

Promoting Agroforestry in the Southwest

Rafael de Grenade



Benefits of Agrobiodiversity

Diversity of agricultural crops and practices that have evolved across time and space

- Crop resilience
- Disease resistance
- Soil preferences and tolerances
- Drought resistance
- Different flowering and ripening times
- Color, flavor, texture
- Cooking/eating/processing qualities
- Food security





Benefits of Forests

Trees provide food, shelter and habitat

Tree fruit, nuts and pods nourish people and wildlife. Flowers support native pollinators.

Trees cool the soil & create microclimates and habitat.



Trees clean the air

In taking carbon from the air, trees replace a greenhouse gas with breathable oxygen.

Tree filter and slow the water

Trees filter pollutants from stormwater. They also help the landscape store water, moderating runoff and floods.



Trees build the soil

Tree roots protect soil from erosion, while fallen leaves provide a natural mulch that builds the soil. Palo verde, ironwood, mesquite and other native trees fix nitrogen.

Benefits of Agroforests

- Adapted to place-specific geographical constraints
- Provide forest functions
- Native and nonnative species of plants and animals
- Community food security
- Embody cultural history (local/diasporic)
- Can promote agrobiodiversity



Baja California Peninsula, Mexico



Lanzarote, Canary Islands, Spain



Challenges to Agroforestry in the Southwest

- Lack of water
- Varied aspect
- Varied elevation
- Variable soils
- Bimodal precipitation
- Extreme temperatures
- Late spring frosts
- Variable frost-free season



Challenges to Agroforestry in the Southwest – Water

1. Natural rain/snowfall

2. Alternative water supplies

- Stormwater
- Grey water
- Reclaimed water

3. Potable water supplies

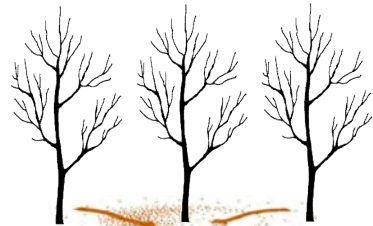
- Groundwater
- City water supplies

Use Natural Topography

- Passive Basins
- Contour Planting

Use Built Topography

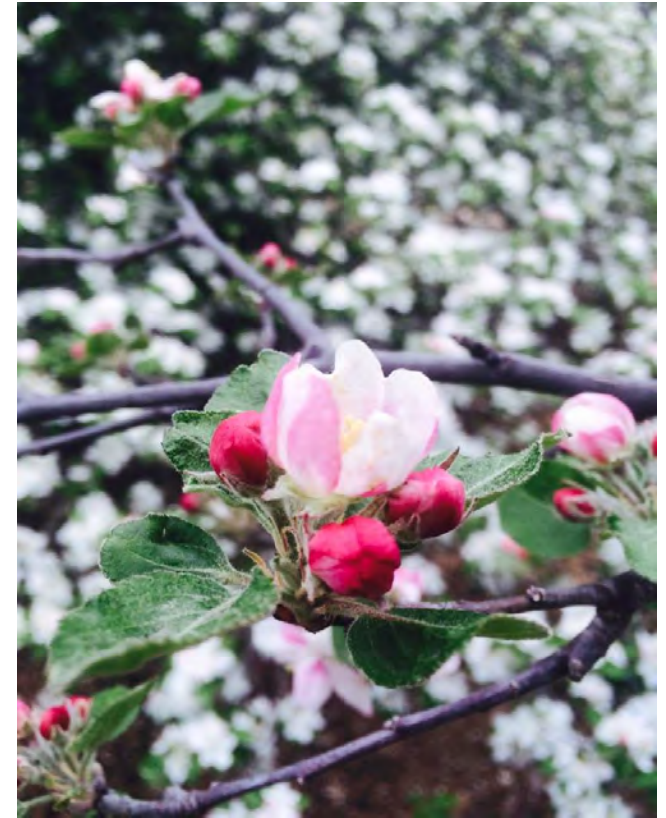
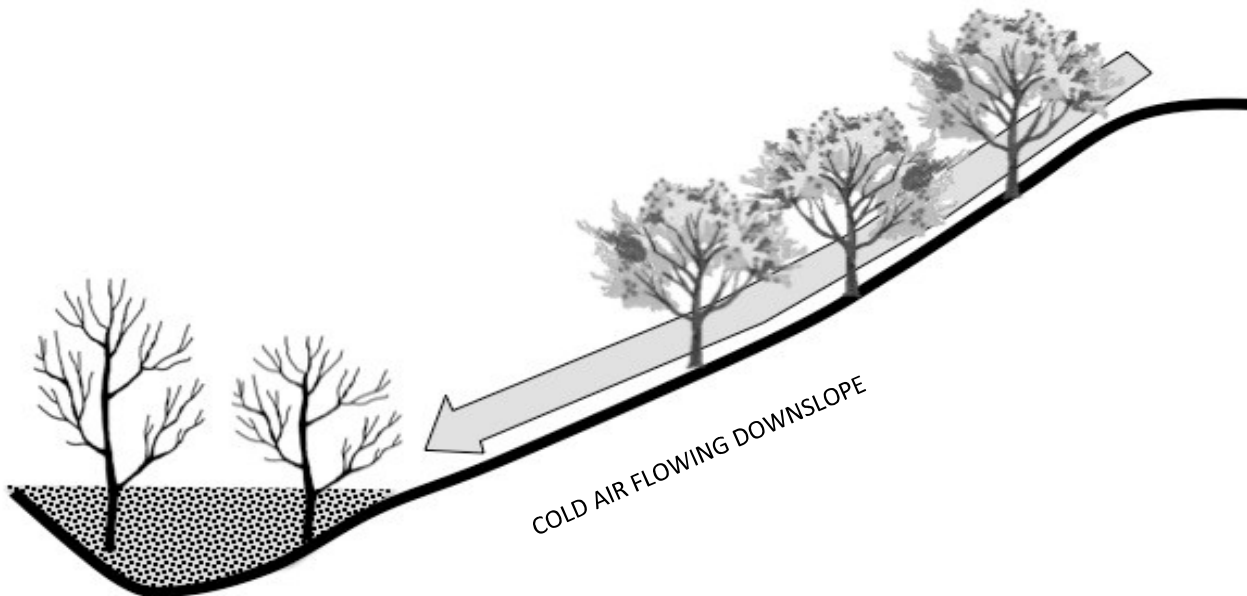
- Curb cuts/scuppers
- Sloping design



Challenges to Agroforestry in the Southwest

Where we plant our orchards in the landscape

- Microclimate
- Tree management
- Flowering time
- Chill hours
- Variety



Microclimate considerations

- Slope
- Cold air flow
- Elevation
- Aspect (sun intensity)
- Shade patterns
- Wind direction
- Vegetation
- Built environment

Challenges to Agroforestry in the Southwest

Tree Management

- Keep trees watered
- Keep trees pruned
- Keep deeply mulched
- Dwarf & semi-dwarf varieties
- Protect during extreme events
- Protect from late spring frosts
- Fabric
- Lights
- Smoke
- Humidity



Opportunities for Agroforestry in the Southwest – LEAF NETWORK



LEAF Network



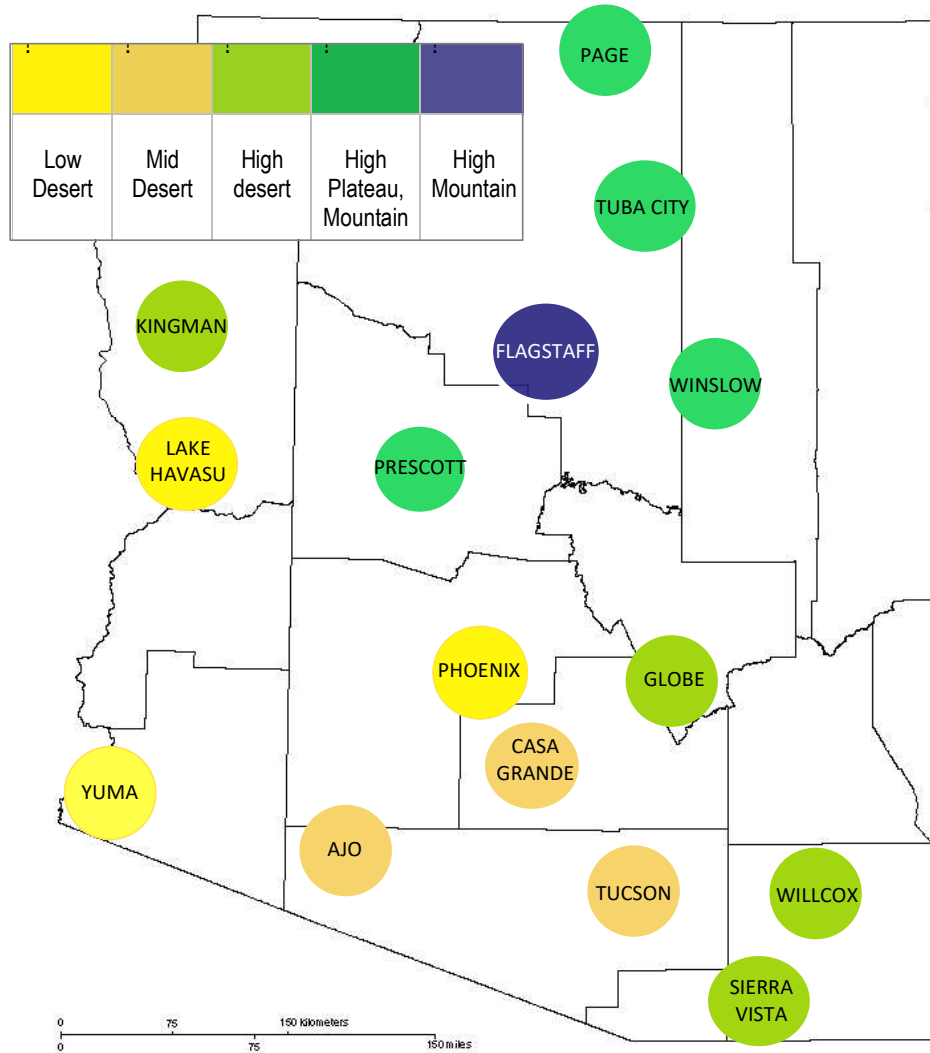
Linking Edible Arizona Forests

leafnetworkaz.org

*To link people with the benefits of edible trees and to support
edible trees with people's stewardship*

Edible Trees for Arizona Climate Zones

MAP OF SELECTED ARIZONA CITY AND TOWN ELEVATION AREAS



ELEVATION AREAS, WATER NEEDS AND CHILL REQUIREMENTS FOR SELECTED EDIBLE TREES IN ARIZONA

TREE SPECIES	Low Desert Lake Havasu City, Phoenix, Yuma	Mid Desert Ajo, Casa Grande, Tucson	High Desert Globe, Kingman, Sierra Vista, Willcox	High Plateau, Mountain Page, Prescott, Winslow, Tuba City	High Mountain Flagstaff	WATER USE: low 12-20in/yr med 20-40 in/yr high 30-50 in/yr	CHILL: Hours between 32 - 45°F needed for proper bud growth, fruit set and growth
Almond	X	X	X			medium	yes
Apple	X	X	X	X	X	medium	yes
Apricot	X	X	X	X		medium	yes
Carob	X	X				medium	no
Cherry	X	X	X	X	X	medium	yes
Citrus	X	X				high	no
Date Palm	X	X				high	no
Elderberry		X	X	X	X	medium	no
Fig	X	X	X			medium	yes
Guava	X					medium	no
Hackberry			X	X	X	medium	no
Hawthorn	X	X	X	X	X	medium	yes
Ironwood	X	X				low	no
Jujube	X	X	X	X	X	medium	yes
Juniper			X	X	X	low	no
Loquat	X	X				medium	no
Mesquite	X	X	X			low	no
Mulberry		X	X	X	X	medium	yes
Oak			X	X	X	medium	no
Olive	X	X				medium	yes
Palo Verde	X	X				low	no
Peach	X	X	X	X		medium	yes
Pear, Asian		X	X	X	X	medium	yes
Pecan	X	X	X			high	yes
Persimmon	X	X	X	X	X	medium	yes
Pinyon Pine			X	X		low	no
Pistachio		X	X			medium	yes
Plum	X	X	X	X	X	medium	yes
Pomegranate	X	X	X			medium	yes
Quince		X	X	X		medium	yes
Saguaro	X	X				low	no
Sapote	X					medium	no
Walnut			X	X		medium	yes

Selected Edible Trees that Grow in Arizona

Much more information about these trees and other edible species is provided at the *LEAF Network website* and the *Arizona Edible Tree Directory*. Characteristics are shown using the symbols placed under the photographs.

General Elevation Areas Where This Tree Could Grow in Arizona

Low Desert	Mid Desert	High Desert	High Plateau, Mountain	High Mountain
Lake Havasu City, Phoenix, Yuma	Ajo, Casa Grande, Tucson	Globe, Kingman, Sierra Vista, Willcox	Page, Prescott, Winslow, Tuba City	Flagstaff

Tree Water Use is Generally

- Low Water Use (12–20 inches/yr)
- Medium Water Use (20–40 inches/yr)
- High Water Use (30–50 inches/yr)

Chill Hours between 32°F and 45°F will be needed to stimulate proper bud growth, fruit set and fruit development



Almond ■■■💧💧



Apple ■■■■■💧💧💧



Apricot ■■■💧💧



Carob ■💧💧



Cherry ■■■■■💧💧💧



Citrus ■💧💧💧



Date Palm ■💧💧💧



Elderberry ■■■■■



Fig ■■■💧💧



Hawthorn ■■■■■💧💧



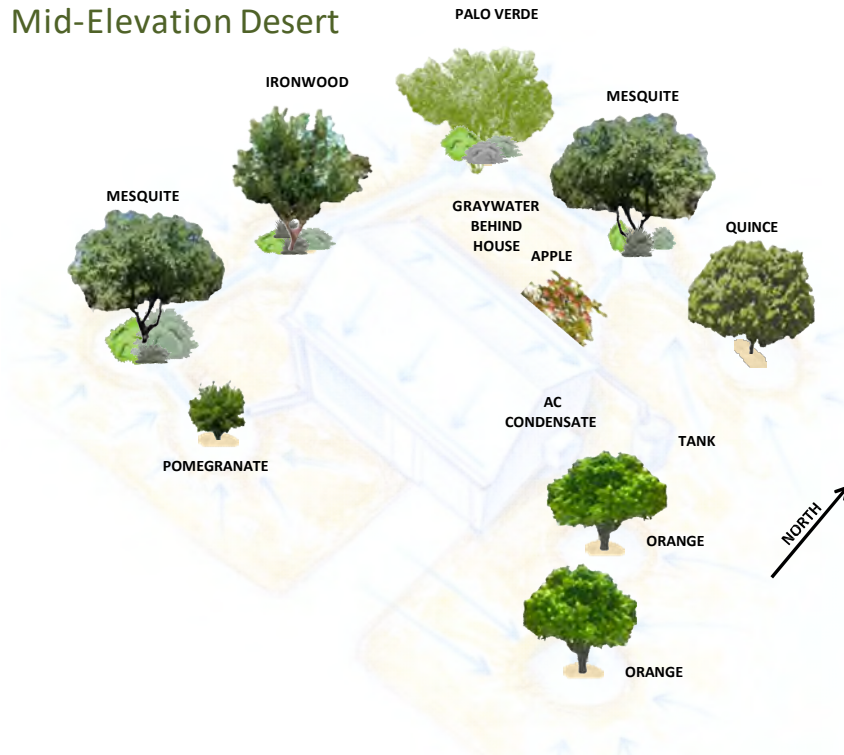
Ironwood ■💧



Jujube ■■■■■💧💧

Edible Forest Design

Mid-Elevation Desert

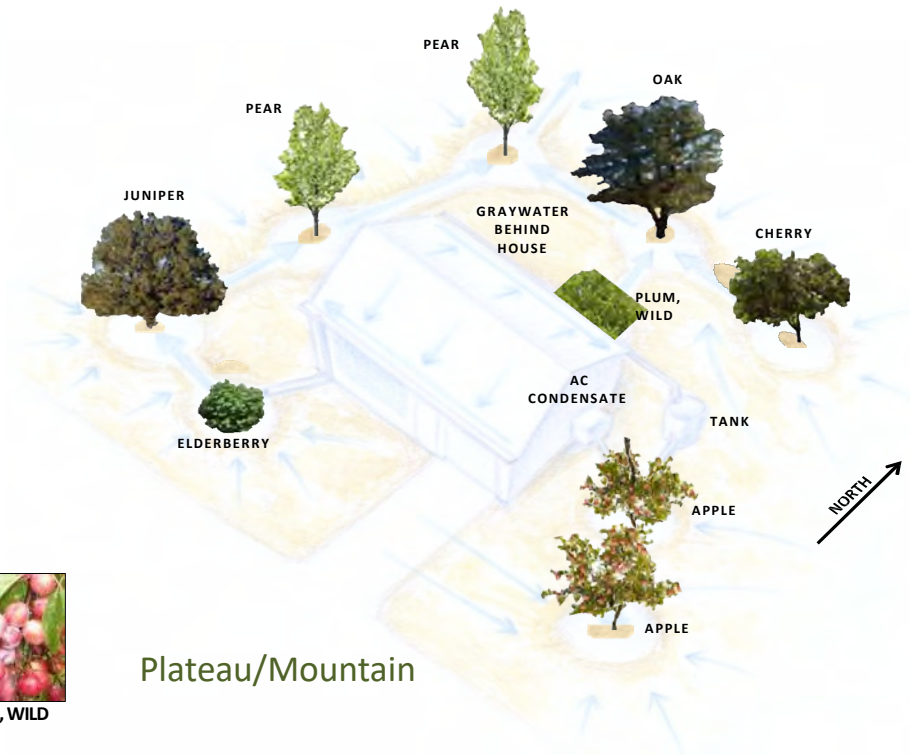


TREE PLANTING LIST FOR HIGH PLATEAU ELEVATION AREA SITE

Edible Tree	Water needs	Chill needs (hours)	Canopy Diameter (feet)	Tree Height (feet)
Apple	medium	100-1500	15-20	15-30
Cherry	medium	400-1400	20-30	30+
Elderberry	medium	unknown	10	10-30
Juniper	low	unknown	20-40	<50
Oak	medium	unknown	40+	60+
Pear	medium	200-1500	15-25	30-60
Plum, wild	medium	150-1500	10-20	10-20

!!TREE!PLANTING!LIST!FOR!MID!ELEVATION!DESERT!SITE!

Edible Tree	Water needs	Chill needs (hours)	Canopy Diameter (feet)	Tree Height (feet)
Apple	medium	100-1500	15-20	15-30
Ironwood	low	none	15-25	15-45
Mesquite	low	none	30	30
Orange	high	none	20	20-30
Palo verde	low	none	25-30	20-30
Pomegranate	medium	50-300	10	15
Quince	medium	100-500	25	15-30



Plateau/Mountain



Pome Fruit

Apples

- Wild apple originated in Central Asia
- Apples do best with cross-pollination
- Immense diversity, 16,000+ varieties
- 350 – 1200 chill hours required
- Used for fresh eating, desserts, drying, juice, hard cider

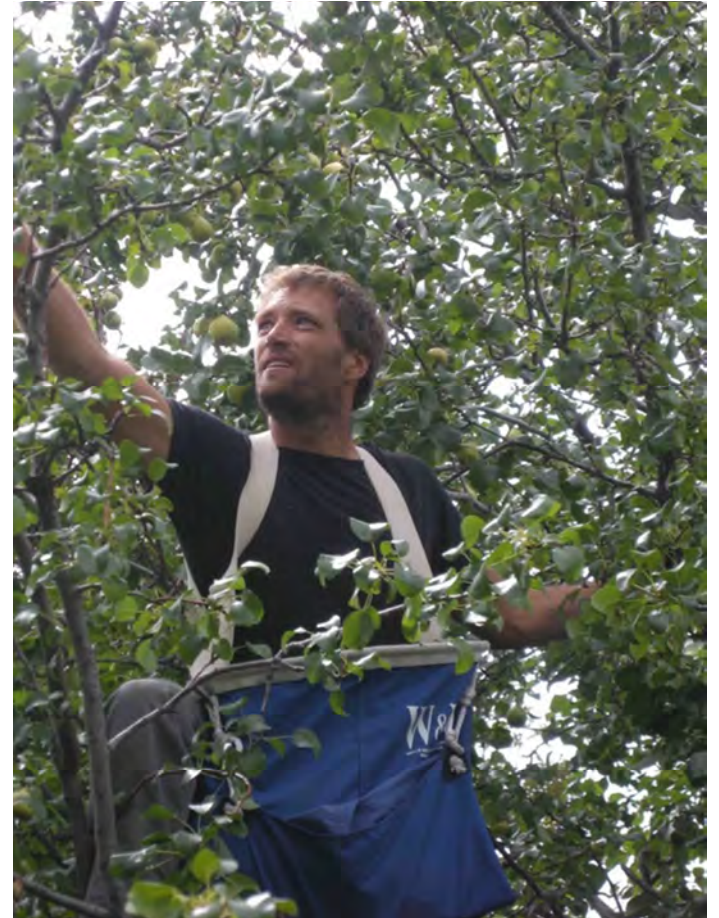


Pome Fruit

Pears & Asian Pears

- Long-lived (200-300+ years)
- 30-60 feet tall; 200-1500 chill hours
- Require cross-pollination
- Asian pears blossoms more frost sensitive

Varieties: Comice, Bartlett, Seckel, Surecrop



Stone Fruit

Varieties: Santa Rose, Satsuma, Elephant heart, Ozark premier

Plums, wild plums

- 3 common types: Japanese, European, and wild plum
- European plums more cold tolerant, mostly self-fertile
- Wild plums form hedges, very cold tolerant



Stone Fruit

Cherries, Wild Black Cherry

- Sour cherries more cold tolerant
- Sweet cherries must be protected from late spring frosts
- Wild black cherries may be made into syrup and jam, taste is sweet-astringent
- Grow 30-60 feet tall
- Varieties: Stella, Isopin
Some need cross-pollination
Sour: Montmorency, Sumadinka



2016 © Kanin Routson

Assorted Minor Trees



Quince



Pomegranate



Jujube



Mulberry

Nut Trees

Walnuts

- Walnuts eaten fresh, roasted, dried, in confections, cakes, ice cream, savory dishes
- Trees need deep soil and deep irrigation
- May reach 40-60 feet tall
- Produce dense, hard wood
- Native to Eastern Europe, Central Asia, and Himalayas
- Wind pollinated

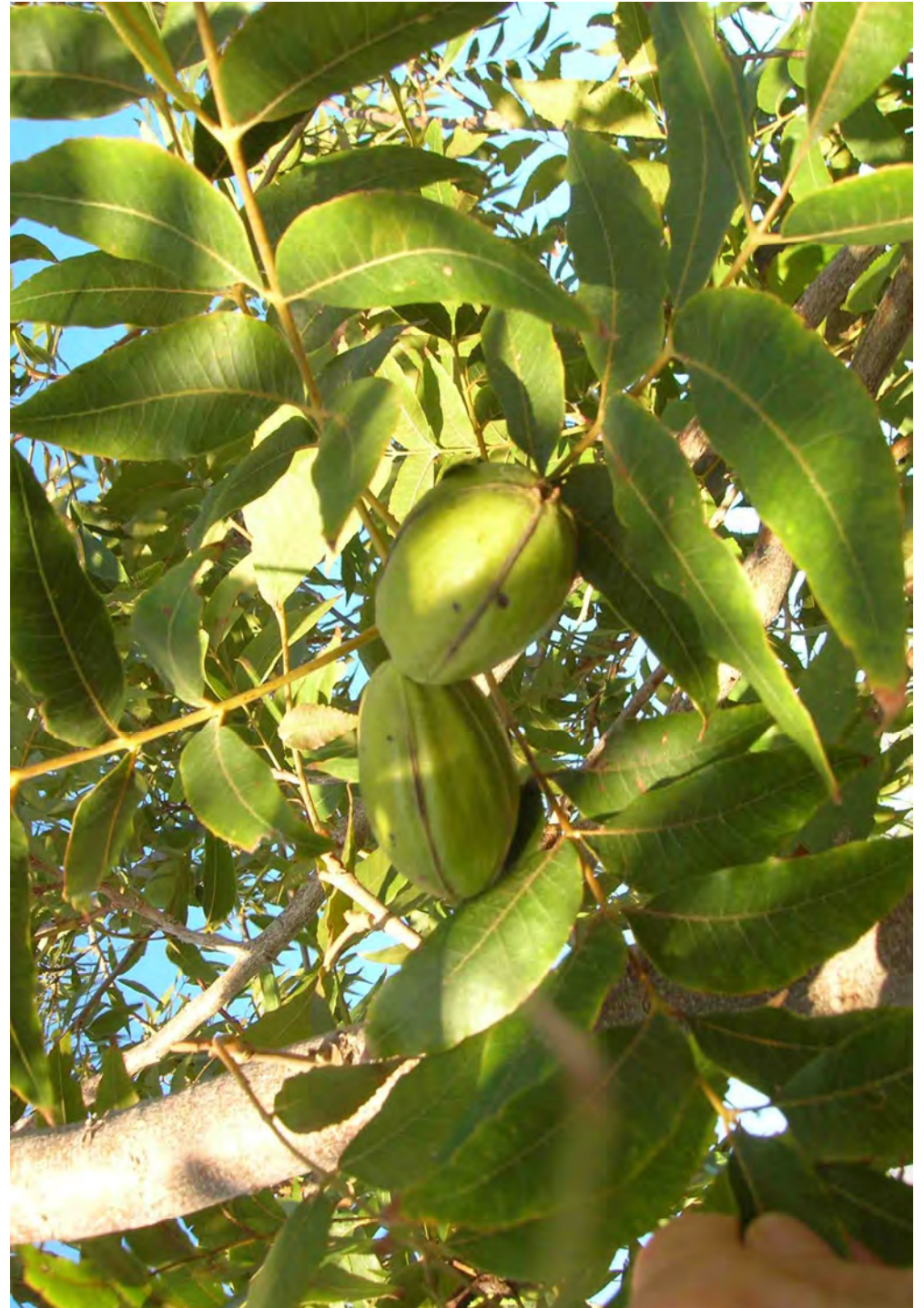


Nut Trees

Pecans

- Tall, spreading trees, 60-120 feet
- Native to southern U.S.
- Need deep soil and irrigation
- Wind pollinated
- Pecan nuts mature in November
- Rich source of flavor and protein

Varieties: Western Schley, Waco, Wichita, Pawnee



Native Trees

Oak

- *Quercus emoryi* – acorns are sweet and do not need processing
- Several species produce edible acorns
- Can be overstory and understory
- Slow growing, reach 60+feet
- Some acorns need to be leached & ground to be enjoyed
- Wildlife food and habitat



Native Trees

Pinyon

- Wild harvested nuts are a major cash crop
- Trees are drought tolerant, but very slow growing
- May live to 1,000 years old
- Nuts are not produced annually
- Wildlife food and habitat



Native Trees

Elderberry

- Abundant blue berries can be made into elderberry wine, jam, syrup, sauces and pies
- Flower clusters can be dipped in batter
- Petals made into tea
- Riparian shrubs or trees
- Wildlife food and habitat



Nonnative Understory Plants



Blackberry



Grape



Currant



Raspberry

Native Understory Plants



Prickly pear



Wild grape



Wild currant



Manzanita



Sumac



Wolfberry

Opportunities for Agroforestry in the Southwest – STOIC CIDER

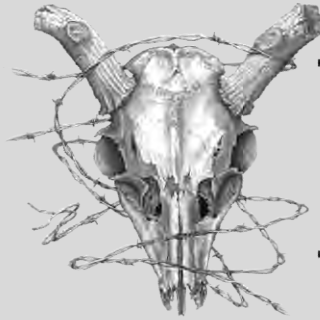
- Kanin Routson, PhD
- 280 historic trees, 43 orchards, 3 states
- 34 named varieties, total of 120 trees
- 110 unknown types, total of 160 trees





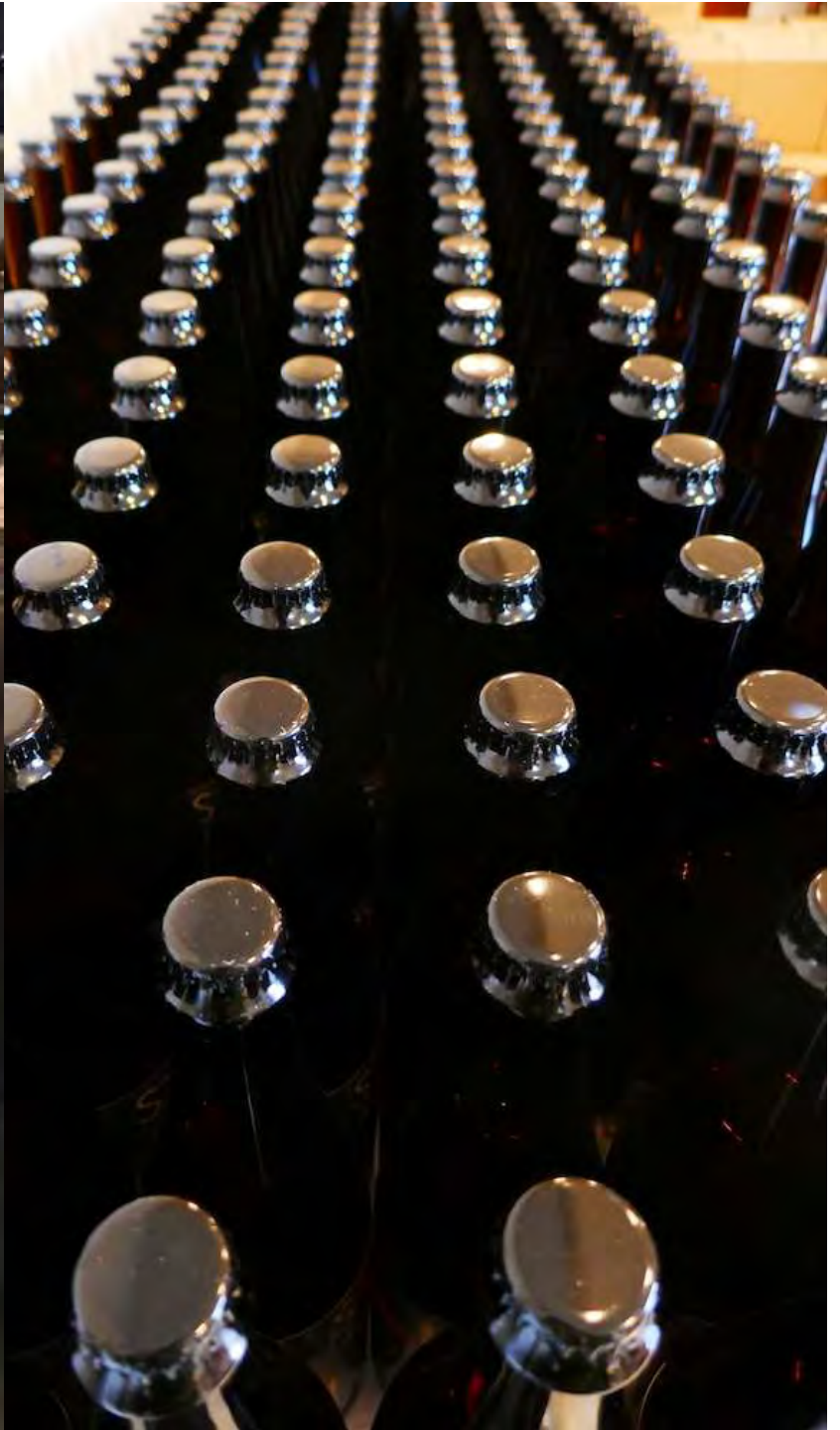






STOIC CIDER







Promoting Community Forests

Community stewardship

- Promoting orchards within communities
- Public gardens and forests
- Fruit growers exchanges
- Inter-generational programs

Germplasm reserves

- Diversity spread across the community
- Trees are longer lived than people
- Thinking on a landscape scale

Resilience for different climate futures

- Chill hours
- Cold/heat tolerance
- Late blooming
- Drought tolerance







Thank You!

