Biophysical Field Methods in the Namib Desert

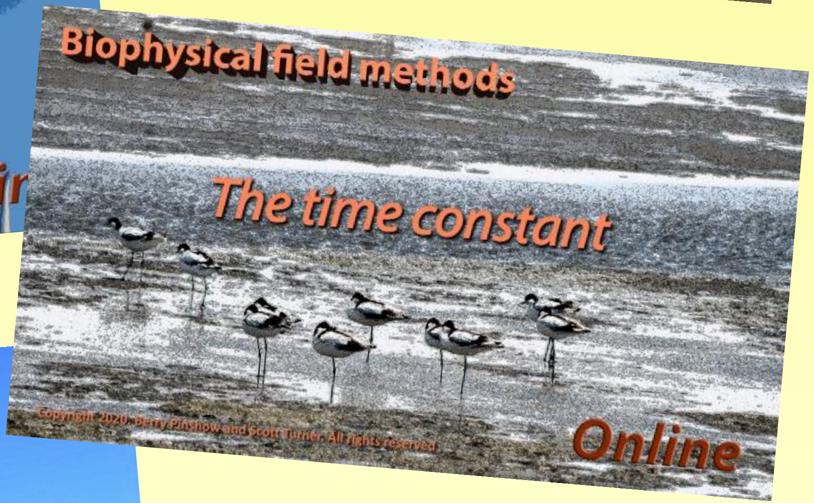
Adaptation to a harsh environment: the Namib desert. An international field workshop

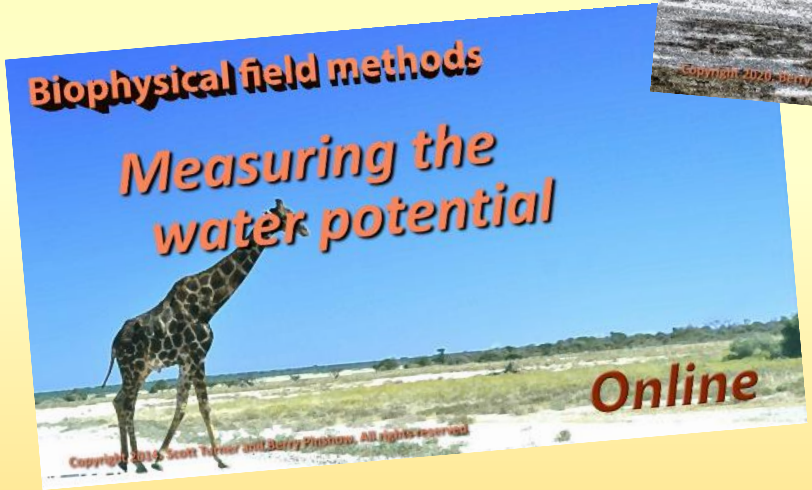
Gobabeb Namib Research Institute, 10-26 February 2020
Ben-Gurion University of the Negev

Before the course …

Prior to leaving for Namibia, students from Israel, Namibia, and South Africa take Biophysical Field Methods, an eight-week online course together to reach a common background level.

Biophysical Ecology in the Namib is the second part of a hybrid online / field course in the biophysics of adaptation to harsh environments.





BPFM Biophysical Field Methods Online

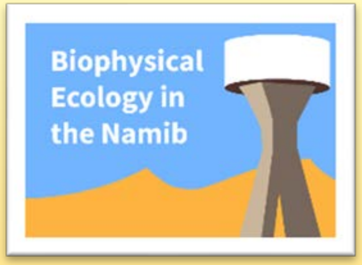
Off to Namibia …

Once students complete Biophysical Field Methods, it's off to Namibia.

For the Israeli students it's a long international flight to Walvis Bay!

Thức Nguyen and Ben Poodiack on the way.

Arrival in Walvis Bay!



Day 1. Settling in at Gobabeb

Students settle in to their accommodation

Gal Lupovitch

The day ends with a meal in the Gobabeb dining hall

Biophysical Ecology in the Namib

Day 2. Orientation

In the morning, Dr Eugene Marais takes everyone on a walk through the desert habitats around Gobabeb

In the riparian corridor of the Kuiseb River

On the dune crest

On a !nara hummock

Paulina Fendinat, Ailly Nambwandja, Prof Nurit Agam, Dr Dilia Kool

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Day 2. Orientation

We also took a bit of time to learn about the instrumentation we will be using.

Prof Scott Turner talks about operative temperature thermometers

Prof Berry Pinshow describes a psychrometer

Dr Dilia Kool demonstrates the micro-lysimeter …

… and a meteorological shield for a thermocouple

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Days 3-5: Field work

We divided up into three groups, for three days of hands-on field work

One problem studied was about desert beetles that are almost always black.

You would expect beetles inhabiting a hot sunny environment to be white!

But, they're black!

Why?

One group implanted fine thermocouples into black desert beetles to measure their operative temperatures in the sun

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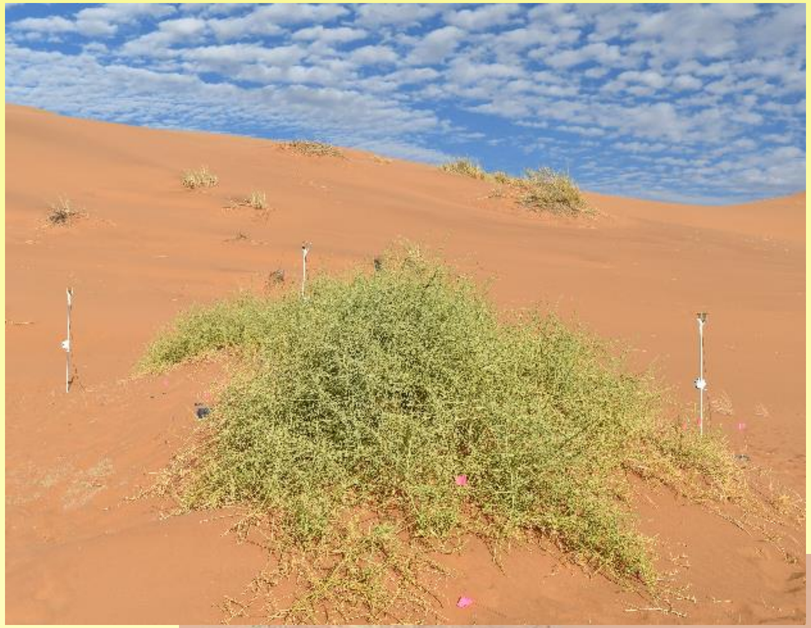
Days 3-5: Field work

A second question addressed was about the indigenous !nara plant (*Acanthosicyos horridus*).

The !nara lives in the dunes in an extremely dry desert, but uses a lot of water. Where does it get water from?
Does the water come from dew and fog?

We set out micro-lysimeters around a !nara thicket to measure air-borne water deposition in dune sands.



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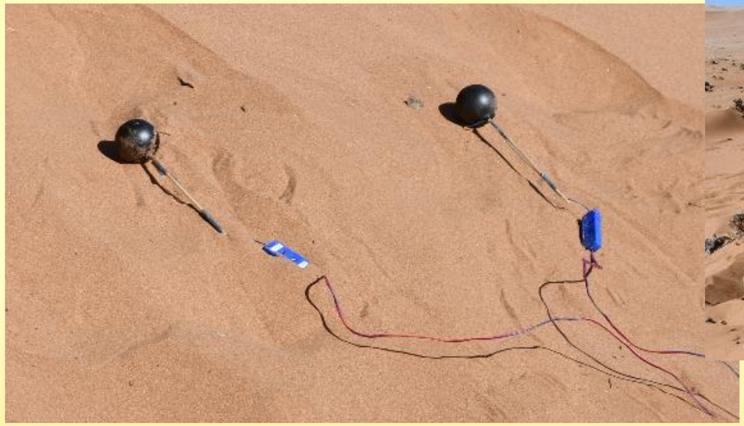
Days 3-5: Field work

The third group posed a question about thermal buffering.

We used operative temperature thermometers (made of painted ping-pong balls) to measure how their temperature responds when environmental temperature suddenly changes.

One ball was filled with water and had had high thermal capacity, while the other was empty and had low thermal capacity.



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Days 3-5: Field work

Each afternoon, we analyzed and discussed the data gathered in the morning.

There was also time to let our hair down.

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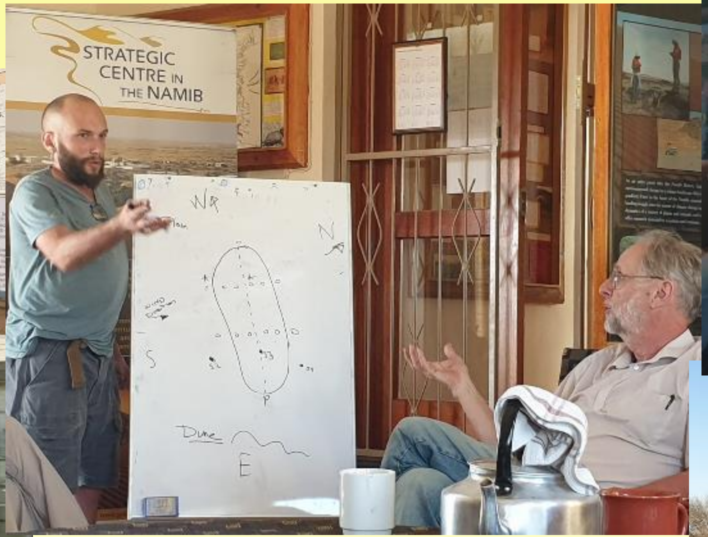
Day 6: Data analysis workshop

After three days of field work, we got down to making sense of the data.

We worked up draft slides to see what worked and what didn't



We had a charrette of posters at Gobabeb, to evaluate what makes a good (and what makes an ineffective) poster

We discussed our own data and how to make sense of them.

We had a sundown discussion about what science is …

… and what science isn't

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Day 7: Namib day trip

On the 7th day, we travelled to the Atlantic ocean, visiting lichen fields, geological formations and local cultural sites.

Arriving at the Walvis Bay lagoon

… watched the flamingoes …

… and had lunch.

Day 7: Namib day trip

In the afternoon we

… looked over the “moonscape” of Goanikontes on the Swakop River …

… checked out some *Welwitschia* …

… enjoyed sundowners looking in vain for *Lithops plants* at the Hamiltonberg …

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Days 8-10: Field work

How fast does a beetle have to run across a hot stretch of sand?

We measured how fast beetles run

Black Namib beetles are often seen running across hot sands. How do they avoid overheating?

One way is to run fast!

We measured temperatures along a transect between two !nara hummocks

Biophysical Ecology in the Namib

Days 8-10: Field work

Just how hot *do* beetles get?

We measured body temperatures of beetles walking across sand …

This involved some pretty close work

… we also used an infrared thermometer to measure beetle surface temperature

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Days 8-10: Field work

Do !nara hummocks actually capture fog?

Fog comes in overnight …

… so we spent the night at a !nara hummock …

… taking overnight measurements of water capture.

It looks like they do (sort of)

!Nara hummocks capture fog water (and so does everywhere else) …

… but !nara hummocks retain the water longer

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Day 12: Data analysis workshop (2)

After the second three days of field work, we learned new methods of data analysis.

Finally, we discussed the data as a group …

… and broke into smaller groups to analyze and interpret our data

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Days 13-14: Overnight trip into the dune sea

After an intense bout of intellectual work, it was time for an overnight outing into the dune sea.

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Days 13-14: Overnight trip into the dune sea

We enjoyed each others' company …

… cooked a nice meal …

… saw interesting nocturnal creatures …

… and woke up to a rare cloudy morning.

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Day 15. Poster workup

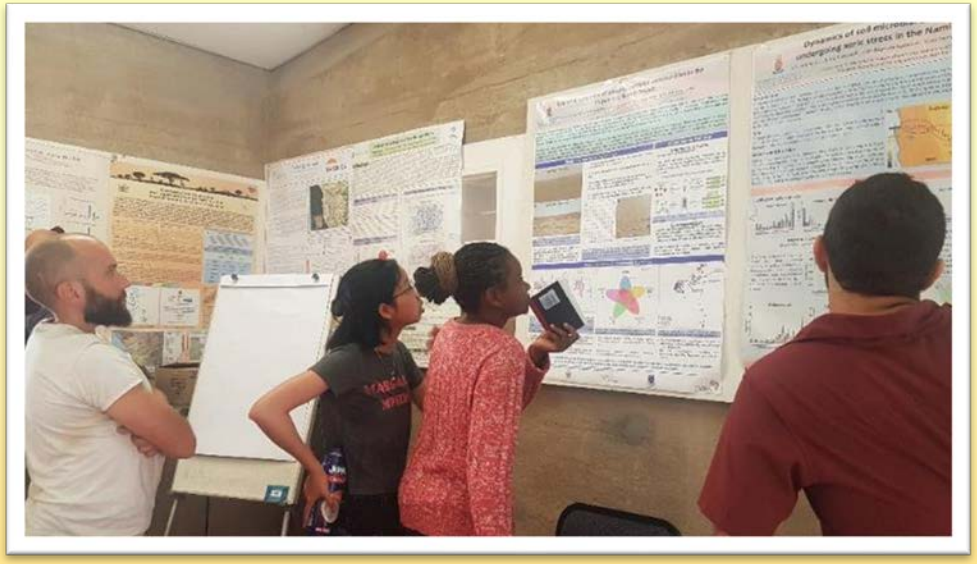
Then we set about making our own, preparing posters describing our findings..

First we had a poster design charette, learning from the work of others (left).

We thought, and worked, together …

… and alone …

… and critiqued each other's work



Day 16. Poster presentations

Then it was time to tell the Gobabeb staff what we had been doing

Prof Berry Pinshow opened the session

Dr Gillian Maggs-Kölling (Director of Gobabeb Namib Research Institute) welcomed us

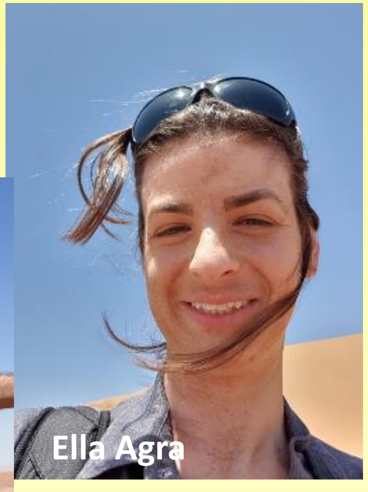
The entire Gobabeb staff attended

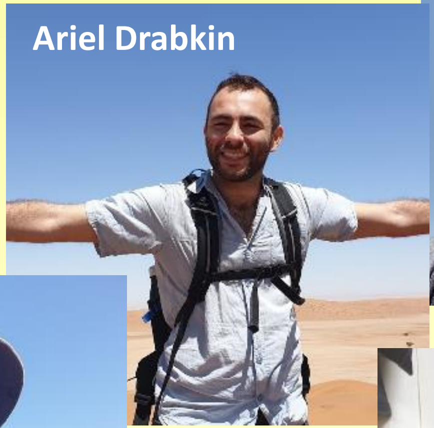
Prof Nurit Agam added her welcome

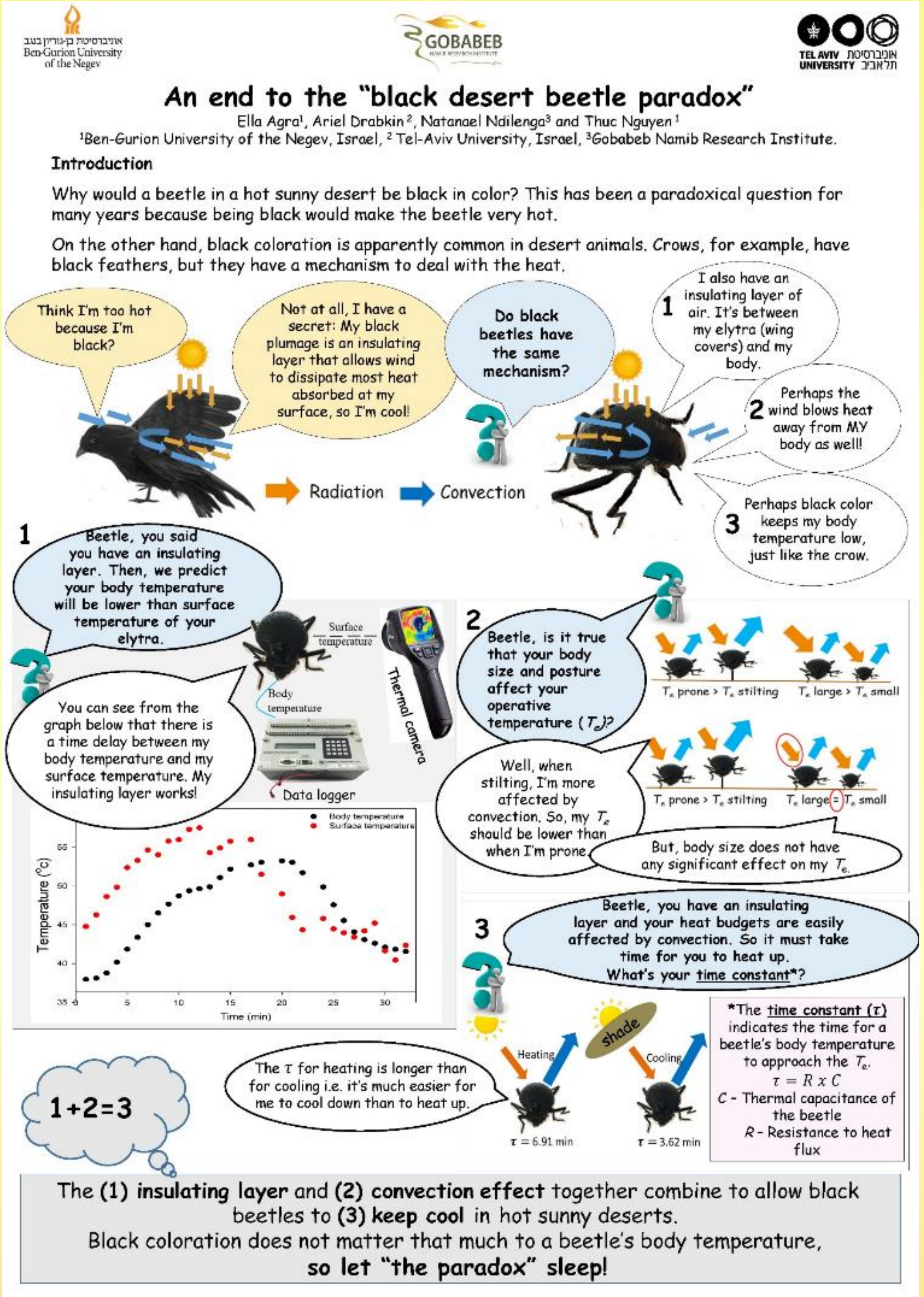
Biophysical Ecology in the Namib

Day 16. Poster presentations

The "Black Desert Beetle Paradox" solved!







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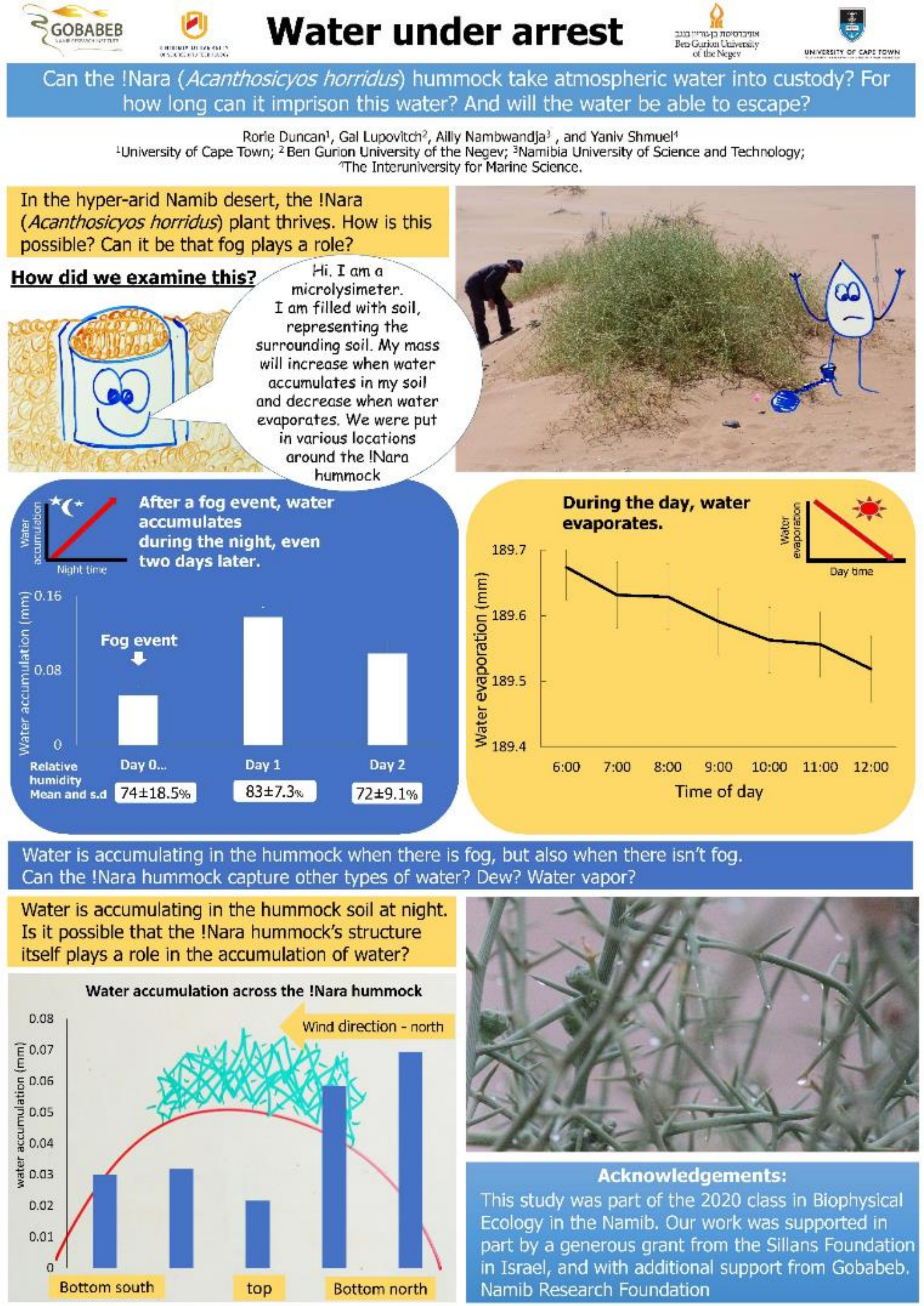
Day 16. Poster presentations

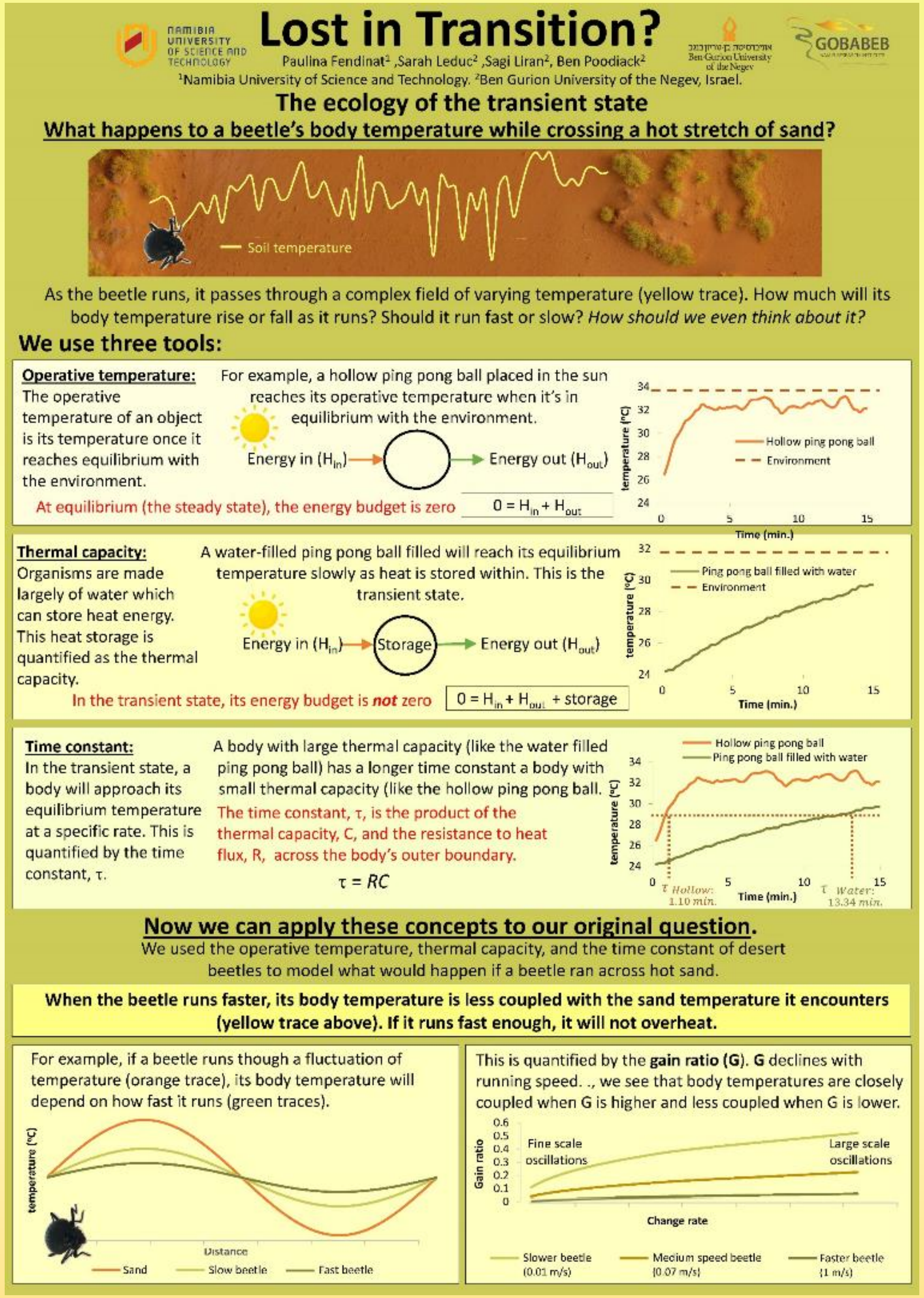
!Nara hummocks help retain water for a longer period



Biophysical Ecology in the Namib

Day 16. Poster presentations

Beetles can use thermal inertia to cross hot sands without overheating, but only if they run really fast.



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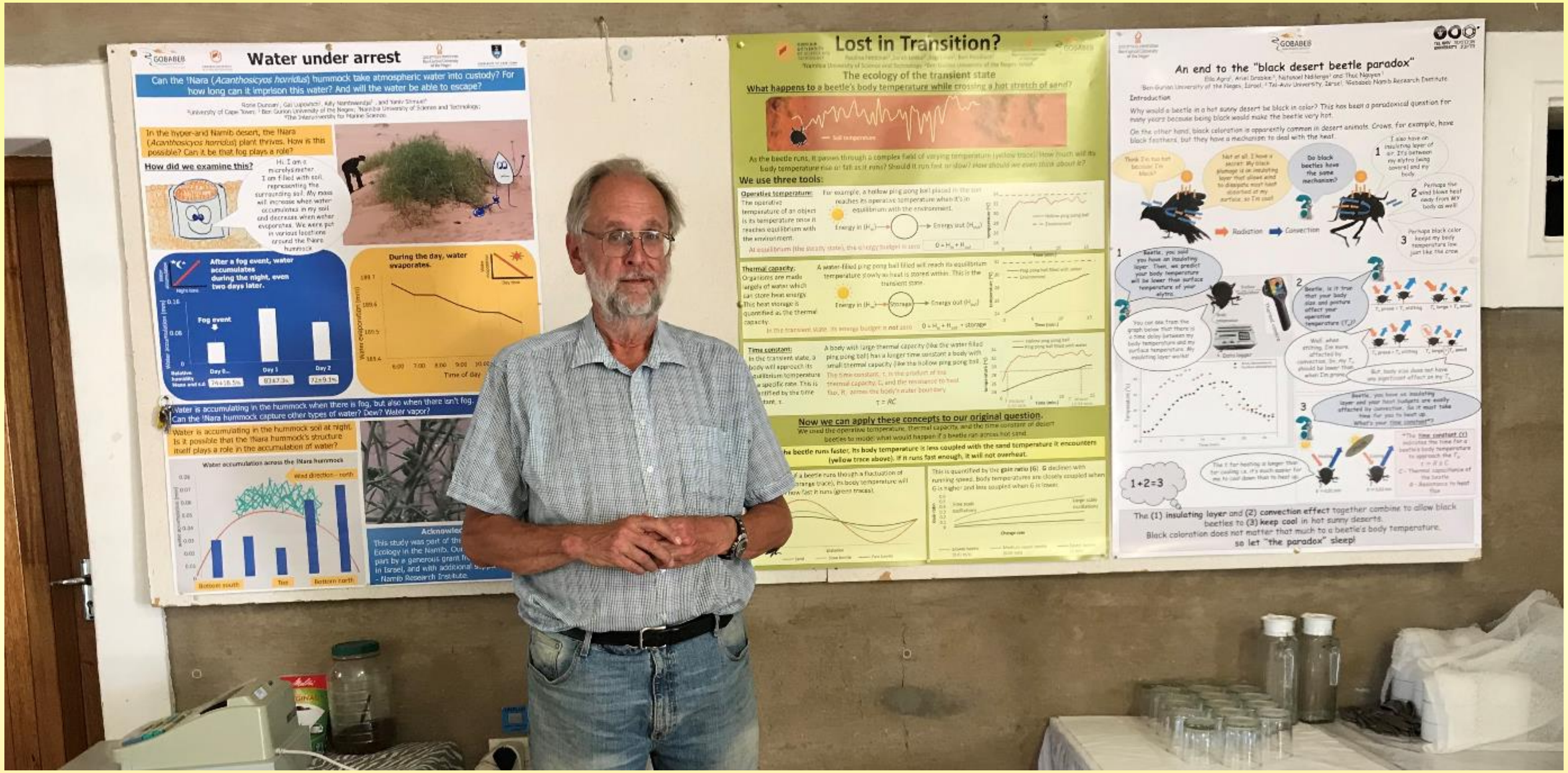
Day 16. Poster presentations

The posters are now on display in the dining hall at Gobabeb, for all to see.



Biophysical Ecology in the Namib

Day 16. We celebrate

Our last night at Gobabeb. We enjoy a good meal …

… and good libations

Biophysical Ecology in the Namib

Day 17. Departure

It was back in the bus from Gobabeb to Walvis Bay, where it all began.

We had a lot of fun, and learned a lot!

Biophysical Field Methods. Class of 2020

Thức Nguyen & Yaniv Shmuel

Natanael Ndilenga

Ella Agra & Liran Sagi

Biophysical Ecology in the Namib

Biophysical Field Methods. Class of 2020

Ariel Drabkin

Gal Lupovitch

Ben Poodiack

Rorie Duncan

Biophysical Field Methods. Class of 2020

Ailly Nambwandja

Sarah Leduc

Paulina Fendinat

Biophysical Ecology in the Namib

Biophysical Field Methods. Leaders

Berry Pinshow, Scott Turner, Eugene Marais

Gillian Maggs-Kölling, Nurit Agam

Nurit Agam

Biophysical
Ecology in
the Namib

Biophysical Field Methods. Leaders

Dilia Kool

Stuart Summerfield, Scott Turner

Biophysical Ecology in the Namib

2020 class: Biophysical Field Methods / Biophysical Ecology in the Namib

Biophysical Ecology in the Namib 2020

Instructors:
Profs. Berry Pinshow (BGU-BIDR), J. Scott Turner (SUNY-ESF) and Nurit Agam (BGU-BIDR), and Drs. Eugene Marais and Gillian Maggs-Kölling (Gobabeb Namib Research Institute)
Teaching Assistant: Dr. Dilia Kool (BGU); ***Technician:*** Stuart Summerfield (BGU);

Institutions:
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UNISA – University of South Africa
NUST - Namibia University of Science and Technology
UCT – University of Cape Town

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