Urban tree health in the Phoenix metropolitan area

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INTRODUCTION

Trees contribute significantly to human health and environmental quality in urban ecosystems by improving energy conservation, increasing carbon storage, removing air pollutants, moderating urban heat island effects, providing recreation and wildlife habitat and increasing aesthetics and property values. The quality of life of nearly 80% of the US population is impacted by urban forests (Dwyer et al. 2003). Despite the economic, aesthetic and environmental benefits of urban forests, assessments of the health of this living resource are rare (Cumming et al. 2001). Monitoring urban forest health is essential to identifying changes within the forest resource as well as providing a foundation for improving resource management practices (McPherson 1993).

METHODS

Sampling Sites

Urban tree health was assessed at 60 sites across a gradient of seven zones from urban core to fringe in Phoenix, Arizona. Gradient zones were based on a preliminary study of near surface atmospheric CO2 concentrations and air temperatures across an urban core to fringe gradient. The sites included a variety of non residential land use types including industrial, institutional, transportation (streetscapes) and parks that were replicated within each of the seven gradient zones. These sites were originally established as part of the Central Arizona-Phoenix (CAP) LTER Survey 200 project that collected intensive data at each site including information on existing vegetation, tree growth, soil chemistry, GPS location, previous land use and socioeconomic factors.

Assessing Tree Health

Over 700 trees were monitored for tree health in the Spring of 2006 using a modification of the protocol in the USDA Forest Service Urban Forest Health Monitoring Manual (Cumming et al. 2001) revised to reflect the unique stresses and diseases that occur in urban areas in the southwestern US. Information collected for each tree included species identification, diameter breast height, canopy condition (very good=4, good=3, fair=2 or poor=1), presence and location of wounding, % canopy dieback, pruning problems (including topping, bark tearing, presence of large stub and flush cuts), and presence of known biotic (diseases and pests) and abiotic problems (stress and problems with unknown etiology).

Figure 1. A. Percentage of trees in each canopy health category. **B.** Percentage of trees with biotic (disease and pest), abiotic, pruning problems and wounding of main trunk, roots or scaffold branches.

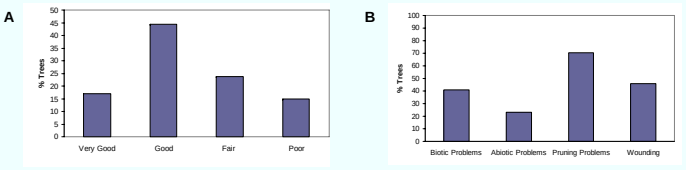

Fig. 2. Percentage of trees with canopy dieback, chlorosis and those with specific disease or pest problems.

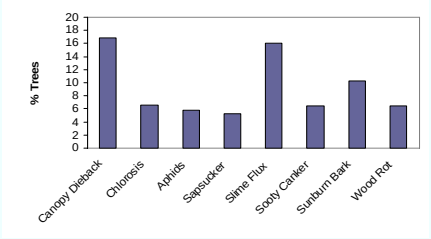

Table 1. Canopy health ratings and biotic and abiotic problems for 11 landscape tree genera common in the Phoenix metropolitan area.

Genera Common Name		Canopy Health	Biotic Problems % Trees	Primary Biotic Problem	Abiotic Problems % Trees	Primary Abiotic Problem
Acacia	N=63	3.03	38.1	Slime Flux = 34%	3.2	
Brachychiton Bottle Tree	N=53	2.42	49.1	Sapsucker = 32% Sooty canker = 17%	49.1	Iron Deficiency = 17% Sunburn = 32%
Eucalyptus	N=40	2.35	35.0	Slime Flux = 25%	25.0	Iron Deficiency = 18%
Fraxinus Ash	N=60	2.55	38.3	Ash Decline = 27% Aphids = 14%	16.7	
Olea Olive	N=60	2.35	30.0	*Verticillium* Wilt = 17%	40.0	Sunburn = 28%
Parkinsonia Palo Verde	N=63	2.79	44.4	Slime Flux = 32% Wood Rot =14%	4.8	
Pinus Pine	N=73	2.49	23.3	Sapsucker = 12%	53.0	Pine Blight = 51%
Prosopis Mesquite	N=73	3.04	67.1	Slime Flux = 63%	0.0	
Quercus Oak	N=51	2.16	70.6	Aphids = 66%	31.4	Sunburn = 20%
Rhus African Sumac	N=49	2.39	18.4	Wood Rot = 8%	28.6	Dieback = 27%
Ulmus Elm	N=56	3.30	25.0	Sooty canker = 16%	1.8	

RESULTS AND DISCUSSION

Tree canopy health of the urban forest was generally good (Fig. 1A). Canopy heath of about 60% of the trees were rated very good or good and the mean canopy health was 2.7 (very good=4 and poor=1). Despite this general trend, a significant number of trees (15%) were rated as having poor canopy health. Biotic and abiotic problems were detected in 90% of trees with poor canopy health. Canopy health varied with plant species, with *Ulmus* species having the highest mean canopy health and *Quercus* species having the lowest mean canopy health (Table 1).

Biotic and abiotic problems were common in urban trees (Fig. 1B). Biotic problems (diseases and pests) were detected in 40% of the trees assessed and abiotic problems in 23% of trees. Common symptoms included canopy dieback (17%) and chlorosis (7%) (Fig. 2). Canopy dieback was associated with known disease problems in ash (Ash Decline caused by phytoplasmas) and olive (Verticillium wilt) (Table 1) trees. Canopy dieback was also associated with problems of unknown etiology in pine (pine blight) and African sumac trees. Physical/mechanical injury to roots, trunk or main scaffold branches was detected in half of the trees and pruning problems in 70% of trees.

Common biotic and abiotic problems were often associated with certain trees species (Table 1).
The most common disease and pest problems included slime flux, sooty canker, wood rot, aphids and sapsucker bird damage (Fig. 2). Slime flux was detected in many of the common trees used in xeriscapes including *Prosopis*, *Acacia* and *Parkinsonia* species. Sooty canker was most commonly observed in bottle trees and elm trees. Aphids were only detected on oak and ash trees. The most common abiotic problems were sunburn of tree bark (10%) and iron chlorosis (3%). Sunburn damage was most commonly detected on bottle trees, olive and oak trees.

References

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This material is based on work supported by the NSF under Grant No.EB-0423704, Central Arizona - Phoenix Long-Term Ecological Research (CAP LTER).