

THE URBAN FARM Summer 2011



Drachman Institute College of Architecture + Landscape Architecture The University of Arizona.

THE DRACHMAN INSTITUTE

The Drachman Institute is a research and public service unit of the College of Architecture and Landscape Architecture at the University of Arizona, dedicated to the environmentally sensitive and resource-conscious development of neighborhoods and communities. The Drachman Institute dedicates its research and outreach activities to the proposition that housing is the buildingblock of neighborhoods, and neighborhoods are the building-blocks of communities.

Designer Rudy Poe **Project Director** Katie Gannon **Director** Brooks Jeffery

The Drachman Institute College of Architecture and Landscape Architecture The University of Arizona 819 E. First St. Tucson, AZ 85721

(520) 626-5293

www.drachmaninstitute.org

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CPPW

Communities Putting Prevention to Work (CPPW) is a national initiative of the Centers for Disease Control and Prevention (CDC).

The goal is to prevent or reduce the spread of obesity and related diseases by increasing opportunities for improved nutrition and active living. The method is implementation of policy, systems and environmental change. Pima County was one of 44 communities nationwide to receive funding for the CPPW grant, part of the American Recovery and Reinvestment Act of 2009.

CPPW is being developed and administered by the Pima County Health Department, in partnership with Activate Tucson, a coalition advocating healthy eating and active living.

A *Let's Move* toolkit for faith-based and neighborhood organizations can be linked to from the website http://www.hhs.gov/fbci/index.html.

ACKNOWLEDGMENTS:

Thanks to Sharayah for helping the Urban Farm in the beginning stages of brainstorming, visioning and concept development.

Thanks to City High School for their past work on the garden. The physical labor and design work they put into the project site have been instrumental in this continued evolution and growth of the farm.

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INTRODUCTION.

PURPOSE OF THIS DOCUMENT

This booklet is meant to provide the Community Food Bank (CFB) Urban Farm with a brief analysis and overview of their site along with a conceptual master plan of how to pattern the spaces and events of the farm. It also offers suggestions on how these ideas could be implemented.

This farm was designed to become a permaculture farm and the ideas shared in this booklet follow the basic ethics and principles of permaculture to the best of the designer's current knowledge and skill level. The designer's goal in this design was to place elements so that they are mutually beneficial, sustainable and minimize human effort while maximizing the output of the farm.

This book should be used as guidance to help the farm implement their vision, find funding and help articulate their vision and goals to the greater community. Changes to the design are welcome and invited especially if they enhance the permaculture principles that provide a multi-layered sustainability strategy.

Community Food Bank

Like all food banks, a large part of the Community Food Bank's (CFB) work centers around meeting our community's hunger needs by gathering and redistributing food. However, we also understand that hunger, poverty, economy, community health and environmental health are all connected, and thus employ an integrated approach to address these issues. Our programs support capacity building for individuals and communities to move towards secure, long term access to good food.

Among other things, we provide free bilingual trainings on home food production and green job skills, offer farm training apprenticeships for teens, manage two community farms, help folks sell their home grown food through farmers' markets, support local agriculture and link local agriculture with food insecure pockets of our community. Our goal is that people gaining education and experience from these programs spread their knowledge to others in their local community, and eventually take leadership in the program itself."

The new community farm furthers efforts towards our department's interconnected goals of promoting local economic development, community building, environmental stewardship, and local food production.

Overview of the Urban Farm

HISTORY

Located south of Silverlake on Cottonwood Lane, bordering the Santa Cruz River, the site was formerly the Farmacy Gardens (late 90's to Early 2000's). City High School took over the parcel in the summer of 2006 to create a garden that could be used to educate their students both in technical aspects of food production, and about larger food systems issues.

Due to constraints of staff, funding, and transportation, City High was not able to maintain their garden over the long term and appealed for support from the CFB in order to use this land to its full potential to serve the surrounding community.

The CFB is currently subleasing the land from City High until a joint lease goes into effect in October, 2011.

PROJECT OBJECTIVES

Through a continuing effort to gather input and put on visioning sessions with all interested neighbors and community members, the Tucson Community Food Bank has distilled the basic objectives of the farm into the following:

- Drive local economic development
- Increase food production in urban Tucson
- Increase access to healthy food in urban Tucson, especially South Tucson and A Mountain, Midvale Park, and Sunnyside neighborhood areas
- Provide working models to drive policy change in urban farming and composting, and inspire similar operations within urban areas
- Community capacity building, especially in South Tucson and A Mountain, Midvale Park, and Sunnyside neighborhood areas

ORGANIZATION AND PLANNING

- A Farm Manager has been hired by the CFB to oversee initial startup and long- term operations of the Urban Farm.
- The CFB is currently applying for funds from the CPPW grant to fund our startup and infrastructure costs.
- Contingent on these funds, the CFB will be able to support the "farmers" on site with seeds, seedlings, tools, compost, garden materials, and technical advice. Technical gardening workshops will also be held regularly onsite.
- The CFB has applied for interns through local volunteer and service organizations to aid in the efforts of the Urban Farm.
- There are many preexisting programs at the CFB that will augment education, labor and community outreach efforts. For instance, farmers who wish to sell their produce on consignment can do so through the CFB Community Foods Consignment program, or beginning farmers can be provided with a mentor through the Garden Mentor program.

SELECTED HISTORY OF SANTA CRUZ RIVER VALLEY

9500-9000 BC

Paleo-Indians inhabited the river banks and valleys, archeological evidence of agriculture. Populations increased during wet years and declined in dry years (this relationship between population and rainfall continues throughout history).

650-1450 AD

Hohokam resided along the Santa Cruz river. Hohokam constructed elaborate, efficient, level and clay-sealed irrigation canals coming off of the river that successfully provided for intensive agriculture and may have significantly affected the river's course and surface flow. No other settlement, including Spanish, Mexican, or Anglo settlers, ever constructed canals that came close to the efficiency and design of the Hohokam. The floodplain zone provided fertile alluvial soil ~20' deep. Wells were dug 6-8' deep to reach water. In addition to agricultural crops like corn, Hohokam diverse diet included cactus fruit, bighorn sheep, mule deer, jackrabbits, mesquite beans, agave, and fish from the river.

Late 1600s

Spanish colonists arrived, most likely travelling up the San Pedro. Colonists introduced new crops and cattle to the region. In general, Spanish colonists, like the famous Father Kino, Pima, and Papago groups shared resources, cooperating jointly in protecting their agriculture and livestock against frequent Apache raids.

1800

The Santa Cruz river no longer flowed to the Gila, except during monsoons.

1833

Significant floods were reported- first recorded environmental effect of overgrazing.

excavated An Hohokam canal in Phoenix, Arizona.



LOCATION AND CONTEXT



Neighborhood Area The farm is located west of the Santa Cruz River.

The residential homes are trailer homes.

People dump construction materials and other garbage into the Santa Cruz River, which will be dealt by the Flood Control District.

Horses do travel the length of the Santa Cruz River, as there are mini-ranches close to the farm.

The land is sparsely vegetated by mesquite and pioneer weed species.



General Area

Located west of the convergence of I-10 and I-19, the farm is less than a mile from A mountain. It is located within the Santa Cruz Southwest neighborhood area which is roughly the area west of the Santa Cruz River.

According to Zillow, 75% of homes are owner-occupied trailer homes and the rest are renters which is higher than the rest of Tucson. Home values are lower (50k to 60k) than average Tucson home prices.

The area is characterized as the following: melting pot, low income, foreign language speaking urbanites, most have a high school education or lower, mainly employed in service jobs, a mix of single income families and seniors over 65 years.

The average commute time to places of work is 26 minutes, slightly more than the rest of Tucson. 90% of Tucson has a higher walk score, meaning this area is car dependent. The nearest grocery store is 1 mile away.

SITE VIEWS AND ANALYSIS.





Western border sparsely vegetated by mature mesquite. Swale runs parallel to road providing extra water to mesquites. Area is set up for developing native hedge.



The eastern border of the site drops off into the Santa Cruz River flood plain. The upper terrace although highly disturbed is drier. Water does drain from the project site toward the Santa Cruz.



This appears to be one of the major drainages running off the site to the Santa Cruz causing significant erosion. Water harvesting can preserve terrace edge.



Existing swale on northern half of site would be ideal for a windbreak, hedge, or food forest. Planting between gaps in existing mesquite vegetation is important.



Blank slate characterizes the project site. Little in the way of vegetation grows because of major disturbance in past. Soil building is a crucial element to the farm.



This is the only walkable entry that leads from the Santa Cruz to the farm. Security and circulation through the farm appears to be an important element for the community.

SITE VIEWS AND ANALYSIS.





These garden beds are already molded and appear to have good soil. Could be an ideal site for another demonstration garden or forested northeastern entry into the farm.



Past ramada structure was burned down. Security and safety are crucial design elements. Perhaps a watchful residence on site would prevent future vandalism?



Vegetation is sparse on the site. What vegetation exists are located in little depressions such as these.



The second swale on the site has mature mesquites and would be ideal for a food forest garden and/or windbreak.



The southern fence line has a swale that runs east to west. The vegetation density is higher here than any other section of the project site. Locating these structures will help create better conditions on site.



An automobile entry is already sited at an intersection and would be an appropriate entry.

SANTA CRUZ RIVER PARK TRAIL



Above: for the full map see Appendix A.

The completed sections of the Santa Cruz River park is from Grant Road to 29th Street and Ajo Way to Irvington Road. The mile long strip that includes the Community Food Bank Southside Farm between 29th Street and Ajo is officially "under solicitation for design." In the future, once this section of trail is complete, it will improve the overall connectivity and recreational quality of Tucson, including amenities like: bicycling, drinking water, equestrian access, exercise stations, historic site, hiking/walking, playground, restrooms, wildlife viewing. In a larger context, the Santa Cruz River park is part of what will one day be part of a 55 mile urban loop that circumambulates Tucson connecting multiple rivers. Historically, the River park is part of National Trail system that signifies the route Juan de Anza traveled to establish the modern-day city of San Francisco, California (Pima County).

The major considerations for design on the farm is to seemlessly connect to the historical and agricultural significance of the Santa Cruz and complement the trail function including its diverse amenities.

WATER ANALYSIS







Large Context

Water flow analysis in the area around the farm shows that sheet flow from the street runs through the site. Since the road is crowned in the middle, only half of the the street flow runs along the north-south boundary of the property line. Relative the entire watershed, the topo map shows that the farm watershed only encompasses the actual area within the property boundaries and some area east and south of the site. Only an acre of sheet flow south of the southern property line flow onto the site. Water begins to concentrate on the northern boundary of the farm presenting a great opportunity for an oasis zone. All other sheet flow generated between the two branches of the Santa Cruz River are diverted west or north of the farm.

On-Site Flows

The farm is relatively flat. Depressions scattered throughout appear to catch water because of concentrated pockets of vegetation like desert broom, tumbleweed and mesquite trees (Refer to Site Views and Analysis, J and K). The soil is very porous and its runoff coefficient would tend to be lower than a clayey soil surface but not as low as a vegetated soil surface.

The topography of the site would indicate that the area bounded by the property line gently slopes (less than 1%) from south to north. However, the sheet flow south of the property line runs from east to west.

The image of the southern boundary shows the vegetation and related water collection area. From this basin, the water appears to run east into the Santa Cruz River.

In summary, to increase water flow onto the farm, water should be diverted directly south of the property boundary toward the eastern boundary.

ANALYSIS SUMMARY

Water

Plant the water. Planting the water means installing as many earthworks and diverting as much sheet flow toward the farm site as possible. The sheet flow from the street that runs the length of the north-south property boundary is a great opportunity. However, south of property boundary exists a drainage that runs east-west into the Santa Cruz. Capturing that drainage flow for use on the farm would be highly recommended.

Food Desert

The surrounding community does not have close access to healthy food and grocery stores. The farm will play a critical role in providing local food and resources on how to improve access to healthy foods.

Santa Cruz River Park Trail

This feature is currently under design and coordinating with the design team will be critical that the trail and the farm interact complement each other in form and function.

SECTOR ANALYSIS.

This summary of energies that pass through the farm site encompasses wind, water, people, views, residences and access points. Because the strongest and most prevalent winds come from the southwest and southeast, windbreaks specifically in those directions are crucial for gardens and people. Because most access points and potential for vandalism are from the east and west security measures like cactus hedges and controlled entry points are important for these directions. Security and views are specifically important to maintain the connection of the farm to the city views to the northwest.

History

The site has been historically used as farm land, sheding light on this fact should be an important aspect of the farm design. City High managed the farm in the past, their visioning and the current community vision should be synthesized.

Environment

Tucson's climate is hot and dry making microclimate strategies an absolute must for food production and places for people.

Security

Vandalism has been an issue in the past. Crime prevention through environmental design should be considered when attempting to create a safe and secure environment that deters theft, vandalism and other crimes.

Community

The Urban Farm is managed by the Community Food Bank whose mission and purpose will define the programs and programming on and of the site.



APPLIED DESIGN PRINCIPLES

PERMACULTURE DESIGN PRINCIPLES



1. Everything is connected t everything else - place elements in relationship to eac other intentionally. 2. Every element should serve many functions - plan shade, food, wildlife habitat beauty, reduced heat island effect, privacy buffer, soil conditioner, and fuel.

- 3. Every function is supported by many element - e.g. water: earthworks, cistern, municipal.
- 4. Plan for efficient energy use using zone and sector analysis.
- 5. Favor use of biological resources over fossil resources - rock mulch versus organic mulch
- 6. Recycle energy on-site: earth from basins becomes pathways, tree litter becomes mulch food waste becomes garden food - "closing t loop" as close to the source as possible.
- 7. Use/accelerate natural plant succession to

EDIBLE FOREST GARDENING

- 1. Healthy plants.
- 2. Self-renewing fertility including existing site conditions.
- 3. Sustainable water demand including desired ecosystem components and ecosystem patterning like site preparation, spacing, structural diversity, sequencing, disturbance regime, and distribution.

CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN

Natural Surveilence

Is a design concept that uses features that increase Elements that help distinguish the domain bethe visibility of the property or building. Includes tween public and private are signs of ownership to proper placement of view corridors, lighting and potential offenders. landscaping. One activity area should have clear view of another activity area. Maintenance

Natural Access Control

Uses elements like hedges, screens, doors, and gates to create the perception of risk to offeneder.

to		create beneficial sites/soils: Sonora cohous-
		ing used 4-wing salt bush to establish vegeta-
ch		tion, increase organic matter, break up soil as
		"pioneer" plant that is then replaced by more
		useful plants.
nt:	8.	Use small scale, intensive systems.
t,	9.	Use a diversity of beneficial species for a pro-
		ductive, interactive system - no monocultures.
	10.	Attitude: "everything works both ways" -
		problems and solutions (stormwater as refuse,
nts		stormwater as refuse/resource).
	11.	Use patterns and edges for best effect: natural
d		patterns like slope, movement of sun or pat-
		terns of wind directing, movement of animals
		through a site, including humans; human
h.		patterns like orientation of houses, overhangs,
		solar arc, raised paths/sunken basins, design
h,		of garden; patterns associated with larger
the		patterns like prevailing wind and beneficial
		storage location of bulk materials.

- 4. Minimal herbivory including management activities like deliberate site and niche availability, coevolution and facilitated species performances.
- 5. Minimal competition.
- 6. Directed succession.
- 7. Overyielding polycultures.

Territorial Reinforcement

A critical practice that includes landscape maintenance and aesthetic to preserve quality of habitation and ownership. Grafitti should be quickly

cleaned however frequent it happens.

PATTERNS.

Pattern language helps to articulate the layout and function of the garden, farm, and settlement in a way that represents the cultural, environmental, functional, economic and aesthetic knowledge of the place. The below list suggests how the designer and farmers of the Urban Farm may articulate and understand the programming and function of the farm. The organization of the below patterns helps to articulate how these patterns apply at different scales although in reality these patterns exist in synchronicity and complementary. This language can be used to communicate your ideas, test them, refine them and perhaps add to them.

Landscape Scale

Productive landscape mosaic Gradient from wild to cultivated

<u>Site Scale</u>

Habitat diversity Zones and sectors Zones of water use Outdoor living rooms Intimacy gradient South facing outdoors Positive outdoor space Hierarchy of open space

Patterns of the garden

Half hidden garden Gaps and clearings Mature-forest forest garden Forest edges Multifunctional patches Windbreak and living air conditioners

Patterns in the garden

Patch disturbance and regeneration Disturbance and maintenance regimes Planting in time – planned succession patterns Paths and nodes Keyhole beds (Page 22) Contoured beds Rootlike Path Geometries Grid patterns for harvest Alley cropping Native edibles everywhere Layers of harvest Staggered harvests Native species Nutrient collectors Diversity of life forms Polyculture patches (Page 22) Cross pollination clusters Functional plants everywhere Stair seats Zen view Tree places Trellised walk Greenhouse

Garden elements

Mulch Living soil Fruitful footpaths Dead wood Compost piles beneficially placed Garden seat Compost Vegetable garden Sitting wall Soft tile and brick Climbing plants

<u>Techniques</u>

Chop and drop No till and till



DESIGN



The Permaculture Farm: A Multilayered Approach

Applying permaculture, food forest and crime prevention through environmental design principles, the farm embodies a layered approach regarding how elements are placed so that each element fulfills the ethics and needs of the following: the community, environment, economy, and function.

Community

The farm is both emphasized as a highly productive food system as well as as an educational center. This is accomplished by offering within the farm a number of demonstration sites, training sites like kitchen areas and demonstration gardens, and more traditional settings like an outdoor classroom spaces.

Environment

Creating habitat is a critical aspect of the farm. In the design, habitat is always integrated with with human circulation and water conveyence. The entire farm is surrounded by native vegetation as a way to create a diverse ecosystem around the farm that invites pollinators and promotes a healthy, balanced insect population.

Economic Production

To meet the hunger needs of the community, tied in with the educational and community aspects of the farm, the design uses polyculture, food forestry, and alley cropping to diversify and intensify the food capacity of the site.

Function

Rainwater harvesting, pedestrian circulation, microclimate creators, habitat and often times food production are bundled into a single area. Unlike many farm systems, which are fragmented and lacking of diversity, the coalescing of these multiple, yet compatible functions, approaches a level of sustainability that takes into account the needs of people, the environment, and available resources. Security hedges of prickley pear and cholla maintain interior visibility and control access.

ZONING



Zoning is a design tool used by permaculture designers to aid in correctly placing elements in correct relationship with one another and in accordance with the needs and attention required of each elements. The ultimate goal is to minimize human work through two main approaches: (1) placing elements that need lots of attention closer to high activity zones and (2) placing compatible elements so that they support each other and are multifunctional.

Zone I: High Activity, High Energy

Zone I surrounds the central gathering and contains all of the most visited areas of the garden and items that require most attention from humans. Elements included in this area are vegetable crops, herb gardens, soft fruit, greenhouses, hoop houses, chickens, goats, propogation area, small scale composting bins.

Zone II: Semi-Intensive

Often adjacent to zone I, zone II requires less attention like occasional weed control and pruning. Elements placed in this area are orchards, larger scale compost areas, beehives, small domestic stock and windbreaks or hedges.

Zone III: Farm Zone

Is the farm zone where commercial crops and animals are placed. It may contain the main commercial crops, barn structures, and larger scale windbreaks.

Zone IV: Semi-Wild

This zone requires the least attention save for pruning or harvest of fuel wood or food. Activities that happen here are wild harvest, forage, pasture, natural forestry systems, and observation of natural area. In this zone, guided succession helps to form the function of the forest.

Zone V: Wild

This zone is unmanaged and natural and is mostly used for recreational purposes. The Santa Cruz River is the zone V area of the farm.

ZONE I: COMMUNITY.

The circular gathering area creates a shaded, cooled outdoor gathering. Ramadas harvest rainwater to supply water to the cool tower. The cool tower and complete shade canopy of trees create a comfortable microclimate even during the summer heat. This is the heart of the farm where many community and work activities take place, including farm stands, cooking, harvest and food preparation, education and music.







Design 19

Zone II: Food Forest....

A permaculture forest garden mimics the architecture and beneficial relationships of a natural forest. Food forests are not 'natural', but are designed and managed ecosystems that are very rich in biodiversity and productivity. In an arid land context a food forest should rely on water sources in the following order: passive rainwater harvesting earthworks, grey water sources then finally municipal water delivered via drip irrigation.



SPACING

Mesquite Layer

Date Palms

Fruit Trees

Shrubs and Groundcover



FOOD FOREST ESTABLISHMENT.

Typically, the main goal of the food forest is the following "to create high, diverse yields from an as selfmaintaining as possible garden that creates maximum ecosystem health" (Jacke 2005). Thus, to design and install a food forest is simply a sequence of choosing plants and deciding when and where to place them while achieving the above goal.

Although beyond the scope of this document, many resources are available that can be instructive on how to install the food forest. Please refer to the appendix for more information on forest gardens. Additionally, these ideas have yet to be adapted to arid land conditions. Below summarizes the major concepts and a suggested successional pattern that transitions from pioneer/climax species to mostly climax food producing species.

Objectives:

- Compositional diversity includes varied species and varieties of plants that similar to companion planting, promote species diversity as the major method of pest control.
- Earthworks: to reduce the amount of groundwater

SEQUENCING

Image Source: Jacke, Dave. Edible Forest Gardens. 2005.





Pattern: Mature Forest

resources used, the food forest should always be tied to a rainwater harvesting earthwork.

- Structural diversity: is reflected from the soil all the way to the shrub layer to the overstory tree species. It creates a number of niches for different plant types. Similar to compositional diversity it provides a diversity of habitat that creates a balanced ecosystem as the main method of pest management.

Establishment

- 1. Site preparation should be preceded with a site analysis determing soil conditions.
 - 2. Spacing includes putting nitrogen fixing trees close to the plant they will assist and fruit producing trees spaced enough to reduce competition and maximize yield.
 - 3. Sequencing refers to the specific patterning of events over time such as weeding, mulching, and planting. For example, pioneer species may be the first step of establishment followed by planting climax and fruit producing species. This directed succession creates the conditions necessary for successful climax environment.





Pattern: Instant Succession

Sequencing is a key step to the food forest. Start with fast growing, sun loving pioneer species and food species. As the tree species grow, the sun-loving shrubs should be replaced with shade tolerant food plants. The forest edge dynamic should be sought to maximize food production capacity. Otherwise, a 100% canopy cover could be obtained.

POLYCULTURE GARDENING

The patterns used in these garden designs are keyhole beds, polyculture patches, and pockets of production.

Keyhole beds offer more bed area compared to foot path area. Less used plants should be placed further from the keyhole and more used plants should be planted closer to the keyhole or foot path. This pattern was first articulated by Bill Mollison one that he derived from the patterns used to transport nutrients and air in the human lungs and intestines.

Polyculture patches are intentional species mixtures to create resource sharing and supportive guilds. The keyhole beds are bordered with perennial shrubs or dwarf fruit trees to diversify habitat and create a microclimate for vegetables.

Pockets of production are mix of diverse perennial food crops and typical gardening plots.





Above: keyhole pattern for community garden spaces. Left: countoured keyhole beds



ALLEY CROPPING



When row sets are spaced at relatively close intervals (40 feet or less), row crops can be grown for several years until the tree canopy begins to compete for sunlight. Management options include: Change the The below information is provided by the USDA Natural Resources and Conservation Service. crop grown in the alleys from row crop to small grain to forage and potentially to tree plantation as the trees mature and the canopy shades the alley crop; Plan for a Definition Alley cropping is the planting of trees or shrubs in two specific crop rotation and manage the trees to keep the or more sets of single or multiple rows with agronomcanopy (competition for light) within the requirements ic, horticultural, or forage crops cultivated in the alleys of the crops grown. between the rows of woody plants.

Purpose

Alley cropping is used to enhance or diversify farm products, reduce surface water runoff and erosion,



	lila	/	//		111-1-
0'	10'		2	.0'	30'

improve utilization of nutrients, reduce wind erosion, modify the microclimate for improved crop production, improve wildlife habitat, and enhance the aesthetics of the area.

Management

Alley cropping is used where improved economics or environmental conditions are desired over the existing farming practices. Alley cropping in addition to the tree or shrub products grown, is used with row, small grain, or specialty crop production. The sites selected must be suited to produce both the woody and herbaceous crop species desired.

For more information refer to References section for a list of resources under "Alley Cropping". Refer to page 29 for a recommended plant list.

NATIVE HARVEST.



SATELITE TOOL SHED.



20



Satelite Tool Shed - Toilet - Sha

Composting / Waterless Toile

Sink (greywater waste Sliding "Barn-Door" Work Sink (greywater waste)

Work Counter (36" high)

Tool Storage

The satellite tool shed serves the needs of the farm workers by providing access to commonly used tools throughout the farm. The added efficiency of having tools accessible where people work is complimented by the combination of a composting toilet, sink, work station/counter, and shade. The architecture continues to uphold the expression of play between earth and industry while celebrating the sustainability in form and function.



The open space can act as a classroom, outdoor office, or just a well-needed respite from the sun. The space is shaded from above with a metal roof on exposed framing and is protected on the west by the solid adobe or rammed-earth walls and a planter screen on the east. The tool shed and toilet room are lit with clerestory ambient light through translucent polycarbonate panels eliminating the need for artificial light or electrical wiring.

WATER HARVESTING.



A swale runs north and south adjacent to the street to water the western border/hedge. It harvest runoff from the street.

Rainwater harvesting structures are emphasized around the central gathering area to provide the supplemental water to create the windbreak and food forest areas. Because the water flow analysis shows a relatively small area of capture, most water was diverted toward the high activity, oasis area.



The swales within the interior of the farm support a food forest. The swale is about two feet deep and four to six feet wide.



ELEMENT MULTIFUNCTIONALITY...



Compost area is placed for best access to street and central location to garden and farm areas to reduce the amount of energy expenditure to drop off and distribute compost. The windbreak completely surrounding creates a calmer microclimate. Since prevailing winds are from the south and slope is from south to north, the organic matter and nutrients will blow onto garden and farm areas.

The north-south orientation of alley crops provide western shade and create a microclimate that prevents evapotranspiration. The alley can fit a small tractor. Over time the tree cover will increase, thus increasing the perennial food crop.

The gathering area is circular and acts as the heart center of the farm. Ramadas provide shade to people and are runoff sources for cisterns. The cisterns provide water to the cool tower during the hot, dry summer season, and they also act as a thermal mass to help moderate the temperature around the gathering area. The thick, deciduous native tree canopy cover stores cool air under its shade which is augmented by the cool tower. The cisterns themselves could be pillars of the ramadas. The sunken center of the gathering area stores cool air during the summer and the pavement heats up during the winter.

The cooling tower should be installed given that the gathering area is sufficiently sheltered to prevent outside wind from blowing cooler air away from the area. The tower should be installed when trees are mature or when the space has sufficient windbreak.

All hedges and windbreaks serve as pedestrian ways, water harvesting earthworks, provide habitat, moderate microclimates, create food, dilineate different spaces, and attract pollinators.

The border of the entire site is a hedge of native plants that also harvest water, provide native edibles, create habitat, shelter the farm from undesireable exterior energies and act as a security barrier preventing unwanted access to the farm at non entry points.

PROJECT SUMMARY

This booklet is meant to provide the Community Food Bank Urban Farm with a brief analysis of their site along with a conceptual master plan of how to organize the spaces and elements of the farm. It also offers suggestions on how these ideas could be implemented, although the designer does suggest more research and planning be put into the food forest concept.

Because much of the northern portion of the site has been developed from past efforts of the City High School and the Audubon Society, the design does little in these areas other than to suggest where buildings and paths may fit in. The rest of the seven acre site is essentially a blank slate ready for significant change.

This farm was designed to become a permaculture farm and the ideas shared in this booklet follow the basic ethics and principles of permaculture to the best of the designer's current knowledge and skill level. Changes to the relationships and placement of programatic elements are suggested especially as site requirements and knowledge of design improve over time. The designer's goal in this design was to place elements so that they are mutually beneficial, sustainable and minimize human effort while maximizing the output of the farm.

Many of the ideas proposed in this booklet are theoretical and have yet to be tested in the specific arid conditions of the Tucson basin. The origins of these ideas have come from examples seen throughout the world like the permaculture designs in Jordan and Spain. In the example of the food forest, the designer has no knowledge of a documented food forest in the Southwest. A great deal more research, experimentation, and planning should take place to create a food forest appropriate to Tucson. This document offers some preliminary information gained from other sources that could help in establishing a food forest.

This book should be used as guidance to help the community and managers implement their vision and find additional funding. Changes to the design are welcome and invited especially if they further enhance the permaculture principles that provide a multi-layered sustainability strategy.

PROGRAMMATIC ELEMENTS

- Food Forest
- Native Harvest Hedge
- Radial Gathering Area
- Polyculture Gardens
- Alley Cropping Farming
- Cooling Tower in Gathering Area
- · Greenhouses, hoop houses, and Tool Sheds
- Compost Toilets

28 Design

• Water Harvesting Swales

FOR WINDBREAKS / FOOD FORESTS

Fruit Trees

Chinese date Zizyphus jujuba carob *Ceratonia siliqua* citrus grapefruit, sweet orange, lemon date palm Phoenix dactylifera fig *Ficus carica* nopal *Opuntia ficus-indica* olive Olea europea peach Prunus persica pomegranate Punica granatum tree of life Moringa oleifera

FOR ALLEY CROPS

Fruit Trees

Chinese date Zizyphus jujuba carob *Ceratonia siliqua* citrus grapefruit, sweet orange, lemon date palm Phoenix dactylifera fig *Ficus carica* nopal *Opuntia ficus-indica* olive Olea europea peach Prunus persica pomegranate Punica granatum tree of life Moringa oleifera

FOR NATIVE HARVEST HEDGE

Cactus

prickley pear Opuntia engelmanii saguaro Carnegeia gigantea staghorn cholla Opuntia versicolor

Nitrogen-fixing Plants

blue palo verde Parkinsonia florida desert ironwood Olneya tesota sweet acacia Acacia farnesiana screwbean mesquite Prosopis pubescens velvet mesquite Prosopis juliflora

Nitrogen-fixing Plants blue palo verde Parkinsonia florida desert ironwood Olneva tesota sweet acacia Acacia farnesiana velvet mesquite Prosopis juliflora

Shrubs chiltepine Capsicum annum desert hackberry Celtis pallida jojoba Simmondsia chinensis oreganillo Aloysia wrightii

Nitrogen-fixing Plants blue palo verde Parkinsonia florida desert ironwood Olneva tesota sweet acacia Acacia farnesiana velvet mesquite Prosopis juliflora

Shrubs quelites Amaranthus palmeri

Shrubs barrel cactus Ferocactus wislizenii brittlebush Encelia farinosa chiltepine Capsicum annum chuparosa Justica californica creosote Larrea tridentata desert hackberry Celtis pallida jojoba Simmondsia chinensis oreganillo *Alovsia wrightii* wolfberry Lycium fremontii quail brush Atriplex lentiformis

APPENDIX B. Santa Cruz River Park



APPENDIX C. SATELLITE TOOL SHED COST ESTIMATE

Marana Farm Satelite Tool Shed/ Outdoor Classroom/ Toilet Cost Estimate - Materials Only

			RSMeans	Other	
		Quantity			
Item		or area	Cost per Ite	em	Total Cost
Foundation (3000 psi conc.)					
Footings	l.f.	52	7.07		\$367.64
Slab	s.f.	320	2.14		\$684.80
Walls (Adobe Block)					
blocks	ea	940		1.5	\$1,410.00
mortar	50# bag	4		15	\$60.00
Roof					
Roof Framing System	s.f.	396	1.47		\$582.12
Beams		1		40	\$40.00
Waterproof Membrane	s.f.	396	0.07		\$27.72
Steel Roofing	s.f.	1		430	\$430.00
Roofing Screws	box of 100	3		14	\$42.00
Gutter	custom				\$200.00
Skylight Walls					
Framing	s.f.	40	0.68		\$27.20
Polycarbonate	min. order	1		550	\$550.00
Upper corner-Flashing	10' lengths	4		4.82	\$19.28
Lower z-Flashing	10' lengths	4		9.3	\$37.20
Columns	ea	4		11.97	\$47.88
Benches		2		125	\$250.00
Work Counter - 12"	l.f.	4.833		5	\$24.17
Screen	s.f.	135		2	\$270.00
Countertop	l.f.	4.833	28.5		\$137.74
Work Sink		1		139	\$139.00
Composting Toilet		1		2099	\$2,099.00
Lavatory		1		78.96	\$78.96
Plumbing (lav & sink)	per lav.	2	47.5		\$95.00
Doors		2	284.17		\$568.34
Sliding Barn Door		1		510	\$510.00
Rainwater Harvesting Cistern					
Concrete Base	ea	1		300	\$300.00
Steel Culvert	4' Dia.	1		220	\$220.00
Lid & seal	ea	1		85	\$85.00
Hose Bib	ea	1		5	\$5.00
Sub-Total					\$9,308.05
Contingency				10%	\$930.80
Total				,•	\$10,238.85
					÷==,======

APPENDIX D Vision Meeting Notes

*'s indicates repeated item

Names attached where someone's specific skill is mentioned

IDENTITY

- Like it was
- Asi Como Era
- Name for Garden
- Smell wet dirt
- Nopales
- Native plants and seeds** Maia, Eric
- Produce Available for Community
- Pick Your Own Food
- The desert
- Beauty
- Cactus Robin West
- Regional history Brett Goble
- History* Paul
- Natural History Eric

FOOD PRODUCTION

- Tomatoes, Corn, Green Beans
- Compost* Abreeza
- Trees Everywhere*
- Green Plants
- Veggies*
- Oregano, Fresh Herbs
- Medicinal Garden
- Pumpkin Patch
- Produce Available for Community* Maia
- Pick Your Own Food*
- Garden Resources Michael Hughes
- Planting****** Michael Hughes, Chris Adams,
- Brett Goble, Sandra, Tina Arter, Debora
- Planting, horticultural design* Eileen Green, Abreeza
- Digging holes
- Weeding* Robin West, Brett Goble
- Water my garden at 5am Tina Arter
- Hard work, common sense Abreeza
- Pest control Abreeza

ANIMALS

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• Animal Habitat*

- Chickens****
- Horses****
- Native Bee Habitat
- Butterflies
- Flowers With Bees
- Birds*
- Bees
- Community Pens for Animals** Ariana
- Helping Animals* Eileen Green, Deirdre Brosnihan
- Emus
- Turkeys
- Ducks
- Geese
- Donkevs
- Dogs** Rosita
- Wildlife*
- Livestock

EDUCATION

- Food Preservation
- Multi-Generational
- School Kids Learning
- Canning Classes** Deirdre Brosnihan, Paul (food preservation),
- Children's Activities
- Know History of Area
- Classes
- Math*
- Writing/ Reading ** Robin West
- Singing
- Go to church
- Videos/ photography*** Suzanne Dhruv,
- Deirdre Brosnihan, Robin West
- Knitting
- Drawing** Chris Adams, Sharaya
- Arranging/ design* Debora
- Civil Engineering skills Deirdre Brosnihan
- Sign language Rosita
- Retired high school teacher, can get youth
- involved and write about the garden and good
- food John Bordenave
- History Barbara
- Music Barbara
- Garden experience**** Barbara, Paul, Andre

- Dominguez, Luis
- Teaching**, research Brett Goble, Paul, Amy Mellor
- "Creative ideas using little resources" Renee Goodneow (Borton El)
- Can make clay pinch pots and other arts and crafts Renee Goodneow (Borton El)
- Can teach workshops on planting and starting a garden* Sandra, Matt Perri
- Feminism Maia
- Painting Debora
- Permaculture design Sharaya
- Youth empowerment Andre Dominguez

COMMUNITY

- Community Feast
- Security
- Neighborhood Families Involved
- Neighborhood Elders Involved
- Neighborhood Youth Involved* Sandra

• Knowledge on Running a Small Business - Eileen

• Making a difference in the community – Eileen

• I can encourage Enchanted Hills NA to be

• Connecting Kids with Nature* – Suzanne

• Learning about Diverse Cultures and food

• Cooking***** - Suzanne Dhruv, Rosita, Barbara,

• Physical fitness, hiking*, rock climbing - Suzanne

100% Community Participation

• Neighbors Growing Food

• People Coming Together

involved – Eileen Green

traditions – Suzanne Dhruv

• Helping clean up – Rosita

My grandson – Robin West

Paul, Amy Mellor, Maia, Abreeza

Dhruv, Eric Dhruv

Dhruv, Abreeza

- Community Events
- Local MusicWorkers of All Ages in Garden

• Families in Soil

• Kids Getting Dirty

• Ownership

Green

Green

- Sewing*** Sandra, Maia, Abreeza, Bob Colby
- Help people be successful, unity, creating paradise Paul
- Food justice** Amy Mellor, Debora, Andre Dominguez
- Drum Debora
- I'm connected with many people Abreeza
- Speak Portuguese Andre Dominguez
- Community Organization Luis

INFRASTRUCTURE

• Cisterns/Water Harvesting Utilized***** - Suzanne & Eric Dhruv, Deirdre Brosnihan, Robin West, Maia, Andre Dominguez

- Artwork*
- Shade* Chris Adams
- Gathering Places
- Security
- Tall Windmill
- Pathways
- Misters in Summer
- Community Pens for Animals
- Community Room
- Pinwheels
- Playground* Chris Adams (can help with construction!),
- Kitchen
- Picnic Area* Ariana
- Ramadas* Eric (help build)
- Seed Harvesting
- Fence Building Michael Hughes
- Irrigation/ Water Management/ Watering** Michael Hughes, Suzanne Dhruv, Jeff Akehurst
- Tree trimming Michael Hughes
- Tree trimming Michael Hug
- Basketball* Ariana
- Carpentry, Basic Construction Brett Goble
- Know how to make adobe Andre Dominguez

CREDITS.....

All site photos and South Tucson photos taken by the Drachman Institute 2011. All renderings of the Urban Farm by Rudy Poe

Page 6: Hohokam canal, Source: http://www.waterhistory.org/histories/hohokam2/#ill1

Page 21: all drawings, Jacke, Dave. Edible Forest Gardens. 2005.

Page 23: alley crop picture, http://www.ncga.com/alleycropping

Page 24: left, http://scrumptious.typepad.com/srbeack/2007/11/prickly-pear-ca.html; center-left, http://www.nadsbakery.com/2010_08_01_archive. html; center-right, http://desertsirena.wordpress. com/2010/06/23/saguaro-fruit-harvest/; right, http:// greenharlow.blogspot.com/2011_01_01_archive.html

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