Sustainability in the High Atlas Mountains of Morocco – Facing the Impacts of Climate Change

Mark Apel
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A composite computer reconstruction of fossils from Jebel Irhoud shows a modern, flattened face paired with an archaic, elongated braincase

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World's oldest *Homo sapiens* fossils found in Morocco

By **Ann Gibbons** | Jun. 7, 2017 , 1:00 PM

For decades, researchers seeking the origin of our species have scoured the Great Rift Valley of East Africa. Now, their quest has taken an unexpected detour west to Morocco: Researchers

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COP (Conference of the Parties) 22
Meeting on Climate Change –
Marrakech, November 2016

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High Atlas Foundation

For sustainable prosperity in Morocco

www.highatlasfoundation.org

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High Atlas Foundation

For sustainable prosperity in Morocco

The High Atlas Foundation is dedicated to catalyze economic growth and endorse grassroots development in disadvantaged communities throughout Morocco.

- Planting and distributing organic fruit and nut trees through nurseries managed by HAF (have already planted well over a million trees and are striving for a billion)
- Women’s Empowerment Training
- Youth and School Programs

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Grant through United Nations Environmental Programme

~$48,000 awarded to HAF in March of 2017

The GEF Small Grants Programme

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High Atlas Foundation

PROJET

"Contribution à la régénération des sols dégradés dans le Haut Atlas, pour soutenir le développement des activités génératrices de revenus, la préservation de la biodiversité et l'appui de l'économie locale, à travers le rétablissement la préservation, l'amélioration et la mise en valeur des terrasses agricoles des riverains et la lutte contre l'érosion et protection des berges de l'Oued Azzaden au Nord Ouest du Parc National du Toubkal."

Octobre 2016 à Septembre 2018

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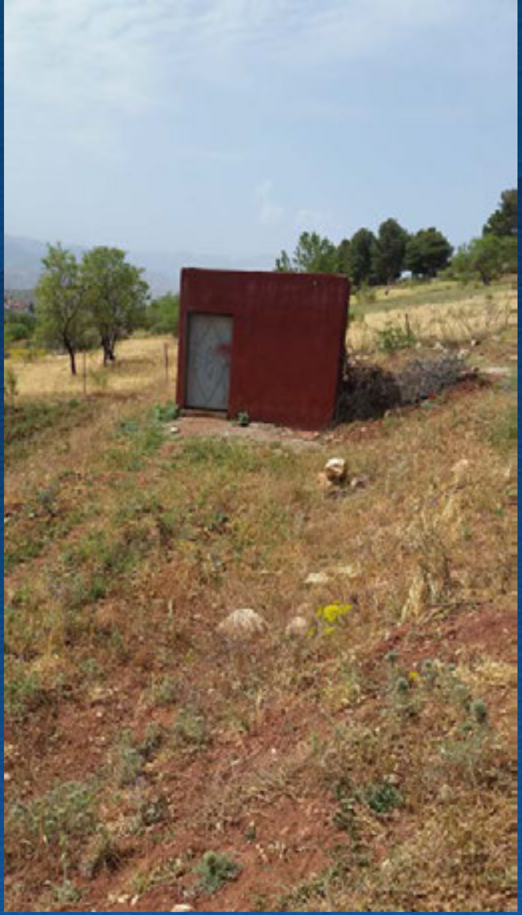

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Site Assessment

- Size of nursery
- Irrigation layout
- Water source(s)
- Pump type
- Well size
- Access to electricity (ONE 'grid')
- Water storage – existing or potential
- Issues related to water demand – is demand met in hottest parts of year?
- Potential for converting to solar pumps?
- Other issues - # trees distributed, status of trees, trespassing

NURSERY MANUAL

Important Considerations for Starting and Expanding HAF Nurseries

USAID FROM THE AMERICAN PEOPLE | FARMER-TO-FARMER | LAND O'LAKES INTERNATIONAL DEVELOPMENT

By Mark Apel, F2F Volunteer, April-May 2017

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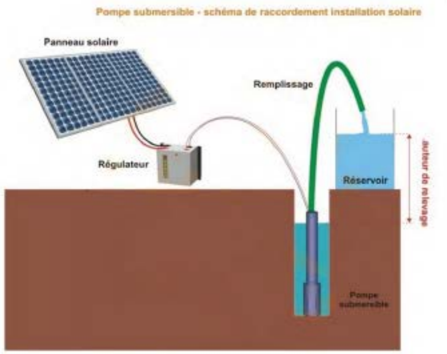


3. Solar-powered submersible electrical pumps

Most solar pumps are DC (courant continu), since the power that is generated by the photovoltaic panels is also DC. It is possible to use photovoltaic panels with submersible pumps that are powered by AC (courant alternatif), but these require an inverter and require more complex, expensive control systems. In all solar photovoltaic systems, an electrical controller (regulateur) is necessary to make sure that enough energy from the sun is available to power the pump. Too little energy and the pump will become damaged. Conversely, the electrical controller also makes sure that too much energy from the sun won't damage the pump motor.

However, where there is access to the electrical grid to power a submersible pump, then connecting to the grid is preferable, assuming reasonable connection costs, since monthly electrical costs are relatively low. Secondly, solar pumps only work during daylight hours and only when there is ample sunlight. Therefore, proper water storage is required. Ample water storage

Valves for distribution lines

Regulator – to control pressure, maintain 40 kpA to 100 kPa for drip tape

Régulateur de Pression pour...

Régulateur de pression plastiq spécial gaine MxF 3/4" Vendu à l'unité

Elbows

Coude pour gaine T.Tape

Coude pour gaine T.Tape ou Taldrip D. 16mm Vente à l'unité

"T" to connect from distribution line to drip tape

Té pour Gaine T.Tape

Té pour gaine T.Tape ou Taldrip Ø16mm Vendu à l'unité

Drip tape – flexible, perforated T. Tape purchased in large rolls

Gaine perforée T.Tape

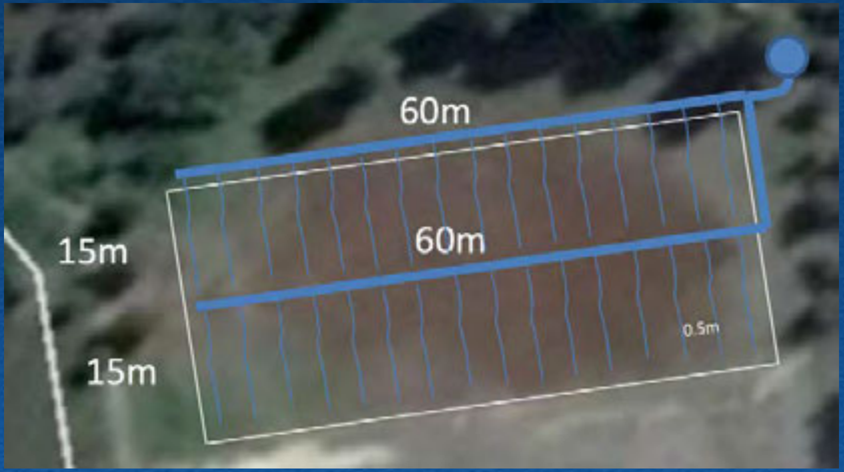
Gaine T.Tape perforée 150 microns non auto-régulante Vend par bobine de 675 ml

Example of components with cost estimates

Travaux d`installation du system d`arrosage	Unité	Quantité	Prix Unitaire en Dh	Total en Dh
Achat et mise en place de tuyau Ø 63	Ml	160	15	2,400
Achat et mise en place de vannes avec manchon de Ø 63	U	3	85	255
Achat et mise en place de coude Ø 63	U	1	15	15
Achat et mise en place de "T" Ø 63	U	1	20	20
Achat et mise en place de bouchon d'arrêt Ø 63	U	2	7	14
Achat et mise en place de vannettes	U	240	5	1,200
Départs joint	U	240	2.5	600
Achat et mise en place de gaine d`irrigation	Ml	4,000.00	0.8	3,200
Total				7,704

Irrigation – Steps to calculating how much drip tape is needed and how much water will be delivered

- Square meters of nursery x 2 = meters of drip tape needed (example: 1800 m2 x 2 = 3600m)



- Meters of drip tape x 3 or 4 or 5, depending on pressure (40 kPa to 100 kPa) = total potential output of water/hour for the nursery

For above example, this means output can vary between
10.8 m3 or 18 m3 per hour

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Frequency of Irrigation

- Norm is to water every 2 days for long periods, like 5 hours each time during hottest time of year.

- Irrigation expert Tom Kimmel recommends more frequent irrigation - every day – less volume of water – 2 hours each time.

In the end, this results in less pumping per week.

4 times/week x 5 hours each time = 20 hours of pumping

7 times/week x 2 hours each time = 14 hours of pumping

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Well grid-tied: 40 cm width, depth to bottom =80 meters, depth to water= 40 meters Current Discharge = 5,000 liters/hour (5 m3/hour) Cost of electricity = 120 to 200 dh per month

Province	Commune	Nom	Coordonnées			Supérficie (meters squared)	Espèce	Irrigation Type	Observations	Grid Tied?	Pump Type	Solar as an Option?	Other Solutions	Water Infrastructure Notes
			Latitude	Longitude	Altitude									
Al Haouz	Imegdal	Ighern	31° 6'12.75"N	8° 8'27.41"O	1101 m	24000 m2	Amandier, caroubier, cognassier, PAM		En fonction	No	No pump onsite - gravity fed from basin with at least 16 meters of head. Back up pump and line from nearby douar. Only needed when pipe from spring is cut.	No - If spring dries up or access to spring is compromised, then solar pump may be a good replacement for diesel-powered pump in adjacent douar.		Water piped 5 km from spring into an open basin (288 m3 volume) 180 m2 x 1.8 m depth; Spring produces 20 liters/minute (1.2 m3/hour) - has been running more or less like this since 1931; Basin gravity feeds to nursery with approximately 16 meters of head. Cost 50,000 dh to build (materials and excavation, hand labor was free); Back-up supply from a well in Douar
	Ourika	Ourika	31°23'35,36'' N	7°48'58,5'' O	813 m	10,000 m2 (1 ha)	Amandier, PAM, caroubier		En fonction	No	Diesel motor powered pump	Yes, need for solar pump, storage tank and automatic timer for irrigation		Diesel-powered pump - need data on depth, ouput, etc
	Tameslohte	Aknich	31°25'39.39"N	8° 2'21.31"O	701 m	2,000 m2	Figuier, grenadier, olivier, vignes, caroubier		En fonction	Yes	Electric submersible pump in place	No	Rainwater harvesting possible from roof of community center building with one or many storage tanks	**Well grid-tied**: 40 cm width, depth to bottom =80 meters, depth to water= 40 meters **Current Discharge** = 5,000 liters/hour (5 m3/hour) **Cost of electricity** = 120 to 200 dh per month **Irrigation:** they pump out well for one hour every day, and then well recharges fully after 24 hours, therefore currently irrigating 5 m3/day **Issue:** need for more irrigation (more than one hour/day) Maybe 10 m3/day?
	Asni	Tadmaint	31°14'11.90"N	7°51'43.12"O	1058 m	10,000 m2	Noyer, amandier		En fonction	No	No pump onsite - gravity fed from spring to basin	Yes, if spring is compromised and a		
	Tamaguert	Tamaguert	31°29'46 55'' N	7°29'14 38'' O	1086 m	2,000 m2	Figuier, grenadier, olivier, vignes, caroubier		En projet	yes	not yet - but likely will be electric grid-tied submersible	No		
	Ait Faska	Ait Faska	31°32'28 36'' N	7°39'27 91'' O	725 m	2,000 m2	Figuier, grenadier, olivier, vignes, caroubier		En projet	yes	not yet - but likely will be electric grid-tied submersible	No		
											Submersible pump powered by diesel generator	Yes Electricity direct to pump is an option,		Must water every other day for 5 hours each time 1 hour of

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