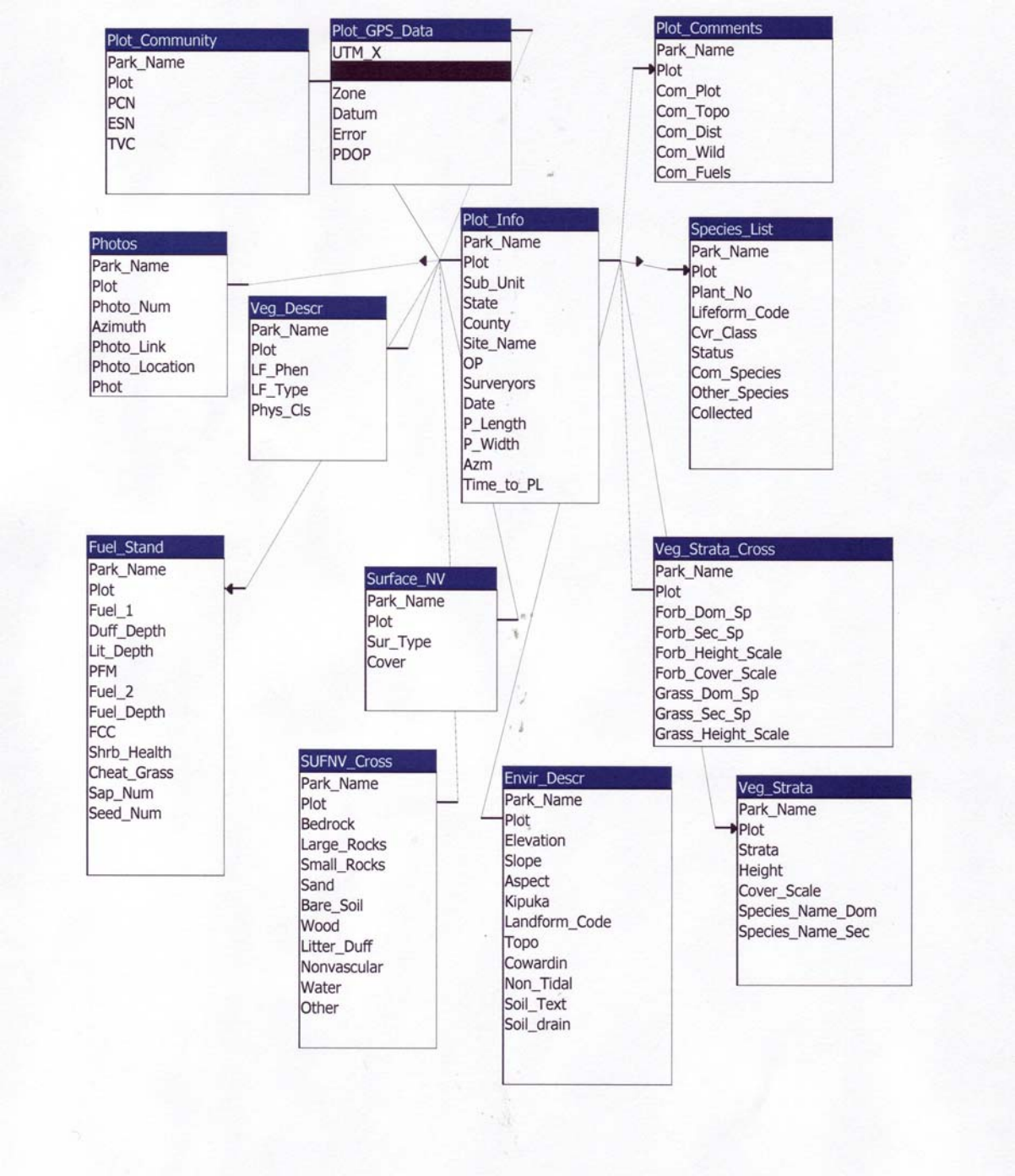


Figure 2. Access Database Relationships

A total of 398 vegetation plots and 108 observation points were collected during May through July 2006. Following data collection, the Field PCs were downloaded into a laptop computer and data was review and checked for entry errors. The information was then transferred from the laptop into the final database on a desktop computer. A description of the procedures is in the appendix of this document.

Data Collection & Forms Used

Each section of the Upper Columbia Basin Plot Collection Data Form is shown below.

Identifiers/Locators Form (Completed for every plot)

Table 2. Identifiers/Locators Form

Plot Code _____ Surveyors: _____ Date___/___/2006
State ID Park Name CRMO Park Site Name (Optional) _____ **Provisional Community** **Name**_____ **Ecological System Name**_____ Total Vascular Cover_____%
GPS rover file _____ Field UTM X___ ___ ___ ___ ___ ___ m E Field UTM Y___ ___ ___ ___ ___ ___ ___ m N Zone: 12 Datum: NAD 83 Estimated Error _____ PDOP _____
Vegetation Plot **OR** Observation Point **Circle One** Plot length ____ (m) Plot width ____ (m) Plot Azimuth ____ Plot Pictures _____ Travel Time to Plot _____ From _____
Comments about plot representativeness, plot layout

This plot header was filled out for every plot. This header information became the plot identifier for each plot in the electronic data recorders and subsequent database. Plot code is simply the plot number. Vegetative plot numbers assigned were from 1 to 200, 800 to 820 and 1000 to 1200, observation points numbers assigned were 8000 to 8100 and 9000 to 9100. Each field crew was assigned a series of unique plot numbers.

In the electronic data recorders, the initials of each crewmember identified the Surveyors. The date, State and Park name were defaults filled in by the field PCs. The field crews utilizing the Provisional Plant Communtiy list found in the appendix of this document identified Provisional Community Names and the Ecological System Names. The field crews to the nearest 1% estimated total vascular cover. GPS rover files were created utilizing the park initials and the plot number both the GPS units and the field crew recorded UTM coordinates and error. The plot type was entered into the field PCs. The size of the plot defaulted to 20 meters square, and plot azimuth defaulted to 360 unless field crews manually changed the entry for a specialized plot. Travel time and landmarks were recorded.

Each of the following sections of the Upper Columbia Basin Plot Collection Data Form became a sub-section in the electronic data recorders. Each required subsection had to be filled out completely before the field crew could exit the data recorder.

Environmental Description Form

Table 3. Environmental Description Form

Elevation (ft)_____ Slope (%) _____ Aspect (degrees)_____		
Kipuka? Yes No	Landform Feature **Circle One** Young lava field Old lava field Cinder cone Cinder field Butte Plain Foothill	
Topographic Position **Circle One** Interfluve Shoulder Backslope Footslope Toeslope Step in slope Valley floor Terrace Channel		
Describe Topographic Position (Optional)		
Cowardin System ___ Upland ___ Riverine ___ Palustrine ___ Lacustrine	Non-Tidal – only if not upland ___Permanently Flooded ___Semi-permanently Flooded ___Seasonally/Temporarily Flooded	___Saturated ___Intermittently Flooded ___Unknown
Unvegetated and Non-Vascular Surface: *(use the cover scale on next page)(Must approximately equal 100%)* ___ Bedrock ___ Large rocks (cobbles, boulders > 10 cm) ___ aa lava ___ Water ___ Litter, duff ___ Small rocks (gravel, 0.2-10cm) ___ Pahoehoe lava ___ Cinder ___ Wood (>1 cm) ___ Sand (0.1-2 mm) ___ Block lava ___ Bare soil ___ Nonvascular ___ Other:_____		
Soil Texture (Pick one) ___ sand ___ loamy sand ___ sandy loam ___ silty clay ___ no soil ___ loam ___ clay loam ___ clay ___ silt		Soil Drainage (Pick one) ___ Well drained ___ Moderately well ___ Poorly drained

The elevation was manually recorded from the GPS units into the field data PCs. The dominant slope was recorded using clinometers and aspect using a compass. Topographic position was recorded from a drop down menu in the field PCs. Cowardin system, soil texture and drainage were selected from the drop down menus. Unvegetated and non-vascular surface was estimated and recorded to the nearest 1%.

The primary concern with invasive species in the preserve and monument were Cheatgrass (*Bromus tectorum*) and rush skeletonweed (*Chondrilla juncea***)**. Observation of each invasive species was recorded using the following table.

Table 4. Invasive Weeds Form

Invasive Species Present	Cover (%) [none, < 1, 1-5, 6-25, 26-50, > 50%]	Size of Infestation [0, < 0.1 , 0.1-1, 1-5 acres]

Table 5. Vegetation Description Form

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Strata & Unvegetated Surface	Height Scale for Strata
Pick one ___Evergreen ___Deciduous ___Mixed (evergreen& deciduous) ___Perennial herbs ___Annual herbs	Pick one ___Broad-leaved ___Needle-leaved ___Graminoid ___Forb ___Pteridophyte	Pick one ___Forest ___Woodland ___Shrubland ___Dwarf Shrubland ___Herbaceous ___Nonvascular ___Sparsely Vegetated	t < 0.5% T 0.49- 0.9% 01 1-1.9% 02 2-4.9% 05 5-9.9% 10 10-14% 15 15-24% 25 25-34% 35 35-49% 50 50-74% 75 75-94% 95 >95%	T <1ft. 01 1-5ft. 05 5-15ft. 15 15-30ft. 30 >30ft

Strata	Height Class	Cover Class	Dominant (Primary) species	Secondary Species
T1 Emergent	_____	_____	_____	_____
T2 Canopy	_____	_____	_____ _____	_____
T3 Sub-canopy	_____	_____	_____	_____
S1 Tall shrub	_____	_____	_____	_____
S2 Short shrub	_____	_____	_____	_____
S3 Dwarf shrub	_____	_____	_____	_____
H Herbaceous	_____	_____	_____	_____
G Graminoid	_____	_____	_____	_____
F Forb	_____	_____	_____	_____
N Non-vascular	_____	_____	_____	_____
O Outside	_____	_____	_____	_____

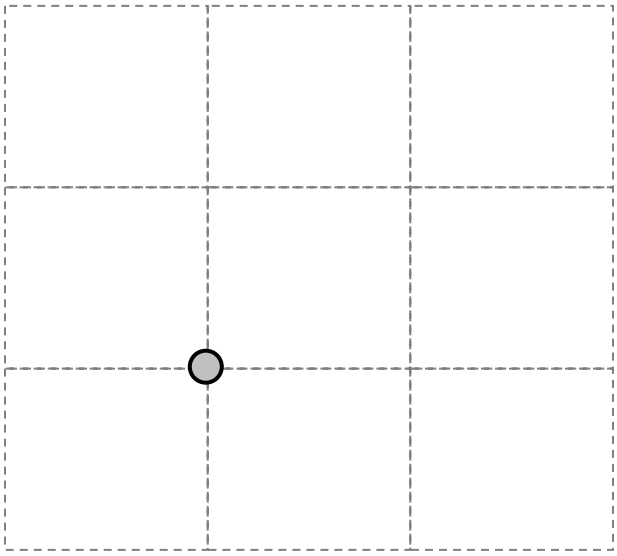
see above table for height and cover scales

Evidence of Natural or Anthropogenic Disturbance:

Evidence of Wildlife Use:

Other Comments (Miscellaneous, Plot "Memory Jogger", etc…)

Plot Map (20X20m cells):



Species List

The species list was as complete as the phenologic development of the plants would allow. Unknown species were collected in the field and labeled accordingly. Each evening the field crews would get together to key out and identify the unknown species. Typically, two individuals would key out the unknowns to verify the first identification. A percentage of dead trees and shrubs were recorded in an attempt to track disease and insect problems that are known to occur on the preserve and monument.

Table 6. Species List Form

Life Form Code	Cover Class	Dead?	Species

Plot Code_____Surveyors: _____ Date: _____/ _____/ _2006__

Species/percent cover: Starting with the uppermost stratum, list all species with % cover for each species in the stratum. Put an asterisk (*) next to any species that appear to be diagnostics for the community in the classification.

LIST SPECIES BY TREES, SHRUBS, GRAMINOIDS, then ***FORBS***.**See strata and cover scales on previous page*

Fuels Data

Fuels data was collected to provide an estimate of expected fire behavior given ignition. This data supplements some existing data collected on the surrounding BLM administered properties.

Fire Regime Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995). Coarse scale definitions for natural (historical) fire regimes have been developed by Hardy *et al.* (2001) and Schmidt *et al.* (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001).

The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation. These five regimes include:

I – 0-35 year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);
II – 0-35 year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
III – 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);
IV – 35-100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
V – 200+ year frequency and high (stand replacement) severity.

As scale of application becomes finer these five classes may be defined with more detail, or any one class may be split into finer classes, but the hierarchy to the coarse scale definitions should be retained.

A fire regime condition class (FRCC) is a classification of the amount of departure from the natural regime (Hann and Bunnell 2001). Coarse-scale FRCC classes have been defined and mapped by Hardy *et al.* (2001) and Schmidt *et al.* (2001) (FRCC). They include three condition classes for each fire regime. The classification is based on a relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g. insect and diseased mortality, grazing, and drought). There are no wildland vegetation and fuel conditions or wildland fire situations that do not fit within one of the three classes.

The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime (Hann and Bunnell 2001, Hardy *et al.* 2001, Schmidt *et al.* 2002). The central tendency is a composite estimate of vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside.

Characteristic vegetation and fuel conditions are considered to be those that occurred within the natural (historical) fire regime. Uncharacteristic conditions are considered to be those that did not occur within the natural (historical) fire regime, such as invasive species (e.g. weeds, insects, and diseases), "high graded" forest composition and structure (e.g. large trees removed in a frequent surface fire regime), or repeated annual grazing that maintains grassy fuels across relatively large areas at levels that will not carry a surface fire. Determination of the amount of departure is based on comparison of a composite measure of fire regime attributes (vegetation characteristics; fuel composition; fire frequency, severity and pattern) to the central tendency of the natural (historical) fire regime. The amount of departure is then classified to determine the fire regime condition class. A simplified description of the fire regime condition classes and associated potential risks are presented in the following table.

Table 7. Fire Regime Condition Class Definitions Form

Fire Regime Condition Class Definitions.		
Fire Regime Condition Class	**Description**	**Potential Risks**
Condition Class 1	Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics. Composition and structure of vegetation and fuels are similar to the natural (historical) regime. Risk of loss of key ecosystem components (e.g. native species, large trees, and soil) is low.
Condition Class 2	Moderate departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are moderately departed (more or less severe). Composition and structure of vegetation and fuel are moderately altered. Uncharacteristic conditions range from low to moderate. Risk of loss of key ecosystem components is moderate.

Fire Regime Condition Class Definitions.		
Fire Regime Condition Class	**Description**	**Potential Risks**
Condition Class 3	High departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are highly departed (more or less severe). Composition and structure of vegetation and fuel are highly altered. Uncharacteristic conditions range from moderate to high. Risk of loss of key ecosystem components is high.

Table 8. Fuel Loading Form

Fuel Loading (tons/acre) < 3 inch diameter fuels ___ < 1 ___ 1.1 - 3 ___ 3.1 - 5 ___ 5.1 - 10 ___ > 10	Average duff depth ___ none ___ < 1 inch ___ 1 – 1.5 inches ___ 1.6 – 2 inches ___ 2.1 – 3 inches ___ > 3 inches	Average litter depth ___ none ___ < 1 inch ___ 1 – 3 inches ___ > 3 inches	Primary Fuel Model (Pick one) ___ None [14] ___ Barren rock [0] ___ Short grass [1] ___ Grass timber [2] ___ Tall grass [3] ___ Low shrub [4] ___ Tall shrub [5]	
Fuel Loading (tons/acre) > 3 inch diameter fuels ___ < 3 ___ 3.1 - 10 ___ 10.1 - 20 ___ > 20	Average Fuel bed depth (live and dead) ___ < 1 ft ___ 1-3 ft ___ > 3 ft	Fire Condition Class (Pick one) ___ CC1 ___ CC2 ___ CC3	Overall health of shrub component ___ No shrubs ___ Productive ___ Declining ___ Decadent ___ Moth kill ___ Fire	Cheatgrass cover (percent) ___ None ___ < 1% ___ 1 – 5% ___ 6 – 25% ___ 26 – 50% ___ > 50%
Fire/fuels Comments:		Number of saplings / acre (trees >4.5 ft tall AND <4" diameter) _____ (1 acre = 220 sq ft)		Number of seedlings / acre (trees <4.5 ft) _____ _____

Each of the above items were drop down menus where the observer selected the appropriate choice for each entry. The seedlings and saplings selection were an estimate of the regeneration found for Limber pine (*Pinus flexilis*). This estimate

provides the Monument Staff with an overview of the health and vigor of this particular species.

Photos

Photographs were taken for each vegetation plot in the 4 cardinal directions. The representative photo was identified in the electronic data recorders. On observation points one representative photo was taken with the bearing recorded in the direction of the photograph. Photographs were downloaded nightly. The photo number assigned to the photo was the plot number followed by the direction the photo was taken. An example is 1105s, meaning the photo was for plot 1105 and it was taken in the direction of south across the plot from the beginning and end of each tape, or corner of the plot.

Table 9. Photo Description Form

	Azimuth (Degrees)	Photo Number	Comments (Optional—e.g. "Looking west across plot.")
Line 1	90	1047e	Plot number 1047photo taken east across plot
Line 2	180	1047n	Plot number 1047photo taken north across plot
Line 3	270	1047w	Plot number 1047photo taken west across plot
Line 4	360	1047s	Plot number 1047 photo taken south across plot

Figure 3. Example Photo of Each Plot

RESULTS

Total Vegetation Plots and Observation Points

A total of 398 vegetation plots and 108 observation points were collected during May through July 2006. The following map shows the plot location across the preserve and monument.

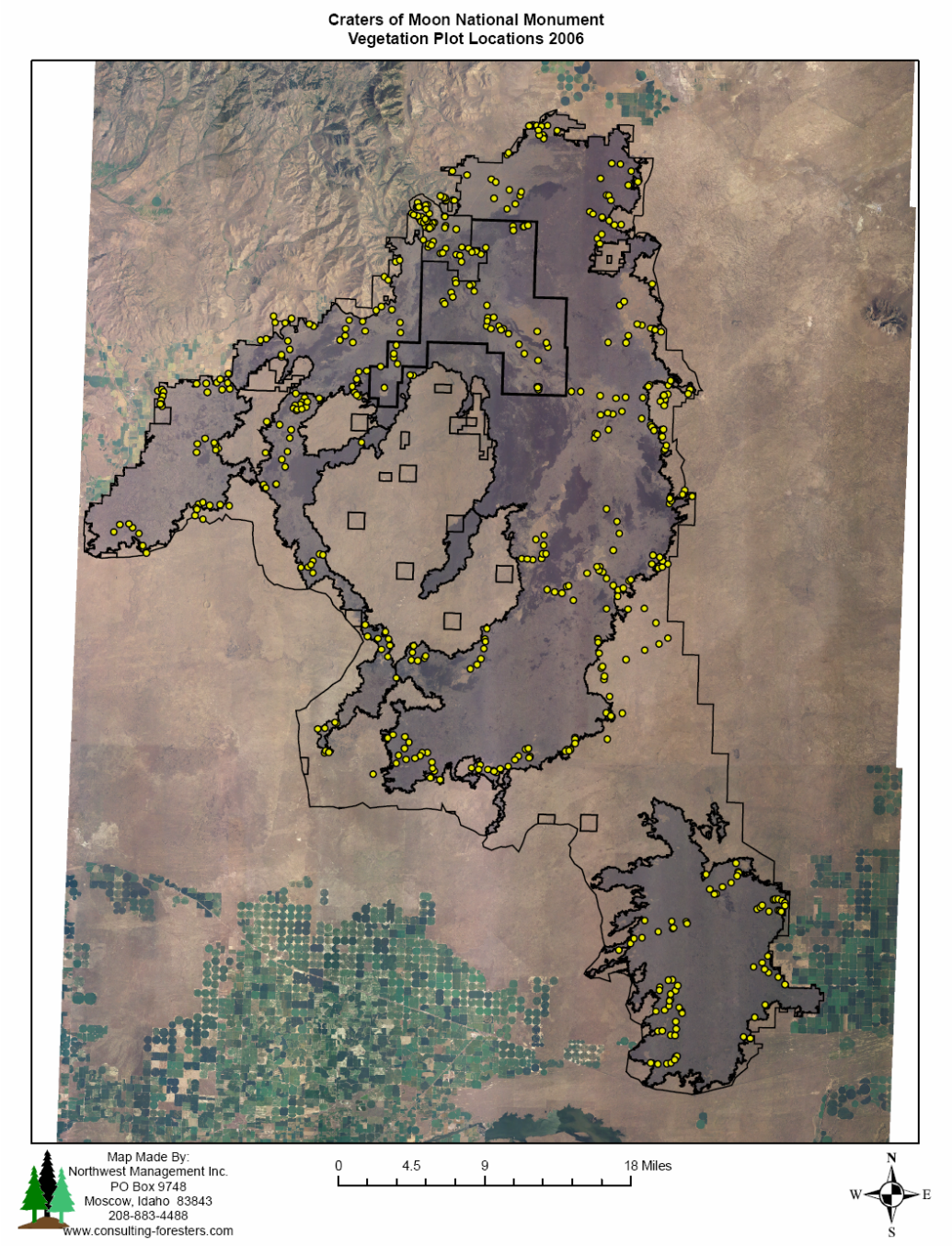


Figure 4. Map of Plot Locations Across the Preserve and Monument.

Preliminary Plant Associations

Field crews identified 141 preliminary plant associations in CRMO, however, after analysis is completed, it is expected some of these plant associations will be grouped together, decreasing the total number of plant associations identified in CRMO.

Forest

There were fourteen coniferous plant associations sampled. Of those sampled, eleven were limber pine (*Pinus flexilis*) and three were Douglas-fir (*Pseudotsuga menziesii*). The limber pine plant associations were most common along the northern one third of the monument and preserve on all aspects. The Douglas-fir plant associations were most common in the northern part of the original monument and north of the highway, primarily on the north aspects. Eight broad-leaved forests were sampled; these included seven quaking aspen (*Populus tremuloides*) and one black cottonwood (*Populus tripocarpa*). The quaking aspen stands were primarily in the extreme north part of the monument and preserve primarily along riparian zones and on the north and east aspects. The black cottonwood was found in remote pockets near wetter areas on the Carey Lava Flow.

Woodland

Nine woodland associations primarily dominated by Rocky Mountain juniper (*Juniperus scopulorum*) and Utah juniper *(Juniperus osteosperma*) were sampled by the field crews. The juniper stands were found in the southern one third of the monument and preserve and along the perimeter of the Wapi lava field.

Shrubland

There were 102 shrubland plant associations identified by the field crews. *Artemisia tridentata* was the dominant shrub species found throughout the monument and preserve.

Artemisia tridentata var*. vaseyana* is the dominant shrub in the northern one third of the monument and preserve. *Artemisia tridentata* var*. wyomingensis* was dominant in the southern two thirds of the monument and preserve. *Artemisia tripartita* was dominant on the deeper soils found in the Kipukas. *Purshia tridentata* plant associations were common on cinder substrates in the northern portion of the original monument and could be found throughout the monument and preserve in isolated pockets. Twelve broad-leaved plant associations were observed on the monument and preserve. The majority of the broad-leaved shrubland associations were found on the lava flows with little to no soil development.

Herbaceous

Sixteen herbaceous plant associations were observed throughout the monument and preserve area. The majority of these herbaceous plant communities were associated with previous wild fires and often contained either planted or invasive species.

Invasive Species

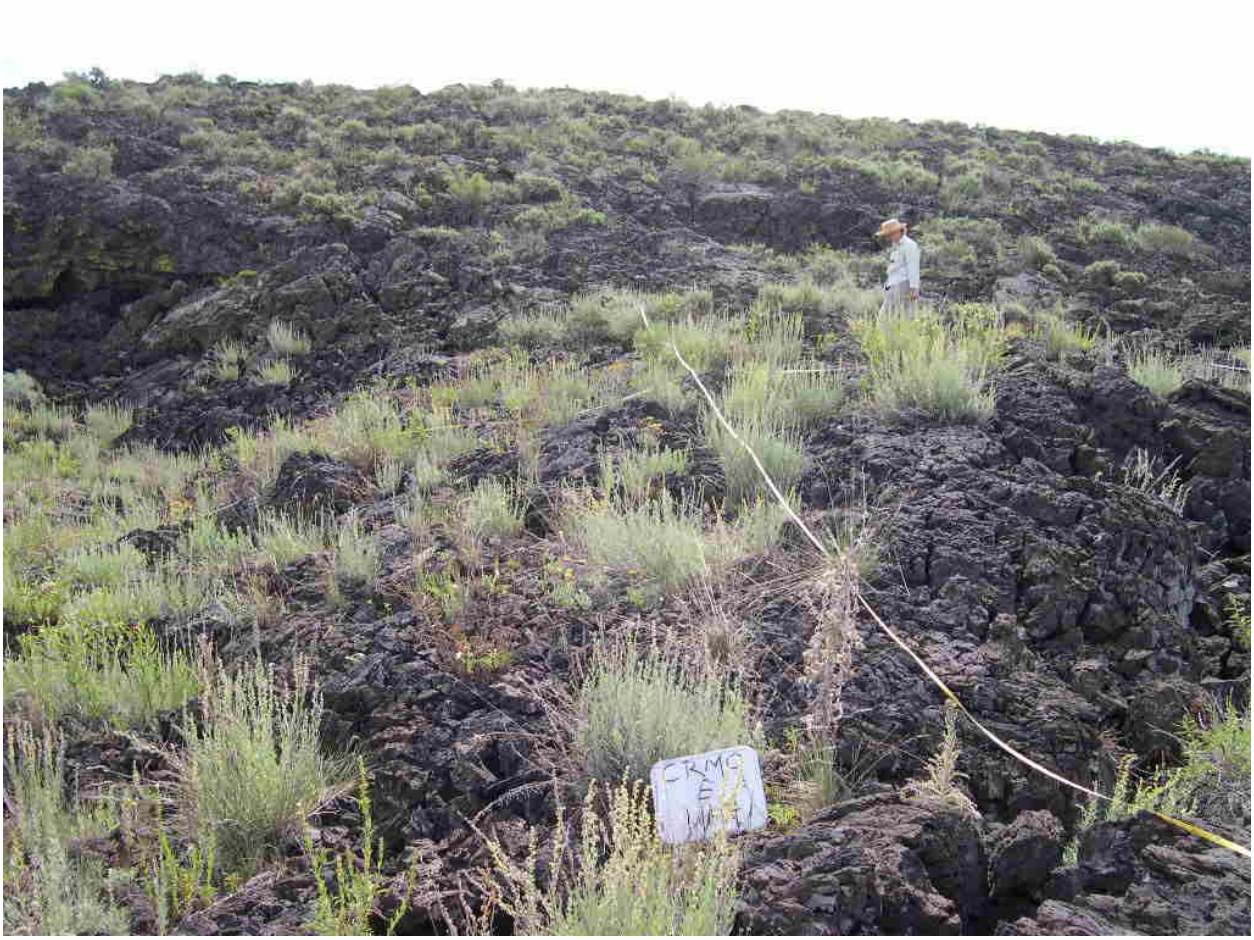
Cheatgrass (*Bromus tectorum*) was the most widespread invasive species found in the monument and preserve. Cheatgrass could be found in most of the kipukas in the southern two thirds of the monument and preserve. Cheatgrass was also common in

the southern one third of the original monument. Rush skeleton weed was present but not common in the monument and preserve. Rush skeleton weed was prevalent southwest of Laidlaw Park and had encroached into the monument and preserve in this area.

Previously Unknown Species and Rare Species

A Curl-leafed Mountain Mahogany (*Cercocarpus ledifolius*) plant association was observed in two locations in the northern one third of the Wapi Lava Field. This species was previously unknown to exist in the monument and preserve.

Artemisia ludoviciana var. ludovicia.plant association was found near the potholes in the Carey Lake area of the monument and preserve. This species is list as rare in the monument and preserve.



Problems on the Ground

Dwarf mistletoe and recently discovered white pine blister rust appear to be the greatest threat to the limber pine plant associations. The dwarf mistletoe is widespread across the monument and preserve. White pine blister rust was discovered in the northern part of the monument and preserve. The invasive species, particularly cheatgrass, may pose the greatest threat to the existing plant communities over time, as it is present across all areas of the monument and preserve.

DISCUSSION

The Craters of the Moon National Monument and Preserve is a dynamic ecosystem covering portions of five counties in southeast Idaho. Topographic position, geologic formations and soil structure appear to drive the plant structure in CRMO.

The initial plant association list is likely to be reduced/consolidated as further analysis is completed. This is due to the weight that the field crews placed on the relative abundance of the invasive species. Many of the plant associations observed by field crews would likely have been identified toward the native bunch grasses 10 to 15 years ago; however, due to the high relative abundance of the invasive species the crews named the plant associations toward the invasive species rather than the native grasses. Many of these plant associations were not on the preliminary list of plant associations.

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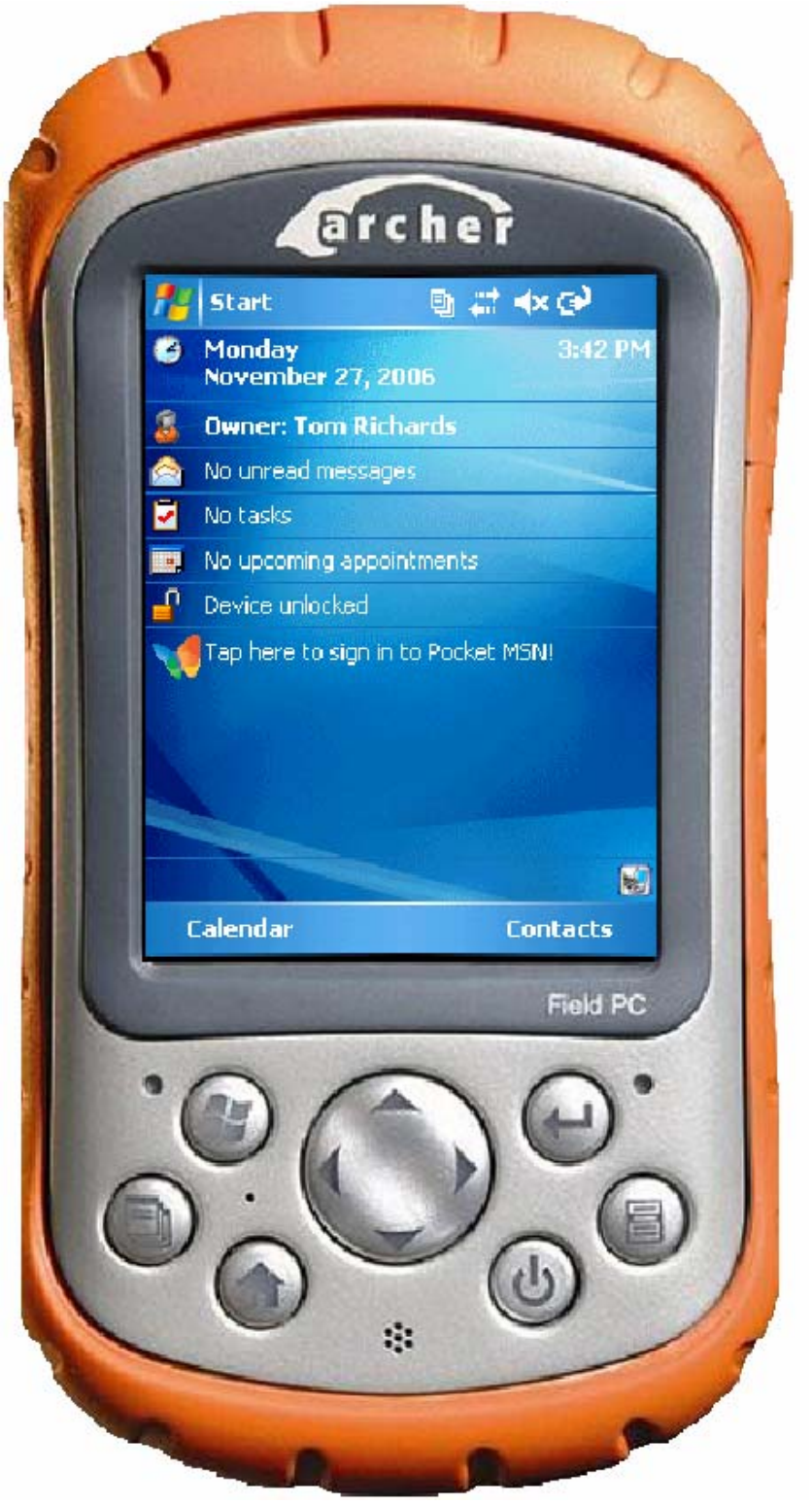
APPENDICES

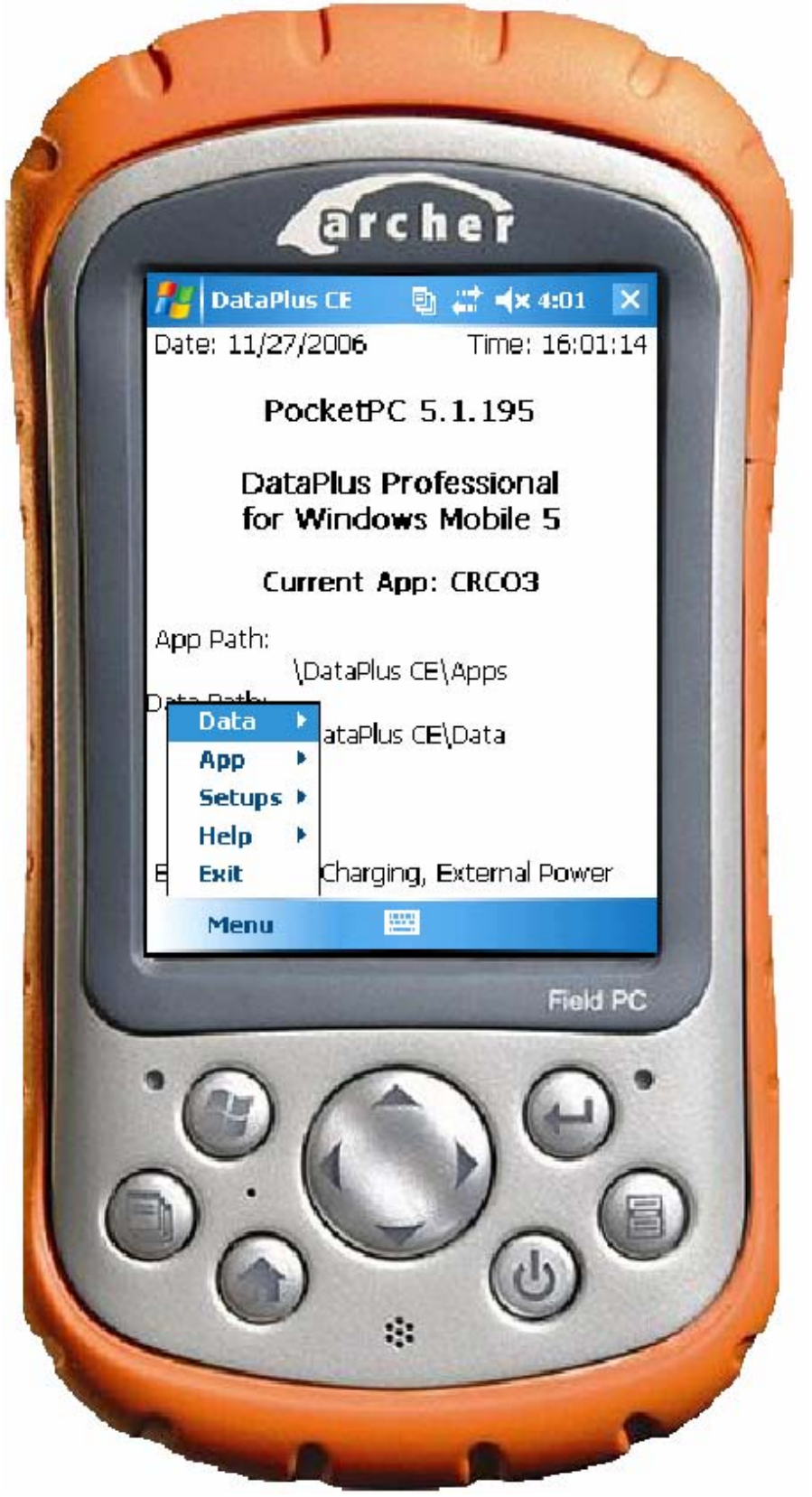
Screen Snapshots
Preliminary Plant Associations
Preliminary Species List
GPS Data Files with Coordinates
Representative Photo for Each Plant Association

Example Screen Snapshots

Archer Field PC – Select start for Dataplus



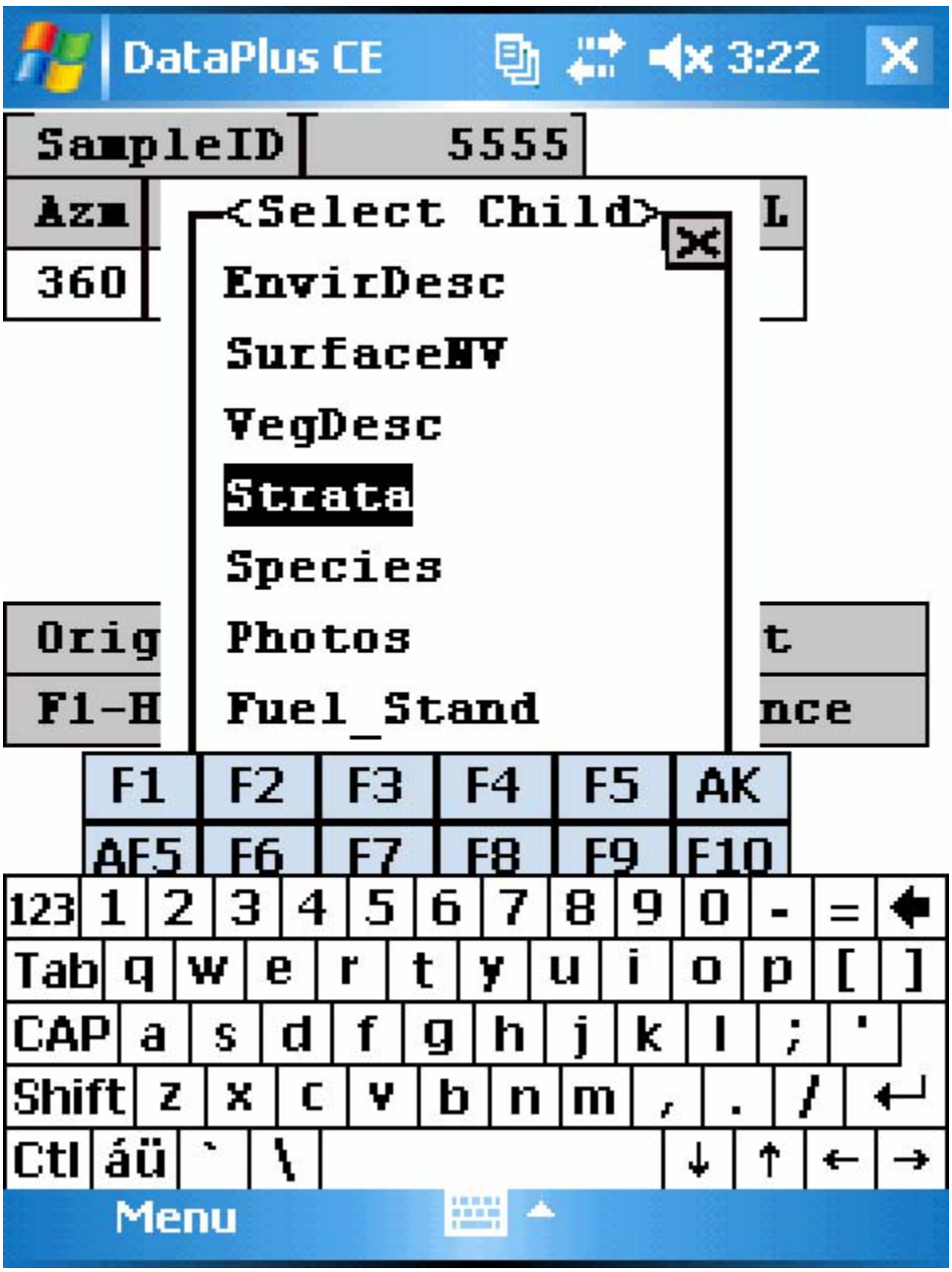
Select Data to access current database



Enter Plot Header Information: Plot Number, Plot Type, Surveyor, Plot Layout, Travel Time, etc.

Hit F4 to access the main drop down menu

Select Form (STRATA)



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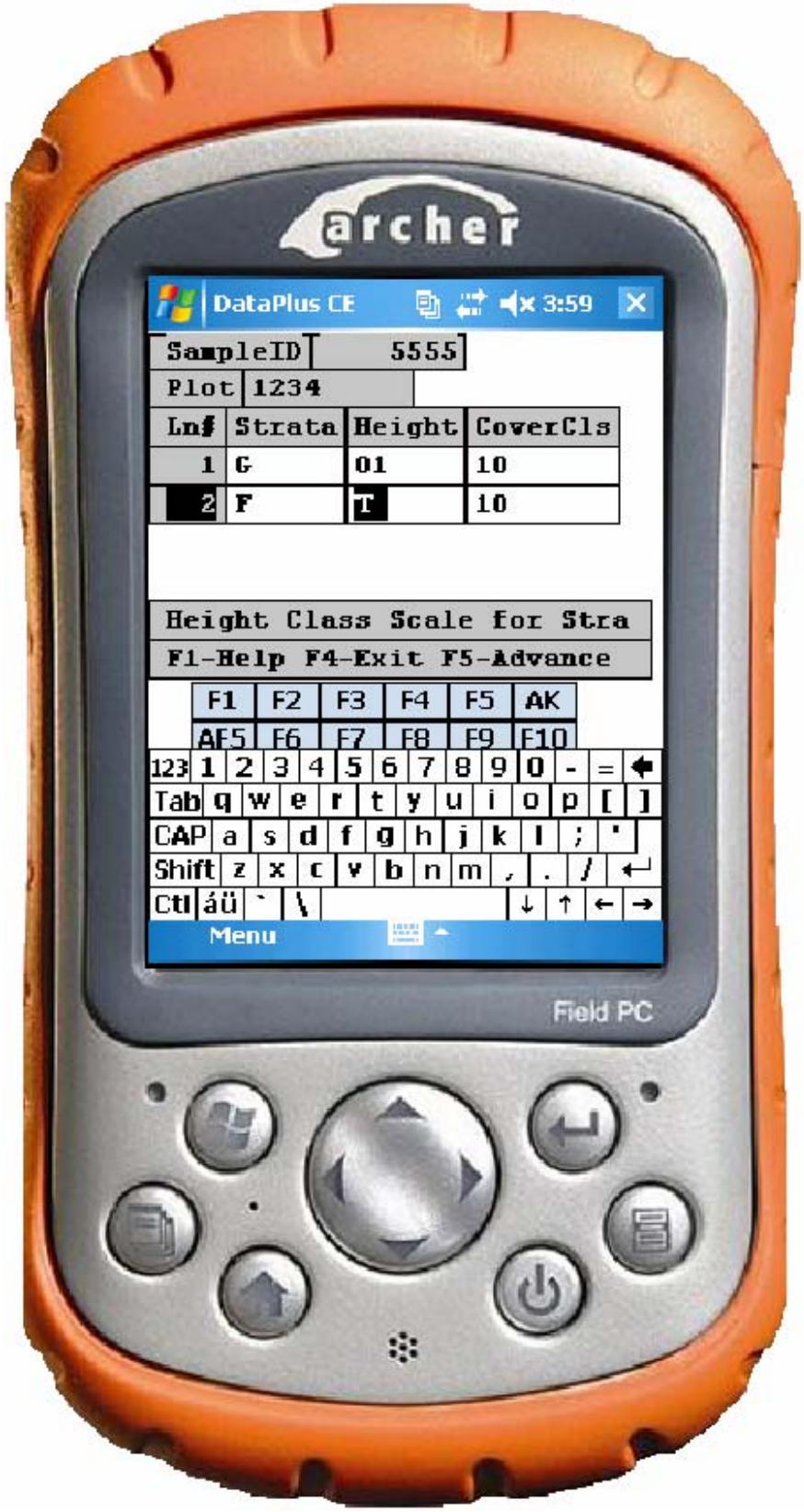
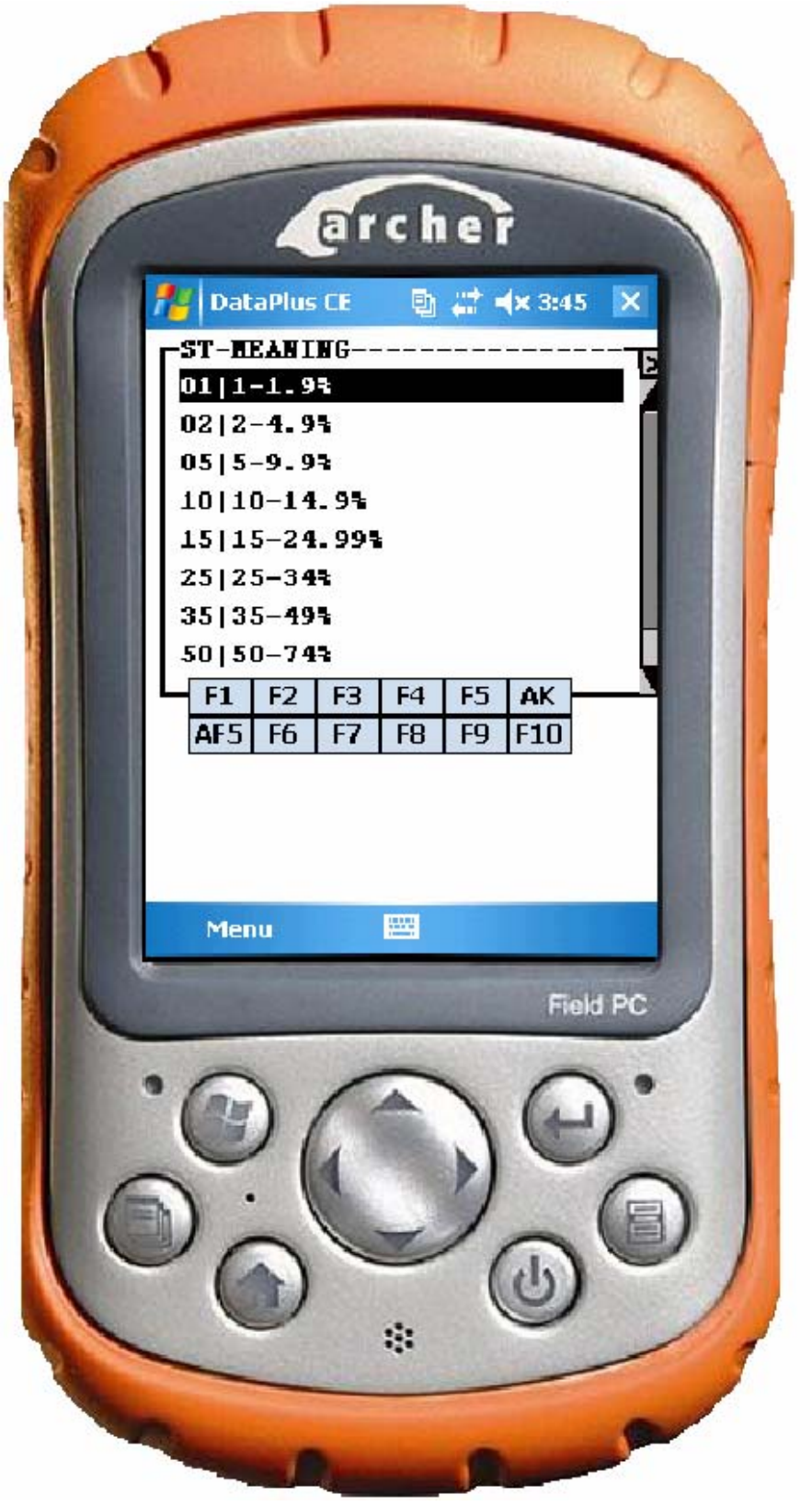


Select Strata

Select Height Class

Select Cover Class



Select Dominant and Secondary Species

Preliminary Plant Associations

Preliminary Species List

GPS Data Files with Coordinates

Maps

Representative Photo (for each plant association)

Vegetation Mapping Project,
Craters of the Moon National Monument and Preserve

Natural Resource Technical Report

November 2006

This report was developed by Northwest Management, Inc. under contract with the National Park Service, Moscow, ID 83843.

Last Page of Document

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