EPA/600/R-12/550 | July 2012 | www.epa.gov/research

United States Environmental Protection Agency

San Pedro River Basin Data Browser

RESEARCH AND DEVELOPMENT

San Pedro River Basin Data Browser

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U.S. Environmental Protection Agency
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Washington, DC 20460

Suggested Citation:

Boykin, K.G., T.S. Schrader, R.K. Guy, W.G. Kepner, A.E. Ernst, A.N. el Sadek, and W.W.S. Yee. 2012. San Pedro River Basin Data Browser. EPA/600/R-12/550. 19 Pp.

ABSTRACT

Acquisition of primary spatial data and database development are initial features of any type of landscape assessment project. They provide contemporary land cover and the ancillary datasets necessary to establish reference condition and develop alternative future scenarios that serve as input variables for various hydrological, habitat, economic, and natural resource models. The purpose of this database is to provide a long-term record keeping (archiving) system with easy public access to an array of spatial data for the entire San Pedro River Basin (U.S./Mexico). We collected spatial and tabular data that were freely available on the Internet; processed data to create seamless datasets; and created land cover datasets at the Ecological System thematic level and National Land Cover Dataset (NLCD) thematic level using Classification and Regression Tree (CART) analysis.

Disclaimer

Users are advised that the majority of coverages within the database have been provided by a number of other agencies. Verification of the quality and use of any data supplied via this product are the responsibility of the user. This report has been subjected to the U.S. Environmental Protection Agency peer and administrative review process and approved for publication.

TABLE OF CONTENTS

LIST OF TABLES viii

LIST OF FIGURES viii

INTRODUCTION 1

APPROACH 2

Spatial and Tabular Collection from Freely Available Internet Sources 2

Data Processing and Co-registration (Including Metadata) 4

Land Cover Mapping 5

Organize Datasets and Supplementary Data and Operationalize into an Online Data Browser 12

CONCLUSIONS 12

REFERENCES 13

APPENDICES 15

Appendix A. Data Inventory 15

Appendix B. List of Datasets Collected with Sources. 16

Appendix C. Training Sites used Per Land Cover Class in Classification and Regression Tree Modeling. 19

LIST OF TABLES

Table 1. Integrated Climate and Land-Use Scenarios Categories Related to the IPCC Emissions Storylines (U.S. Environmental Protection Agency 2009, Nakicenovic and Swart 2000). 4

Table 2. List of ETM+ satellite images for use in land cover mapping of San Pedro Watershed. 6

Table 3. Crosswalk of Ecological Systems and National Land Cover Dataset Classifications. 11

LIST OF FIGURES

Figure 1. San Pedro Watershed River Basin (U.S./Mexico) 3

Figure 2. ETM+ Scenes for land cover mapping in the San Pedro Study Area. 7

Figure 3. Mapping zone and San Pedro watershed boundary used for Classification and Regression Tree (CART) land cover mapping 8

Figure 4. Ecological systems mapped for the San Pedro watershed study area using Classification and Regression Tree (CART) analysis. 9

Figure 5. National Land Cover Dataset mapped for the San Pedro watershed study area using Classification and Regression Tree (CART) analysis. 10

ACKNOWLEDGEMENTS

Support for this data browser and report were provided by the U.S. Environmental Protection Agency (EPA), Region 9 and the Office of Research and Development. The report and database have been subjected to the EPA peer and administrative review process and have been approved for publication. We would like to also acknowledge the key reviewers, David C. Goodrich (USDA Agricultural Research Service, Southwest Watershed Research Center, Tucson, AZ) and David F. Bradford (USEPA, Office of Research and Development, Las Vegas, NV) for this report. Our thanks in particular go to Shea Burns (USDA/ARS-SWRC) for assisting us with obtaining the ICLUS datasets.

INTRODUCTION

The San Pedro River Basin Data Browser was developed by the New Mexico Cooperative Fish and Wildlife Research Unit (New Mexico State University, Las Cruces, NM) in conjunction with EPA Region 9 (San Francisco, CA) and the EPA Office of Research and Development (Landscape Ecology Branch, Las Vegas, NV).

The goal of the EPA Landscape Sciences Program is to improve decision-making relative to environmental management through the development of an integrated system of landscape metrics, spatial statistics, and various process models. The program has operated simultaneously along two lines, 1) a research component to develop and test landscape indicators and assessment protocols, and 2) an implementation component to demonstrate the application of landscape analysis protocols to ecological and hydrological assessments via geographic initiatives.

Acquisition of primary spatial data and database development are initial features of any landscape assessment project. They provide contemporary land cover and the ancillary datasets necessary to establish reference conditions and develop alternative future scenarios that serve as input variables for various hydrological, habitat, economic, and natural resource models. The purpose of this database is to provide a long-term record keeping (archiving) system with easy public access to an array of spatial data for the entire San Pedro River Basin (approximately 9,800 km^2) from the headwaters in Cananea, Sonora to the confluence with the Gila River at Winkelman, Arizona (Figure 1). The upper watershed (Cananea, Sonora to Redington, Arizona) encompasses an area of approximately 7,600 km^2 (5,800 km^2 in Arizona and 1,800 km^2 in Sonora, Mexico); the lower basin below Redington includes an additional 2,200 km^2. A similar geospatial database was developed specifically for the Upper San Pedro watershed during an earlier research campaign (Kepner et al. 2003, http://www.epa.gov/nerlesd1/land-sci/san_pedro/).

The most important features developed by the New Mexico Cooperative Fish and Wildlife Research Unit for this database are two digital land cover maps (and associated metadata files) generated from imagery originally acquired via the Southwest Regional Gap Analysis Project (http://fws-nmcfwru.nmsu.edu/swregap/). The source data are 30 m pixel resolution Landsat 7 ETM+ images (Path/Row 35/37, 35/38, and 35/39) obtained during the spring, summer, and fall of 1999-2000. They were assigned a coordinate system based on the information in their metadata and then put into a common projection (UTM Zone 12, NAD83). The map products include a 34-class digital land cover map classified to the Ecological System level of the National Vegetation Classification System (http://earth.gis.usu.edu/swgap/data/atool/files/swgap_legend_desc.pdf) and an aggregated 10-class land

cover map classified to Formation level of the National Land Cover Dataset (NLCD; Comer and Schulz 2007, Jennings et al. 2009).

The output of this project provides data elements (Appendix A and B) that include an online database that will facilitate spatial analyses of physical, biological, and chemical functions of the watershed.

APPROACH

Spatial and Tabular Collection from Freely Available Internet Sources

We collected spatial and tabular data from a variety of sources (See Appendix B). Data collection consisted of searching the internet to identify spatial datasets applicable to the San Pedro Study Area (Figure 1). We used an initial list of spatial datasets compiled by the EPA (Kepner et al. 2003, http://www.epa.gov/nerlesd1/land-sci/san_pedro/). We collected additional datasets that were freely available on the internet for inclusion. All datasets collected were assigned a coordinate system based on the information in their metadata and then put into a common projection (UTM Zone 12, NAD83). Datasets were exported to a shapefile (for vector datasets) or ESRI grid or ERDAS .img (for grid datasets). Datasets were then compressed as individual .zip files using WinZIP 9.0. Soil Survey Geographic (SSURGO) and State Soil Geographic (STATSGO, aka U.S. General Soil Map) data were obtained from the USDA/NRCS Geospatial Data Gateway. Federal Geographic Data Committee (FGDC) compliant metadata for new datasets were created after processing. Datasets covered the Arizona portion, the Sonora portion, or the entire watershed (Entire Basin). Categorically, these included hydrological, geological, elevation, and land cover (Appendix B).

Additionally, we downloaded the EPA Integrated Climate and Land Use Scenario (ICLUS v 1.3) datasets (EPA 2009, 2010). The ICLUS datasets are in ESRI grid format (100 m resolution). The project housing densities are in 10-year increments from the year 2010 to the year 2100, and based on five climate change scenarios (Table 1): A1, B1, A2, B2 and BC. The five scenarios represent different Intergovernmental Panel on Climate Change (IPCC 2001) emission storylines related to population growth and economic strategy (EPA 2009). This resulted in a total of 50 spatial datasets.

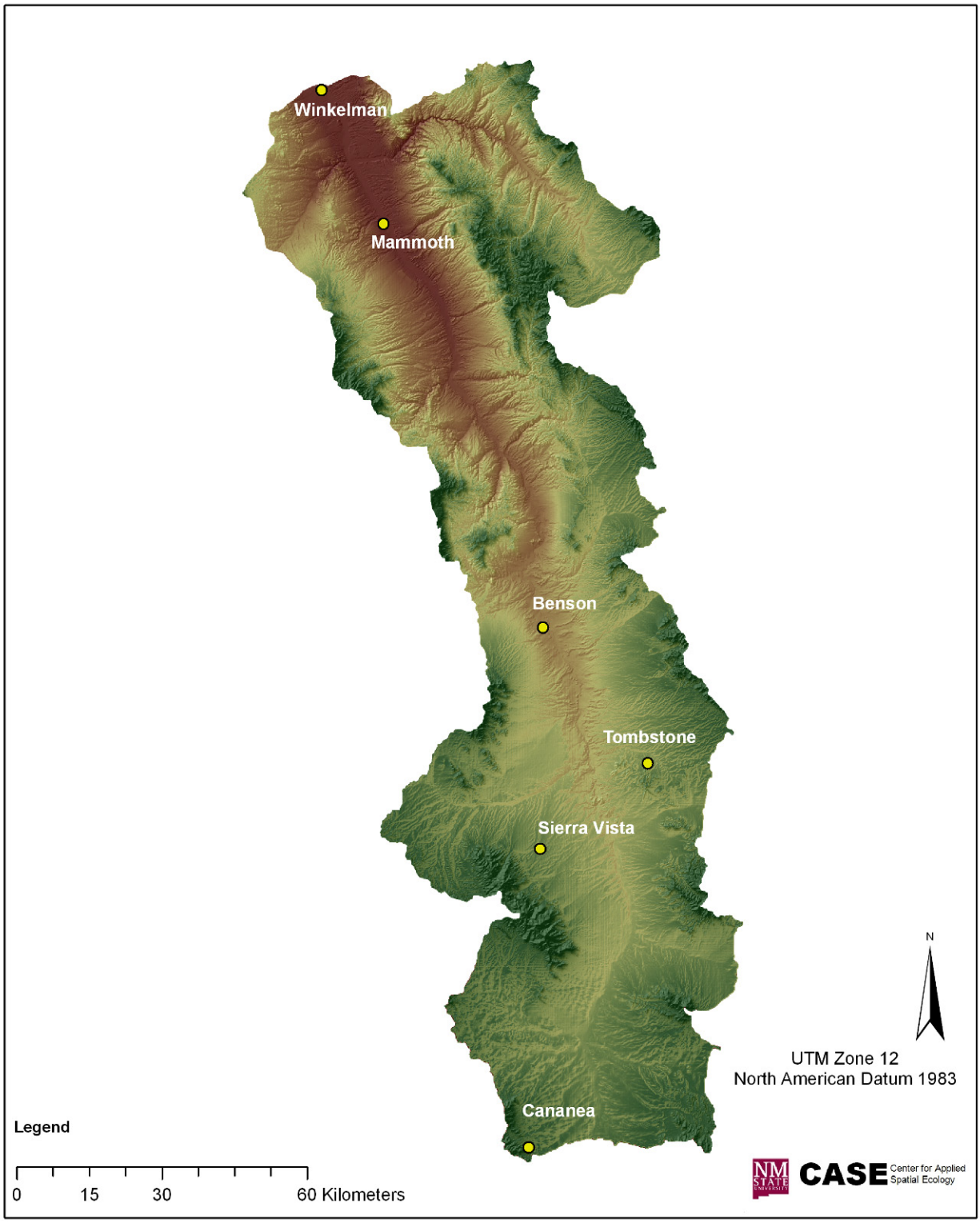

Figure 1. San Pedro Watershed River Basin (U.S./Mexico)

Table 1. Integrated Climate and Land-Use Scenarios Categories Related to the IPCC Emissions Storylines (U.S. Environmental Protection Agency 2009, Nakicenovic and Swart 2000).

Scenario	Description
BC	Baseline Condition. Medium fertility, medium domestic migration, and medium international migration.
A1	Low fertility, high domestic and international migration. Fast economic growth, low population growth, and high global integration.
B1	Low fertility and domestic migration, high international migration. Globally integrated world with emphasis on environmentally sustainable economic development.
A2	High fertility and domestic migration, medium international migration. Continued economic development with regional focus and slower economic convergence between regions.
B2	Medium fertility and international migration, low domestic migration. Regionally oriented world of moderate population growth, local solutions to environmental and economic issues.

Data Processing and Co-registration (Including Metadata)

Data that were of the same type with similar attributes (e.g., roads) were merged to form a seamless data layer. This was only possible for vector coverages, roads, streams, and ownership as there were differences in the United States and Mexico datasets. Standards used within the United States vary depending on agency and focus. These differences increase when combining data from the United States and Mexico. An example is the combined roads coverage for the study area. Discrepancies exist between where each country identified the international border and the detail in which the roads were mapped.

Once datasets were downloaded, they were manipulated in ArcGIS 9.3 and ArcGIS 10 in order to clip the data to the area of the San Pedro River Basin. Raster datasets were rescaled to a 30 m resolution. If data were downloaded in subsets of the river basin, then each subset was mosaicked together in order to create a seamless dataset prior to masking the data to the river basin.

Some datasets were too large to mosaic into seamless datasets. Both DRGs and DOQQs were downloaded in their native format as MrSID rasters, a format meant to handle very large data. Converting these datasets to ERDAS Imagine (.img) or .tiff formats would have resulted in a loss of detail. Therefore, both DRGs and DOQQs were downloaded by county in order to be easily referenced and retain detail.

Once all datasets were collected they were projected to NAD 83 Albers UTM Zone 12 to create uniform data in a common projection. After they were projected, metadata were created for each dataset using a combination of the original metadata. We generated the metadata using the EPA Metadata Editor 3.1 and validated it for completeness. All files were then zipped using WinZip 9.0.

Land Cover Mapping

We created a land cover map for the San Pedro Watershed using methods similar to the Southwest Regional Gap Analysis Project (Prior-Magee et al. 2007) to derive an Ecological System level (Comer et al. 2003) land cover map for the Entire Basin (Lowry et al. 2007a, Lowry et al. 2007b). We obtained imagery (Landsat 7 ETM+) for the San Pedro Basin with dates (Table 2; Figure 2) similar to the Southwest Regional Gap Analysis Project (1999 – 2001). Three seasons of imagery were used to coincide with spring, summer, and fall. A mosaic of each season was created using ERDAS Imagine 8.6 for a larger area of southeastern Arizona, southwestern New Mexico, and Sonora, Mexico (Figure 3). This included one mapping zone from SWReGAP (New Mexico Map Zone 3) and the San Pedro watershed boundary. Imagery derived derivatives (e.g. tasseled cap datasets) were created for Classification and Regression Tree (CART) modeling. The DEM and DEM derived datasets of slope, aspect, and landform were also created from the Shuttle Radar Topography Mission (SRTM). Existing training site datasets from the Southwest Regional Gap Analysis Project were used as training sites for CART modeling. This included 1399 points for 26 land cover classes (Appendix C).

Modeling used ERDAS, CART Sampling Tool, and See5 software to generate the land cover map. The final map was derived by using most of the training sites (99%) with < 1% used for validation. No minimum samples were used. We used See5 to construct the classifier tree using a boost of 15 trials and no global pruning (See methods in Lowry et al. 2007a). The output image was clumped using four connected neighbors and eliminated any area less than 0.4 ha. Non-CART modeled classes were first clustered using an unsupervised classification and then identified as urban, agriculture, open water, and fire scar areas. These classes were pasted back into the final land cover map. We provide a dataset at the broadest scale and another dataset clipped to the buffered San Pedro watershed boundary.

We used the SWReGAP land cover legend (see description of SWReGAP ecological systems at http://earth.gis.usu.edu/swgap/data/atool/files/swgap_legend_desc.pdf). The resulting land cover dataset had 34 land cover types in the study area (Figure 4). The ecological systems dataset was aggregated (Table 3) to the National Land Cover Dataset (NLCD) dataset (Fry et al. 2011) with 10 land cover types (Figure 5).

No accuracy assessment was conducted on these datasets. However, Lowry et al. (2007a, 2007b) discuss assessments using this protocol.

Table 2. List of ETM+ satellite images for use in land cover mapping of San Pedro Watershed.

Path/Row	Season	Date
35/37	Spring	5/7/2000
	Summer	9/12/2000
	Fall	11/13/1999
35/38	Spring	4/5/2000
	Summer	9/12/2000
	Fall	11/13/1999
35/39	Spring	04/05/2000
	Summer	09/12/2000
	Fall	11/13/1999
36/37	Spring	4/12/2000
	Summer	6/15/2000
	Fall	10/19/1999

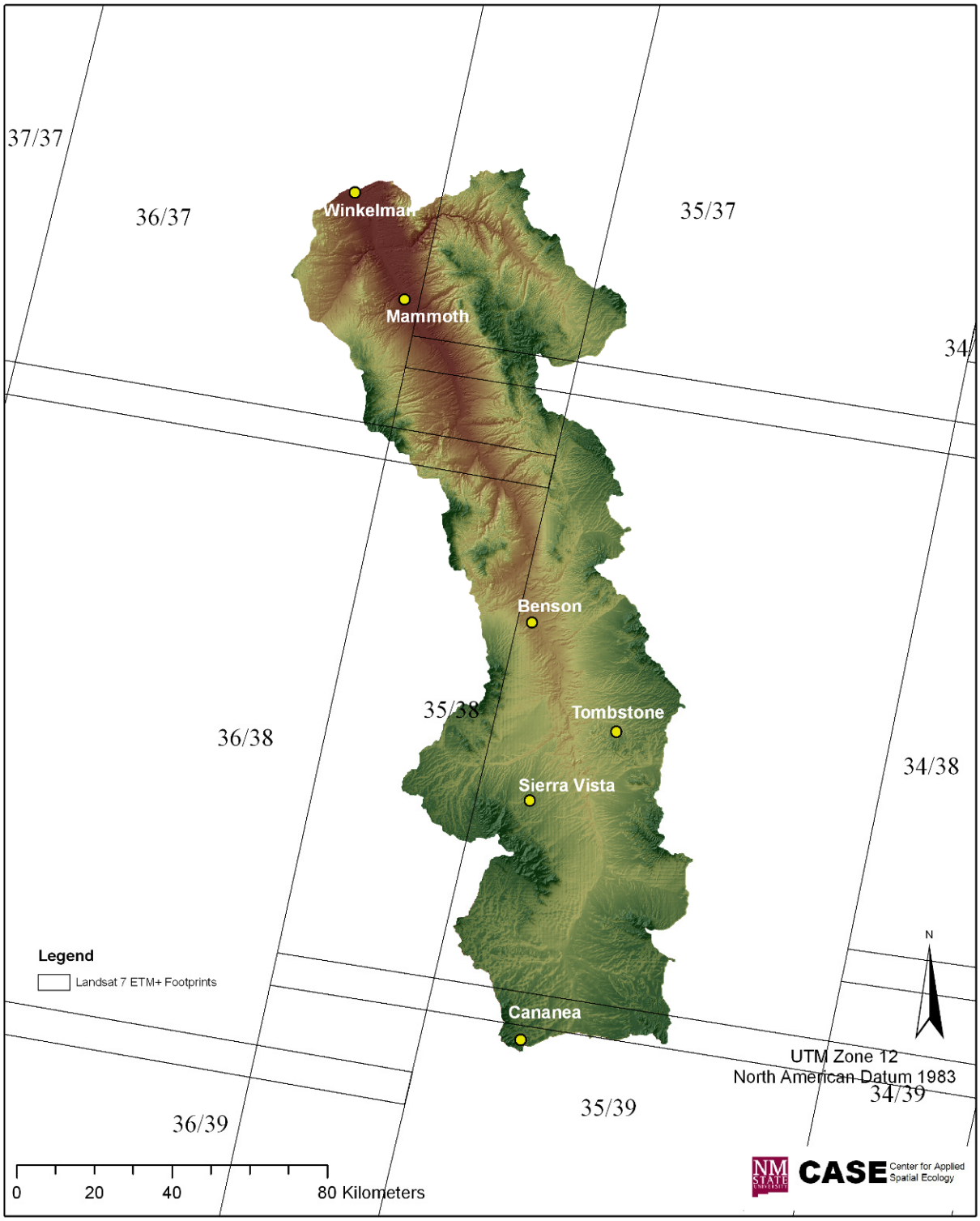

Figure 2. Landsat ETM+ Scenes for land cover mapping in the San Pedro Study Area.

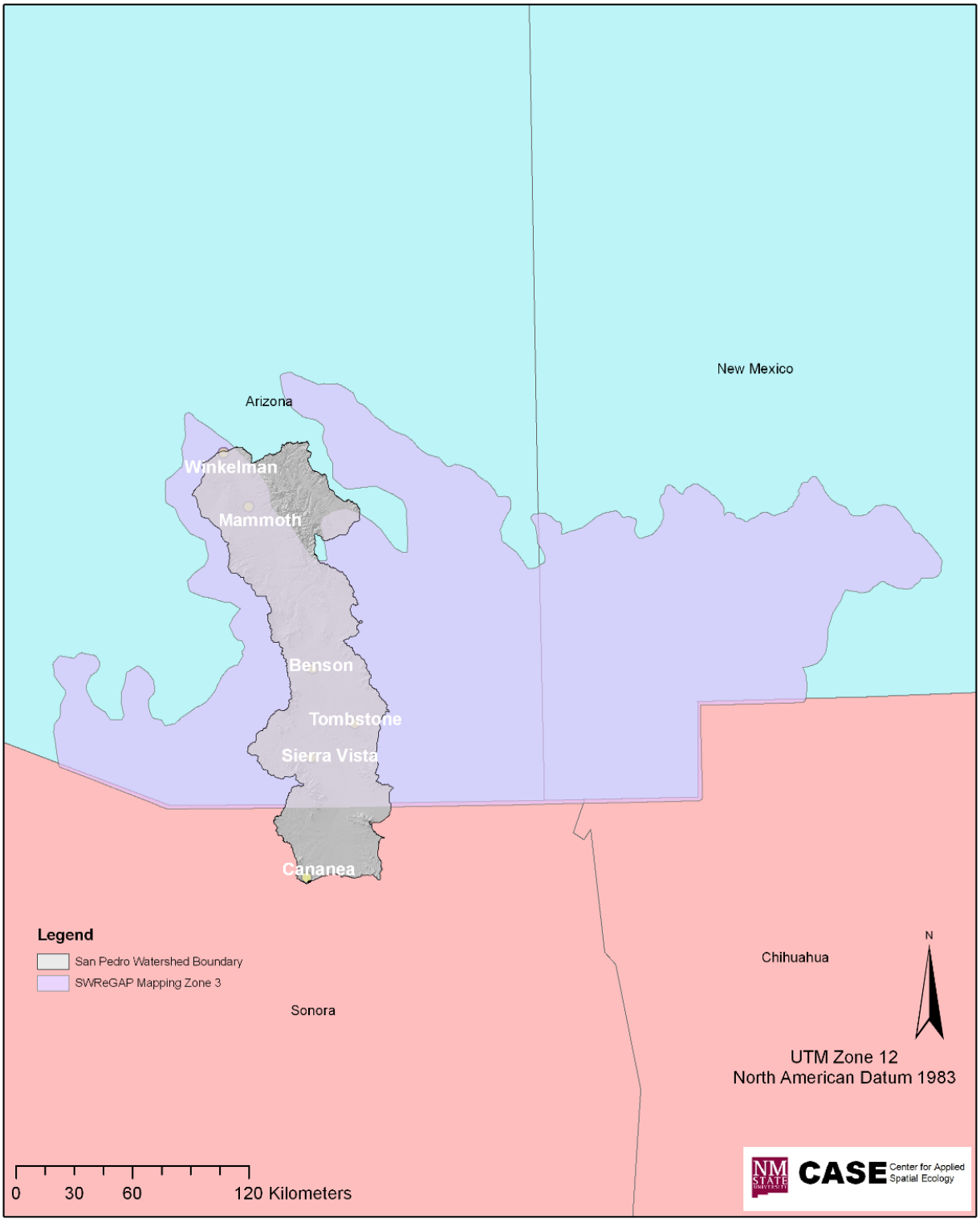

Figure 3. Mapping zone and San Pedro watershed boundary used for Classification and Regression Tree (CART) land cover mapping.

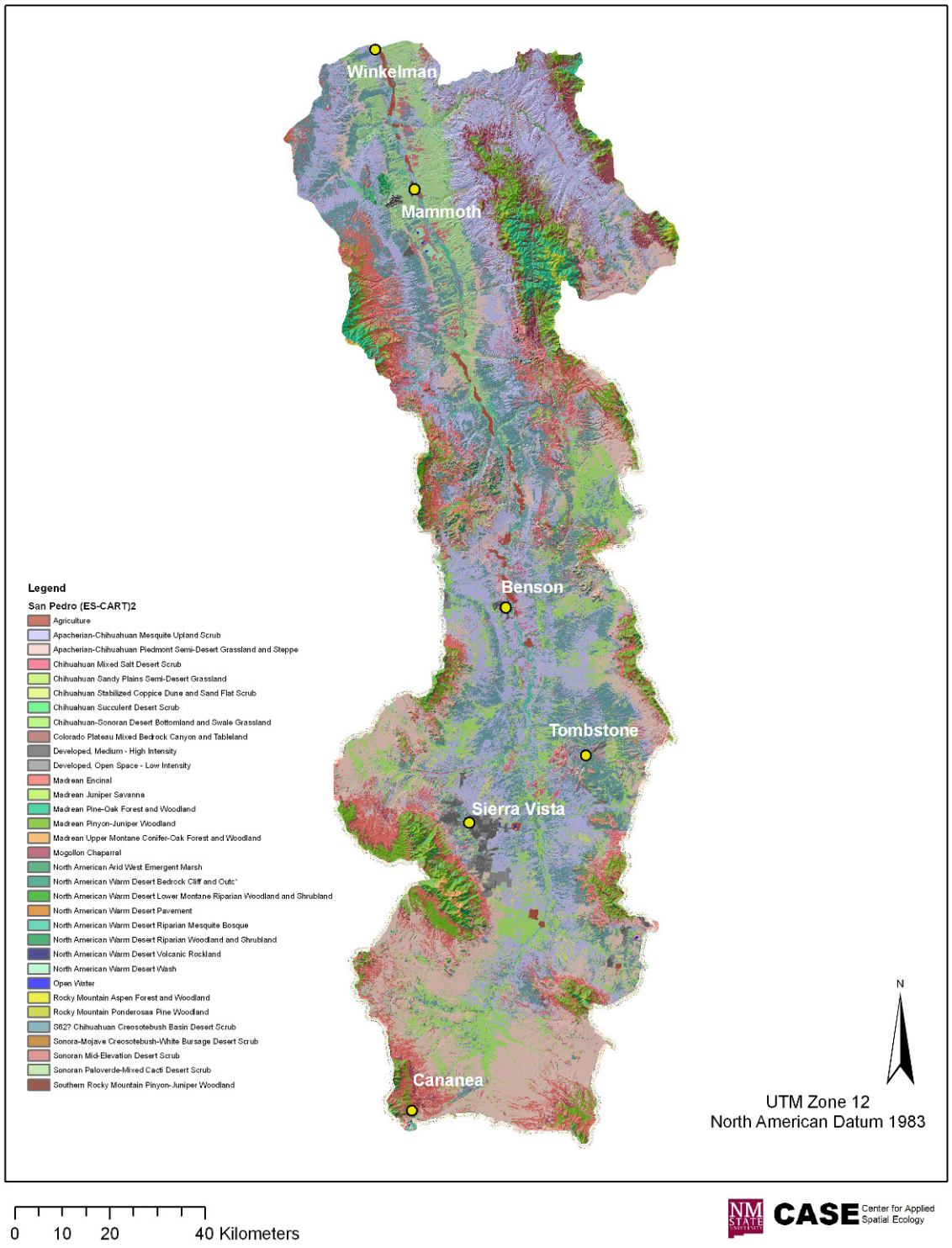

Figure 4. Ecological systems mapped for the San Pedro watershed study area using Classification and Regression Tree (CART) analysis.

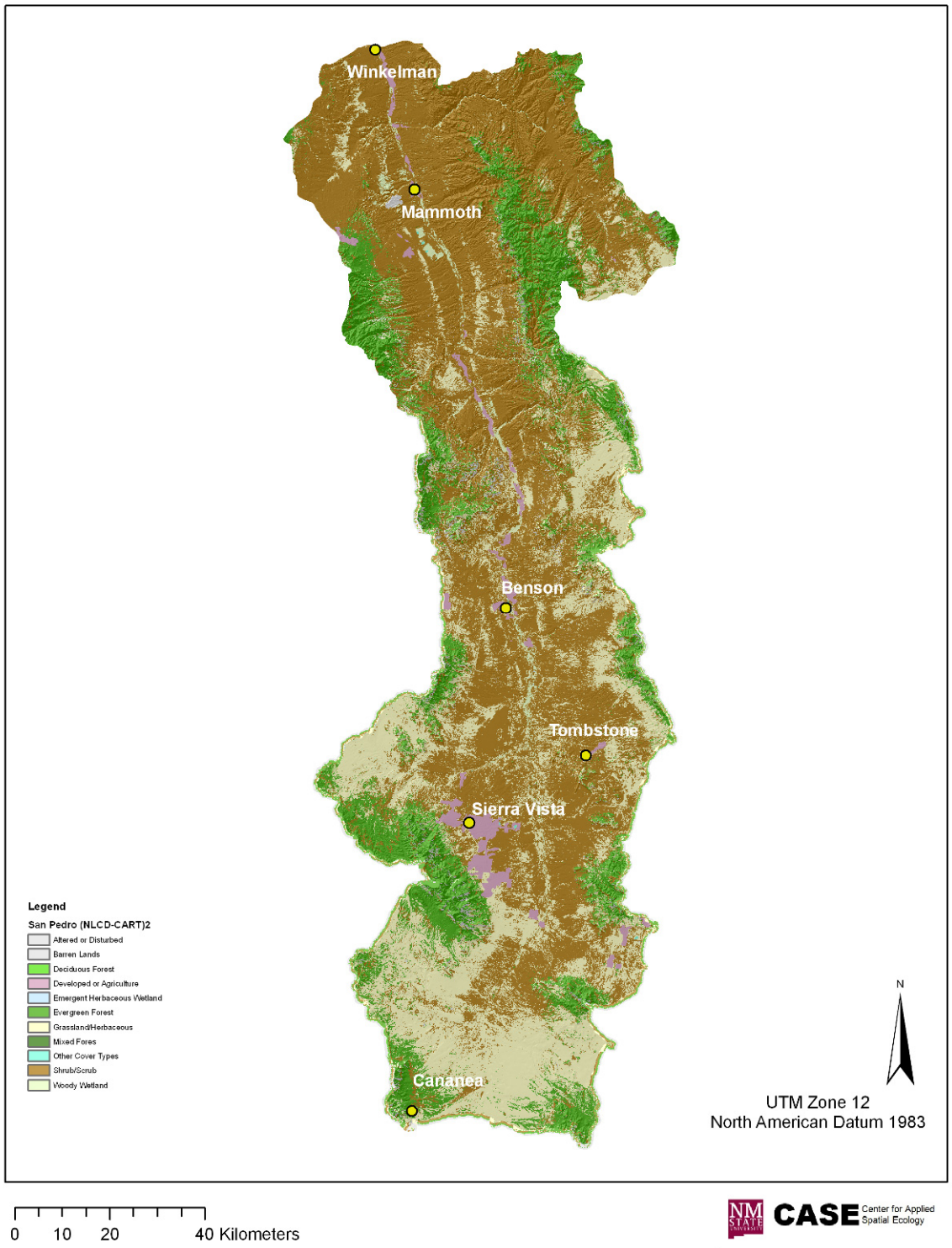

Figure 5. National Land Cover Dataset mapped for the San Pedro watershed study area using Classification and Regression Tree (CART) analysis.

Table 3. Crosswalk of Ecological Systems and National Land Cover Dataset Classifications.

Code	NLCD Description	SWReGAP Land Cover Description	% of Area
S016	Barren Lands	North American Warm Desert Bedrock Cliff and Outcrop	0.7%
S010	Barren Lands	Colorado Plateau Mixed Bedrock Canyon and Tableland	4.9%
S021	Barren Lands	North American Warm Desert Pavement	0.1%
S019	Barren Lands	North American Warm Desert Volcanic Rockland	0.2%
S112	Evergreen Forest	Madrean Pinyon-Juniper Woodland	4.4%
S036	Evergreen Forest	Rocky Mountain Ponderosa Pine Woodland	10.2%
S038	Evergreen Forest	Southern Rocky Mountain Pinyon-Juniper Woodland	3.1%
S051	Evergreen Forest	Madrean Encinal	0.9%
S035	Evergreen Forest	Madrean Pine-Oak Forest and Woodland	1.2%
S111	Evergreen Forest	Madrean Upper Montane Conifer-Oak Forest and Woodland	0.2%
S023	Deciduous Forest	Rocky Mountain Aspen Forest and Woodland	4.3%
S069	Shrub/Scrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	12.1%
S057	Shrub/Scrub	Mogollon Chaparral	2.3%
S116	Shrub/Scrub	Chihuahuan Mixed Salt Desert Scrub	0.9%
S058	Shrub/Scrub	Apacherian-Chihuahuan Mesquite Upland Scrub	6.5%
S061	Shrub/Scrub	Chihuahuan Succulent Desert Scrub	0.0%
S129	Shrub/Scrub	Sonoran Mid-Elevation Desert Scrub	1.1%
S062	Shrub/Scrub	Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	5.6%
S063	Shrub/Scrub	Sonoran Paloverde-Mixed Cacti Desert Scrub	8.1%
S068	Shrub/Scrub	Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub	1.2%
S077	Grassland/Herbaceous	Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	9.3%
S113	Grassland/Herbaceous	Chihuahuan Sandy Plains Semi-Desert Grassland	0.2%
S115	Grassland/Herbaceous	Madrean Juniper Savanna	0.2%
S097	Woody Wetland	North American Warm Desert Riparian Woodland and Shrubland	0.1%
S098	Woody Wetland	North American Warm Desert Riparian Mesquite Bosque	0.2%
S020	Woody Wetland	North American Warm Desert Wash	0.1%
S094	Woody Wetland	North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0.1%
S100	Emergent Herbaceous Wetland	North American Arid West Emergent Marsh	0.2%
D03	Altered or Disturbed	Recently Mined or Quarried	0.3%
D04	Altered or Disturbed	Invasive Southwest Riparian Woodland and Shrubland	0.3%
N22	Developed or Agriculture	Developed, Medium - High Intensity	1.5%
N80	Developed or Agriculture	Agriculture	15.7%
N21	Developed or Agriculture	Developed, Open Space - Low Intensity	1.5%
N11	Other Cover Types	Open Water	2.3%

Organize Datasets and Supplementary Data and Operationalize into an Online Data Browser

All datasets collected were uploaded to a project website. These were organized by pages in order to provide an intuitive and user-friendly navigation environment. Main categories covered in separate webpages (and subsets thereof) included the home page with an introduction to the project, the GIS datasets, contact information, related links and references to the project such as to SWReGAP, and a copy of this document.

Datasets were organized by their category: Land Cover, Hydrology, Elevation/Geology, Ancillary, and Integrated Climate and Land Use Scenarios (ICLUS).

These were arranged in a table under each category. Columns in the table include the name of the dataset, the locality of the dataset ("Arizona", "Mexico", or "Entire Basin"), the file format, a link to an image of the dataset in JPEG format, a link to metadata for the dataset in HTML format, and a link to the online source of the dataset. ICLUS, however, links to a separate webpage where the datasets are organized by scenario and year.

CONCLUSIONS

Land cover datasets were created for the San Pedro watershed. The two thematic scales at which these data were created provide a baseline for alternative futures work similar to Steinitz et al. (2003) and hydrological analysis similar to Kepner et al. (2004). Furthermore, these datasets provide base datasets for habitat modeling as conducted in Boykin et al. (2007) and Boykin et al. (2008).

Additionally, we made available seamless Integrated Climate and Land Use Scenarios, elevation, geology, hydrology, satellite imagery, and ancillary datasets. Finally, these datasets were uploaded and organized into an online data browser in order to be easily accessible for public access and download. The datasets created from this effort also support and extend the datasets previously collected as part of The San Pedro River Geo-data Browser and Assessment Tools (Kepner et al. 2003, http://www.epa.gov/nerlesd1/land-sci/san_pedro/).

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APPENDICES

Appendix A. Data Inventory

There are a number of data elements associated with the San Pedro River Data Browser (http://fws-case-12.nmsu.edu/SanPedro/). All data are provided in WinZIP 9.0 compressed zip files.

Data elements include:

1. Data Collection
   - Minimum of 30 datasets and associated metadata for use in subsequent tasks.
2. Data Process
   - Zip files of seamless datasets and associated metadata
3. Land Cover Mapping
   - Land cover map for San Pedro River Basin study area
     - Ecological System Level similar to product for SWReGAP
     - NLCD Classification
   - Combined DEM for San Pedro River Basin Study Area
   - FGDC metadata for delivered geospatial datasets
4. Summary report describing methods, processing, and data

Appendix B. List of datasets collected with sources.

Data Type	Area	Dataset	Source
Ancillary	Arizona	AZ Roads	United States Department of Transportation
	Arizona	AZ Non-Populated Names	http://datagateway.nrcs.usda.gov
	Arizona	AZ Geographic Names Populated	http://datagateway.nrcs.usda.gov
	Arizona	AZ Quad 12k	http://datagateway.nrcs.usda.gov/
	Arizona	AZ Quad 24k	http://datagateway.nrcs.usda.gov/
	Arizona	AZ County	http://www.epa.gov/esd/land-sci/san_pedro/geodata/arizona.html
	Sonora	Sonora Place names	http://www.epa.gov/nerlesd1/land-sci/san_pedro/geodata/sonora
	Sonora	SO Roads	http://www.epa.gov/esd/land-sci/san_pedro/geodata/sonora.html
	Entire Basin	SP Quad 100k	http://datagateway.nrcs.usda.gov/
	Entire Basin	SP Quad 250k	http://datagateway.nrcs.usda.gov/
	Entire Basin	SP Study Area	Created for this project
	Entire Basin	SP Roads	Created for this project
	Entire Basin	SP Names	Created for this project
Census	Arizona	AZ Census Tracts	http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm?sfips=04
	Arizona	AZ Urban Areas	http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm?sfips=04
	Sonora	SO Population Centers	http://www.epa.gov/nerlesd1/land-sci/san_pedro/geodata/sonora
DEM/ Derivatives	Entire Basin	SP Aspect	http://seamless.usgs.gov/ for Arizona
	Entire Basin	SP DEM	http://seamless.usgs.gov/ for Arizona
	Entire Basin	SP Hillshade	http://seamless.usgs.gov/ for Arizona
	Entire Basin	SP Slope	http://seamless.usgs.gov/ for Arizona
	Entire Basin	SP DEM (filled)	http://seamless.usgs.gov/ for Arizona
	Southern AZ and Sonora	Shuttle Radar Topography Mission (SRTM)	SRTM elevation dataset created for this project
	Southern AZ and Sonora	Landform	Landform dataset created from SRTM elevation dataset
DOQQ	Arizona	Pinal County DOQQs	http://datagateway.nrcs.usda.gov
	Arizona	Cochise County DOQQs	http://datagateway.nrcs.usda.gov
	Arizona	Graham County DOQQs	http://datagateway.nrcs.usda.gov
	Arizona	Pima County DOQQs	http://datagateway.nrcs.usda.gov
	Arizona	Santa Cruz County DOQQs	http://datagateway.nrcs.usda.gov
DRG	Arizona	Pinal County DRGs	http://datagateway.nrcs.usda.gov
	Arizona	Cochise County DRGs	http://datagateway.nrcs.usda.gov
	Arizona	Graham County DRGs	http://datagateway.nrcs.usda.gov

Data Type	Area	Dataset	Source
	Arizona	Pima County DRGs	http://datagateway.nrcs.usda.gov
	Arizona	Santa Cruz County DRGs	http://datagateway.nrcs.usda.gov
Geology	Arizona	AZ Geology	http://pubs.usgs.gov/of/2005/1305
	Arizona	AZ NHD Flowline	http://www.horizon-systems.com/nhdplus/HSC-wthCO.php
	Arizona	AZ NHD Area	http://www.horizon-systems.com/nhdplus/HSC-wthCO.php
	Arizona	AZ NHD Point	http://www.horizon-systems.com/nhdplus/HSC-wthCO.php
	Arizona	AZ NHD Waterbody	http://www.horizon-systems.com/nhdplus/HSC-wthCO.php
	Arizona	streamgages_project.htm	http://nationalatlas.gov/atlasftp.html#realstx
Hydrology	Arizona	AZ 8-Digit HUCs	http://datagateway.nrcs.usda.gov, http://www.blm.gov/az/st/en/prog/maps/gis_files.html
	Sonora	SO Streams	http://www.epa.gov/nerlesd1/land-sci/san_pedro/geodata/sonora
	Entire Basin	SP Accumulation	http://seamless.usgs.gov/ for Arizona
	Entire Basin	Flow Direction	http://seamless.usgs.gov/ for Arizona
	Entire Basin	SP Subwatersheds	http://seamless.usgs.gov/ for Arizona
	Entire Basin	SP Streams	Created for this project
Land Cover	Entire Basin	Ecological Systems	Created for this project using classification and regression tree (CART)
	Entire Basin	National Land Cover Dataset	Created for this project using classification and regression tree (CART)
	Southern AZ and Sonora	National Land Cover Dataset	Created for this project using classification and regression tree (CART)
Land Ownership	Arizona	AZ Allotment	http://www.fs.fed.us/r3/gis/cor_gis.shtml
	Arizona	AZ Pasture	http://www.fs.fed.us/r3/gis/cor_gis.shtml
	Arizona	AZ PLSS USA	http://nationalatlas.gov/atlasftp.html?
	Arizona	AZ PLSS COUNTY	http://www.geocommunicator.gov/GeoComm/lsis_home/home/index.shtm
	Arizona	SWReGAP Ownership	Southwest Regional Gap Analysis Project Stewardship Digital Data http://fws-nmcfwru.nmsu.edu/swregap/
	Arizona	SWReGAP Management Status	Southwest Regional Gap Analysis Project Stewardship Digital Data http://fws-nmcfwru.nmsu.edu/swregap/
	Arizona	SWReGAP Stewardship	Southwest Regional Gap Analysis Project Stewardship Digital Data http://fws-nmcfwru.nmsu.edu/swregap/
	Sonora	SO Private	http://www.epa.gov/nerlesd1/land-sci/san_pedro/geodata/sonora
	Sonora	SO Ejido	http://www.epa.gov/nerlesd1/land-sci/san_pedro/geodata/sonora
	Sonora	SO Ownership	Created for this project
	Entire Basin	SP Ownership	Created for this Project

Data Type	Area	Dataset	Source
Satellite Imagery and Derivatives	Southern AZ and Sonora	Spring	ETM+ mosaic created for this project
	Southern AZ and Sonora	Spring Tasselled Cap	Tasselled cap transformation of ETM+ mosaic created for this project
	Southern AZ and Sonora	Summer	ETM+ mosaic created for this project
	Southern AZ and Sonora	Summer Tasselled Cap	Tasselled cap transformation of ETM+ mosaic created for this project
	Southern AZ and Sonora	Fall	ETM+ mosaic created for this project
	Southern AZ and Sonora	Fall Tasselled Cap	Tasselled cap transformation of ETM+ mosaic created for this project
Soils	Arizona	AZ SSURGO	http://soils.usda.gov/survey/geography/ssurgo/.
	Arizona	AZ STATSGO	http://www.soils.usda.gov/survey/geography/statsgo/
	Entire Basin	SP FAO Soils	Land and Water Development Division, FAO
Weather	Arizona	AZ NWS Gauges	http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=205305
ICLUS v1.3 (Integrated Climate and Land Use Scenarios; 2010-2100)	Arizona	Housing density allocated at 1 ha resolution	

Appendix C. Training Sites used per land cover class in Classification and Regression Tree Modeling.

Value	Code	NLCD Description	SWReGAP Land Cover Description	Training Sites
15	S016	Barren Lands	North American Warm Desert Bedrock Cliff and Outcrop	13
18	S019	Barren Lands	North American Warm Desert Volcanic Rockland	10
19	S020	Woody Wetland	North American Warm Desert Wash	14
20	S021	Barren Lands	North American Warm Desert Pavement	10
22	S023	Deciduous Forest	Rocky Mountain Aspen Forest and Woodland	1
33	S035	Evergreen Forest	Madrean Pine-Oak Forest and Woodland	20
35	S038	Evergreen Forest	Southern Rocky Mountain Pinyon-Juniper Woodland	1
45	S051	Evergreen Forest	Madrean Encinal	128
51	S057	Shrub/Scrub	Mogollon Chaparral	44
52	S058	Shrub/Scrub	Apacherian-Chihuahuan Mesquite Upland Scrub	154
55	S061	Shrub/Scrub	Chihuahuan Succulent Desert Scrub	6
56	S062	Shrub/Scrub	Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	160
57	S063	Shrub/Scrub	Sonoran Paloverde-Mixed Cacti Desert Scrub	9
56	S067	Shrub/Scrub	Chihuahuan Creosotebush Basin Desert Scrub mapped as S62 in SWReGAP	47
59	S068	Shrub/Scrub	Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub	35
65	S077	Grassland/Herbaceous	Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	322
80	S094	Woody Wetland	North American Warm Desert Lower Montane Riparian Woodland and Shrubland	11
83	S097	Woody Wetland	North American Warm Desert Riparian Woodland and Shrubland	6
84	S098	Woody Wetland	North American Warm Desert Riparian Mesquite Bosque	24
85	S100	Emergent Herbaceous Wetland	North American Arid West Emergent Marsh	5
90	S109	Grassland/Herbaceous	Chihuahuan-Sonoran Desert Bottomland and Swale Grassland	186
91	S111	Evergreen Forest	Madrean Upper Montane Conifer-Oak Forest and Woodland	5
92	S112	Evergreen Forest	Madrean Pinyon-Juniper Woodland	82
93	S113	Grassland/Herbaceous	Chihuahuan Sandy Plains Semi-Desert Grassland	19
95	S115	Grassland/Herbaceous	Madrean Juniper Savanna	13
96	S116	Shrub/Scrub	Chihuahuan Mixed Salt Desert Scrub	74

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