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Title

Mexican Spotted Owl Surveys at the Valles Caldera National Preserve in 2004

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

Executive Summary

Survey efforts in the Valles Caldera National Preserve (VCNP) have been limited since the inception of the Preserve in 2000. Some Mexican spotted owl [*Strix occidentalis lucida* (MSO)] surveys were completed in 2001 and 2002 (Johnson 2001, Johnson 2002) with no MSOs being reported. Before the VCNP was created, the land was under private ownership and MSO surveys were not completed. The surveys completed in 2004 looked at all suitable areas of the VCNP for the first time. Five owl species were recorded in the VCNP but no MSOs were identified.

The objective of this study was to comprehensively evaluate and survey all of the potential nesting habitat on the VCNP. Time and effort as well as equipment was provided by Los Alamos National Laboratory for this study. Additionally, the principal investigators provided several hours of volunteer time for this study.

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Introduction

The Mexican spotted owl [*Strix occidentalis lucida* (MSO)] was listed as a "threatened" species under the Endangered Species Act in 1993 (USFWS 1993) and a recovery plan was developed in 1995, with an eventual goal to remove the owl from the list of threatened and endangered species (White et al. 1999). The MSO's presence has been recorded in northern New Mexico as far back as the turn of the century and is perhaps more abundant than realized, though still not numerous, with only 49 separate nesting locations known in northern New Mexico in 1985 (Johnson and Johnson 1985). With its listing in 1993, more effort has been put into searching for locations. Recent territorial occupancy and productivity in the Jemez Mountains are low, and the local Jemez Mountains population is especially vulnerable because it is small and unable to fill its habitat (Johnson 1997). Since 1995, yearly surveys completed at Los Alamos National Laboratory (LANL) have confirmed the existence of two locations where MSOs have been found; at least one of these locations has been occupied by a breeding pair (Keller et al. 1998; Keller, Pers. Comm.).

Development of a Geographic Information System (GIS) Based Habitat Model

A MSO habitat model was developed for the Jemez Mountains area including the area around LANL and the Valles Caldera National Preserve (VCNP). The model was developed using Environmental Systems Research Institute's (ESRI) ArcGIS software with Spatial Analyst. The habitat model was developed to support survey efforts for field ornithologists responsible for conducting spotted owl surveys on both the Caldera and LANL lands. The purpose of the model was to develop a logical approach to assessing which areas ornithologists should survey for owl occupancy. This model is classified as inductive and descriptive.

Studies and research of habitat use by MSO in the Jemez Mountains (USDI 1995; LANL 1998; Keller, Pers. Comm.) indicate that MSOs nest in areas with the following characteristics:

- areas dominated by mixed-conifer and ponderosa pine forest;
- in steep narrow canyons with slopes greater than 40 percent;
- at elevations greater than 1981 m (6500 ft) but less than 3048 m (10,000 ft);
- in rocky cliff sides, crevices, and concave areas within canyon walls;
- in wilderness locations or other remote locations where noise and disturbance levels are low with large areas of contiguous habitat; and
- in areas not affected by catastrophic wildfire.

These characteristics were the foundation criteria for developing the nesting habitat model.

Model Variables

Based on the habitat characteristics, a raster-based (grid cell) model was developed with six model variables (habitat elevation, habitat slope, habitat curvature, habitat land cover, no-burn habitat, and acceptable-noise habitat). Nesting suitability was determined in areas where all of these variables were present. The variables and processes used are summarized in a flowchart described in Figure 1.

Before nesting suitability could be determined, a grid needed to be created for each habitat variable. The data input layers used to created these variable grids were a 10-meter resolution Digital Elevation Model [DEM (USGS 2001)], 10-meter resolution land cover grid (McKown et al. 2003), a polygon shapefile of developed areas with associated noise levels (Bennett 2004), and a polygon shapefile indicating areas of severe wildfire burn (BAER 2000; BNM 1999).

Habitat Elevation

The habitat elevation grid was derived from the DEM by assigning a one to all grid cells with values between 1981 and 3048 m (6500 and 10,000 ft) and assigning a zero to all other values. The assignment of new values was accomplished by using the Spatial Analysts conditional local function (con) in raster calculator. The new grid contains those elevation values that are suitable for nesting owls (Figure 2).

Habitat Slope

The habitat slope grid was also created using two separate steps. The first step created a percent slope grid from the DEM using the ESRI's surface command slope and specifying the output grid to be in units of percent. In the next step, we used the Spatial Analyst con statement on the area slope grid to assign a one to all grid cells with values greater than 40% slope and a zero to all other values. This step created a slope grid of acceptable slope values for nesting owls (Figure 3).

Habitat Curvature

A two-step process was also used to create the habitat curvature grid. Using ArcINFO GRID, the DEM was used to create a surface curvature as well as a profile curvature grid. Positive values of the profile grid related to convex surfaces, and negative values defined concave surfaces. From the profile curvature grid, a habitat concavity/curvature grid was created by assigning a one to all grid cells with values less than zero and assigning all other values zero. This grid now represents those potential concave canyon wall surfaces that owls might nest in (Figure 4).

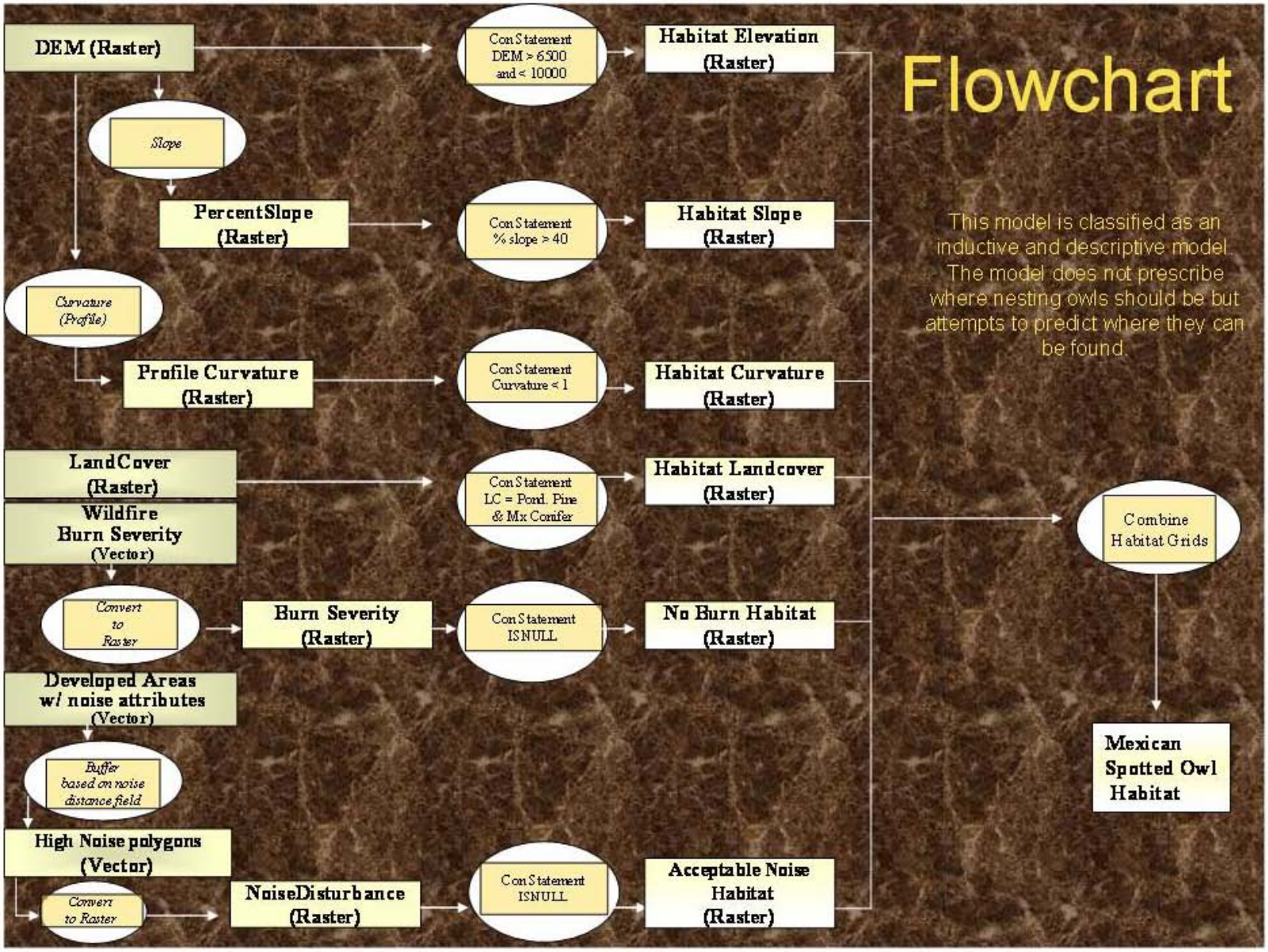

Figure 1. A flowchart of the variables and process used to create nesting suitability model for MSOs.

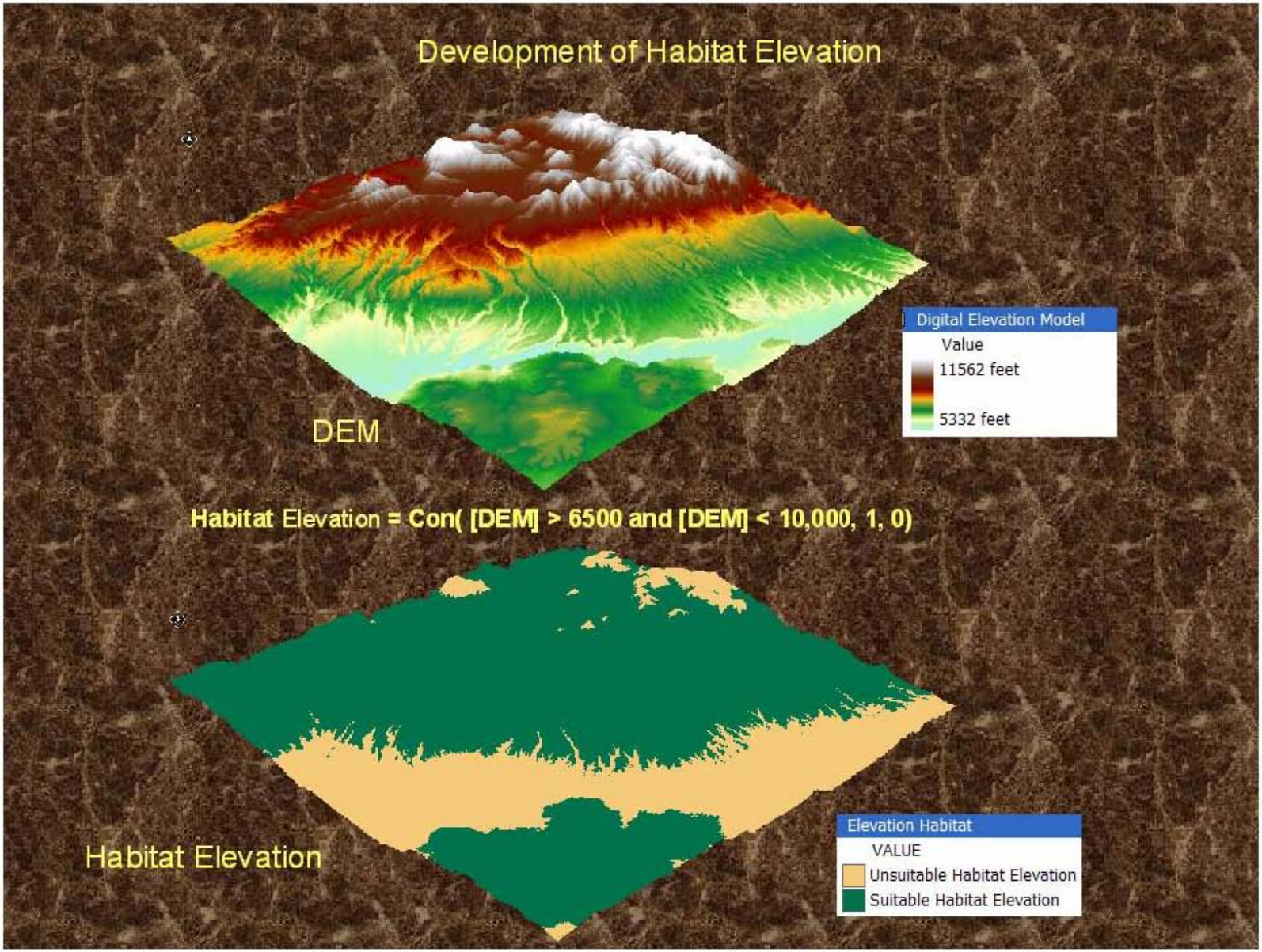

Figure 2. Development of habitat elevation using a U.S. Geological Survey DEM.

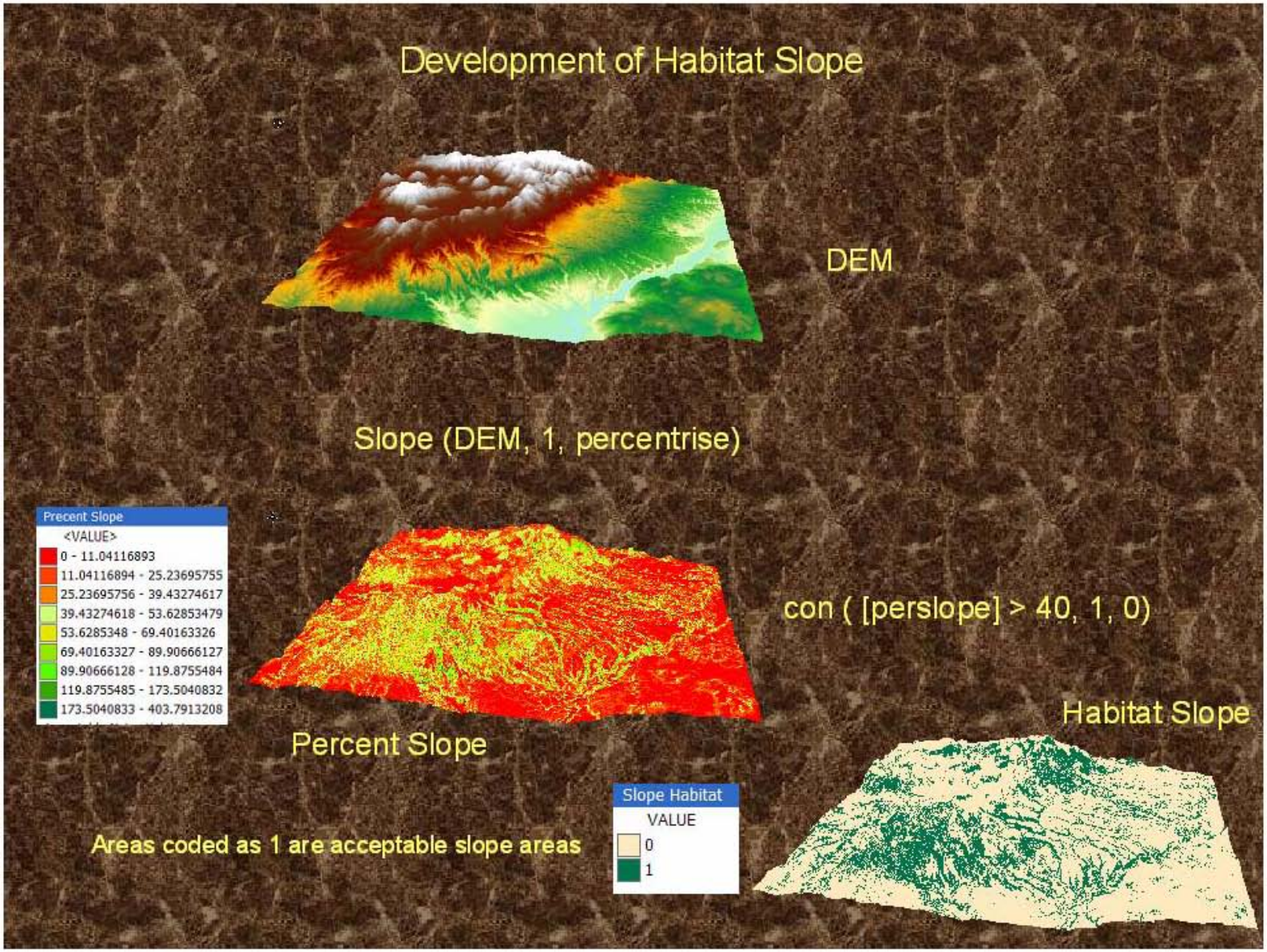

Figure 3. Development of the habitat slope grid.

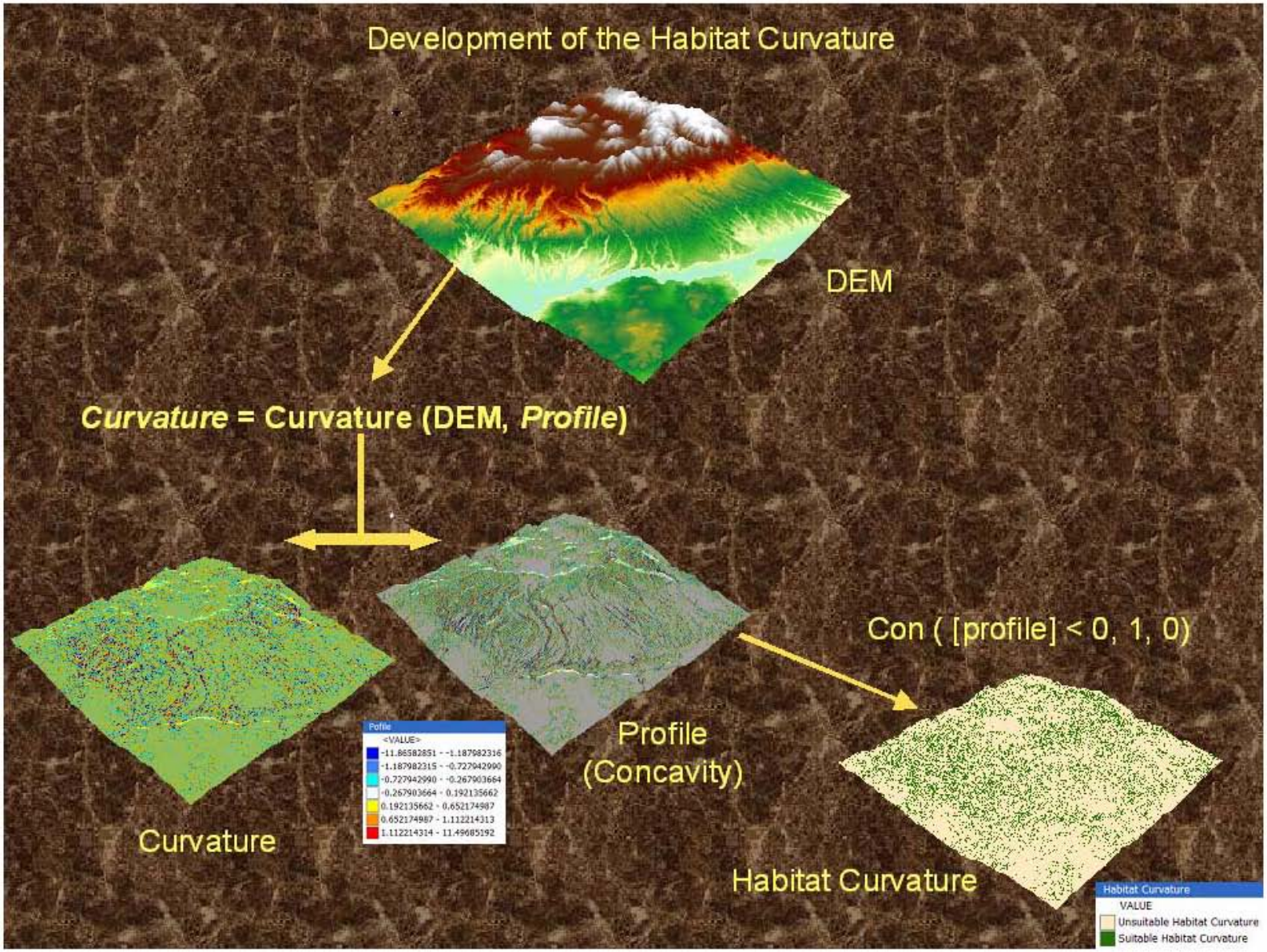

Figure 4. Development of habitat curvature.

Acceptable-Noise Habitat

Development of the acceptable-noise habitat grid was a multistep process. We used a polygon shapefile of developed areas within the Jemez Mountains study area. Each polygon had an associated qualitative attribute of level of development based on noise generation. There were four levels defined, high development with 75-dBA noise level, moderate development with 65-dBA noise level, low development with noise levels at 55 dBA, and very low development with noise levels at 35 dBA. Noise levels for the developed areas were based on published findings from Canter (1977). Each polygon was then buffered (ArcMap Buffer Wizard) based on the distance required to dissipate the noise to a level of 35 dBA. All developed areas were assumed to be point sources and the point distance equation was used to determine the buffer distance (Canter 1977). The buffered polygon shapefile showing high-noise areas was converted to a grid. In the conversion to grid, the high-noise-level polygons were converted to grid cells and given values of one or greater and the low-noise areas were coded as no data values. We created an acceptable noise habitat grid by using a conditional statement to convert the no data values to ones and all the remaining values to zero. The resulting grid shows where noise levels are suitable for nesting owls (Figure 5).

Land Cover Habitat

The development of the land cover habitat grid was a simple one-step process. We selected out only those cells representing ponderosa pine and mixed conifer land cover types using a conditional statement. These selected cells were assigned a value of one and all other values were given a value of zero. The resulting grid contained the land cover types used by nesting owls (Figure 6).

No-Burn Habitat

To develop a no-burn habitat grid, severely burned areas from a wildfire burned area polygon shapefile were converted to raster. After the conversion, all grids cells showing severe burn were coded as zero and all other grid cells were coded to a value of one using a conditional statement. The resulting grid shows areas of no burn/acceptable burn (Figure 7).

Potential Nesting Habitat

MSO nesting habitat was developed by multiplying the habitat layers (no-burn habitat, acceptable-noise habitat, habitat land cover, habitat curvature, habitat slope, and habitat elevation) together. The resulting suitability grid shows those areas where acceptable values of the six variables exist. If any one variable was not present in a given grid cell the multiplication of the values would yield a zero for that cell and the habitat would not be coded as suitable (Figure 8).

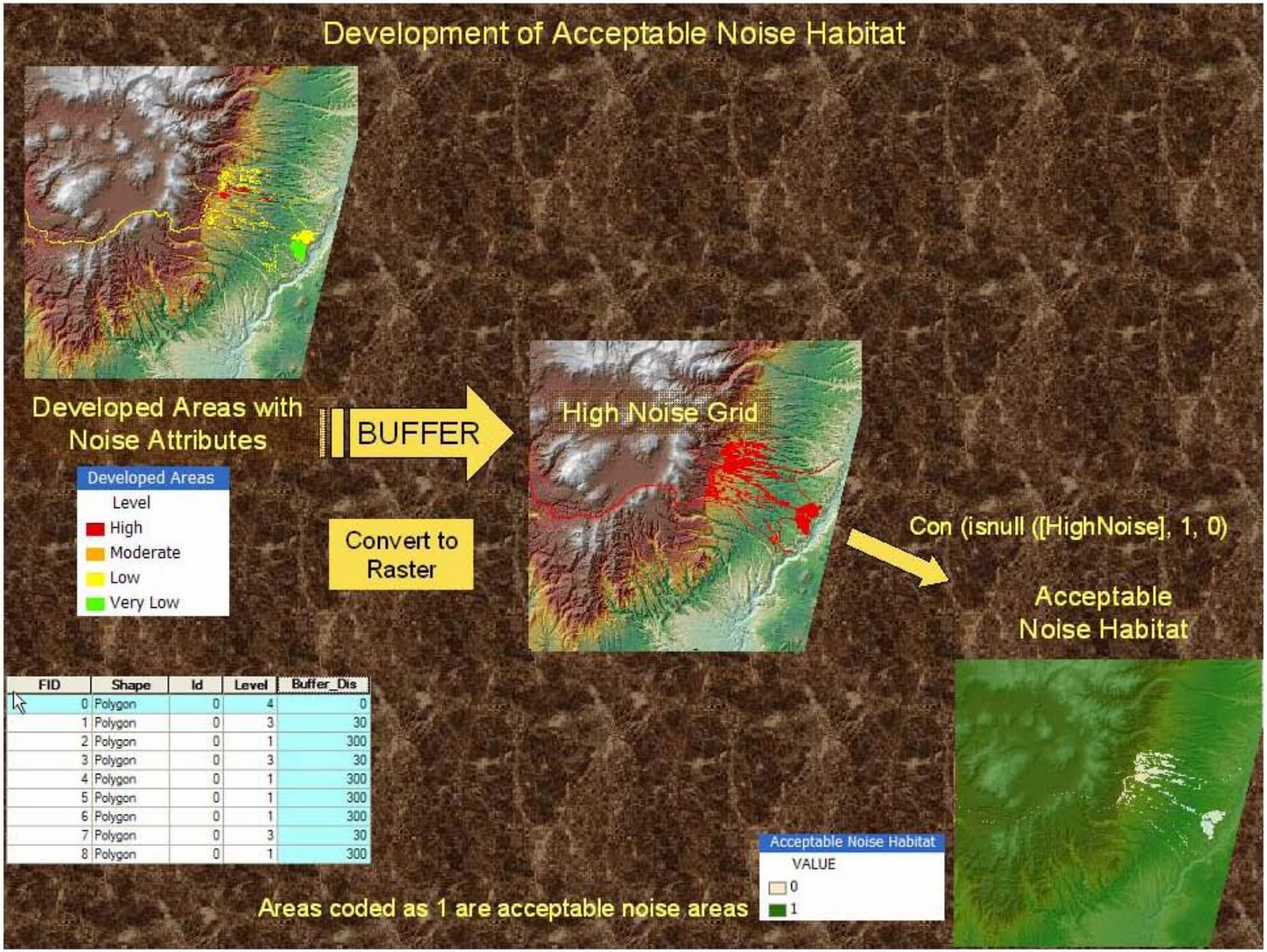

Figure 5. Development of acceptable-noise habitat.

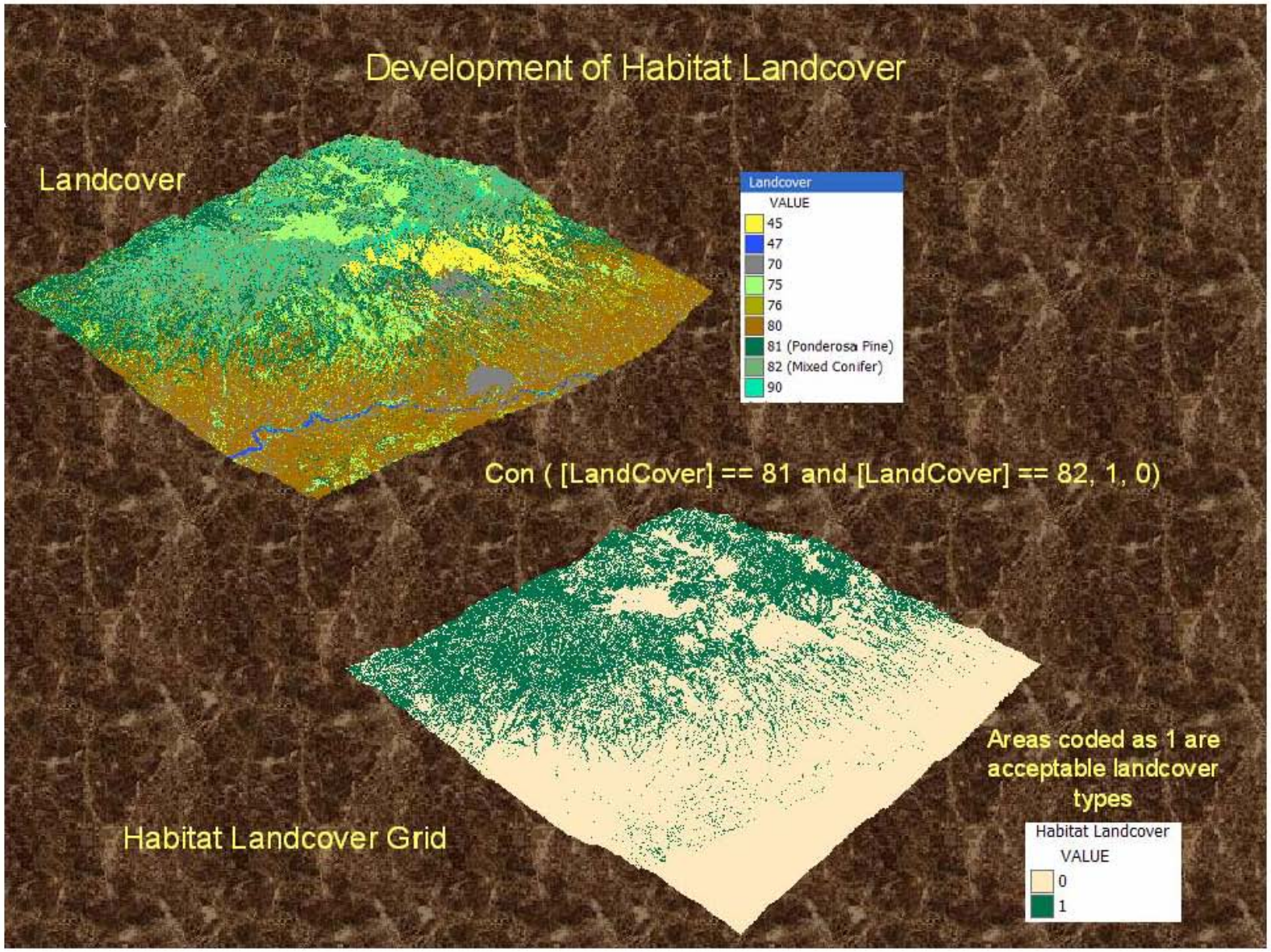

Figure 6. Development of the land cover habitat grid.

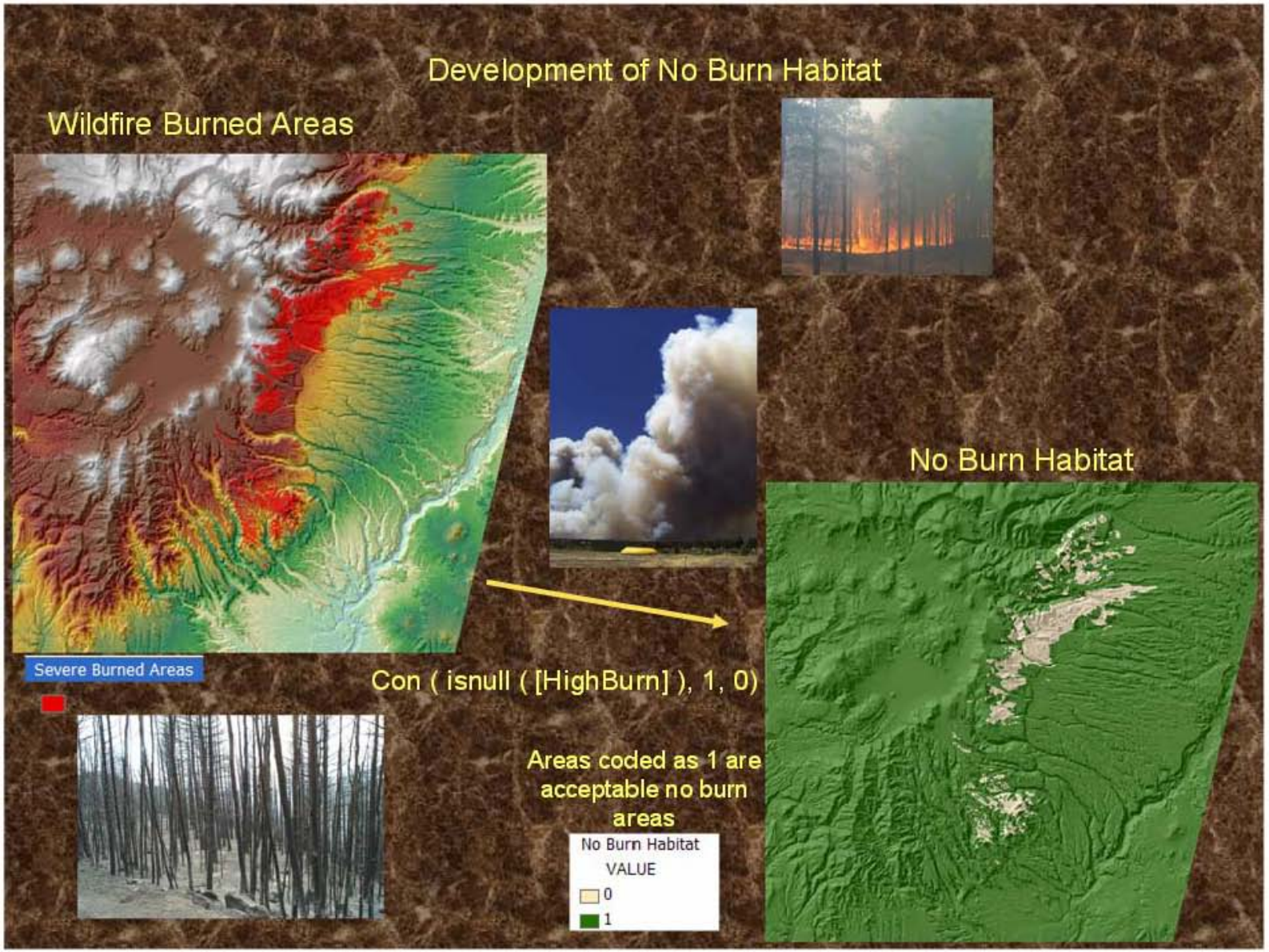

Figure 7. Development of no-burn/acceptable-burn habitat.

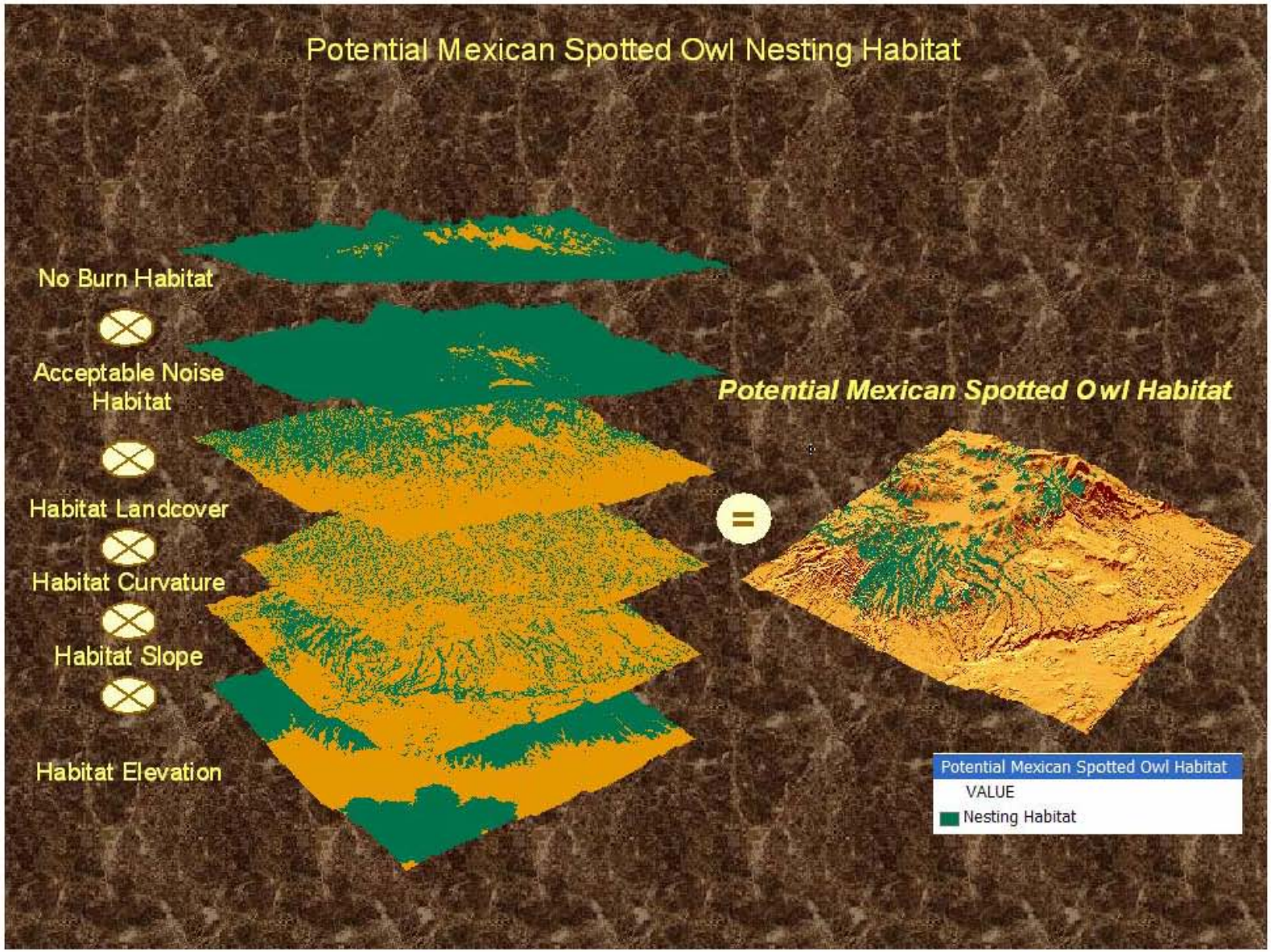

Figure 8. Development of the potential nesting habitat suitability grid for MSO.

Model Limitations

This model was developed specifically to predict potential nesting areas for Mexican spotted owl and is not suitable for evaluating roosting and/or foraging habitat. In addition, the spatial extent of the model is limited to the Jemez Mountains within the defined study area. This model was developed to assist ornithologists in their surveys for locating nesting spotted owls and has not been thoroughly ground checked or verified. The model should be used in conjunction with occupancy surveys until validation and verification are complete.

Locating Calling Stations and Survey Methods

The GIS model that was developed output a map that graphically showed the best potential habitat. Principal investigators went out to the VCNP in April during daytime field visits to look at all the potential habitat identified by the GIS model. The areas that contained rocky outcrops and deeper canyons were identified as having the highest probability of occupancy. Calling points were dispersed along roads between 0.75 and 1.0 mile apart. The survey route covered the habitat that was identified in the GIS model and deemed suitable in the initial daytime field visits. A total of 24 calling stations were established throughout the VCNP (Figure 9). An eastern and western route were established with 12 calling stations in each route. The survey methods used in this inventory follow the protocols established by the U.S. Forest Service. These protocols are included with the survey permits from the U.S. Fish and Wildlife Service.

Results

There were five owl species recorded during this survey effort. No MSOs were found. The five owl species were the great horned owl [*Bubo virginianus* (GHOW)], flammulated owl [*Otus flammeolus* (FLOW)], western screech-owl [*Otus kennicottii* (WESO)], long-eared owl [*Asio otus* (LEOW)], and northern saw-whet owl [*Aegolius acadicus* (NSWO)]. The total number of owls heard, broken down by species is shown in Table 1. The number and species of owls heard, broken down by survey date and calling station number is shown in Table 2.

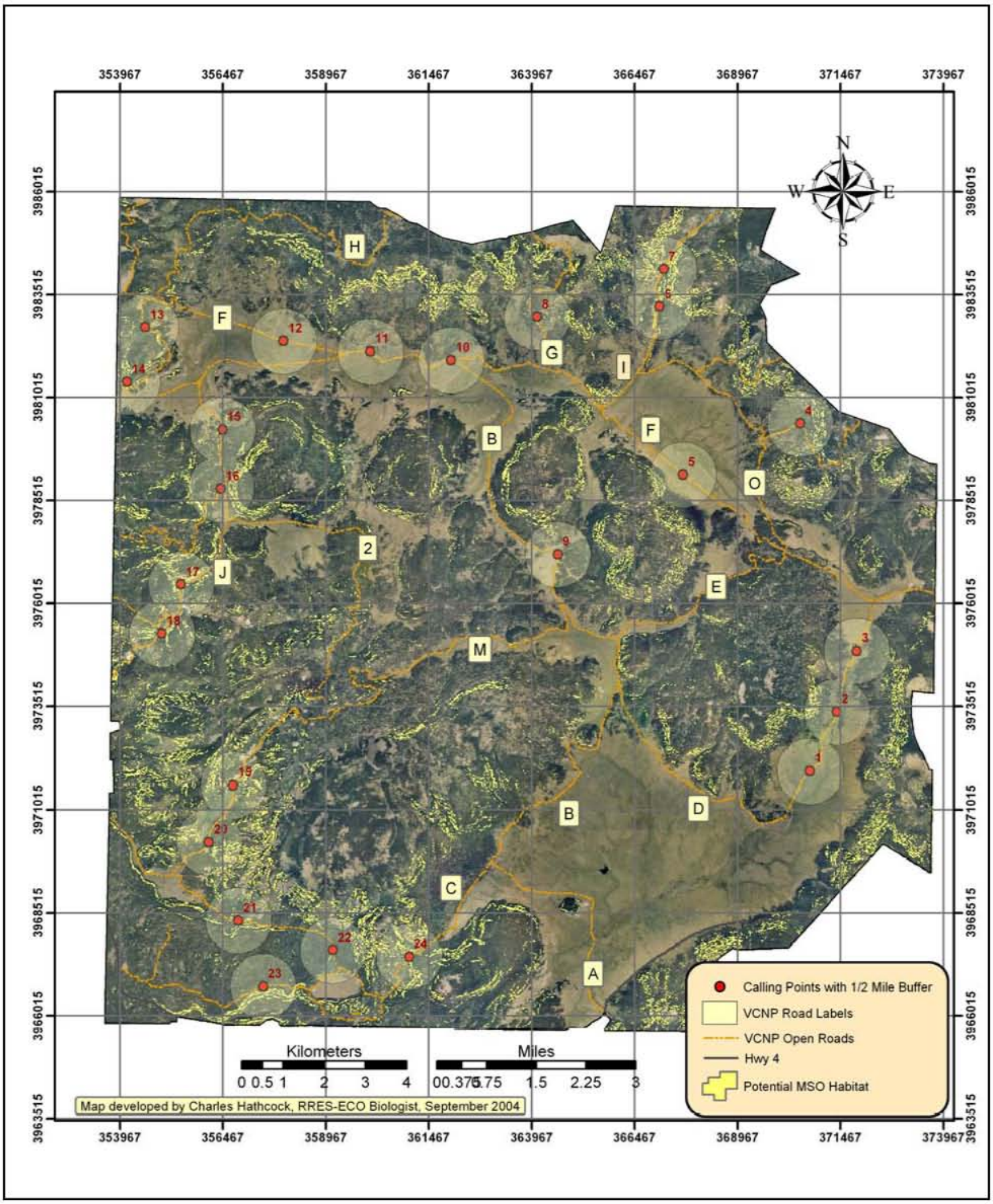

Figure 9. Survey locations at the VCNP in 2004.

Table 1. Total Number of Individual Owls Heard by Species

Owl Species	Total Number Heard
GHOW	8
LEOW	18
NSWO	8
WESO	3
FLOW	21

Table 2. Owl Species Heard by Survey Date and Calling Station Number

Calling Station Number	Survey Date	Owl Species
1	05/18/2004 05/25/2004 06/01/2004	GHOW LEOW FLOW (2)
2	06/01/2004	FLOW (2)
3	05/18/2004 05/25/2004 06/01/2004	GHOW LEOW FLOW (2)
4	05/18/2004 05/18/2004 05/25/2004 06/08/2004	GHOW NSWO NSWO LEOW
5	05/18/2004 05/18/2004 05/18/2004 05/25/2004 05/25/2004 06/01/2004 06/01/2004 06/08/2004	GHOW NSWO LEOW NSWO LEOW GHOW FLOW FLOW
6	05/18/2004	LEOW (2)
7	05/18/2004 06/01/2004 06/08/2004	LEOW FLOW (2) LEOW (3)
8	05/25/2004 06/01/2004	FLOW LEOW
9	06/01/2004 06/01/2004	NSWO GHOW
10	06/01/2004 06/08/2004	WESO LEOW

Table 2. (cont.)

Calling Station Number	Survey Date	Owl Species
11	05/25/2004 06/01/2004 06/08/2004 06/08/2004	WESO FLOW FLOW NSWO
12	06/01/2004 06/08/2004	WESO GHOW
13	05/29/2004 06/05/2004 06/05/2004	NSWO FLOW LEOW
14	05/29/2004	FLOW
15	None	None
16	06/15/2004	FLOW (2)
17	05/22/2004	LEOW
18	None	None
19	None	None
20	05/22/2004	LEOW
21	05/22/2004 06/05/2004 07/02/2004	LEOW LEOW NSWO
22	07/02/2004	FLOW
23	05/22/2004 07/02/2004	GHOW FLOW
24	06/15/2004	FLOW (2)

Discussion

The elevational gradient at the VCNP is on the high end of what is considered potential MSO habitat. This could explain the absence of MSOs on the VCNP. The low productivity of the Jemez Mountains population of MSOs could also explain the absence on the VCNP. A more comprehensive survey could be performed if the resources are allocated to the project.

Notable Sightings

The only notable raptor sighting during this project was an osprey (*Pandion haliaetus*). It was perched in a snag at the junction of roads I and F.

Management Recommendations

- Develop areas of the VCNP that have activity and noise restrictions during critical time of the MSO mating season.
- Limit tree cutting to smaller trees (less than 8 inches DBH) on slopes over 40%.
- Continue yearly monitoring of owls on the VCNP.
- Thinning of smaller trees and ground-clearing burns should be used to open up areas currently in a “dog hair” forest situation.
- Studies should be undertaken to determine prey base for the MSO.

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