Increasing water availability

Rainwater harvesting and use in Arid environments

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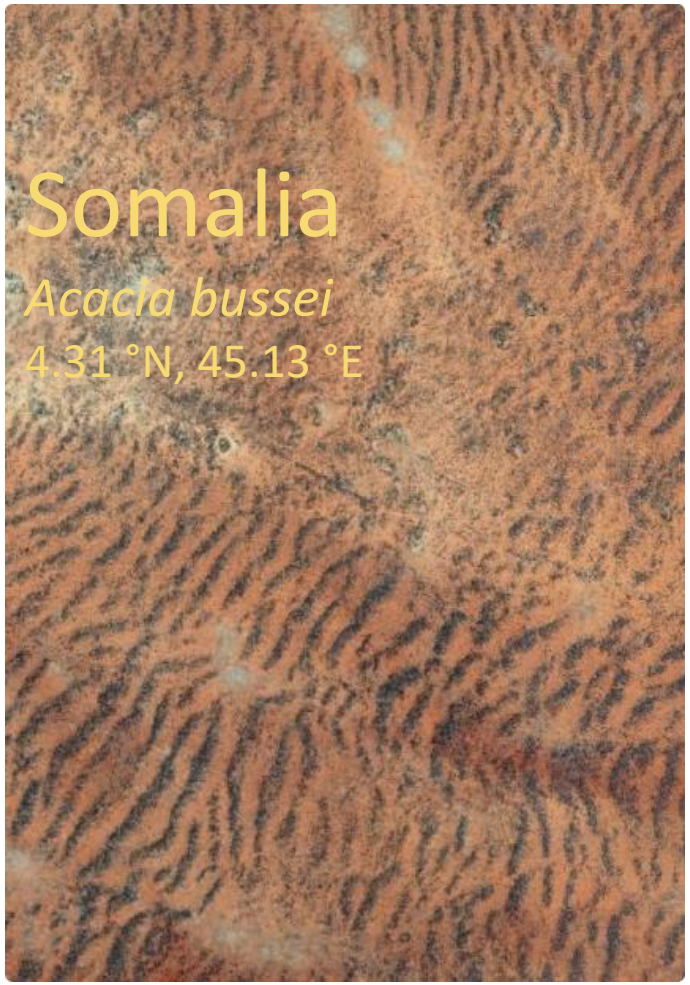
Tiger bush ecohydrology



- Natural solution to water scarcity
  - Insufficient water to cover whole area with bush
  - Crusted bare areas are slightly higer in topography and produce overland flow ➔ limited soil moisture availability, no plant survival in dry periods
  - Bush growth occurs in slight depressions that are fed by rainfall, but also receive overland flow from crusted bare areas
  - Infiltration occurs in bush areas, enough soil moisture for bush survival
  - Produces wavelike striped patterns
  - Litter decay produces toxicity in soil that also governs pattern formation where there is sufficient rainfall

Learn to know the area and planning

- The best way to study an area is a remote sensing / data exercise in combination with field visits to key location
- We start with compiling maps and data in QGIS, including topography, soil, drainage network and land cover
- We do field verification
- For assessment of direct runoff – overland flow we need to process long-term precipitation information
- We combine the information to obtain CN values and calculate spatial variation in direct runoff, runoff and erosion maps
- Identify intervention options (biophysical and socio-economic factors)
- We use multiple maps to plan intervention and monitoring strategy

Water harvesting potentials

If you want to implement a certain type of water harvesting technique:

- What type of water do you need to harvest?
  - Liquid water, to be used for domestic, agriculture or industrial water supply
  - Soil moisture – Green Water
  - Groundwater – Blue water
- Where and when do you need the water?
- What option is best (hillslope, in-stream)?
- How much water can you harvest?
- What are downstream consequences of implementation?

- Rainwater harvesting leads to reduction of the fast river runoff component
  - Channel precipitation, quickflow (overland and throughflow) and baseflow (groundwater flow)
- Land surface runoff (direct runoff) can be estimated from daily rainfall using the Curve Number (CN) method
- Distribution of rainfall into direct runoff (overland flow) and infiltration

Curve Number method

- CN values published in tables

Water Balance $P = I_a + F + Q$

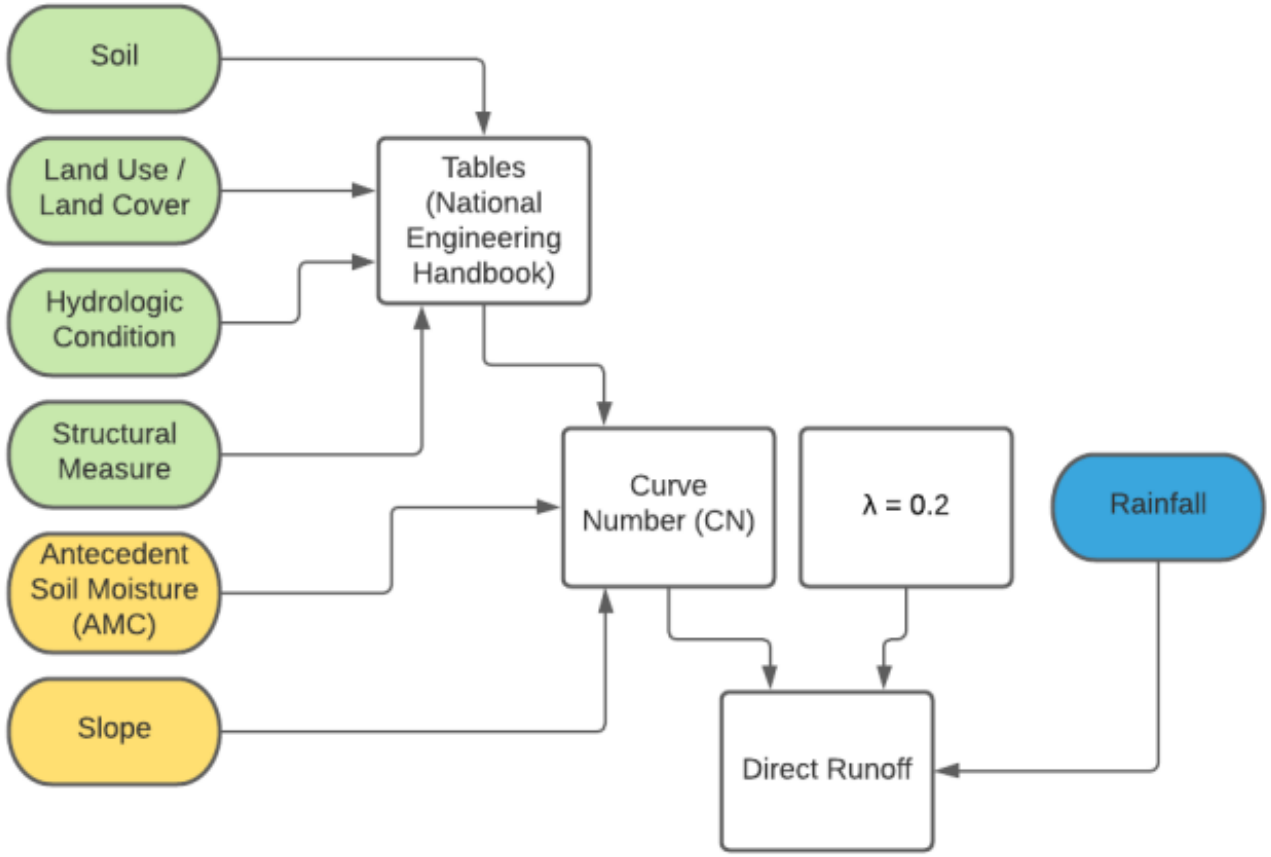
Hypothesis $\frac{Q}{P - I_a} = \frac{F}{S}$

$S = \frac{25400}{CN} - 254$

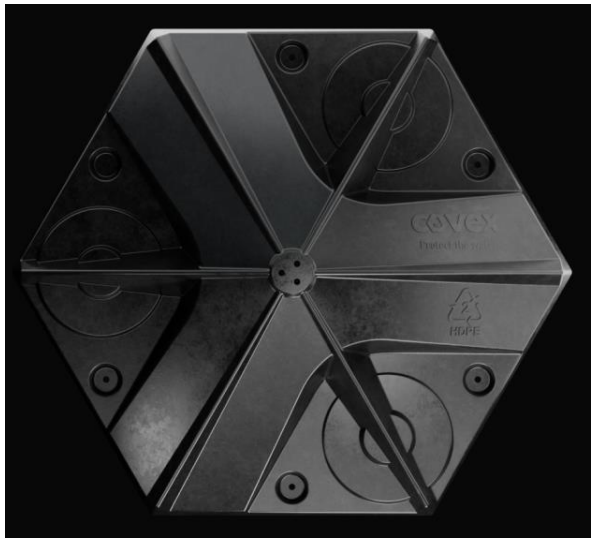
$I_a = \lambda S$

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

P = total rainfall, I_a = initial abstraction, F = cumulative infiltration, Q = direct runoff, S = potential maximum retention



Reduction of open water evaporation Mafraq region



- Apply floating cover
- Reservoir area 2120 m^2, filled with groundwater for irrigation purposes
- Mean evaporation rate without cover 4.6 mm d^{-1}
- Mean evaporation rate with cover 0.1 mm d^{-1}
- Water saving 3,483 m^3 a^{-1} or 87,000 m^3 in 25 years
- Purchase costs USD 21,200 + shipping to Aqaba USD 11,800 = USD 33,000.
- Costs water gained: USD 0.38 per m^3

Source: https://covex-cove.webflow.io/#details

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