RESILIENCE DESIGN FOR CLIMATE CHANGE

TOOLS TO HELP YOUR PROGRAMS ADAPT AND PROSPER

- **Climate Specific Soil Building & Buffering**
- **Regenerative Fertility Creation**
- **Water and Nutrient Cycling**

Knowledge Sharing Meeting
Washington, DC , January 2016

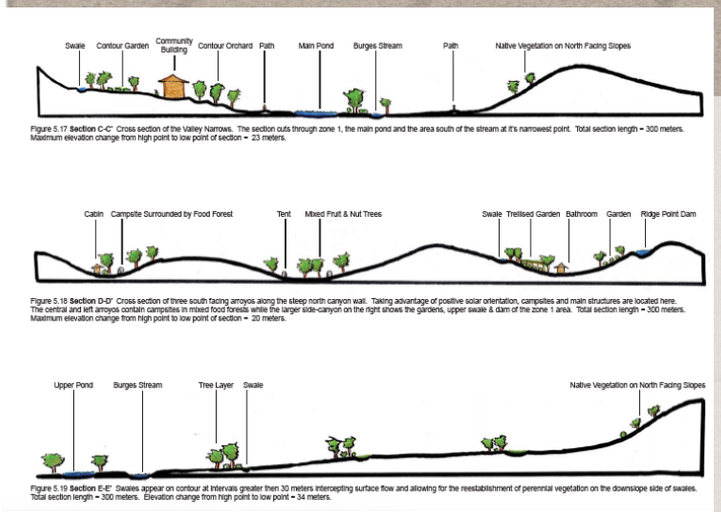


Figure 5.17 **Section** C-C' Cross section of the Valley Narrows. The section cuts through zone 1, the main pond and the area south of the stream at it's narrowest point. Total section length = 300 meters. Maximum elevation change from high point to low point of section = 23 meters.

Figure 5.18 **Section** D-D' Cross section of three south facing arroyos along the steep north canyon wall. Taking advantage of positive solar orientation, campsites and main structures are located here. The central and left arroyos contain campsites in mixed food forests while the larger side-canyon on the right shows the gardens, upper swale & dam of the zone 1 area. Total section length = 300 meters. Maximum elevation change from high point to low point of section = 20 meters.

Figure 5.19 **Section** E-E' Swales appear on contour at intervals greater then 30 meters intercepting surface flow and allowing for the reestablishment of perennial vegetation on the downslope side of swales. Total section length = 300 meters. Elevation change from high point to low point = 34 meters.

What Does Resilience Look Like in the Landscape?

What do you see?


Now over 125
organic items
1.29

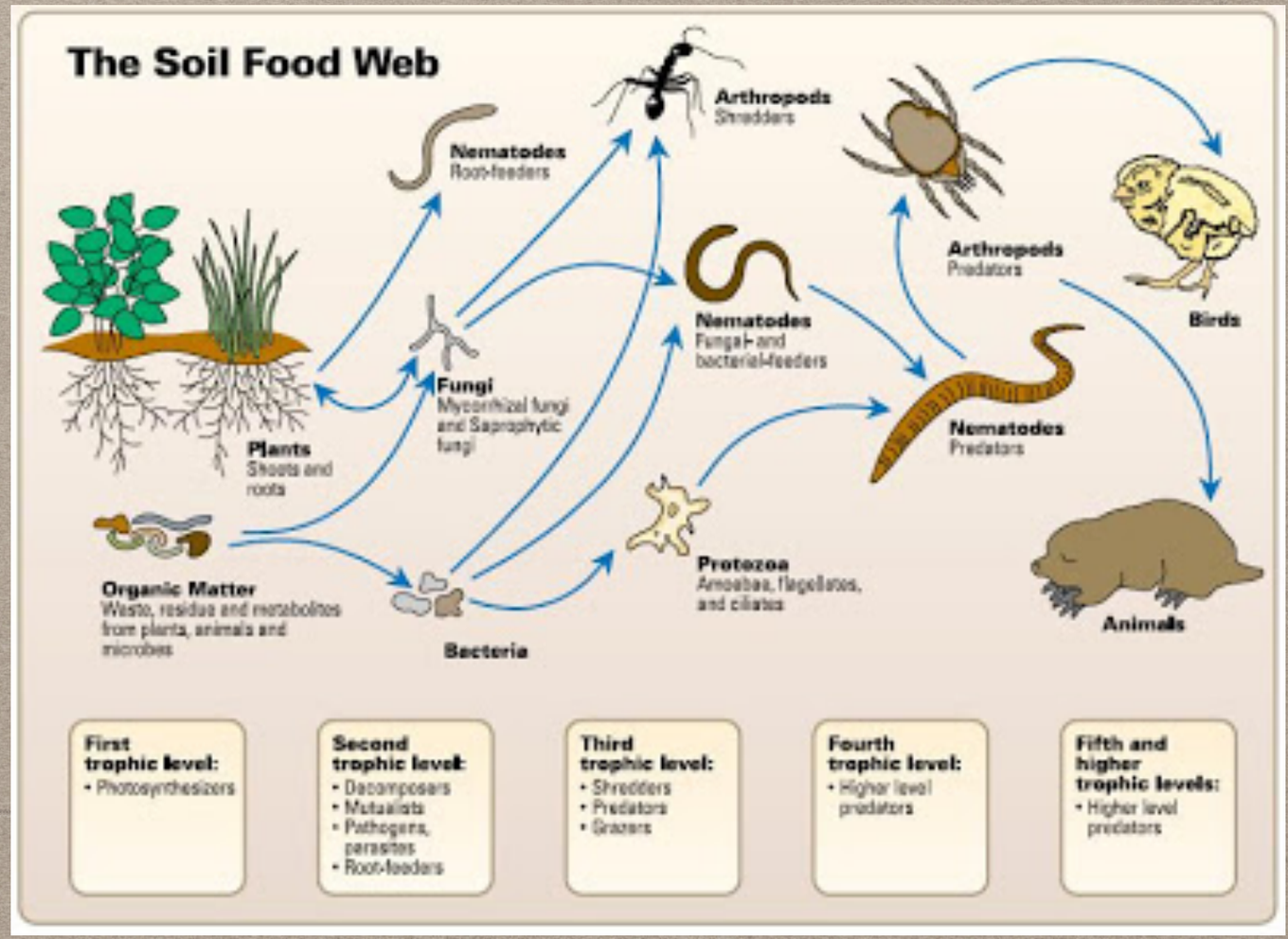
Climate Change, Agriculture, & Innovation

RESILIENCE COMES FROM RELATIONSHIPS

Whole Systems Integration for Agroecosystem Health and Climate Buffering

The Relationship Between:

- Ecosystem and Economics
- Nutrition and Soil Biology
- Water, Food, & Infrastructure
- Agriculture, Springs and Bore Holes



opulation density, soil nutrient depletion, and economic growth in sub-Saharan Africa

Pay Drechsel [a,*], Lucy Gyiele [a], Dagmar Kunze [b], Olufunke Cofie

[a] International Board for Soil Research and Management (IBSRAM), Regional Office for Africa, c/o KNUST,
[b] Food and Agriculture Organisation (FAO) of the United Nations, Regional Office for Africa, PO Box 162

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Abstract

Soil nutrient depletion is considered as the biophysical root cause of declining per capita food production in sub-Saharan Africa (SSA). Data from 37 countries in SSA confirm a significant relationship between population pressure, reduced fallow periods and soil nutrient depletion (including erosion), indicating a generally unsustainable dynamism between population, agriculture and environment. It is estimated that nutrient depletion accounts for about 7% of the agricultural share in the average Gross Domestic Product of SSA with national values ranging up to 25%, indicating soil nutrient mining as a significant basis of current economic performance. With respect to

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THE MINERAL DEPLETION OF FOODS AVAILABLE TO US AS A NATION (1940–20 A Review of the 6th Edition of McCance and Wid

DAVID THOMAS**

Mineral Exploration, Fellow of the Geological Society, a founder Member of th of Nutritional Therapists

"A knowledge of the chemical composition of foods is the first essential i dietary treatment of disease or in any quantitative study of human nutrition"

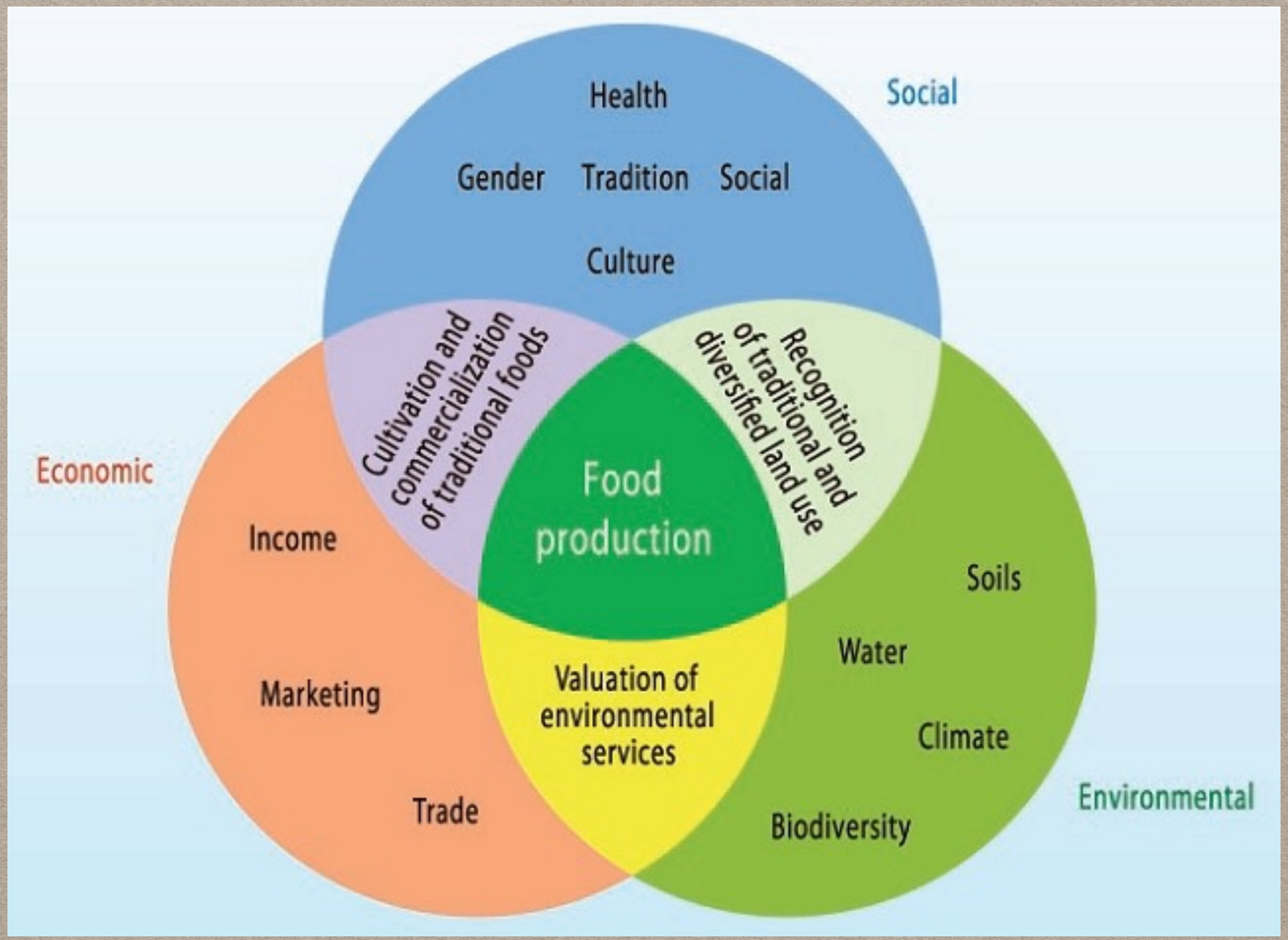
ABSTRACT

Over the past 60 years there have been fundamental changes in the quality and quantity of f available to us as a nation. The character, growing method, preparation, source and ultim presentation of basic staples have changed significantly to the extent that trace elements a micronutrient contents have been severely depleted. This trend, established in a review of th 5th Edition of McCance & Widdowson's The Composition of Foods, is still apparent in this review of the 6th edition of the same work. Concurrently there has been a precipitous change towards convenience and pre-prepared foods containing saturated fats, highly processed meats and refined carbohydrates, often devoid of vital micronutrients yet packed with a cocktail of chemical additives including colourings, flavourings and preservatives. It is proposed that these changes are significant contributors to rising levels of diet-induced ill health. Ongoing research clearly demonstrates a significant relationship between deficiencies in micronutrients and physical and mental ill health.

Findings

"Agricultural research and innovation remains important to find together with farmers site-adapted measures for both soil fertility conservation, nutrient replenishment, and yield increase in general. The technologies are in principle known; the task is determining which one fits best into each local context."

What is an Agroecosystem?



A biological and natural based resource system managed by humans for the primary purpose of producing food as well as other social, cultural and ecological services

Permaculture - Agroecology

An Integrated Design Science

For Agroecosystem Development

Use and Value Diversity

Using Biological Resources

Using Small Scale Intensive

Energy Efficient Planning

Energy Cycling

Multiple Elements & Functions

Accelerating Succession

Resilience Design is an whole systems ethical design process that draws from science, indigenous understanding and natural patterning

Big Pattern to Details

Edge Harmonics

Relative Location

Design Methodologies

Attitudinal Principles

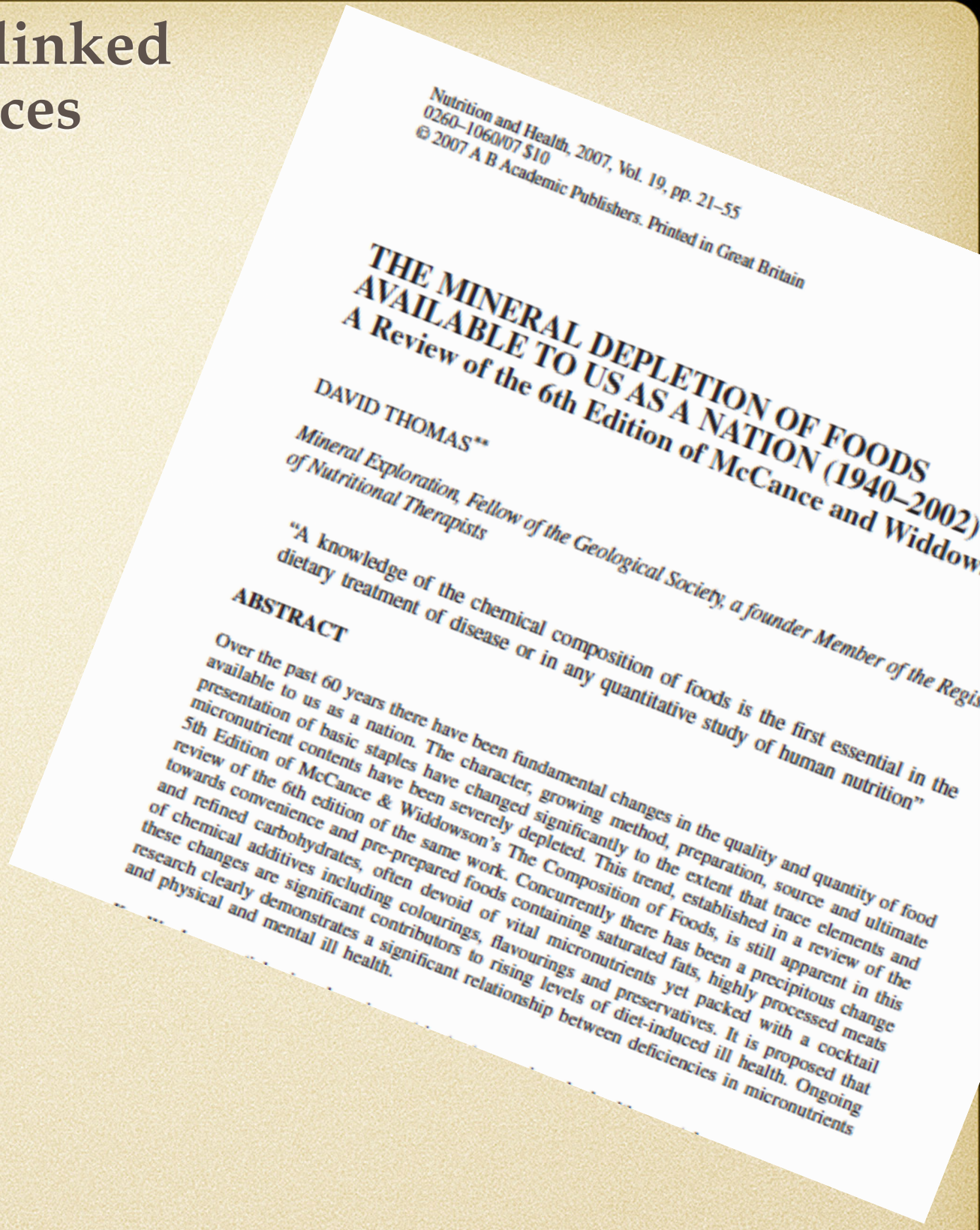
Care of the Earth

Care of the People

Return of Surplus

Mineral depletion in our Food is linked to industrial agriculture practices

- Increased use of NPK which is micro-nutrient deficient
- Damage of chemical fertilizers to endomycorrhizal fungi
- Lack of organic matter and beneficial soil biology



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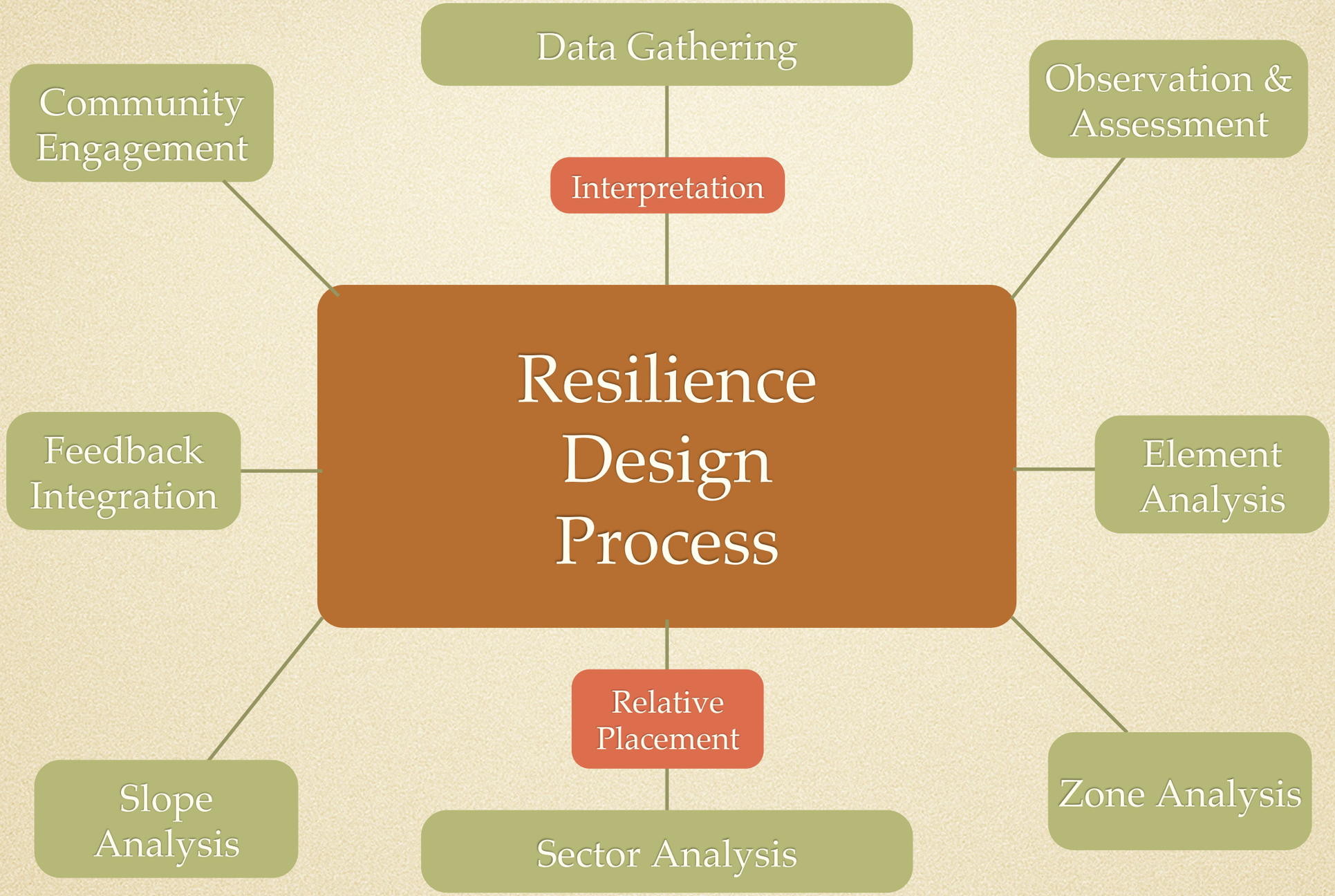
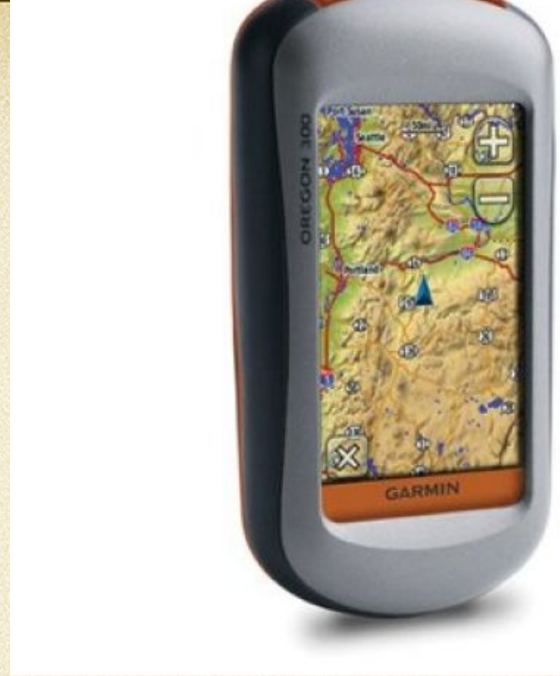


These methodologies are a **scaleable tool** that is sensibly applied in site specific applications to rural, peri-urban and urban sites of human settlement

Physical Tools For Resilience Tracking

Water pH/TDS



GPS

Site-Level

Soil pH Meter

Refractometer

Compass

Erosion and Productivity

The productivity of some lands has declined by 50% due to soil erosion and desertification. Yield reduction in Africa due to soil erosion may range from 2 to 40%, with a mean loss of 8.2% for the continent

- Source: [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/?cid=nrcs142p2_054028]

Vertical Farming, Nutrient Dense Foods,
Better Use of Resources

Site Context Specific Design to Slow, Spread and Infiltrate Water and Nutrient; Perennial Fertility

If you get the SOIL BIOLOGY in balance, you don't have to worry about the CHEMISTRY

Monocrop: 10:1 Calories in/out
Biointensive: 1:34 Calories in/out

Fast Carbon Pathways, Ecosystemic Thinking, Stacking Functions

Soil Structure, Mimicing Nature, Balance of Bacteria/Fungi for healthy soil structure & optimal crop yield

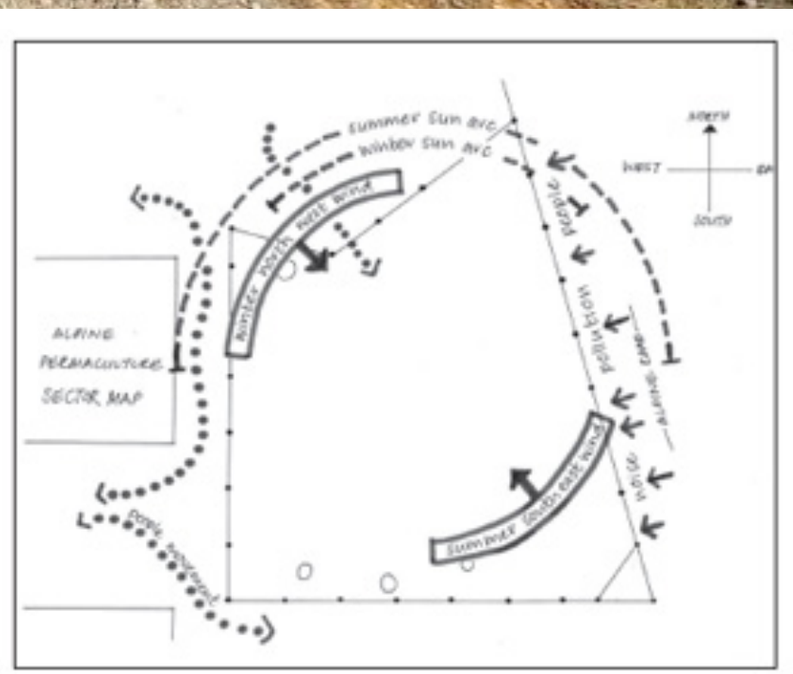
KEY FACTS

- By 2050, agricultural production must increase by 60 percent globally – and by almost 100 percent in developing countries – in order to meet food demand alone.
- 33 percent of soil is moderately to highly degraded due to erosion, nutrient depletion, acidification, salinization, compaction and chemical pollution.
- A shortage of any one of the 15 nutrients required for plant growth can limit crop yield.
- In most developing countries, there is little room for expansion of arable land: virtually no spare land is available in South Asia and the Near East/North Africa.
- Where land is available, in sub-Saharan Africa and Latin America, more than 70 percent suffers from soil and terrain constraints.
- More efficient use of water, reduced use of pesticides and improvements in soil health can lead to average crop yield increases of 79 percent.

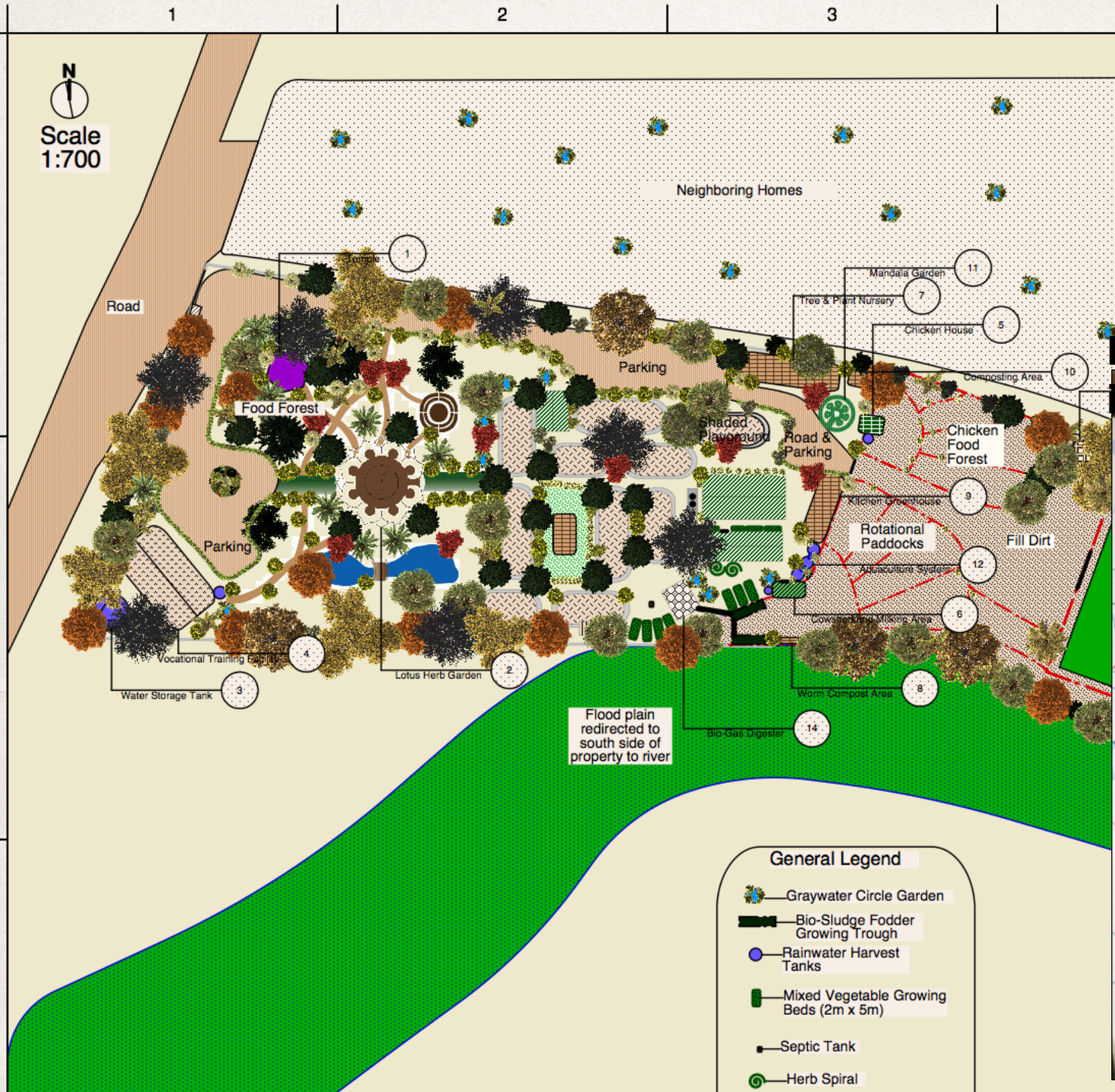
Small Farm Development - Kenya

Former 5 acre dump site for neighboring high-density, low-income community

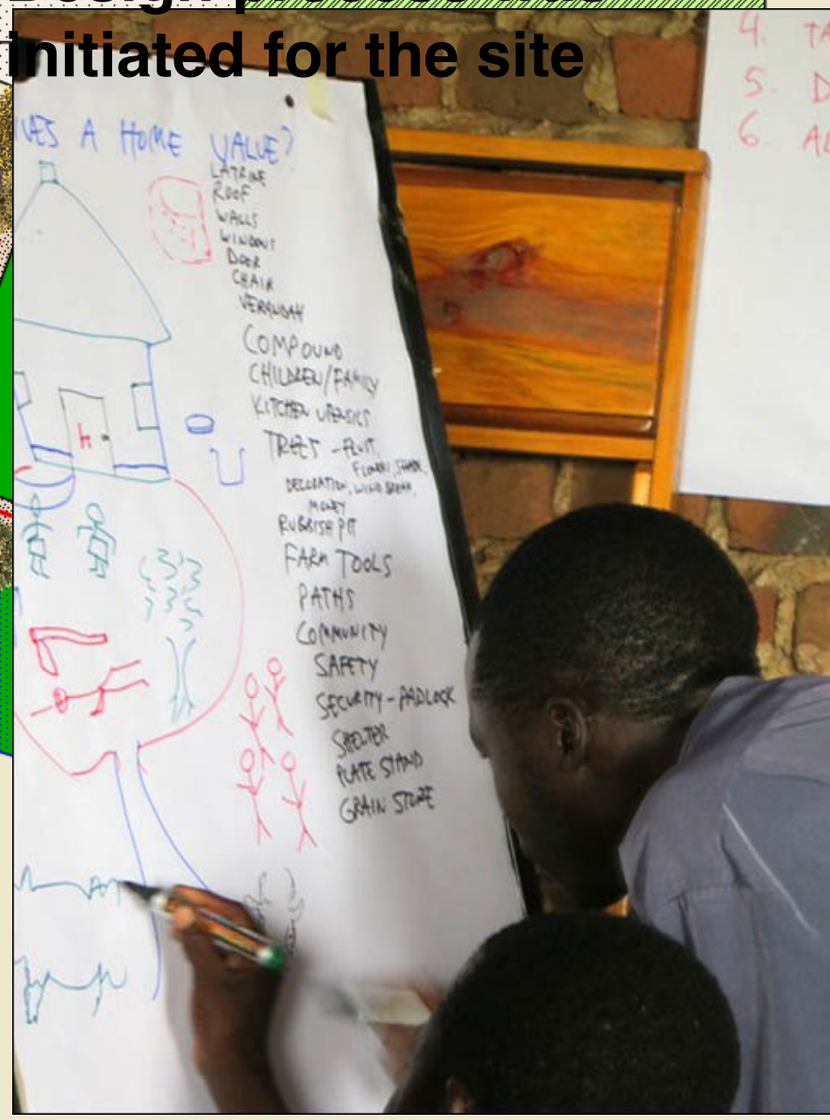
Poor soil structure and nutrient profile



Initial Resilience Design Process



Design process was initiated for the site



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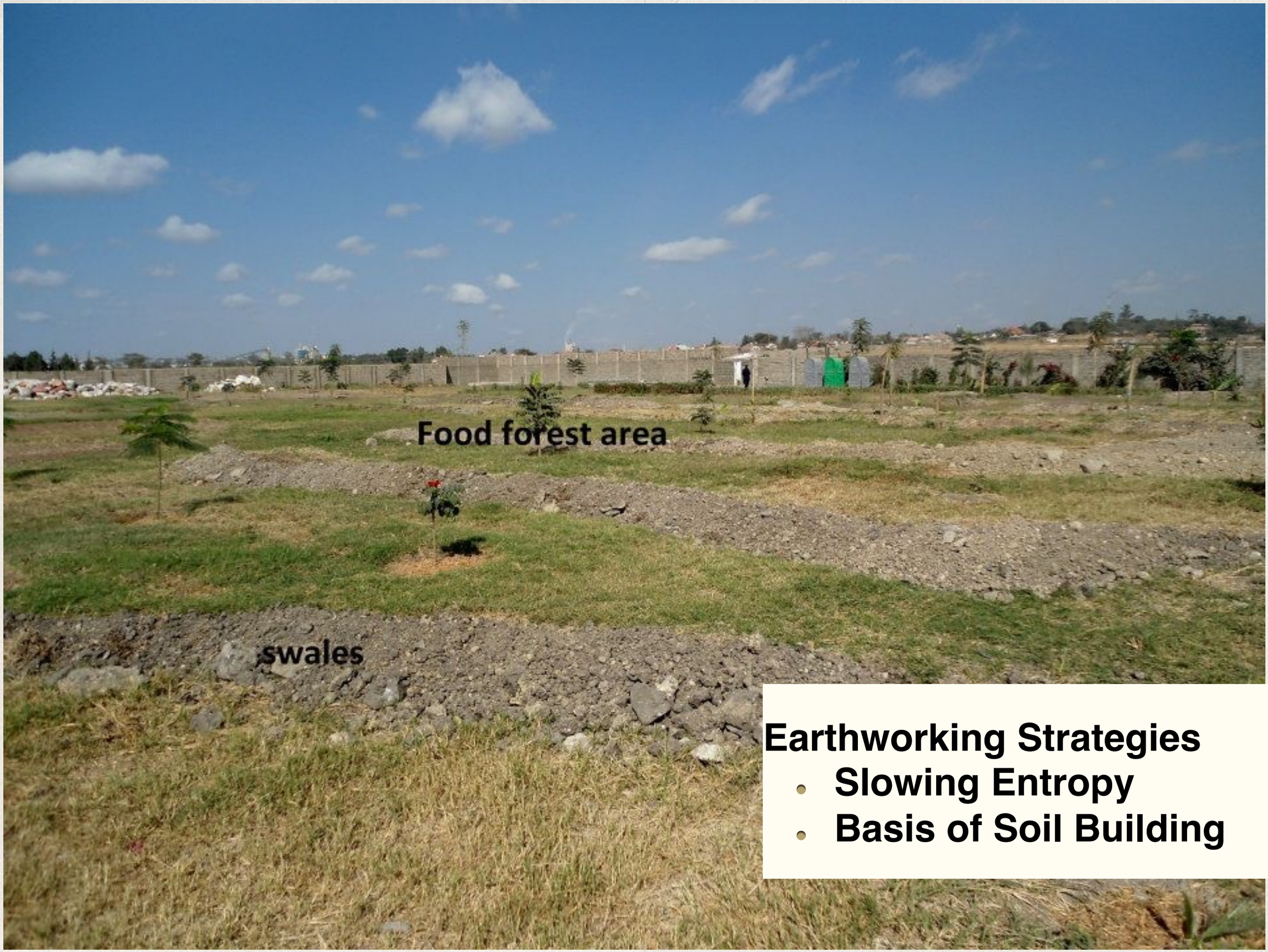

Earthworking Strategies

- Slowing Entropy
- Basis of Soil Building

Benefits of Earth Shaping

- **Erosion mitigation**
- **Water/nutrient harvesting and reticulation**
- **Micro-climate creation**
- **Perennial planting structure**
- **Bore Hole Recharge**

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Alley cropping agroforestry system with perennials and annual production

Nutrition per square meter of planting is nearly 10x that of a mono crop system

Mulches, support species (nutrient fixing, etc.), perennial and annuals, earthworks, and patterning create soil building systems

Animal integration is essential for healthy and effective nutrient cycling.

Resource Identification and Waste integration using BIOGAS DIGESTERS

Three years of soil building and growth

Practical Application of Resilience Design

USAID - *TOPS* RESILIENCE DESIGN TRAININGS

- Malawi - Nov 2015/Jan 2016
- Zimbabwe - March 2016

- More to Come…

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www.casitasvalley.com

www.permaculturedesign.us

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