



## Ecology of the Arava

**Coordinator: Dr. Elli Groner,**

3 weekly lecture hours and 2 one-day tours, 3 credits

### **Course description**

This course will present an overview of the ecology of the Arava Desert. In this course, basic principals of ecology and then desert ecology will be introduced. Student will learn about desert food webs, interaction between ecosystems, pollution and other risks to the conservation of the Arava. We will study the link between the Arava ecosystems. We will study plants, arthropods, mammals and birds of the terrestrial ecosystem and the principles and wildlife of the sea. While learning about different ecosystem and taxon we will study the anthropogenic impact on wildlife.

### **Grade components:**

Final exam 40%

Quizzes 15%

Participation, discussions 10%

Projects, exercises, homework 35%

Exams will be made up of multiple choice questions as well as some essay questions testing the understanding of the material and the ability to extrapolate to similar problems. Exercises will include written work on either the reading material or the material taught in class. Exercises will also include trip reports, linking the ecology of the area and anthropological pressures on the environment.

### Projects

1. Acacia trees – characteristics of wadis using aerial photos and ground truthing and validation. Project will be divided to 2 parts: the first is identical for the whole class and done individually. The second is done in groups of 3 with each group taking another wadi.
2. Biodiversity – working in pairs getting data and analyzing it for local ecosystems. Includes a written paper and an oral presentation.

### Readings:

The biology of deserts – David Ward 2009. Oxford university press. 339 pp

## **Classes**

### **Lesson 1**

Topic: Introduction to Ecology

Definition, history and disciplines of ecology.

Reading – none

### **Lesson 2**

Topic: Desert ecology principles

Definition of deserts, course structure, the difficulties of living in the desert, adaptations.

Reading:

- Ward pages 1-10

### **Lesson 3**

Topic Acacia trees in the Arava

Decline of the tree populations, causes and life history

Reading:

- Anthropogenic causes of high mortality and low recruitment in 3 Acacia tree taxa in the Negev desert, Israel – Ward and Rohner 1997

### **Lesson 4**

Topic: Landscape evolution of the Arava (Guest speaker: Hanan Ginat)

The formation of the geological units of the Arava, geomorphology and abiotic conditions for the life in the Arava

Reading:

- Natural history and evolution of the worlds deserts – Ezcurra, Global 2006

### **Lesson 5**

Topic: *Acacia hike*

Estimating population health, reading photo aerials, preparation for Acacia project

Reading:

- Three way interactions between Acacia, large mammalian herbivores and bruchid beetles – a review – Or and Ward 2003
- Acacia trees as keystone species in Negev desert ecosystems – Munzbergova and Ward

### **Lesson 6**

Topic: Conservation ecology

Principles of conservation, DPSIR model, ecosystem services

Reading:

- Ward pages 177 – 199

### **Lesson 7**

Topic: Samar sand dunes

Sand dunes, biodiversity, conservation

Reading:

- Shanas et al. 2010

## **Lesson 8**

Topic: Biodiversity

What is biodiversity, its importance and how to measure it

*Trisemester 1 exam (30 minutes)*

## **Lesson 9**

Topic: Biodiversity of the Arava

What is unique about the biodiversity of the arava. Explanation on the biodiversity project

Reading: none

## **Lesson 10**

Topic: conservation issues at the arava (Guest speaker: Taal Goldman)

anthropogenic impacts on the Arava landscape: causes and implications. SABABA's activities.

Relationships between government authorities, local people and nature.

- Reading – Ecosystem and human well-being MEA

## **Lesson 11**

Topic: Energy flow in the desert

HSS model, Oksanen theory, energy flow between plants and invertebrates, rainfall, unpredictability, heat, productivity and diversity

- Reading - How can high animal diversity be supported in low-productivity deserts? – Ayal *et al.* 2001

## **Lesson 12**

Topic: Water in the Arava (guest lecturer: Hanan Ginat)

Rainfall, runoff water, floods, climate change

Reading

- Do Acacia and Tamarix trees compete for water in the Negev desert? – Sher , Wiegand and Ward 2010

## **Lesson 13**

Topic: *Arava trip*

Samar Sand dunes, Chai Bar, Ein Evrona, Bird reserve

Reading:

## **Lesson 14**

Topic: Plant adaptations to the desert (guest lecturer: Pua Bar, 3 hours)

Adaptations of plants to dry and unpredictable conditions including CAM, phenology, accumulation of water, root dynamics. Flora of Israel, ecoregions, Arab-Saharo distributions

Reading

- Ward pages 29-65

## **Lesson 15**

Topic: Conservation issues in the Arava (guest lecturer: Benny Shalmon)

Priorities of the INPA, methods of nature protection

Reading:

- Arid Lands pages 97-116

## **Lesson 16**

Topic Ecosystems of the Arava (guest lecturer: Hila Sagie)

What are ecosystem services, cultural affect on the values of ecosystem services

Reading:

- The value of the world's ecosystem services and natural capital – Costanza et al 1997

## **Lesson 17**

Topic: Animal adaptations to the desert

How animal cope with the aridity, heat and low productivity

Reading:

- Jordan country study on biological diversity: The herpetofauna of Jordan – Ahmad Disi 2002. Pages 25-39

## **Lesson 18**

Topic: Conservation in the Negev

Preparations to the Negev trip

Reading:

- Ungulates of Makhtesh Ramon: dynamics, behavior, and their conservation implications – David Saltz
- plants species diversity and population dynamics in Makhtesh Ramon – David Ward

## **Lesson 19**

Topic: Landscape units of the Arava (guest lecturer: Hadas Nisim)

Heterogeneity of the Arava

Reading:

- Deserts and the planet – linkages between deserts and non-deserts – Safriel 2006

## **Lesson 20**

Topic: Conservation in the Negev

Reading:

- Ward pages 217 - 245

## **Lesson 21**

Topic: bird adaptation to deserts (guest lecturer: Anton Khalila)

Reading - TBA

## **Lesson 22**

Topic: bird migration via the Arava (guest lecturer: Anton Khalila)

Reading - none

## **Lesson 23**

Topic: Students presentation

The biodiversity project

Reading - none

## **Lesson 24**

Topic: Desert food webs

Reading:

- Adaptation of animals to desert conditions pages 47-69
- Invertebrates in hot and cold arid environments – L. Somme pages 237-242
- Energetic of desert invertebrates – H Heatwole pages 229-236

## **Lesson 25**

Topic: Socio-ecology of the Arava

Reading: none

## **Lesson 26**

Topic: Planning in the arava

Reading - none

## **Exam**

Extra readings:

- Evaluating the viability of Acacia populations in the Negev Desert: a remote sensing approach - Lahav-Ginott, Kadmon and Gersani 2001
- Ward pages 66-101
- Invertebrates in hot and cold arid environments – L. Somme pages 25-38