

Potential attributes of water use variation in mixed use residential landscapes



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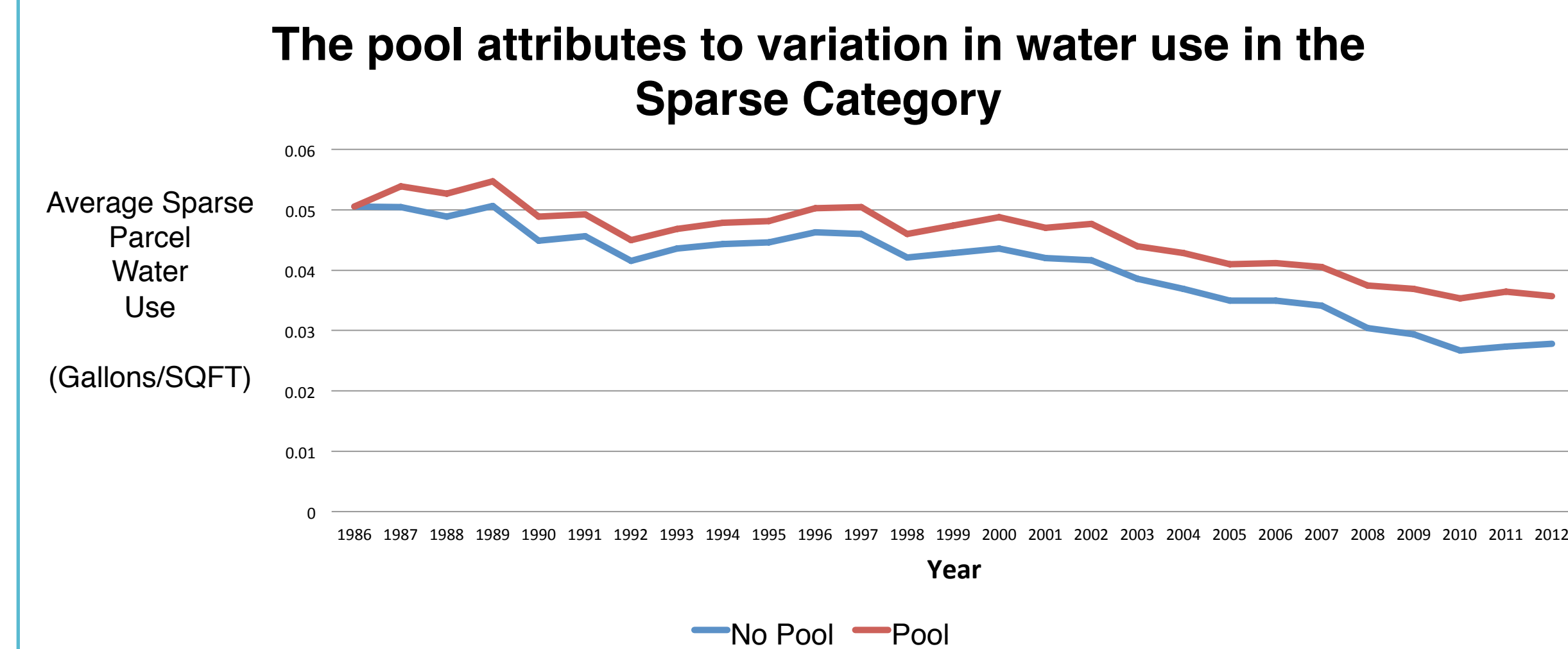


What are the potential outdoor attributes of water use variation among residences in the “Sparse Plant Coverage” category?

Landscape coding and water variation

City of Phoenix Water Services Department developed a landscape coding system that utilizes review of aerial photography, an assessment and water use database and a GIS platform to characterize the landscapes of single individual residential parcels and explain water use by landscape type. This system is relatively new and is still being revised to improve coding and subsequent analysis – it is less than 18 months old and was developed to verify assumptions made about the prevalence of desert landscaping in the City’s water master planning model.

The landscape – water use project and associated data have been very successful at explaining variations in water use by residential units and providing avenues for a variety of follow-up research. The relatively simple system of coding parcels as predominantly ‘turf’, ‘extensive plant coverage’, ‘moderate/sparse plant coverage’, ‘arid’ and ‘transition’ turned out to be a very good way of identifying categories of water users that have different use characteristics and of explaining changes in water use over the 1986 to 2012 period. Coding parcels as having either no pools or full pools also proved to be a good way to explain residential water use (Flory, Frost, & Arnold, 2012)



The next step in analyzing the connection between water use and landscape characteristics was to try to ‘drill down’ beyond the differentiation provided by using the six standard categories cited. While some of the categories like turf, extensive plant, and arid exhibited relatively low levels of variance and appeared to be useful as a means of characterizing landscapes, the moderate and sparse plant coverage categories exhibited a tremendous amount of variation, indicating that those categories might be best subdivided into more categories. Attempts were made to try to discern what specific attributes might be causing the significant variation in water use in the sparse and moderate classes, with mixed success.

Compared high water users with low water users in Sparse category

Steps taken to evaluate outdoor attributes as possible indicators to the variation:

1. Out of 34,647 total coded parcels, 11,991 or about one-third coded Sparse
2. 8120 Sparse parcels remain from criteria : not questionable, no pool or full pool; built between years 1960-198; and lot size: 5000-16000 square feet
3. Access databases from GIS-based database to link Sparse parcels with 2012 water use on a gallons/square foot (G/SQFT) basis
4. Created a frequency distribution of Sparse parcels based on the 2012 water use data with 50 intervals or bins of 0.0014511 G/SQFT
5. Eliminated the outliers which resulted in a range: 0-0.0734 G/SQFT
6. Selected the first three bins (0-0.0062 G/SQFT) or 262 parcels
7. Selected the last five bins (0.0599-0.0734 G/SQFT) or 332 parcels
8. Examined and re-coded the 594 parcels using aerial photography from a GIS-based database and an illustrated guide provided by WSD staff

1) Consistency of coding

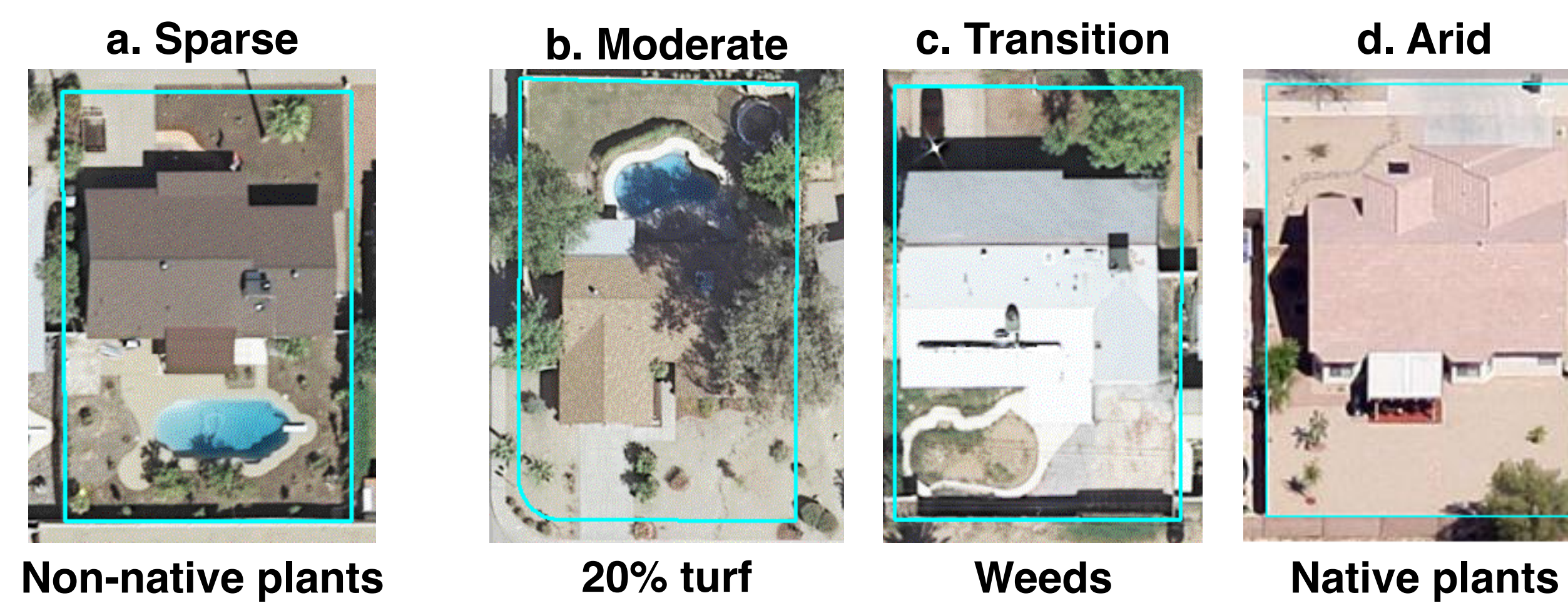
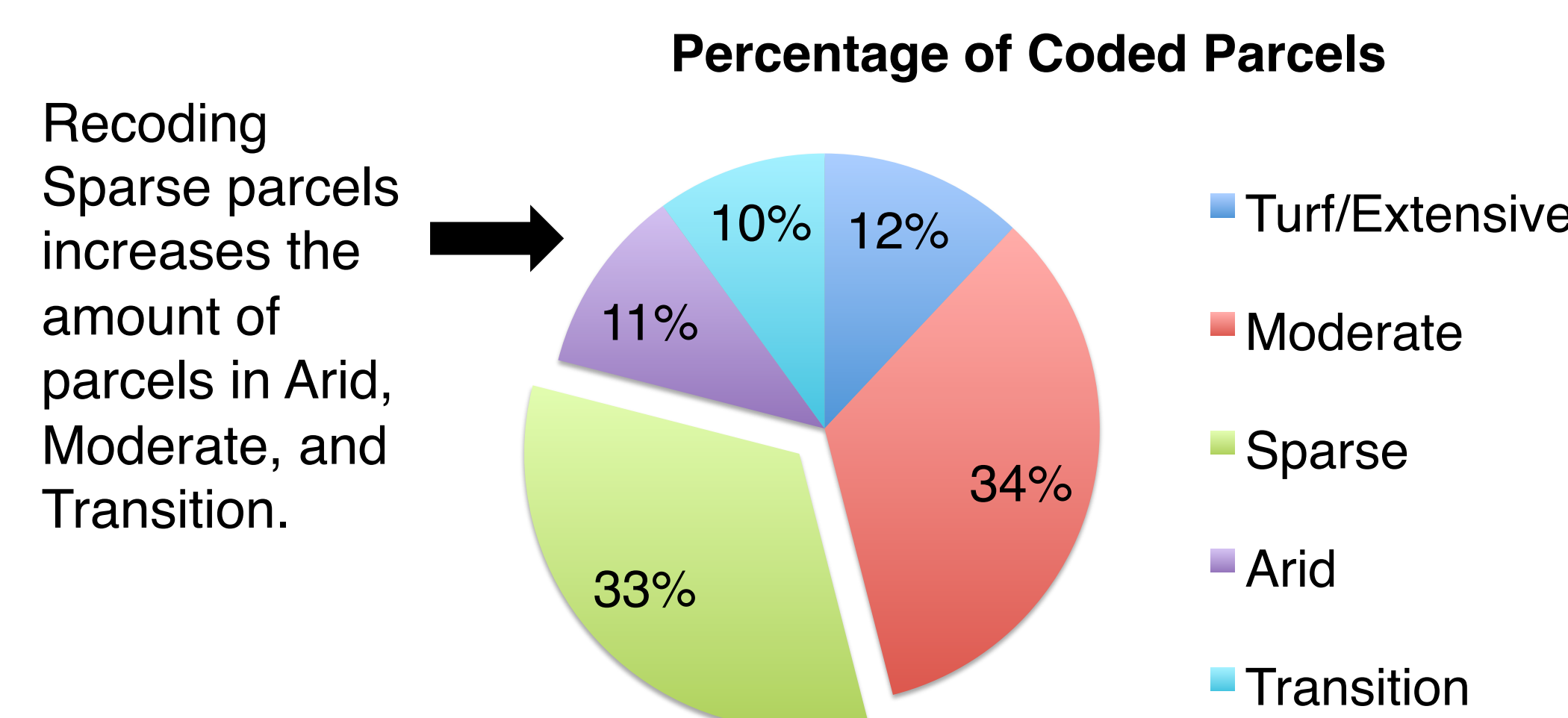


Figure a. Example of a Sparse parcel: no turf, no weeds; has non-native plants
Figure b. Sparse parcel with turf (< 30%) should be Moderate
Figure c. Sparse parcel with weeds or dormant turf should be Transition
Figure d. Sparse parcel with only native plants should be coded as Arid

There is a significant variation in how individual interns characterized different kinds of landscapes. While there were few instances of interns coding a parcel that should have been ‘arid’ as a ‘turf’ or ‘extensive plant coverage’, or vice versa, there were numerous cases where a parcel coded as ‘sparse’ should have been coded as ‘arid’ or ‘moderate’. For example, the coding manual specifies that a parcel with a small amount of turf should be classified as ‘moderate plant coverage’, yet numerous parcels coded as ‘sparse’ showed 10 to 30 percent turf. Similarly a number of parcels with cactus were incorrectly coded as being ‘sparse’ instead of ‘arid’. Furthermore, most of the parcels with weeds or uniformly brown turf were incorrectly coded as being ‘sparse’ instead of ‘transition.’

2) Reliability of the Coding Process



The parcels that have been coded need to be reviewed for consistency with the manual and that much of the variability encountered to date in the ‘sparse’ category is likely due to the inherent subjectivity of the coding process combined with a misinterpretation of the coding rules. It is anticipated that a systematic review and in many cases re-coding of parcels will result in numerous ‘sparse’ parcels being moved to either ‘arid’ or ‘moderate plant coverage’ categories, thereby causing variance to decline in the ‘sparse’ category and producing a more accurate estimate of average water use for sparse parcels. It is also suggested that more time be spent with staff responsible for coding of parcels on training so that the ‘sparse’ code is used more sparingly.

3) Plant type and density



Figures g-h. Sparse parcels with similar water use show variation in plant density

An investigation of plant types, number of plants and other attributes within the sparse category yielded no immediate information that could be used to establish further sub-categories such as ‘less than three plants’ and ‘three plants or more’ or ‘predominantly shrubs’ and ‘predominantly trees’. Further analysis of data may eventually produce refined categorization that better explains water use in the sparse plant coverage class, but at this point no advances have been achieved.

Potential attributes of water variation:

- Many of the Sparse parcels can be characterized as other landscape categories, especially Moderate, Transition, and Arid.
- The recoding of parcels reduces the water variance with the Sparse category, and at the same time increases the amount of parcels in Moderate, Arid, and Transition categories
- Plant type and density may help to refine the coding process which will better explain water use in the sparse category.

Suggestions for the coding process:

- Random sample of and recode Sparse and Moderate parcels and compare coded with to determine the reliability of the coding process
- After re-coding parcels, comparing the new Sparse parcels with the original Sparse parcels to determine the change in water variation
- Tree density as an indicator of water variation was tested in this study by counting the amount of vegetation of each parcel but was found inconclusive and more research on the relationship between amount of vegetation and water use is needed.

Reference

Flory, Bruce, Doug Frost & Tom Arnold, “Water Provider Information Needs and Innovative Research,” Presentation, Understanding Residential Water Use: New Approaches to Analyzing, Projecting and Managing Demand Conference from Decision Center for a Desert City and ASU Center for Environmental Economics and Sustainability Policy, Tempe, AZ, May 11, 2012.

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