Cienega Watershed Erosion Management & Restoration Plan

Final Draft

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Introduction

This report contains the background of the Cienega watershed, an explanation of the site sensitivity and capability analysis, a full series of maps that describe the conditions in the watershed, a proposed framework for prioritizing these factors, and finally the priority areas as identified by the proposed framework. This plan was created in 2016-17 to provide major stakeholders including residents, land and watershed managers with a method of prioritizing erosion restoration projects occurring in the Cienega Watershed and surrounding communities. This report was developed by Watershed Management Group, contracted by Cienega Watershed Partnership, funded through a grant from the Bureau of Land Management. This Plan is the foundation of a larger package of efforts to develop an erosion control and riparian restoration prioritization process, a community engagement plan and develop and implement a series of trainings in the watershed on small scale erosion control that landowners, ranchers and cowboys can implement.

Background

Cienega Watershed Partnership (CWP), a 501(c)(3) nonprofit organization founded to support stewardship initiatives in the Cienega Watershed region of Southeastern Arizona. Recognizing the threat that encroaching development and increasing public demands on resources and for recreation posed to the Watershed, CWP facilitates cooperative actions that steward the natural and cultural resources of the Cienega Watershed while enabling sustainable human use. The CWP has brought together local landowners, public land users, and over twenty local conservation organizations and government agencies with an existing or potential interest in the Watershed. CWP partnerships represent a broad group of stakeholders, including federal agencies, non-profit organizations and interest groups, land managers and local citizens, and research institutions. For a full list of CWP partnerships, see appendix A.

The watershed itself is noteworthy, not only for the environmental quality, but also the collaborative partnerships that have formed between the many members of the Cienega Watershed Partnership. The variety of groups working on behalf of the land have found the common ground that is necessary to successfully manage the watershed for its long term sustainable uses. The landscape's rigorous riparian habitat has been designated as one of the Outstanding Arizona Waters (A.A.C. R18-11-112(G)). This title provides the creek additional protections to protect its high water quality.

One risk to the riparian area is erosion. Erosion can negatively impact rangeland conditions, impacting the primary land use in the watershed (USDA 2013). The Cienega watershed has over 100 stock ponds that are used for grazing, and reintroductions of the endangered Chiricahuan Leopard Frog and some threatened fish species (USDA 2013). Increased sediment yield could put these important infrastructural assets at risk.

Drought and dropping water tables have shown evidence of headcutting in the river channel and in upland areas. Many efforts have been made to slow and stop the erosion, including a comprehensive monitoring study conducted by CWP member, Pima Association of Governments Watershed Planning Program (PAG 2010). Headcutting in the riparian area could result in channelization, lower water tables, and eventual die-off of riparian vegetation and habitat. Additionally,infrastructure such as roads and fence lines are in proximity to moving headcuts in the upland landscape, and would be costly to repair.

There is need for a coordinated management plan that will allow the independent stakeholders to address the erosion areas under their jurisdiction while also keeping with a watershed wide approach. The goal for this project is to provide a tool for decision-making that will enable the collaborative land users to make decisions independently while working in the same framework as their collaborators and partners.

Data Acquisition and Plan Development Process:

Two approaches were employed to identify erosion restoration priorities and gather the data used in this plan:

A) Expert Knowledge Acquisition and Process Verification
In spring 2016, a steering committee was formed to guide the development of a Prioritization Process/Decision Support Tool (DST) for decision making for upland, arroyo and riparian restoration, and use our collective knowledge to ID areas to investigate. Example criteria included high risk, important/resource value, position in watershed, scale of impact, achievability, knowledge, landowner sensitivities, accessible, management/jurisdiction, affordable, clearances. We established and documented goals and procedures needed to move forward as related to erosion restoration efforts, training, outreach to people living, working and recreating in the watershed.

In summer 2016, four CWP stakeholder engagement workshops were conducted. Stakeholders were grouped into the same four CWP Technical Teams as their annual State of the Watershed meetings: Uplands, Riparian, Cultural History, and Landscape-Wide. In these workshops, local experts reviewed data, criteria and provided input on implementation strategies. For a sample agenda, see appendix D.

This series of stakeholder workshops were used to record knowledge of current conditions in the watershed. Expert Land managers recorded their knowledge of known erosion sites. This information was gathered into Knowledge Acquisition Sheets (attached in Appendix D and E) and were used to inform the near-term restoration priorities, and will be used to groundtruth the results generated in the second aspect of this plan, a geospatial site sensitivity study (see part B of this section).

In addition to these participation workshops, feedback and additional Knowledge Acquisition Sheets were obtained during several presentations at local symposiums, work days and during the spring and fall BLM Biological Planning meetings, which part of the BLM Las Cienegas National Conservation Area Adaptive Management Plan. Local landowners and ranchers were also contacted, however landowners have proven hesitant to talk about erosion on their properties or even public land leases.

Local landowners often have in depth and specialized knowledge that would be a valuable part of this plan. The Near Term restoration plan includes erosion restoration trainings on private ranch lands. It is anticipated that these trainings will go a long way in encouraging valuable input from landowners and ranchers moving forward.

In fall 2016, a wider scope of partners collaborated on peer review and acquiring site specific knowledge. This included meetings with the FROG project personnel, the US Forest Service, BLM personnel, and local landowners.

B) The geospatial site sensitivity analysis

GIS data was collected and analyzed to assess natural conditions across the study area. A Site Sensitivity and Capability Analysis (SSCA) was the basic approach for this prioritization model. Many watershed management problems require land users to make decisions that require analyzing many types of data, information that comes in different formats and structures that, like apples and oranges, are difficult to compare. The SSCA approach enables the tool user to understand complicated problems and find solutions that must meet multiple criteria.

At its core, an SSCA is a series of weighted overlays that combine multiple quantitative and qualitative factors into a final sum. The first overlay consists of biophysical factors that contribute to erosion. Sites were determined to be of high priority wherever conditions for erosion were overlaid with valued resources, as identified in the stakeholder workshops. Finally, a simple feasibility overlay was applied to identify which sites could be ideal for erosion restoration workshops and volunteer groups, or where more specialized expertise would be required. The knowledge of known erosion sites recorded in the stakeholder workshops were used to verify the results from a geospatial site sensitivity study. A Full explanation of a SSCA is provided in Appendix B. A Flow chart which helps visualize the process is provided in Appendix C.

This plan has been adopted by the CWP board as a living document. Current work includes ground-truthing and review by the Advisory Workgroup.

Recommendations

Given the results of the analyses, the restoration recommendations of this plan are as follows:

Near Term: The following sites have been documented by CWP expert stakeholders as priority areas, and will be addressed in the near term. The order of restoration will be determined by following the prioritization flowchart in Appendix C and by cross-referencing the SSCA. See Figure 1 for specific locations of the following sites.

- Empirita sites (2 sites)
- 49 Wash
- Horseshoe Bosque site
- Pantano Dam (downstream)
- Los Pozos Gulch.
- Gardner Canyon (4 sites)

For each of the selected sites we will assess watershed condition, determine watershed size, estimate 2-, 10-, & 100- year peak flows, estimate channel flow depths and velocities, assess geomorphology, and identify type of erosion occurring. Restoration techniques will use the minimum tools and simplest design necessary to slow the flow. Native materials and natural designs will mimic the natural system as much as possible.

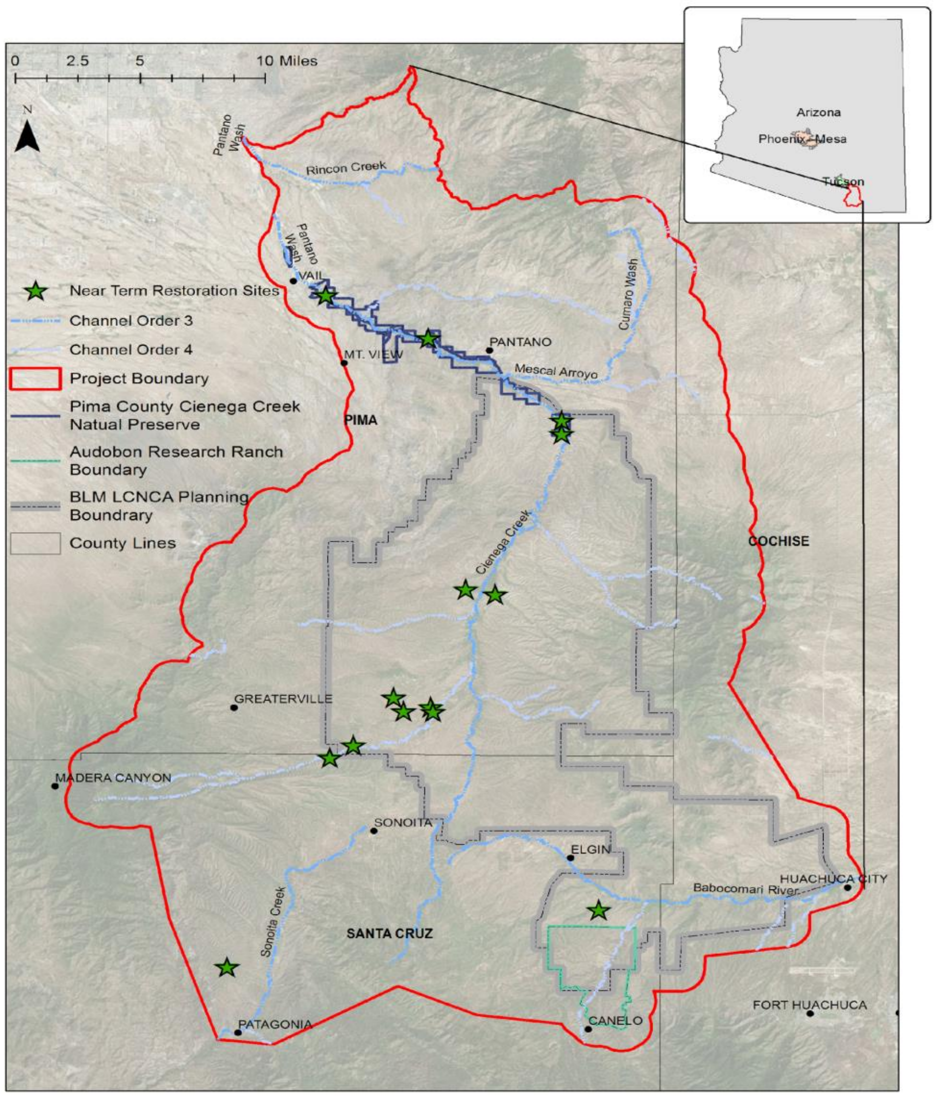
Long Term: The SSCA has been formally approved by CWP board as a living plan and will be completed Spring 2017. The results of the SSCA will be modified Using the known sites (listed above) to improve the models' ability to accuracy predict current conditions and will be used to identify future restoration sites after further refinement.

Regional Context of Study Area:

The Cienega Watershed, southeast of Tucson, Arizona, is a HUC 10 Watershed within the Santa Cruz River watershed. In order to extend the value of this information to all CWP partners, the project area was expanded to include neighboring communities and contributing peripheral environmental systems. Thus the study area includes portions of some surrounding watersheds. Figure 1 shows the location of the study area, select research and planning areas within the study area, and the surrounding region.

The Cienega Creek is a perennial intermittent stream whose headwaters start in springs in the southwestern region, and flows north east into the Pantano wash. Water in the Cienega creek is of superb water quality, and portions have earned the Outstanding Arizona Waters designation, which gives the creek extra protection for the preservation of water quality.

Figure 1: Plan Analysis Project Boundary and Regional Context



Geospatial Methods:

The SSCA was initiated by defining the problem, and breaking it into submodels. Factors of each submodel were identified, and reclassified into a common 1-10 scale. A thorough literature review for standard practices and interviews with land managers and CWP members were used to determine the reclassification of factors. An explanation of each decision is included. After reclassification, each of factors are mapped independently, as the original and reclassified data. Then the factors were merged into the sub-overlays, both as pairs, and as a final three-factor overlay.

Defining the Problem:

The problem in the watershed is that erosion is occurring, and we need to know where. After we know where the conditions are prime for erosion, we need to decide which ones to tackle first. The prioritization considers the severity of the problem, if any environmental or society values were present and at risk, and finally, the feasibility of solving those problems.

Sub-Overlays and Summary of Included Factors:

There are three suboverlays, each containing a variety of layers including but not limited to the following:

1) Biophysical Factors of Erosion:
    - Percent Slope (10m resolution)
    - Soil Characteristics, specifically soil Erodibility Factor (k value)
    - Curve Value, to estimate rain water run off
    - Roads, which can accelerate erosion
2) Environmental Values:
    - Historic Structures and Archaeological Sites
    - Infrastructure: stock tanks
    - Threatened and Endangered Species Habitat
    - Water Resources: Shallow Groundwater Areas
    - Publicly Visible, and Popular Recreation Areas
3) Feasibility Factors:
    - Position in the Watershed: Higher positions will be addressed first to induce positive secondary impacts downstream
    - Access: Distance from Roads, Location of Campsites
    - Logistics: Cultural Clearances, NEPA Clearances, Maintaining previous work, Preservation of long term monitoring research sites
    - Severity and complexity of the problem: Ecological Site State and Transition Phase
        - To avoid duplication, this factor was included in the Feasibility suboverlay when displayed independently, but was only considered once during the final weighted overlay process.

This information is also visualized in the flowchart provided in Appendix C.

Data:

Data sources:

Many CWP partners provided data, and this project would not have been possible without their contributions. Proprietary data was contributed from Bureau of Land Management, Pima Association of Governments, Sky Island Alliance, The Nature Conservancy, Natural Resources Conservation Service, and Pima County Regional Flood Control District.

Open source data included the US Census, US Geological Survey, US Department of Agriculture, Pima County.

Specific data sources are provided with each map.

Data Management:

The Project area boundary was created by adding a 1 mile buffer to the Cienega Watershed, allowing the project area to account for shifts in the aquifer over time. Surrounding research areas, such as Audubon Appleton-Whittell Research Ranch, the LCNCA Planning Area, and the Pima County Cienega Creek Natural Preserve were also added. The Agua Caliente watershed was added on the North end for its significant role in the Cienega Natural Preserve. Finally, the study area was manually extended to the South and West to include nearby communities.

Once completed, the study area boundary was used to clip the results to the watershed boundary.

Geoprocessing/Model Building:

ArcGIS Model Builder was used to construct a model for further the site sensitivity analyses. Basic tools such as clip, merge, extract by mask, and erase were used occasionally, and is documented in the model. Some intermediate tools that were used:

Task: Add buffers to a dataset

> Tool: Euclidean distance was used to create a raster file with a distance gradient in order to add buffers to featured areas, where required.

Task: Aggregate feature classifications to correspond to sensitivity thresholds

> Tool: Reclassify was used to aggregate feature classifications according to the thresholds and to

assign the sensitivity scores found in the research stage.

Task: Overlay & simultaneously analyze factors

Tool: The weighted sum tool is the final step in analysis, allows various weights to be assigned to different factors, overlays and displays the various site sensitivity analyses.

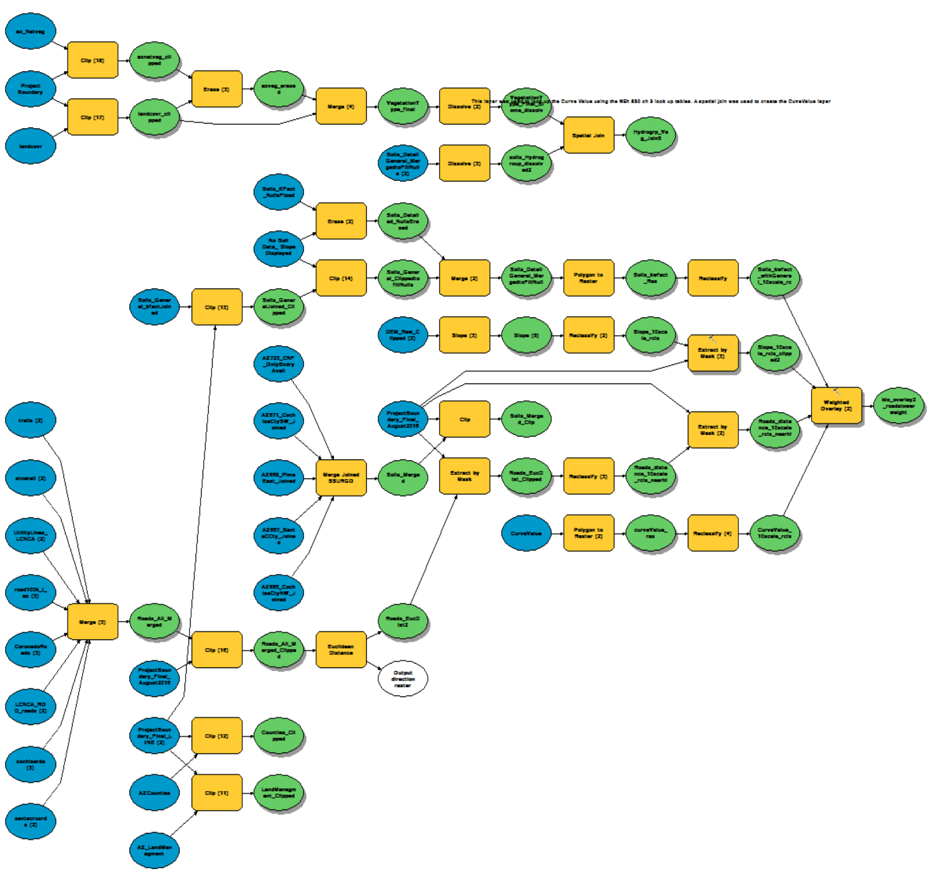
Any additional geoprocessing is explained in the corresponding sections.

Data Analysis

Suboverlay 1: Biophysical Factors:

The following section will describe the biophysical factors used to produce the weighted sum environmental sensitivity analysis. Each subsection includes: an inventory of each factor, the reasoning for the sensitivity thresholds chosen, and the results of the reclassification into sensitivity scores. Figure 2 shows an overview of the process of creating the environmental sensitivity analysis.

Figure 2: Model Builder Process



Soil Erodibility:

Soil type is the foundation of watershed management, and its composition highly influences all other biophysical factors. Soils are composed of types of soil particles, water, and organic material. Various combinations of these components will react differently to stresses and context, such as slope stability, vegetation and cohesion. Soil erosion is an important part of environmental sensitivity that will be exacerbated with development. The degree of soil particle cohesion is expressed as that soil's "k factor." A High K factor will be coarser soil and therefore more erodible (Randolph 2012).

Soils data was collected from the USDA detailed SSURGO and the more general STATSGO soil surveys (USDA 2013). Some areas were not mapped in the detailed 2013 survey, and the general survey was used to fill in these areas where possible. The remaining null values areas were reclassified from "No Data" to a 0 so that they were not excluded from the final analysis. Erodibility factors ranged from .02 to .55 in value, and were reclassified into equal breaks. See Figure 3 for soils inventory and reclassification.

Slope:

Slope is included, because steep slopes increase flow velocities and in areas with roads or lack of vegetative cover can increase erosion. Data was sourced from the USGS Digital Elevation Model (10 m resolution), and converted into slope, using the slope tool (USGS 2013).

The spread of values was tighter in the lower end and very broad at the higher end. To capture the nuances in slope, quantiles were used to form the reclassification breaks.

Figure 4 shows the slope sensitivity inventory and reclassification.

Curve Number:

Curve numbers are used to estimate the volume of rainwater runoff. Curve number evaluation works well in hydrologic systems that are dominated by overland flow and shallow subsurface flow, like the Cienega Watershed.

The Curve number is a function of vegetated cover (data from Pima County) and hydrologic soil group (data from USDA soils survey). The NRCS Hydrology National Engineering Handbook provided the curve number values in look-up table 9-2 (NRCS 2004).

Inconsistent data on vegetation condition and knowledge that the landscape is general managed with sustainable practices, it was assumed that most areas would be in fair to good condition. Previous studies from the US Department of Agriculture have shown that erosion conditions have improved considerably since the 1990s (USDA 2013). To be conservative in the calculations, “fair” condition was applied across the study area.

The same data management process was followed as the soil erodibility section, Soils data was collected from the USDA detailed SSURGO and the more general STATSGO soil surveys (USDA 2013). Some areas were not mapped in the detailed 2013 survey, and the general survey was used to fill in these areas where possible. The remaining null values areas were reclassified from “No Data” to a 0 so that they were not excluded from the final analysis.

The higher the curve number value, the more runoff will be generated. Curve Numbers were reclassified into equal breaks.

Figure 5 shows the resultant curve number data inventory and reclassification.

Roads, Trails, Utility Lines

Roads, trails and utility lines are known to accelerate erosion by intercepting sheet flow, channeling runoff, and capturing drainage flows at road crossings.

Road locations were provided by the BLM, Sky Island Alliance, and Pima County. Distance from roads was calculated using the Euclidean distance tool.

Erosion sites located on or within 50 feet of a road were reclassified as 10. Sites within 500 feet were reclassified into values 9-7, and the remaining distances were reclassified by 500 feet intervals.

Figure 6 shows the results from the roads inventory and reclassification.

Biophysical Suboverlay Results

Finally, the previous four layers were merged into an overlay to show where conditions may lead to accelerated erosion. Soil erodability and slope were given 30% weight, roads 15% and curve value 25%. Figure 7 shows the results of this weighted overlay with the near-term restoration sites identified.

Figure 8 provides the same results, as well as the known erosion control sites identified during the stakeholder workshops and by BLM staff. These sites are identified here in order to guide preliminary ground-truthing of the model results.

Biophysical Overlay Figures and Results

Figure 3 Soil Erodibility Factor

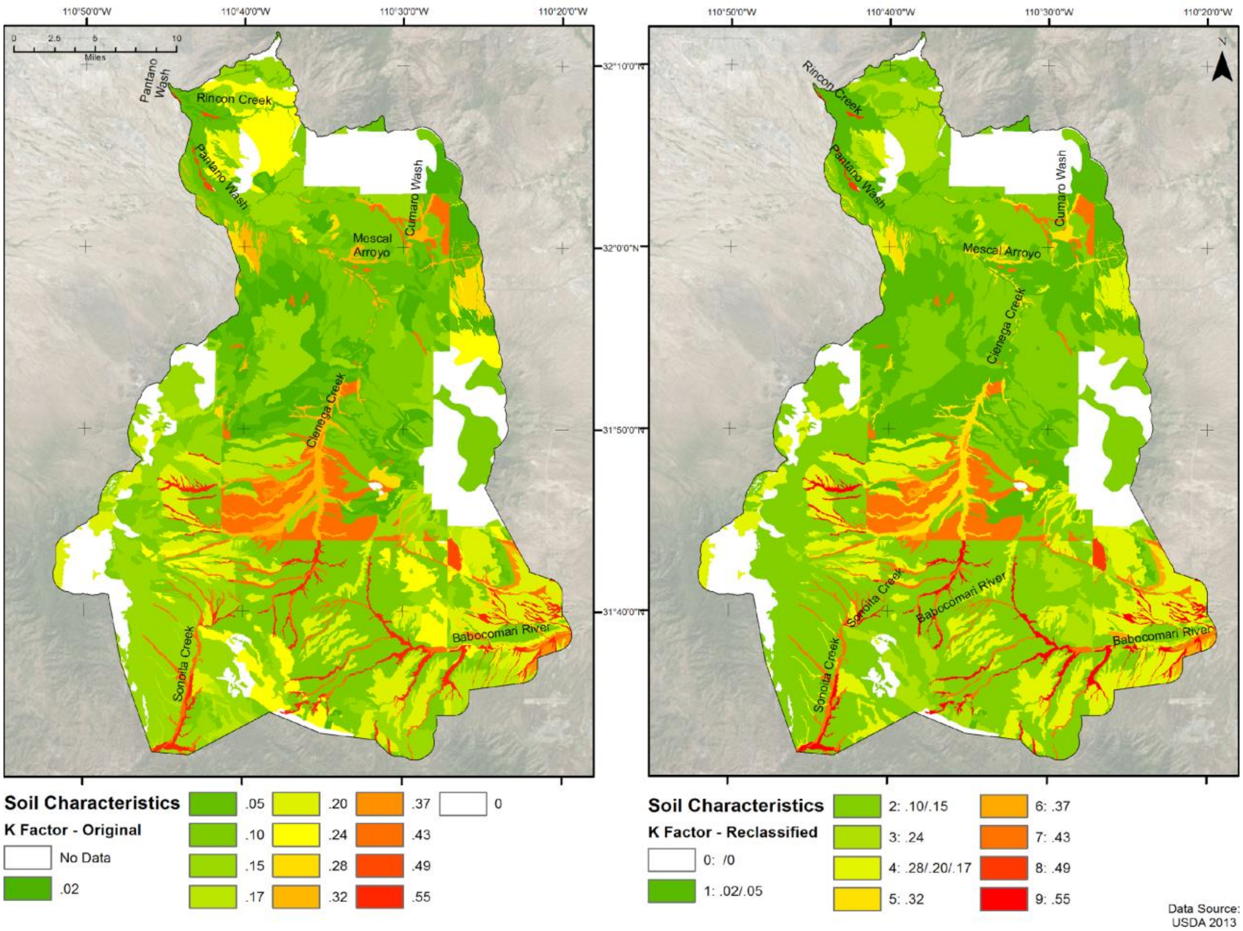


Figure 4: Percent Slope

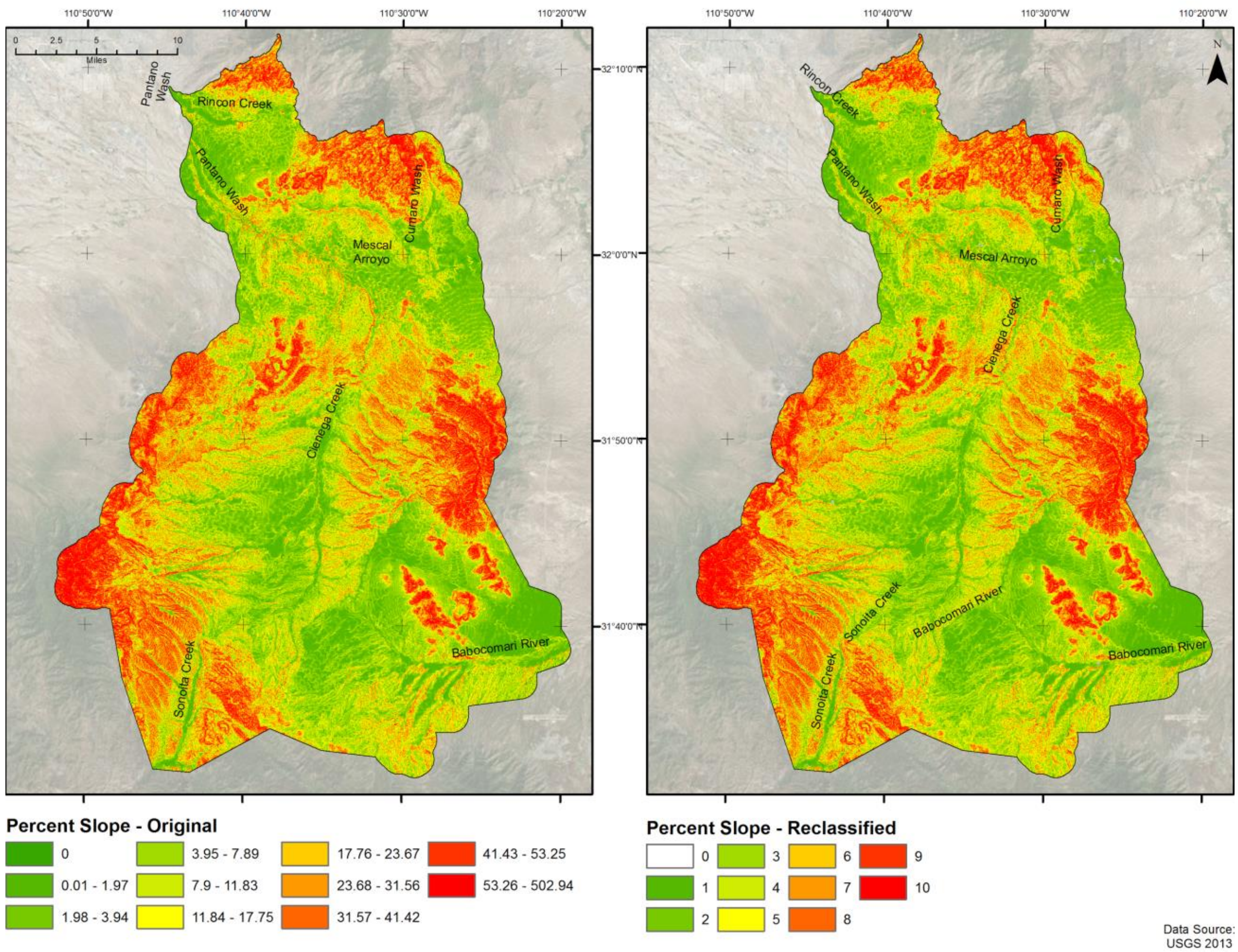


Figure 5: Curve Value

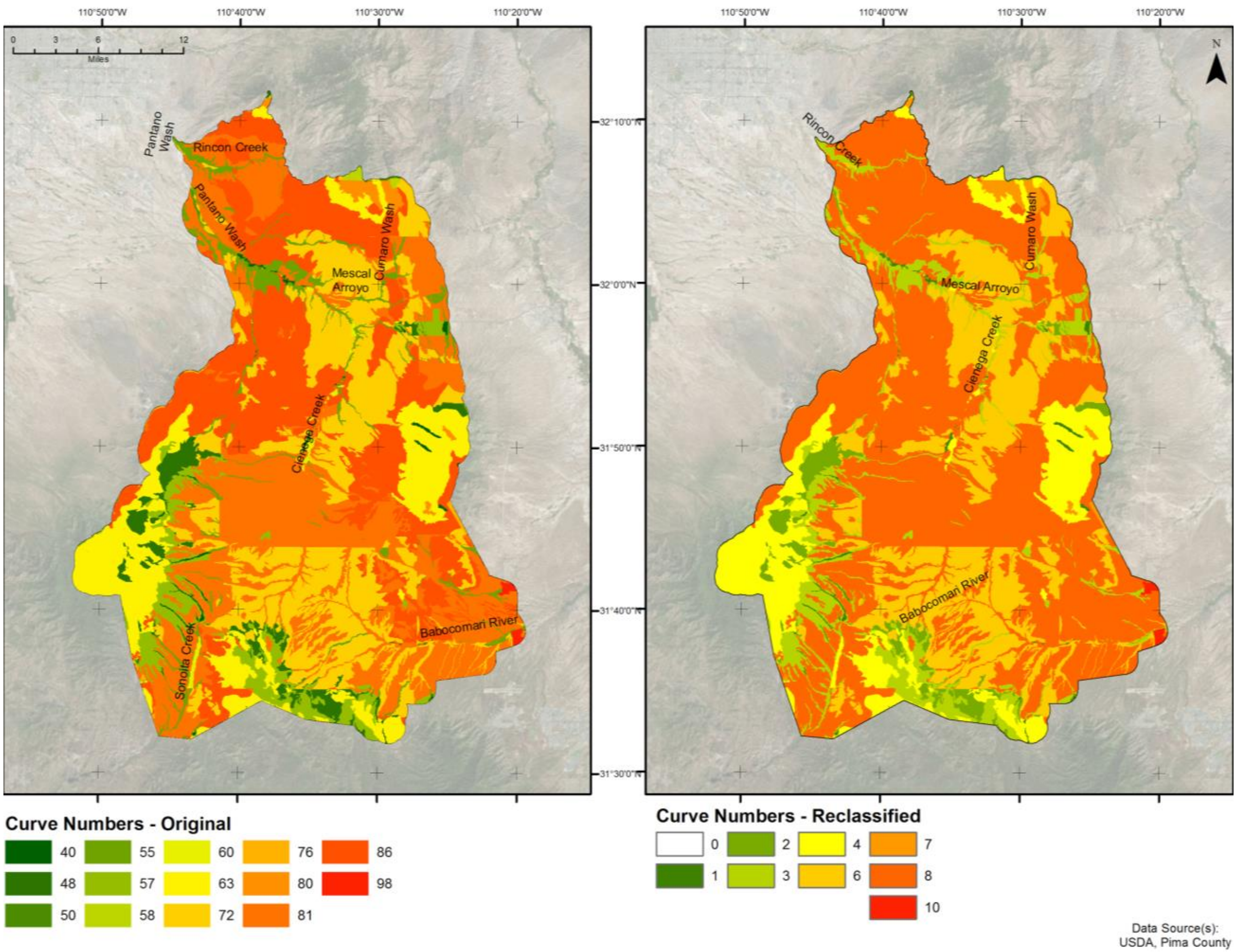


Figure 6: Proximity to Roads, Trails, Utility Lines

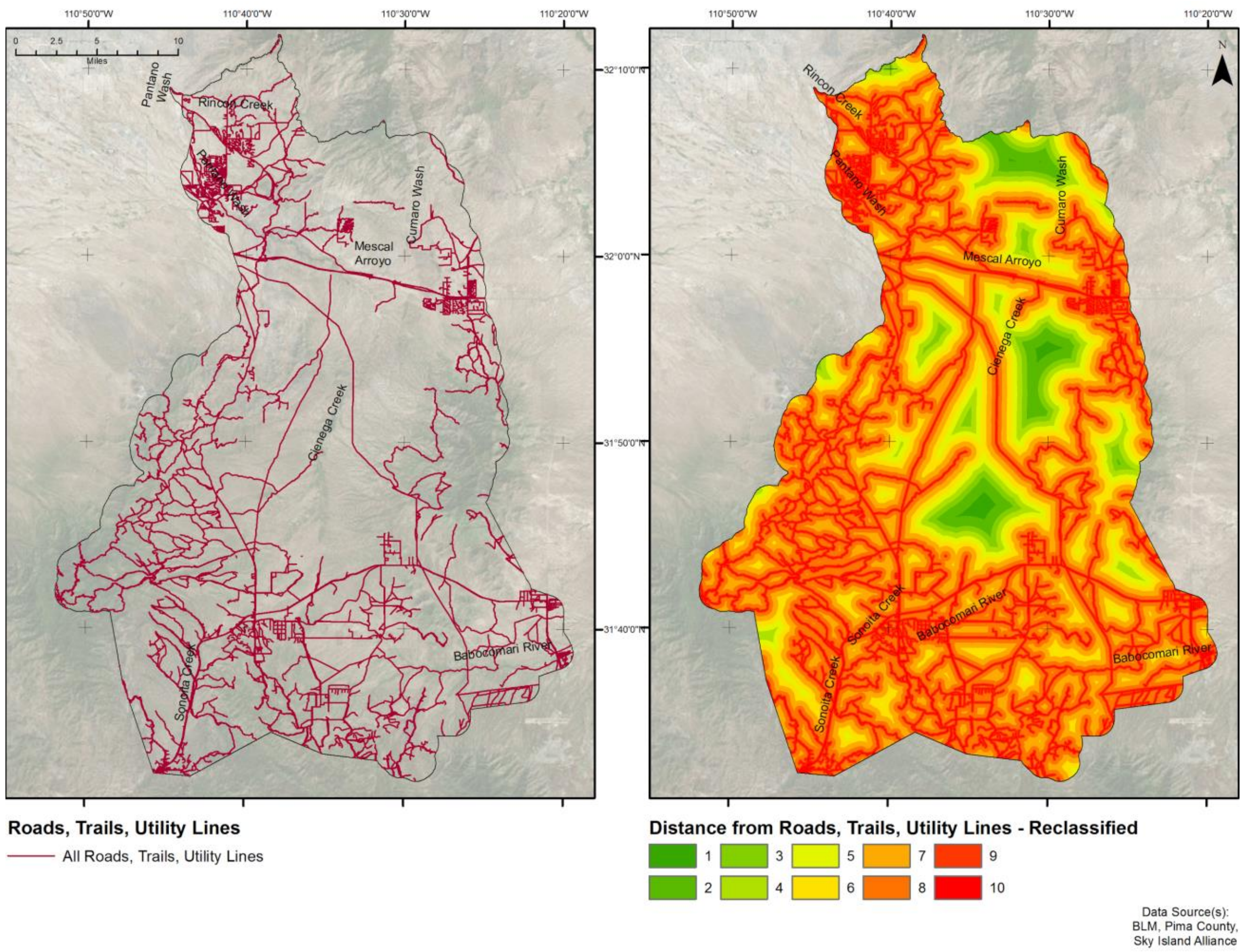


Figure 7: Overlay Results

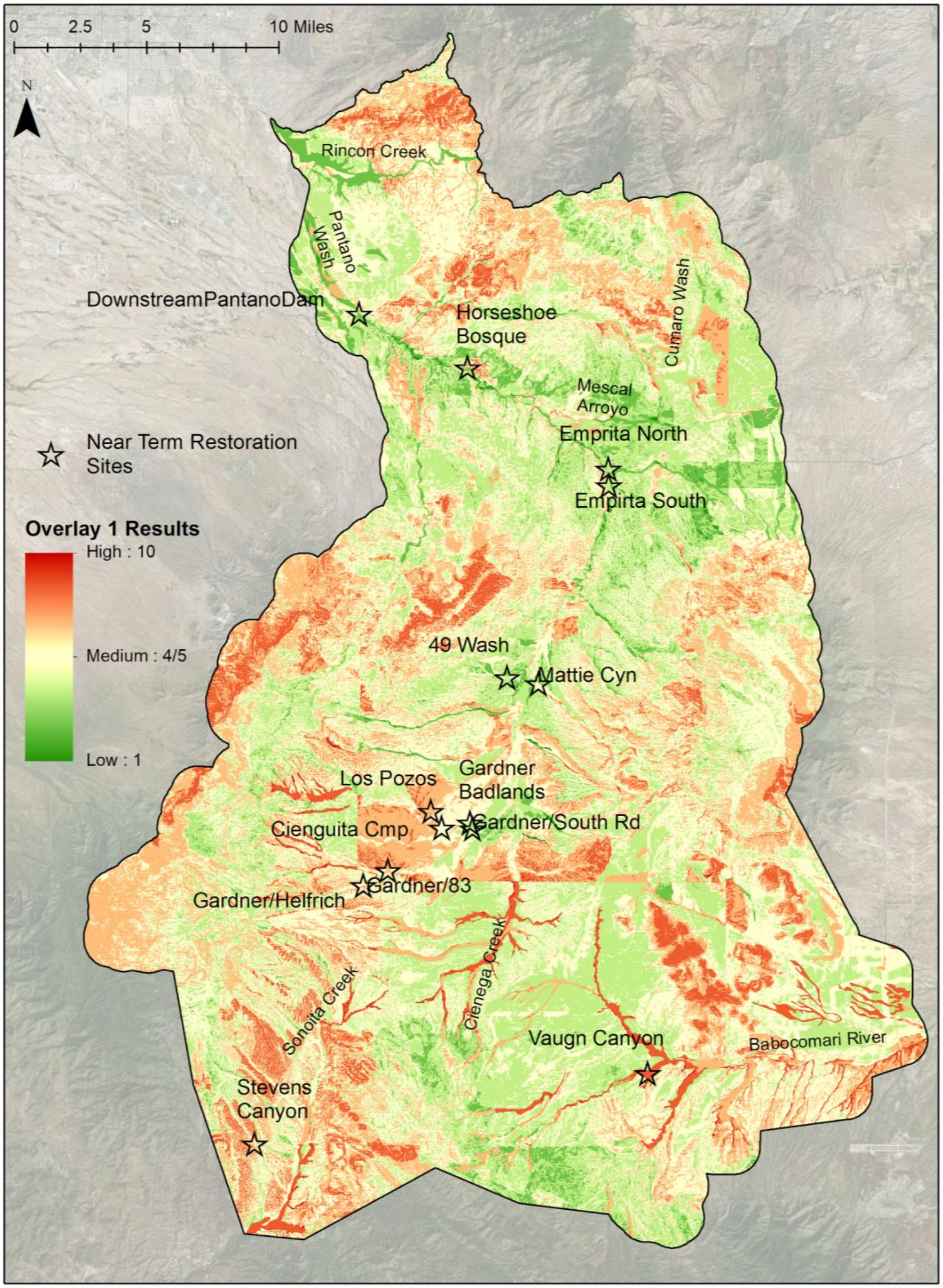
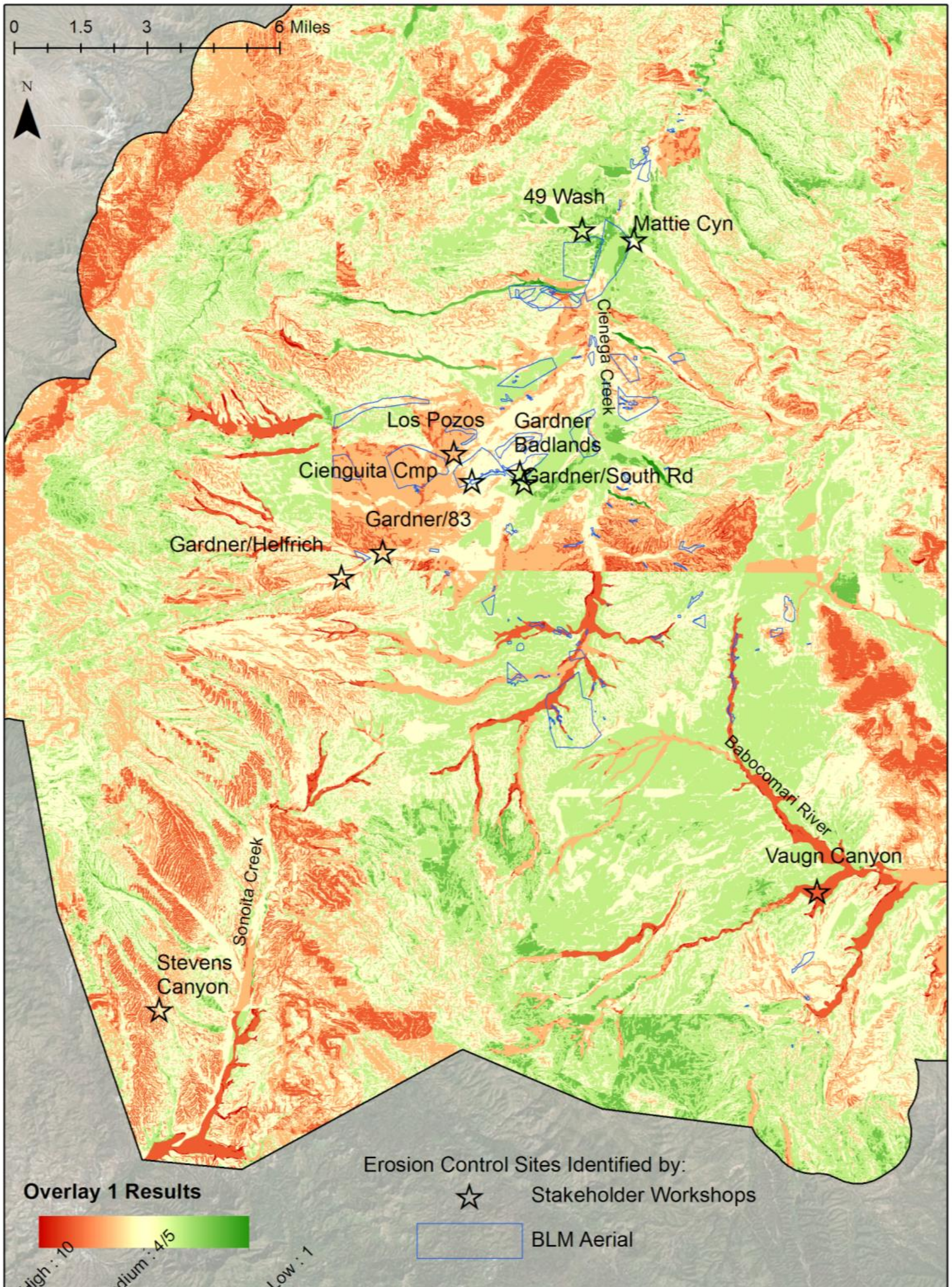


Figure 8: Overlay Results with pre-identified erosion areas, used as ground-truthing



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Acknowledgements:

The following individuals gave significant contributes to the development of this restoration plan:

Core Advisory Team Members: Mead Mier, CWP, PAG; Ben Lomeli, BLM; Gita Bodner, TNC; Dave Murray, BLM; Shela McFarlin, CWP

Stakeholder Workshop Participants: The cultural theme group included Shela McFarlin(CWP), Alison Bunting (Empire Ranch Foundation), Courtney Rose (Pima Co), Gita Bodner (TNC), Amanda Smith(PAG), and Carla Kerekes Martin (ERF). The landscape theme group included Larry Fisher (CWP), Carianne Campbell (SIA), Dave Murray (BLM), and Amanda Smith (PAG). The riparian theme group include Jennifer Varin (CNF), Scott Wilbur (AZLWT), Doug Duncan (FWS), Frank Postillion (PC RFCD), Don Carter (PC PNR), Iris Rodden (PC PNR), Hans Huth and Ron Tiller (ADEQ), Ben Lomeli (BLM), and Amanda Smith. The upland theme group included Phil Heilman (ARS), John Milliken (AAF), Linda Kennedy (ARR), Alix Rogstad (State Forestry), Brian Powell (PC OCS), Gita Bodner (TNC), Doug Siegel (PC PNR), and Vanessa Prileson (PC PNR).

Special Advisors on Erosion Modeling: Hans Huth (ADEQ), Phil Geurtin (UA), and Laura Norman (USGS)

In Addition Coronado National Forest field staff have provided valuable input on the process.

Appendix A: CWP Partnerships and scope of stakeholders

Federal, State, and Local Government Agencies

Bureau of Land Management (Tucson Field Office) | Coronado National Forest (U.S. Forest Service) | Saguaro National Park (National Park Service) | U.S. Fish and Wildlife Service | U.S. Geological Survey National Research Program: Tucson | Arizona Game and Fish Department | Pima Association of Governments | Pima County Natural Resources, Parks, and Recreation | Pima County Cultural Resources and Historic Preservation Division | Pima County Department of Transportation | Pima County Development Services | Pima County Regional Flood Control District

Research and Science Organizations

The University of Arizona – School of Natural Resources and the Environment | The University of Arizona – CLIMAS Climate Assessment for the Southwest | The University of Arizona – Arid Land Studies | The University of Arizona – Arizona NEMO (Nonpoint Education for Municipal Officials) | The University of Arizona – Institute of the Environment | The University of Arizona – Sustainability of Semi-Arid Hydrology and Riparian Areas | The University of Arizona – Cooperative Extension 4-H Youth Development

Non-Governmental Organizations

The Nature Conservancy | Sky Island Alliance | Rincon Institute | Sonoran Institute | Arizona Center for Nature Conservation – Phoenix Zoo | Arizona Land and Water Trust | Empire Ranch Foundation | Audubon Appleton-Whittell Research Ranch | Colossal Cave Mountain Park | Watershed Management Group

Interest Groups

Save the Scenic Santa Ritas | Sonoita Crossroads Community Forum | Rincon Valley Coalition | Southern Arizona Buffelgrass Coordination Center | Pima Trails Association | Arizona Trail Association | Huachuca Hiking Club | Sonoran Desert Mountain Bicyclists | Vail Preservation Society

Schools and Youth Education Groups

Empire High School | Cienega High School | Vail School District | Civano Middle School | Ironwood Tree Experience

Local Businesses, Landowners, and Residents

Among many are included: Clyne Ranch | Caldwell Design | High Haven Ranch | Kelso Family | Slattum Family | Vera Earl Ranch | Walker Ranch | Current and retired agency employees

Funding Agencies and Other Supporters

Conservation Lands Foundation | National Fish and Wildlife Foundation | Wells Fargo | Southwest Arts and Cultural Heritage Foundation | Summit Hut | Patagonia

Appendix B: A Primer on the Site Sensitivity and Capability Method

A Site Sensitivity and Capability Analysis (SSCA) was the basic approach for this prioritization model. Many watershed management problems require land users to make decisions that require analyzing many types of data, information that comes in different formats and structures that, like apples and oranges, are difficult to compare. The SSCA approach enables the tool user to understand complicated problems and find solutions that must meet multiple criteria.

This method was initially developed by the environmental planner Ian McHarg, as a means of using the environmental characteristics of a site to inform planning land uses decisions. The results were land uses that were "designed by nature" instead of at odds. Since its initial development, this approach has been used for many applications, including groundwater protection, and low income housing developments.

At its core, an SSCA is a series of weighted overlays that combine multiple quantitative and qualitative factors into a final sum.

In an overlay analysis, the problem, in our case erosion restoration prioritization, must be defined and broken down into submodels. In our case, we have three such submodels: erosion condition, valued resources at risk, and feasibility. Each of these submodels will have various input layers: for erosion condition, we considered slope, soil characteristics, runoff and precipitation, and roads.

Each input layer will be in a different numbering structure and range. To combine them for analysis each layer is reclassified into a common scale, such as 1 to 10, with 10 being the most favorable conditions. For example, the USDA soil characteristics provides soil erodibility factor with a range of numerical values from .02 to 0.7 as the most erodible. These values will be reclassified into the 1 – 10, with .7 as the most erodible, level 10.

> *ESRI Online uses the following simple example. "in a simple housing suitability model, you may have three input criteria: slope, aspect, and distance to roads. The slopes are reclassed on a 1 to 10 scale with the flatter being less costly: therefore, they are the most favorable and are assigned the higher values. As the slopes become steeper, they are assigned decreasing values, with the steepest slopes being assigned a 1. You do the same reclassification process to the 1 to 10 scale for aspect, with the more favorable aspects, in this case the more southerly, being assigned the higher values. The same reclassification process is applied to the distance to roads criterion. The locations closer to the roads are more favorable since they are less costly to build on because they have easier access to power and require shorter driveways. A location assigned a suitability value of 5 on the reclassed slope layer will*

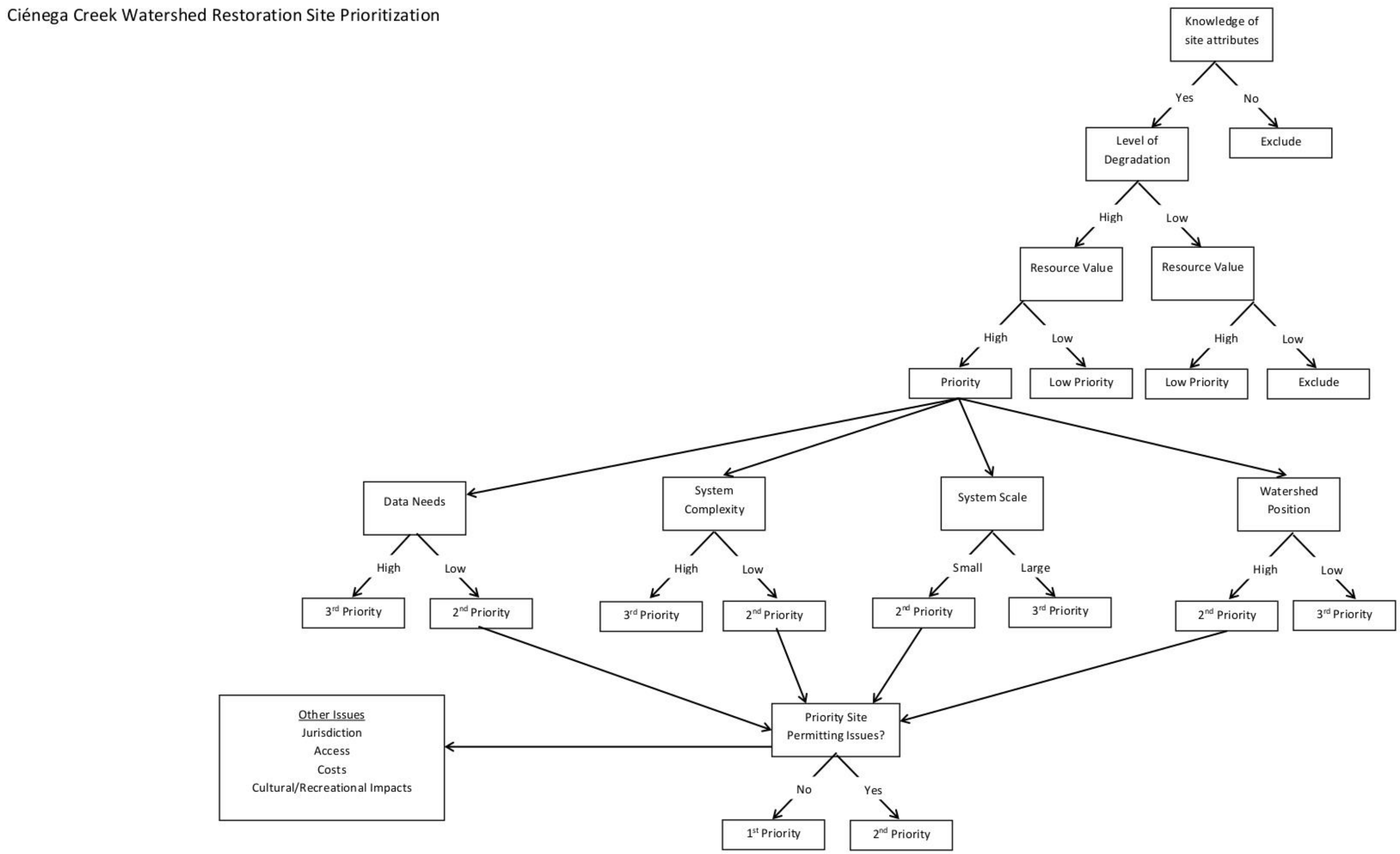
be twice as costly to build on as a slope assigned a value of 10. A location assigned a suitability of 5 on the reclassed slope layer will have the same cost as a 5 assigned on the reclassed distance to roads layer.

Each of the criteria in the weighted overlay analysis may not be equal in importance. You can weight the important criteria more than the other criteria. For instance, in our sample housing suitability model, you might decide, because of long-term conservation purposes, that the better aspects are more important than the short-term costs associated with the slope and distance to roads criteria. Therefore, you may weight the aspect values as twice as important than the slope and distance to roads criteria.

*The input criteria are multiplied by the weights and then added together. For example, in the housing suitability model, aspect is multiplied by 2 and the three criteria are added together, or represented another way, (2 * aspect) + slope + distance to roads.*

The final step of the overlay analysis process is to validate the model to make sure what the model indicates is at a site is actually there. Once the model is validated, a site is selected and the house is built." - http://pro.arcgis.com/en/pro-app/tool-reference/spatial-analyst/how-weighted-overlay-works.htm

Appendix C: Project Prioritization Flow Chart



Appendix D: Sample Stakeholder Workshop Agenda and Knowledge Acquisition Sheet

Cienega Watershed Partnership Restoration Prioritization Process Meeting

1-1:15 –Introduction, purpose and process

This CWP grant from the BLM allows us to make a long term, regionally coordinated plan for restoration instead of piecemeal one site at a time. A working tool that will incorporate data on erosion factors, both natural and human related, that will spit out a priorities for erosion restoration. This way, erosion areas can be addressed efficiently and easily, building upon the on the ground knowledge and research and making it readily accessible for each restoration opportunity that comes along. This tool can be used to identify erosion sites that are easily accessible by volunteers, or on private land for a ranching workshop, and even what has been permitted by BLM and shovel ready.

1:15-2:00 –Discuss approach, mapping and weighting of parameters

Past phases of this effort so far included major data collection across the watershed. Next phases of this project include working with the other technical teams. We will conduct “Living in the Watershed” outreach, linking to WMG’s Get Wet Guides, and restoration workshop trainings on three sites in the area.

There are a variety of characteristics available to assess erosional areas, and to define priority sites including form and function of the erosion, rates of erosion and sediment movement, upland condition, infrastructure locations, proximity to critical resources such as wetlands and Ciénega Creek, previous research, restoration, and observations, and in coordination with the BLM and partners. See next page for some of the attributes we are considering.

2:00-3:00 –Mapping exercise

The Cienega Watershed, plus some additional areas that impact and benefit the watershed, such as neighboring communities, and contributing aquifers, have been selected for our study area. A variety of features are displayed in order to inspire the gears in your noggin to start turning, but there is a lot more to it than what is displayed on the maps – that’s where the worksheets come in. You may be able to suggest more landscape data that is available.

What’s missing?
Where are the critical resources? What are the critical issues?

Site Knowledge Acquisition Form

Authors Name(s): Todays Date:

Contact Info (for follow up):

Site Name (Optional, but helpful for future reference):

Location (as specific as possible bc this is used to truth the model, match the site with other sources of information. Consider using the map grid for lat/long):

Site Description: In your own words, what is the issue that you think may need to be addressed in this particular location?

Site Characteristics (natural): What is the natural setting of the area? (e.g. is it in a stream, floodplain, upland? Are there notable habitats, vegetation, geology, or soil features?)

Site Characteristics (human): What human values are at stake? What is known about land ownership, infrastructure, or nearby land uses that might affect this area?

Treatment Considerations: When planning treatments to fix the problems and to benefit the resources described above, what should we consider to inform our choices? i.e. access, material availabilty, neighbors, outreach, TES species, permitting, etc.

<u>Other Important Insights you can offer</u>: including feedback on the process or this scoring sheet

Personal Overall Knowledge of Site:	*Somewhat familiar*				*Very familiar*

A. Problem description:

Type of problem:	*Headcut*	*NickPoint*	*Sheet Erosion*	*Water Quality*	*Other:*
Size of problem area:	*very isolated*				*Expansive*
Level of Degradation :	*Low*		*Medium*		*High*
Has this site been the location of previous restoration efforts :	*No*	*Yes*	*Anticipated/Planning Already Begun*		
Trajectory of problem :	*getting better*		*aparently stable*		*worsening*

B. Site characteristics, natural

Surface Water immediately at risk?	*Active Channel*	*Spring(s)*	*Wetlands*	*No*	*Unk*
Wetlands immediately at risk?	*Yes*	*No*	*Unk*		
Other Values at Risk	*Floodplain*	*Swale*	*Grassland*	*Other:*	
TE/Sensitive Species affected?	*Yes*	*No*	*Maybe - Suitable Habitat Present*		
Invasive species issues?	*Yes*	*No*	*Species?*		*Unk*
Cultural Sensitivity Level?	*Unknown*	*High Site Potential*			*Low Site Potential*

C. Site characteristics, human (land use, jurisdiction, etc.)

Jurisdiction?	*County:*	*State*	*Federal: (which agency?)*	*Private*	*Is the land owner interested in working with us? Yes / No*	
Infrastructure at Risk of Damage if Problem Persists?	*Road*	*Structures - Modern*	*Structures - historic*	*Fence Lines*	*Other*	
Potential Causes identified?	*Unknown / Other:*	*Road, Including GasPipieline*	*High human Use*	*Concentrated Cattle Use - example water tank, or high traffic area*	*De-Vegetation*	
Visibility?	*Not visible*	*Somewhat visible*	*Site highly visible to public*			
Land Use?	*Livestock*	*Recreation*	*Preservation*	*Industrial*	*Residential*	

D. Treatment considerations

Suitable types of treatment:	*Upland Structures*	*Channel Structures*	*Road Repair/Re-Drainage Actions*	*Other:*	*Unknown:*	
Size of upland treatments recommended:	*point location: <1 acre;*	*small: >1-10 acres;*	*med: 10-99 acres*	*large: >100 acres*		
Geologic control/Hydrological Connection						
Size of channel treatments recommended	*(1: point location, work by hand;*	*2: several structures, work by hand;*	*3: some engineering. heavy machinery for <1 week;*	*4: large structures, complex engineering, heavy machinery for >2 weeks)*		
Permitting	*Planned (3-5 years)*	*Planned (1-2 years)*	*Yes w/ DNA*	*N/A (Private Land or..)*		

Accessibility	*Very Accessible - next to a road*	*Within a short distance (<1 mi) from road*	*>1 mile from road*		
Pre and -Post-Restoration Monitoring	*Often Visited Site*	*Easily Accessible Site*	*Nearby well to track groundwater results*	*Other posibilities:*	
Expertise/preparation needed to make treatments effective & prevent harm	*Rank 1 - 5; 1 - acheivable with basic training or supervision (example, revegetation or one rock dams*				
	5 - requires extensive training and environmental awareness to avoid additional damage (ex in-stream headcut				
Will this site potentially impact a Long Term Study Site?	*No*	*Unk*	*Yes - please describe*		
Expected Benefits from Treatment? Circle all that apply:	*Stabilize channel*	*Reduce sediment load*	*Hold soil in place*	*Improve plant productivity*	*Enhance groundwater recharge*
	Improve wildlife habitat	*Protect infrastructure*	*Other:*		
Expected Time Frame for Results	*Long term*				*Short term*
Notes:					

This page is designed to inform the modeling process: These scores will help weight some information more than others within the model by giving some factors additional weight. For example, if any of these consistently score highly, then the related data may be amplified

In Generalized Conditions - all else equal, A) Rank these in terms of Contribution of Erosion Risk, which biophysical factors are a large factor:

	Less		More	Notes:
Steepness of Slope	1	2	3	
Soil Erodibility Score (K Factor)	1	2	3	
Underlying Geology	1	2	3	
Dropping Water Table	1	2	3	
Distance to Sinks	1	2	3	
Low Vegetation Cover - root structure	1	2	3	
Low Vegetation cover - canopy	1	2	3	
Bare Ground	3	2	1	
Roads, other channelization	1	2	3	
Sediment Load (In balance)	1	2	3	

Other Factors:

B) Rank In order of Valued Resources or Attributes, what should be protected first:

	Less		More	Notes:
Infrastructure	1	2	3	
Wildlife, Crucial Habitat	1	2	3	
Veg Communities (Sacaton,				
Cottonwood/Willow, etc)	1	2	3	
Watershed Position (low to high)	1	2	3	
Publicly Visible Sites	1	2	3	

Recreation Potential	1	2	3
Cultural Sites/Potential	1	2	3
Surface Water	1	2	3
Recharge Potential	1	2	3

Other Values:

Comments: