

Session 5

Principles to Practice: Water

Speaker: Brad Lancaster

- The life and work of Zephaniah Phiri Maseko—an innovative farmer in Zimbabwe and Lancaster’s mentor—conveys the principles of water harvesting
 - Phiri turned to farming after being fired from his government post for political activism
 - His only assets remaining: a 3 hectare farm and the Bible
 - He was able to transform his degraded land by following several basic principles
 - Area’s annual precipitation: 550 mm

• **8 Water-Harvesting Principles**

- A great way of buffering against extremes

1. Long and Thoughtful Observation

- Humans are powerful instruments of observation
 - Phiri first began his work by simply observing his land when it rained
 - Observed where water quickly ran off, where it gathered
 - The hill above his land so eroded that bare bedrock was exposed
 - During storms, the water would “flash” off the hill and erode more of his soil downhill
 - Phiri also observed that a bump perpendicular to the flow that slowed the flow

2. Start at the Top of the Watershed and Work Your Way Down

- We’re tempted to start at the bottom where we see the most water, but that’s not what is causing the flooding
 - Starting at the top addresses the problem
- Starting from the top of the hill, Phiri began to build rock walls perpendicular to the slope
 - Chickens were no longer lost to flooding
 - At a point where the slope became more gradual, Phiri dug ditches to catch water
- If installing a tank, you place it on higher ground, not on lower ground
 - Gravity then helps feed water from catchment to rest of property

3. Start Small and Simple

- By keeping the initial intervention on a small scale, you are able to err and adapt
 - A mistake at this scale is a learning opportunity, not a catastrophe
- Directing water from a hardscape surface, like a roof, allows you to double or triple your available rainfall
 - Water catchment tank near house allows for water to be used in other areas as needed

- Plant trees near house where they can capture this “extra” rainfall
 - “Catcher’s mitt” design: trees planted on western, northern, and eastern sides of house
 - In winter, able to capture sunlight from low sun
 - In summer, trees provide shade and cooling effect on house
 - Climbing vine can act as windbreak that shields the house
- “Grey water”—used water from kitchen and laundry chores—can be used in nearby kitchen gardens
- “Water plantation”: at bottom of hill, Phiri dug to bedrock to trap water and ensure that it seeps into surrounding soil
 - Surface water is more susceptible to evaporation than subsurface water
 - This pit doubles as a rain gauge
 - If filled twice a year, Phiri knew that there was enough water in soil to last him through prolonged dry period (when combined with other onsite reservoirs)
- Erosion Triangle: Speed, Depth, Volume
 - When any of these factors are decreased, the ability of water to erode decreases (and vice versa)
 - Man-made infrastructures like canals increase all 3 factors of Erosion Triangle

4. Slow, Spread, and Infiltrate

- The more you spread the water across a large surface area, the better the soil is able to absorb it
- High-capacity systems better handle intense storms of short duration

5. Always Have an Overflow and Use It as a Resource

- Water tanks without a built-in design for overflow can flood and damage house foundations
- Use overflow from tank to feed tree or another tank
 - “Fruition pits”: holes that trapped water, in which Phiri then planted fruit trees
 - After 19 years, the vegetation in this area is very dense
 - Act as windbreaks, which reduce evaporative pressures of high winds

6. Maximize Living and Organic Matter

- Mulch decreases loss to evaporation and increases infiltration rate of water
- If the site doesn’t have active soil biology, it will never come close to its potential
 - Mycorrhizae increase root area 100x over, allowing plants to reach more water
 - Mycorrhizae won’t be have desired effect without organic matter
- Phiri gives fruit tree transplants to neighbors to help build organic matter and “re-spongify” their soils
 - At first, 90% of the trees died when transplanted. Neighbors planted the trees, but didn’t “plant” the water
 - Over time, neighbors have increasingly adopted his principles

7. Maximize Beneficial Relationships and Efficiency by “Stacking Functions”

- “Stacked functions” of tree cover: fruit production, wildlife habitat, windbreak
- Reservoir ponds double in function as habitat for fish
 - When ponds dry up, Phiri hosts fish fry with neighbors

8. The Feedback Loop: Long and Thoughtful Observation

- Over 30 years, Phiri constantly modified his techniques
- His work has been recognized by the Zimbabwean government and neighbors have adopted his techniques
 - Key to adoption: they saw the techniques on a working farm
 - Demonstration sites fail when they are built in artificially pristine surroundings
 - Female farmers nearby have leapfrogged him and done in 10 years what it took him 30 years to do
 - The women who worked with Mr. Pierre knew exactly how transfer information effectively; they distilled the essential principles into 3 songs
- Phiri has been raised the water table so much that the pump is no longer needed for annual crops
- **Water-harvesting project in Arizona**
 - On his own property, Brad Lancaster has used water harvesting to restore vegetation and raise awareness of water conservation in the Tucson community
 - Area annual rainfall is 150 mm
 - The improvements in vegetative cover have served to bring back two dozen native bird species and improve the soil
 - These species were selected based on the principles of ethnobotany
 - Take a hike in the local wilderness and observe what species of native vegetation grow where (i.e., high spot or low spot on slope)
 - “Nature is the encyclopedia”
 - University of Arizona study found that organic mulch had 10 times the bioremediation potential of rock mulch
 - Water-harvesting run-off from street curbs has the potential to irrigate 400 fruit trees per mile
 - Projects have seen increased attention from community
 - Tucson local government now allows cutting curbs to allow street-flow irrigation
 - There are now fairs in Tucson to promote food from native vegetation