

Establishing a Decision Making Tool to Reduce Drought Vulnerability in Residential Urban Landscapes



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Objectives

The objectives of this research are to:

- 1) Categorize Albuquerque residential landscapes into distinct categories and use the knowledge of landscape categories to assess their vulnerability to drought.
- 2) Develop a landscape water budget web interface.

Introduction

Agricultural and hydrological drought indices showed that New Mexico is suffering from long-term drought (Gutzler, 2003). Knowledge about landscape types in Albuquerque (Fig. 1) and their performance under different moisture levels could better inform decisions on how to cope with drought conditions.

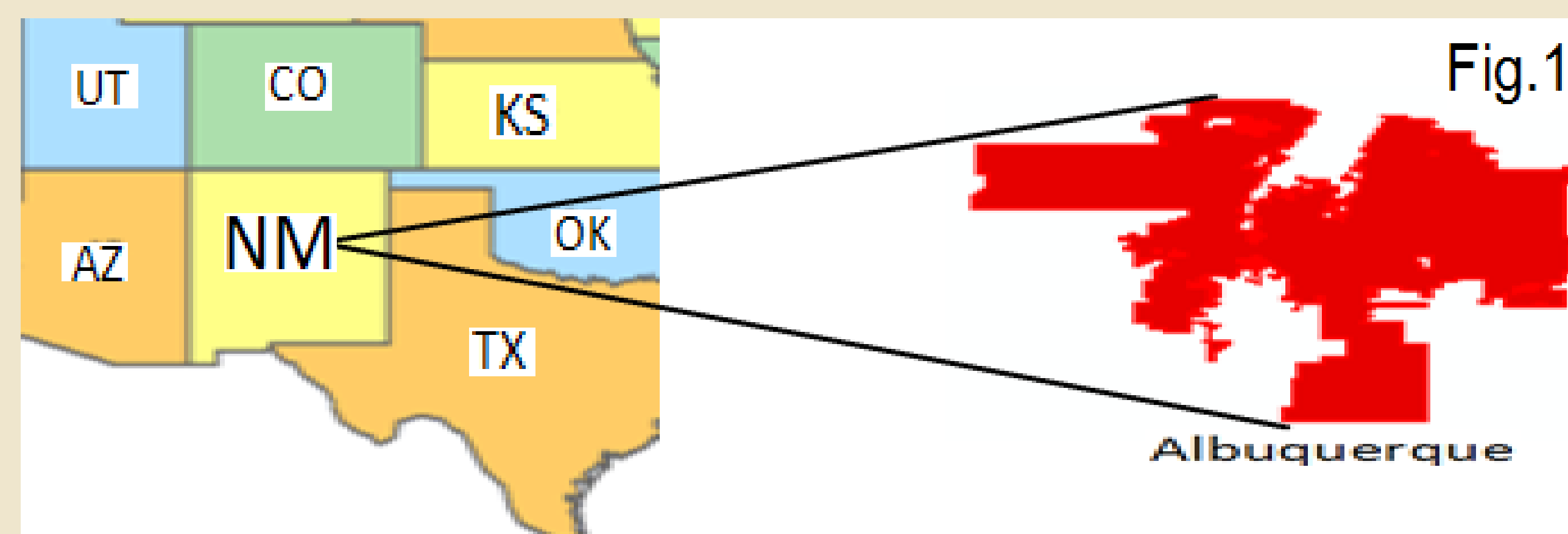


Fig. 1

Methodology

Sampling Method

We used the city of Albuquerque parcel, land use, zip codes and municipal limits maps together with the County (Bernalillo) Assessor's Office database to create an integrated Geographic Information System (GIS) map of Albuquerque. We sampled information from Albuquerque-owned parcels in each zip code (Fig. 2).

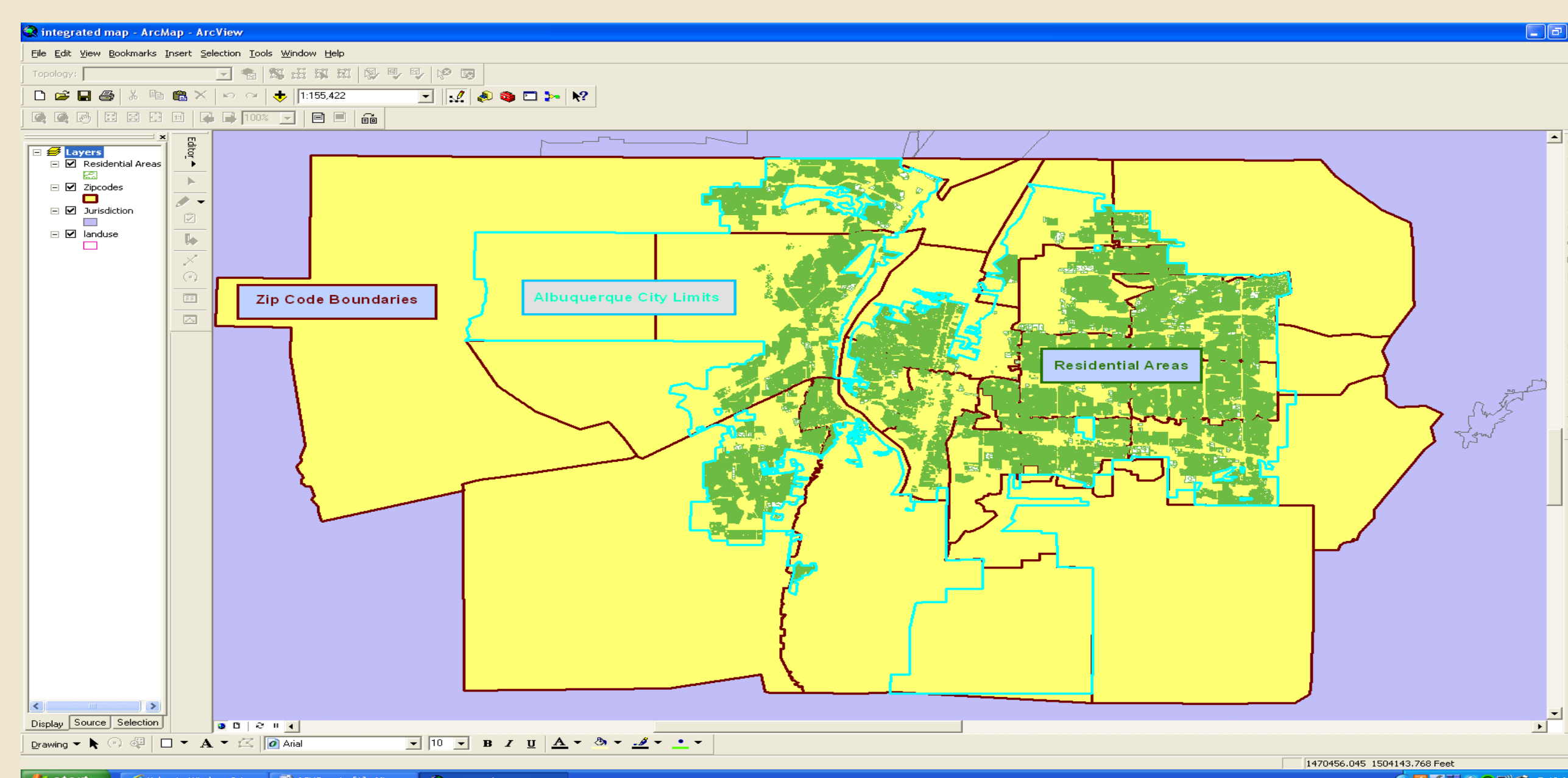


Fig. 2: Integrated GIS map of Albuquerque city parcels, land use and zip codes layers.

Landscape Components Extraction

Bernalillo County's true color aerial photography with 1/2 foot (0.15 m) resolution (Mid-Region Council of Government, 2008) will be processed using ENVI software (ITT VIS). Supervised classification will be used to classify vegetation types and impervious surfaces (Fig. 3).

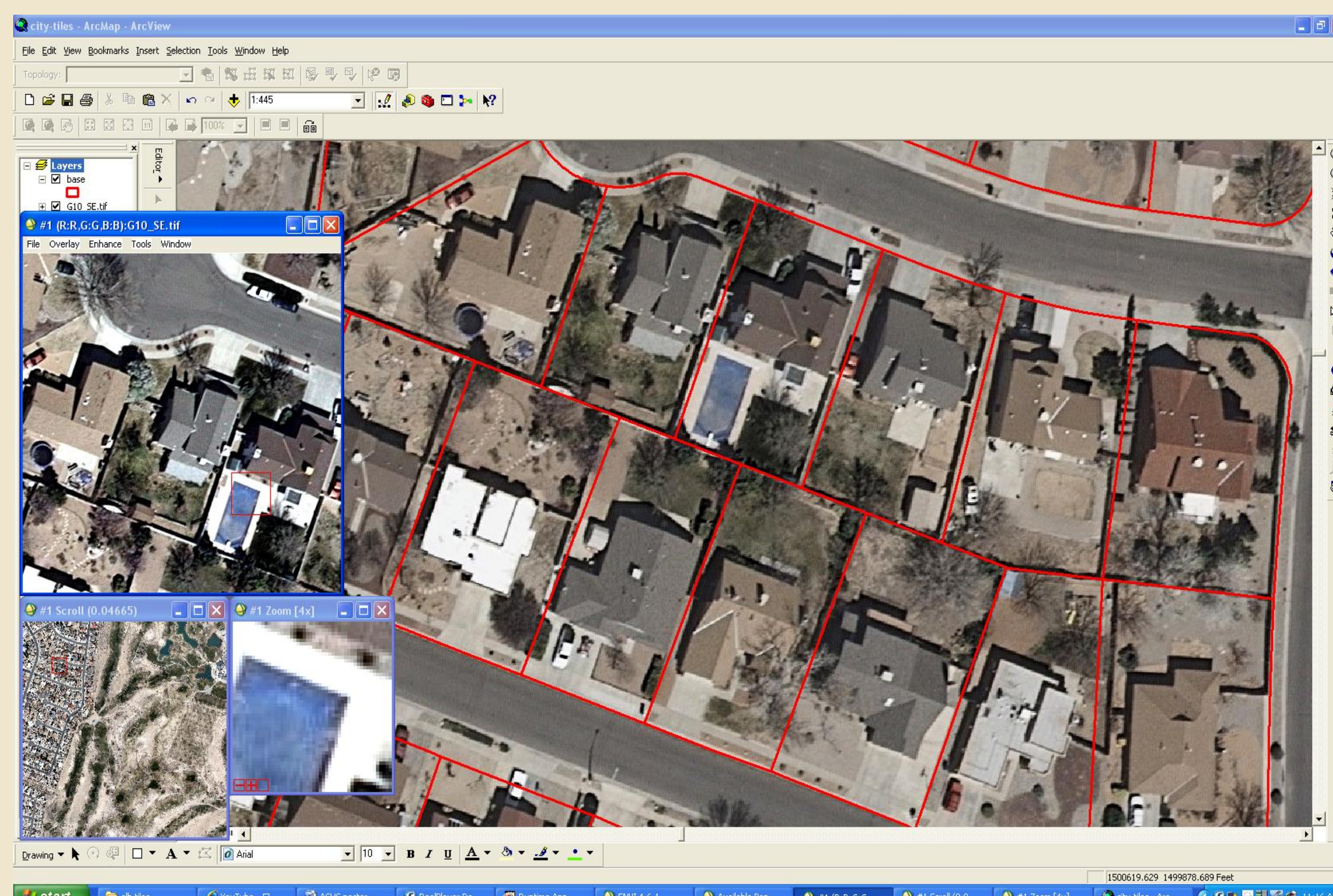


Fig. 3: Aerial photography of Albuquerque landscapes in GIS and ENVI FX.

Landscape Categories

Vegetative proportions (water requiring landscape elements) will be analyzed to find out percentage of parcels that belong to each landscape category (Table 1). The landscape category with the highest percentage of parcels will be considered the common landscape type in a zip code.

Table 1: Proposed categories of landscape in Albuquerque, New Mexico

Category #	Grass (%)	Trees (%)	Shrubs (%)	Category name
1	0-25	25-50	50-75	Shrubby-Tree Landscape
2	>25-50	0- <25	25-50	Grassy-Shrub Landscape
3	>50-75	25-50	0- <25	Grassy-Tree Landscape
4	>75-100	0- <25	0- <25	Grassy Landscape

Relationships among Landscape Categories and Zip Code Median Income

We will test whether landscape categories are related with median income. Median income of Albuquerque zip codes were grouped (Table 2).

Table 2: Classification of zip codes into their median income ranges

Zip codes	Range of Median Income per Year				
	15-30,000	>30-45,000	>45-60,000	>60-75,000	>90,000
87102	87106	87109	87120	87122	
87108	87104	87112	87114		
	87105	87113			
	87121	87111			
	87107				
	87123				
	87110				

(American Online, 2008)

Water Budget Calculator Web Interface

We are currently developing a water budget calculation interface based on a Modified Annual Water Budget Formula (Fig. 4).

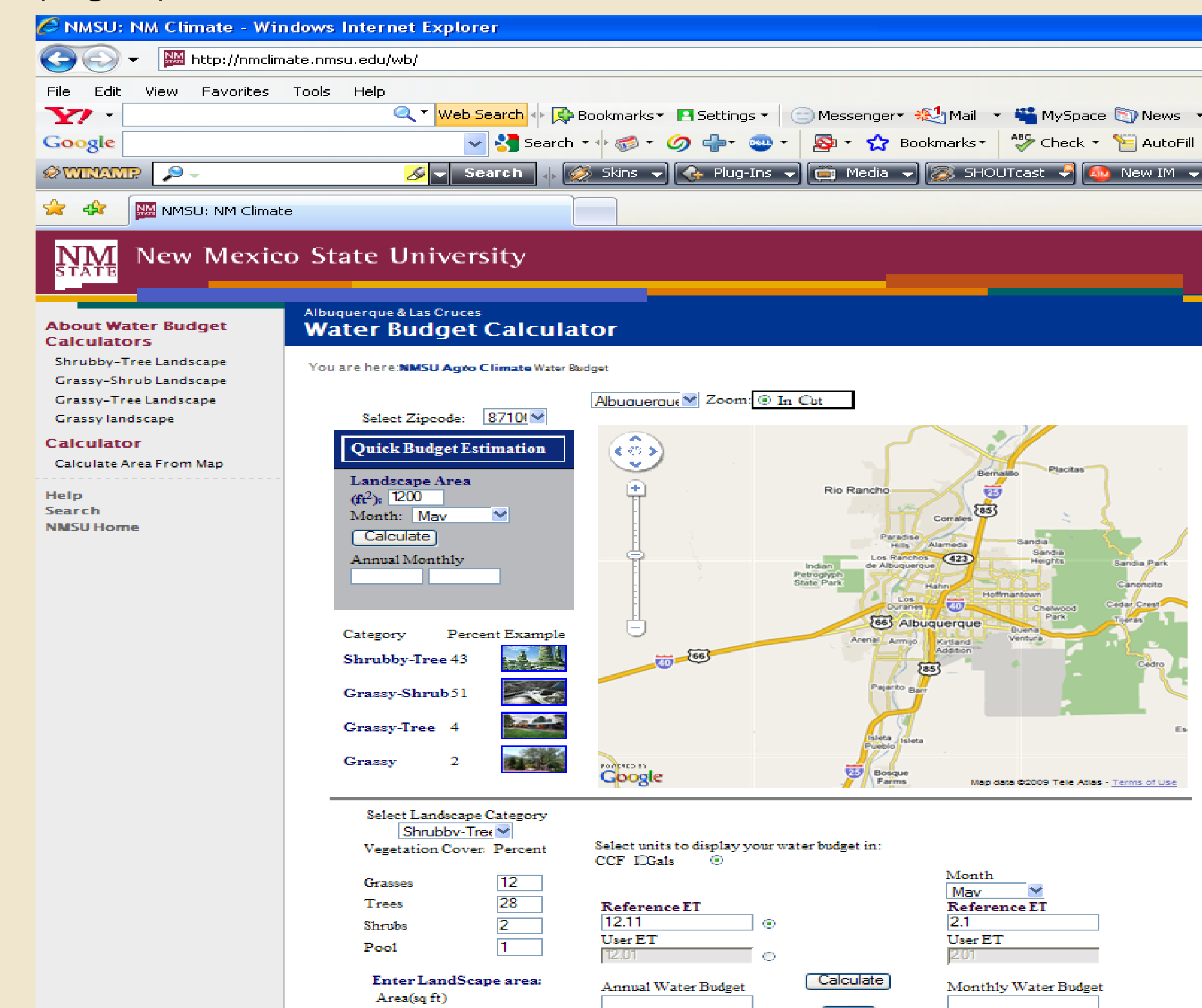


Fig. 4. Water budget calculator web interface of Albuquerque residential landscapes.

Modified Annual Water Budget Formula =

$$[(GLA+PA)*GAF] (ET_c) (CF) + (TLA*TAF) (ET_c) (CF) + (SLA*SAF) (ET_c) (CF)$$

Where: ET_c = Zip code annual ET_c , CF = Conversion factor (0.632 gal/square foot inch);
 GLA = Grass landscape area; GAF = Grass adjustment factor; TLA = Trees landscape area;
 TAF = Trees adjustment factor; SLA = Shrubs landscape area; SAF = Shrubs adjustment factor.

Reference Evapotranspiration

Geographic Information System was used to identify the decimal degrees of five purposive points in each zip code for reference evapotranspiration (ET_0) calculation (Fig. 5). Reference evapotranspiration values for each zip code will be averaged to give one ET_0 for each zip code in the water budget interface.

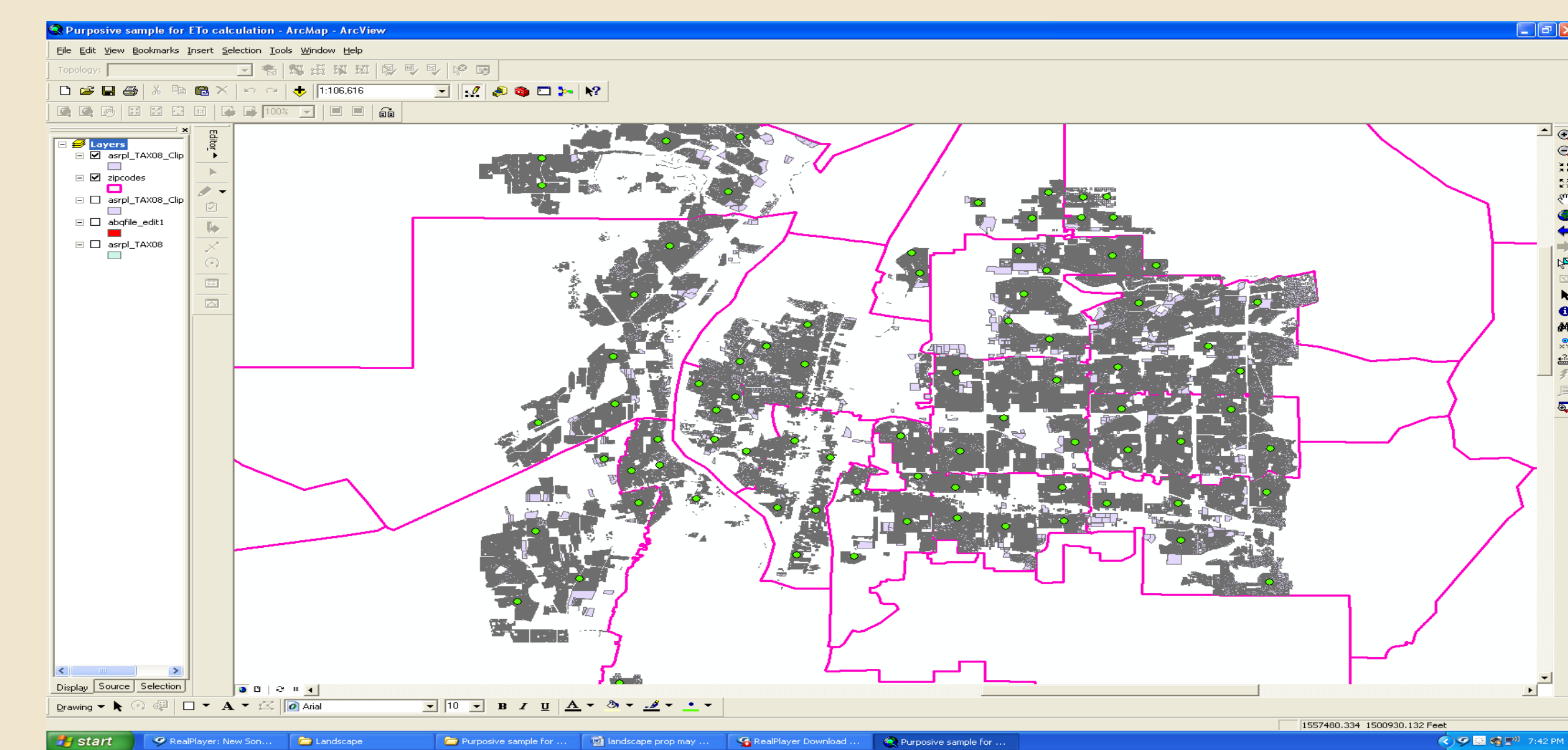


Fig. 5. Reference evapotranspiration points in each zip code.

Literature Cited

Gutzler D. (2003). Drought in New Mexico: history, causes, and future prospects. New Mexico Decision Makers Field Guide, no. 3: 101- 105. Available at: <http://hdl.handle.net/1928/290>.