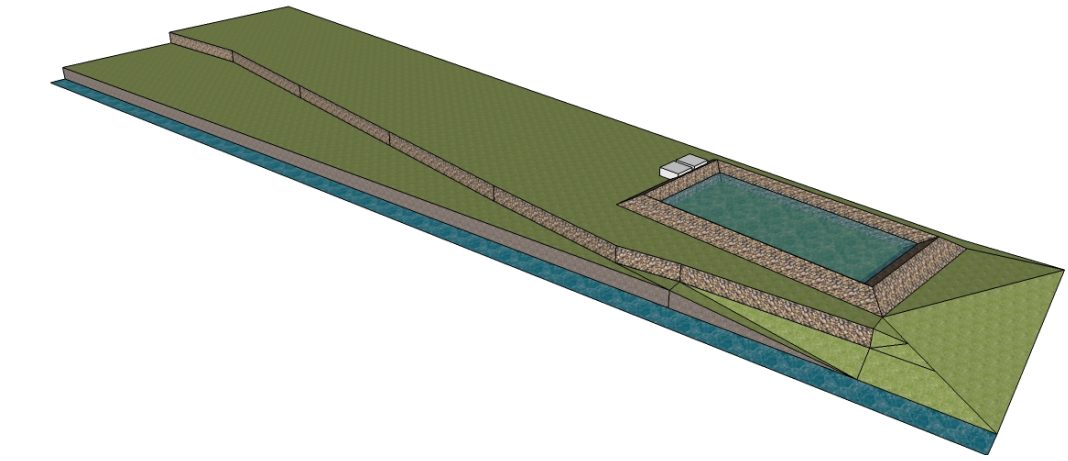
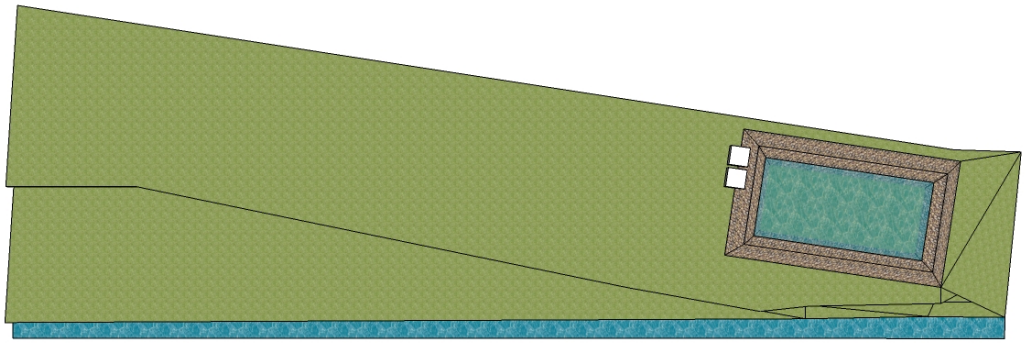
Tel Hima activities outline

Intervention summary

The intervention in Tel Hima aims to create a demonstration of a sustainable agricultural system that increases total productivity and lengthens the production calendar at the site by making optimal use of the primary water resource – the warm, slightly saline spring. The intervention aims to provide an alternative to current agricultural practices which are actually having a negative long-term effect on soil fertility, while maintaining present day functionality of the spring – i.e. ensuring the water source remains accessible for livestock watering and recreation.





Intervention detail

1) Aquaculture pond

The first stage of the intervention is to use the warm water from the spring to grow fish, year round, for food in the community. An 18m^3 pond will be created and stocked with 150-200 native tilapia fish (e.g. *Sarotheredon galileus*). The pond will be fertilised using locally available livestock manures to establish an aquatic food chain on which the fish are able to feed naturally. Water quality will be maintained by keeping a low stocking density (around 3-5kg/m^3), and by a continual low-flow discharge and water replacement.

The pond will be orientated to take advantage of the prevailing wind to maximise aeration and water circulation. As such, the long axis of the pond will run in the direction of the prevailing wind (approximately East/West)

The pond to be constructed will have a maximum depth of 1.5m, and be filled with water to a depth of 1.2m. The water level in the pond will be the same as that in the cattle drinking trough, and at least 0.2m higher than the surface depth of the highest terrace.

The pond will be rectangular, with sides sloping at an angle of 30°. The pond will be constructed by excavating a hole of the correct dimensions and lining it and carefully laying rocks on top of the liner to protect the liner from UV radiation and punctures. The rocks will be held in place with a thin layer of cement – essential considering the occasional need to walk in the pond to harvest fish. Pond dimensions will be as follows:

Base length: 4.8m
Upper boundary (1.5m above base): 5.2m x 10m
Water surface (at 1.2m above base): 4.2m x 9m
Total water volume: 18.56m^3

Water delivery will be by a 50mm diameter pipe taking water from the spring to the aquaculture pond. This pipe will travel underground to the aquaculture pond and will be protected from being trampled by cows by being encased in a 3” steel pipe.

Water overflow from the pond will be managed by means of a sluice gate built in to the upper rim; a section of 4” pipe will be encased in the upper rim 1.2m above the pond floor on the downstream end of the pond.

Nutrient rich water overflowing from the pond (approximately 625 l/day) will be filtered to remove coarse solids, and then used to irrigate crops planted on the terraces.

2) Solids filtration

Immediately downstream from the pond, and along the same axis, will be a small settling tank to allow precipitation of larger particles, and a header tank to maintain a constant pressure in the irrigation system and to provide buffering for variations in water flow.

These components will be covered to obstruct light (and thus reduce algal growth) and potentially stocked with freshwater crustaceans that can consume suspended solids. Two IBC liquid storage tanks will be used to construct these components. One of the IBCs will be cut into two sections of 0.5m deep (settling tanks) and the other will be left intact (header tank). The IBC sections will be connected together via 4" pipe. The outflow to the irrigation network will be via 50mm pipe, fitted with a 100μm filter and a valve that can be closed to allow cleaning of the filter.

These two components will be dug into the ground and covered to prevent light intrusion from either the sides or top. Water surface level will be the same as that of the pond, and at least 0.2m higher than the surface of the highest terrace.

3) Desalinating agriculture system

The remainder of the site – approximately 625m^2 on the south side of the existing stream channel – will be devoted to a desalinating agricultural system, cultivating predominately perennial tree and shrub species. The primary focus of this system will be to produce livestock fodder, and thus reduce the largest single expense incurred by farmers in the community. Given that the water from the spring is slightly saline, the plants selected for growth here are those which actively assimilate salts from soils/water into their tissues, thus removing the salts from the environment. By ensuring water is delivered to the crops at the optimal rate – i.e. the rate at which they can take up salts – and taking steps to reduce evaporation from the soil (mulching, encouraging a dense canopy of vegetation, and reducing wind speeds) then we will be able to ensure that the long term effect of this agricultural system is soil improvement, rather than the soil salinization prevalent throughout the community at present.

This agricultural area will be levelled into two to three terraces, as terracing increases the opportunity for rainwater capture, and reduces runoff and associated soil erosion.

4) Desalinating wetland trial

It is proposed to construct three small constructed wetland systems on the north side of the spring (and thus not at risk of being trampled by livestock) to monitor the desalinating potential of various plant assemblages in a continual flow wetland system.

These systems will each be constructed from one 200L blue barrel cut longitudinally to make two channels, each of which will be filled with tuff (volcanic rock) and planted accordingly. Water flow will be managed to give a 0.5 – 1 day residence time within each system, with source water being drawn from the spring, and effluent water returning to the pool. On project completion, and as a follow on activity in the future, salinity of influent and effluent water will be measured and the desalinating potential of the various plant assemblages assessed.

Intervention activities

- Ascertain exact area available for project development (completed).
- Design intervention systems (completed).
- Take water samples and analyse spring water salinity, nutrient, mineral and contaminant content.
- Construct aquaculture pond
- Prepare and level terraces; build retaining walls where necessary
- Prepare terraces for tree planting (dig holes)
- Install irrigation network
- Bring and plant trees and shrubs
- Stock fish into pond
- Deliver training to beneficiary community – aquaculture, agroforestry and appropriate irrigation techniques

Materials lists

1) Aquaculture system

100m^2 Pond liner (0.6mm)
Round stones – sufficient for pond
Cement – sufficient for pond
20m of 50mm irrigation pipe
15m of 3” steel pipe
50mm pipe end cap with coarse filter
4x 50mm irrigation pipe elbow
1x fish seine net (6m length, 1.5m height)
1x fish scoop net
4m 4” pipe
2x 4” 45° pipe elbow

2x 4” pipe elbow
1x 4” pipe cap
6x 4” rubber grommet
100m^2 bird netting
200x tilapia fingerlings (*Sarotherodon galileus*)
50x freshwater shrimp fingerlings (*Machrobrachium rosenbergii*) if available
40kg aquaculture feed

2) Solids filtration

2x 1m^3 IBC tank (cubic, white tank in metal frame)
5x 4” rubber uniseal
1x 2” wall connector
2x 2” threaded elbow FM
1x 2” agricultural valve
1x 2”, 100µm filter
1x 2” to 1” FF reducer
1x 1” to 25mm irrigation pipe adapter
10m^2 lightproof insulation

3) Desalinating agricultural system

90 trees
235 grasses/herbs/shrubs
2500 m^2 cardboard
50 tonnes rotted manure
600m irrigation tubing 16mm
50m irrigation tubing 25mm
45x 25mm to 16mm connecting T-junctions
325 valves
120 bales straw (or equivalent shredded plant material)
Fleece (if available)

Species list:

Balanites aegyptiaca
Salvadora persica
Moringa peregrina
Prosopis nigra
Prosopis tamarugo
Prosopis juliflora
Sclerocarya birrea
Tamarix spp.
Phoenix dactylifera
Delonix regia
Geoffroea decorticans
Terminalia catappa
Ziziphus spina-christi
Purslane spp.
Atriplex spp.
Salicornia bigelovii
Acacia nilotica
Acacia tortilis
Faidherbia albida
Calotropis procera
Leucaena leucocephala
Chamaecytisus palmensis
Diplachne fusca

4) Desalinating wetland trial

3x 200L blue barrels
1m^3 Tuff (volcanic rock)
10m 25mm irrigation pipe
2x 25mm T junction
1x 25mm L
3x 25mm valve
3x 25mm to 1" adapter
1x 1" coarse filter
1x 2", 100µm filter
2x 2" to 1" FF reducer
6x 2" wall connector
6x 110mm pipe, 0.5m length
6x 110mm pipe cap
6x 110mm rubber grommet
6x 2" elbow FM

Monitoring equipment
1x refractometer
1x ammonia test kit
1x nitrate test kit
1x graduated measuring jug (2L)