Program Outline

Prepared for Bonnie Richardson, City of Tempe

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Suggested Implementation: FY 2017

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Project Scope

Students in the Urban Sustainability Best Management Practices course at Arizona State University (ASU) were asked by a representative from the City of Tempe to design a community engagement program to support their Urban Forestry Master Plan currently in development. This document outlines the program background, logistics, marketing, and curriculum recommended to the City of Tempe for the creation of this program.

Figure 1 Image of Tempe, Arizona from Google Maps.

The Problem

Imagine walking down the block to a local Tempe store in mid-July. Are you darting from one small shade spot to another, desperately trying to escape the heat? Since the heat is so intense and you know there is minimal shade on your route, do you choose to drive instead? Due to the combined impact of climate and rapid urbanization in the Phoenix metropolitan area of Arizona over the past decade, the temperature within the city has and will continue to increase.

An analysis of Phoenix Sky Harbor airport in 2000 showed that nighttime air temperatures exhibit drastic differences between rural and urban areas, by as much as 11°F (6°C) in the summer (Brazel et al., 2000). When built-up urban areas are hotter than the surrounding desert areas, this phenomenon is referred to as the Urban Heat Island (UHI) effect. Buildings, pavement, and other man-made infrastructure all absorb heat during the day and then release it slowly at night, causing this effect. Increasing temperatures may threaten long-term tourism and resident happiness. For these reasons and more, the City of Tempe decided to develop an Urban Forestry Master Plan.

The Vision

Research suggests increases in vegetation coverage can help reduce urban heat by shading building surfaces, deflecting radiation from the sun, and releasing moisture into the air (Middel, Chhetri, Quay, 2015, Environmental Protection Agency, 2015). Although vegetation includes any type of plant, the specific focus of this report is on trees. Many tree species absorb gaseous pollutants (NO_2, SO_2, and O_3) that contribute to smog formation and negatively impact human health (Wise et al., 2010). Thus, increasing canopy cover will help improve air quality. Furthermore, through the combination of evapotranspiration and shade provided by trees, buildings adjacent to trees require less air conditioning (Wise et al., 2010). In turn, reducing the use of air conditioning leads to personal economic savings and reduced greenhouse gas emissions.

Increased healthy tree canopy may improve access to shade, increase comfort, and enhance the beauty of Tempe neighborhoods. These changes will also support Tempe's goal of becoming a city where people can walk to many different amenities in 20 minutes or less.

These strategies will encourage citizens to become more active outdoors and in their communities. However, this plan cannot be effectively implemented by the city alone, citizens must be meaningfully engaged.

Ficus trees provide shade for pedestrians on Mill Avenue. Photo by Tim Hacker at East Valley Tribune.

A Solution

A community engagement and empowerment program should be launched with the Urban Forestry Master Plan itself in order to build community buy-in and help spread change without relying on additional city personnel. Research indicates tree planting initiatives across the nation receiving limited funding are most effective when combined with community engagement programs (Young, 2011). Due to the experiential success of Master Gardener and Master Recycler programs across the United States, ASU students developed the subsequent Master Urban Forester program outline intended to enhance community engagement. The program is designed to foster empowering knowledge, skills, experiences, and connections focused on helping citizens bolster tree and shade coverage in Tempe. After completing the program, Master Urban Foresters will also mobilize efforts within their own neighborhoods and advocate for the beautification, increased walkability, and improved comfort provided by trees. Furthermore, this program serves as a platform for people from different backgrounds and communities to connect and learn together.

"Tree planting initiatives across the nation receiving limited funding are most effective when combined with community engagement programs."

Figure 2 More information on common trees in the Phoenix Metropolitan region and the amount of shade they provide is detailed in Appendix A and B. Image from Google Maps.

Program Overview

Through a robust offering of activities, training, tours, lectures, volunteer opportunities and discussions; community members engaged in the Master Urban Forester program will be prepared to make long-lasting positive change in their community. The focus of this training is to increase tree and shade coverage within the community and provide opportunities for social connection and citizen

empowerment. Each class will include either a tour or speakers, group discussion, and an opportunity to de-brief. Volunteering and take-home activities will be done outside class.

Program Goal: Empower citizens to preserve and enhance the comfort, health, and beauty provided by Tempe's urban forest.

Desired Outcomes

Anticipated results of providing comprehensive training in urban forest principles, planting, and maintenance are as follows:

- Increase overall understanding and participation in urban forestry related volunteer opportunities.
- Improve trainees' knowledge and skills to advocate for a healthy urban forest in their community.
- Enhance awareness and support of Tempe Urban Forestry Master Plan.
- Empower participants to lead positive change in their community through hands-on activities.
- Cultivate collaborative relationships between citizens and the City of Tempe.

After Tempe received the NFL Super Bowl XLIX Forestry Grant in 2014, community members were able to plant 27 additional trees at Goodwin Park. Photo by League of Arizona Cities and Towns.

PROGRAM DESCRIPTION FOR THE PUBLIC

This section describes different components of the program which would be made public on the program's webpage housed within the City of Tempe website. A program outline including the budget and communication plan for internal use at the city follows this section.

Who should apply?

- Persons at least 18 years old; the City of Tempe will consider a 17-year old with a parent or designated guardian attending all events with them.
- Residents of Tempe or individuals working in Tempe businesses and institutions
- Students attending college in Tempe

Course Schedule:

The course will consist of five lectures and four tour sessions for approximately **15 hours of 'in-class' education**. Lectures will be scheduled in the evenings starting at 6:30 p.m. and ending around 8:30 p.m. to be held at rotating community centers across the city (i.e. Library rooms).

Transportation will not be provided. There will be two classes a year, one starting in **early September** and one starting in **early February**. *Participants can miss up to one lecture and one field trip. Missed hours must be made up by attending similar sessions with another organization, attending a tour, or additional volunteer service.*

Topics Discussed:

- Benefits of increased canopy and vegetation:
    - Social and health (less heat stroke)
    - Environmental (protecting habitat)
    - Economic (increased property values)
- Proper maintenance of desert trees in the urban forest
- Pros and cons of different species in Tempe
- How to organize a tree planting in coordination with infrastructure (water lines, cables, etc.)
- How a biodiverse canopy increases ecological resilience to threats (pests, disease)

Figure 3 The Desert Botanical Garden in Phoenix, AZ.

Service Learning & Volunteering:

- A minimum of 15 volunteer hours are required to become a Master Urban Forester.
- Volunteering will be completed within six weeks of the in-person course ending.
- At least 5 hours (of total volunteer hours) must be with K-12 students.

Course Evaluations:

Upon completing the program, all participants will complete a course evaluation. Ideas and feedback may also be shared during the span of the course to ensure group learning needs are met.

Post-Program:

Master Urban Foresters are encouraged to stay connected with each other, the city, and the community through social media, volunteering, community projects, and more! They will be asked to complete their 15 hour volunteer requirement after the course is over to ensure they have opportunities to apply their knowledge.

Course Fee:

- Individual (age 18+) - $15
- Guardian and student - $20
- Business/corporate representative (sponsorship package) – $50

Course fee goes towards tour costs and a t-shirt.

Participants Requirements:

1. Complete and submit application (insert hyperlink) to Master Urban Forester Program Manager, _____ at _____. It can also be mailed or dropped off at the _____. There is no deadline. Applicants should apply by _____ to ensure an interview for admission. Twenty to thirty minute interviews with the Program Manager will take place over the phone or digital medium (Skype). Only 20 participants will be accepted in order to foster discussion and hands-on learning.
2. If application is approved, full payment of course fee is due by the first lecture.

Requirements: Attend 15 hours of training including tours and lectures, and complete volunteer hours, evaluations and take home assignments.

INTERNAL PROGRAM OUTLINE

This section details specific components of the program which will be helpful when building support for implementation and relevant for writing grant proposals to fund the program.

Timeline

1. Post-class enrollment:

- Hire Program Manger to lead the following efforts.
- Create a Facebook page and Instagram so students can stay connected during and after the program. This page can be used to post events and share ideas.
- Confirm speakers and tour guides.
- Create and launch online program application form.
- Create online portal for students to record their volunteer hours and engagement.
- Market program (see subsequent Marketing Strategy).

2. Selection Phase:

- Review applicants and interview (max 20 participants).
- Confirm cohort and email congratulations for being selected and details for first meeting

3. Class:

- Follow the curriculum plan and adapt accordingly.
- Coordinate speakers/ tours.
- Answer questions over email and the phone.
- Send out reminder emails with directions to meeting/ tour location.

4. Post-class:

- Students will need to volunteer 15 hours and report engagement metrics before officially completing the program.
- Upon completion, all Urban Master Urban Forester photos and names will be added to the program's page on the City of Tempe's website
- Incorporate into program feedback provided by students in class and through the survey.
- Track progress based on metrics described later and report through social media and traditional media sources

Program Marketing/ Communication Strategy

1. Share information through the city's social media (Facebook, twitter) and encourage partners to do the same. Also create shareable digital infographic with important details of program.
2. Contact local news entities like Arizona Republic, Channel 3, and Fox 10.
3. Ask partners to send out emails to their members/network.
    - Nancy Selover (State Climatologist and ASU Senior Sustainability Scientist)
    - Habitat for Humanity
    - Arizona State University
        - Global Institute of Sustainability
        - Arizona State University Alumni Association
        - Walton Sustainability Solutions Initiative
        - Sustainable Cities Network
        - Central Arizona Project Long Term Ecological Research (CAP-LTER)
        - Graduate & Professional Student Association (GPSA)
    - Local Nurseries

4. Pitch the program to community groups:
    - Desert Botanical Garden
    - Kiwanis
    - Valley Permaculture Alliance
    - The Rotary Clubs of Tempe
    - Osher Lifelong Learning group

5. Include information about the program on the Tempe Today with the water bill for Tempe residents.

Curriculum

Speaker and tour suggestions and contact information is included in the subsequent section. This overview of curriculum is in no way limiting. In fact, the Program Manager is encouraged to adapt the program to address specific cohort needs, interests, and knowledge gaps. Since speaker and tour cancellations may occur and rain/ severe weather may interrupt the schedule, it's important to have a Plan B set of activities and content. Lastly, it's important not to distribute curriculum to students in order to maintain excitement and the element of surprise.

Class 1: Get to know each other and the Urban Forestry Program

Learning outcomes: Participants meet each other, learn about the City of Tempe's forestry efforts, and discuss the benefits of increasing tree canopy.

- Ice Breakers (i.e. share 3 unique things about yourself)
- Discuss program guidelines and expectations
    - Share relevant previous experience and reason(s) for interest in program.
    - Discuss volunteering, tree plantings, and more without giving away the schedule
- 10 minute break
- Speakers: Representatives from Walton Sustainability Solutions Initiative and City of Tempe:
    - Introduce the Urban Forestry Master Plan
        - Discuss $10,000 neighborhood grant offered by the City of Tempe so residents can do further projects in community
        - Discuss protocol for citizens to plant trees in their community
    - Discuss benefits of increasing canopy and vegetation in urban areas
- De-brief and discuss logistics for tour next week.
- Homework for next class: Review the Urban Forestry Master Plan and make one interesting post on social media or comment to a friend about what you learned.

Class 1: Questions to Discuss

1. What are potential benefits and trade-offs of planting trees in Tempe?
2. How do you want trees being planted in a neighborhood in Tempe?
3. If you planted trees in your community, what would you plant, where?
4. How would you convey the message of the pros and cons of planting trees in your neighborhood to your community?

Tour 1: ASU Arboretum

Learning outcomes: Students study the role of plants and trees in urban socio-ecological systems.

- Ask Tour Guide to discuss the following:
    - How do microclimates on ASU campus influence which trees are planted?
    - Which trees do the best, worst? Why?
    - How has the Arboretum been designed to increase shade?
- Homework for next class: Research which trees should be planted in urban area in Sonoran Desert. Utilize this website to calculate the benefits of planting trees on your property: http://treebenefits.com/calculator. Bring results to class and be ready to share.

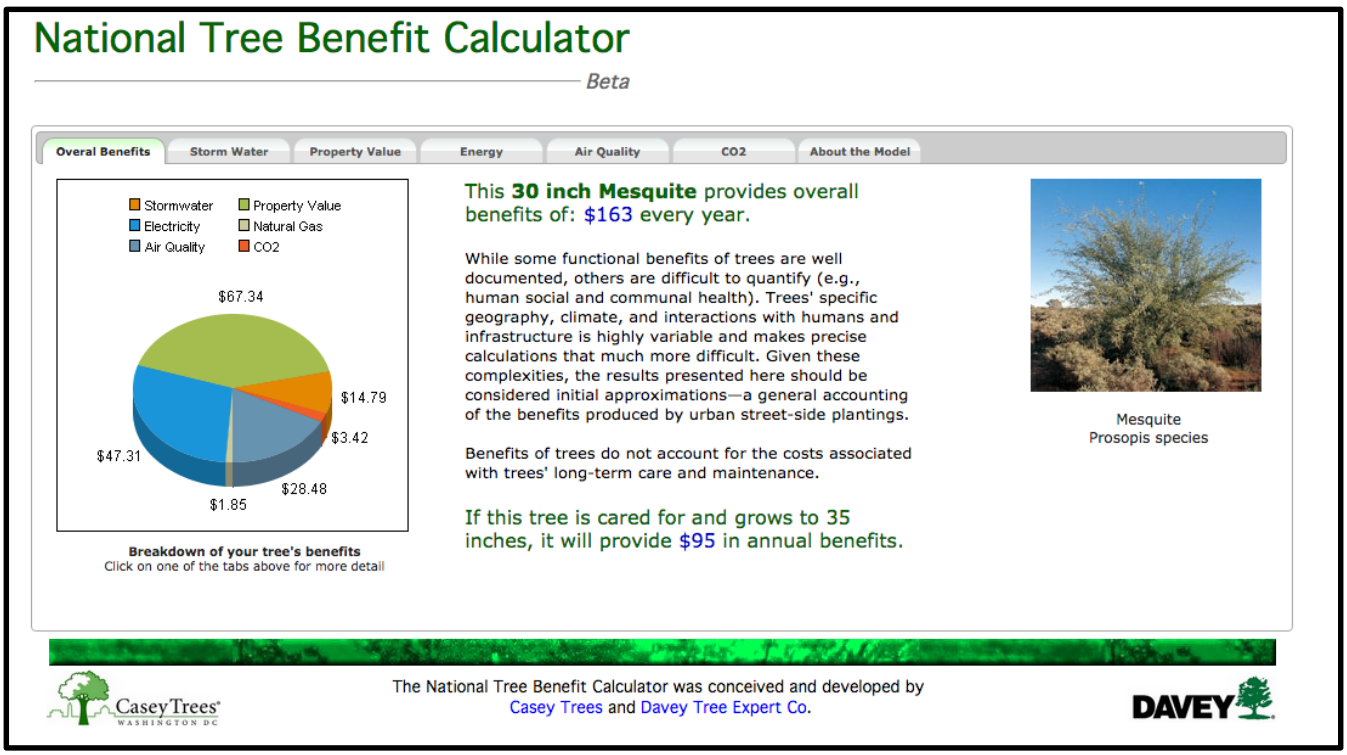

Figure 4 This website (http://treebenefits.com/calculator) calculates the benefits of planting certain species related to your zip code.

Class 2: What should we plant?

Learning outcomes: Students will know what plants/trees are native to the Sonoran Desert and what they should plant in Tempe.

- Speaker #1:
    - Discuss Sonoran Desert ecosystem, native plants, and dangers of non-native species
    - Give photo examples of common native and non-native species
- 10 minute break
- Speaker #2:
    - Explain basic plant biology and urban ecology overview (focus on trees)
    - Discuss which trees should be planted in Tempe
        - Ask students to share their homework assignment
        - Provide handout with graphics about potential species
- De-brief and discuss logistics for tour next week.
- Homework for next week: Consider where to plant trees on private property or in the community. Consider barriers to planting and the diversity of vegetation in the neighborhood. Discuss thoughts with neighbors and bring written observations to next non-tour class.

Class 2: Questions to Discuss

1. What is/are your favorite trees? Why?
2. How many of those are from Arizona? How many are invasive?
3. What are Biogenic Volatile Organic Compounds (BVOCs)?
4. What are the major causes of forming ground ozone?
5. How would you advise people from your neighborhood to plant trees?
6. How do we know a tree is good for planting in urban area?

Tour 2: Desert Botanical Garden

Learning outcomes: Students understand why some plants only grow in the Phoenix metro region, the importance of biodiversity, aesthetic benefits, and economic benefits.

- Ask Tour Guide to discuss the following:
  - Functions of different plants in different geographic areas within the Sonoran
  - Most and least resilient species characteristics
- Homework: Share photos/ content from experience through social media or to friends (if you don't have social media).

Class 3: Caring for an Urban Forest

Learning outcomes: Learn the steps for proper tree planting and maintenance.

**Note about scheduling: Plan to hold class in a community building less than .5 mile from a park where a tree can be planted.*

- Go to nearby park owned by the city and watch/ help city employee plant a tree
- Reflect and discuss homework
- Break
- Speaker #1: How to properly plant a tree
  - Discuss watering, pruning, and fertilizing trees
  - Tree Owner's Manual (http://na.fs.fed.us/urban/treeownersmanual/)
- Homework: Research methods of composting which could be implemented at the level of a desert home or community.

Class 3: Questions to Discuss

1. What about urban areas could potentially be harmful for trees?
2. How would you show people how to take care of different trees?
3. What are important tips for taking care of desert trees in a city?

Tour 3: Garden Pool

Learning outcomes: Students learn how to plant, prune and compost trees within an urban forest.

- Ask Tour Guide to discuss the following:
    - How does composting work at Garden Pool?
    - What types of trees thrive here?
    - What are the biggest barriers and challenges with trees?
    - How is tree health maintained and assessed at Garden Pool?

Class 4: Let's plant!

*Learning outcomes: Students will learn how to physically plant a tree with their new knowledge from the course. They will also discuss the tools necessary to do so and how they would attain these for neighborhood planting events. *Will need a rain plan.*

- Students will plant a tree in one or two of their communities. Location(s) will be chosen democratically by the class based on greatest need.
- Speaker: City of Tempe representative
    - Discuss how to write a successful proposal for the $10,000 neighborhood grant offered by the City of Tempe
    - Discuss protocol for citizens to plant trees in their community

Class 4: Questions to Discuss

1. What does a wining proposal to the city for a grant look like?
2. What are common mistakes in grant proposals to the city?
3. How would you spend a grant award of $500, $1,000, or $10,000?

Tour 4: Singh Farms

Learning outcomes: Learn about planting fruit trees for food and shade. Also learn about composting, soil health, and watering tips.

- Discuss benefits of biodiversity

Class 5 (last class): Recap, discuss next steps, and celebrate!

Learning outcomes: Students will get to ask any remaining questions they have and will discuss their overall experience in the program.

- Engage in a roundtable dialogue of what went well in class and what should be improved.
- Discuss volunteer opportunities, program requirements, and personal action plans.
- Eat food and share photos of the experience on slideshow (optional).
- Photo opportunity and 'ceremony' (send certificate after completion of volunteer hours).

Budget

In late 2015, the City of Tempe was one of three cities nation-wide to be awarded an American Forests Relief Grant for $100,000. The Master Urban Forester program may receive some of this funding due to the emphasis on community leader empowerment. This success shows Tempe is competitive for federal urban forestry awards due to the desert location and focus on engaging citizens as change makers. Other grant proposals will need to be crafted in order to launch the specific program outlined in this report. This section outlines what expenses should be considered during future grant applications.

- The city will not provide compensation for lecturers or tour guides nor gas and transportation. Students of the program are encouraged to utilize public transportation or organize car-pooling over the Master Urban Forester Facebook page and/ or phone.
    - Directions will be provided for each tour and lecture location.
- The cost of trees will be waived due to donations or covered through City of Tempe neighborhood grant funding. The recommended tree to plant at city parks is a 24-inch box tree which costs approximately $100. Communities are encouraged to plant 15 gallon trees which are less expensive and require minimal equipment to plant.
- Materials and tools to plant will be provided by City of Tempe. Furthermore, since classes will be held in different community rooms across the city, there will be no cost affiliated for space.

Total costs affiliated with the program: approx. $23,630

1. Program Manager to coordinate program: $20,520 a year ($38/ hour) for 20 hours/ week during programs (12 weeks) and 10 hours a week during off-program time (30 weeks). Although the two cohorts combined will be in the program for a total of 18 weeks (9 weeks each), the Project Manager will only need to work full time 12 weeks out of 18. This position should be housed in the City of Tempe and targeted towards Masters students and experienced professionals seeking part-time employment. Sustainability skills should be outlined in the job description. Insurance will not be included since part-time.
    a. 12 weeks out of year program will run x 20 hours = 240 hours on class cycle
    b. 30 week off-program cycle x 10 hours = 300 hours off class cycle
    c. 10 weeks off (in the summer)
2. Course refreshments: $1,000 per cohort, total = $2,000 per year
    a. 5 classes x $200 for food = $1,000 (approx. $9 per person)

3. 100% recycled Anton Sport T-shirts: $15 each x 23 + tax = approx. $355 x 2 = $710
    a. T-shirts will be provided to all Master Urban Foresters, the Program Manager, the Mayor, and a City of Tempe representative.
4. Potential tour costs: $200 x 2 cohorts = $400
    a. $8 each for Desert Botanical Gardens Tour
    b. Note: If no funding is secured for tours then all tours with fees may be made optional.

Metrics

In order to track success of the program, the below metrics should be monitored and evaluated by the Program Manager on a cohort by cohort basis.

- # applicants
- % drop rate of program
- # service hours
- # of people reached during engagement
- # people reached a year on Urban Forester Facebook page
- Participant overall satisfaction with experience (1-5)

The goal is to have 20 students a cohort with no drop-outs, although a 5% drop-out is acceptable. Since each student must complete 15 service hours, the target service hours is at least 300 per cohort. Appropriate engagement goals will be determined after first cohort. Metrics will be shared with the media as appropriate and distributed to the City of Tempe staff and partners every cohort.

Photo depicting a tree planting is from the City of Tempe's website.

Tours & Guests

This tour list is not exhaustive and will continue to evolve over the course of the program. Agritopia is included as a 'Plan B' option if another tour gets canceled. Tours will last for approximately one hour.

Tour Destination	Contact	Contact Information	Cost
Singh Farms	Ken Singh	(480) 225-7199 900 E Thomas Rd, Scottsdale, AZ	TBD
Desert Botanical Gardens	Customer Service	(480) 481-8188 1201 N. Galvin Parkway Phoenix, AZ	$8 per person
Garden Pool	Dennis	dennis@gardenpool.org http://gardenpool.org/book-a-tour	free
Mayas Farm at South Mountain	Maya Dailey	(480) 236-7097 6106 S. 32nd Street Phoenix, AZ	Small fee TBD
ASU Arboretum	Arboretum/Grounds Services: Deborah Thirkhill	(480) 268-4165 https://cfo.asu.edu/fdm-arboretum	Access free, tour guide fee TBD
Agritopia	Katie Critchley	katie@agritopia.com	$50 for group

Local family transformed pool and entire backyard into food-producing ecosystem with over ten fruit-producing trees. Photo from http://gardenpool.org/.

Session Instructors

The Program Manager will need to contact session instructors to ensure they are able and willing to assist with this program without compensation. These contacts are yet to be confirmed.

Speakers	Organization/Expertise	Contact Information
Nancy Selover	AZ State Climatologist	selover@asu.edu (480) 965-0580
Ariane Middel	Senior Sustainability Scientist, ASU/ *UHI and cooling aspects*	ariane.middel@asu.edu (480) 727-9228
Jim Anderson	Retired Professor, ASU/ *air quality issues associated with some tree species*	janderson@asu.edu (480) 965-7139
Lyssa Hall	Neighborhood Specialist at City of Phoenix Neighborhood Services Division	lysistrata.hall@phoenix.gov (602) 495-0118
Richard Adkins	Forestry Supervisor, City of Phoenix Parks	richard.adkins@phoenix.gov (602) 319-7399
Tony Brazel	Emeritus Professor, School of Geographical Sciences, ASU/ *Phoenix climate*	abrazel@asu.edu (480) 965-7533
Anne Reichman	Sustainable Cities Network, ASU	anne.reichman@asu.edu (480) 965-2168
Kate Radosevic	Valley Permaculture Alliance	(602) 535-4635 x104
Ryan Wood	Watershed management group	(520) 396-3266 x9

CONCLUSION

This program was designed to turn regular citizens into empowered, educated leaders dedicated to preserving and enhancing the comfort, health, and beauty of Tempe's urban forest. The first step is to share this concept with stakeholders internal and external to the city. After receiving approval for this program, the next step is to apply for grant funding so a Program Manager may be hired. Students created a detailed outline of the curriculum, budget, potential speakers, and more so the City of Tempe would be ready to move forward after completion of this report.

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APPENDIX A

The two most common trees found within the Phoenix area are the Mesquite (*Prosopis velutina*) and also the Blue Palo Verde (*Parkinsonia florida)*. Commonly known as the "velvet" mesquite, the *Prosopis velutina* produces filtered shade and often serves as a nurse tree for other slow growing plants like cacti (Schuch, Kelly, 2003). In the winter, the velvet mesquites fine textured leaflets fall off, which drastically reduces shading during these months. The second most popular species, the Blue Palo Verde, ranges from large shrubs to medium sized trees and are native to the Sonoran Desert (Schuch, Kelly, 2003). Because their canopy is denser than the mesquites, and their maximum height can get up to around 30 feet, the quality of shade from this species tends to be better.

There are numerous species to choose from when deciding which is best for your home or neighborhood. Usually, it will depend on your specific circumstance (the layout of the area you are considering, the amount of time you can spend on maintenance, water usage, etc.). The Desert Botanical Garden collaborated with Arizona Community Tree Council to create their very helpful "Guide to Arizona Desert Shade Trees" (AMWUA, 2008). In this document, they have a user-friendly infographic that serves as a "one-stop guide to a variety of shade trees that grow well in the dry Arizona Sonoran Desert environment." Many of the trees on this list are commonly seen in the Phoenix area. The two that stand out on the list as having the largest canopies are the Chinese Elm (*Ulmus parvifolia*), and the Indian Rosewood (*Dalbergia sissoo*). While both species provide large amounts of shade, it is important to note that they should not be planted near electric lines due to their height.

Chinese Elm (left) and Indian Rosewood (right).

APPENDIX B

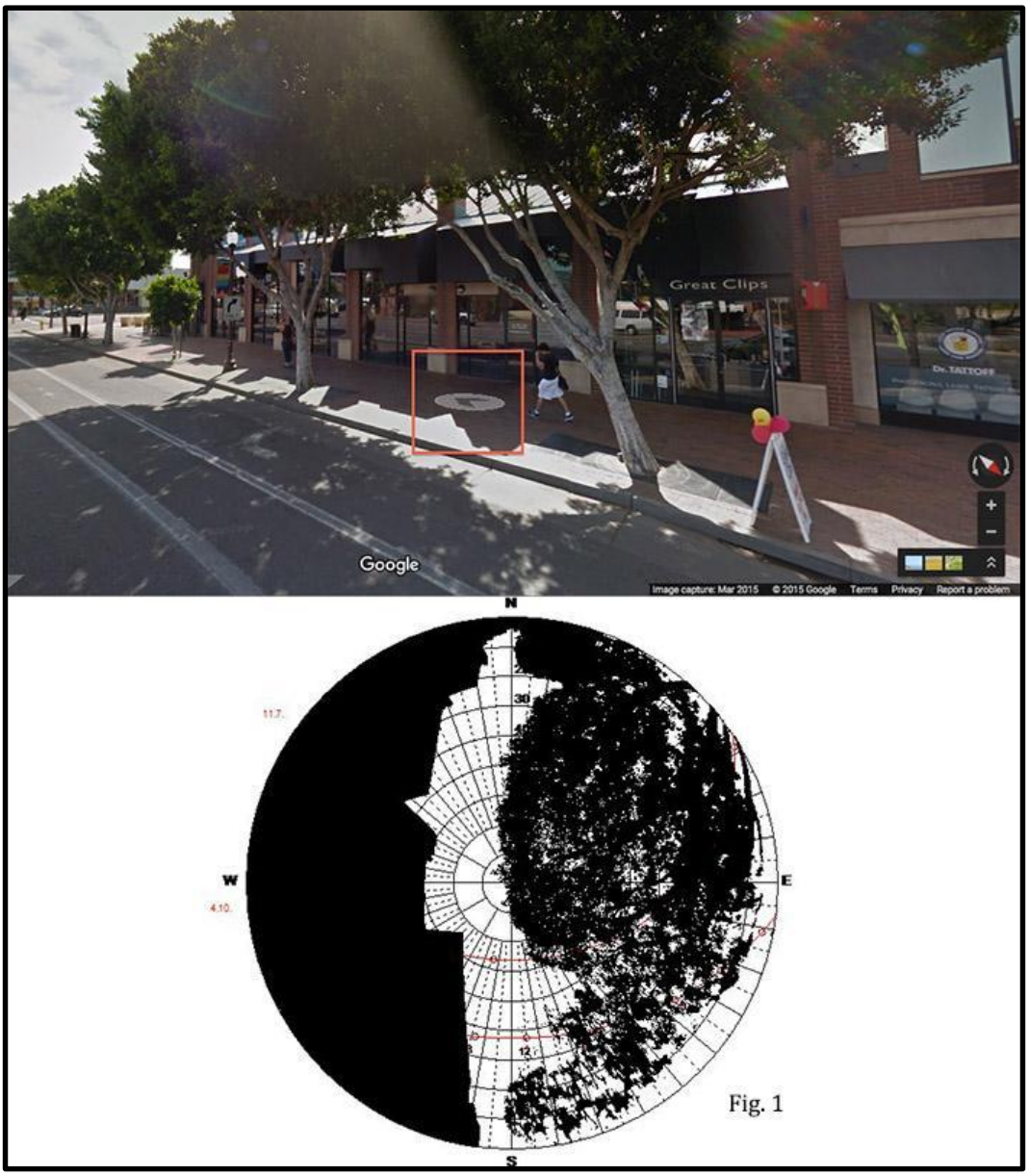

Image above: Increased vegetation in Tempe creates more shade, which improves comfort and increases walkability. Fig. 1 shows the fraction of sky visible when the spot located inside the red square is viewed from the ground up (as if laying on one's back). The black parts are shaded while white space shows area unshaded.

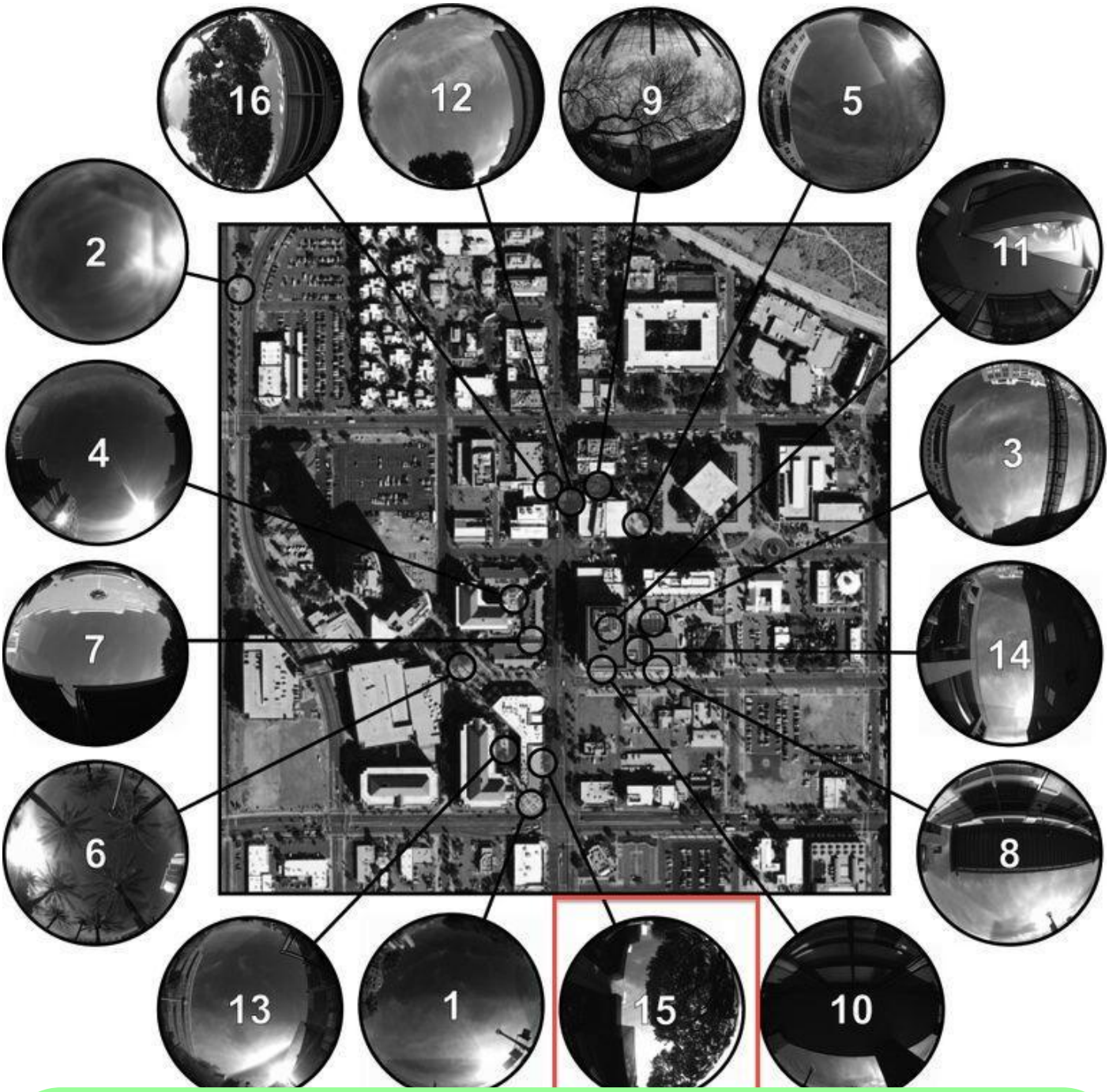

Fig. 1 shows Site #15 in this satellite image of Mill Avenue and the surrounding area in downtown Tempe. This is the expanded birds-eye view of the area. Students at ASU who are currently studying the microclimate of certain spots around downtown Tempe created the image above. They are finding that sites like #15, which have a significant amount of shading from vegetation, have lower ground temperatures, which leads to greater human comfort.