

The Root Zone: Soil Physics & Beyond



BARD-Hosted 2016 Kirkham Conference and the Research Workshop of the Israel Science Foundation

Ben-Gurion University of the Negev, Sede Boqer Campus,
Israel, 10-14 April



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SCHEDULE

- 18:00 Reception dinner at Sfinat Hamidbar
- 19:00 **Opening Lecture:** Hendrik Bruins, Ben-Gurion University of the Negev
Planning for food security: Global perspectives, roots and reserves
- 20:00 Ensemble Joya

Welcome!



- 9:00-9:20 **Welcome and Opening Remarks**
Naftali Lazarovitch, Ben-Gurion University of the Negev
Dan Blumberg, Vice President and Dean for Research and Development, Ben-Gurion University of the Negev

Session 1: Don Kirkham

Prsident: Brent Clothier, Plant & Food Research

- 9:20-9:50 Jan Hopmans, University of California, Davis
Progress in root zone research: A tribute to Don Kirkham
- 9:50-10:20 *Kirkham Medal Ceremony*
Rien van Genuchten, Federal University of Rio de Janeiro
Going back to our roots

10:20-11:00 **Coffee Break** (KKL Building)

Session 2: Water flow and uptake

Prsident: Uri Shani, Hebrew University of Jerusalem

- 11:00-11:30 Mathieu Javaux, Université catholique de Louvain
Modeling root water uptake and growth in heterogeneous soils
- 11:30-12:00 Maciej Zwieniecki, University of California, Davis
Active control of water fluxes in plants
- 12:00-12:30 Jirka Simunek, University of California, Riverside
Modeling root water and nutrient uptake using a macroscopic approach
- 12:30-12:45 Valentin Couvreur, Université catholique de Louvain
An upscaling model describing root radial hydraulic conductivity from cross-section anatomy and aquaporin expression patterns
- 12:45-13:05 Discussions
- 13:05-14:30 **Lunch** (KKL Building)
Sede Boqer room check-in

Session 3: Root respiration and soil aeration

President: Shmulik Friedman, ARO, Volcani Center

- 14:30-15:00 Scott Jones, Utah State University
Considerations for growing plants in the reduced gravity of space: gas percolation and root intrusion effects in porous media
- 15:00-15:30 Shimon Rachmilevitch, Ben-Gurion University of the Negev
Root respiration in response to abiotic stress and neighbors
- 15:30-15:45 Indira Paudel, ARO, Volcani Center
Quantifying the CO₂ transported in xylem and soil in grapefruit orchards
- 15:45-16:00 Ilan Ben-Noach, ARO, Volcani Center
Barrel experiments for evaluating the effects of oxygation of clayey soils on pepper yield and continuum modeling of air injection into the root zone
- 16:00-16:20 Discussions
- 16:20-17:00 **Coffee Break** (KKL Building)

Session 4: Solute uptake by roots

President: Moshe Silberbush, Ben-Gurion University of the Negev

- 17:00-17:30 Hans Lambers, The University of Western Australia
Plant phosphorus acquisition strategies on the world's most phosphorus-impooverished soils
- 17:30-18:00 Jonathan Lynch, Pennsylvania State University
Anatomics: exploiting root anatomical phenes to develop crops with improved soil resource capture
- 18:00-18:15 Uri Nachshon, ARO, Volcani Center
Soil structure and texture manipulation to control root zone salt distribution
- 18:15-18:30 Travis Luc Goron, University of Guelph
Root acclimation responses by finger millet to nitrogen starvation
- 18:30-19:00 Discussions
- 19:00 **Dinner** (Dining Room)
- 21:00 **Pub & Music**

6:30-8:00 Early morning desert walk (optional, meeting at Field School)

Session 5: Root-soil interface and noninvasive measurements

Prsider: Alex Furman, Technion, Israel Institute of Technology

8:30-9:00 Jan Vanderborght, Forschungszentrum Jülich
Combination of root zone process observations with process models

9:00-9:30 Andrea Carminati, Georg-August University Goettingen
Biophysical rhizosphere processes affecting root water uptake

9:30-10:00 Tiina Roose, University of Southampton
Multiscale image-based modelling of plant soil interaction

10:00-10:15 Nele Friederike, Richter-Harder, Georg-August-University of Goettingen
Hydraulic conductivity of roots, soil and their interface

10:15-10:35 Discussions

10:35-11:15 **Coffee Break** (KKL Building)

Session 6: Root morphology, architecture and growth

Prsider: Alon Ben-Gal, Volcani Center

11:15-11:45 Boris Rewald, University of Natural Resources and Life Sciences
A root is a root is a root? The importance of differentiating between root types

11:45-12:15 Alain Pierret, Institut de Recherche pour le Développement
The role of deep roots in deep critical zone processes

12:15-12:45 Hinanit Koltai, ARO, Volcani Center
Strigolactones are regulators of root development and response to phosphate deficiency

12:45-13:00 Sigal Savaldi-Goldstein, Technion - Israel Institute of Technology
Regulation of root growth by brassinosteroids

13:00-13:20 Discussions

13:20-14:50 **Traditional Israeli Lunch** (Midrasha center)

Session 7: Biophysical processes in the soil

Prsident: Pedro Berliner, Ben-Gurion University of the Negev

- 14:50-15:20 Paul Hallett, University of Aberdeen
Rhizosphere by design: root traits that physically manipulate soil
- 15:20-15:50 Teamrat Ghezzehei, University of California, Merced
Rhizosphere hydrodynamics: how do roots modulate flow and transport properties in their immediate environment
- 15:50-16:05 Nimrod Schwartz, Université catholique de Louvain
The impact of mucilage exudate on root water uptake: a numerical study
- 16:05-16:20 Ravid Rosenzweig, Geological Survey of Israel
Direct measurement of hydraulic properties of unsaturated biofilm-affected soils
- 16:20-16:40 Discussions

Session 8: Poster Session and Dinner

Prsidents: Adi Perelman and Naftali Lazarovitch, Ben-Gurion University of the Negev

At the lobby of the French Associates Institute for Agriculture and Biotechnology of Drylands

- 17:00-18:00 Flash two-minute oral presentations by poster authors
- 18:00-19:00 Mingling and discussions
- 19:00-21:00 **Dinner & Music**

Poster authors and titles

- | | | |
|---|---|---|
| 1 | Nicolai P. Koebernick
<i>University of Southampton</i> | Root hair impact on soil structure formation in the rhizosphere |
| 2 | Harini Rangarajan
<i>Pennsylvania State University</i> | Multi-objective optimization of root systems using evolutionary algorithms: matching root systems and environments |
| 3 | Hannah Schneider
<i>Forschungszentrum Jülich</i> | Root cortical senescence influences radial water and nutrient transport in barley |
| 4 | Gaochao Cai
<i>Forschungszentrum Jülich</i> | Parameterization of root water uptake models that consider dynamic root distributions and compensation |
| 5 | Nathaniel A. Bogle
<i>University of California, Berkeley</i> | Effect of native shrubs on water retention, hydraulic conductivity, and soil surface evaporation in the peanut basin, Senegal |
| 6 | Jessie Godfrey
<i>University of California, Davis</i> | Salt exclusion and dilution through dispersal in pistachio |
| 7 | Yong Zhou
<i>Texas A&M University</i> | Landscape-scale spatial patterns of root distribution along the soil profile: linking aboveground plant communities to belowground biogeochemical cycling |
| 8 | Sarah Garre
<i>Université de Liège</i> | Impact of tillage practices on soil moisture dynamics in a temperate climate: potential of 3-D electrical resistivity tomography (ERT) |

Poster authors and titles (continued)

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|----|--|--|----|---|--|
| 9 | Fabio J. Mallmann
<i>University of California, Riverside</i> | Effects of plant roots on modelling the vertical transport of copper and zinc in a clayey oxisol contaminated by long-term pig slurry amendments | 18 | Dagmar van Dusschoten
<i>Forschungszentrum Jülich</i> | Correlating root length densities with vertical soil water depletion profiles |
| 10 | Laura J. Cooper
<i>University of Southampton</i> | Image-based modelling of two fluid flow in soil | 19 | Tamir Kamai
<i>ARO, Volcani Center</i> | A perfect-conductor approach for the heat-pulse method |
| 11 | Adi Perelman
<i>Ben-Gurion University of the Negev</i> | Plant water-uptake effects on salt distribution at the root-soil interface | 20 | Jennifer Pett-Ridge
<i>Lawrence Livermore National Lab</i> | Carbon transformations in the rhizosphere: the critical role of microbial functional capacity |
| 12 | Mary Beth Kirkham
<i>Kansas State University</i> | Root uptake of heavy metals from an abandoned mine site | 21 | Ido Regev
<i>Ben-Gurion University of the Negev</i> | Root system development as a stochastic growth process |
| 13 | Shmulik Friedman
<i>ARO, Volcani Center</i> | Factors affecting the aeration status of the root zones in drip-irrigated orchards | 22 | Amar Singh
<i>Technion - Israel Institute of Technology</i> | Activity of the brassinosteroid transcription factors BZR1/BES1 blocks developmental reprogramming in response to low phosphate availability |
| 14 | Alon Ben-Gal
<i>ARO, Volcani Center</i> | Applied physics for water and nutrient use efficiency: ultra-high frequent application and salinity and their effects on root uptake | 23 | Effi Tripler
<i>Arava R&D</i> | Laboratory validation of compensative root water uptake |
| 15 | Tamir Klein
<i>ARO, Volcani Center</i> | Belowground carbon trade among tall forest trees | 24 | Nicole Rudolph-Mohr
<i>University of Potsdam</i> | Multi-imaging approach to study the root-soil interface |
| 16 | Andrew Ireson
<i>University of Saskatchewan</i> | Estimation of field-scale root zone soil moisture | 25 | Chen Fengxian
<i>Ben-Gurion University of the Negev</i> | Surface activity of root mucilage at the solid-liquid-air interfaces: the effect of polysaccharide/lipid ratio |
| 17 | Helena Guerra
<i>Katholieke Universiteit Leuven</i> | Linking soil-root interface and bulk salinities to improve macroscopic modeling of osmotic stress effects on root water uptake | 26 | Robert Heinse
<i>University of Idaho</i> | Morphology of soil pipes created by root decay and combustion |

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| 27 | Andreas Pohlmeier
<i>Forschungszentrum Jülich</i> | Imaging of root water uptake by MRI in combination with tracer motion |
| 28 | Dilia Kool
<i>Ben-Gurion University of the Negev</i> | Evaluation of heat-pulse sensor to measure evaporation in a desert vineyard |
| 29 | Ido Nitsan
<i>ARO, Volcani Center</i> | The effects of plant roots on the hydraulic conductivity of water-saturated soils |
| 30 | Allen G. Hunt
<i>Wright State University</i> | From soils to allometry |
| 31 | Ellen R. Graber
<i>ARO, Volcani Center</i> | Do organic chemicals that accompany biochar play a role in plant growth? A study of root hair development in Arabidopsis as affected by humic-like substances extracted from biochar |
| 32 | Patompong Saengwilai
<i>Mahidol University</i> | Genetic variation for root architecture in response to drought stress of maize inbred lines in the Drought Tolerant Maize for Africa (DTMA) project |
| 33 | Laura Satkowski
<i>University of Missouri</i> | Sorption and transport of imidacloprid in agroforestry buffer, grass buffer and cropland soils |
| 34 | Shmuel Assouline
<i>ARO, Volcani Center</i> | Impact of water regime and growing conditions on soil-plant interactions: from single plant to field scale |

Educational trip in the Dead Sea area

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|-------------|---|
| 7:00-7:40 | Drive, Sede Boqer Campus - HaMakhtesh HaGadol |
| 7:40-8:10 | Breakfast (Colored sands) |
| 8:50-10:15 | Coffee, Kikar Sdom Zohar experimental station:
Commercial vegetable production; get together with BARD TAC members & staff.
Presentation: BARD Operations and Funding Opportunities |
| 10:30-11:00 | Overlook on Southern Dead Sea and the Dead Sea Works |
| 11:00-13:30 | Floating in the Dead Sea near the Crowne Plaza Hotel and Lunch at hotel area (Ein Bokek) |
| 13:45-15:30 | Masada National Park |
| 17:00-19:00 | Bikaat Arad - wastewater treatment and irrigation of orchards |
| 19:10-21:10 | Dinner (Arad) |

Session 9: Rhizosphere heat regime

Presider: Noam Weisbrod, Ben-Gurion University of the Negev

- 8:30-9:00 Robert (Bob) Horton, Iowa State University of Science and Technology
Heat transfer in the root zone: measurements, models, and unresolved questions
- 9:00-9:20 Or Sperling, ARO, Volcani Center
Temperature gradients within trees assist carbohydrate allocation
- 9:20-9:40 Moses Kwame Aidoo, Ben-Gurion University of the Negev
*Mechanisms associated with the tolerance of bell pepper (*Capsicum annum L.*) root zone response to low temperature*
- 9:40-10:00 Elad Levintal, Ben-Gurion University of the Negev
Free and forced convection in high-permeability porous media
- 10:00-10:20 Discussions
- 10:20-11:00 **Coffee Break** (KKL Building)

Session 10: Rhizosphere microbiome

Presider: Harry Vereecken, (Forschungszentrum Jülich)

- 11:00-11:30 Mary Firestone, University of California, Berkeley
The interconnected rhizosphere
- 11:30-12:00 Dror Minz, ARO, Volcani Center
The root zone from the microbial point of view
- 12:00-12:30 Yan Jin, University of Delaware
Plant-growth promoting rhizobacteria enhances plant drought stress tolerance by mediating physicochemical and hydrological changes in rhizospheric soil
- 12:30-12:45 Rachel Neurath, University of California, Berkeley
Rhizosphere control of soil carbon association with fresh mineral surfaces
- 12:45-13:05 **Discussions**
- 13:05-14:00 **Lunch** (Dining Room)
- 14:00-17:00 **Discussion, summary and conclusions**
(Presider: Jan Vanderborght, Forschungszentrum Jülich)

GENERAL INFORMATION

Wireless Connection on Campus

In order to connect to the wireless network, please follow the below procedure

1. Connect to the wireless network called just4visitors (this is a non-secure network)
2. After connecting, surf to any site using your browser (make sure that your browser is not set to work with the proxy server on the browser)
3. On the screen that will appear, choose OK

Meeting & Sitting Area:

Participants are invited to take a few minutes to relax in between lectures, as well as interact with fellow participants at the faculty lounge (previously known as the KKL meeting & sitting area).

Refreshments & pastries will be available at coffee breaks only. There is a wireless connection at this site.

Accommodation and Baggage Storage:

On Monday, April 11, we will be changing our lodging location from Mashabim to the facilities on campus (either the Field School or the University Guest House rooms).

There is a baggage storage room available in the Evens Hall building. Please note that regular check-in time is at 2 pm and therefore check-in and transfer of baggage will take place during the (longer) lunch break on Monday. There will be a conference vehicle check-in luggage and participants, although it is within a walking distance.

Check-out time is by 10 am. Therefore, please make sure on the morning of your departure, to take your belongings with you and properly check out of your hostel/ guest house. You will be able to use the same storage facilities at the Evens building, on the day of departure, and again, there will be a conference vehicle available to transport luggage from the accommodation area to the conference

Halls at about 8:30 each morning. Please coordinate with the organizers at the registration/information desk, or contact Amber, our guest coordinator.

Supplies, Banking and Shopping

The “commercial center” of Midreshet Ben-Gurion (where the Sede Boqer Campus is located) has a supermarket (with an indoor cash withdrawal option), post office (with some limited banking options) and some shops. Additional and larger commercial facilities can be found at the nearby towns of Mitzpe-Ramon, Yerukham and, of course, metropolitan Beer-Sheva. Please check at the registration desk for more details.

General Advice:

The Sede Boqer Campus is located amidst beautiful scenery. If you are lucky, you will notice herds of ibexes wandering in the area... However, we recommend that you do not wander off very far into the desert alone. Distances in the desert are difficult to judge, and flash floods on rainy days in this area are extremely dangerous and unpredictable.

Still have a question?

The Conference Secretariat is here to help! Please approach the registration/information desk for more details and answers to your queries. After conference hours, if your problem has not been resolved, and in particular, in cases of emergency you may always call the relevant person from the following list:

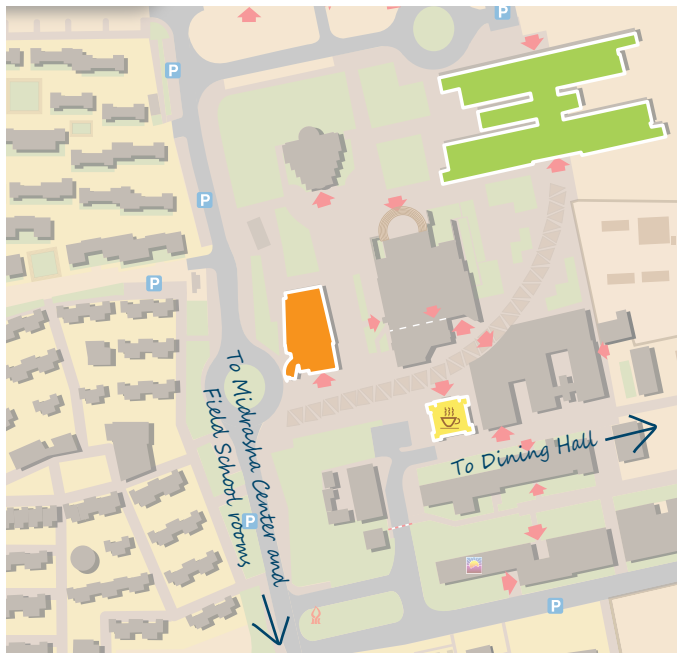
CONTACT DETAILS




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Dorit Korine, Event Coordinator +972-52-3541375

Sede Boqer Campus Map



-  George Evens Family Auditorium
-  Faculty Lounge (KKL Building)
-  French Associates Institute for Agriculture and Biotechnology of Drylands