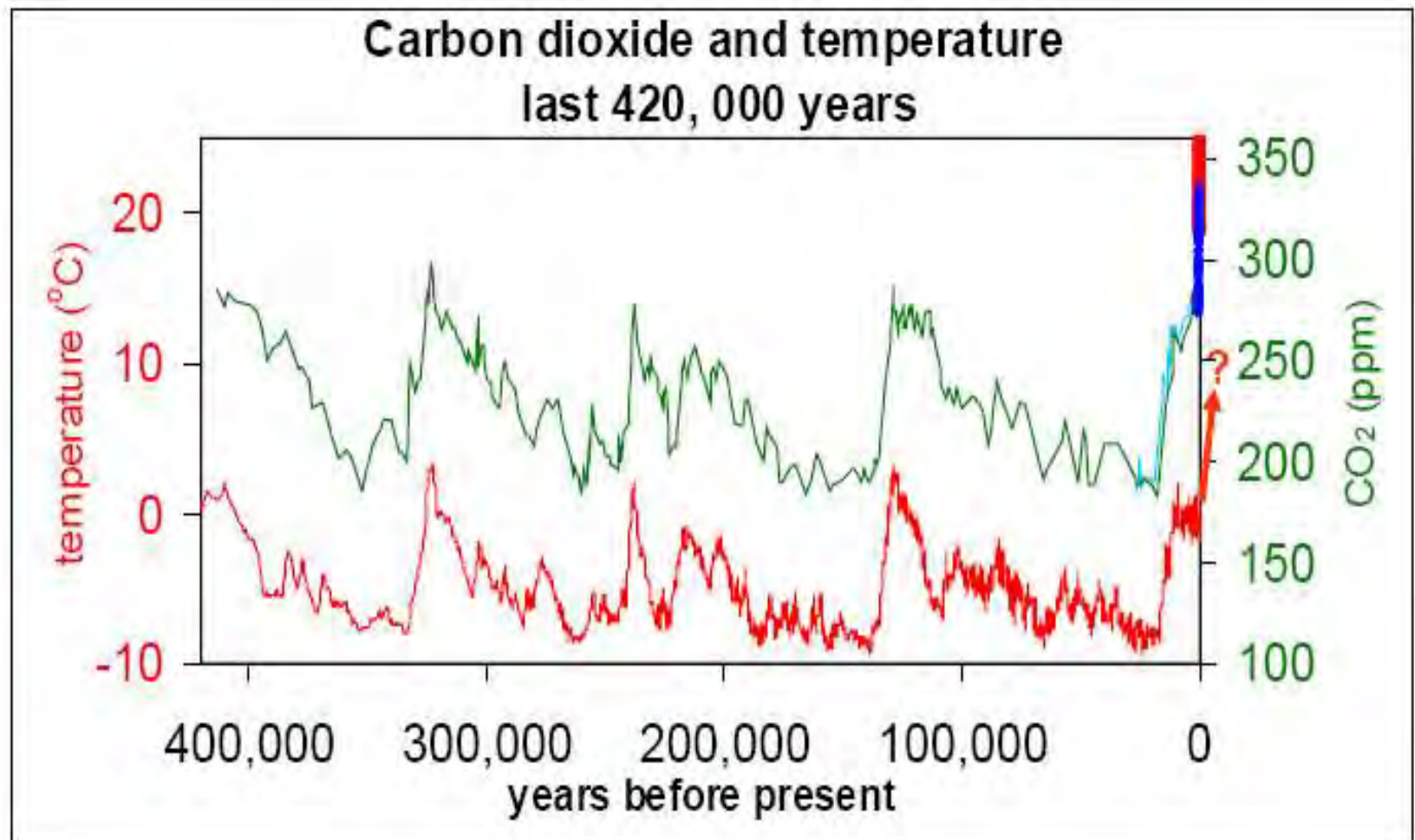


Zones 3, 4 & 5



The present CO₂ level is unprecedented in at least the past 420,000 years and it is expected to rise to 550-950 ppm by the year 2100

Temperatures may rise by 1.4-5.8°C by 2100

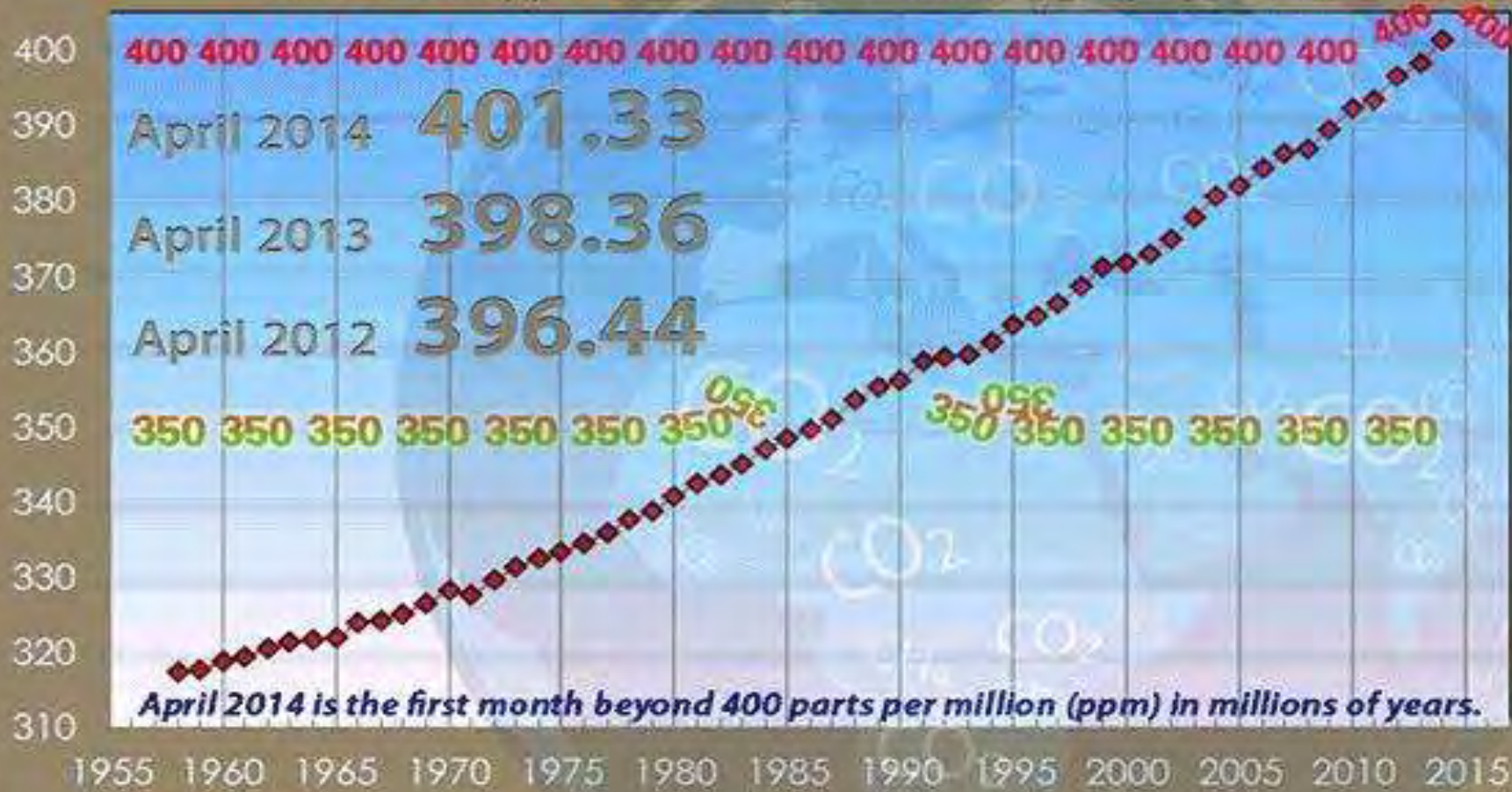
Atmospheric CO₂

April 1958 - April 2014

April CO₂ | Year Over Year | Mauna Loa Observatory

Data: Scripps Institution of Oceanography

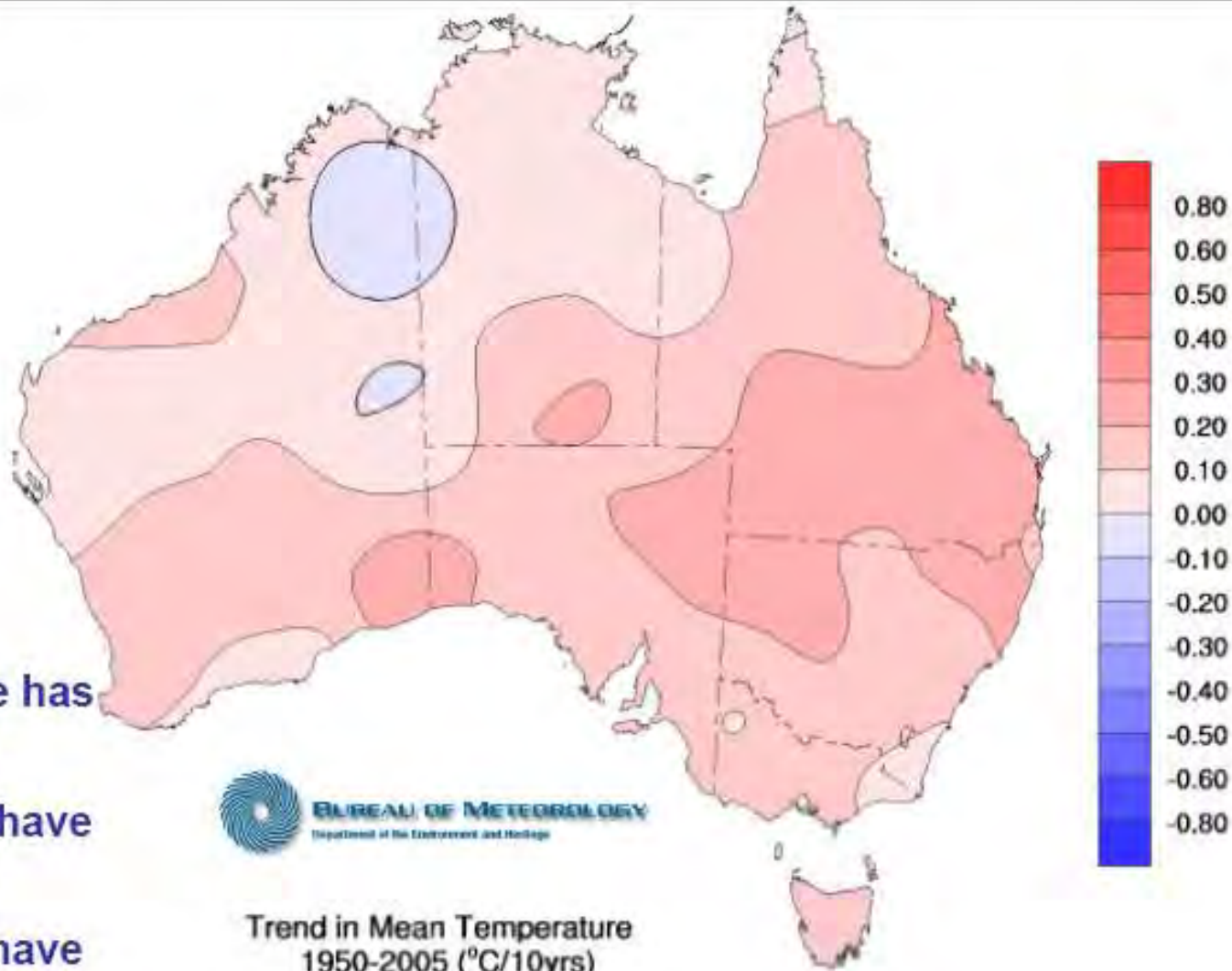
Concentration of Atmospheric CO₂ (ppm)



CO₂Now.org

Featuring Scripps data of May 1, 2014

Temperature change 1950-2005: most warming in the south and east, least in the northwest



Climate change in SA

Conservative figures relating to 2070

Rainfall – In cropping areas likely to reduce by 30% in spring and 20% in winter.

Average temp - up by a 3 – 6 degrees C. Extreme days should reach 50 degrees C regularly.

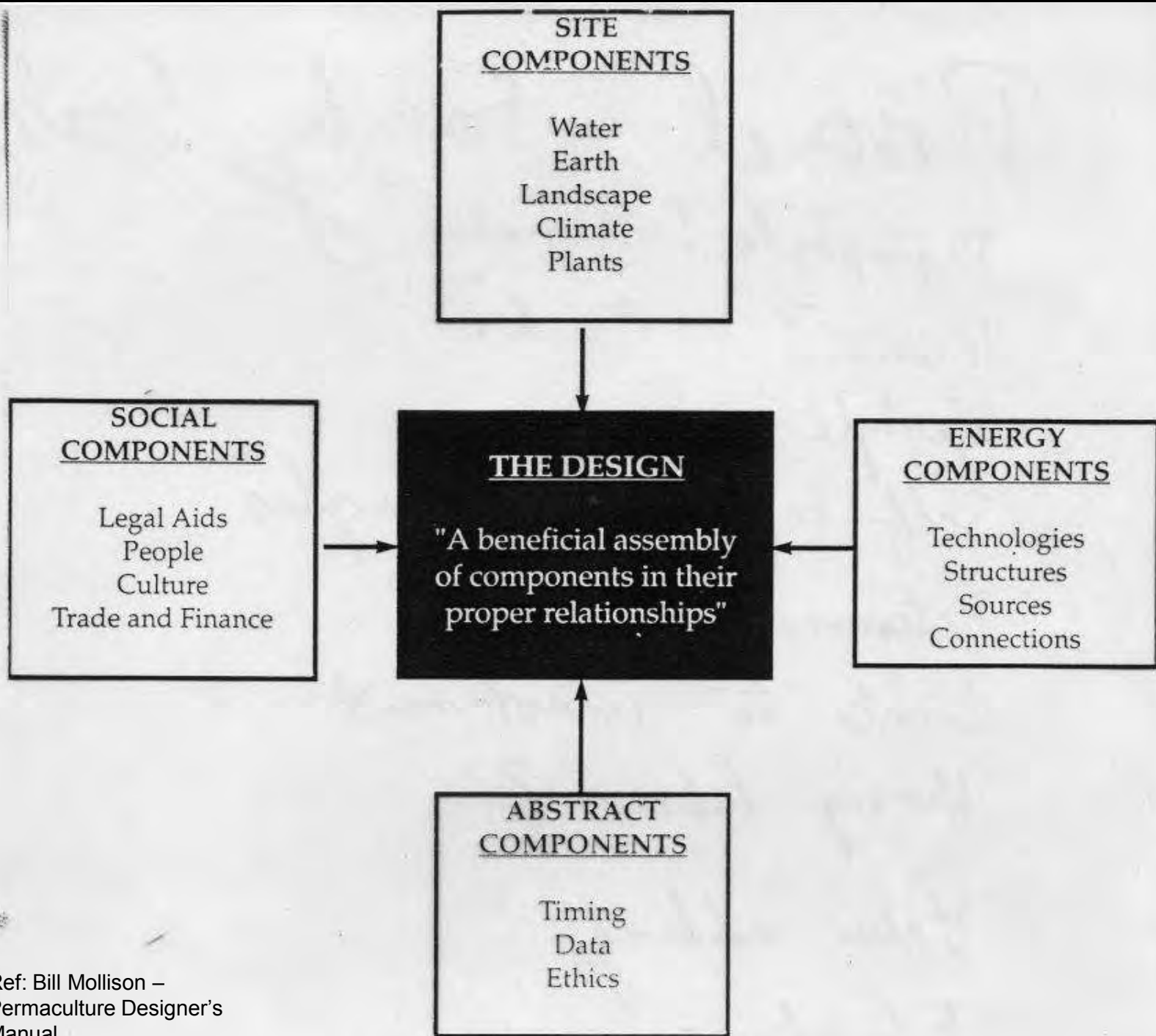
Warmer winter will disrupt the pollination and flowering of many tree crops

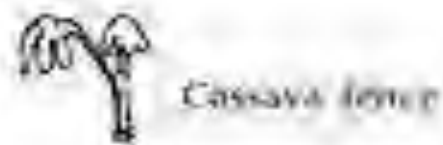
CO2 levels - may almost double

Sea level – up by almost half a metre

Murray flows – further reduced

Source CSIRO





Cassava tuber



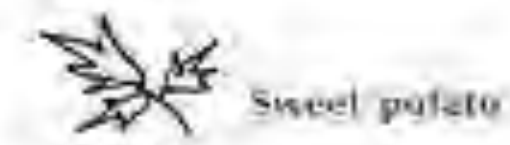
Eggplant



Taro



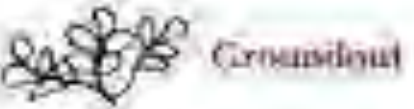
Pumpkin



Sweet potato



Bean



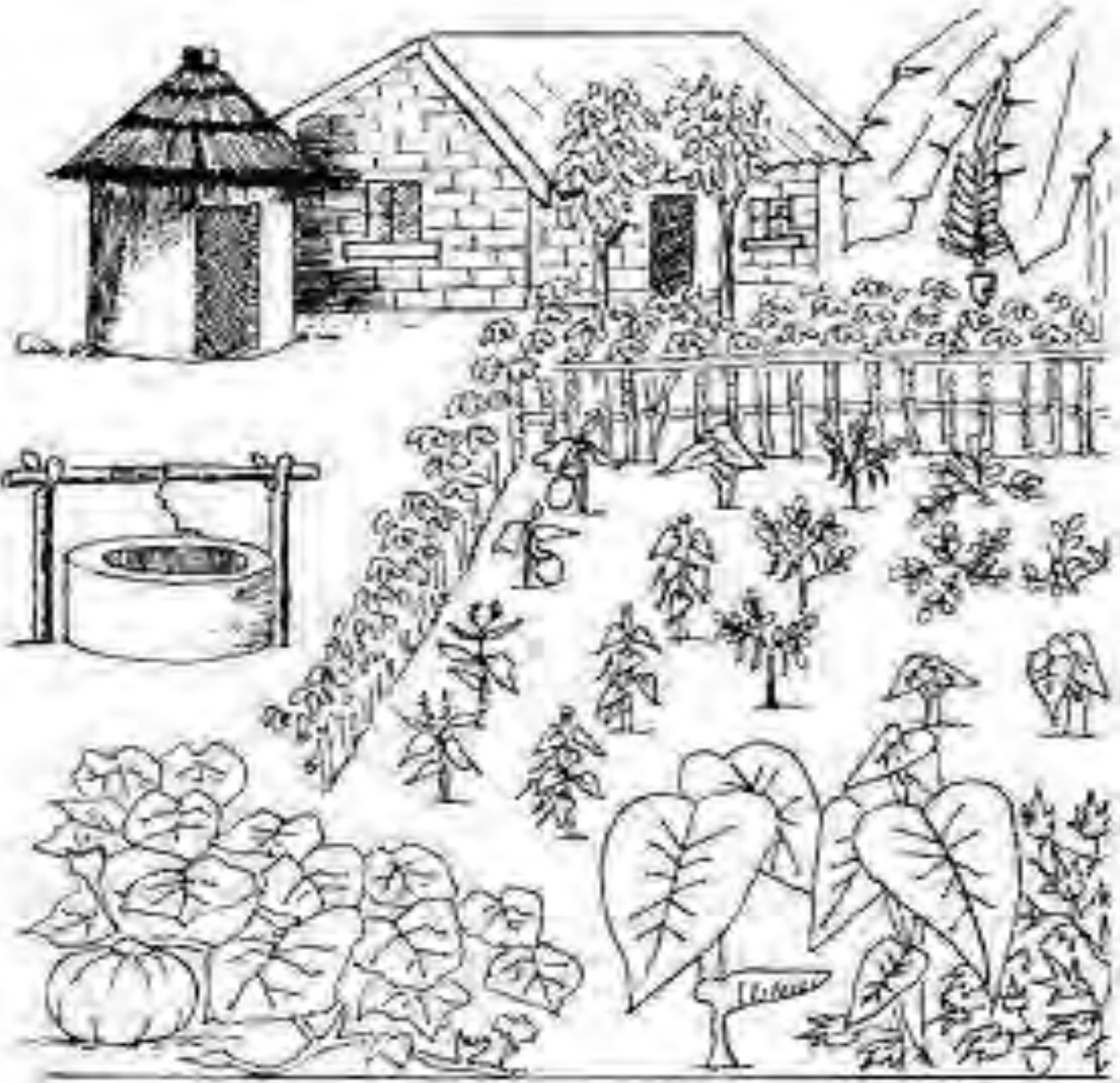
Cresshead



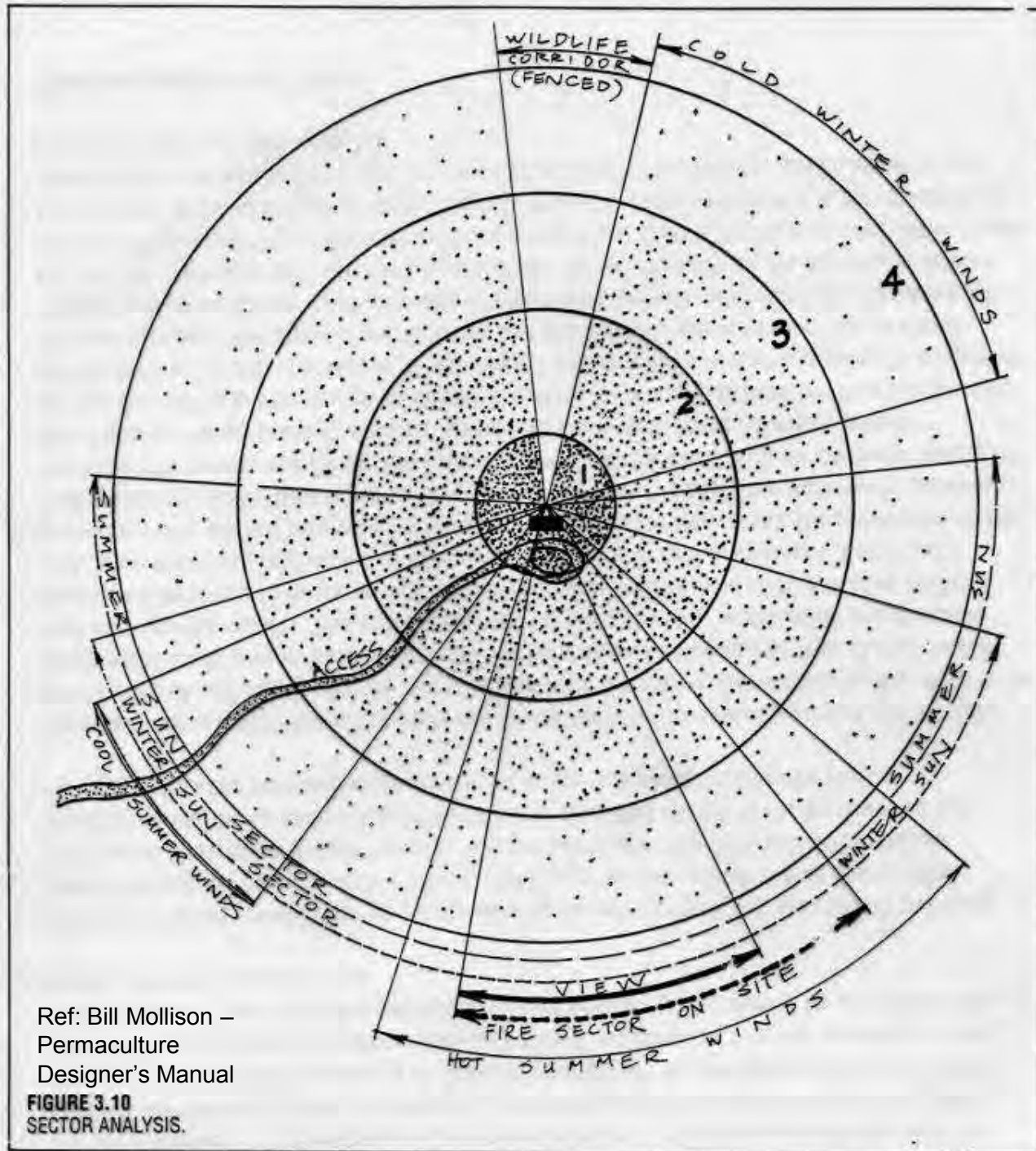
Chilli



Amaranth



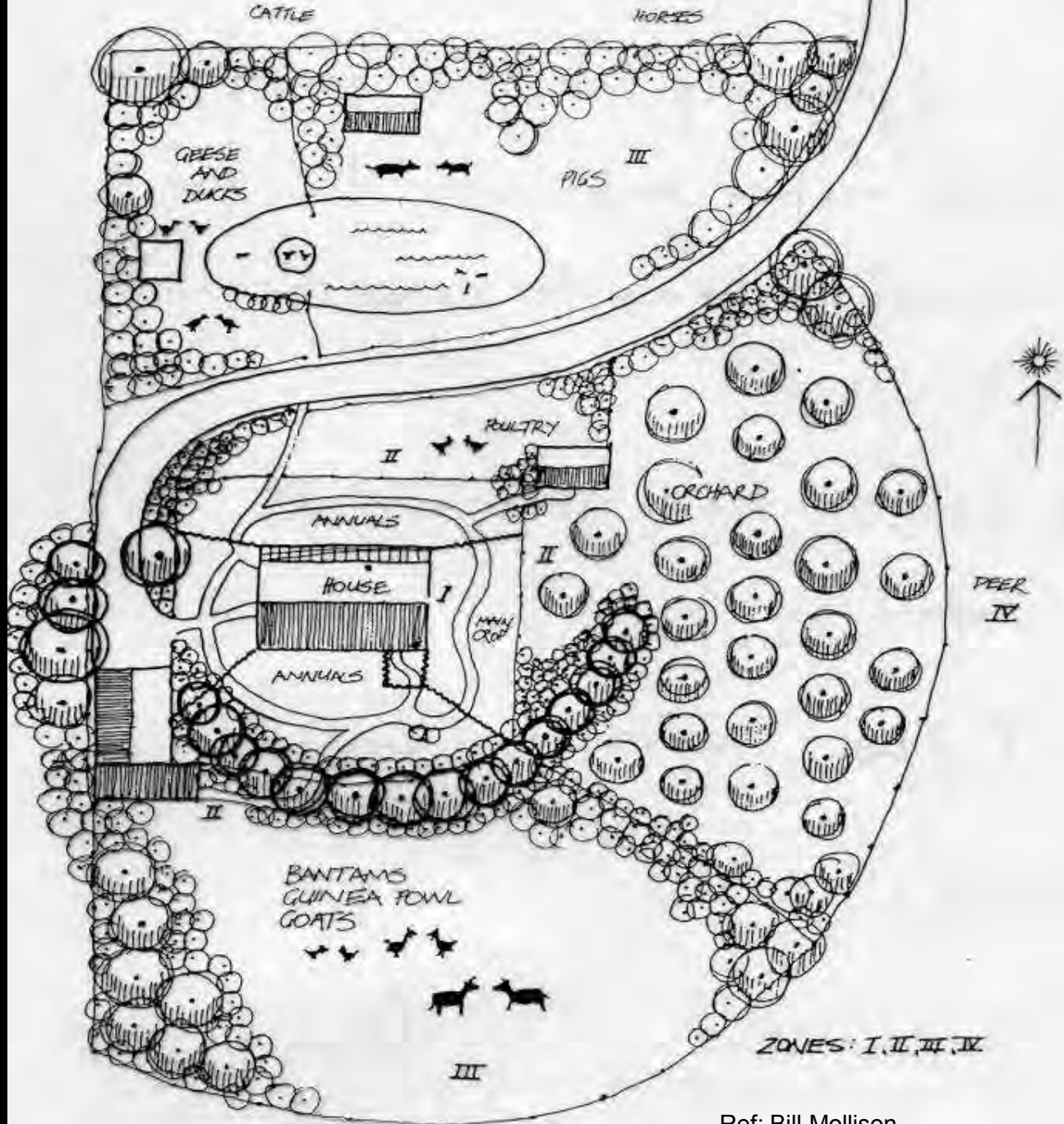
Ref: Bill Mollison –
Permaculture Designer's
Manual



Ref: Bill Mollison –
Permaculture
Designer's Manual

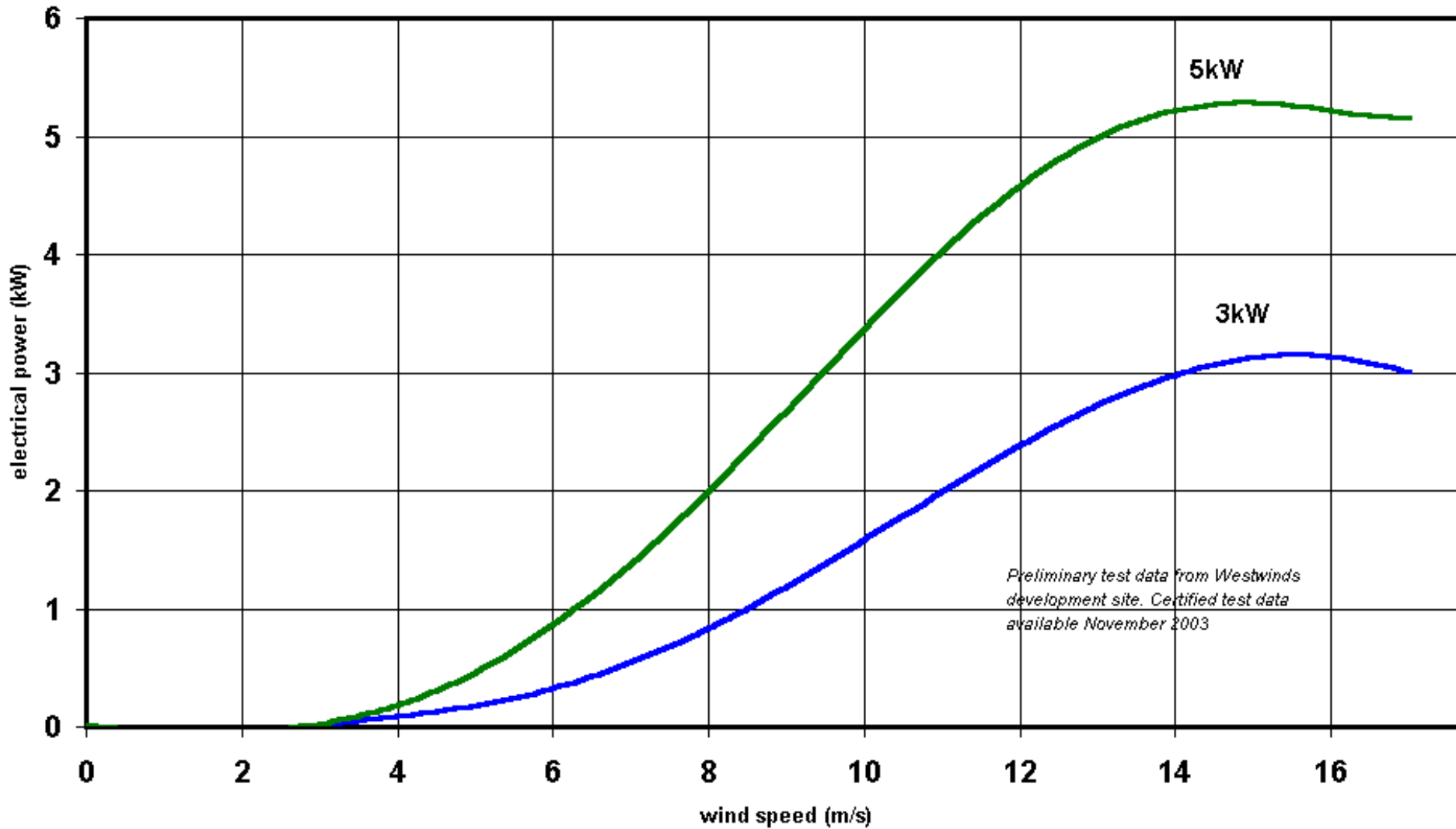
FIGURE 3.10
SECTOR ANALYSIS.





Ref: Bill Mollison –
 Permaculture Designer's Manual

Wind Power Potential



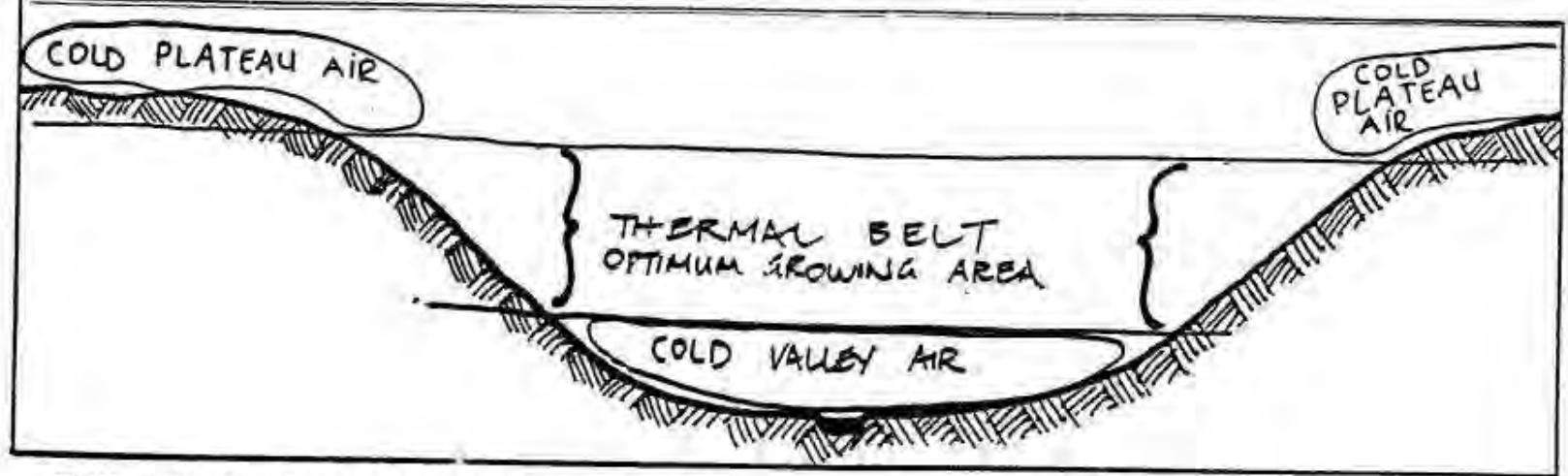


FIGURE 2.3 The "thermal belt" in a valley lies between layers of cold air and is the optimum area for house, orchard, and gardens.

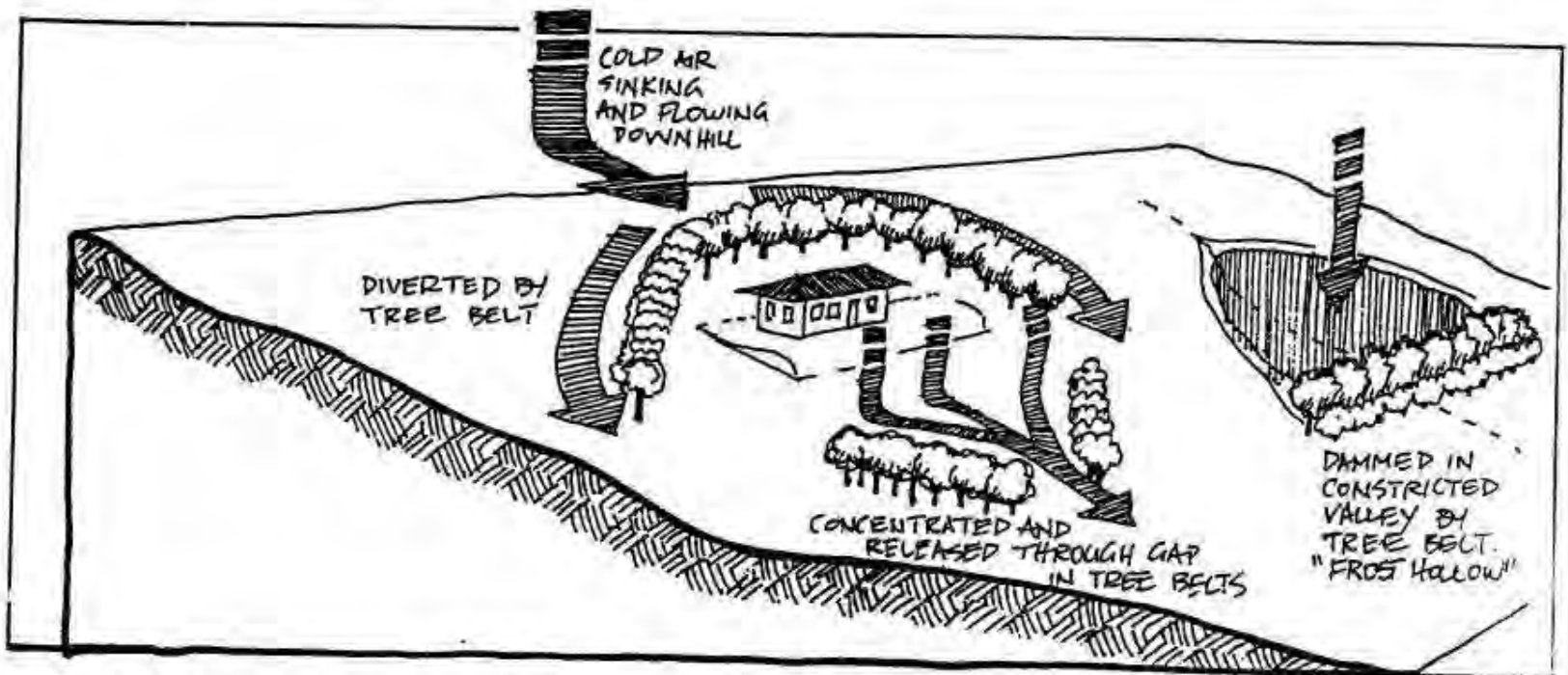


FIGURE 2.4 How cold air flows downslope. Note ways to avoid frost pockets by using vegetation to divert cold air.



Image © 2008 DigitalGlobe

97 m

©2008 Google

34°36'48.91" S 138°43'17.36" E

May 27, 2006

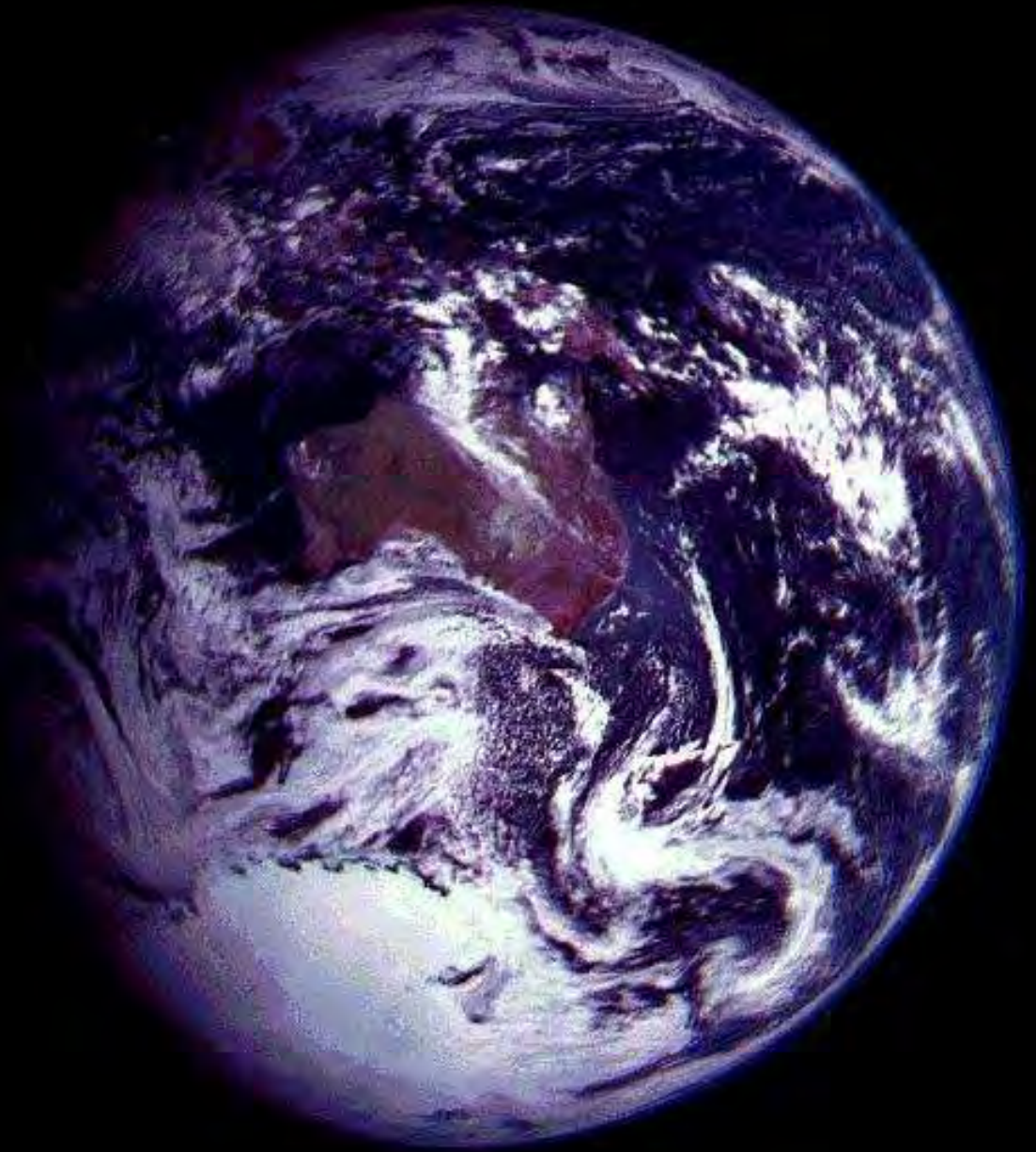
Eye alt 325 m



Latitude?

Elevation?

Proximity to
sea?



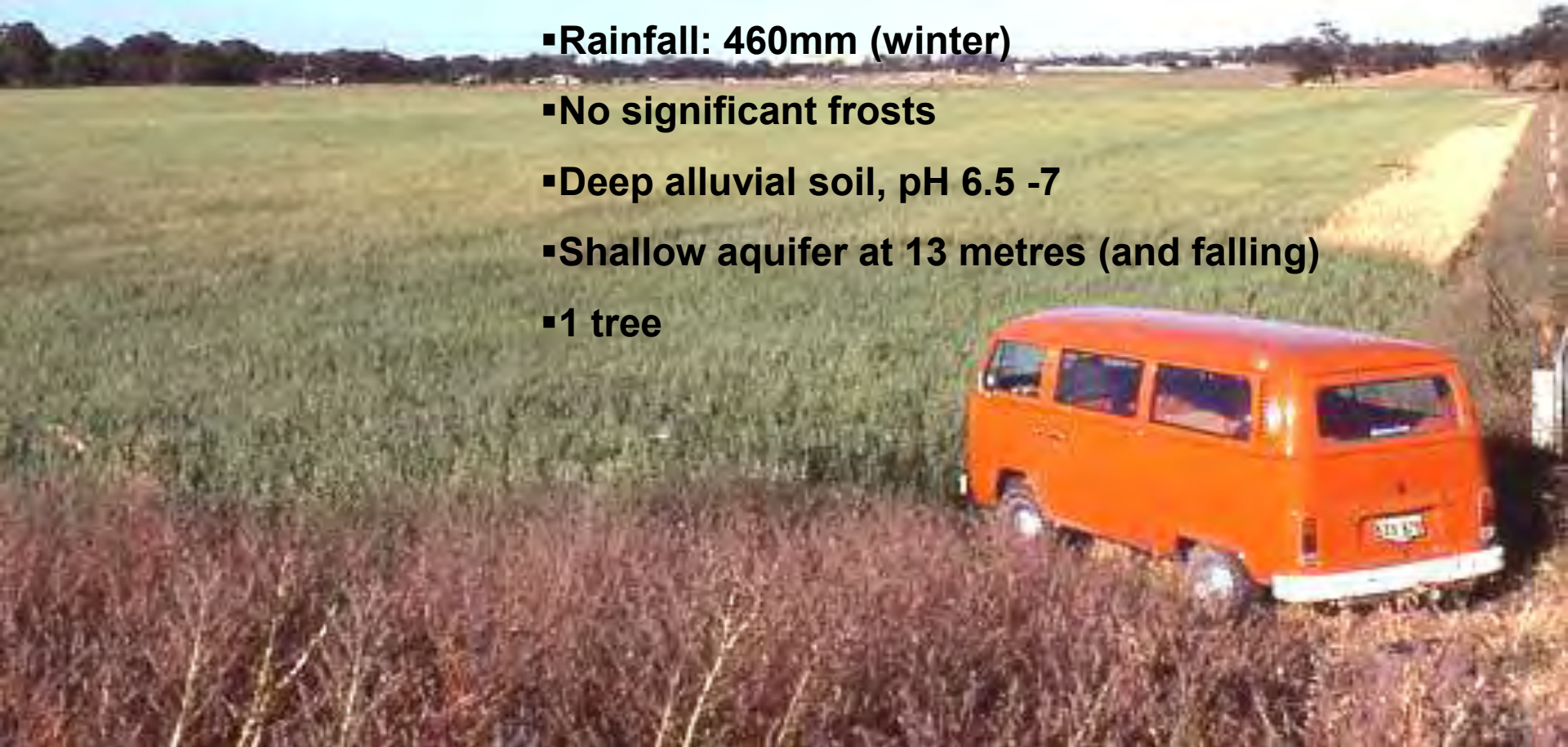


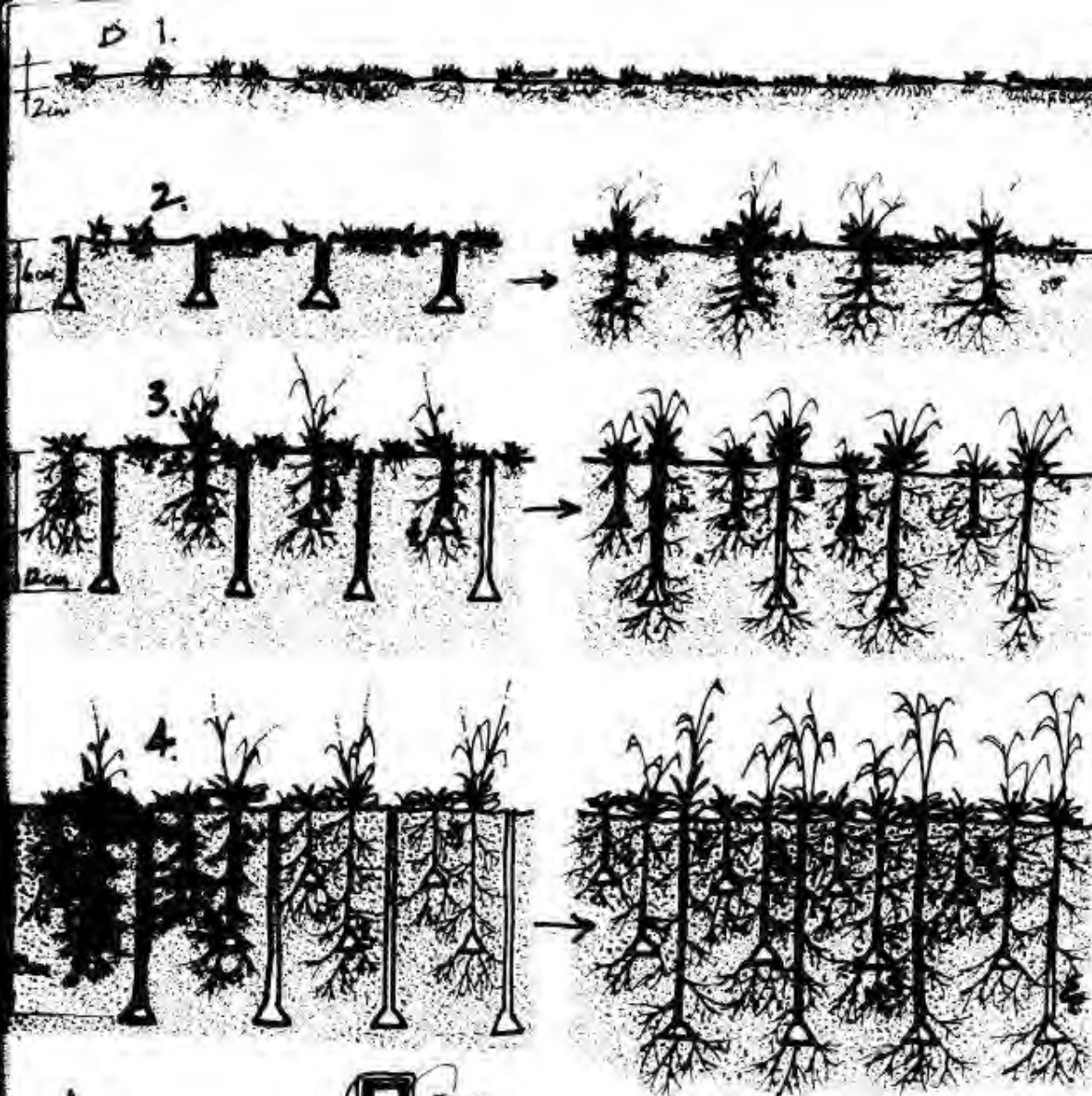




Planning and development started in 1983

- On the Gawler River, 50km North of Adelaide
- 15 Ha
- Mediterranean climate
- Rainfall: 460mm (winter)
- No significant frosts
- Deep alluvial soil, pH 6.5 -7
- Shallow aquifer at 13 metres (and falling)
- 1 tree





A

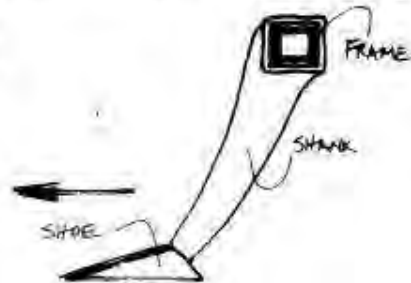


FIGURE 2.18 CHISEL PLOUGHING

(A) Chisel plough shank (from the Wallace Soil Conditioner)

(B) In pasture: 3-4 sequences with increasing depth of lines creates deep (18cm) humus soils over 1-2 growing seasons.



SWEP ANALYTICAL LABORATORIES

A.C.N. 005 031 569
 UNIT 47/174 BRIDGE ROAD, KEYSBOROUGH, VIC 3173 AUSTRALIA
 POSTAL ADDRESS: P.O. BOX 590 NOBLE PARK VIC.3174
 TELEPHONE: (03) 9701 6007 FAX: (03) 9701 5712
 email: tmswep@connexus.apana.org.au

Appendix 3

18/04/2000

REPORT ON SAMPLE OF : Soil

Page No:1

FILE NO : 000412137

DATE RECEIVED : 13/04/2000

CLIENT : THE FOOD FOREST
 ATT: GRAHAM T BROOKMAN
 PO BOX 859
 GAWLER, SA 5118

CLIENT ID : THE003

REFERENCE :
 SAMPLE ID : SAMPLE #1/SOIL

PHONE : 08 85226450
 REF. ID :

LAND USE : WALNUTS
 ANALYSIS REQUIRED : Full

ITEMS		RESULTS	DESIRABLE LEVEL
COLOUR : DARK GREY BROWN			
TEXTURE : SILTY CLAY LOAM			
PH(1:5 Water)		6.1	6.0-7.0
PH(1:5 0.01M Ca Cl)		5.6	
ELECT. CONDUCTIVITY	EC $\mu\text{s/cm}$	524	<315
TOTAL SOLUBLE SALT	TSS ppm	1729.2	<1040
AVAILABLE CALCIUM	Ca ppm	2060	2203
AVAILABLE MAGNESIUM	Mg ppm	156	233
AVAILABLE SODIUM	Na ppm	121.9	< 186
AVAILABLE HYDROGEN	H ppm	32	32
AVAILABLE NITROGEN	N pp..	19.4	50
AVAILABLE PHOSPHORUS	P ppm	128.9	40
AVAILABLE POTASSIUM	K ppm	339.3	250
AVAILABLE SULPHUR	S ppm	5.5	3 - 5
AVAILABLE COPPER	Cu ppm	04.30	2
AVAILABLE ZINC	Zn ppm	15.60	3 - 5
AVAILABLE IRON	Fe ppm	21	> 20
AVAILABLE MANGANESE	Mn ppm	61	> 20
AVAILABLE COBALT	Co ppm	02.80	0.5-0.7
AVAILABLE MOLYBDENUM	Mo ppm	00.50	0.5-0.7
AVAILABLE BORON	B ppm	00.50	0.4-0.6
TOTAL ORGANIC MATTER	OM %	2.9	3 - 4
TOTAL PHOSPHORUS	TP ppm	NR	
EXTRACTABLE ALUMINIUM	Al ppm	NR	
TOTAL NITROGEN	N %	NR	
CHLORIDE	Cl ppm	NR	

NR = Not Required

HORTICULTURAL CROPS AND GARDEN PLANTS

SALINITY

(MAXIMUM)

VEGETABLES

TREES

ORNAMENTALS

Ultra Sensitive

(Completely intolerant of salt)

300 mg/l.

Loquat

Violets

Sensitive

700 mg/L

French beans
Strawberry
Peas (not above 575)

Walnut

Bauhinia
Cladiolus
Fuchsia
Camelia
Azalea
Begonia

Dahlia
Poinsettia
Aster
Rose
Zinnia

Moderately Sensitive

850 mg/L

Beans (broad & field)
Celery
Lettuce
Potato (sweet)
Radish
Raspberry

Apple
Apricot
Almonds
Lemons
Orange
Grapefruit
Quince
Peach
Pear
Prune, Plum

Coprosma
Vinca
Bougainvillea
Hibiscus
Carnation

Moderately Resistant

1300 mg/L

Onions
Broccoli
Cantaloup
Cauliflower
Cereals
Carrot (after 3-4
fern leaves)
Gherkins
Cucumber
Potatoes (must have
good drainage)
Sweet corn

Grape vines
Fig
Olive
Pomegranate

Chrysanthemum
Stock
Oleander

Resistant

1700 mg/L

Artichoke
Tomato (furrow)

Technical Specifications of 'cultured compost'

Typical Analysis w/w (dry basis)

Nutrients and trace elements are derived from natural ingredients used

- Organic Carbon 35%
- Total Nitrogen (N) 2.0%
- Total Phosphorus (P) 0.4%
- Total Potassium (K) 1.0%
- Total Sulphur (S) 0.39%
- Total Calcium (Ca) 1.4%
- Total Magnesium (Mg) 0.35%
- Total Iron (Fe) 0.39%
- Total Manganese (Mn) 0.01%
- Total Copper (Cu) 0.01%
- Total Zinc (Zn) 0.01%

FARM DERIVED INPUTS



Ash



Compost

Soil nutrient levels over time at The Food Forest

– expressed as a relationship with recognised ‘ideal soil nutrient levels for pistachio nut growing’
(being the right hand [purple] column for each nutrient)

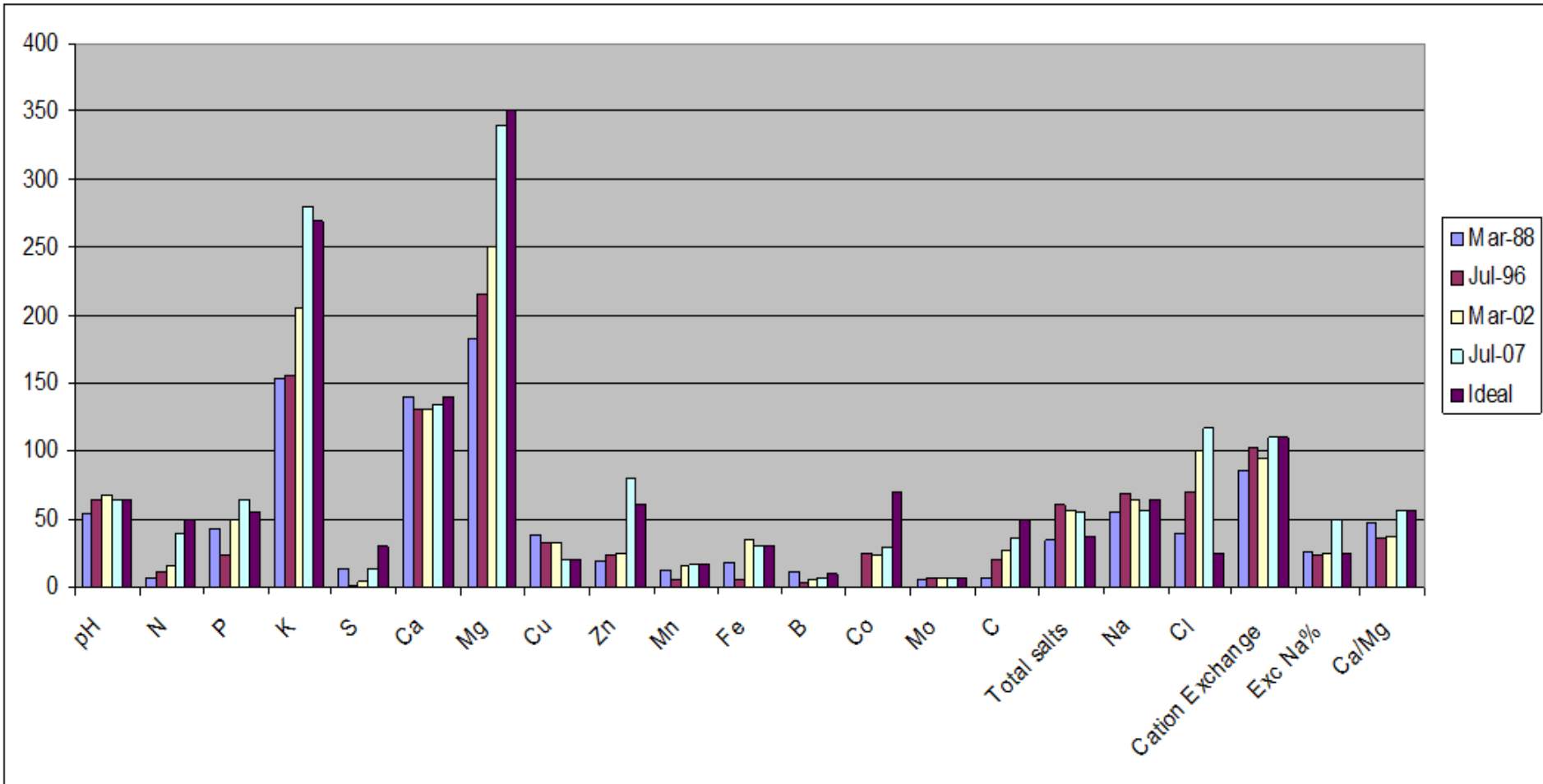




Image © 2008 DigitalGlobe

37 m

34°36'45.21" S 138°43'12.22" E

May 27, 2006

Eye alt 117 m

©2008 Google

Strawbale coolroom





PROCESSING ON SITE

Dehydrator

Locally designed & made

Efficient

Clean heat





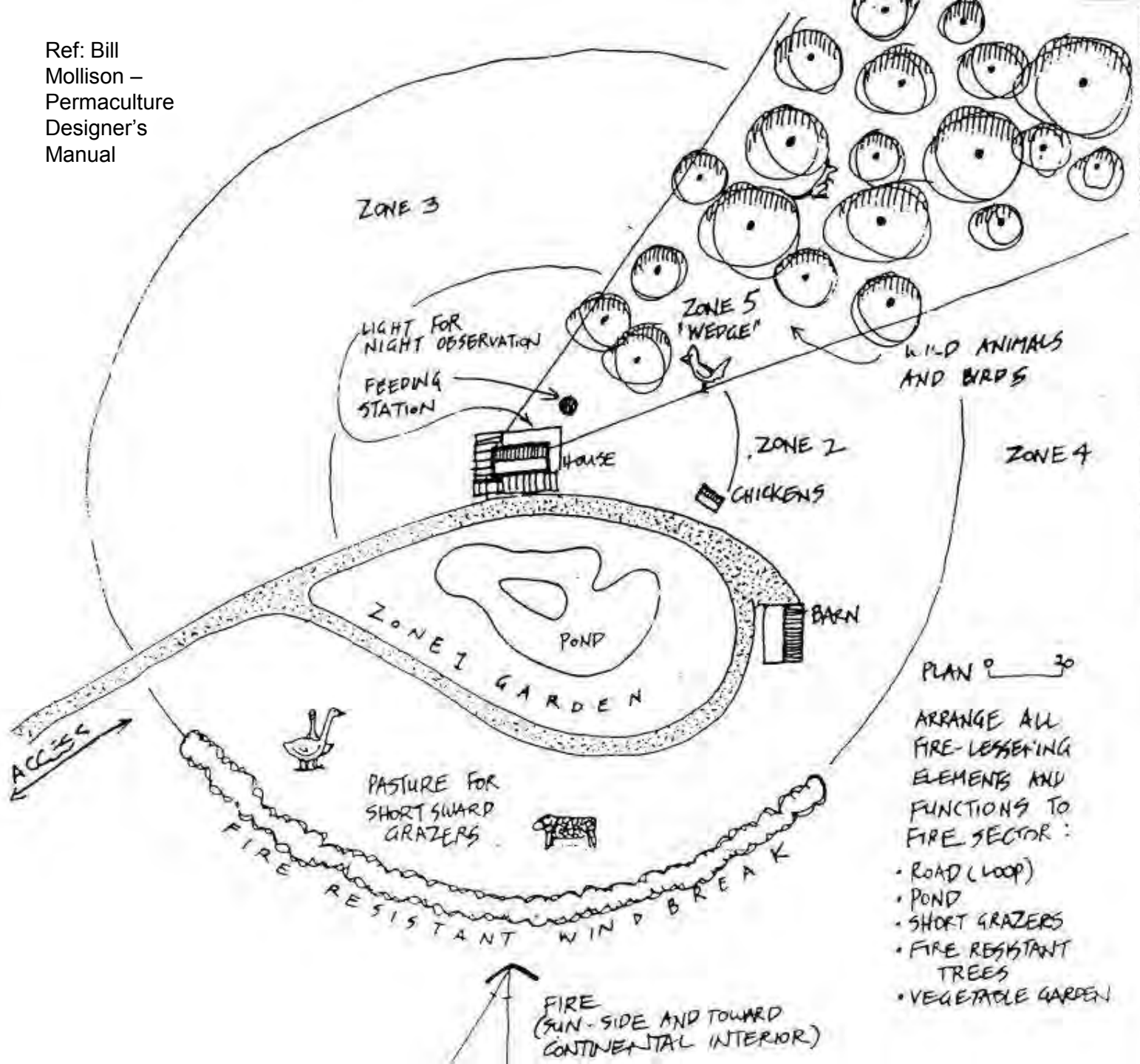
The Food Forest
Sparkling Cider



330ml Wine of Australia



Ref: Bill Mollison – Permaculture Designer's Manual

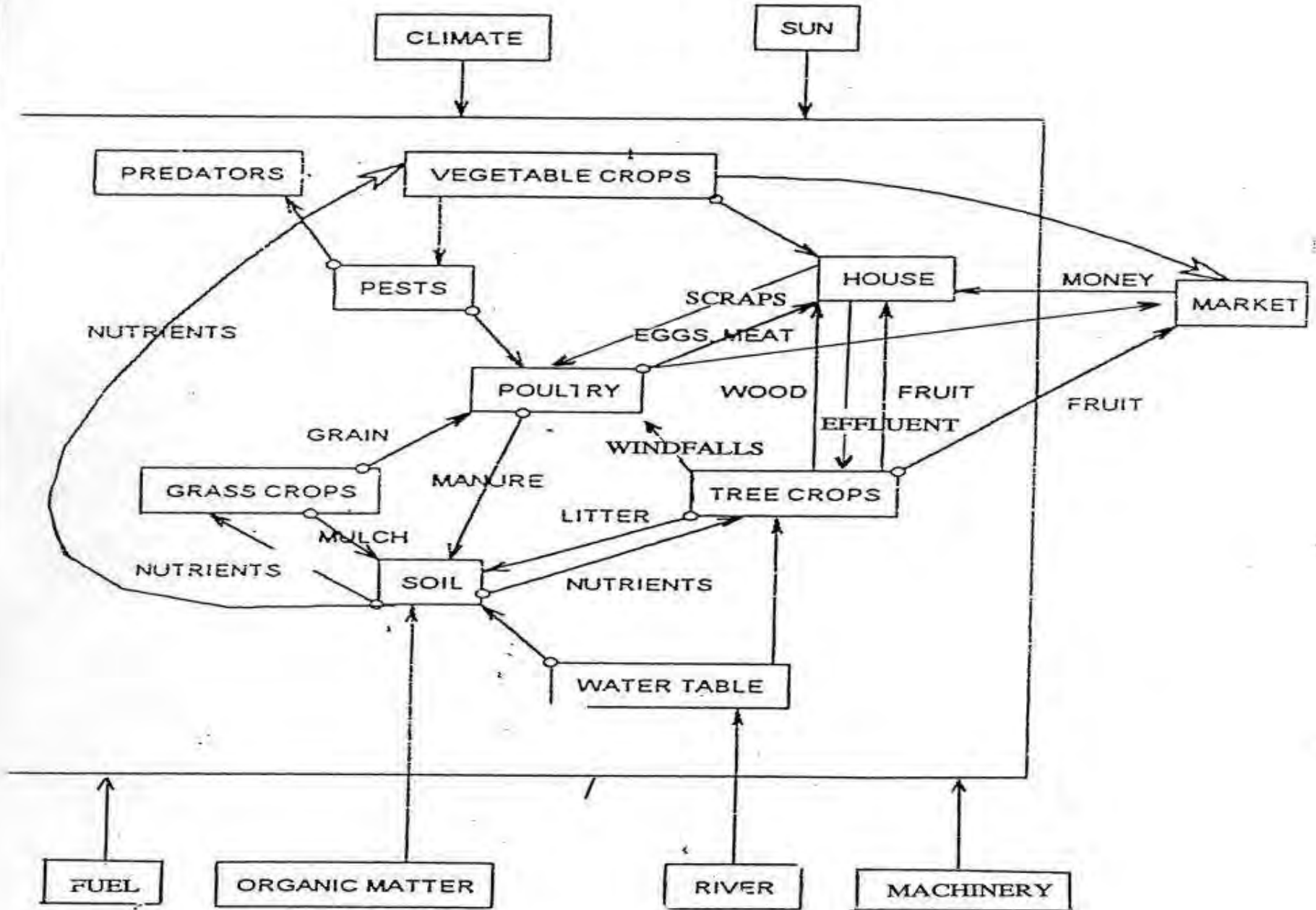


PLAN 9 30

ARRANGE ALL FIRE-LESSENING ELEMENTS AND FUNCTIONS TO FIRE SECTOR:

- ROAD (LOOP)
- POND
- SHORT GRAZERS
- FIRE RESISTANT TREES
- VEGETABLE GARDEN

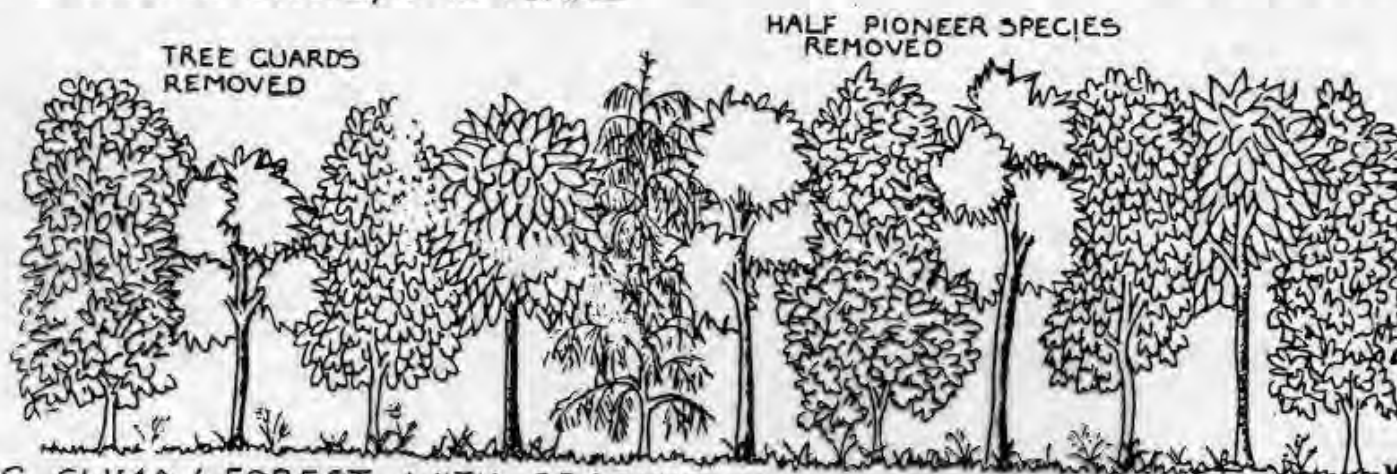
Systems Diagram showing energy flow



A. ESTABLISHMENT OF PIONEER SPECIES, 1-5 YEARS



B. SECOND STAGE, 5-10 YEARS



C. CLIMAX FOREST WITH GRAZING ANIMALS



Zone planning

Placing elements according to how much we use them, how often we need to maintain or harvest them and how much energy and water they use.

- **Zone Zero** is the space in your mind where creative design occurs, it is the arrangement of the family and the way it lives; the way the house is arranged, cooking is done, finances are managed and dreams realised

- **Zone One** is closest to the house. It is most intensively-used area and typically contains annual gardens, herbs, workshop, glasshouse, storage areas, a few small frequently used trees eg a lemon tree. The area uses much water, mulch and manure and is highly productive. No animals remain on a patch of ground permanently

Secrets of Zone 1 - the backyard

- Storing – water, firewood, salvage materials
- Constructing – chicken arks, solar cookers, bike trailers
- Drying – clothes, fruit, firewood
- Cooking - pizzas, BBQs, pit roasts
- Shading – the family, walls of the house, cooling plants
- Relaxing and playing
- Learning
- Habitat – birds, worms, guinea pigs, predators, bees
- Transforming – grapes into wine, weeds into compost
wastewater into irrigation water

Zone 1 contains the perennial garden supports avocados, bananas, sugar cane, Vietnamese taro and other species requires some 500mm of irrigation annually. This delivered by dripper tapes spaced 500mm apart



- **Zone Two** is also intensively managed with shrubs, fruit trees, berries and herbs in multi-layered food forests. Drip irrigation is used and poultry are integrated into the system. It is an area requiring regular management and uses significant amounts of mulch, manure and water



zone 5

Gawler River
zone 5

zone 3

revegetation/forestry
vegetables

zone 1

recycling

olive grove

food processing

walnuts

windbreak

Gawler Bypass

zone 2

tank

studio

zone 3

pistachios

learning centre

home orchard

yabbie ponds

cropping

zone 3
pomes

canary island pines

zone 4

experimental

agroforestry demo

biodiversity block

carobs

zone 5

pecan nuts

pistachios

Jack Cooper Drive

jojoba

Further from the home are species requiring spot irrigation. Using drippers, deficit irrigation and mulch pome and stone fruit are grown with a boost of 200mm of water.

Plantings are more widely spaced than in the perennial garden



- **Zone Three** has low-maintenance orchards, dryland field crops and pastures, larger animals such as geese, sheep and wallabies for wool, meat, down, milk etc. Minimal irrigation may be used. Windbreaks and hardy tree crop plantings are used to control wind speed. Spot manuring

In the outer zones, 3 and 4, about 100mm of irrigation is used to grow carobs, pistachios, jojoba and olives. Tree spacings are even wider to allow a greater soil mass to be exploited for water







**Looking South
View in 1986**

12 years later...

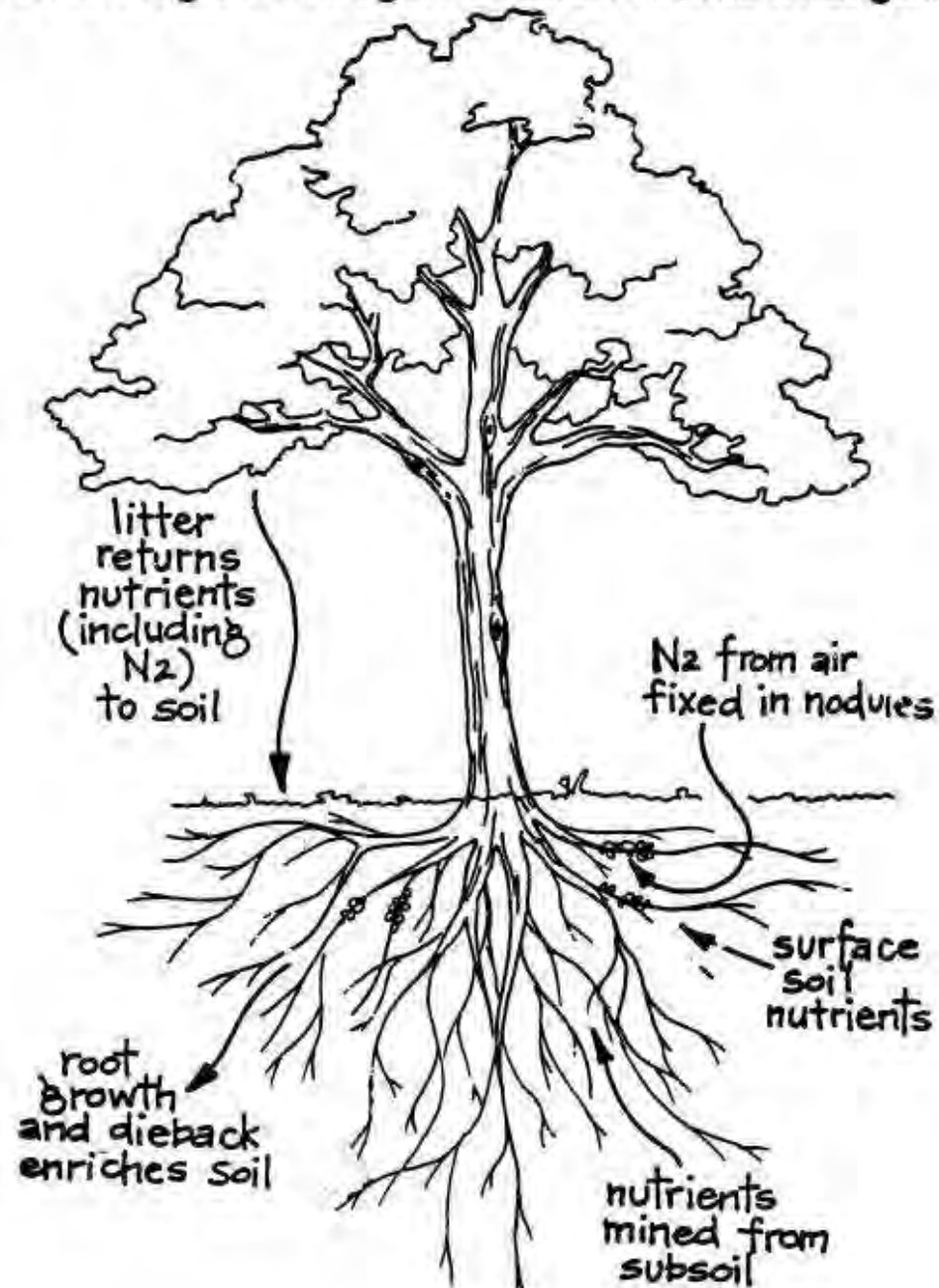


- **Zone Four** is minimally managed, is essentially dryland and only small amounts of trace elements and manure are used, usually to establish plantings. It has forest and agro-forest for timber and firewood and miscellaneous production (eg resins, wattle seed), pastures and hardy animals

Coppicing for firewood production

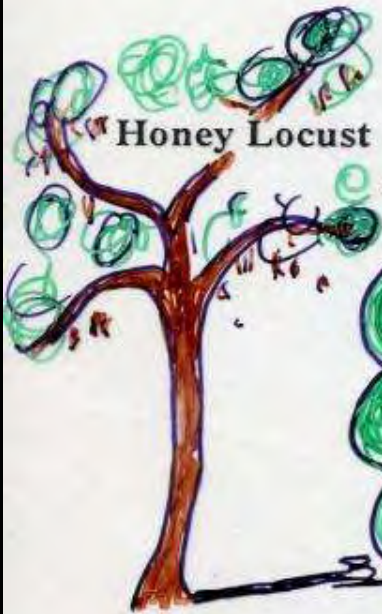


How Biological Nitrogen Fixation Works in Legumes



Ref: Bill Mollison –
Permaculture Designer's Manual

Hills Agroforest



Algerian Oak



Tagasaste



Holm Oak



Cork Oak



Casuarina



Wallaby



Goose



Alpaca

Species and features for an Adelaide Hills Permaculture

Agroforest

Honey Locust, Algerian Oak, Tagasaste,
Holm Oak, Cork Oak, Casuarina spp, Pinus sp
Wallaby, Goose, Alpaca

Orchard

Apple, Pear, Nashi, Plum, Quince, Mandarin
Chook, Goose, Wallaby, Alpaca, Potoroo

Woodlot

Euc grandis, maculata, globulus, nitans

Ac melanoxylon, intertexa (interplanted)

Biodiversity Block (includes Bush Tucker spp)

Native Apricot, Melaleuca spp, Kangaroo grass,
Native Cherry, Ac retinodes, Euc obliqua, Native
Currant etc etc

Organic Garden

Summer Lettuce, Asian Leaf Crops, various
Herbs, Veg and Edible Flowers

Geese:

Webbed feet

**Grassy weed
grazers – esp**

Couch & Kikuyu

Gourmet food



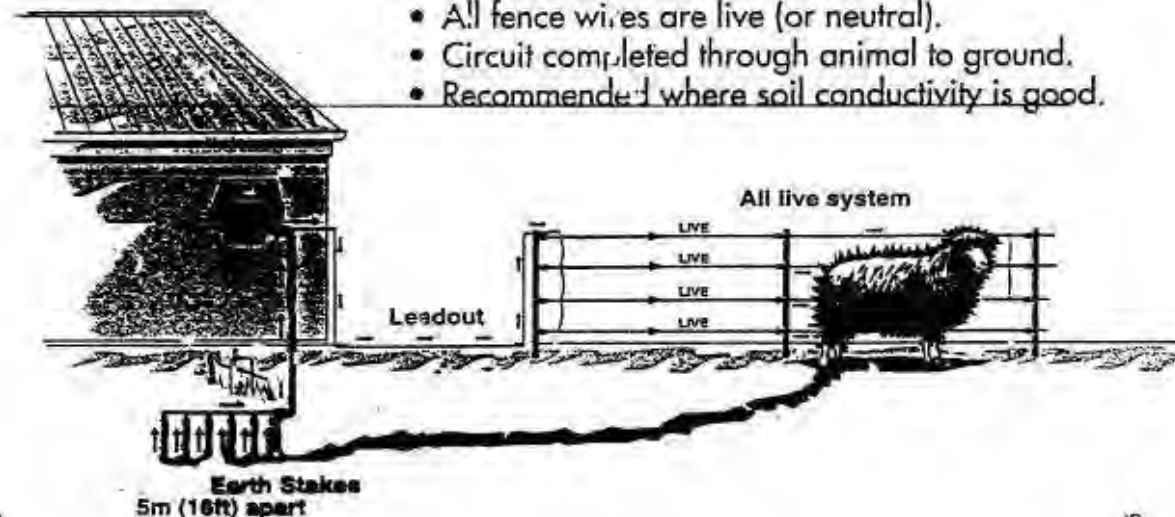
Fox and rabbit proof fence built in 1993



TYPES OF EARTH SYSTEM

Ground Earth-Return

- All fence wires are live (or neutral).
- Circuit completed through animal to ground.
- Recommended where soil conductivity is good.



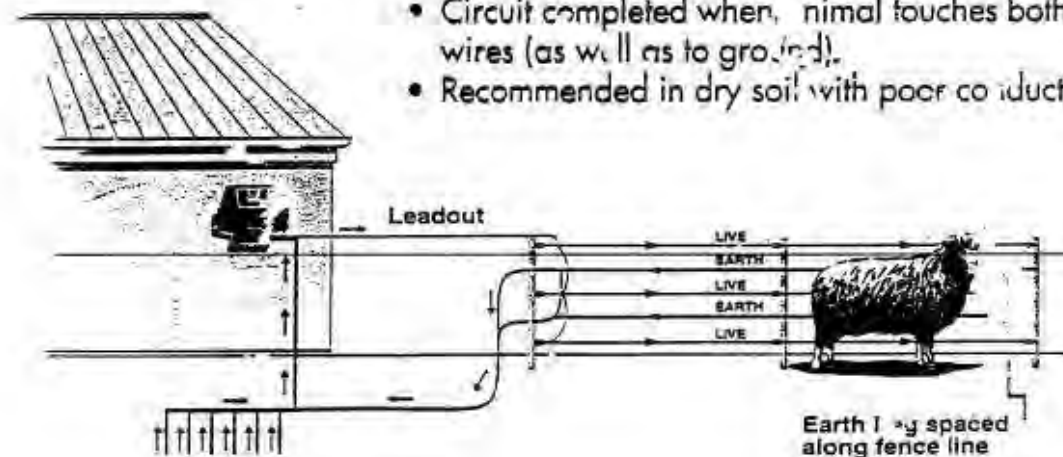
Sheet 2

Page 5

Ref: Sunbeam
electric fence
manual 1997

Fence Earth-Return

- Earth and live wires are alternated.
- Circuit completed when animal touches both wires (as well as to ground).
- Recommended in dry soil with poor conductivity.



Permanent Fence Layout

LAYOUT EXAMPLE

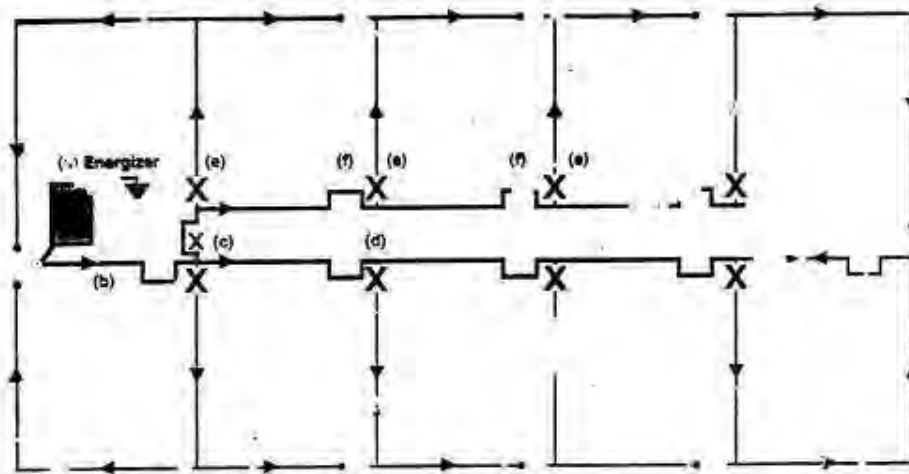
The diagram below illustrates some points about fence layout.

- (a) Energizer is located in a farm building.
- (b) The leadout feed can take several forms:
 - one single wire with high conductive characteristics (i.e. 4mm (3/8") wire or aluminium wire)
 - several sizes of 2.5mm (12/2 g) fence wire connected in parallel.
- (c) A cutout switch where the leadout splits at this point enables half of the fence system to be switched off.
- (d) Layout incorporates a central race to ease of stock movement.

- (e) Each fence subdivision is connected to the leadout feed wire(s) through a cutout switch. This enables each section to be isolated for fault finding purposes.
- (f) For gates you should note that:
 - Insulated cable must be used underground
 - Cutout switches are recommended at all gateways for fault finding

Other Points to Note:

- Only one energizer must be connected to a fence line.
- The subdivisions of the fence do not have to complete an electrical circuit. Each subdivision terminates at a strain insulator. The circuit is completed when an animal touches the fence.



KEY

- leadout feed wire(s)
- fence subdivisions
- X cutout switches

KEY

- leadout feed under gate
- fence feed under gate
- ⊕ energizer earth

- **Zone Five** is virtually unmanaged and contains much of the indigenous flora and fauna. It is a haven for native species and a biodiverse balance-tank for the more intensively managed part of the property with its many exotic species and their pests, a place to get close to nature, to hunt or possibly...to be hunted!



Australian Natives

Value adding

Bio regional ID

Landcapability

Diverse systems



Acacia victoriae



Quandongs

WEED CONTROL

Soft footed animals:
Less soil compaction



Bettongs eat soursob bulbs & revegetate



Wallabies are good weed grazers too

THE CAPE BARREN GOOSE



Specific grazing habits

**Useful in orchard
management**

Protected species



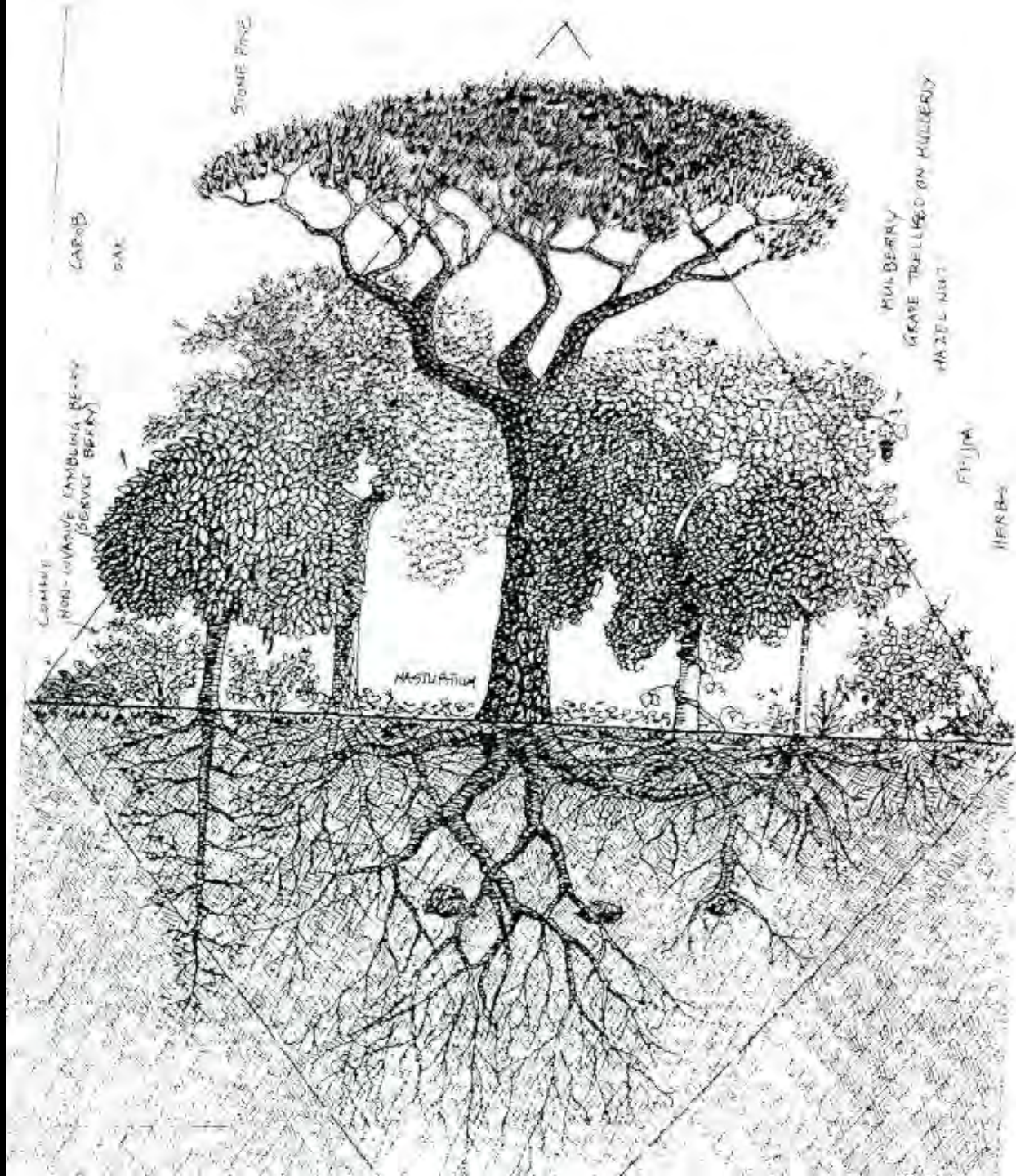
**Bio- diversity
creates habitat which also
helps with pest control**



Orchard design and management



Ref: Bill Mollison –
Permaculture Designers
Manual



Mean Annual Chill Units at present and projected to 2030

	PRESENT			2030		
Station	Ave Chill Units	% years > 800 Chill Units	% years > 1200 Chill Units	Ave Chill Units	%. years >800 Chill Units	%.years >1200 Chill Units
Adelaide	700 approx				0	0
Renmark	1187	100	52	529-983	0-91	0-5
Loxton	1295	100	69	668-1108	6-100	0-31
Lenswood	2747	100	100	1729-2437	100	94-100

Adelaide's mean temp has gone up by 1 degree C in 50 years. CSIRO predictions allow for a possible further increase of up to 1.5 degrees by 2030

**Uni California Data Approx. Hours required
<7.2 degrees C**

**Equiv. Time in Days/Weeks if Continuously exposed to
<7.2 or Below**

Apple ^a	1200-1500	7-9 weeks	400-1800
Apricot ^a	700-1000	4-6 weeks	350-1000
Blueberry (northern)			700-1200
Cherry, sour		7 weeks	700-1300
Cherry, sweet	1100-1300	6-8 weeks	600-1400
Currant			800-1500
Filbert (Hazelnut)	1500	9 weeks	800-1600
Gooseberry			800-1500

Sunscreen for fruit



Trials in Australia show that coating apples, and other fruits, with Surround WP crop protectant manufactured by the Engelhard Corporation and distributed by Agnova, can reduce sunburn damage by as much as 73 percent. In that study, 73 percent damage reduction translates to a marketable yield increase of 34 percent

<http://www.fatcow.com.au/c/AgNova-Technologies>

Orchard establishment

- windbreaks
- ripping & amendments
- mulch & compost
- weed control
- pre-pruning,
- root ball, bare-rooted & bagged trees
- roostocks into field for later grafting
- planting plans

13
WORCESTER
PEARMAIN
CRAB
APPLE
LORD
GALA
GALA
BOONZA
SUNSHOWER
GRANNYSMITH

14
GRANNY
SMITH
ROXBWOOD
ROXBWOOD
MID SEASON
REDELIC
APPLES
K. IDS
DAYTON
STAYARS
WINGSAP
GALA
GALA
GALA
FLAVORSUM
NORTHERN
SPY
LENG
NORTHERN
SPY
KARA
KARA
LATE PRUNE
CLEMENTINE

(3)
15
SENSATION
BUBBLE PROSC.
PACHAM
NIMBOLNOL
COX
COX
FUJI
FUJI
GLENHEIM
CHIEFT
GLENHEIM
HIEARLY
X FUJI
NORTHERN
SPY
LENG
FUJI
FUJI
NEW TOWN
GREEN
PIPPIN.

with L'Inconnue graft
16
TSULI
YALI
KOSUI
SHINSUI
CROFTON
CROFTON
PRINCE
ALFRED
PRINCE
ALFRED
BESTOOL
FLAVORSUM
PINKLADY
PINKLADY
PINKLADY
PINKLADY

17
VINES
CARDINAL
EMERIE KARINA
SEAFLOSS
FLAME
S
FLAME
S
PERLETTE
PERLETTE
KARINA
SULTANA M12
THOMUSCAT
GORDO (HARDMANN)
MUSCAT
HAMBURG
MUSCAT H.
REDMAMA
ITALIA
ITALIA
KISHIMISHI
CALMERIA
CALMERIA
EMPEROR

18
DAYTON
DAYTON
DAYTON
JOHNAFEE
JOHNAFEE
JOHNAFEE
PRIMA
PRIMA
PRIMA
PRIMA
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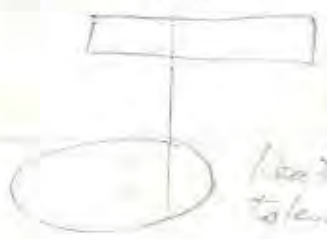
19
MADONNA
TUM
FLAMECREST
FLAMECREST
FLAMECREST
FLAVOUR
CREST
FLAVOUR
CREST
VITTO
ITALIAN
PRIMA
PRIMA
PRIMA

20
DO. BR.
MAYO
RETROR'S SEEDS
FLAMECREST
FLAMECREST
CARDINAL
CARDINAL
CARDINAL
CARDINAL
PEACHLINE
DATE
HIEARLY
TODAY. REDDEL
ON 1925
heat
sensitive
heat
tolerant

↑ N

3 ADDRESS → 4

↙



Pest Management

Biodiversity is the main answer. If it fails.....

- Observe day, night with and without light. Video cameras, books and museum services for wine and beer traps, linseed oil

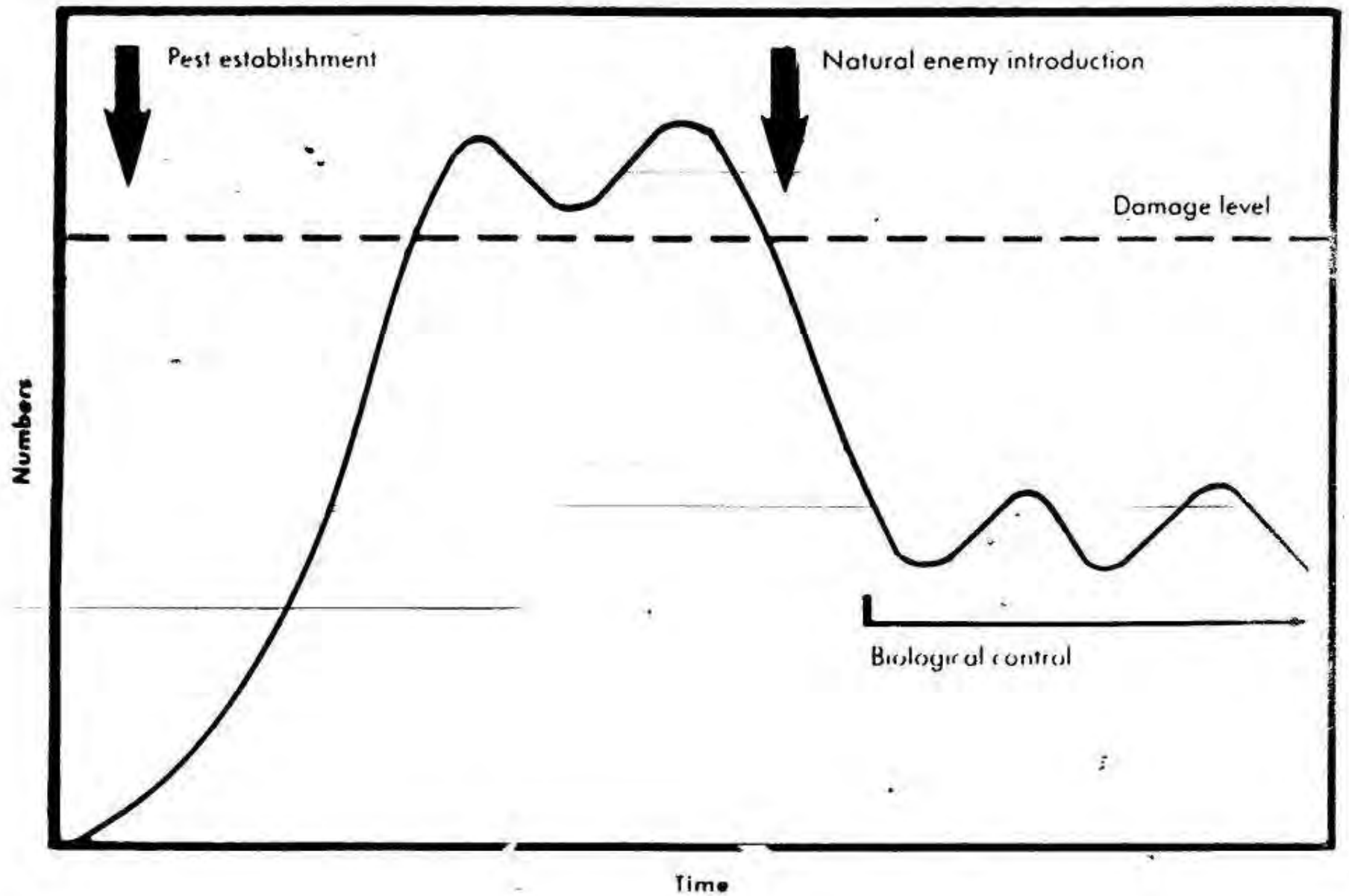
Insects:

Insect exclusion covers eg fruit fly

- Trap crops, (mustard favoured over caulis), companions, garlic etc bug juice
- identification are invaluable.
- Pit traps, port



Brown Tree Frog



Individual pests

Use of chooks, good composting and weed control are central. Companion planting may help

- Earwigs Poultry, traps and sacrificial crops
- Crickets Chooks
- Caterpillars Oils, soap, derris, ash, *Bacillus thuringensis*, hosing, hand picking
- Beetles Derris, diatomaceous earth, flooding, trap lights
- Mites Minimise dust, increase soil carbon, use sulphur

Diseases

Adaptation and pruning are the main answers

- Mildew: Whey, milk, sulphur, copper, good training (shaping) of trees
- Blight: Copper, Prep 501
- Shothole: Copper, Bordeaux
- Brown Rot: hygiene, sulphur, copper
- Gumosis: Copper, Pruning
- Compost teas and microbial preps

Application methods

- Sprayers:
- Knapsack
- Tractor-drawn
- Airblast
- Micromist
- ATV-mounted units