

Plant Guilds Design for Zones 2-3

4-Acre Permaculture Farm, Kurukshetra, Haryana

Food Forest & Production Zone Integration

Date: January 28, 2026
Status: Implementation Ready - Comprehensive Guild Design
Climate: Subtropical (Hot summers 40°C+, Mild winters 5-10°C, Monsoon 450-600mm)
Soil: Alkaline (pH 7.5-8.5), Sandy loam, Low initial organic matter

EXECUTIVE SUMMARY

This document provides **detailed plant guild designs** for Zones 2 and 3, creating functional polycultures that maximize:

- **Nitrogen fixation** (reduce external fertilizer by 60-80%)
- **Pest management** (beneficial insect habitat, repellent plants)
- **Water retention** (deep-rooted accumulators, mulch producers)
- **Soil building** (chop-and-drop biomass, root diversity)
- **Yield stacking** (7-8 layers: canopy, understory, shrub, herbaceous, ground cover, root, vine)

Guild Philosophy: Each tree becomes the center of a **cooperative plant community** where every species supports the others through nutrient cycling, pest control, microclimate creation, and mutual support.

Climate Adaptation: All species selected for **heat tolerance, alkaline soil tolerance, and low water needs** once established.

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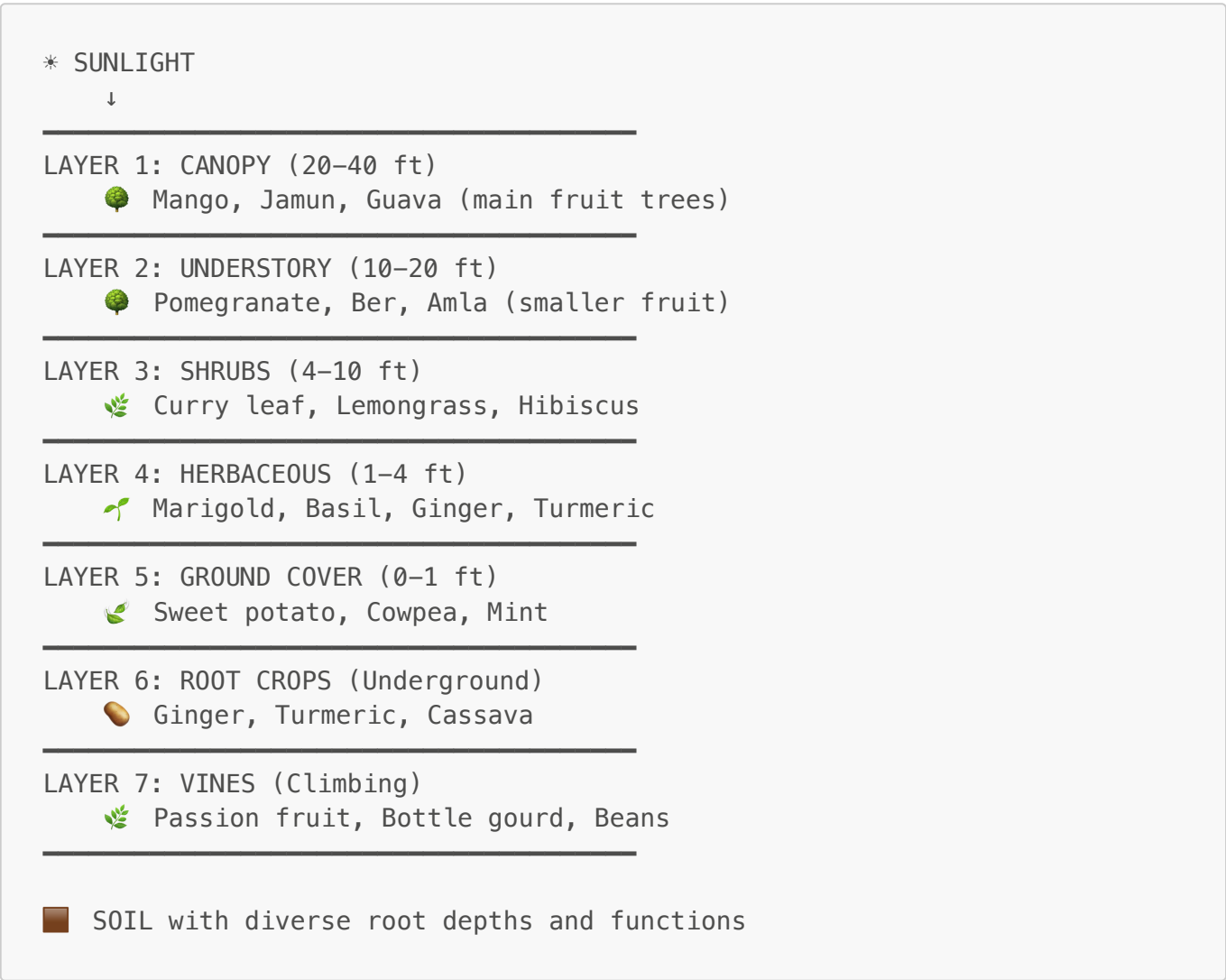
1. WHAT IS A PLANT GUILD?

Definition

A **plant guild** is a group of plants that:

- Grow well together
- Support each other's growth
- Provide multiple functions
- Create a resilient mini-ecosystem

The 7-Layer Food Forest Model



Guild Functions (Every Guild Should Include)

- ✅ **Nitrogen Fixer** - Adds nitrogen to soil
- ✅ **Dynamic Accumulator** - Mines deep nutrients, brings to surface
- ✅ **Pest Repellent** - Confuses/repels harmful insects
- ✅ **Beneficial Insect Attractor** - Brings predators/pollinators
- ✅ **Mulch Producer** - Provides organic matter
- ✅ **Suppressor** - Fills niche to prevent weeds
- ✅ **Edible/Useful** - Human food, animal fodder, medicine, or material

2. ZONE 2 FOOD FOREST GUILDS (0.96 ACRES)

Zone 2 Context

Location: 110-310 feet from north boundary

Area: 41,800 sq ft = 0.96 acres

Tree Capacity: 110-140 trees

Integration: Chickens (Zone 2A), Ducks (Zone 2B), Production Pond (SE corner)

Water: Swales 1-5 cascade through zone, pond at 245ft

Sub-zones:

- **Zone 2A (110-210ft):** Chicken rotation + food forest (20,900 sq ft)
- **Zone 2B (210-310ft):** Duck forage + pond + food forest (20,900 sq ft)

GUILD TYPE 1: MANGO GUILD (Primary Canopy Tree)

Species: Mango (*Mangifera indica*)

Characteristics:

- Height: 30-40 ft mature
- Spread: 30-40 ft
- Fruiting: Year 5-7, then 50-150 kg/tree/year
- Lifespan: 100+ years
- Sun: Full sun required
- Water: Drought-tolerant once established
- Spacing: 25-30 ft from other trees

MANGO GUILD COMPOSITION (Year 1 Planting)

LAYER 1: CANOPY (20-40 ft)

- **MANGO** (center of guild) - 1 tree

LAYER 2: UNDERSTORY (10-20 ft) - Plant 20-25ft from mango

- **Nitrogen Fixer:** Gliricidia (*Gliricidia sepium*) - 2 trees, EAST + WEST sides
 - Function: Fixes 50-100 kg N/acre/year, chop-and-drop mulch
 - Distance from mango: 20-25 ft (won't compete)
 - Management: Coppice 3-4x/year, use leaves as mulch

LAYER 3: SHRUBS (4-10 ft) - Plant 10-15ft from mango

- **Pest Management:** Curry Leaf (*Murraya koenigii*) - 2 bushes, NORTH + SOUTH
 - Function: Repels fruit flies, edible leaves
 - Distance: 12-15 ft from mango
- **Beneficial Insects:** Lemongrass (*Cymbopogon citratus*) - 3 clumps around guild

- Function: Attracts predatory wasps, repels mosquitoes, culinary/medicinal
- Distance: 10-12 ft from mango

LAYER 4: HERBACEOUS (1-4 ft) - Plant 5-10ft from mango

- **Nitrogen Fixer + Pest Control:** Pigeon Pea (*Cajanus cajan*) - 4-6 plants in ring
 - Function: Fixes nitrogen, windbreak, edible dal, repels nematodes
 - Distance: 8-10 ft from mango (forms protective ring)
 - Lifespan: 3-5 years, then replace
- **Dynamic Accumulator:** Comfrey (*Symphytum officinale*) - 4 plants (cardinal directions)
 - Function: Deep roots (8-10 ft) mine nutrients, chop-and-drop mulch
 - Distance: 6-8 ft from mango
 - Harvest: 3-5 times/year for mulch
- **Pest Repellent:** Marigold (*Tagetes erecta*) - 8-12 plants in inner ring
 - Function: Repels aphids, whiteflies, nematodes
 - Distance: 4-6 ft from mango
 - Annual, replant each year

LAYER 5: GROUND COVER (0-1 ft) - Plant 3-8ft from mango

- **Nitrogen Fixer + Edible:** Cowpea (*Vigna unguiculata*) - Broadcast seed
 - Function: Fixes nitrogen, edible pods, suppresses weeds, living mulch
 - Distance: 3-8 ft from mango (avoid trunk contact)
 - Lifespan: Annual, replant each monsoon
- **Edible Ground Cover:** Sweet Potato (*Ipomoea batatas*) - 6-8 cuttings
 - Function: Weed suppression, edible tubers, living mulch
 - Distance: 4-8 ft from mango
 - Harvest: 4-6 months after planting

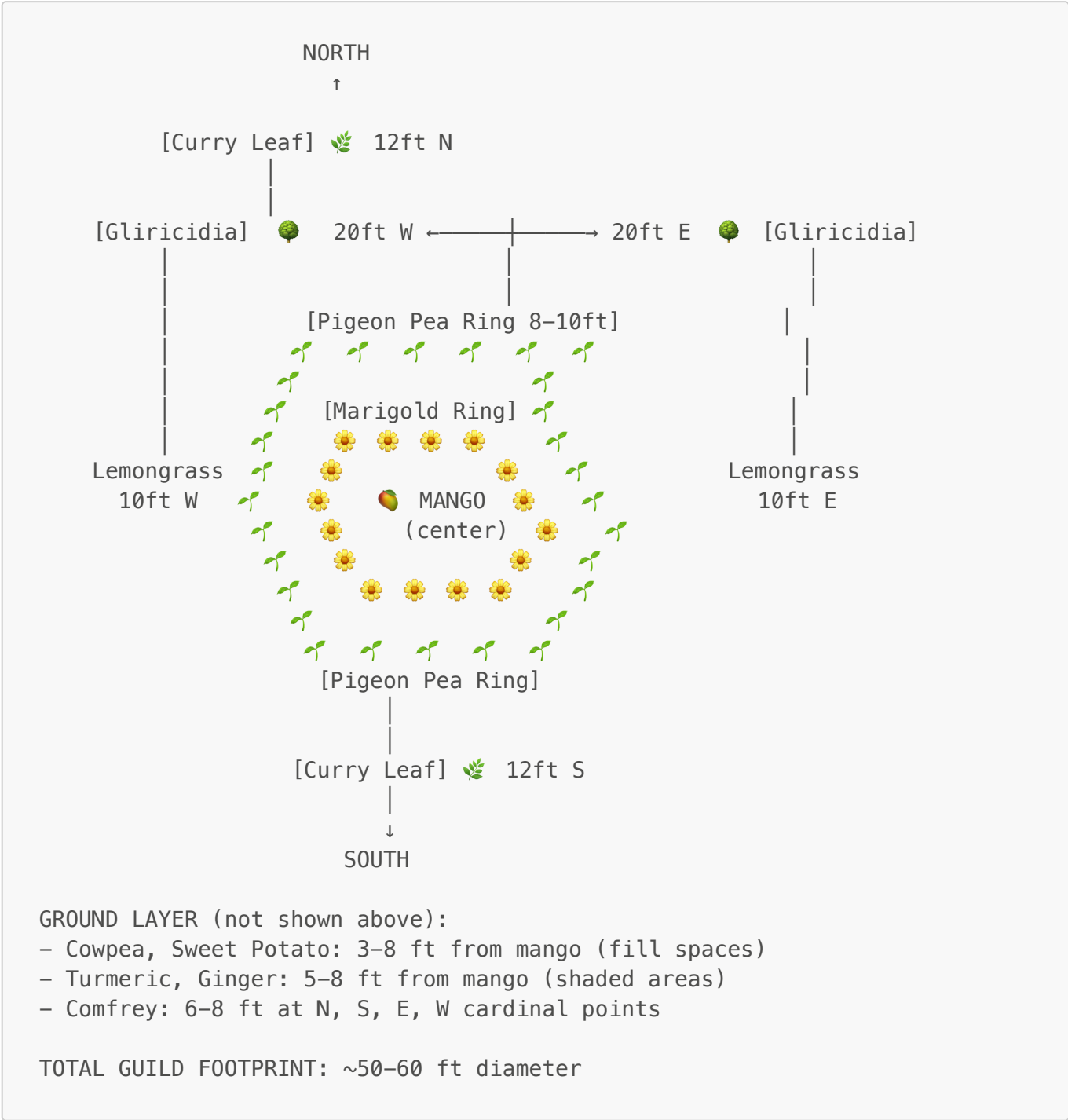
LAYER 6: ROOT CROPS (Underground) - Plant 5-8ft from mango

- **Medicinal/Edible:** Turmeric (*Curcuma longa*) - 8-12 rhizomes
 - Function: Pest repellent, edible/medicinal, shade-tolerant
 - Distance: 5-8 ft from mango
 - Harvest: 9-10 months after planting
- **Edible/Cash Crop:** Ginger (*Zingiber officinale*) - 8-12 rhizomes
 - Function: Edible/medicinal, shade-tolerant, pest repellent
 - Distance: 5-8 ft from mango
 - Harvest: 8-9 months after planting

LAYER 7: VINES (Climbing) - Year 3+ only, after mango established

- **Nitrogen Fixer:** Climbing Bean (*Phaseolus vulgaris*) - 2-3 plants on Gliricidia trellis
 - Function: Fixes nitrogen, edible beans
 - Distance: Climbs Gliricidia trees (not mango directly)
 - Season: Winter (November-February)

MANGO GUILD SPATIAL LAYOUT (Top View)



MANGO GUILD FUNCTIONS SUMMARY

Function	Plants Providing	Benefit
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Function	Plants Providing	Benefit
Nitrogen Fixation	Gliricidia, Pigeon Pea, Cowpea, Beans	80-120 kg N/year, reduces fertilizer need 70%
Pest Management	Curry Leaf, Lemongrass, Marigold, Turmeric	Repels fruit flies, aphids, nematodes
Beneficial Insects	Lemongrass, Marigold, Pigeon Pea flowers	Attracts predatory wasps, ladybugs, bees
Mulch Production	Gliricidia, Comfrey, Pigeon Pea, Cowpea	200-400 kg biomass/year, maintains soil moisture
Nutrient Mining	Comfrey (8-10 ft deep roots)	Brings Ca, K, P from subsoil to surface
Weed Suppression	Cowpea, Sweet Potato, dense planting	90% weed reduction
Food Production	Mango, Pigeon Pea, Cowpea, Sweet Potato, Turmeric, Ginger, Curry Leaf, Beans	7-8 different foods from one guild!

Total annual value from ONE Mango Guild (Year 5+):

- Mango: 50-150 kg @ ₹20/kg = ₹1,000-3,000
- Pigeon Pea: 3-5 kg dal @ ₹100/kg = ₹300-500
- Cowpea: 10-15 kg @ ₹40/kg = ₹400-600
- Sweet Potato: 20-30 kg @ ₹30/kg = ₹600-900
- Turmeric: 8-12 kg @ ₹200/kg = ₹1,600-2,400
- Ginger: 8-12 kg @ ₹150/kg = ₹1,200-1,800
- Curry Leaf, Lemongrass: ₹500-1,000/year
- **TOTAL: ₹5,600-10,200/year from one 60ft diameter circle!**

GUILD TYPE 2: GUAVA GUILD (Smaller Canopy Tree)

Species: Guava (*Psidium guajava*)

Characteristics:

- Height: 15-20 ft mature
- Spread: 15-20 ft
- Fruiting: Year 3-4, then 40-80 kg/tree/year
- Multi-season fruiting (2-3 crops/year possible)
- Sun: Full sun to partial shade
- Water: Low water needs once established
- Spacing: 15-20 ft from other trees

GUAVA GUILD COMPOSITION (Simplified - Smaller Footprint)

LAYER 1: CANOPY (15-20 ft)

- **GUAVA** (center) - 1 tree

LAYER 2: UNDERSTORY (8-12 ft) - Plant 12-15ft from guava

- **Nitrogen Fixer:** Moringa (*Moringa oleifera*) - 2 trees, EAST + WEST
 - Function: Fixes nitrogen, edible leaves/pods, fast-growing
 - Distance: 12-15 ft from guava
 - Management: Coppice 3-4x/year for drumstick harvest

LAYER 3: SHRUBS (3-6 ft) - Plant 8-12ft from guava

- **Pest Management:** Tulsi/Holy Basil (*Ocimum tenuiflorum*) - 4 plants around guild
 - Function: Repels fruit flies, medicinal, edible
 - Distance: 8-10 ft from guava
- **Dynamic Accumulator:** Aloe Vera (*Aloe barbadensis*) - 4 clumps (cardinal directions)
 - Function: Medicinal, minimal water, helps retain soil moisture
 - Distance: 10-12 ft from guava

LAYER 4: HERBACEOUS (1-3 ft) - Plant 4-8ft from guava

- **Nitrogen Fixer:** Clover (*Trifolium*) or Lucerne/Alfalfa (*Medicago sativa*) - Broadcast
 - Function: Fixes nitrogen, living mulch, fodder
 - Distance: 4-8 ft from guava (avoid trunk)
- **Pest Repellent:** Chrysanthemum (*Chrysanthemum morifolium*) - 6-8 plants in ring
 - Function: Natural pyrethrin (insecticide), beautiful flowers
 - Distance: 5-8 ft from guava

LAYER 5: GROUND COVER (0-1 ft) - Plant 3-6ft from guava

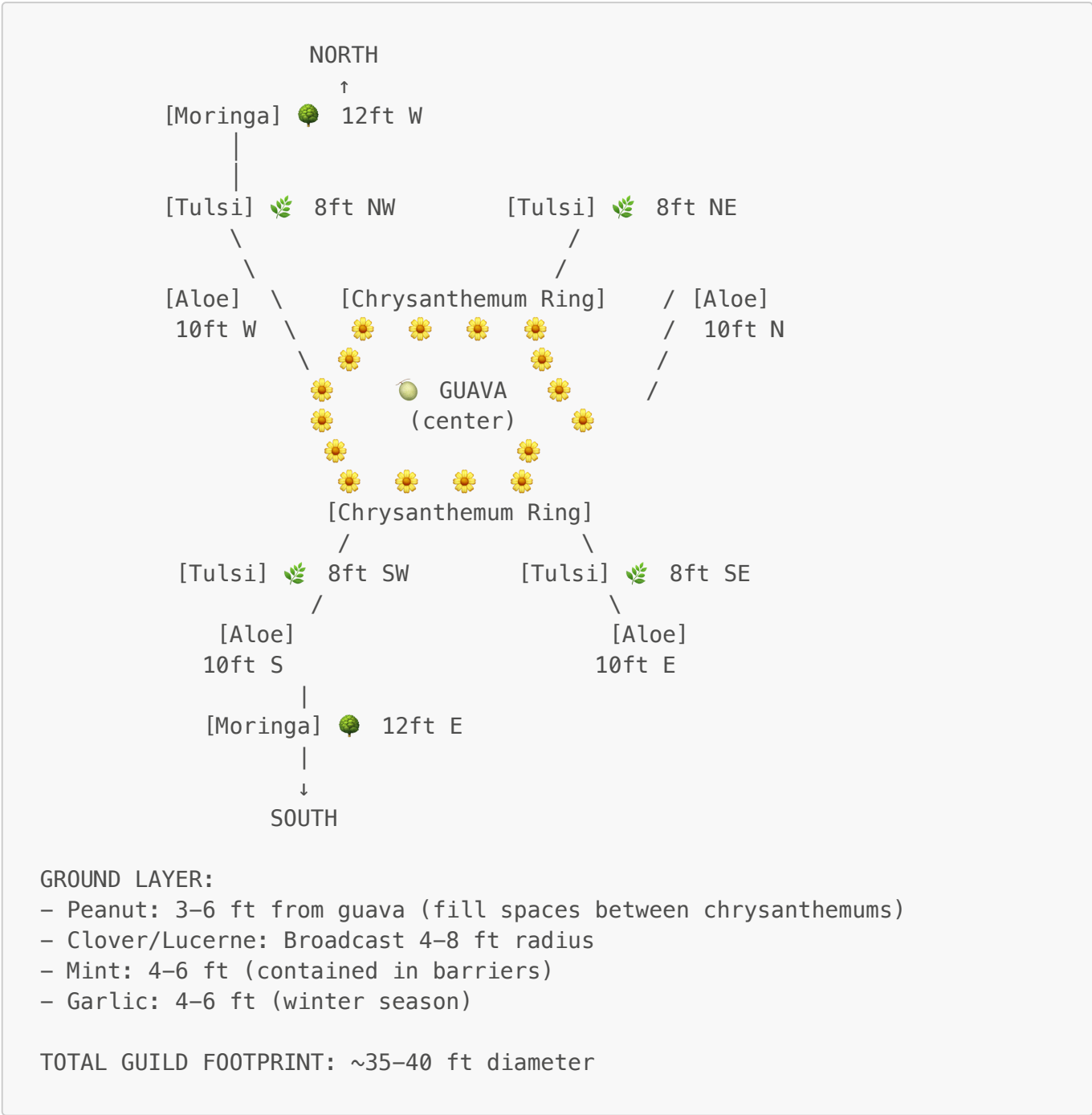
- **Edible + Nitrogen Fixer:** Peanut (*Arachis hypogaea*) - 12-16 plants
 - Function: Fixes nitrogen, edible nuts, weed suppression
 - Distance: 3-6 ft from guava
 - Harvest: 4-5 months
- **Mulch Producer:** Mint (*Mentha*) - 4-6 runners (contained)
 - Function: Ground cover, pest repellent, culinary
 - Distance: 4-6 ft from guava
 - WARNING: Can be invasive, plant in barriers

LAYER 6: ROOT CROPS - Plant 4-6ft from guava

- **Edible:** Garlic (*Allium sativum*) - 12-20 bulbs (winter season)
 - Function: Pest repellent, edible/medicinal
 - Distance: 4-6 ft from guava

- Season: Plant November, harvest March

GUAVA GUILD SPATIAL LAYOUT (Top View)



GUAVA GUILD FUNCTIONS SUMMARY

Function	Plants	Annual Benefit
Nitrogen Fixation	Moringa, Clover, Peanut	60-80 kg N/year
Pest Management	Tulsi, Chrysanthemum, Garlic	50-70% pest reduction

Function	Plants	Annual Benefit
Food Production	Guava (40-80 kg), Moringa pods (5-10 kg), Peanuts (3-5 kg), Garlic (2-3 kg)	₹3,500-6,500/year
Medicinal	Guava (leaves/fruit), Tulsi, Aloe Vera	₹1,000-2,000/year value
Mulch/Fodder	Moringa, Clover	100-200 kg biomass/year

Guava Guild = IDEAL for Zone 2 because:

- Smaller footprint (works with chicken/duck integration)
- Multi-season fruiting (2-3 crops/year)
- Early production (Year 3-4 vs Mango Year 5-7)
- Medicinal value (guava leaves for tea, tulsi for immunity)

GUILD TYPE 3: JAMUN GUILD (Drought-Resistant Canopy)

Species: Jamun/Black Plum (*Syzygium cumini*)

Characteristics:

- Height: 25-35 ft mature
- Spread: 25-30 ft
- Fruiting: Year 5-7, then 50-100 kg/tree/year
- Extremely drought-resistant
- Medicinal (diabetes management)
- Sun: Full sun
- Spacing: 25-30 ft from other trees

JAMUN GUILD COMPOSITION (Focus: Water Conservation + Medicinal)

LAYER 1: CANOPY (25-35 ft)

- **JAMUN** (center) - 1 tree

LAYER 2: UNDERSTORY (10-15 ft) - Plant 20-25ft from Jamun

- **Nitrogen Fixer + Medicinal:** Sesbania (*Sesbania grandiflora*) - 2 trees, NORTH + SOUTH
 - Function: Fast nitrogen fixer, edible flowers, medicinal
 - Distance: 20-25 ft from Jamun
 - Flowers: Edible in curries, high protein

LAYER 3: SHRUBS (4-8 ft) - Plant 10-15ft from Jamun

- **Medicinal:** Amla/Indian Gooseberry (*Phyllanthus emblica*) - 2 shrubs, EAST + WEST
 - Function: Vitamin C powerhouse, medicinal, pest-resistant

- Distance: 12-15 ft from Jamun
- NOTE: Can also be grown as small tree (20 ft)
- **Pest Management:** Neem (*Azadirachta indica*) - 2 young trees, NW + SE
 - Function: Natural pesticide, medicinal, shade
 - Distance: 15-20 ft from Jamun (will grow large, plan spacing)

LAYER 4: HERBACEOUS (1-4 ft) - Plant 5-10ft from Jamun

- **Nitrogen Fixer:** Sunn Hemp (*Crotalaria juncea*) - 8-12 plants in ring
 - Function: Fast nitrogen fixer (100+ kg N/acre/year), green manure
 - Distance: 8-10 ft from Jamun
 - Lifespan: Annual, replant each year
- **Medicinal + Pest Repellent:** Artemisia (*Artemisia annua*) - 4-6 plants
 - Function: Antimalarial, pest repellent, aromatic
 - Distance: 6-8 ft from Jamun

LAYER 5: GROUND COVER - Plant 3-8ft from Jamun

- **Nitrogen Fixer + Edible:** Mung Bean (*Vigna radiata*) - Broadcast seed
 - Function: Fixes nitrogen, edible sprouts/beans, weed suppression
 - Distance: 3-8 ft from Jamun
 - Season: Multiple crops possible (60-70 day harvest)

LAYER 6: ROOT CROPS - Plant 5-8ft from Jamun

- **Edible + Medicinal:** Cassava/Tapioca (*Manihot esculenta*) - 4-6 cuttings
 - Function: Carbohydrate staple, drought-resistant, long storage
 - Distance: 6-8 ft from Jamun
 - Harvest: 8-12 months

JAMUN GUILD FUNCTIONS SUMMARY

Medicinal Focus: Jamun + Amla + Neem + Artemisia = "Healing Grove"

- Jamun: Diabetes management (fruit, leaves, bark)
- Amla: Vitamin C, immunity (highest natural Vitamin C)
- Neem: Antibacterial, antifungal, skin health
- Artemisia: Antimalarial, fever reduction

Nitrogen Fixation: Sesbania + Sunn Hemp + Mung Bean = 120-150 kg N/year

Drought Resilience: All species extremely low water needs once established

Total Guild Footprint: ~55-65 ft diameter

GUILD TYPE 4: NITROGEN FIXER GUILD (Swale Berms)

Location: Swale 1-5 Berms (110ft, 160ft, 210ft, 260ft, 310ft marks)

Purpose: Primary nitrogen fixation, biomass production, living fence, fodder

Spacing: 10-15 ft apart along swale berms (each swale = 209 ft length = 14-21 trees per swale)

SWALE BERM NITROGEN FIXER GUILD COMPOSITION

PRIMARY SPECIES (Plant 10-15ft apart along berm):

1. **Gliricidia (*Gliricidia sepium*)** - 30% of swale trees
 - Function: Fast nitrogen fixer, coppice 4-6x/year, living fence
 - Height: 10-15 ft (coppiced regularly)
 - Biomass: 100-200 kg/tree/year
2. **Subabul/Leucaena (*Leucaena leucocephala*)** - 30% of swale trees
 - Function: Nitrogen fixer, fodder (high protein), fast-growing
 - Height: 15-20 ft (coppiced)
 - Biomass: 100-200 kg/tree/year
 - WARNING: Can be invasive, manage actively
3. **Moringa (*Moringa oleifera*)** - 20% of swale trees
 - Function: Nitrogen fixer, edible leaves/pods, medicinal
 - Height: 8-12 ft (coppiced)
 - Harvest: Drumsticks 2-3x/year
4. **Sesbania (*Sesbania grandiflora*)** - 20% of swale trees
 - Function: Fast nitrogen fixer, edible flowers, green manure
 - Height: 10-15 ft
 - Flowers: Edible, high protein

UNDERSTORY LAYER (Plant 5-8ft downslope from swale berm):

- **Pigeon Pea (*Cajanus cajan*)** - Every 8-10 ft along swale
 - Function: Nitrogen fixer, edible dal, windbreak
 - Height: 6-10 ft
 - Lifespan: 3-5 years
- **Tephrosia (*Tephrosia candida*)** - Every 12-15 ft
 - Function: Nitrogen fixer, green manure, pest repellent
 - Height: 3-6 ft

GROUND COVER (Below swale berm, 0-5ft from water's edge):

- **Vetiver Grass (*Chrysopogon zizanioides*)** - Continuous hedge along swale edge
 - Function: Erosion control, water purification, medicinal roots

- Height: 4-6 ft
- Spacing: 6-inch gaps between clumps

SWALE BERM GUILD FUNCTIONS

Function	Annual Output	Value
Nitrogen Fixation (5 swales × 15 trees avg × 10 kg N/tree)	750 kg N/year	₹15,000-20,000 (replaces urea)
Biomass/Mulch (75 trees × 150 kg avg)	11.25 tons/year	₹10,000-15,000 (compost value)
Fodder (Subabul, Moringa, Pigeon Pea)	3-5 tons/year	₹15,000-25,000 (animal feed)
Edibles (Moringa pods, Sesbania flowers, Pigeon Pea dal)	100-200 kg/year	₹8,000-15,000
Erosion Control (Vetiver)	Priceless	Prevents swale degradation

Total Value from Swale Guilds: ₹48,000-75,000/year

GUILD TYPE 5: POND EDGE GUILD (Zone 2 Production Pond)

Location: Zone 2B Production Pond at 245ft (30ft diameter, 5ft deep)

Purpose: Water quality, fish support, edible aquatic plants, duck forage

POND EDGE GUILD COMPOSITION (Concentric Rings)

RING 1: WATER PLANTS (0-12 inches deep in pond)

- 1. Azolla (*Azolla pinnata*)** - Floating nitrogen fixer
 - Function: Fixes nitrogen (5-10 kg N/month), duck feed, fish feed
 - Coverage: 10-20 sq ft section of pond (controlled)
 - Harvest: 2-3x/week (fresh duck food)
- 2. Water Spinach/Kangkong (*Ipomoea aquatica*)** - Shallow water edge
 - Function: Edible greens (family + ducks), water purification
 - Planting: Rooted at pond edge, spreads in water
 - Harvest: Weekly cutting
- 3. Lotus (*Nelumbo nucifera*)** - Deep water (3-5 ft)
 - Function: Edible roots/seeds/leaves, ornamental, shade (fish cooling)
 - Planting: 2-3 plants maximum (don't cover entire pond)

- Harvest: Seeds in fall, roots in winter

RING 2: POND MARGIN (0-3 ft from water's edge)

- 4. **Canna Lily (*Canna indica*)** - 3-4 ft tall, 8-10 plants around pond
 - Function: Water filtration (removes toxins), edible rhizomes, ornamental
 - Distance: Right at pond edge (roots in water)
- 5. **Papyrus (*Cyperus papyrus*)** - 4-6 ft tall, 6-8 clumps
 - Function: Water filtration, habitat (frogs, dragonflies), duck nesting material
 - Distance: Pond edge

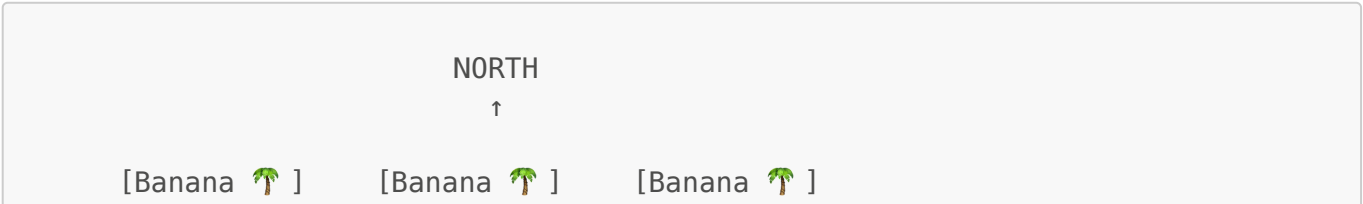
RING 3: UPLAND EDGE (3-8 ft from pond)

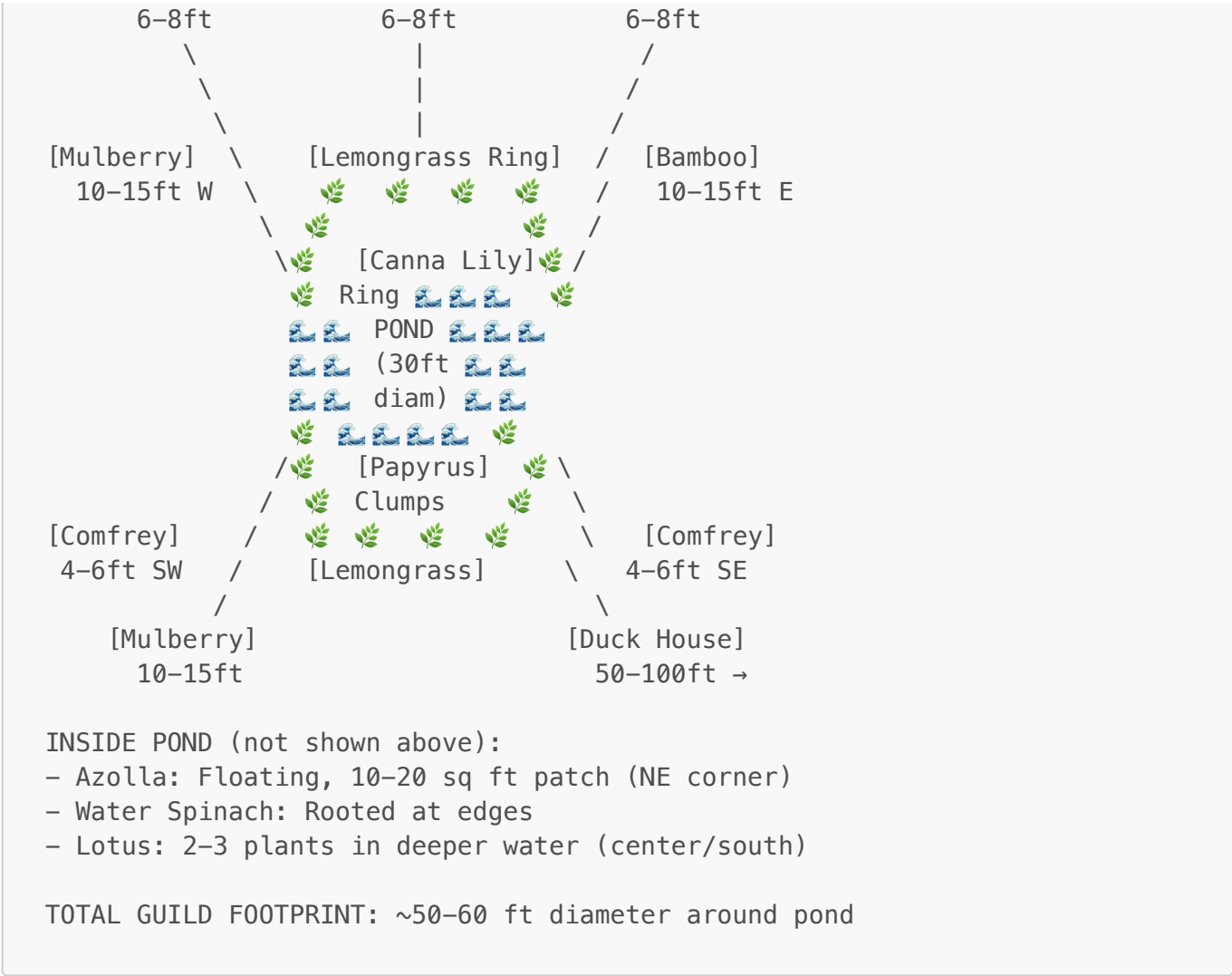
- 6. **Lemongrass (*Cymbopogon citratus*)** - 12-16 clumps around pond
 - Function: Repels mosquitoes, culinary, medicinal, duck-safe
 - Distance: 3-5 ft from pond edge
- 7. **Banana (*Musa paradisiaca*)** - 4-6 plants (north side of pond for shade)
 - Function: Shade (cools pond), edible fruit, mulch from leaves
 - Distance: 6-8 ft from pond edge
 - Variety: Dwarf banana (8-10 ft tall)
- 8. **Comfrey (*Symphytum officinale*)** - 8-12 plants around pond
 - Function: Deep roots (mines nutrients), chop-and-drop into pond (fish food), medicinal
 - Distance: 4-6 ft from pond edge
 - Harvest: Cut leaves monthly, drop into pond

RING 4: OUTER EDGE (8-15 ft from pond)

- 9. **Mulberry (*Morus alba*)** - 2-3 trees
 - Function: Fodder (excellent duck/chicken food), fruit, shade, silkworm host (optional)
 - Distance: 10-15 ft from pond
- 10. **Bamboo (*Bambusa spp.*)** - 2-3 clumps (EAST side only, as windbreak)
 - Function: Windbreak, construction material, erosion control
 - Distance: 12-15 ft from pond
 - WARNING: Plant clumping variety only (not running bamboo)

POND GUILD SPATIAL LAYOUT (Top View)





POND GUILD FUNCTIONS SUMMARY

Function	Plants	Annual Benefit
Nitrogen Fixation	Azolla	60-120 kg N/year (feeds back into system via ducks/fish)
Water Purification	Canna, Papyrus, Water Spinach	Removes excess nutrients, prevents algae blooms
Duck Food	Azolla, Water Spinach, Comfrey	₹5,000-10,000/year (feed cost savings)
Fish Food	Azolla, Comfrey leaves, Banana leaves (insect habitat)	₹2,000-4,000/year (feed savings)
Human Food	Lotus (seeds/roots), Water Spinach, Banana, Mulberry	₹3,000-6,000/year
Mosquito Control	Lemongrass (repellent), Papyrus (dragonfly habitat)	Priceless (health benefit)
Cooling/Shade	Banana, Lotus, Mulberry	3-5°C temperature reduction in pond (fish welfare)

Pond Guild = Most Productive Per Square Foot!

- 50 ft diameter circle = 1,963 sq ft
- Annual value: ₹10,000-20,000
- Value per sq ft: ₹5-10/sq ft (vs ₹1-3/sq ft for annual crops)

3. ZONE 3 PRODUCTION GUILDS (0.70 ACRES)**Zone 3 Context**

Location: 310-455 feet from north boundary

Area: 30,305 sq ft = 0.70 acres

Layout: 3 rows (N-S):

- Row 1 (310-360ft): Fruit orchard - 40-50 trees
- Row 2 (360-420ft): Annual crops - 0.29 acres (intensive rotation)
- Row 3 (420-455ft): Biomass/fodder - 32-40 nitrogen-fixer trees

Key Difference from Zone 2:

- Zone 3 = **PRODUCTION focus** (main food harvest)
- Zone 2 = **FOOD FOREST focus** (polyculture, animal integration)
- Zone 3 guilds = **simpler, more orchard-style** (easier harvesting)

GUILD TYPE 6: ZONE 3 ORCHARD GUILD (Simplified Food Production)

Design Philosophy: "Fruit Trees + Simple Understory"

Why Simpler Than Zone 2?

- Easier harvest access (ladder work, fruit collection)
- More sun to ground layer (better for annual crop rotation)
- Less foot traffic conflicts
- Focus on quantity over ecosystem complexity

STANDARD ZONE 3 ORCHARD GUILD (For Mango, Jamun, Guava)**LAYER 1: CANOPY**

- **Main Fruit Tree** (center) - Mango/Jamun/Guava

LAYER 2: NONE (in Zone 3 orchard)

- Reason: Keep it simple, maximize sun to ground

LAYER 3: SHRUBS (Minimal, only at cardinal points)

- **4 Curry Leaf bushes** at N, S, E, W (10-12 ft from tree)
 - Function: Pest management, edible, doesn't compete

LAYER 4: HERBACEOUS (Ring only)

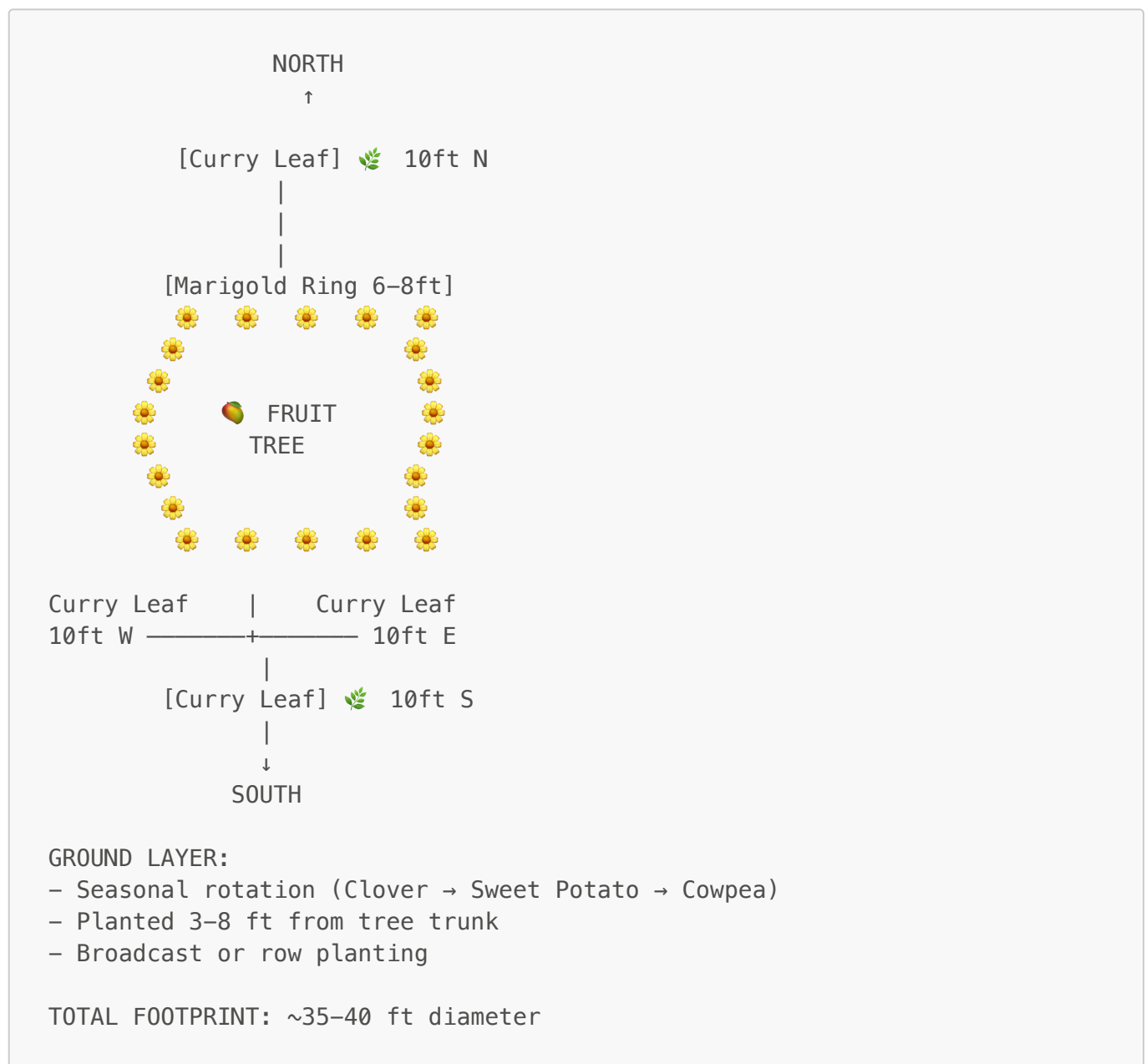
- **Marigold Ring** (6-8 ft from tree, 16-20 plants)
 - Function: Nematode control, pest repellent
 - Annual, replant each year

LAYER 5: GROUND COVER (Seasonal rotation)

- **Winter:** Clover or Fenugreek (nitrogen fixation, edible)
- **Summer:** Sweet Potato or Peanut (edible, weed suppression)
- **Monsoon:** Cowpea (nitrogen fixation, edible pods)

LAYER 6: ROOT CROPS (Optional, only if time available)

- Garlic (winter) or Turmeric (monsoon) in outer ring

ZONE 3 ORCHARD GUILD SPATIAL LAYOUT (Simplified)

Annual Work:

- Plant marigolds once/year (February)
- Rotate ground cover 3x/year (November, March, July)
- Harvest curry leaf as needed (weekly)

Annual Value:

- Fruit: ₹1,500-3,000 (depends on tree species/age)
- Ground cover: ₹500-1,200 (edibles + nitrogen value)
- Curry leaf: ₹300-600
- **TOTAL: ₹2,300-4,800/year per tree**

GUILD TYPE 7: ANNUAL CROP COMPANION GUILDS (Zone 3 Row 2)

Location: Zone 3 Row 2 (360-420ft from north, 0.29 acres)

Purpose: Maximize annual vegetable/grain production with strategic companion planting

COMPANION GUILD 1: WHEAT + MUSTARD (Winter Season)

Main Crop: Wheat (*Triticum aestivum*) - 0.15 acres (half of Row 2)

Companion: Mustard (*Brassica juncea*) - Broadcast in 2-ft wide strips every 20 ft

Why This Works:

- Mustard = Biofumigant (releases compounds that suppress soil pathogens)
- Mustard attracts beneficial insects (predatory wasps love mustard flowers)
- Mustard greens edible (harvest before wheat matures)
- No competition (mustard harvested 30 days before wheat)

Layout:

[Wheat bed 20ft] → [Mustard strip 2ft] → [Wheat bed 20ft] → [Mustard strip 2ft] → [Wheat bed 20ft]

Annual Benefit:

- Wheat: 375-525 kg (₹7,500-13,125)
 - Mustard greens: 40-60 kg (₹800-1,800)
 - Soil health: 20-30% disease reduction
 - **Total: ₹8,300-14,925**
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COMPANION GUILD 2: TOMATO + BASIL + MARIGOLD (Spring Season)

Main Crop: Tomato (*Solanum lycopersicum*) - Staked, 200-300 plants

Companions:

- 1. **Basil (*Ocimum basilicum*)** - 1 plant per 3 tomatoes
 - Function: Repels aphids, whiteflies, improves tomato flavor
 - Spacing: Interplanted between tomato rows
- 2. **Marigold (*Tagetes*)** - Border rows + every 8-10 tomatoes
 - Function: Repels nematodes, aphids, attracts pollinators
 - Spacing: 3-ft spacing in borders, scattered in beds

Layout:

```
[Marigold border]
[Tomato row] - [Basil] - [Tomato] - [Basil] - [Tomato]
[Tomato row] - [Basil] - [Tomato] - [Basil] - [Tomato]
[Marigold border]
```

Annual Benefit:

- Tomatoes: 600-900 kg (₹12,000-22,500)
- Basil: 10-15 kg (₹2,000-4,500)
- Pest reduction: 40-60% (₹2,000-4,000 pesticide savings)
- **Total: ₹16,000-31,000**

COMPANION GUILD 3: GOURD + CORN + BEAN (Monsoon "Three Sisters")

Traditional Polyculture Adapted for Monsoon:

- 1. **Corn (*Zea mays*)** - Structural support, 150-200 plants
 - Spacing: 3 ft apart
 - Function: Trellis for beans, shade for gourds
- 2. **Climbing Beans (*Phaseolus vulgaris*)** - Nitrogen fixer, 150-200 plants
 - Spacing: Planted at base of each corn stalk
 - Function: Fixes nitrogen (50-80 kg N/acre), edible pods
- 3. **Ridge Gourd (*Luffa acutangula*) or Bottle Gourd** - Ground cover
 - Spacing: Between corn mounds
 - Function: Living mulch, edible vegetables

Layout:

```
[Corn mound] - [Gourd vine spreading between] - [Corn mound]
|                                                     |
```

[Beans climbing]	[Beans climbing]
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Annual Benefit:

- Gourds: 400-600 kg (₹4,000-9,000)
- Corn: 100-150 kg (₹2,000-3,750)
- Beans: 80-120 kg (₹4,000-7,200)
- Nitrogen fixation: ₹1,500-2,500 (fertilizer savings)
- **Total: ₹11,500-22,450**

GUILD TYPE 8: BIOMASS/FODDER GUILD (Zone 3 Row 3)

Location: Zone 3 Row 3 (420-455ft from north, 0.17 acres)

Purpose: Maximum nitrogen fixation + biomass for compost + fodder for animals

Species Mix (32-40 trees total, planted 15-20ft apart):

1. **Subabul (*Leucaena*)** - 10-12 trees (30%)
2. **Gliricidia** - 8-10 trees (25%)
3. **Moringa** - 6-8 trees (20%)
4. **Sesbania** - 4-5 trees (12%)
5. **Mulberry** - 4-5 trees (12%)

Understory: Pigeon Pea Hedge

- Continuous hedge along southern edge
- Planted 8-10 ft apart
- Coppice annually for biomass + dal harvest

Ground Cover: Perennial Peanut (*Arachis glabrata*)

- Broadcast throughout Row 3
- Fixes nitrogen, suppresses weeds, no harvest needed (just biomass)
- Never needs replanting (perennial)

BIOMASS GUILD MANAGEMENT (Critical for Farm Success)

Coppicing Schedule:

- Subabul, Gliricidia: Every 60-90 days (4-6 cuts/year)
- Moringa: Every 45-60 days (6-8 cuts/year)
- Sesbania: Every 60-75 days (5-6 cuts/year)
- Mulberry: Every 90-120 days (3-4 cuts/year)

Annual Biomass Production:

- 36 trees average × 120 kg/tree/year = **4,320 kg (4.3 tons)**

- Pigeon Pea hedge: ~800 kg/year
- **Total: 5+ tons biomass/year**

Usage Allocation:

- 50% to compost system (2.5 tons) → 8-10 cubic yards finished compost
- 30% to mulch (Zones 2-3 fruit trees) (1.5 tons)
- 20% to animal fodder (1 ton) → Supplements chicken/duck feed

Nitrogen Contribution:

- 5 tons biomass @ 3% N content = **150 kg nitrogen/year**
- Equivalent to: ₹3,000-4,000 worth of urea fertilizer

4. UNIVERSAL GUILD PRINCIPLES

Principle 1: Spacing by Mature Size

Critical Mistake to Avoid: Planting too close!

Tree Type	Mature Spread	Minimum Spacing
Mango, Jamun	30-40 ft	25-30 ft from other canopy trees
Guava, Pomegranate	15-20 ft	15-20 ft from other trees
Nitrogen Fixers (Gliricidia, Subabul)	15-20 ft	15-20 ft from each other
Moringa, Sesbania	10-15 ft	10-15 ft from each other

Rule of Thumb: Guild footprint = Tree mature spread + 50%

- Mango guild: 30 ft spread + 50% = **45 ft radius minimum**
- Guava guild: 20 ft spread + 50% = **30 ft radius minimum**

Principle 2: Succession Planting (Don't Plant All at Once!)

Year 1: FOUNDATION

- Main canopy tree (Mango, Jamun, Guava)
- Nitrogen fixers (Gliricidia, Moringa) at edges
- Fast-growing ground cover (Cowpea, Sweet Potato)

Year 2: SUPPORT SPECIES

- Shrubs (Curry Leaf, Lemongrass, Tulsi)
- Herbaceous perennials (Comfrey, Pigeon Pea)
- Continue ground cover rotation

Year 3-5: FINAL LAYERS

- Vines (only after main tree 6+ ft tall)

- Additional shrubs as needed
- Refine based on observation

Why Succession?

- Avoids overwhelming planting work
 - Allows you to see what space is actually available
 - Main tree gets 1-2 years without competition
 - Learn and adapt as you go
-

Principle 3: Observation Before Action

Walk Your Guilds Weekly:

- What's thriving? (Plant more of this!)
- What's struggling? (Adjust spacing, water, or remove)
- What pests do you see? (Add pest-repellent plants)
- Where are the gaps? (Add ground cover or mulch)

Example Observations:

- "Marigolds in full sun doing great, but shaded ones dying" → Plant marigolds only in sunny spots
 - "Comfrey near swale is 2x bigger than uphill comfrey" → Water is key, plant comfrey near water sources
 - "Chickens eating all the sweet potato vines" → Fence sweet potato or move to duck zone
-

Principle 4: Feed the Soil, Not the Plant

Guild Soil Building Strategy:

- **Never bare soil** - always mulched or living ground cover
- **Chop-and-drop** - Cut nitrogen fixer branches, lay at tree base (breaks down in 4-8 weeks)
- **Compost tea** - Diluted compost tea drenches every 2-4 weeks (liquid fertility)
- **Mulch rings** - 4-6 inch mulch around each tree (keep 3-4 inches away from trunk)

Annual Soil Amendment Cycle:

1. **Month 1 (July):** Apply compost (5-10 kg per tree)
2. **Month 4 (October):** Chop-and-drop nitrogen fixers
3. **Month 7 (January):** Apply vermicompost (3-5 kg per tree)
4. **Month 10 (April):** Chop-and-drop + mulch replenishment

Result After 3-5 Years:

- Soil organic matter: 1-2% → 4-6% (4x increase!)
 - Water retention: 50-100% improvement
 - Earthworms: 10-50x increase
 - Fertilizer needs: 80-90% reduction
-

5. SEASONAL MANAGEMENT CALENDAR

JANUARY-FEBRUARY (Winter - Cool, Dry)

Tasks:

- Prune deciduous trees (mango, jamun)
- Plant garlic in guilds
- Harvest winter vegetables
- Chop-and-drop nitrogen fixers (slow decomposition, builds mulch)
- Apply vermicompost to fruit trees

Planting:

- Annual herbs: Dill, Coriander
 - Winter ground cover: Fenugreek, Mustard
-

MARCH-MAY (Summer - Hot, Dry, 35-45°C)

Tasks:

- CRITICAL IRRIGATION (trees can die without water)
- Mulch replenishment (6-inch depth minimum)
- Harvest wheat (March)
- Plant summer vegetables (tomatoes, eggplant, peppers)
- Harvest pigeon pea dal

Planting:

- Summer ground cover: Peanut, Sweet Potato
- Heat-tolerant herbs: Basil, Tulsi

Stress Management:

- Water trees 2-3x per week (deep watering)
 - Shade sensitive plants (temporary shade cloth)
 - Harvest leafy greens before they bolt
-

JUNE-SEPTEMBER (Monsoon - Wet, Humid, 30-35°C)

Tasks:

- **MAIN TREE PLANTING WINDOW** (60-70% of annual planting)
- Plant all fruit trees (mango, guava, jamun)
- Plant all nitrogen fixers
- Establish ground covers
- Monitor for fungal diseases (high humidity)
- Chop-and-drop nitrogen fixers (fast decomposition, feeds trees)

Planting:

- Monsoon ground cover: Cowpea, Mung Bean
- Ginger, Turmeric (root crops)
- Monsoon vegetables: Gourds, Okra

Caution:

- Overwatering possible (check soil before irrigating)
- Fungal issues (neem spray every 2 weeks)
- Weed pressure high (mulch, mulch, mulch!)

OCTOBER-DECEMBER (Post-Monsoon - Mild, Dry, 15-25°C)

Tasks:

- Harvest turmeric, ginger
- Plant winter crops (wheat, vegetables)
- Fertilize fruit trees (compost application)
- Prune nitrogen fixers (major coppicing)
- Harvest fruit (guava, pomegranate)

Planting:

- Winter ground cover: Clover, Fenugreek
- Cool season vegetables: Peas, Carrots, Spinach

6. IMPLEMENTATION ROADMAP (Year 1-5)

YEAR 1: FOUNDATION PLANTING

Monsoon (June-July) - MAIN PLANTING WINDOW:

- Plant all canopy trees (Mango, Jamun, Guava) - 90-120 trees across Zones 2-3
- Plant nitrogen fixers on swale berms (60-75 trees)
- Install tree guards (essential!)
- Mulch heavily (4-6 inch depth)

Post-Monsoon (August-October):

- Add fast-growing support species:
 - Pigeon Pea (nitrogen fixer, 3-year lifespan)
 - Marigold (annual, pest control)
 - Curry Leaf (shrub, pest control)
- Plant first ground covers:
 - Cowpea (monsoon into fall)
 - Sweet Potato (fall into winter)

Winter (November-February):

- Plant winter ground cover (clover, fenugreek)

- Monitor tree establishment (>80% survival target)
- Begin first chop-and-drop cycle (pigeon pea, early nitrogen fixers)

Year 1 Costs:

- Trees (90-120 canopy + 60-75 nitrogen fixers): ₹10,000-20,000
- Tree guards: ₹15,000-20,000
- Support plants: ₹3,000-5,000
- **Total: ₹28,000-45,000** (₹7,000-11,250 per family)

Year 1 Output:

- Minimal food (some pigeon pea dal, sweet potatoes)
- **Focus: Establishment, not production**

YEAR 2-3: ESTABLISHMENT & EARLY PRODUCTION

Main Activities:

- Trees growing (2-4 ft tall by Year 3)
- Add shrub layer (curry leaf, lemongrass, aloe)
- Add herbaceous perennials (comfrey, artemisia)
- Refine ground cover rotations based on observation
- Begin coppicing nitrogen fixers (biomass production)

First Food Production:

- **Year 2:** Pigeon pea dal (40-60 kg), Sweet potato (100-150 kg), Herbs
- **Year 3:** Guava fruit starts (20-40 kg), Pomegranate (10-20 kg)
- Ground covers: 200-400 kg/year (peanuts, cowpea, sweet potato)
- Nitrogen fixer chop-and-drop: 1-2 tons biomass/year

Annual Value (Year 2-3):

- Food production: ₹10,000-25,000/year
- Biomass/compost value: ₹5,000-10,000/year
- **Total: ₹15,000-35,000/year** (₹3,750-8,750 per family)

YEAR 4-5: EARLY MATURITY

Main Activities:

- Trees 4-6 ft tall, some beginning to fruit
- Full guild layers established
- System increasingly self-maintaining
- Compost production 8-10 cubic yards/year

Food Production Increasing:

- **Year 4-5:** Some mango/jamun starting (10-30 kg per tree)

- Guava production increasing (40-60 kg per tree)
- All understory layers producing
- Nitrogen fixers providing 3-5 tons biomass/year

Annual Value (Year 4-5):

- Food production: ₹40,000-80,000/year
- Biomass/compost/fodder: ₹15,000-25,000/year
- **Total: ₹55,000-105,000/year** (₹13,750-26,250 per family)

ROI Milestone: Initial investment (₹28,000-45,000) paid back by Year 3-4!

YEAR 6-10+: MATURE PRODUCTION

Main Activities:

- Most fruit trees in full production
- Guilds mature and stable
- 80-90% self-maintaining (minimal inputs needed)
- System resilience high (pest/disease/drought tolerant)

Full Production:

- Mango guilds: ₹5,600-10,200/guild × 10-12 guilds = ₹56,000-122,400
- Guava guilds: ₹3,500-6,500/guild × 15-20 guilds = ₹52,500-130,000
- Jamun guilds: ₹3,000-6,000/guild × 8-10 guilds = ₹24,000-60,000
- Zone 3 simplified guilds: ₹2,300-4,800/tree × 40-50 trees = ₹92,000-240,000
- Swale nitrogen fixer guilds: ₹48,000-75,000/year
- Pond guild: ₹10,000-20,000/year

Total Guild Production Value (Year 10+):

- **Zones 2-3 Combined: ₹282,500-647,400/year**
- **Per Family: ₹70,625-161,850/year**

This doesn't include Zone 1 kitchen gardens or Zone 2 animal products!

CONCLUSION

Summary of Guild Benefits

Economic:

- Year 1 investment: ₹7,000-11,250 per family
- Year 10+ returns: ₹70,625-161,850 per family/year
- ROI: 9-23x return on investment
- Payback period: 2-4 years

Ecological:

- Soil organic matter: 4-6x increase in 5 years
- Water retention: 50-100% improvement
- Nitrogen fixation: 200-300 kg N/year (₹4,000-6,000 fertilizer savings)
- Biodiversity: 40-60 plant species vs. 3-5 in conventional farms
- Pest resilience: 50-70% reduction in pest damage
- Drought resilience: 80% reduction in irrigation needs after Year 5

Social:

- Food diversity: 15-20 different foods from guilds year-round
 - Food security: 70-90% vegetable/fruit independence
 - Knowledge: Each guild teaches ecological principles
 - Community: Shared management builds cooperation
 - Children's education: Living classroom for next generation
-

Critical Success Factors

1. **START IN MONSOON** (June-July) - 80% of planting success comes from timing
 2. **PLANT NITROGEN FIXERS FIRST** - They build soil for others
 3. **MULCH OBSESSIVELY** - 4-6 inch depth, replenish 2-3x/year
 4. **OBSERVE WEEKLY** - Adjust based on what you see, not what the plan says
 5. **BE PATIENT** - Year 1-3 = establishment, Year 4-10 = acceleration
-

Next Steps**This Month:**

1. Share guild designs with all 4 families
2. Select 3-5 "test guilds" to establish this monsoon (don't do all at once!)
3. Source tree saplings from local nurseries
4. Prepare planting pits (60 days before monsoon)

Within 3 Months:

1. First guild planting (June-July monsoon)
2. Document what works/doesn't work
3. Adjust future guilds based on learning

Within 1 Year:

1. 20-30 guilds established (30% of total)
 2. First harvests (pigeon pea, sweet potato, herbs)
 3. Lessons learned integrated into Year 2 expansion
-

Plant guilds are not just agricultural technique - they are cooperative communities that demonstrate the abundance possible when we design with nature rather than against it.

In 5-10 years, when your children can walk through the food forest harvesting mangoes, guavas, turmeric, and dal from the same 60-foot circle, they'll understand the magic of guilds:

"Everything supports everything else. That's how nature works. That's how WE should work too."

Document Status: Implementation Ready

Next Action: Family review + select test guilds for June 2026 monsoon planting

Questions: Use for sprint planning and guild establishment prioritization

Designed following permaculture principles: Observe and Interact, Catch and Store Energy, Obtain a Yield, Apply Self-Regulation, Use Renewable Resources, Produce No Waste, Design from Patterns to Details, Integrate Rather than Segregate, Use Small and Slow Solutions, Use and Value Diversity, Use Edges and Value the Marginal, Creatively Use and Respond to Change.