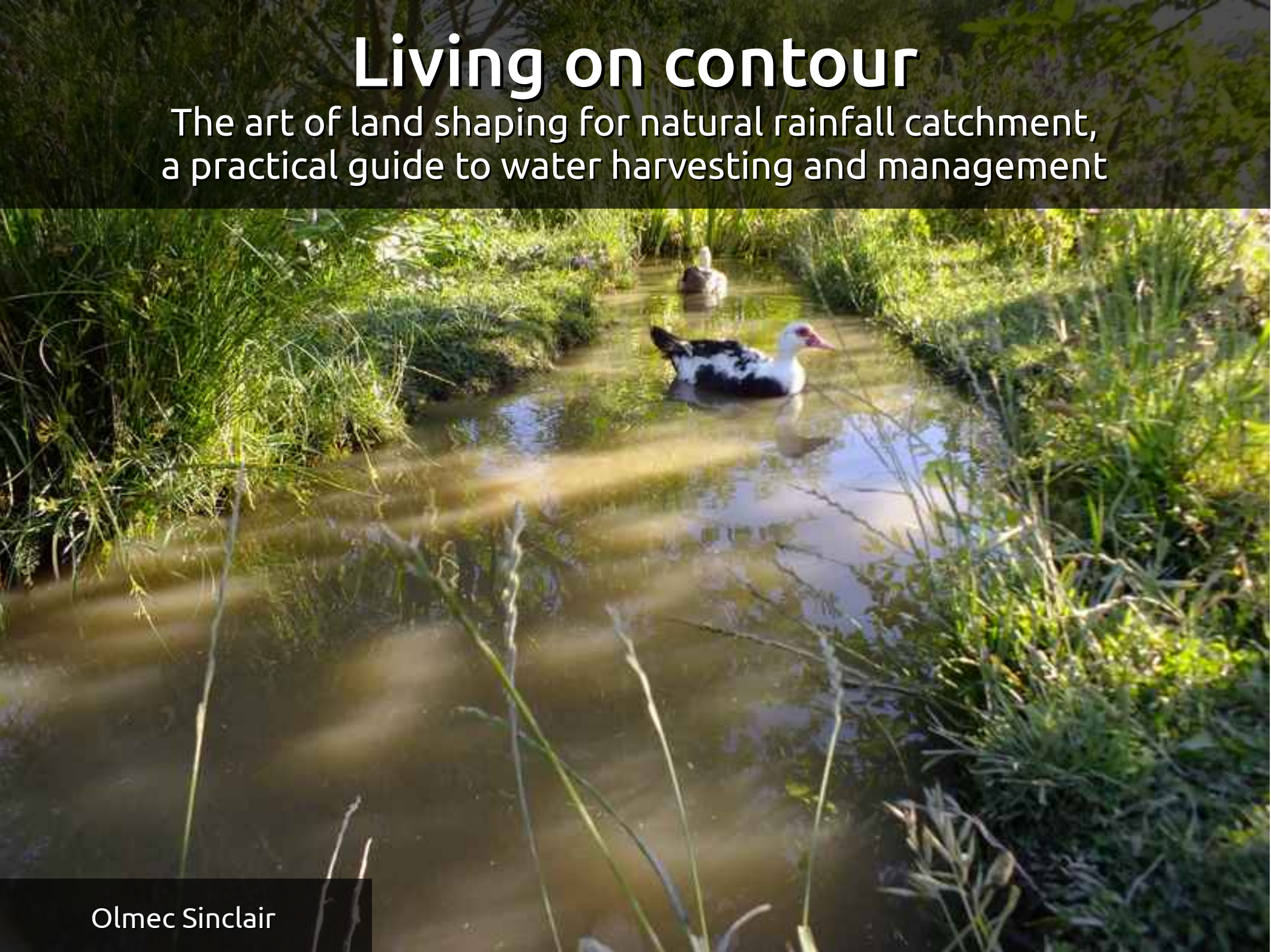
Living on contour

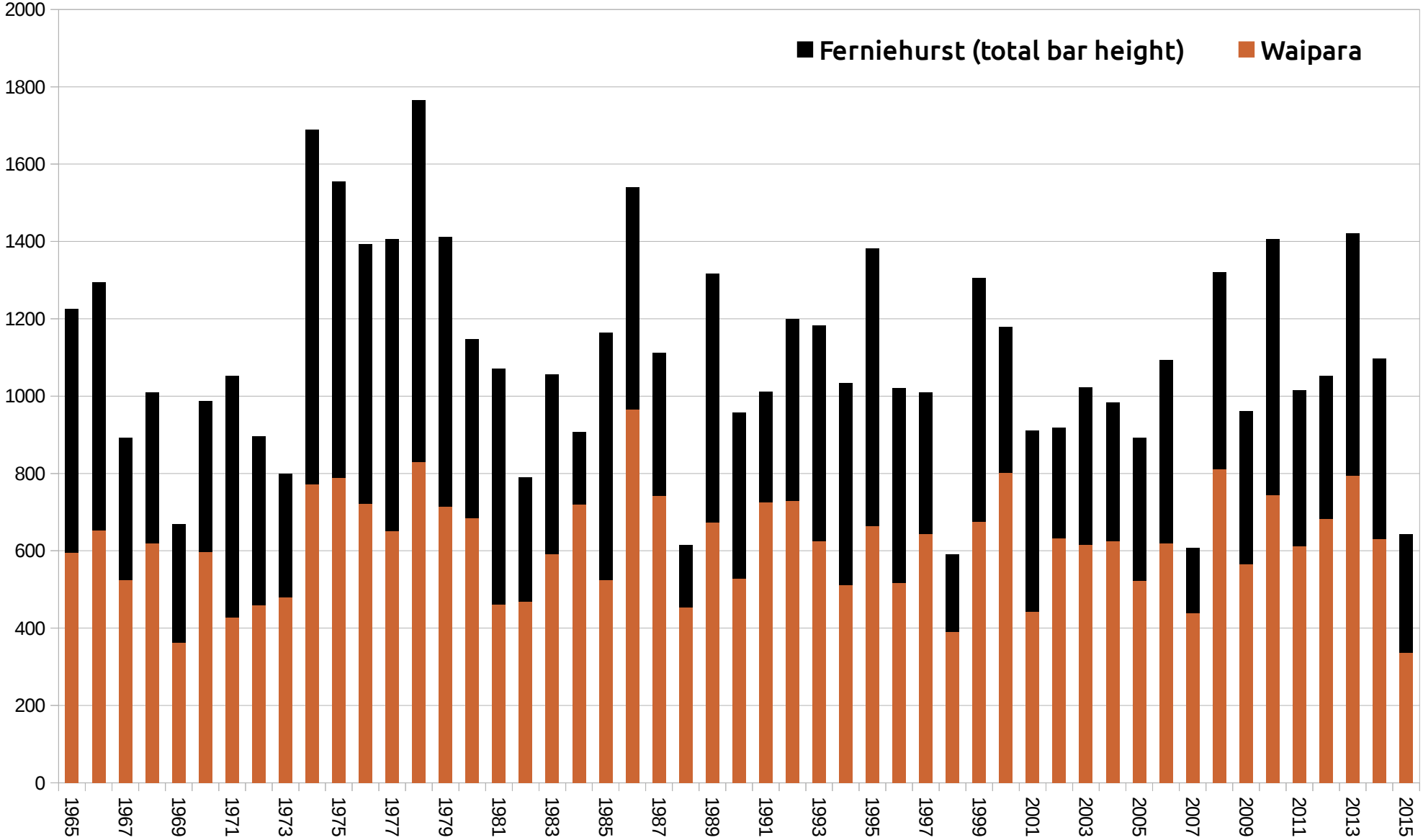
The art of land shaping for natural rainfall catchment, a practical guide to water harvesting and management



Olmec Sinclair

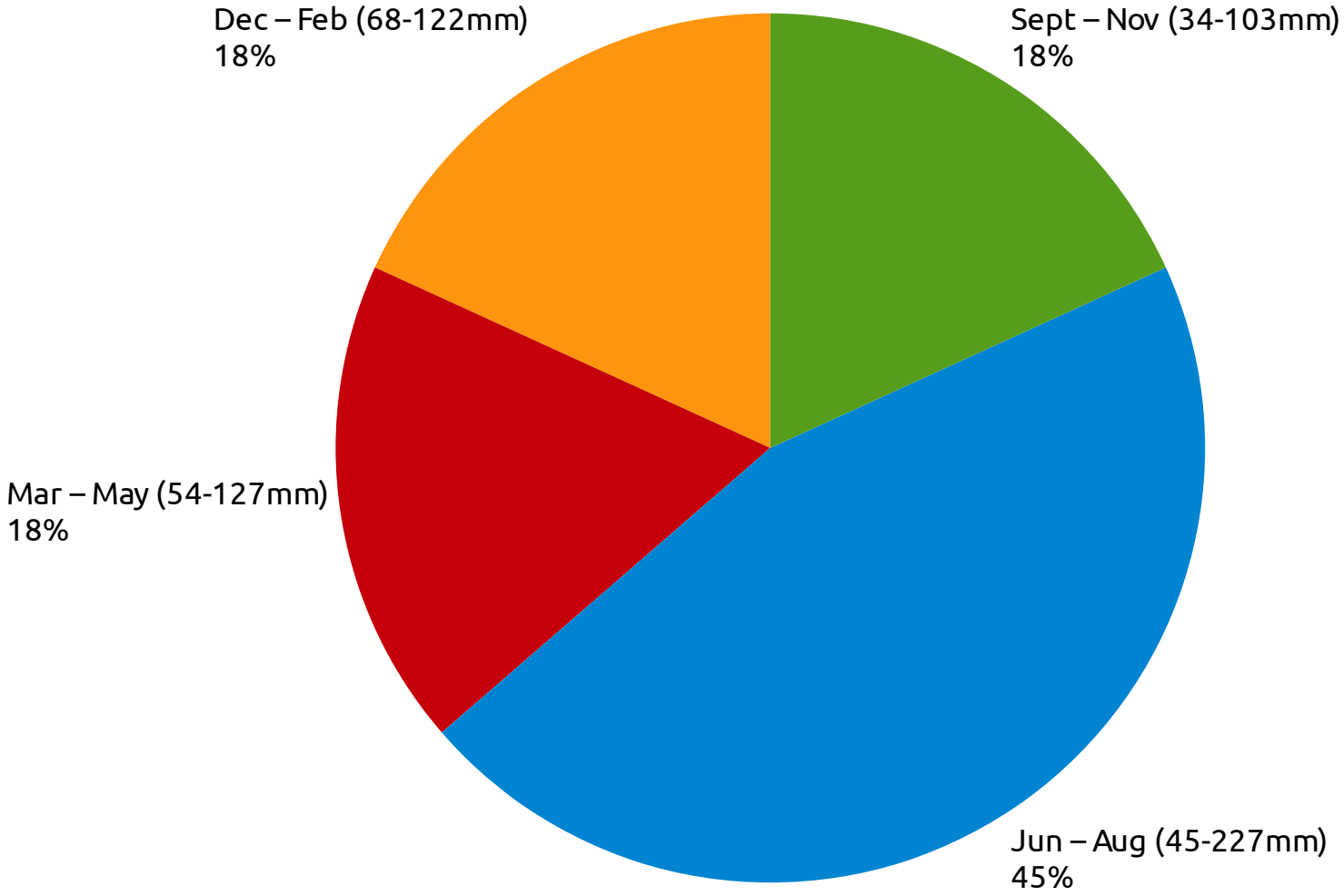
Deserts are dry and dead, water is the foundation of life

Desert oasis in Libya

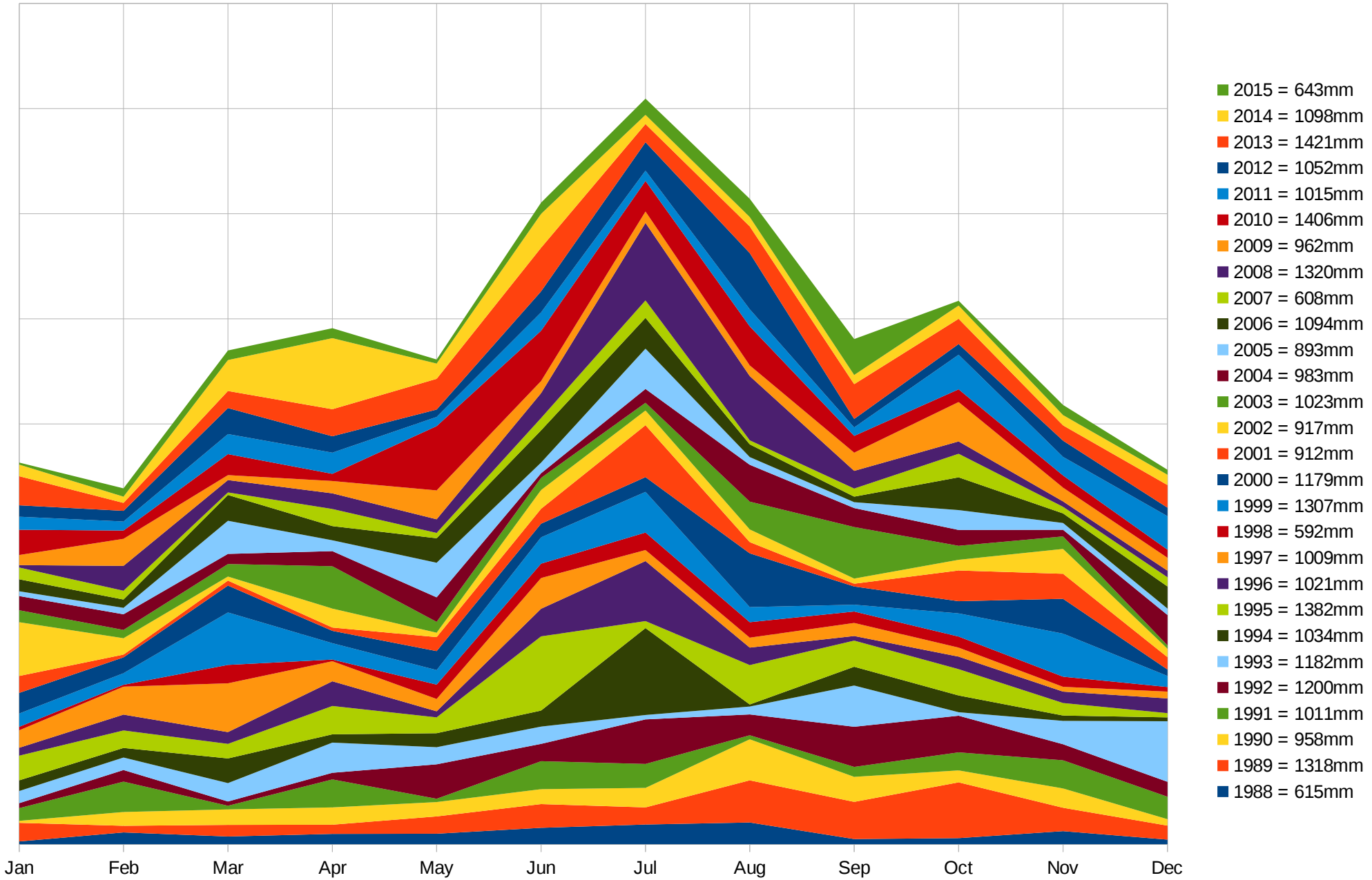


Here, it's more frequently wet than dry...

Annual rainfall (mm) NIWA datasource



Maximum single day rainfall (based on 1990 – 2014 NIWA data)



Annual rainfall (based on 1988 – 2015 NIWA data)

What makes a drought

- Reduced rainfall and hot drying wind. Climate change predicts increasing temperatures, wind speeds and extremes in wet and dry
- Removal of trees and other vegetation reduces soil organic matter and water holding capabilities while increasing moisture evaporation and the chance of erosion
- Compaction of soil by heavy machinery and livestock leads to increased runoff, especially during heavy rain, carries off valuable nutrient and does not recharge local water table
- Frequent cultivation destroys soil water holding capabilities and increases deep compaction

Don't rely on

Technology

(It's probably a boondoggle)

All technical 'solutions' include

- Complexity in knowledge and parts
- Upfront and ongoing costs
- Wear and tear, damage and maintenance
- Obsolescence (old version no longer supported)
- Reliance on centralised and distant industrial system

three step drought proofing

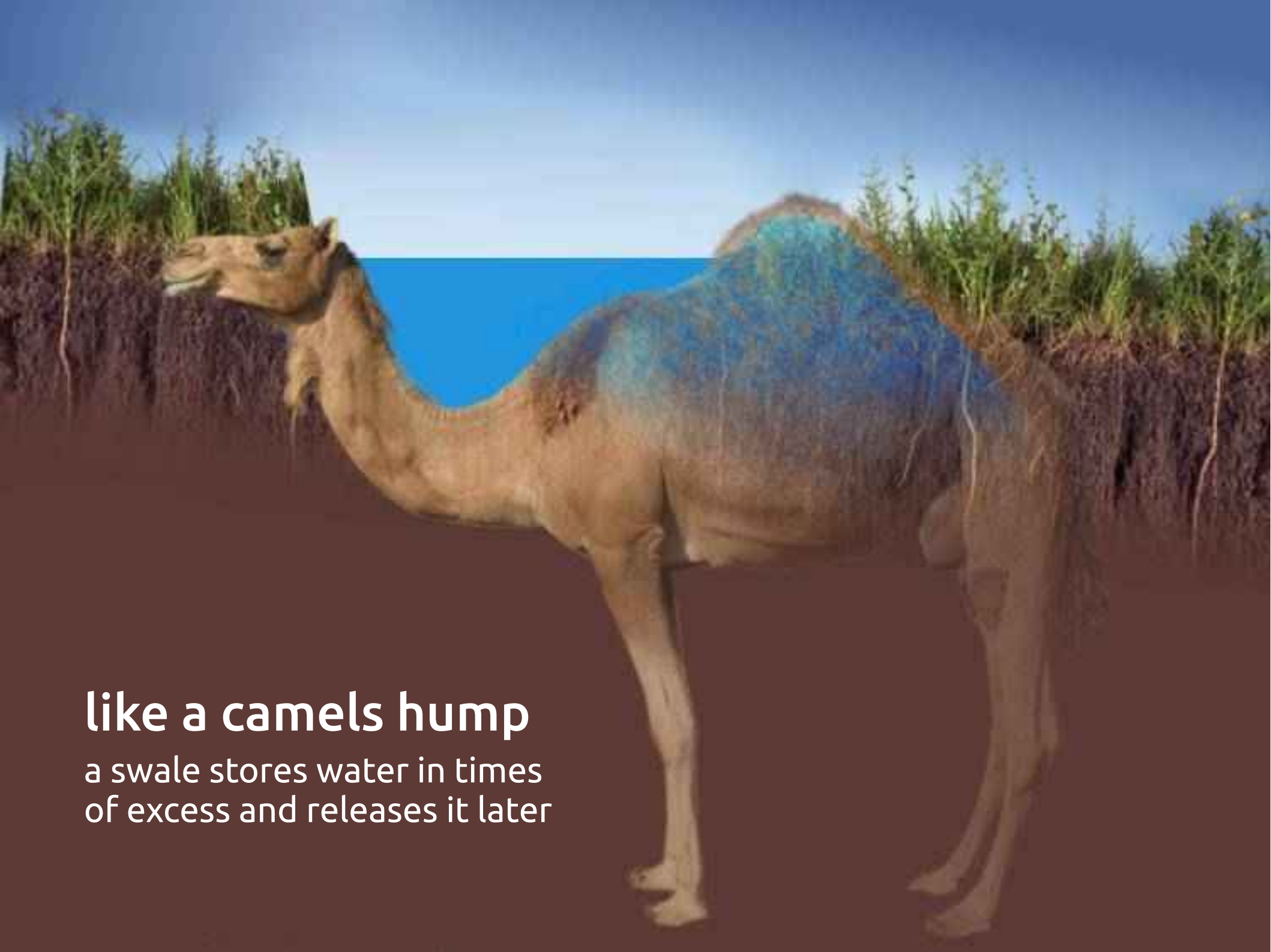
Step 1

capture annual rainfall and surface flows

The primary objectives

- Slow water down to reduce erosion
- Spread water out or move from wetter to dryer areas
- Allow water to sink in (infiltrate) to charge the soil / aquifer
- Capture and store rainfall high on the landscape or near large catchment surfaces
- Work with gravity / contour
- Transfer nutrient to desirable locations (animals uphill of plants)
- Increase land surface area with humps and hollows and plants

The way of the swale

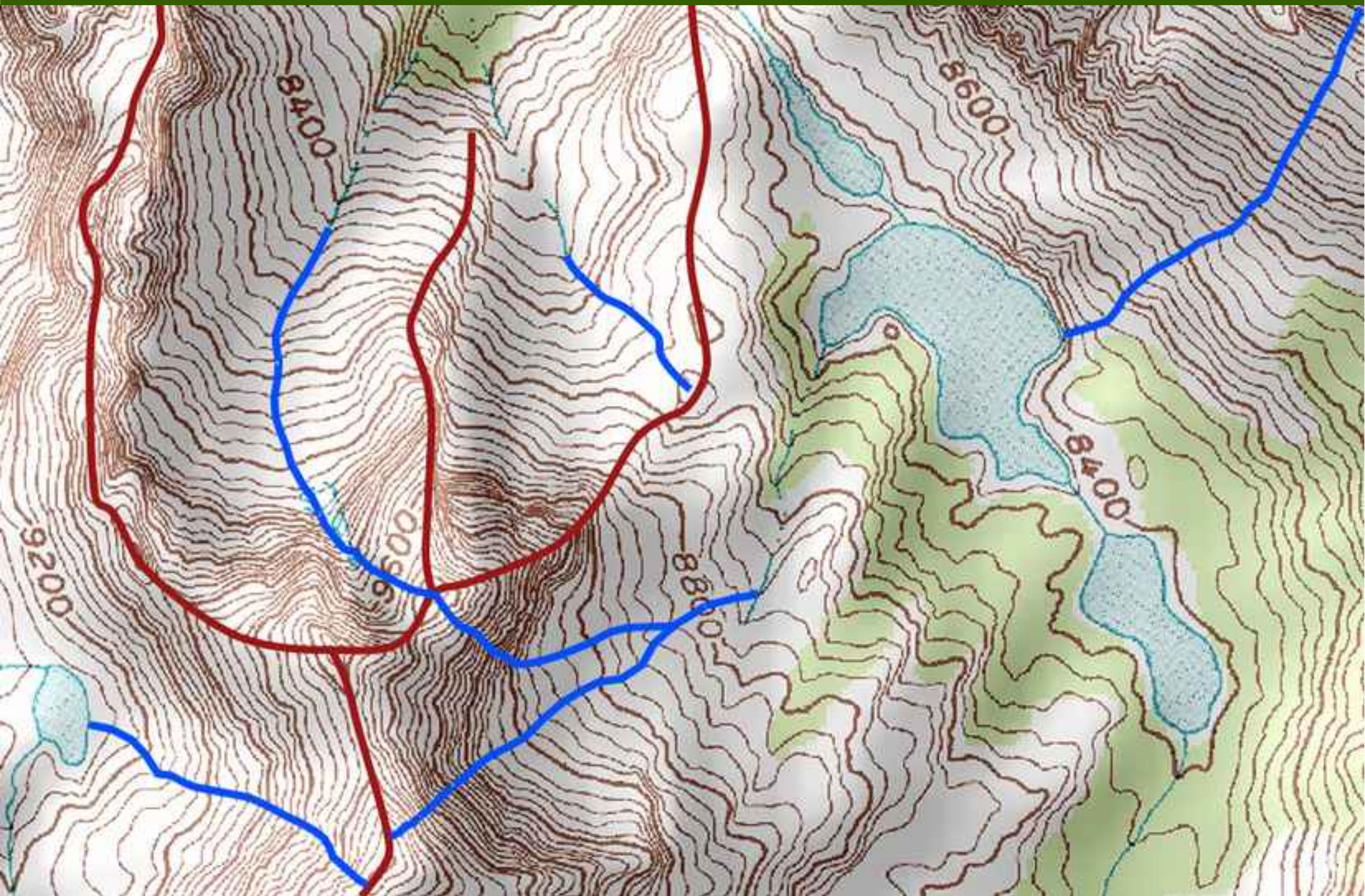


like a camels hump

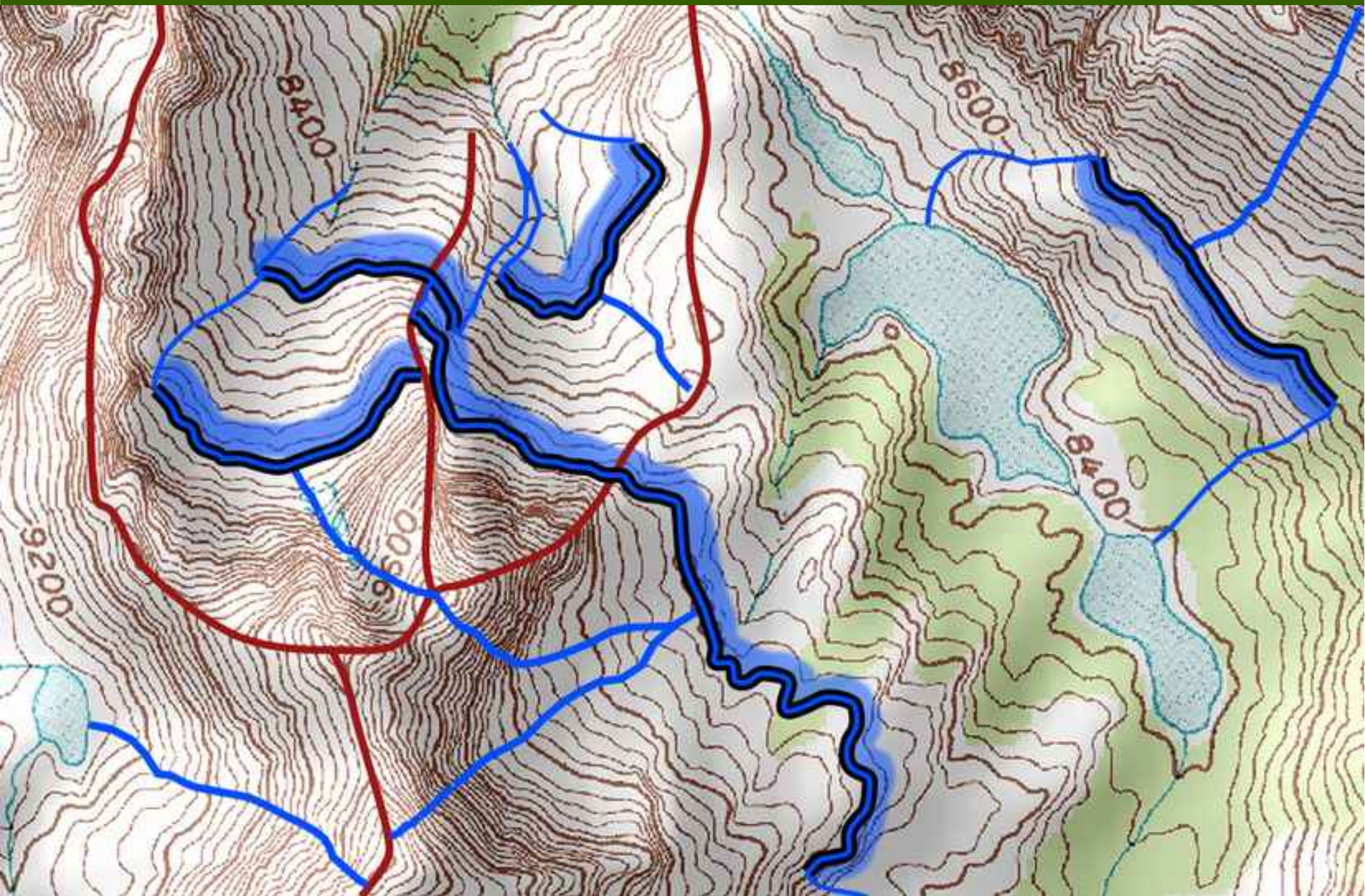
a swale stores water in times
of excess and releases it later

Contours on topographical map

Dry ridges, wet valleys



Spread water along contour toward the ridges



Terracing in Asia Retaining water for rice growing

Although labour intensive to produce, rice is one of the few crops that can be grown repeatedly in the same location

Inca settlement in South American Andes

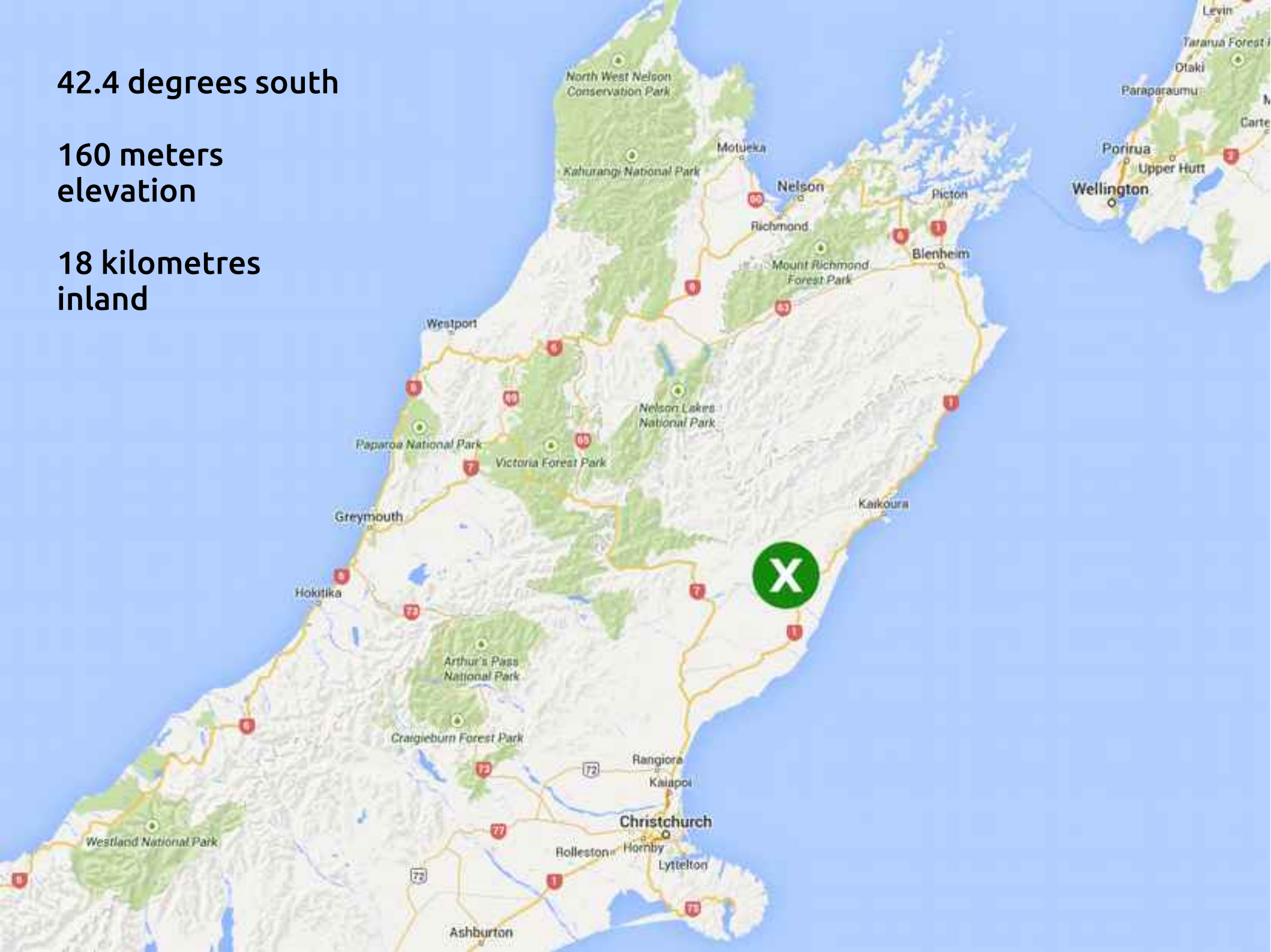
Example of landscape rehydration

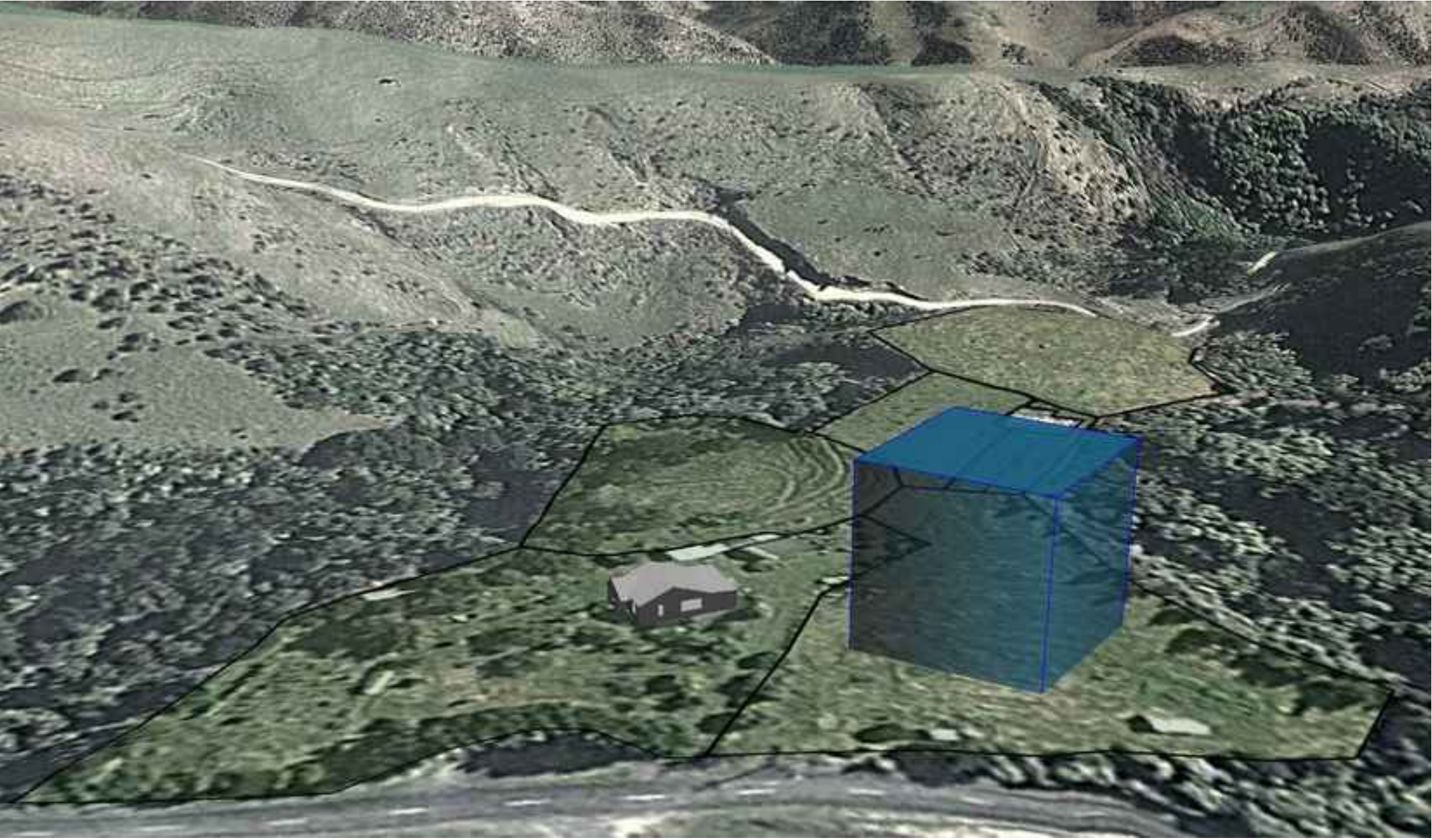
Loess Plateau China

42.4 degrees south

160 meters elevation

18 kilometres inland





1000mm average yearly rainfall landing on 1.5 hectares is:

- **15,000 cubic meters**
- **15 million litres**
- **a cube measuring 24 meters along each side**

Calculating rainfall catchment

1) Work out the catchment area (in meters) by multiplying lengths and widths. Remember that the area is as seen from above or plan view, not the actual surface area since pitched roofs have a larger area than a flat surface.

2) Multiple the catchment area by your average annual rainfall, again in meters, to get the yearly cubic meters of rain.

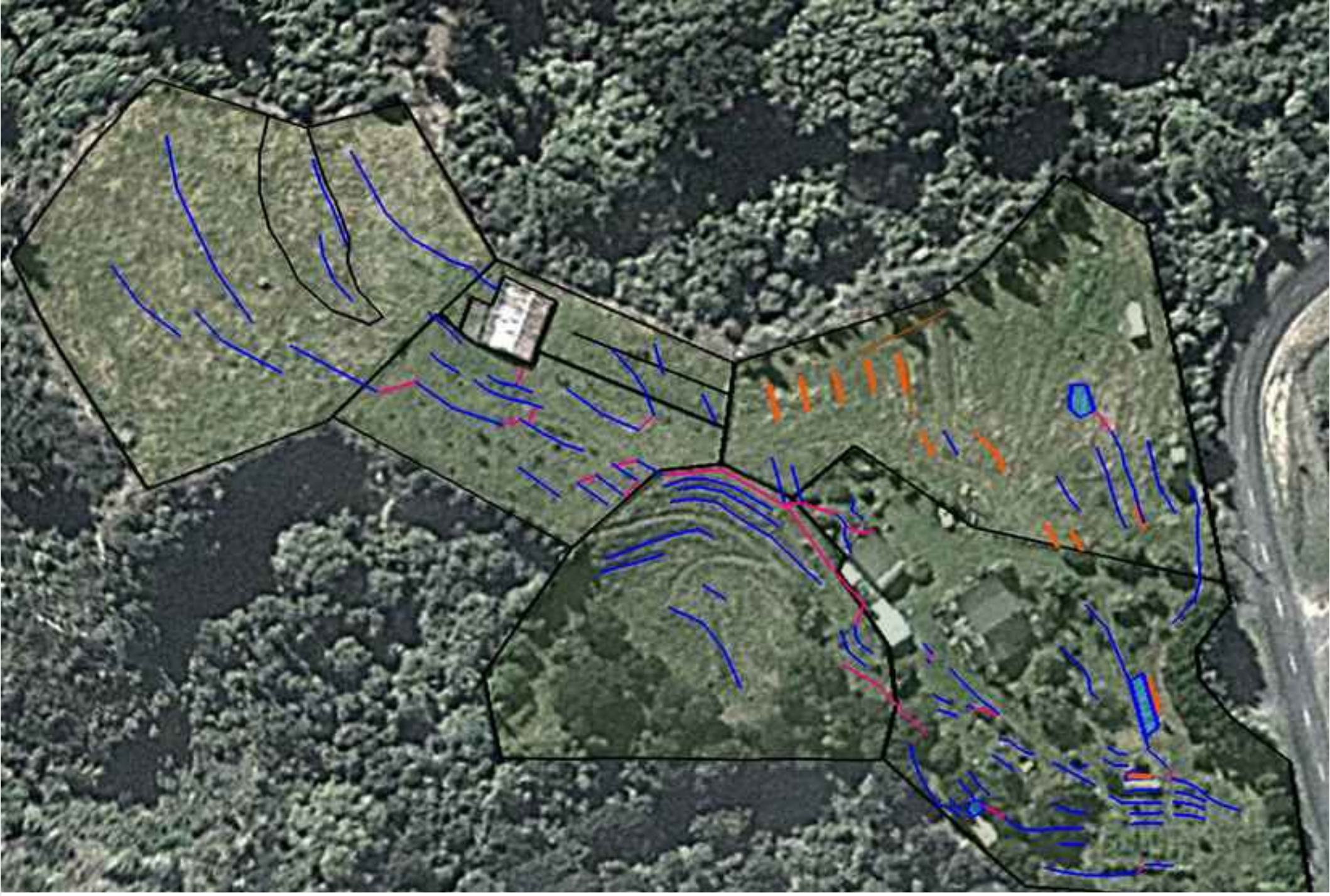
3) Multiply this number by 1000 to get litres

10mm of rain falling on 1 hectare (10,000m2) results in a total of 100m3 of water or 100,000 litres.

That's a cube of 4.6 meters.

Below: Before (2010)

Right: After (2015)



Swales at blockhill **Swale** **Overflow** **Raised wood core**

Slow & spread Water should take a long, meandering course across the landscape

Sink it seasonal ponds seep water to plantings below while offering habitat

Animals & swales above plants distribute nutrient & water with gravity

Overflow pipe in plughole can be pulled out to drain the bath

Where to start

Catch and keep water high on the landscape.

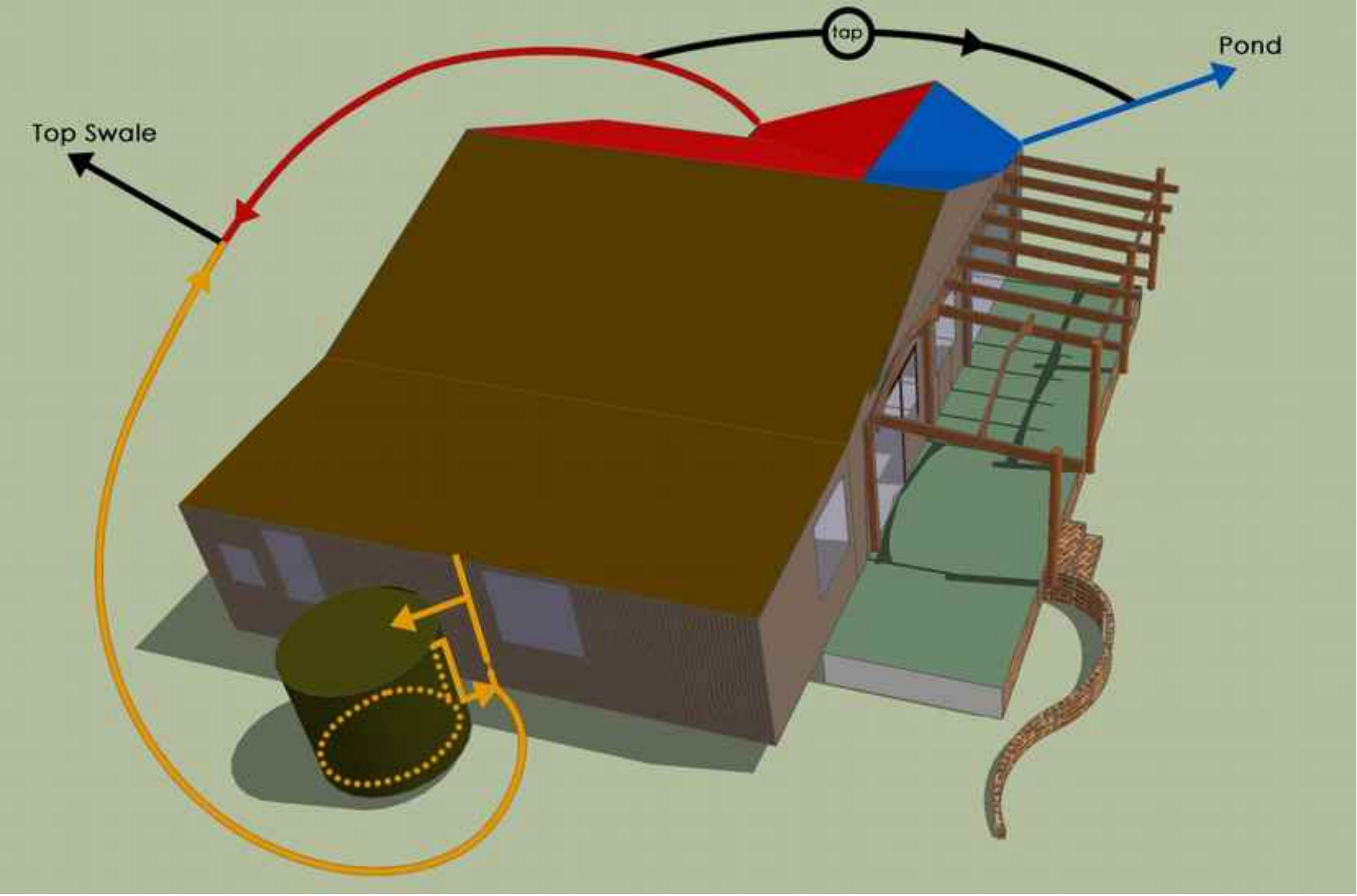
- Keep it simple
- Work with gravity as much as possible

Purify and store drinking water

Down spout from steel roof

First 10 litres or so is flushed to help remove impurities

Concrete tank overflows to top swale



Rainwater collection For every 1mm of rain, 100 litres goes into the top swale

Primary swale catches 100 litres per millimetre of rain from house roof plus uphill run off

Main vegetable garden beds and paths on contour, fed with overflow

Step 2

Improve soil water holding capacity

Every 1% of organic matter in the soil enables absorbtion of

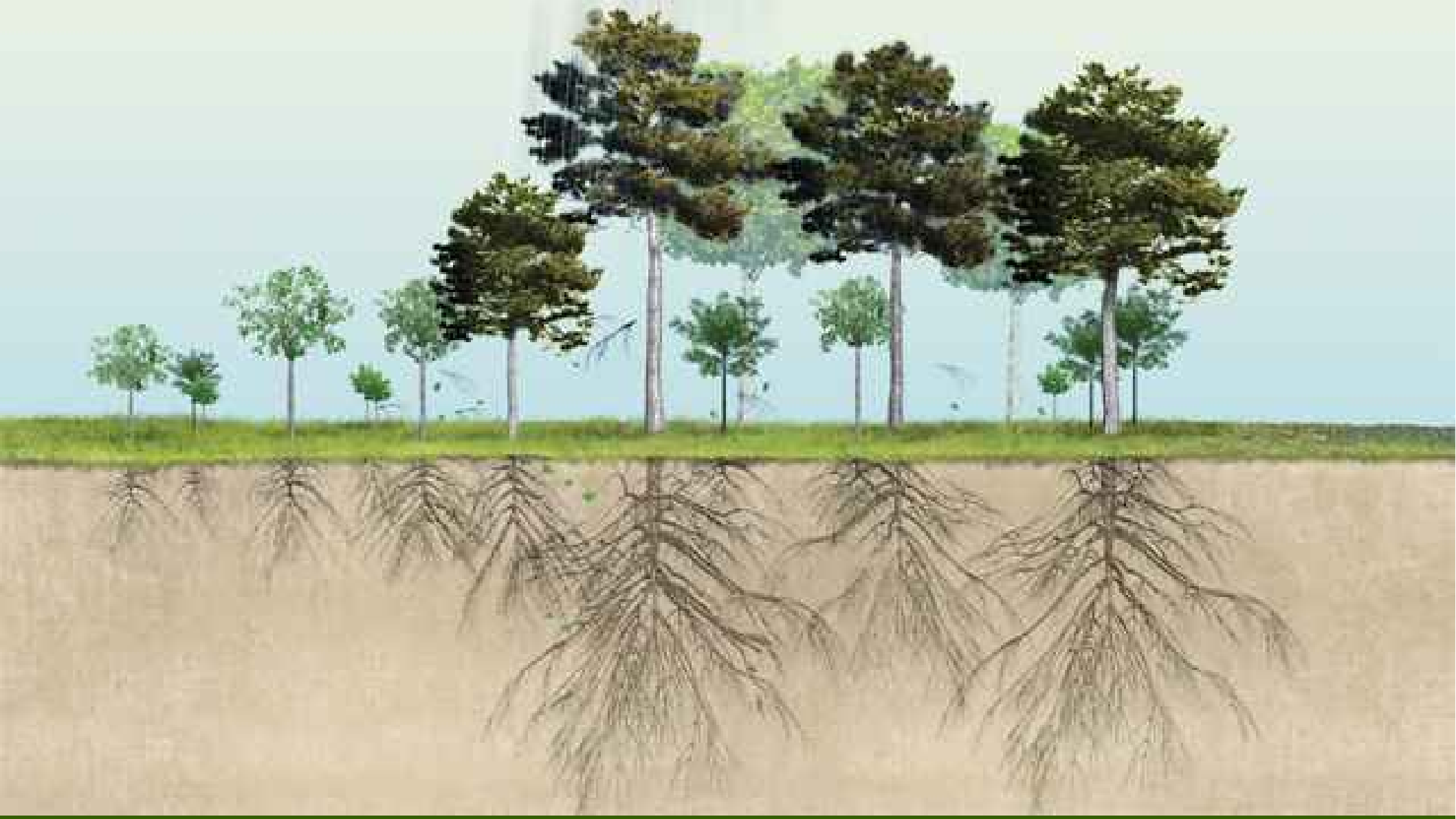
154,000 litres per hectare

15.4 litres per square meter

15.4mm of rainfall


natural mulch

King of the mulch!



Step 3

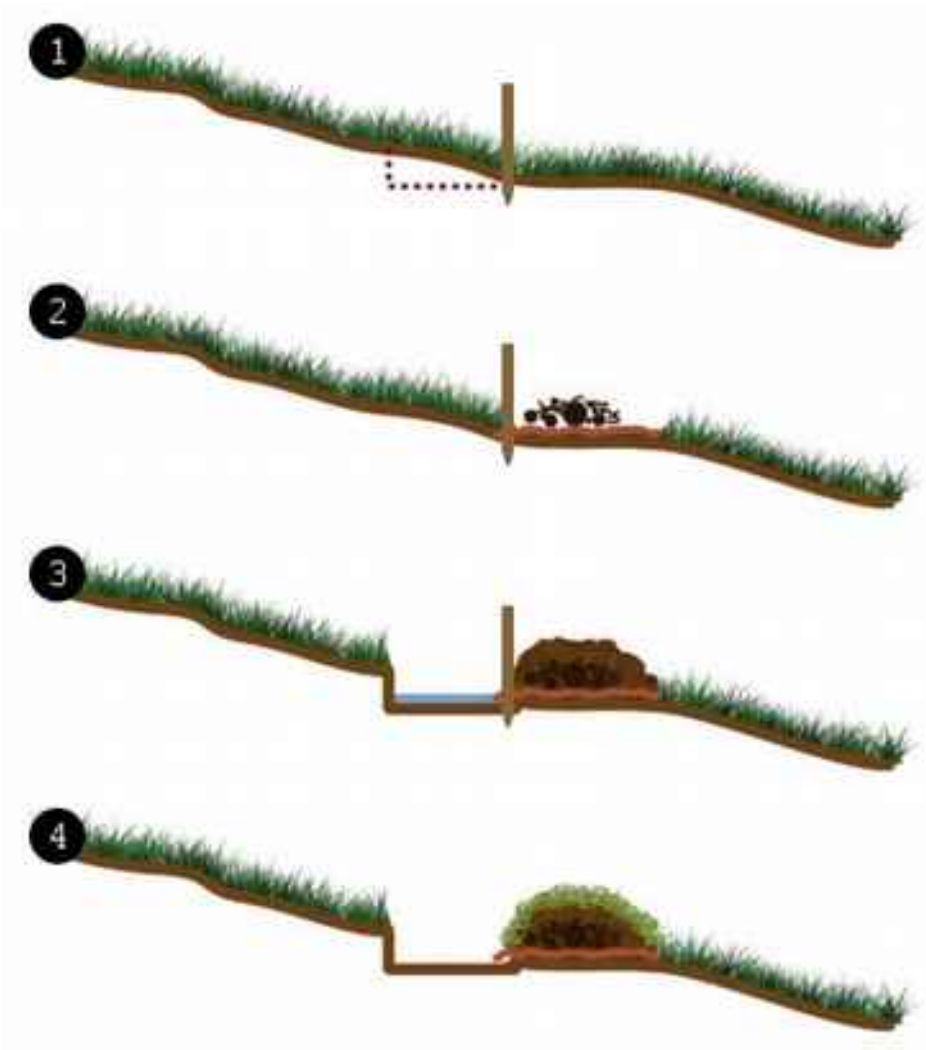
Increase surface area

Use surface to catch dew and condensation

Multiple benefits of trees

in no particular order

- Human food and animal fodder
- Physical barrier
  - Shelter (wind, rain and cold air)
  - Shade
  - Living fences
- Moisture
  - Raise humidity
  - Huge surface area captures mist and dew
  - Roots lift water towards the surface and improve soils ability to absorb water
- Soil building and improvement
  - Leaf litter builds organic matter
  - Nitrogen (select species)
  - Concentrations of manure from shade seeking animals and birds
- Soil stabilisation and erosion control
- Aesthetics (colourful leaves, flowers etc.)
- Cornerstone for biodiversity (habitat for insects, bees, birds...)
- Wood for fuel and construction
- Perennial (plant once)



Swale Construction process

Design considerations

Soil type

- **Clay** – deeper and narrower for slow infiltration and greater water storage
- **Sand / shingle** – shallower and wider due to rapid infiltration and less stable soil

Spacing

Closer in wetter climates, farther apart in drier areas. Consider how they are to be used and accessed.

Link swales together to manage overflow

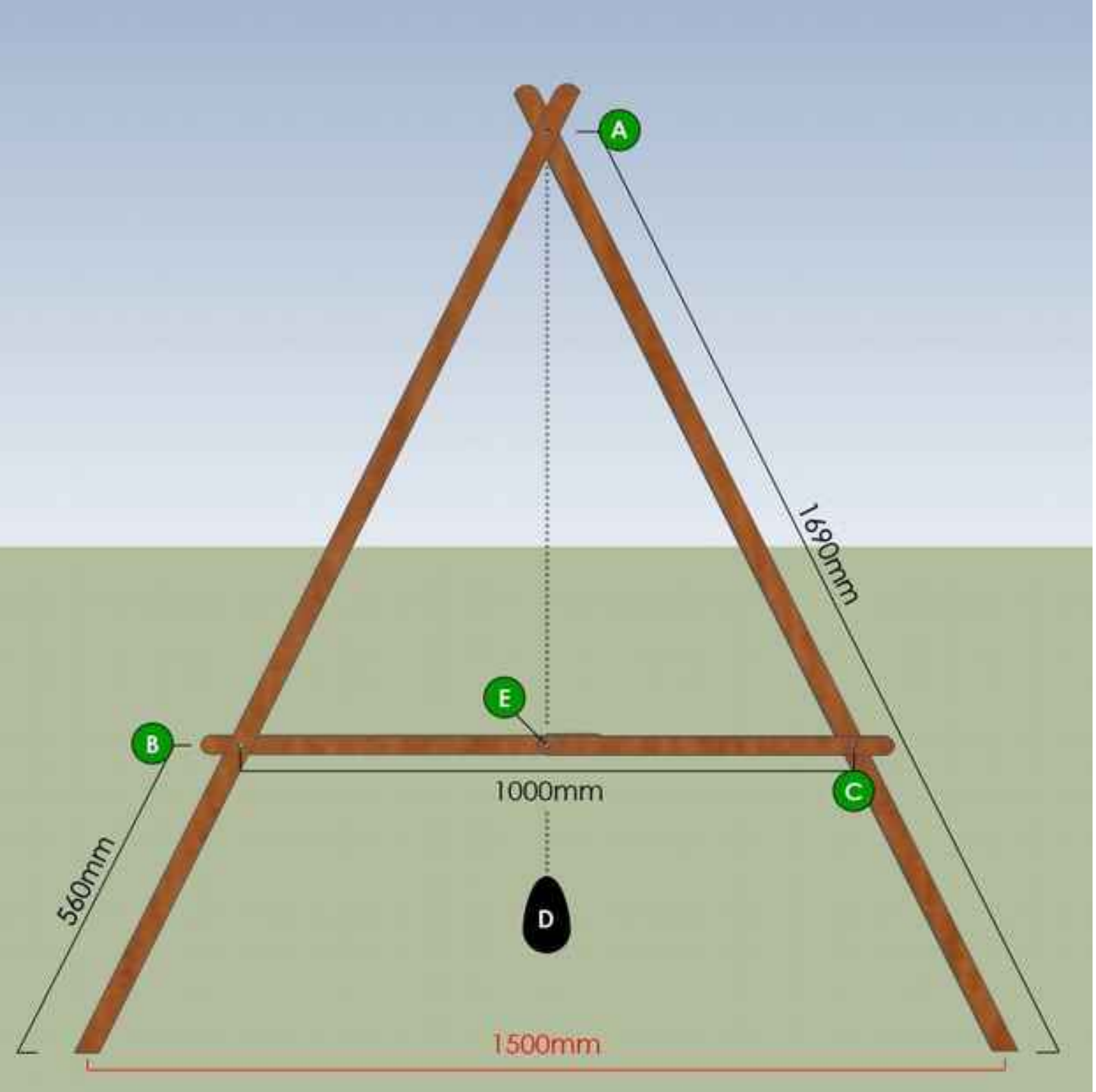
Overlap swales to catch overflow

Leave gaps for access and navigation and to aid air drainage

Run pathways on contour or slightly pitched to direct overflow

Swale making tools

- A-Frame for finding level
- Shovel (or spade for steeper terrain)
- Marker pegs
- Hammer



A-Frame level Construction

This plan results in a device whose feet spacing is 1.5m making it easy to quickly measure the length of pegged out line

Find and mark contour

Move soil to the downhill side, level bottom with water

Mulch and plant

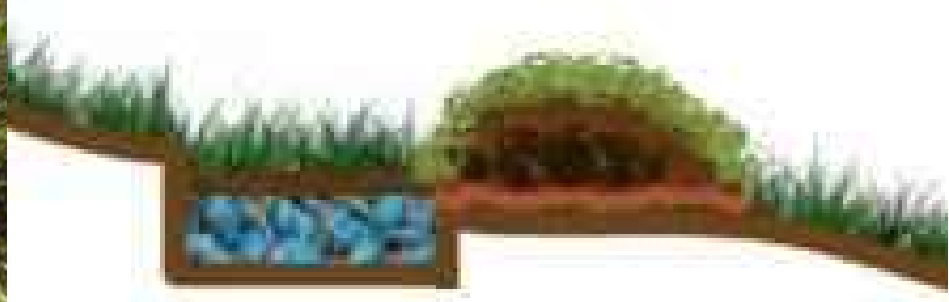
Increase surface area humps and hollows create more surface & micro climates

Polish and improve

Terracing with a mini excavator

Variations

Secret Swale



Swale trench can be back filled with shingle, bark chip etc. to allow water to infiltrate while leaving the surface flush with original ground level.

Wood filled swales, raised gardens or hugelkultur on contour


Feb. 2014


April

Contour earthwork with tractors

Gallery & inspiration


Everything drains here, the lowest point

Winter '13

Summer '14


Oct. 2012


1 and a half years later


Another year and a half


NOW


15mm in 24 hours


9 months earlier


Blending into the landscape

Conclusion

Positives

- ✔ Low cost, low technology approach to water management and irrigation
- ✔ Helps build micro-climates through wind protection and cool air drainage that can be exploited for gardening
- ✔ Segments the landscape in attractive ways
- ✔ Eliminates erosion and run off
- ✔ Distributes animal 'nutrient' if present

Considerations

- ✗ Makes moving large vehicles around difficult if not planned well
- ✗ Can be difficult to fit amongst existing trees & buildings
- ✗ Smaller swales can become a tripping hazard if they get obscured by grass
- ✗ Design overflow to handle water volumes to avoid erosion problems
- ✗ On steep land start at the bottom and work up as terraces are stabilised with plantings

Rota takes a bath

Book your visit to learn about:

- Swales & water harvesting
- Food forest gardening
- Permaculture thinking & design

www.blockhill.co.nz