

Automated Stand Delineation for FORVIS:
A Case Study in the El Malpais Region of New Mexico



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Introduction

Historically stands formed the first level of organization in forest management and inventory. The Society of American Foresters defines a stand as “a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.” (The Society of American Foresters, 1998). In the past, stands were manually interpreted using hard-copy stereo pairs, aerial photography and mylar overlays.

With the advent of Geographic Information Systems, stands could be onscreen digitized using digital imagery. While an improvement, digitizing is very time consuming and costly when working in large areas. Currently with enhanced computer technology, software and digital imagery, stands can be delineated using an automated process. This automated process utilizes image segmentation, an image processing technique available from Definiens Developer software formerly known as eCognition. It should be noted that there are numerous segmentation algorithms that have been developed, or are currently being developed. Some of these programs are freeware such as SPRING (Sistema de Processamento de Informacoes Georeferenciadas) developed by the Brazilian National Institute for space research (<http://www.dpi.inpe.br/spring/english/index.html>). A popular lower cost option is Berkeley Image Segmentation software (<http://www.berkenviro.com/berkeleyimgseg/>).

The goal of this project is to delineate forest stands for BLM lands in the Malpais Region of New Mexico. The end results can then to be used with a BLM database called The Forest Vegetation Information System (FORVIS). FORVIS is a system for the storage, retrieval, and analysis of both tabular and spatial data about forested lands. One objective of the database is to organize attribute data about vegetative areas and their associated land management events. This report outlines the process used to delineate stands within this area of New Mexico and integrating it with the FORVIS database structure.

The Study Area

The Malpais Region is located in Cibola County in West-Central New Mexico, near the El Malpais National Monument. The total acreage of the analysis area is over 689,000 acres and includes 26 twelve digit HUCs (Hydrologic Unit Code) watershed areas. The Hydrologic Unit system is a standardized watershed classification system developed by USGS in the mid 1970s. Hydrologic units are watershed boundaries organized in a nested hierarchy by size, the twelve digit HUCs being the smallest watershed size. The FORVIS database

structure uses the twelve digit HUCs in its coding structure so stand boundaries need to share a boundary with the twelve digit HUCs. For this analysis, HUCs were selected based on the availability of cloud free imagery within the study area. Not all of the HUCs that contain BLM land in the region could be processed as some areas were cloud covered and not usable.

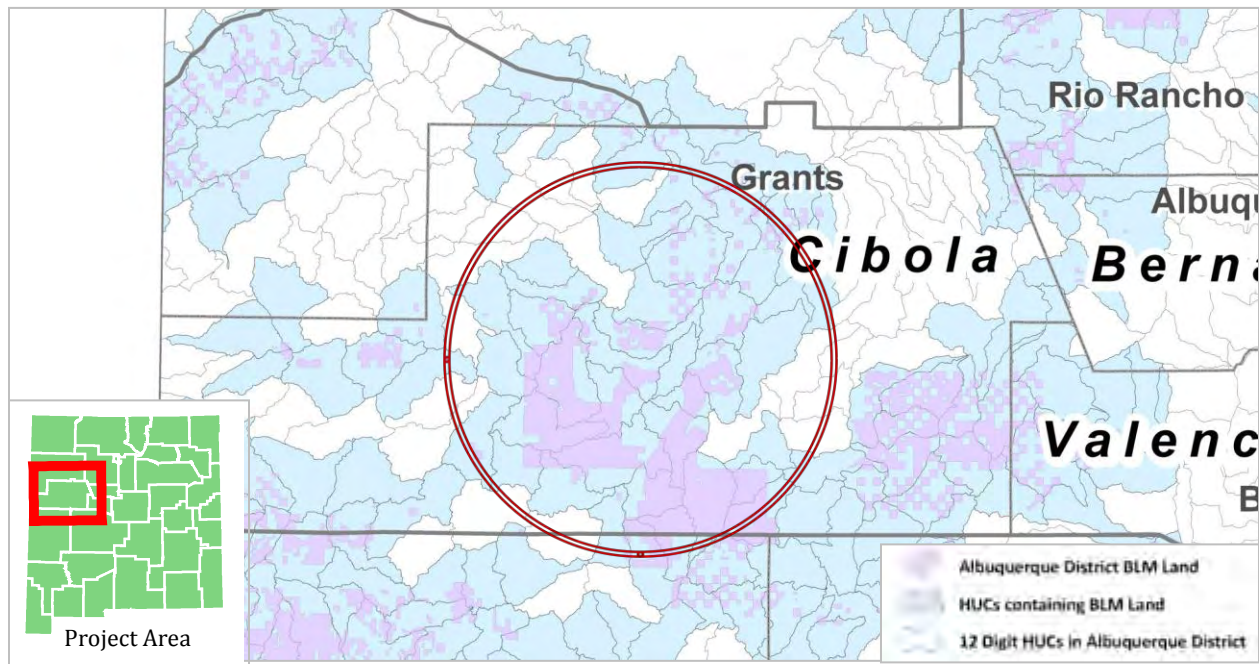


Figure 1. Malpais region study area with Hydrologic Unit Code (HUC) boundaries.

Stand Delineation Methodology

Data Preparation

The first step in the stand delineation process involves acquiring and preparing the raster data used in the segmentation. Système Pour l'Observation de la Terre (SPOT) satellite imagery and 10 meter digital elevation data were used as the main data inputs. The imagery and elevation data were processed so that they could be easily incorporated within Definiens Developer. A majority of the data preparation and pre-processing work was done using ERDAS Imagine software.

SPOT Imagery Collection and Processing

SPOT is a French satellite series that collects mid-resolution earth observation data. SPOT operations began with SPOT 1 in 1986 and the most recent SPOT 5 satellite was launched in May of 2002. SPOT 5 has four spectral bands these are, B1 Green (0.50 – 0.59 μm), B2 Red (0.61 – 0.68 μm), B3 Near infrared (0.78 – 0.89 μm) and B4 Shortwave Infrared (1.58 – 1.75 μm). The cell size of the first three bands is 10 meter, while the fourth band is 20 meter. For this analysis Band 4, Shortwave Infrared (1.58 – 1.75 μm), was not needed and was removed before any pre-processing was applied to the imagery.

The USGS recently developed an agreement so that SPOT 4 and 5 satellite imagery are available for most of the continental US, downloadable from the USGS Earth Explorer Website. The SPOT 5 imagery used in this analysis was downloaded from their website <http://earthexplorer.usgs.gov/>. Use of the free SPOT 4 and SPOT 5 data are restricted to federal, state and local civil government agencies and their cooperators.

Two cloud free SPOT 5 scenes, acquired on September 18, 2010, were selected and downloaded from the USGS Earth Explorer Website. Once downloaded, band 4 (Shortwave Infrared) was removed and the imagery was geo-rectified using 2009 National Agriculture Imagery Program (NAIP) Orthophotography for Cibola and Catron Counties. SPOT imagery was used for this analysis because we could get more recent imagery and with its' near infrared spectral band vegetation is more easily identified.

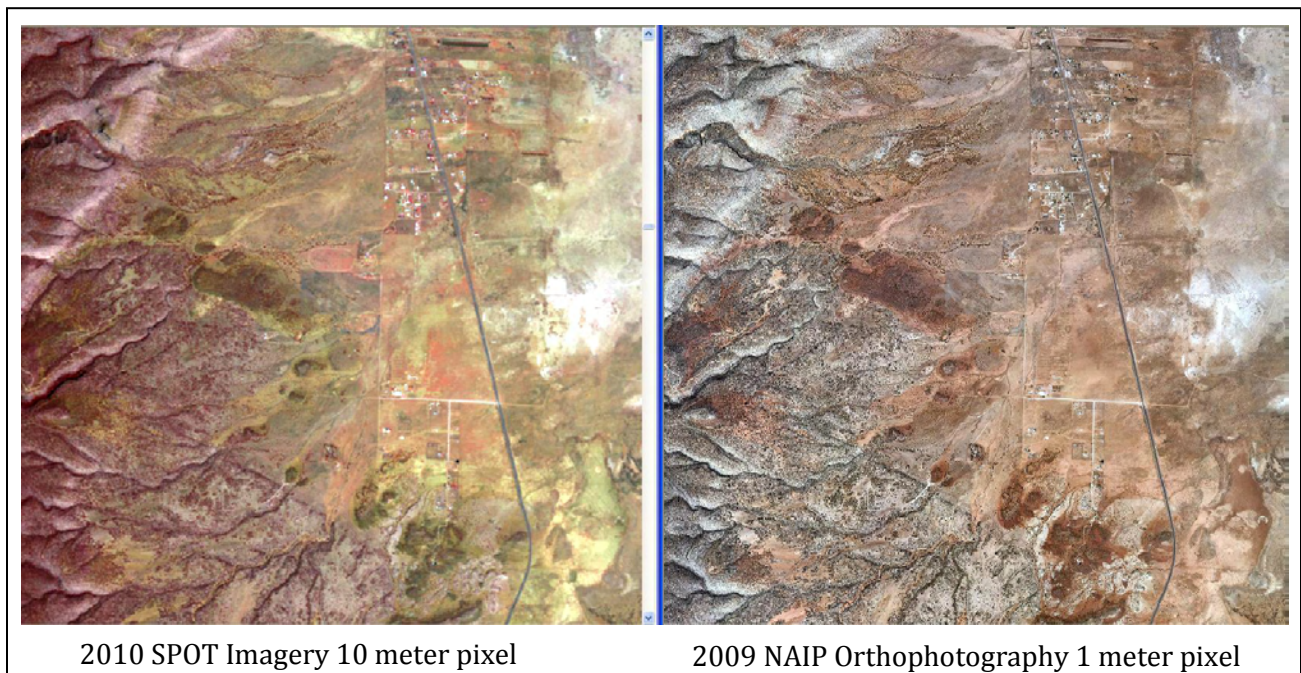


Figure 2. 2010 SPOT imagery and 2009 NAIP orthophotography comparisons.

SPOT imagery was also a good choice due to the 10 meter cell size. This matched the 10 meter elevation data and allowed them both to be used together without any resampling of cell size.

Once the SPOT 5 imagery was geo-rectified band ratios were created to enhance the vegetation signal. These two band ratios are The Normalized Difference Vegetation Index (NDVI) and Infrared/Red (IR/R).

Band ratios are simply a ratio between two digital values from separate spectral bands. Ratios are effective in enhancing information found in satellite imagery. For vegetation, band ratioing is useful because of the inverse relationship between vegetation brightness in the red and infrared part of the spectrum. This is due to the absorption of red light by chlorophyll and the strong reflection of infrared radiation in the mesophyll cells found in the leaves of plants. NDVI and IR/R can provide a measure of photosynthetic activity and biomass within a pixel (Campbell, 2005).

NDVI and IR/R band Ratios were calculated using the 2010 SPOT imagery and were later used as input into the analysis. These ratios were calculated as: $NDVI = (SPOT \text{ Band } 3(NIR) - \text{Band } 2(\text{Red})) / (\text{Band } 3(NIR) + \text{Band } 2(\text{Red}))$; IR/R is simply a result of $SPOT \text{ Band } 3(NIR) / \text{Spot Band } 2(\text{Red})$. (Figure 3.)

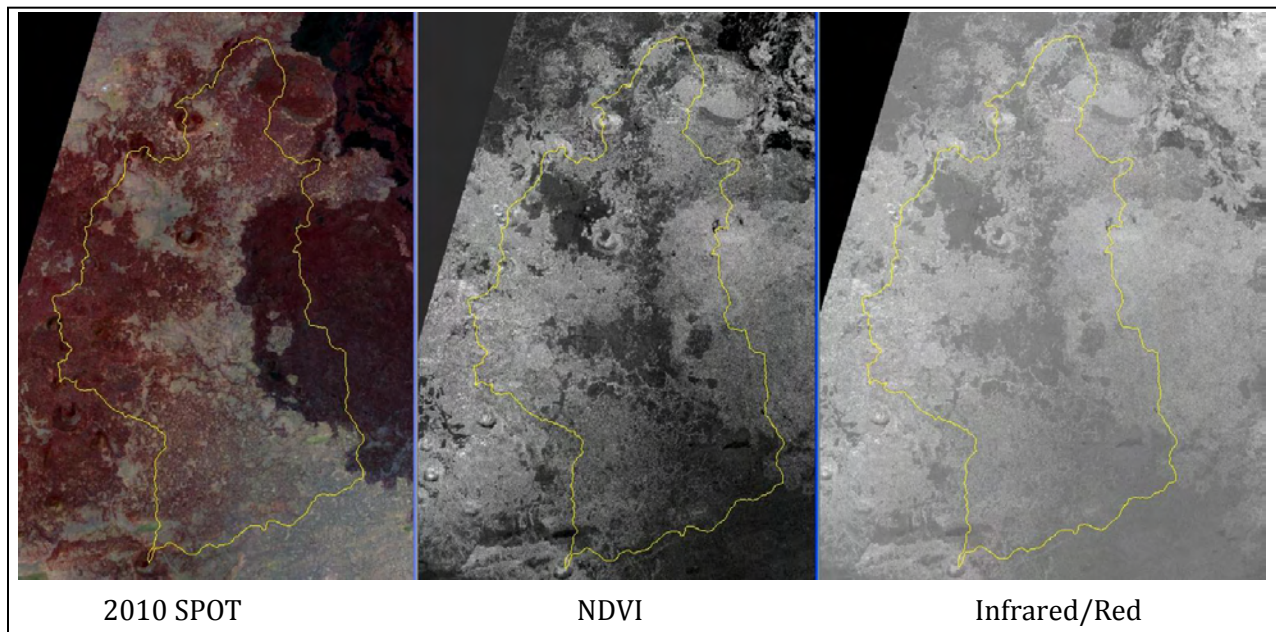


Figure 3. 2010 SPOT imagery and NDVI and IR/R band ratio creation.

Elevation Data

In generating the stand boundaries it was desirable to have the boundaries follow the general topographic shape of the landscape. To do this we incorporated a 10meter Digital Elevation Model (DEM) made available from the USGS National Elevation Dataset (NED) <http://ned.usgs.gov/>. Using ERDAS Model Maker we created three hillshade images and then combined them into one layer. The three hillshades were generated at different solar azimuths, 120, 240 and 360 degrees. These were combined and the resulting image provided a topographic representation of the landscape without shadows. This fully illuminated hillshade image was used as an input into the segmentation process (Figure 4).

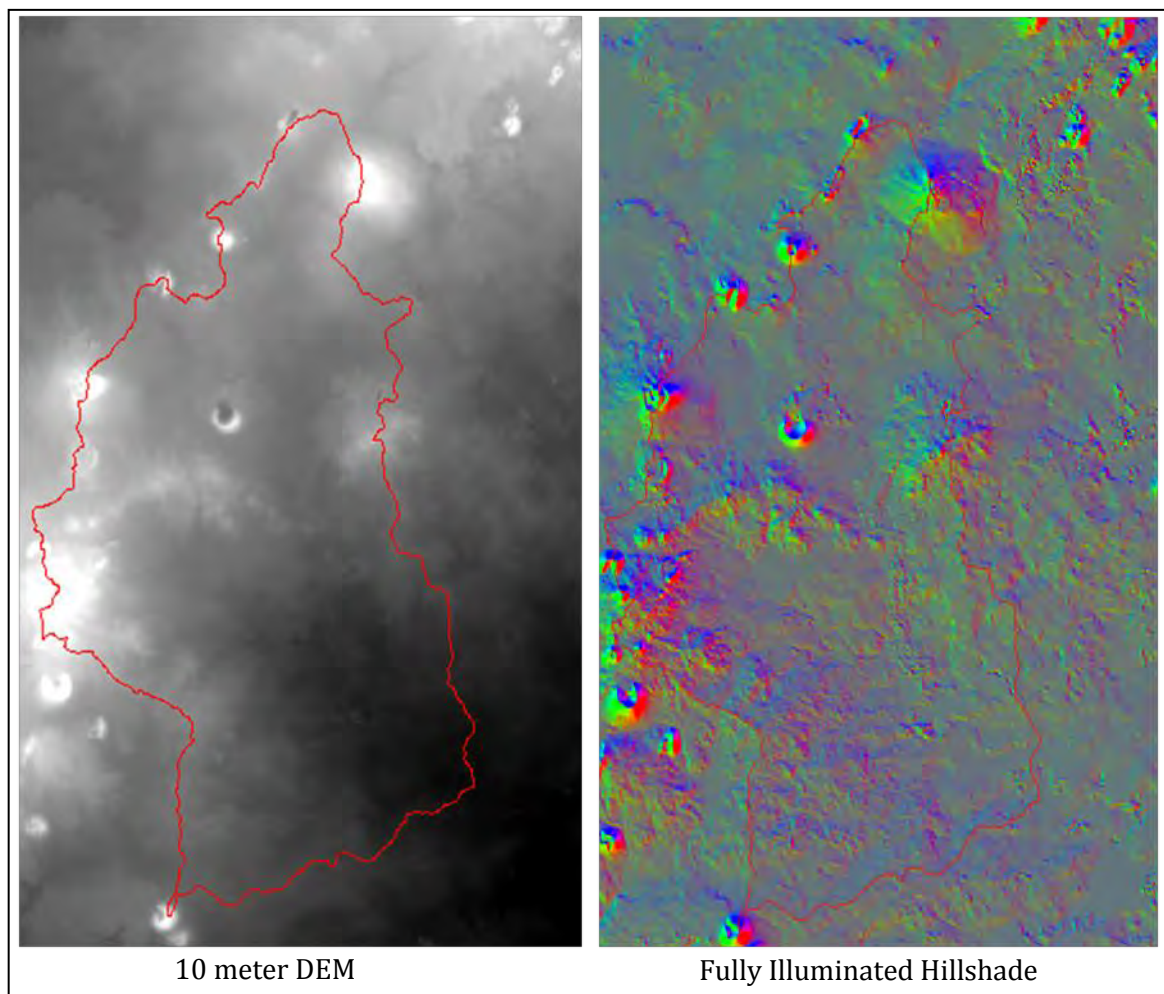


Figure 4. Example of DEM and associated fully illuminated hillshade image.

After the SPOT and DEM layers were assembled, a mask of the study area was created. The extent of the study area was buffered by 100 meters and then converted to a raster grid with the same cell size and projection as the other input layers. The mask was used as an input into the segmentation process instead of clipping all of the layers to the same extent (see Figure 5).

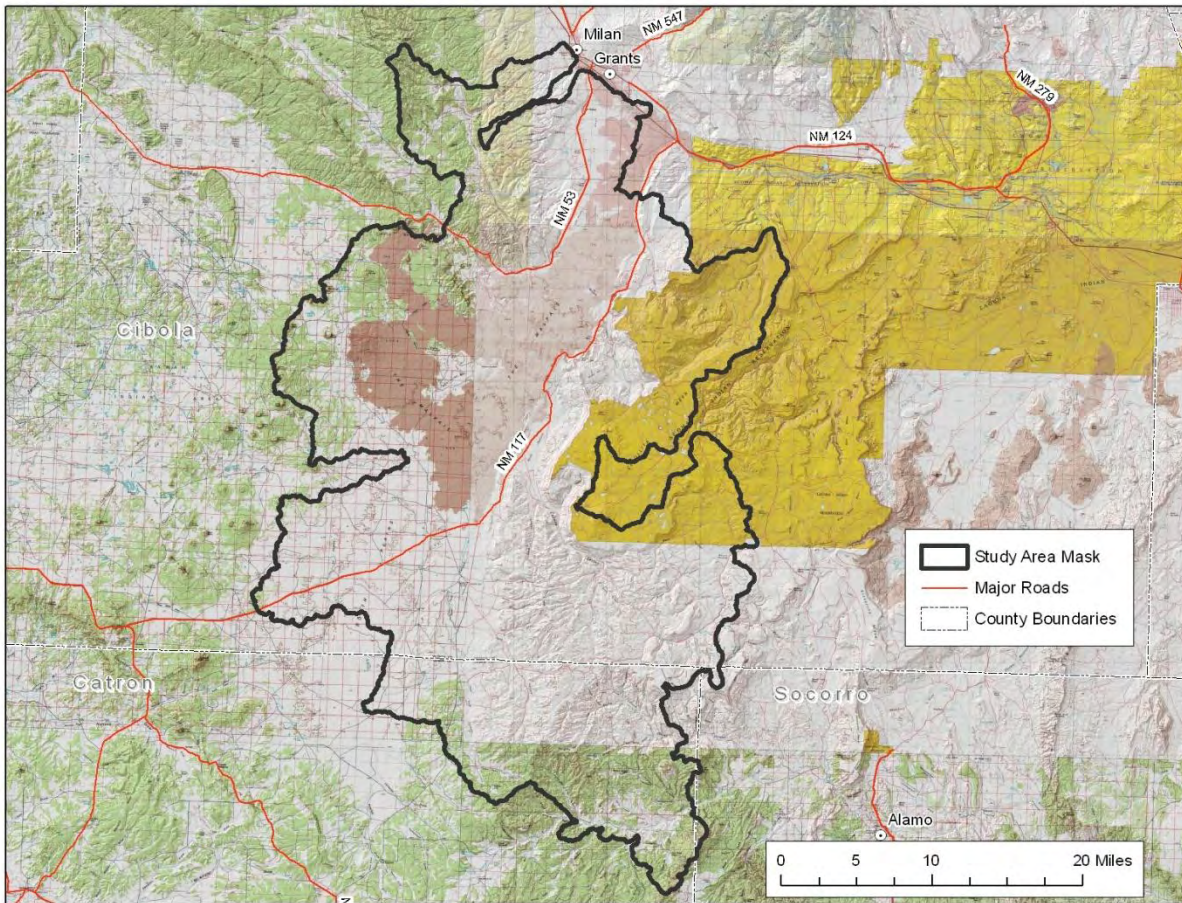


Figure 5. Extent of study area mask.

For the mask, the study area was given a value of 1 and all other data outside given a value of zero. All of the input data layers had a cell size of 10 meters and were in the UTM, zone 13, NAD 83 projection system. A flow chart of the data preparation flow chart is found in Figure 6.

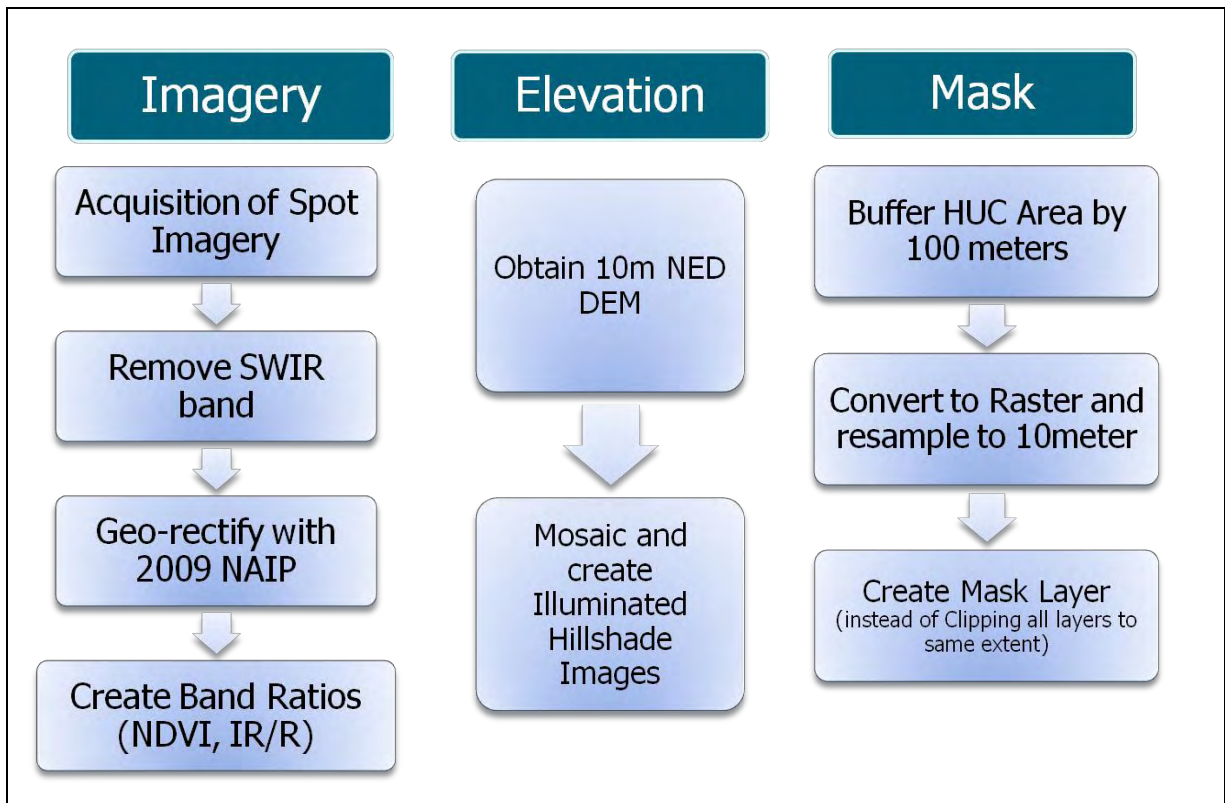


Figure 6. Data preparation flow chart .

Image Segmentation

Segmentation is a process of partitioning a digital image into multiple segments, or groups of pixels. One result of this process is to simplify the image into something that is more meaningful or is easier to analyze. For this project we used Definiens Developer software, previously known as eCognition. Definiens Developer software was used to create a multiresolution segmentation, which is a multi-step process.

Within Definiens Developer a new project was created and all of the data layers used in the analysis were loaded. All data layers used in the project had the same cell size and were in the same projection system. Definiens Developer offers many types of segmentation, but for this project a multiresolution segmentation was employed. The input data layers were set with appropriate weights, so that those layers with more

influence were given a higher weight. In this case, the SPOT Bands Red and Near Infrared and the Band Ratios of NDVI and IR/R were given the highest weight since they provided the best indicator of healthy vegetation (see Figure 7).

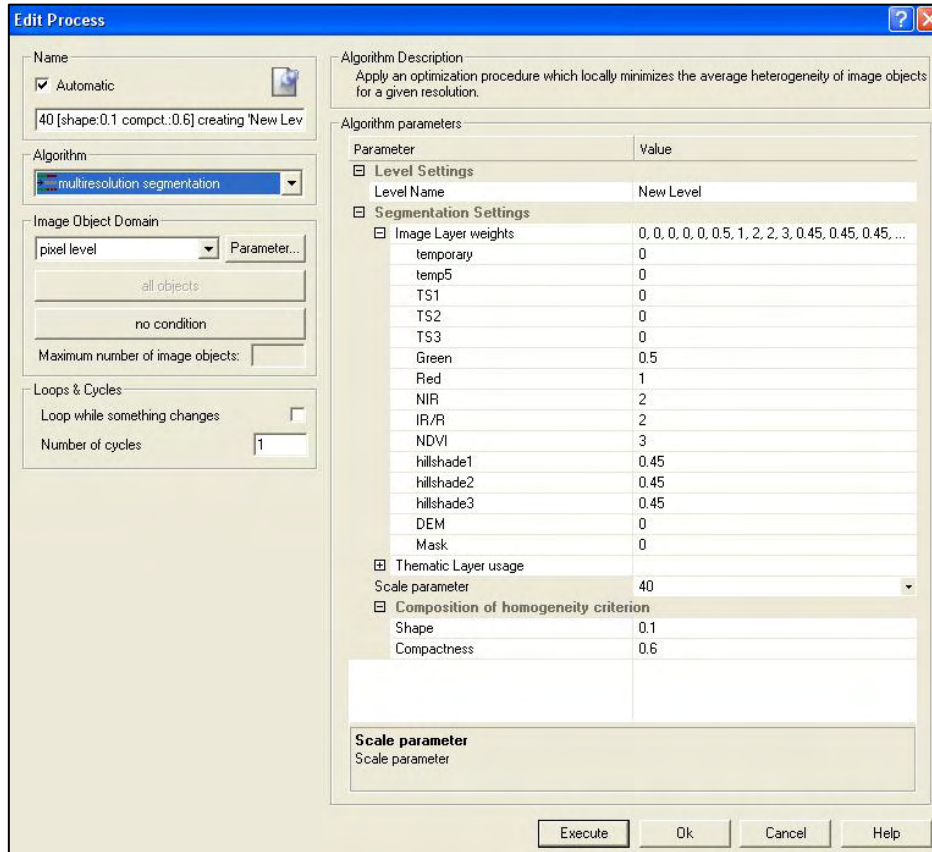


Figure 7. Multiresolution segmentation settings within Definiens Developer.

In the multiresolution segmentation process, the user can define some aspects of the generated segments. Changing the scale parameter determines the average size of the resulting image objects or segments. The smaller the scale parameter value, the smaller the resulting segments will become. For this study it was agreed upon with BLM representatives that a scale parameter of 40 was appropriate. An example of different scale parameter settings is found in Figure 8. The image objects shape and form is determined by the input data layers, weights, scale parameter and the composition of homogeneity criterion (the shape and compactness values). For these values, there is no magical number that can be applied for all images. There is a trial and error process in which you modify the scale parameters, shape and compactness settings until the user is satisfied with the results.

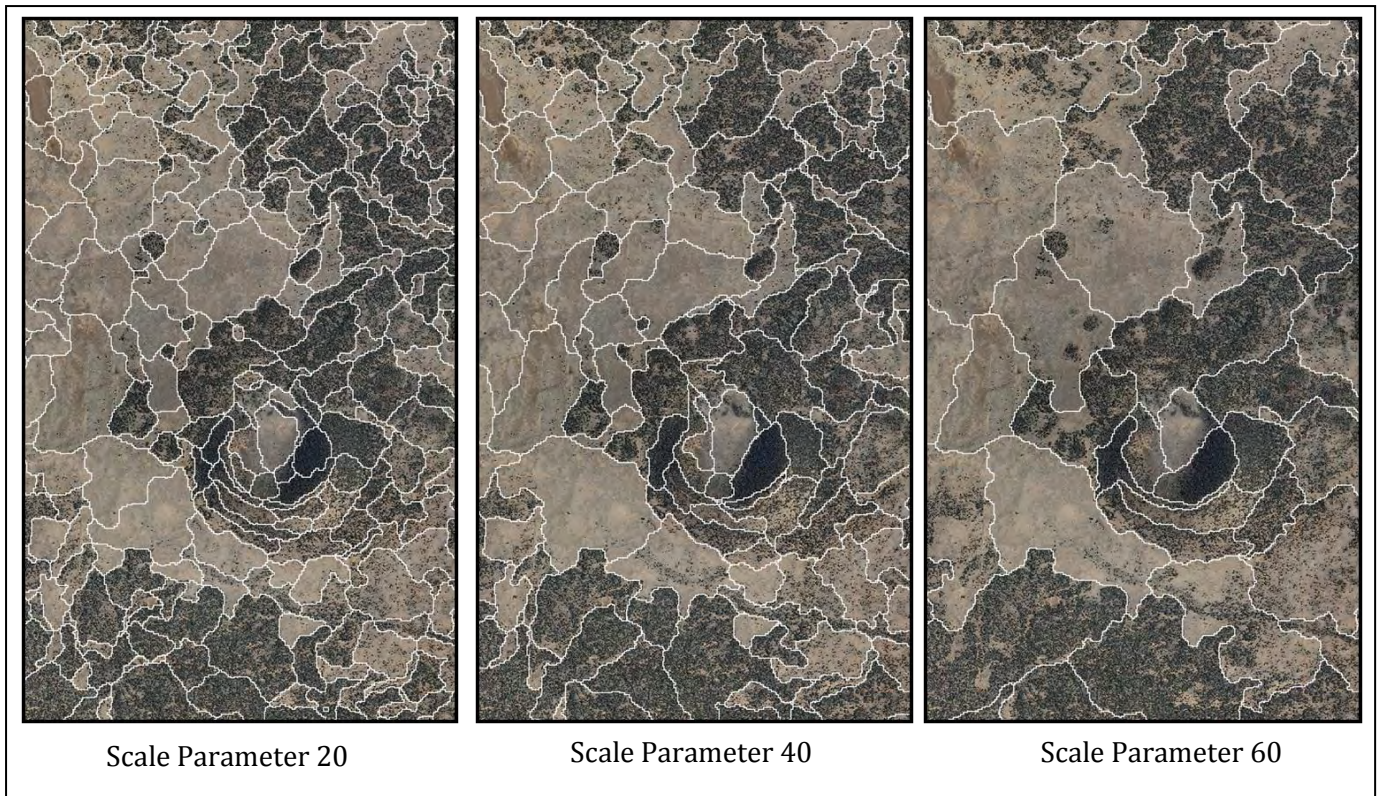


Figure 8. Different Scale Parameter results within Definiens Developer (eCognition).

After the multiresolution segmentation was completed, a filter was applied to the image objects to remove some of the rough, pixel shaped edges. Within Definiens Developer a focal majority filter was applied to the raster image objects using a 3x3 pixel rectangular kernel size. Once the majority filter was completed the image objects were exported to an ArcGIS Shapefile.

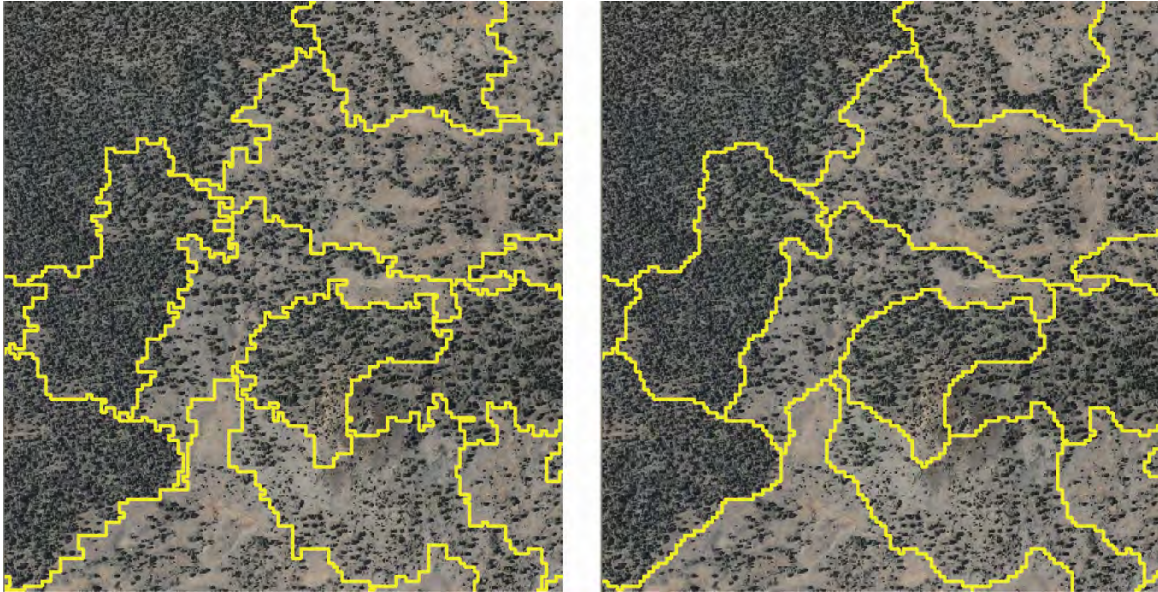


Figure 9. Focal majority filter applied to multiresolution segmentation (scale 1:10,000).

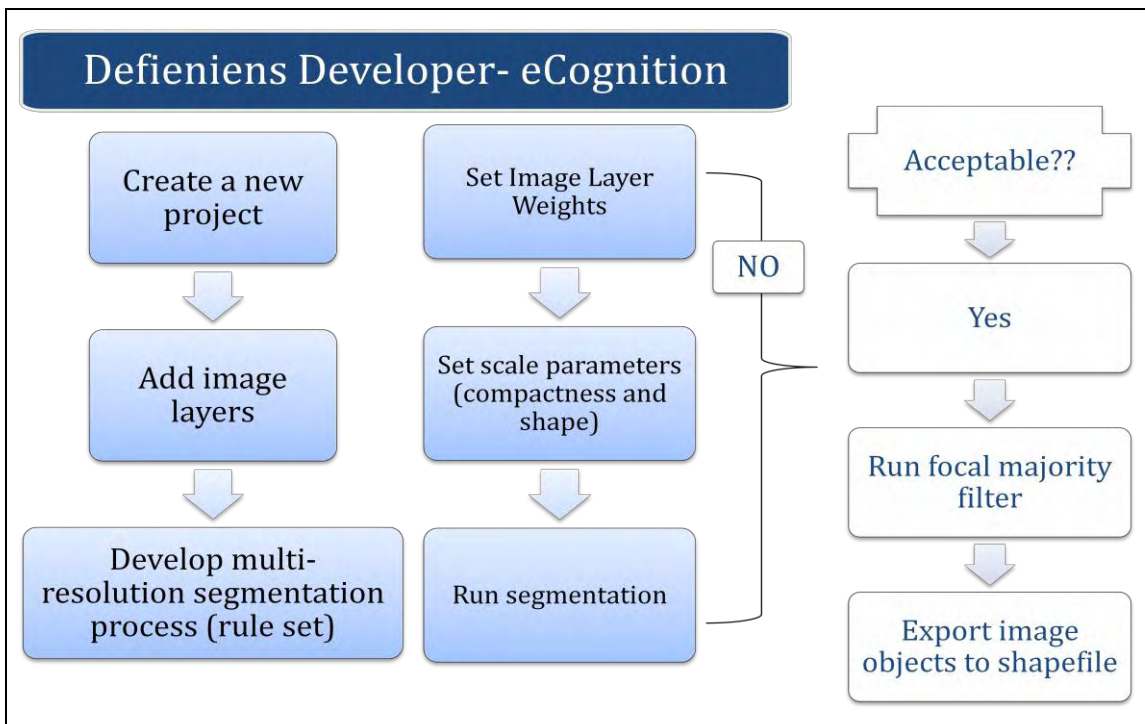


Figure 10. Definiens Developer Flow Chart.

GIS Post Processing

While the focal majority filter removed some of the rectangular edges within the segments, more post processing was needed in order to smooth the pixilated polygon borders. The exported polygon segments were loaded into ArcGIS and the 'Simplify Line or Polygon' tool was used to remove excess vertices. A 10 meter maximum offset was set for the tolerance. Next, the polygons were smoothed using the PEAK smoothing algorithm with the tolerance set to 45. The results of the GIS post processing transforms a raster looking pixilated file into one that looks more like a hand-drawn file. An example of this process result is found in Figure 11.

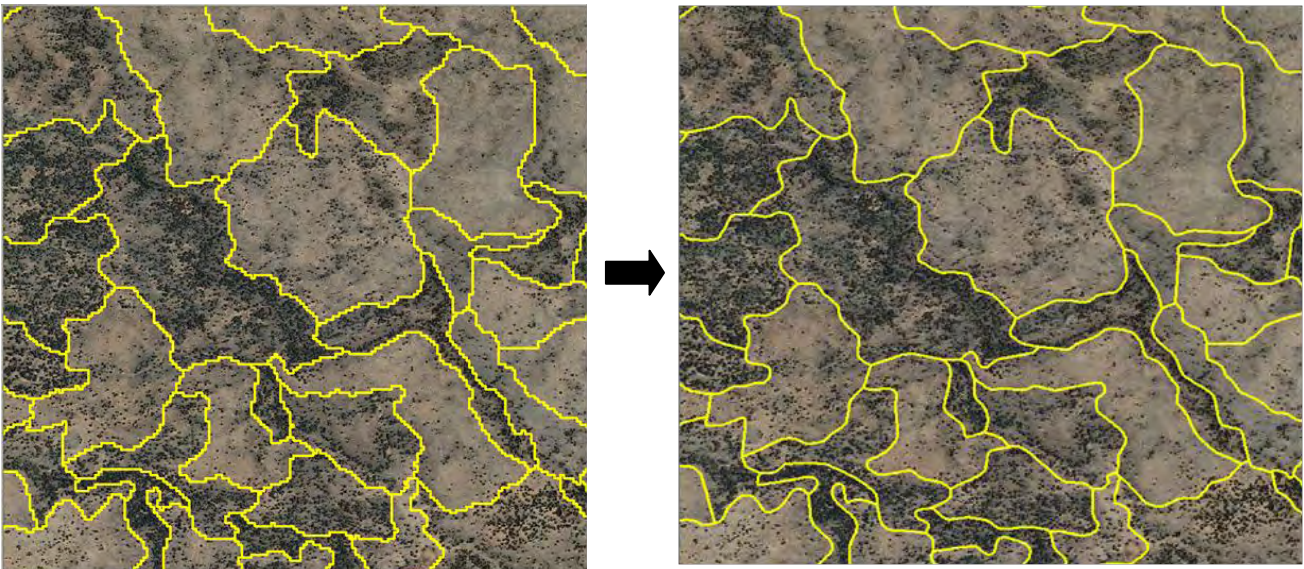


Figure 11. GIS post processing and smoothing of polygons (scale 1:10,000).

Incorporating HUC Boundaries

As FORVIS uses the twelve digit HUC watershed boundaries as part of its structure, the HUC boundaries needed to be joined with the final stand boundaries. Within ArcGIS, The stand boundary shapefile and the twelve digit HUC boundary shapefile were combined using the union command. Incorporating these HUC boundaries created a large number of sliver or small polygons that needed to be merged with neighboring ones. Unfortunately there was no way to automate this process and small polygons were manually merged with their appropriate neighbors.

FORVIS Coding

After merging the small polygons, the attribute table was edited to include the FORVIS coding system. Each stand was given a unique ID based on a 13 digit coding structure (see Table 1). The first two numbers represent the state, in this case NM for New Mexico. The second two numbers are the BLM Administrative Unit Codes. For this project we were in the BLM Albuquerque District so the codes were either 1A – Rio Puerco Field Office or 1B – Socorro Field Office. The next six numbers represent the HUC ID based on a letter coding system which truncates the 12 digit code to a six digit code. The last three numbers represent the stand ID, so that each stand is given a unique number ranging from 001-999. This limits the number of stands so that there cannot be more than one thousand individual stands within a given HUC boundary. These codes were applied to every stand polygon in the project area.

		New Mexico			
FORVIS				Unit ID	
State	Unit	HUC6	Stand		
2	2	6	3	13 digits	(16 avail)
NM	1A	xxxxxx	001		
Huc 6 Codes:					
Example	130202040103	Chujilla		NCCEBD	
00	A	Forvis ID:	NM,1A,NCCEBD,001		
01	B				
02	C				
03	D	Administrative Unit Codes:			
04	E				
05	F		<i>Albuquerque District</i>		
06	G	1A	Rio Puerco Field Office		
07	H	1B	Socorro Field Office		
08	I	1C			
09	J		<i>Farmington District</i>		
10	K	2A	Farmington F.O.		
11	L	2B	Taos Field office		
12	M	2C			
13	N	2D			
14	O		<i>Las Cruces District</i>		
15	P	3A	Las Cruces F.O.		
16	Q	3B	Pinos Altos Unit		
17	R		<i>Pecos District</i>		
18	S	5A	Roswell Field office		
19	T	5B	Fort Stanton ACEC		
20	U	5C	Carlsbad Field office		

Table 1. FORVIS coding structure.

LANDFIRE Vegetation Attributes

To provide information as to the general type of vegetation found within these stands, USGS/ USFS LANDFIRE data were used to populate information found within the stand polygons. Specifically LANDFIRE existing vegetation type and existing vegetation cover classifications were used. USGS/ USFS LANDFIRE data from May of 2010 were obtained on DVD. The LANDFIRE raster data were mosaiced and then clipped to the study area using ArcGIS. Zonal statistics were then used to find the most common occurring value for vegetation type and cover found within each of the individual stand polygons.

Zonal statistics are the calculation of one or many common statistics for data (pixels) inside a certain zone, usually defined by a polygon shapefile. For this analysis, the majority statistic was calculated which determines the value that occurs most often of all cells in the input raster that belong to the same zone as the output cell. For both the LANDFIRE existing vegetation type and existing vegetation cover raster files, majority zonal statistics were calculated within each individual stand boundary.

The resulting majority statistics were determined for each stand and the attribute data were joined to the stand boundary shapefile. The following fields were included from the LANDFIRE data, Existing Vegetation Type Name, Existing Vegetation System Group, Society of American Foresters & Society of Range Management Cover Type, National Vegetation Classification System Physiognomic Order, National Vegetation Classification System Physiognomic Class, National Vegetation Classification System Physiognomic Subclass, Aggregated Existing Vegetation Types Based on Dominant Species or Groups of Dominant Species and Existing Vegetation Cover (percent vegetative cover). An example of the zonal statistics results with LANDFIRE existing vegetation cover is found in Figure 12.

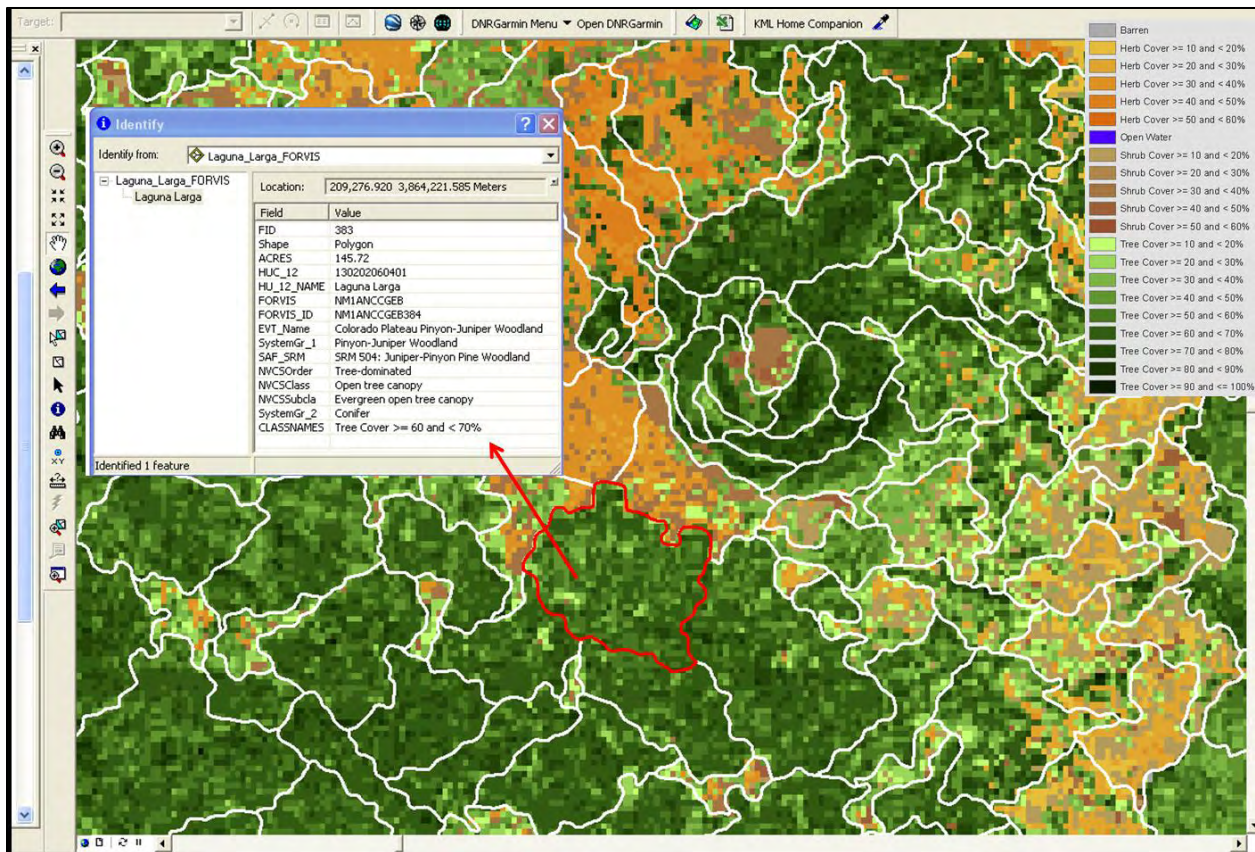


Figure 12. Example of zonal statistics results with stand boundaries and LANDFIRE existing vegetation cover.

Results

The extent of the final stand boundaries includes 26 HUCs an area greater than 689,000 acres within the BLM Albuquerque administrative district (see Figure 13). The stand boundaries can be used within the FORVIS database structure and facilitate BLM project planning and analysis. The LANDFIRE vegetation descriptions can aid in the inventory and monitoring of vegetation. While there are some limitations with the LANDFIRE vegetation classification system, the FORVIS database structure is adaptable and easily edited. As more detailed vegetation classifications are developed the FORVIS tables can be modified. The FORVIS database structure allows for both general and detailed vegetation descriptions as well as updating of management events that may take place in the future. When treatments, such as thinning or controlled burns are applied on the landscape, the FORVIS database can be updated. Current project funding was limited to this area of New Mexico but the procedures developed could easily be applied to other areas across the state.

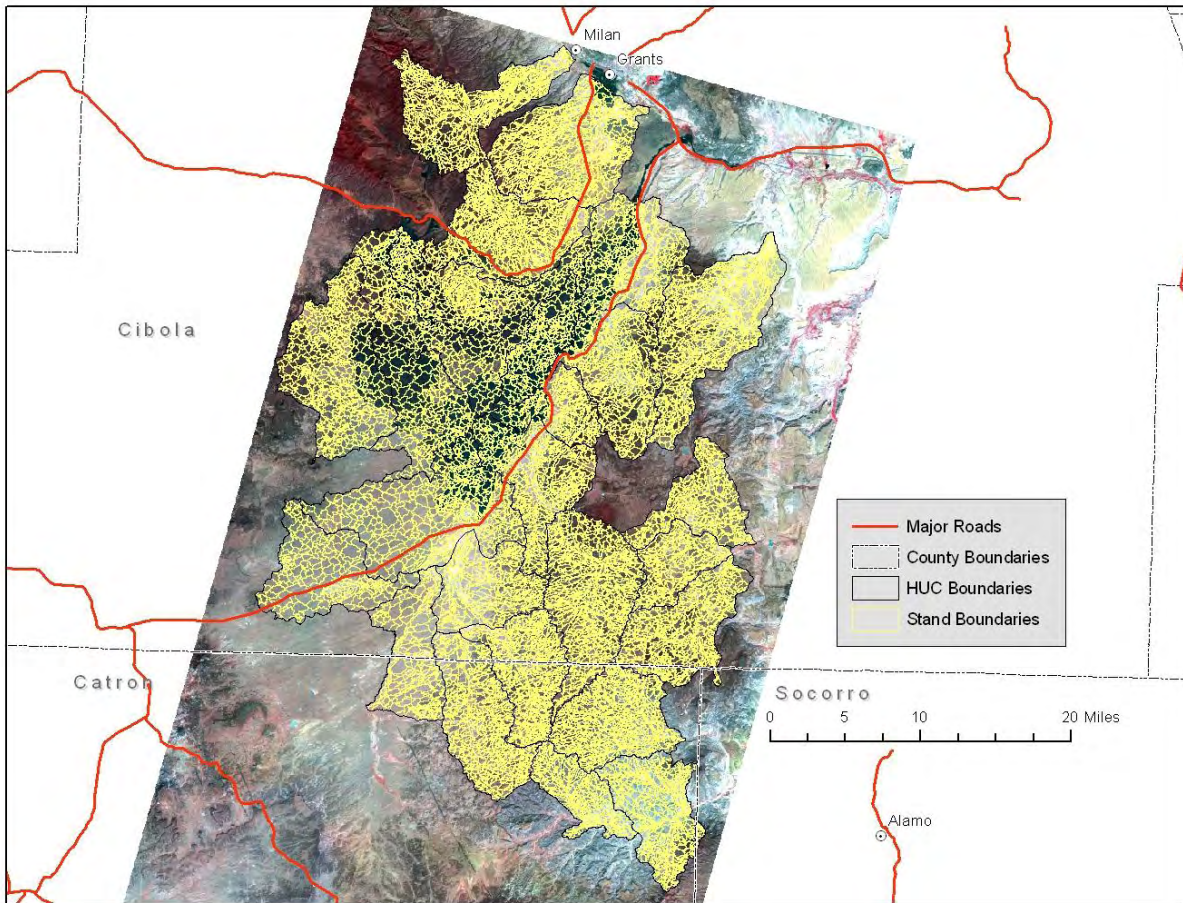


Figure 13. Final FORVIS stand boundaries extent with 10m SPOT imagery

References

Campbell, James B, 2008. *Introduction to Remote Sensing*. The Guilford Press, New York, NY.

Definiens AG. 2008. *Definiens Developer 8 Users Guide*. Munich.

Hamilton, R., K. Megown, T. Mellin, and I. Fox. 2007. *Guide to Automated Stand Delineation Using Image Segmentation*. RSAC-0094-RPT1. Salt Lake City, UT: USDA Forest Service, Remote Sensing Applications Center.

Jensen, John R., 2000. *Remote Sensing of the Environment. An Earth Resource Perspective*. Prentice Hall, Upper Saddle River, New Jersey.

Shapiro, Linda G. and George C. Stockman, 2001. *Computer Vision*. Prentice Hall, Upper Saddle River, New Jersey.

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Appendix A. Metadata

Malpais FORVIS Stand Boundaries

Metadata:

also available as

- [Identification Information](#)
- [Data Quality Information](#)
- [Spatial Data Organization Information](#)
- [Spatial Reference Information](#)
- [Entity and Attribute Information](#)
- [Distribution Information](#)
- [Metadata Reference Information](#)

Identification_Information:

Citation:

Citation_Information:

Originator:

The New Mexico Forest and Watershed Restoration Institute (NMFWRI)

Publication_Date: 03/2011

Title: Malpais FORVIS Stand Boundaries

Geospatial_Data_Presentation_Form: vector digital data

Online_Linkage: none available at this time

Description:

Abstract:

This Malpais FORVIS stand boundary shapefile contains stand boundaries and related information for the Malpais region in New Mexico. Stands are defined as any natural or artificially created vegetation which exhibits enough homogeneity to make it distinguishable from surrounding areas. Stands are both forested and non-forested. The dataset was developed for forest planning and project analysis and for use with the Forest Vegetation Information System (FORVIS). Data were created using 10 meter SPOT imagery (acquired in September of 2010), 10 meter National Elevation data and Definiens Developer (eCognition) software. Associated FORVIS codes were attributed based on USGS 12 digit Hydrologic Units. USGS USFS Landfire National Data were used to provide information on the existing vegetation type and vegetation canopy cover found within the stand boundaries.

Purpose:

To aid in forest planning, project analysis and use within the Forest Vegetation Information System (FORVIS).

Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 9/18/2010
Currentness_Reference: ground condition
Status:
Progress: Complete
Maintenance_and_Update_Frequency: As needed
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -108.269101
East_Bounding_Coordinate: -107.620174
North_Bounding_Coordinate: 35.179340
South_Bounding_Coordinate: 34.349660
Keywords:
Theme:
Theme_Keyword_Thesaurus: ISO 19115 Topic Category
Theme_Keyword: Stands
Theme_Keyword: FORVIS
Theme_Keyword: Vegetation
Place:
Place_Keyword: Malpais, New Mexico
Access_Constraints:
Distribution of the dataset will be at the discretion of the BLM.
Use_Constraints:
The NMFWRI uses the most current and complete data available. Using GIS data for purposes other than those for which they were created, may yield inaccurate or misleading results. NMFWRI reserves the right to correct, update, modify, or replace GIS data without notification.
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Patti Dappen and Joe Zebrowski
Contact_Organization: The New Mexico Forest and Watershed Restoration Institute
Contact_Position: GIS Specialists
Contact_Address:
Address_Type: mailing and physical address
Address: 140 Lora Shields Science Building
Address: PO Box 9000
City: Las Vegas
State_or_Province: New Mexico
Postal_Code: 87701
Country: USA
Contact_Voice_Telephone: 505-426-2086
Contact_Facsimile_Telephone: 505-426-2192
Contact_Electronic_Mail_Address: prdappen@nmhu.edu
Contact_Electronic_Mail_Address: jpzebrowski@nmhu.edu
Native_Data_Set_Environment:
Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcCatalog 9.3.1.1850

Data_Quality_Information:

Lineage:

Source_Information:

Source_Citation:

Citation_Information:

Originator: US Department of Interior, US Geological Survey

Publication_Date: 09-18-2010

Title: SPOT5 Imagery (10 meter) Path 562 Row 281

Edition: Scene ID 55622811009181804452J0_1GST

Geospatial_Data_Presentation_Form: remote-sensing image

Other_Citation_Details:

Use of data is restricted to federal, state, and local civil government agencies and their cooperators.

Online_Linkage: <<http://edcsns17.cr.usgs.gov/NewEarthExplorer/>>

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 9-18-2010

Source_Currentness_Reference: ground condition

Source_Information:

Source_Citation:

Citation_Information:

Originator: US Department of Interior, US Geological Survey

Publication_Date: 09-18-2010

Title: SPOT5 Imagery (10 meter) Path 562 Row 280

Edition: Scene ID 55622801009181804372J0_1GST

Geospatial_Data_Presentation_Form: remote-sensing image

Other_Citation_Details:

Use of data is restricted to federal, state, and local civil government agencies and their cooperators.

Online_Linkage: <<http://edcsns17.cr.usgs.gov/NewEarthExplorer/>>

Source_Information:

Source_Citation:

Citation_Information:

Originator: US Department of Interior, US Geological Survey

Publication_Date: March 2008

Title: National Elevation Data 10 meter, Cibola County New Mexico

Geospatial_Data_Presentation_Form: raster digital data

Online_Linkage: <<http://ned.usgs.gov/>>

Source_Information:

Source_Citation:

Citation_Information:

Originator: US Department of Interior, US Geological Survey

Publication_Date: April 2007

Title: National Elevation Data 10 meter, Catron County New Mexico

Geospatial_Data_Presentation_Form: raster digital data

Online_Linkage: <<http://ned.usgs.gov/>>

Source_Information:

Source_Citation:

Citation_Information:

Originator: USDA/NRCS - National Cartography & Geospatial Center

Publication_Date: June 2002

Title: 12-Digit Watershed Boundary Data 1:24,000 for New Mexico

Geospatial_Data_Presentation_Form: vector digital data
Source_Information:

Source_Citation:

Citation_Information:

Originator: USDA-FSA Aerial Photography Field Office

Publication_Date: 20090724

Title: 2009 NAIP OrthoImagery Cibola County New Mexico

Geospatial_Data_Presentation_Form: remote-sensing image

Source_Information:

Source_Citation:

Citation_Information:

Originator: USDA-FSA Aerial Photography Field Office

Publication_Date: 20090713

Title: 2009 NAIP OrthoImagery Catron County New Mexico

Geospatial_Data_Presentation_Form: remote-sensing image

Process_Step:

Process_Description:

Spot 5 Imagery were downloaded from USGS Earth Explorer website (<http://edcns17.cr.usgs.gov/NewEarthExplorer/>) for the study area in west-central New Mexico near the El Malpais National Monument. Two cloud free scenes were selected from Path 526 and Rows 280 and 281, images were acquired on 9-18-2010. Both Spot 5 images were rectified using 2009 1 meter NAIP imagery from Cibola and Catron counties. Contiguous 12 digit watershed boundaries found within these images were used to the subset the area processed. Band ratios, NDVI and IR/R were calculated for the SPOT images. 10 meter elevation data were processed to develop a fully illuminated hillshade. All data layers were entered into Definies Developer (eCognition). A multiresolution segmentation was applied to the image layers with appropriate weights and a scale parameter of 40. Segments were filtered to remove most polygons smaller than 5 acres. The resulting polygons were smoothed using ArcMap software. The 12 digit hydrologic unit boundaries were joined with the resulting stand boundaries. After the join, small sliver polygons were merged with appropriate neighbor polygons. FORVIS codes were applied based on 12 digit hydrologic unit boundaries, BLM administrative districts, and stand IDs. USGS USFS Landfire National Data were used to provide information on the existing vegetation type and vegetation canopy cover found within the stand boundaries. Zonal statistics were applied to find the majority value for each Landfire class within each stand boundary and associated fields were then joined to the attribute table.

Process_Date: 2010

Process_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Patti Dappen

Contact_Organization: The New Mexico Forest and Watershed Restoration Institute

Contact_Position: GIS Specialist

Contact_Voice_Telephone: 505-426-2080

Contact_Facsimile_Telephone: 505-426-2192

Contact_Electronic_Mail_Address: prdappen@nmhu.edu

Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Vector

Point_and_Vector_Object_Information:

SDTS_Terms_Description:
SDTS_Point_and_Vector_Object_Type: G-polygon
Point_and_Vector_Object_Count: 14860

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Horizontal_Coordinate_System_Definition:
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Grid_Coordinate_System:
Grid_Coordinate_System_Name: Universal Transverse Mercator
Universal_Transverse_Mercator:
UTM_Zone_Number: 13
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: 0.999600
Longitude_of_Central_Meridian: -105.000000
Latitude_of_Projection_Origin: 0.000000
False_Easting: 500000.000000
False_Northing: 0.000000
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:
Abscissa_Resolution: 0.000000
Ordinate_Resolution: 0.000000
Planar_Distance_Units: meters
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1983
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137.000000
Denominator_of_Flattening_Ratio: 298.257222

Entity_and_Attribute_Information:
Detailed_Description:
Entity_Type:
Entity_Type_Label: Malpais_Forvis_stand_boundaries
Attribute:
Attribute_Label: FID
Attribute_Definition: Internal feature number.
Attribute_Definition_Source: ESRI
Attribute_Domain_Values:
Unrepresentable_Domain:
Sequential unique whole numbers that are automatically generated.
Attribute:
Attribute_Label: Shape
Attribute_Definition: Feature geometry.
Attribute_Definition_Source: ESRI
Attribute_Domain_Values:
Unrepresentable_Domain: Coordinates defining the features.
Attribute:
Attribute_Label: HUC_12
Attribute:
Attribute_Label: HU_12_NAME

Attribute_Definition: 12 Digit Hydrologic Unit Code
Attribute_Definition_Source: United States Geologic Survey, Reston, VA
Attribute:
Attribute_Label: ACRES
Attribute_Definition: Acreage
Attribute_Definition_Source: ESRI
Attribute:
Attribute_Label: FORVIS
Attribute_Definition:
 FORVIS Codes based on HUC codes and BLM Administrative Unit Codes.
Attribute_Definition_Source: US Department of Interior, Bureau of Land Management
Attribute:
Attribute_Label: TYPE_NAME
Attribute_Definition: Existing vegetation type name
Attribute_Definition_Source: Landfire
Attribute:
Attribute_Label: SYSTEMGR_1
Attribute_Definition: Existing Vegetation System Group Identification
Attribute_Definition_Source: Landfire
Attribute:
Attribute_Label: SAF_SRM
Attribute_Definition:
 Society of American Foresters & Society of Range Management Cover Type
Attribute_Definition_Source:
 Society of American Foresters & Society of Range Management Cover Type
Attribute:
Attribute_Label: NVCSORDER
Attribute_Definition: National Vegetation Classification System Physiognomic Order
Attribute_Definition_Source: National Vegetation Classification System
Attribute:
Attribute_Label: NVCSCCLASS
Attribute_Definition: National Vegetation Classification System Physiognomic Class
Attribute_Definition_Source: National Vegetation Classification System
Attribute:
Attribute_Label: NVCSSUBCLA
Attribute_Definition: National Vegetation Classification System Physiognomic Subclass
Attribute_Definition_Source: National Vegetation Classification System
Attribute:
Attribute_Label: SYSTEMGR_2
Attribute_Definition:
 Aggregated existing vegetation types based on dominant species or groups of dominant species
Attribute_Definition_Source: Landfire
Attribute:
Attribute_Label: COVER_CLAS
Attribute_Definition: Existing Vegetation Cover
Attribute_Definition_Source: Landfire

Distribution_Information:

Resource_Description: Distribution is at the discretion of the BLM.

Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Transfer_Size: 127.973

Metadata_Reference_Information:
Metadata_Date: 20110304
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: The New Mexico Forest and Watershed Restoration Institute
Contact_Person: Patti Dappen and Joe Zebrowski
Contact_Position: GIS Specialists
Contact_Address:
Address_Type: mailing and physical address
Address: 140 Lora Shields Science Building
Address: Box 9000
City: Las Vegas
State_or_Province: New Mexcio
Postal_Code: 87701
Contact_Voice_Telephone: 505-426-2080
Contact_Facsimile_Telephone: 505-426-2192
Contact_Electronic_Mail_Address: prdappen@nmhu.edu
Contact_Electronic_Mail_Address: jpzebrowski@nmhu.edu
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998
Metadata_Time_Convention: local time
Metadata_Extensions:
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile

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