

Using *Acacia tortilis* demography to predict vegetation shift in the gravel plains of Sharjah, United Arab Emirates



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Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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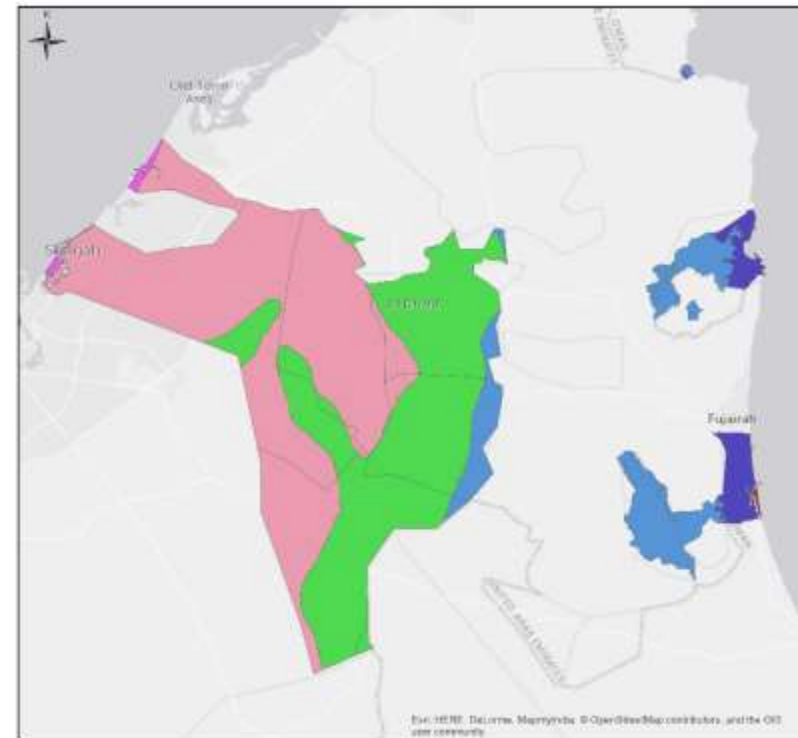
Google earth

Acacia tortilis gravel plains, Sharjah

- ▶ 30% of the Emirate
- ▶ Communal rangelands
- ▶ Alluvial/important recharge areas in foothills of the Hajar mountains.
- ▶ *Acacia tortilis*
 - ▶ Persist for extremely long periods in a healthy ecosystem
 - ▶ In hyper-arid environments recruitment is an infrequent event taking place only under specific environmental conditions.
 - ▶ Seedlings die off after extended periods of moisture deficits.



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Habitat data generated and
supplied by AGEDI



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Elebridi Protected Area



Elebridi Protected Area

- ▶ 1700 ha
- ▶ Proclaimed and fenced in 2012
- ▶ Previously communal grazing lands for camels, donkeys and goats.
- ▶ Recreational 4x4 driving
- ▶ *Acacia tortilis*, *Rhyza stricta*
 - ▶ Annual green flush 38 species
annual grasses (4), forbs (32)
and Geophytes (2)



Acacia tortilis recruitment and seedling survival

- ▶ Rainfall 2013/2014 >80 mm
 - ▶ Established 20 sample sites
 - ▶ January 2014: Counted and measured the heights of seedlings
 - ▶ Recounted in October 2014
 - ▶ Counted 'dead' seedlings.
 - ▶ Recounted January 2015
 - ▶ Rainfall = 10 mm
 - ▶ Counted resprouting seedlings
 - ▶ Seedling = any young tree below 15 cm in height.
- ▶
- Green flush
 - *A. tortilis* germination
 - resprout



Acacia tortilis recruitment and seedling survival

	Elebredi Protected Area	Communal rangelands
Seedlings/m ² After season*	4 ± 2.7	1 ± 1.6
Summer die-off	69.80 %	100%
Seedlings/m ² After summer	1 ± 2.9 (t ₉ =2.2, P<0.001)	0
Increase in seedling height	1.9 ± 6.9 cm	
Number of stems	increase from 1 to 2	
Resprouting	6 %	

Bruchid beetle infestation = 70 ± 16%

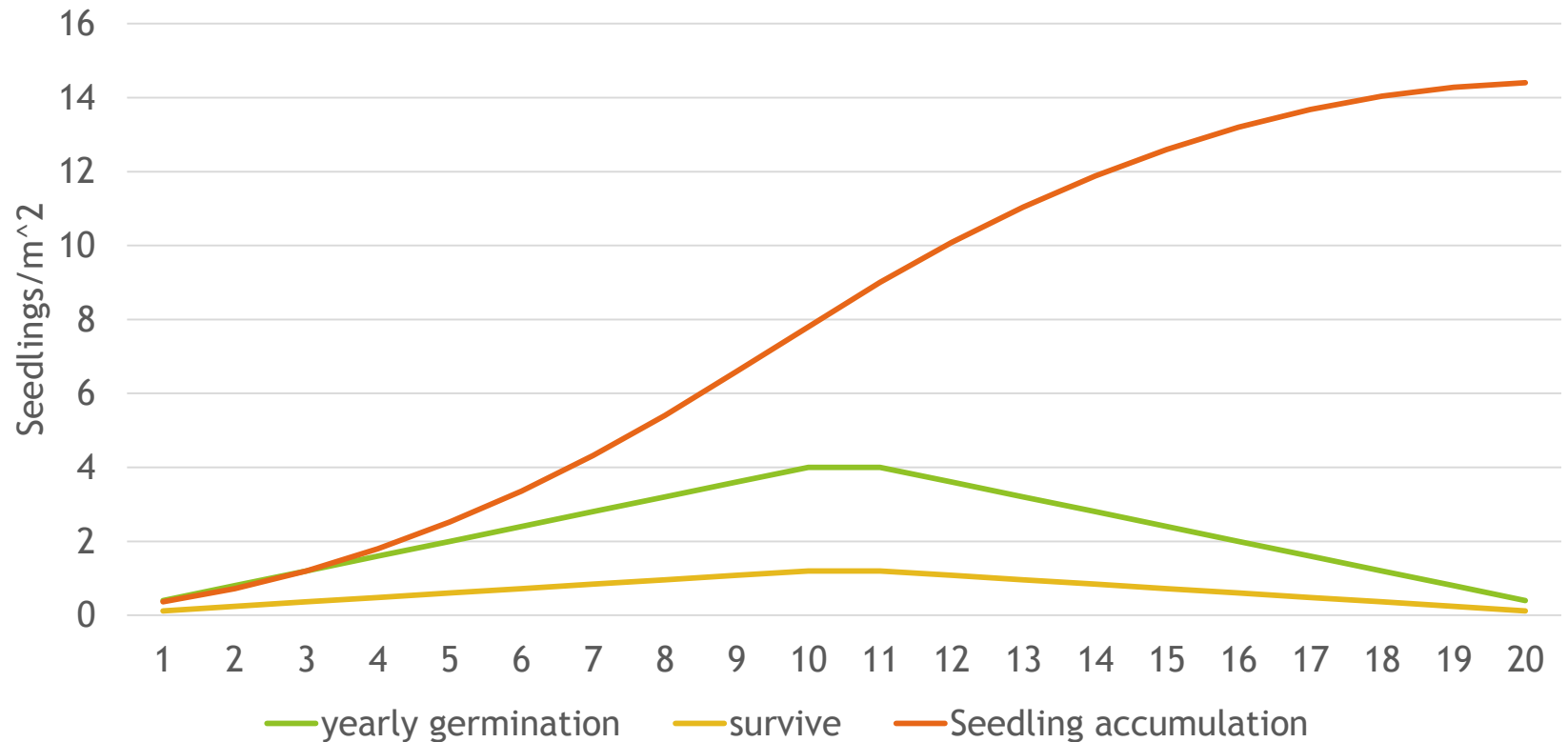
Why are seedling not surviving?

- ▶ In the Protected Area
 - ▶ Heat stress
 - ▶ Extremely low water availability
 - ▶ Competition
- ▶ Outside the protected area
 - ▶ Camel, donkey and goat grazing
 - ▶ Low Microhabitat availability
 - ▶ Homogenization of the landscape and no drainage gulleys.
 - ▶ Compacted soils



Simple population model

- ▶ 8-9 year rainfall cycle.
- ▶ Rainfall is sporadic
- ▶ 80 mm rain = germination and 10 mm rain = no germination
- ▶ Very simple model which will be strengthened with additional data over time.



Adult trees

	Elebridi Protected Area		Outside Protected area/communal rangeland	
	<u>Height (m)</u>	<u>Density (trees/km)</u>	<u>Height (m)</u>	<u>Density (trees/km)</u>
Tall	3.06 ± 0.905	1.56	5 ± 1.79	0.5
Medium	1.32 ± 0.32	0.6		
Small	0.54 ± 0.203	1.36	0.46 ± 0.371	0.8
Seedlings		26.48		2.7
Total tree		1.17		0.8

- ▶ Dead trees throughout the landscape in Elebridi Protected Area.
- ▶ No dead trees in the communal rangeland - removed for firewood



Can adult trees persist in the landscape

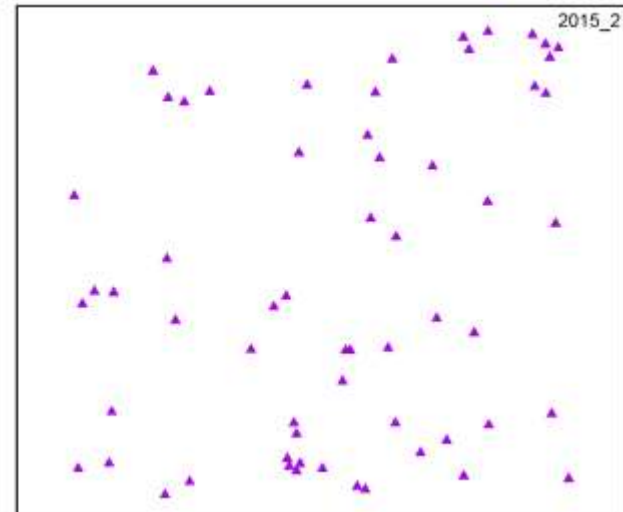
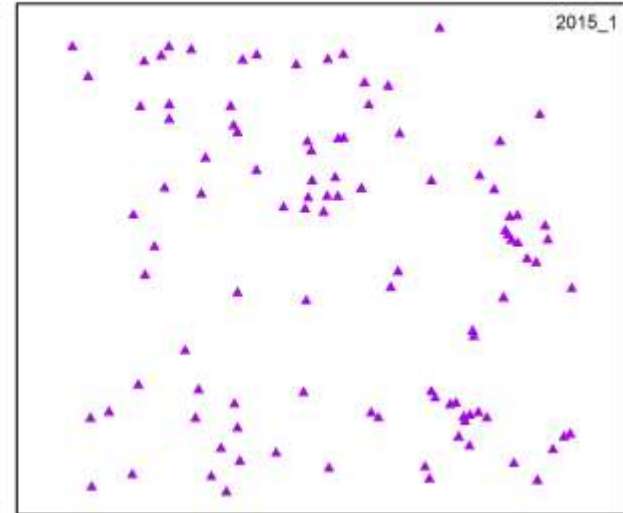
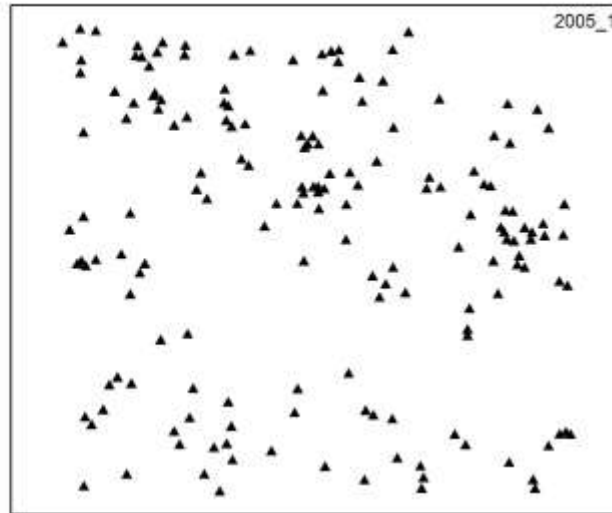
- ▶ Compared tree density between 2005 and 2015
- ▶ Used 25m aerial photography and Google Earth imagery
- ▶ Compared three 1km² plots

	Number of trees in 1 x 1 km sample plot		
	1	2	3
2005	165	100	207
2015	101	59	165
Change	-38.79 %	-41 %	-20.29 %



Population Decline

Tree loss between
2005 and 2015



Causes and implications of population decline

- ▶ Fire wood
 - ▶ Large trees
- ▶ Herbivory
 - ▶ Medium and small trees
 - ▶ Seedlings (additional impact from rodent populations)
- ▶ Reduced germination
- ▶ Seed availability - browsing
- ▶ Appropriate habitats for recruitment



Causes and implications of population decline

- ▶ Reduced ecological services
 - ▶ High runoff
 - ▶ Soil loss
 - ▶ Loss of annual seed bank - no green flush.

- ▶ Vegetation Change
 - ▶ Shrub species start to become the dominant plants
 - ▶ Unpalatable
 - ▶ When browsed they do appear to be quite sensitive.

Vegetation change

