David Pearlmutter October, 2020

BRIEF CURRICULUM VITAE

• Personal Details

David Pearlmutter

Birth: 16/3/1962, New Jersey, USA

Immigration to Israel: 8/7/1987

Work: Department of Geography and Environmental Development / Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede-Boqer Campus 84990 Israel, +972-8-6596879, davidp@bgu.ac.il

Home: PO Box 23 Midreshet Ben-Gurion 84990 Israel, +972-52-3747109

• Education

B.Arch. – 1981-1986, University of Texas at Austin, School of Architecture

M.A. – 1992-1996, Ben-Gurion University of the Negev, Department of Geography and Environmental Development. Advisors: Prof. A. Bitan and Prof. Y. Gradus
Thesis title: "The effects of urban geometry on microclimatic conditions in a desert city"

Ph.D. – 2000-2006, Technion - Israel Institute of Technology, Faculty of Architecture and Town Planning. Advisors: Prof. P. Berliner and Prof. E. Shaviv
Title of thesis: "The microclimatic influences of urban surface geometry: A physical modeling study in hot-arid conditions"

• Employment History

2019-	Full Professor, Department of Geography and Environmental Development / Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev
2017-2019	Adjunct Researcher (Associato), Institute for Biometeorology (IBIMET), Italian National Research Council (CNR), Florence, Italy
2016-2019	Visiting Researcher (sabbatical, September-February), Institute for Biometeorology (IBIMET), Italian National Research Council (CNR), Florence, Italy
2009-2019	Associate Professor, Bona Terra Department of Man in the Desert, Swiss Institute for Dryland Environmental and Energy Research, Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev
1996-2009	Senior Researcher (tenured), Department of Man in the Desert, Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev
2001-2002	Visiting Scholar (sabbatical), School of Architecture, College of Architecture Planning and Landscape Architecture, University of Arizona, Tucson Arizona
1987-1996	Architect/Researcher, The Desert Architecture & Urban Planning Unit, Jacob Blaustein Institute for Desert Research, Ben-Gurion Univ. of the Negev

• Professional and educational activities

Professional activities

2008-present	International Association for Urban Climate – Board member and Editor, *Urban Climate News: Quarterly Newsletter of the IAUC*
2010-2016	Chair, Department of Man in the Desert, Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev
2010-2011	Israel Green Building Council – Education Committee and academic chair of professional course: *Green Building: From Theory to Practice*
2011-2014	University Senate, Ben-Gurion University of the Negev
2012-2017	Aviv Consulting – National Green Building Pilot Project (Head of research team, funded by Israel Ministry of Environmental Protection)
2013-2017	European Commission – Vice-Chair of COST Action FP1204, "Green Infrastructure approach: linking environmental with social aspects in studying and managing urban forests" (*GreenInUrbs*). Israeli representative, member of Management Committee and Editor of published book summarizing the work.
2018-2022	European Commission – Chair of Working Group on Built Environment, COST Action CA17133, "Implementing nature based solutions for creating a resourceful circular city" (*CircularCity*). Israeli representative, member of Management Committee and lead author of initial review paper.

Courses taught

1989-1990	"Introduction to Bio-Climatic Design," Bezalel Academy of Fine Arts, Department of Environmental Design (with Y. Etzion, I.A. Meir and E. Erell).
1992-2000	"Fundamentals of Environmentally Responsive Architecture in Desert Regions," Ben-Gurion University School of Continuing Education.
1997-2000	"Climate-Conscious Architectural Design," WIZO Neri-Bloomfield College of Environmental Design (with Y. Etzion, I.A. Meir and E. Erell)
2000-2001	"Principles of Building Envelope Heat Transfer," Albert Katz International School for Desert Studies (BGU).
2000-2001	"Trends and traditions in Desert Architecture" and "Urban microclimate of desert settlements," in the framework of "The Human Dimension: Living in Drylands," Albert Katz International School for Desert Studies (BGU).
2001-2002	"Climatic Design Studio," University of Arizona School of Architecture (with Prof. N. Chalfoun).
2001-2002	"Advanced Computer Energy Analysis," University of Arizona School of Architecture (with Prof. N. Chalfoun).
2002-present	"Research Methods in Desert Architecture," Albert Katz International School for Desert Studies (BGU).
2002-present	"Fundamentals of Climatic Builiding Design in the Desert," Albert Katz International School for Desert Studies (BGU).
2009-2011	"Green Building: From Theory to Practice," Israel Green Building Council.

2011-2012	"Greener Building: Analyzing of Change in Large Socio-technical Systems," Albert Katz International School for Desert Studies (BGU).
2012	"Introduction to Green Building," Department of Geography and Environmental Development (BGU).
2016-	"Energy and Climate in the Design of the Built Environment," Department of Geography and Environmental Development (BGU).
2019-	"A Geographic Perspective on Bioclimatic Architecture," Department of Geography and Environmental Development (BGU).
2020-	"Urban Design Workshop – The Green Neighborhood," Department of Geography and Environmental Development (BGU).

Research students

Master's degree students

Nora Huberman, MA, 2006, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with Y. Etzion), "Life cycle energy costs of building materials: Alternatives for a desert environment" (Awarded Kreitman Scholarship for new PhD students)

Sigal Rosenfeld, MA, 2006, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with Y. Etzion), "The passive cooling potential of watered roofs"

Shiri Fundaminsky, MA, 2007, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with M. Schwartz), "Stakeholder attitudes toward energy-efficient Building: A neighborhood case study" (Awarded International Solar Energy Society student research prize)

Jeremy Cohen, MA, 2007, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with M. Schwartz), "Energy consumption and the socioeconomic organization of kibbutzim in the Arava" (Awarded Scholarship Award for Excellence, Bona Terra Foundation)

Yael Bar-Ilan, MA, 2008, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with A. Tal), "Policy mechanisms for promoting energy-efficient building: Suitability and application in Israel"

Suleiman Halasah, MA, 2010, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with D. Feuermann), "Life-cycle energy analysis of photovoltaic systems in the Arava: A generation-scale comparison"

Dixin Jiao, MA, 2010, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev, "The relation between urban microclimate and subjective thermal sensation in an arid region"

Dana Shapiro, MA, 2011, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with M. Schwartz), "The effects of transportation costs on kibbutz enterprises"

Dmitry Grychkov, MA, 2012, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with Y. Garb), "Cultural aspects of human thermal comfort"

Dan Price, MA, 2012, Porter School of Environmental Studies, Tel Aviv University (with G. Biger), "Ramat Aviv Gimel: A Sustainable Neighborhood?"

Keren Snir, MA, 2014, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with E. Erell), "The moderating effects of surface cover vegetation on microclimate in a built environment in the desert"

Morel Weisthal, MA, 2015, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with A. Peeters), "The assessment of potential energy savings in Israel through climate-conscious residential building design"

Liron Dan, MA, Porter School for Environmental Studies, 2015, Tel Aviv University (with N. Austerlitz), "Selection of materials for green building: Reducing environmental impacts and achieving economic savings using a life-cycle planning approach"

Yaakov Florentin, MA, 2016, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with E. Gal and B. Givoni) "A Comparative life-cycle energy and carbon analysis of hemp-based building materials in an arid environment"

Hojin Yu, MA, 2016, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with M. Schwartz) "Life-cycle assessment of an energy-economy nexus: The case of Israel and South Korea"

Shahar Oannou, in progress, MA, Albert Katz International School for Desert Studies, Ben-Gurion University of the Negev (with E. Gal) "Insulating soil-based biocomposite wall materials"

Inbal Gadish, in progress, MA, Porter School for Environmental Studies, Tel Aviv University (with H. Saaroni) "Assessment of thermal comfort conditions in a densifying urban business district

Hodaya Dazanshvili, in progress, MA, Department of Geography and Environmental Development, Ben-Gurion University of the Negev (with M. Kissinger) "Material and embodied energy flows in the construction of residential neighborhoods in Israel"

Michelle Levenson, in progress, MA, Department of Geography and Environmental Development, Ben-Gurion University of the Negev (with O. Aleksandrowicz) "Pedestrian behavior and thermal perception under varying urban microclimatic conditions"

PhD Students

Nora Huberman, PhD, 2012, Kreitman School for Advanced Graduate Studies, Ben-Gurion University of the Negev (with E. Gal and I.A. Meir), "Energy efficient structural forms: Analysis and applications for desert and seismic areas"

Maritt Sever, PhD, 2016, Kreitman School for Advanced Graduate Studies, Ben-Gurion University of the Negev (with Y. Garb), "Professional perceptions of influence in environmentally-responsive design"

Shula Goulden, PhD, 2016, Kreitman School for Advanced Graduate Studies, Ben-Gurion University of the Negev (with Y. Garb and E. Erell), "Green building in Israel: Networks and discourse of environmental governance"

Elise Machline, PhD, 2018, Kreitman School for Advanced Graduate Studies, Ben-Gurion University of the Negev (with M. Schwartz) "The social impact of green buildings: A Franco-Israeli comparison"

Maria Goldstein, PhD, in progress, Kreitman School for Advanced Graduate Studies, Ben-Gurion University of the Negev (with M. Schwartz) "Socio-economic aspects of the Net-Zero Energy approach to neighborhood-scale development in Israel"

Yaakov Florentin, PhD, in progress, Kreitman School for Advanced Graduate Studies, Ben-Gurion University of the Negev (with E. Gal) "Development and Life-Cycle Energy and Carbon Analysis of a Functionally Graded Biocomposite Building Material"

Tzur Blank, PhD, in progress, Kreitman School for Advanced Graduate Studies, Ben-Gurion University of the Negev (with O. Aleksandrowicz) "Development of an integral microclimatic analysis tool for combating urban heating"

Post-docs

Limor Shashua-Bar, Post-Doc, 2010, Ben-Gurion University of the Negev (with E. Erell), "The combined effect of trees and grass on urban microclimate in arid regions"

Nora Huberman, Post-Doc, 2016, Ben-Gurion University of the Negev (with E. Gal), "Embodied energy of building materials and tools for life-cycle optimization"

Elise Machline, PhD, 2018, Ben-Gurion University of the Negev (with M. Schwartz) "Gentrification effects of eco-disrict development in France and Israel"

• Awards, Citations, Honors, Fellowships

1988 **Sheba Award for Excellence**, The David and Paula Ben-Gurion Fund, Awarded for the design of the Blaustein International Center complex

1998 **Best Paper Award,** Passive and Low-Energy Architecture (PLEA) 14th International Conference, Awarded for the paper, "Street canyon geometry and microclimate: Designing for urban comfort under arid conditions"

2000 **Best Paper Award**, Passive and Low-Energy Architecture (PLEA) 16th International Conference, Awarded for the paper, "A GIS framework for studying post-occupancy climate-related changes in residential neighborhoods" (with Y. Etzion, B. Portnov, E. Erell and I.A. Meir)

2003 **Best Paper Award,** Fifth International Conference on Urban Climate (ICUC) graduate student competition, Awarded for the paper, "Development of a scale-modeling technique for urban microclimatic analysis" (with P. Berliner and E. Shaviv)

2003 **Best Paper Award,** Passive and Low-Energy Architecture (PLEA) 20th International Conference, Awarded for the paper, "Analyzing the microclimatic influence of urban canyon geometry with an open-air scale model" (with P. Berliner and E. Shaviv)

2006 **Gerhard Karplus Award for Excellence in Research,** The Faculty of Architecture and Town Planning, The Technion – Israel Institute of Technology, Awarded for the PhD Thesis, "The microclimatic influences of urban surface geometry: A physical modeling study in hot-arid conditions" (supervised by P. Berliner and E. Shaviv)

2011 **Project of the Year 2011**: Emilio Ambasz Award for Green Architecture, Architecture of Israel and the European Union, Research Category Second Prize (with E. Erell, I.A. Meir, Y. Etzion and Y. Rofe)

2012 **Top Cited Article 2009-2011**, *Landscape and Urban Planning* (92:3-4), "The cooling efficiency of urban landscape strategies in a hot dry climate" (with L. Bar & E. Erell)

2014 **Top Cited Article 2008-2013**, *Energy and Buildings* (40:837-848), "A life cycle energy analysis of building materials in the Negev desert" (with N. Huberman)

• **Scientific Publications** (* since appointment as Associate Professor)

a) H-index from ISI:20 (not updated - Scopus:17 Google Scholar:23)
b) Total number of citations of all articles from ISI:1,321 (n/a - Scopus:903 GS:1815)
c) Total number of citations without self-citations from ISI:1,221 (n/a - Scopus:812)

Authored Books

Pearlmutter, D., E. Erell, I.A. Meir, Y. Etzion and Y. Rofe (2010) *Design Manual for Bioclimatic Building in Israel*, Israel Ministry of National Infrastructures, Jerusalem (in Hebrew).

Bar-Ilan Y., D. Pearlmutter and A. Tal (2010) *Building Green: Promoting energy efficiency in Israel*, Technion – Israel Institute of Technology. (5 citations)

Erell E., D. Pearlmutter and T. Williamson (2011) *Urban Microclimate: Designing the Spaces Between Buildings*, James & James/Earthscan, London. (101 citations)

Editorship of collective volumes

Etzion, Y., E. Erell, I.A. Meir, and D. Pearlmutter (1994) *Architecture of the Extremes - Proceedings of the 11th PLEA International Conference, Dead Sea, Israel,* The Desert Architecture Unit, J. Blaustein Institute for Desert Research, Ben-Gurion University of the Negev.

Pearlmutter, D., C. Calfapietra, R. Samson, L. O'Brien, S. Krajter Ostoić, G. Sanesi, R. Alonso del Amo (2017) *The Urban Forest: Cultivating Green Infrastructure for People and the Environment*. Springer, Cham Switzerland, 351pp.

Refereed chapters in collective volumes and conference proceedings

1. Etzion, Y. and D. Pearlmutter (1989) "Student housing at Sede-Boqer." In: *Global Environment and Architecture in the Post-Industrialized Age* - Proceedings, PLEA Conference, Nara, Japan.

2. Etzion, Y., E. Erell, I.A. Meir, D. Pearlmutter and M. Belaish (1989) "The Blaustein International Center for Desert Studies." In: *Global Environment and Architecture in the Post-Industrialized Age* - Proceedings, PLEA Conference, Nara, Japan.

3. Pearlmutter, D. (1992) "The thermal performance of vaulted roofs in hot arid zones." In: *Energy and Building in the Mediterranean Area* - Proceedings, Third International Conference, Thessaloniki, Greece.

4. Meir, I.A. and D. Pearlmutter (1992) "Attached Courtyards - Asset of Debit?" In: *Energy and Building in the Mediterranean Area* - Proceedings, Third International Conference, Thessaloniki, Greece.

5. Pearlmutter, D., E. Erell and Y. Etzion (1992) "Monitoring an insulated earth-sheltered structure in a desert climate." In: *Proceedings, Fifth International Conference on Underground Space and Earth-Sheltered Structures,* Delft, The Netherlands.

6. Etzion, Y., I.A. Meir, D. Pearlmutter and M. Tene (1993) "Project monitoring in the Negev and Arava, Israel." In: *Solar Energy in Architecture and Urban Planning* - Proceedings, Third European Conference on Architecture, Florence, Italy.

7. Etzion, Y., E. Erell, D. Pearlmutter and M. Tene (1993) "Effects of soil temperature and insulation on the behavior of an earth-sheltered desert structure." In: *Solar Energy in*

Architecture and Urban Planning - Proceedings, Third European Conference on Architecture, Florence, Italy.

8. Pearlmutter, D., H. Di, Y. Etzion, E. Erell and I.A. Meir (1994) "The development of an evaporative cooling tower for semi-enclosed spaces." In: *Architecture of the Extremes* - Proceedings, 11th PLEA International Conference, Dead Sea, Israel.

9. Pearlmutter D., H. Di, Y. Etzion, E. Erell and I.A. Meir (1995) "The development of an evaporative cool tower for semi-enclosed spaces." In: *Passive Cooling of Buildings* - International Symposium, Athens, CIENE, University of Athens and European Commission, DG XVII for Energy, June 1995, pp.271-279.

10. Pearlmutter D. and I.A. Meir (1997) "Housing policy and climatic architecture: the missing link." In: *Sustainable Communities and Architecture - Bioclimatic Design in Cold Climates* - Proceedings of the Fourteenth PLEA 97 International Conference, Kushiro, Japan, January 1997, pp.3.25-3.30.

11. Pearlmutter D. and I.A. Meir (1997) "Lightweight housing in the arid periphery: Implications for thermal comfort and energy use." In: H.J. Bruins, H. Lithwick, Y. Gradus (eds.), *The Arid Frontier: Interactive Management of Environment and Development*, Kluwer Academic Publishers, pp.365-381.

12. Pearlmutter D. (1998) "Street canyon geometry and microclimate: Designing for urban comfort under arid conditions." In: Maldonado E. and Yannas S. (eds.) *Environmentally Friendly Cities*, Proceedings of PLEA '98, Lisbon, Portugal, June1998, pp. 163-166.

13. Pearlmutter D. and P. Berliner (1999) "Urban microclimate in the desert: Planning for outdoor comfort under arid conditions." In: Portnov B. and Hare A. (eds.) *Desert Regions: Population, Migration, and Environment*, Springer-Verlag Berlin Heidelberg, pp. 279-289.

14. Portnov B.A. and D. Pearlmutter (1999) "Sustainable population growth of urban settlements." In: Portnov B. and Hare A. (eds.) *Desert Regions: Population, Migration, and Environment*, Springer-Verlag Berlin Heidelberg pp. 37-60.

15. Portnov B.A. and D. Pearlmutter (1999) "Private construction as a general indicator of urban development." In: Portnov B. and Hare A. (eds.) *Desert Regions: Population, Migration, and Environment*, Springer-Verlag Berlin Heidelberg pp. 61-86.

16. Etzion Y., B. Portnov, E. Erell, I. Meir and D. Pearlmutter (2000) "A GIS framework for studying post-occupancy climate-related changes in residential neighborhoods." In: Steemers K. and Yannas S. (eds.) *Architecture, City, Environment*, Proceedings of PLEA 2000, Cambridge, UK, July 2000, pp. 678-683/781-782.

17. Pearlmutter D., P. Berliner and E. Shaviv (2003) "Development of a scale-modeling technique for urban microclimatic analysis." In: Klysik, K., T.R. Oke, K. Fortuniak, C.S.B. Grimmond and J. Wibig (eds.) *Proceedings of Fifth International Conference on Urban Climate*, Lodz, Poland, September 2003, pp. 359-362.

18. Pearlmutter D., P. Berliner and E. Shaviv (2003) "Analyzing the microclimatic influence of urban canyon geometry with an open-air scale model." In Bustamante, W.G. and Collados, E.B. (eds.) *Proceedings of Passive and Low Energy Architecture 20th International Conference*, Santiago de Chile, November 2003, pp. 623-628.

19. Huberman, N. and D. Pearlmutter (2004) "Life Cycle Energy Performance of Building Materials: Alternatives for a Desert Environment." In: *Built environments and environmental buildings*: Proceedings of the 21st International PLEA Conference, Eindhoven, The Netherlands.

20. Erell, E., Y. Etzion, D. Pearlmutter, R. Guetta, D. Pecornik, H. Zimmerman and F. Krutzler (2005) "A novel multi-stage down-draft evaporative cool tower for space cooling. Part 1: Aerodynamic design." In: Santamouris, M. (Ed.) *Proceedings of PALENC 2005*, First International Conference on Passive and Low-Energy Cooling for the Built Environment, Santorini, Greece, May 2005, pp. 521-528.
21. Erell, E., Y. Etzion, D. Pearlmutter, R. Guetta, D. Pecornik, H. Zimmerman and F. Krutzler (2005) "A novel multi-stage down-draft evaporative cool tower for space cooling. Part 2: Preliminary experiments with a water spraying system." In: Santamouris, M. (Ed.) *Proceedings of PALENC 2005*, First International Conference on Passive and Low-Energy Cooling for the Built Environment, Santorini, Greece, May 2005, pp. 529-536.
22. Pearlmutter, D., C. Freidin and N. Huberman (2005) "Sustainable Building and Alternative Materials in the Negev Desert." In: *Action for Sustainability*: World Sustainable Building Conference, Tokyo, September 2005.
23. Pearlmutter D., P. Berliner and E. Shaviv (2006) "Current research and challenges in urban climate research in arid regions." In: *Proceedings of Sixth International Conference on Urban Climate*, Goteborg, Sweden, June 2006.
24. Kruger E.L and D. Pearlmutter (2007) "The impact of densification on air-conditioning loads in a dry environment: using a semi-empirical model for street canyon temperatures as input for thermal simulations." In: *Tenth International Conference on Computers in Urban Planning and Urban Management*, Iguassu Falls, Brazil, July 2007.
25. Cohen J., D. Pearlmutter and M. Schwartz (2007) "Energy consumption trends in the Eilot region: A case study of four kibbutzim." In: *The First International Conference on Sustainable Energy as a Catalyst for Regional Economic Development*, Eilat, Israel, June 2007.
26. Bar-Ilan, Y., D. Pearlmutter and A. Tal (2007) "Policy mechansms for promoting energy-efficient building in Israel." In: *The First International Conference on Sustainable Energy as a Catalyst for Regional Economic Development*, Eilat, Israel, June 2007.
27. Kruger E.L., D. Pearlmutter and P. Berliner (2007) "Modeling the effects of urban evapotranspiration under desert conditions." In: *ENCAC*, Ouro Prieto Brazil, Aug. 2007.
28. Shashua-Bar L., E. Erell and D. Pearlmutter (2008) "The Cooling Effect and Water Use Efficiency of Urban Landscape Strategies in a Hot Dry Climate." In: *PLEA 2008 – 25th Conference on Passive and Low Energy Architecture*, Dublin, October 2008.
29. Huberman N. and D. Pearlmutter (2008) "Efficient structural roof form as a tool for energy savings in building design." In: *Proceedings of PLEA 2008 – 25thConference on Passive and Low Energy Architecture*, Dublin, October 2008.
30. * Pearlmutter D. (2009) "Research in Desert Architecture." In: Hare A.P. and Kressel G.M. (Eds.) *The Desert Experience in Israel: Communities, Art, Science and Education in the Negev*, pp. 160-163.
31. * Shashua-Bar, L., D. Pearlmutter and E. Erell (2009) "Microscale vegetation effects on outdoor thermal comfort in a hot-arid environment." *Proceedings of the seventh International Conference on Urban Climate (ICUC-7)*, Yokohama, Japan, June-July 2009.
32. * Pearlmutter D. and N. Huberman (2010) "Alternatives for improving the life-cycle energy efficiency of low-rise buildings. " In: *Proceedings of the US-Israel Workshop on Sustainable Buildings – Materials and Energy*, 12-13 July 2010, Technion, Haifa.

33. * Pearlmutter D., J. Dixin and Y. Garb (2011) "The index of thermal stress as a predictor of subjective thermal sensation in a hot-arid urban environment," *Proceedings of the 19th International Congress of Biometeorology*, Auckland New Zealand, December 4-8, 2011.
34. * Pearlmutter D., H. Saaroni and T. Hatuka (2011) "Climate and Perception in Jaffa Slope Park, Tel Aviv-Jaffa: A Public Open Space Case Study," *Public Open Spaces in the Sustainable City*, Blaustein Institutes for Desert Research, Israel, December 19-21, 2011.
35. * Erell E., D. Pearlmutter and D. Boneh (2012) "Effect of high-albedo materials on pedestrian thermal comfort in urban canyons," *Proceedings of the Eighth International Conference on Urban Climate (ICUC-8)*, Dublin, Ireland, August 6-10, 2012.
36. * Hartz, D., T.P. Lin, M. Loughman and D. Pearlmutter (2012) "Human Thermal Comfort Applications: Australia, Israel, Taiwan and USA," *Proceedings of the Eighth International Conference on Urban Climate (ICUC-8)*, Dublin, Ireland, Aug. 6-10, 2012.
37. * Pearlmutter, D. (2013) "Microclimatic effects of trees and vegetative ground cover in a hot-arid urban environment," *Proceedings of the 16th European Forum on Urban Forestry*, Milano, Italy, May 7-11, 2013.
38. * Snir K., D. Pearlmutter and E. Erell (2013) "The Moderating Effect of Desert Ground Cover Plants on Pedestrian Thermal Sensation," *Proceedings of PLEA2013 - 29th Conference, Sustainable Architecture for a Renewable Future,* Munich, Germany, September 10-12, 2013.
39. * Kalman Y., D. Pearlmutter and E. Erell (2013) "Impact of increasing the height o fTel Aviv buildings on pedestrian comfort and building energy efficiency," *Proceedings of PLEA2013 - 29th Conference, Sustainable Architecture for a Renewable Future,* Munich, Germany, September 10-12, 2013.
40. * Meir I.A., A. Peeters, D. Pearlmutter, S. Halasa, Y. Garb and J.M. Davies (2013) "Green building standards in MENA. State of the art, trends, challenges," *Proceedings of PLEA2013 - 29th Conference, Sustainable Architecture for a Renewable Future,* Munich, Germany, September 10-12, 2013.
41. * Pearlmutter, D. (2014) "Multi-scale energy modeling: Materials, buildings and urban spaces," *Proceedings of the US-Israel Workshop on:Industrial Ecology in Multi-Scale Design and Construction of Sustainable Built Environments*, 9-11 March 2014, Tel Aviv.
42. * Pearlmutter, D. (2014) "Recent studies on the Microclimatic effects of urban green spaces in a hot-arid environment," *European Forum on Urban Forestry*, Lausanne, Switzerland, June 3-7, 2014.
43. * Pearlmutter, D. and F. Ugolini (2014) "Improving the cooling efficiency of urban trees in hot-arid regions with deficit irrigation," *Urban Environmental Pollution: Climate Change and Urban Environment*, Toronto, Canada, June 12-15, 2014.
44. * Pearlmutter D., H. Saaroni and T. Hatuka (2014) "Microclimate and thermal perception in a Mediterranean coastal urban park," *International Geographical Union Regional Conference*, Krakow, Poland, August 18-22, 2014.
45. * Pearlmutter D. (2014) "A European consortium for promoting green infrastructure in urban areas," *International Conference on Geotourism Development*, Miskolc, Hungary, October 16-18, 2014.
46. * Pearlmutter D. (2015) "Watts in a comfort index: Evaluating pedestrian energy exchange and thermal stress in urban environments*," ICUC9 - 9th International Conference on Urban Climate*, Toulouse, France, July 20-24, 2015.

47. * Sever M., Y. Garb and D. Pearlmutter (2015) "Building in Resilience: Long-term Considerations in the Design and Production of Residential Buildings in Israel." In: Masys A. (Ed.) *Disaster Management: Enabling Resilience*, pp. 65-90. Springer, Cham Heidelberg New York Dordrecht London.

48. * Chiesa G., N. Huberman, D. Pearlmutter and M. Grosso (2017) "Potential for creating comfortable conditions with evaporative cooling in Mediterranean cities." In: Howlett, R et al. (Eds.) *Energy Procedia* 111: 598-608. *Proceedings of 8th International Conference on Sustainability in Energy and Buildings*, Turin Italy, September 11-13, 2016.

49. * Pearlmutter D., M. Petralli, M. Napoli, L. Massetti, G. Brandani, S. Orlandini (2017) "Park design and pedestrian thermal stress: evaluating the effects of shade and ground surface materials." *In: Proceedings of Passive & Low-Energy Architecture 2017*, Edinburgh UK, July 3-5, 2017.

50. * Pearlmutter D., M. Petralli, L. Massetti, M. Napoli, G. Brandani, S. Orlandini, B. Gori (2018) "Effects of Deciduous Shade Trees on Surface Temperature and Pedestrian Thermal Stress" (invited presentation). *In: Tenth International Conference on Urban Climate (ICUC-10)* New York City, USA, August 6-10, 2018.

51. * Pearlmutter D. (2018) "Climatology and the urban environment: Nature-Based Solutions." *Workshop on Climatologia e ambienti urbani: Le Nature based solutions come elemento di resilienza urbana*. Firenze, Osservatorio Ximeniano, October 19-20, 2018.

52. * Pearlmutter, D., Florentin, Y., Oannou, S., Ugolini, F., Gal, E. (2020) "Development of sustainable biocomposite building materials for promoting the transition to a circular economy." *Online Symposium on Circular Economy and Sustainability*, Alexandroupolis, Greece, July 1-3, 2020.

Refereed articles and refereed letters in scientific journals

Citations according to: ISI Web of Science (http://apps.webofknowledge.com/); Scopus (http://www.scopus.com/); Google Scholar (https://scholar.google.co.il)

Journal rankings according to: ISI Web of Science (https://jcr.clarivate.com); SJR (http://www.scimagojr.com/)

Legend (superscript): Principal Investigator [PI], student [S], post-doctoral fellow [PD], co-researcher [C], technician [T]

1. Pearlmutter, D. [PI] and Y. Etzion [PI] (1993) Student housing at Sede-Boqer: A geometric response to desert conditions, *Journal of Architectural and Planning Research* 10(3):242-260. (1/0/4 citations; IF 0.5; 20/83; Q1)

2. Pearlmutter, D. [PI], E. Erell [PI] and Y. Etzion [PI] (1993) Monitoring the thermal performance of an insulated earth-sheltered structure: A hot-arid zone case study, *Architectural Science Review* 36(1):3-12. (9/14 citations; IF 0.9; 9/83; Q1)

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Published scientific reports and technical papers

1. Etzion Y., E. Erell and D. Pearlmutter (1991) "Monitoring the Thermal Performance of an Earth Sheltered Structure in the Negev Highlands." Final report to the Israel Ministry of Energy and Infrastructure, Research and Development Division.
2. Etzion Y., I.A. Meir, D. Pearlmutter (1993) "Project Monitoring in the Negev and the Arava." Final Report to the Israel Ministry of Energy and Infrastructure.
3. Etzion Y., E. Erell, I.A. Meir and D. Pearlmutter (1996) "Energy-Efficient Technology Testing Building, Jaffa." Final Report submitted to the Israel Ministry of Energy and Infrastructure.
4. Pearlmutter, D. (1996) "The Effects of Urban Geometry on Microclimatic Conditions in a Desert City." M.A. Thesis, Department of Geography and Environmental Development, Ben-Gurion University of the Negev.
5. Etzion Y., B. Portnov, E. Erell, I.A. Meir and D. Pearlmutter (2000) "A Computerized System for Tracking Modifications to Housing in Ministry of Housing Neighborhoods." Final research report to the Israel Ministry for Housing.
6. Pearlmutter D., E. Erell, I.A. Meir, Y. Etzion and Y. Rofe (2005) "Design Manual for Bioclimatic Construction in Israel." Interim report submitted to the Israel Ministry of National Infrastructures.
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8. Erell E., E. Etzion, D. Pearlmutter and W. Motzafi-Haller (2006) "Multi-stage Down-Draft Evaporative Cool Tower for Large Closed and Semi-enclosed Spaces." Final report submitted to the BMBF (Germany) and Ministry of Science and Technology, Israel.
9. Gal, E. and D. Pearlmutter (2010) "Analysis of heat transfer in ESB elements," Nesher - Israel Cement Industries Ltd.
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11. Pearlmutter, D. and M. Weistal (2013) "Roadmap to Zero Carbon Israel: The potential for Energy Conservation in Israel through Climatic Building Design," Israel Energy Forum.
12. Pearlmutter D., I.A. Meir, N. Huberman-Meraiot and L. Dan (2013) "Development of a National Database for Embodied Energy of Building Materials in Israel," Final report to the Office of the Chief Scientist, Israel Ministry of Energy and Water Resources (formerly National Infrastructures).
12. Garb Y., D. Pearlmutter, E. Erell and N. Becker (2015) "Survey of Green Building Incentives and their Adaptation for Israel," Final report to the Office of the Chief Scientist, Israel Ministry of Environmental Protection.
13. Pearlmutter D. and E. Gal (2015) "Climatically-optimized insulation based on graded materials," Final report to the Office of the Chief Scientist, Israel Ministry of Economy.

• **Research Grants** (all authors listed are principal investigators)

Etzion Y., D. Pearlmutter and E. Erell (1990) "Monitoring the performance of an earth-sheltered structure in the Negev Highlands," Israel Ministry of Energy and Infrastructure.

Etzion Y., I.A. Meir and D. Pearlmutter (1992) "Project monitoring in the Negev and Arava," Israel Ministry of Energy and Infrastructure.

Etzion Y., E. Erell, I.A. Meir and D. Pearlmutter (1995) "Energy-Efficient Technology Testing Building, Jaffa," Israel Ministry of Energy and Infrastructure.

Etzion Y., B. Portnov, E. Erell, I.A. Meir and D. Pearlmutter (1998) "A Computerized System for Tracking Modifications to Housing in Ministry of Housing Neighborhoods," Israel Ministry for Housing.

Pearlmutter D. (1999) "A 'model city' for urban microclimate research," Dr. Sonia and Berthold Badler Endowment Fund for Architecture (US$30,000).

Etzion Y., E. Erell and D. Pearlmutter (2001) "Multi-stage down draft evaporative cooling tower for cooling large enclosed and semi-enclosed spaces," Israel Ministry of Science, Culture and Sport (36 months, DM294,122).

Etzion Y., I.A. Meir, E. Erell and D. Pearlmutter (2004) "Design Manual for Bio-Climatic Construction," Israel Ministry for National Infrastructures (24 months, NIS 322,000).

Gal, E. and D. Pearlmutter (2010) Analysis of heat transfer in ESB elements," Nesher - Israel Cement Industries Ltd. (8 months, NIS 50,000).

Gal, E. and D. Pearlmutter (2010) "Energy Analysis of Green Prefabricated Dwellings," Ackerstein Corp. (12 months, NIS 130,000).

Garb Y., D. Pearlmutter, E. Erell and N. Becker (2011-2014) "Incentives for Green Building in Israel," Israel Ministry of Environmental Protection (36 months, NIS 300,000).

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Pearlmutter D. and Aviv Consulting (2012-2017) "National Green Building Pilot Project," Israel Ministry of Environmental Protection. (est. NIS 100,000/year).

Pearlmutter D. and E. Gal (2013-2014) "Climatically-optimized insulation based on graded materials," *Magneton* – Chief Scientist, Israel Ministry of Economy (NIS 340,000).

Gal, E., D. Pearlmutter and A. Peled, (2015-2018) "New Sustainable Structural Elements for Massive Building Applications," Israel Ministry of Science, Technology and Space, National Framework for Applied Science and Engineering Research (NIS 1,288,000).

Isaac, S., I.A. Meir, E. Gal, D. Pearlmutter, G. Rabinowitz (2015-2019) "Achieving near Zero and Positive Energy Settlements in Europe using Advanced Energy Technology," EU – Horizon 2020 (NIS 1,500,000)

Pearlmutter, D. (2019-2022) "Development of an integral microclimatic analysis tool for combating urban heating," Israel Science Foundation (NIS 932,000)

• **Patents**

2015 Pearlmutter D., E. Gal, D. Dvorkin, S. Fraimovich “MONOLITHIC BUILDING BLOCK", P-13163-UK, UK.

2015 Fraimovich S., Dvorkin D., Gal E., Pearlmutter D., Huberman-Meriot N. Levtzion A. "WALL PROFILE GENERATOR FOR STRUCTURES", P531934GB, UK.

• **Present Academic Activities**

Research in progress

Urban microclimate and pedestrian thermal stress:
Following on previous findings (43), the influence of long-term acclimation on pedestrian thermal perception is being analyzed based on a systematic comparison made between two study groups with divergent climato-cultural backgrounds. This experiment is the first of its kind to isolate participant samples with well-defined "thermal histories," and to statistically determine the extent to which sensitivity to heat or cold stress is differentiated by previous climatic adaptation. The findings of this line of work may have significant implications for urban design and energy consumption in the built environment.

Life-cycle energy efficiency of building systems and materials:
The embodied energy and carbon of a range of materials have been assessed through direct process analysis (51), and their operational energy implications are being evaluated experimentally. Innovative biocomposites based on plant-fiber insulation, as well as structural elements integrating carbon-fiber textile reinforcing, are being analyzed in terms of their potential for reducing life-cycle energy-use and net CO_2 emissions. Optimization tools are being developed to refine the configuration of graded building envelope components that combine the essential properties of high thermal resistance and heat capacity with improved embodied energy efficiency and carbon balance. The life-cycle energy implications of imported energy-intensive products are being investigated using input-output analysis (50).

Social and governance aspects of sustainability in the built environment:
Barriers to the implementation of strategies for building energy-efficiency and urban sustainability are being investigated at the national level in Israel, with comparative reference to trends in European countries. A cost-benefit analysis of construction in accordance with the Israeli green building standard, a comparative assessment of the relationship between green building and social housing, and an analysis of technologies for achieving a "net-zero" energy balance at the scale of urban districts are all in progress, with support from national and international funding agencies.

• **Synopsis of Research** *(numbers in parentheses indicate relevant publications in the list of refereed articles in scientific journals)*

My research addresses arhcitectural and urban design problems related to energy, climate and sustainable development in the built environment. The main themes of my early work in desert architecture were described within a multi-scale conceptual framework (12,16), and summarized in a number of review papers (23-25). While these studies focused largely on design strategies for improving the operational energy efficiency of individual buildings (1-8), more recent work has broadend the scale and scope of this analysis by following three main lines of inquiry: 1) the influence of urban design on microclimate and thermal comfort; 2) the life-cycle energy efficiency of buildings, materials and structural systems; and 3) understanding and overcoming barriers to the implementation of sustainable design practice.

Urban microclimate and pedestrian thermal stress

Research on urban microclimate was initiated with the goal of developing predictive models that could be applied in the design of urban spaces, and early work focused on the effects of urban geometry on the pedestrian-environment energy balance (11, 18, 19, 20, 21). The development of an "open-air scaled urban surface" hardware modeling approach allowed for the comparison of different physical configurations under actual climatic conditions, and this research was the first of its kind to successfully demonstrate aeordynamic and thermodynamic similarity between an urban scale model and a full-scale urban scenario (18). The prediction of pedestrian energy exchange was refined by adapting the Index of Thermal Stress (ITS), a bio-meteorological comfort model which accounts for metabolic and evaporative heat as well as the primary environmental energy exchanges by radiation and convection (21), to urban settings. It was found that the microclimatic benefit of “compactness,” as expressed by a large ratio of building height to street width, is increasingly pronounced in summer as canyon axis orientation approaches north-south, as solar radiation is intercepted by buildings rather than people. Overall the results (from winter as well as summer) highlighted the potential advantage in arid regions of a climatically “selective” urban fabric – combining relatively compact streets in most orientations, especially north-south, with less-constricted east-west streets integrating localized elements such as deciduous shade trees. Subsequently the open-air scaled urban surface was employed to examine the contribution of green space within the urban fabric (31), quantifying the latent heat flux as a function of the surface area available for evaporation. Results indicated that the proportion of the radiant energy budget represented by evaporative heat loss increased linearly with the ratio between vegetative cover and the "complete" three-dimensional urban surface area.

A full-scale monitoring study (32,37,41) was then conducted to analyze the water and energy balance in compact urban spaces with different vegetative landscape treatments. This controlled outdoor experiment was the first in a series of studies that used the ITS model to assess the thermal effects of urban vegetation and to evaluate the "cooling efficiency" of irrigated landscaping by comparing its potential to reduce bodily heat gain with the quantity of water required for its irrigation. Extensive measurements were made in two semi-enclosed courtyards with various combinations of mature trees, artificial shading, grass and paving. For each landscape configuration, ITS was calculated from measured data to evaluate thermal comfort based on radiative and convective pedestrian-environment energy exchanges and sweat efficiency, and expressed on a thermal sensation scale. The cooling efficiency was gauged by comparing the evapotranspiration of the given landscape treatment with the reduction in thermal stress, both expressed in terms of their equivalent energy (latent heat and overall exchange, respecctively). It was found that while conditions in a paved, unshaded courtyard were uncomfortable throughout the summer daytime hours, each of the landscape treatments made a clear contribution to improved thermal comfort. Shading reduced the duration of discomfort by over half and limited its maximum severity, and when combined with grass yielded comfortable conditions at all hours. The effect of trees was more pronounced than that of the artificial mesh, due to the latter's elevated radiative surface temperature. It was found that a combination of locally adapted shade trees and irrigated ground cover not only creates thermally comfortable conditions in otherwise stressful outdoor environments, but requires less water for irrigation than exposed grass alone. Given the exorbitant water requirements of grass, a further experimental study investigated the potential of succulent plants for use as an alternative in urban landscaping (49). Small plots planted with a total of six species were used to compare the characteristic albedo and radiant surface temperature, as well as the water requirements, of different types of ground-cover vegetation. It was found that while the succulent varieties maintained slightly higher surface temperatures than grass, their reduced water loss under conditions of limited irrigation endowed them with

a higher cooling efficiency. The relatively severe thermal stress imposed by both bare soil (due to its high albedo and intense reflected radiation) and artificial turf (due to its low albedo and high radiant surface temperature) were quantitatively demonstrated.

Because the correlation between the biophysical indicator ITS and the subjective perception of thermal comfort was originally based on observations made under controlled indoor conditions, a study was carried out to test this relationship in outdoor spaces (43). Calculated values of the index, based on measurements in a hot-arid urban setting, were found to correlate closely with subjective thermal sensation as expressed in questionnaire responses by pedestrians in the same set of locations. While a number of personal and experiential factors were found to impact thermal perception, the "neutral point" at which thermal sensation was neither uncomfortably hot or cold was found to correspond in a variety of different circumstances to a physical situation in which the dissipation of heat from a person's body was precisely in balance with that person's internal metabolic heat production (ITS=zero). A separate case study of a Mediterranean coastal urban park with large expanses of unshaded grass and concrete paving examined the ways in which thermal discomfort is perceived by local residents, and results indicated that the expressed thermal preferences of the park's users align robustly with predictions based on ITS (45).

Life-cycle energy efficiency of building systems and materials

An especially effective approach for low-energy climatization of enclosed or semi-enclosed spaces in hot-arid regions is the use of evaporative cooling, and a series of research studies examined the potential for improving its efficiency and practical integration in actual buildings (6, 28-29). A down-draft tower for evaporative cooling was tested and it was found that outlet temperatures could easily be maintained close to the ambient wet bulb temperature, but that the overall cooling capacity was limited by the aerodynamic efficiency of the tower. This limitation was addressed in the development of an experimental tower with two separate air intakes, and contoured inlet and outlet air deflectors (28-29). When a substantial air flow was initially generated by either means, the curved deflector at the tower's outlet was found to increase the volumetric flow rate by 15-25%.

Roof geometry and treatment were shown in early studies (1,3) to play a key climatic role in desert buildings. Green roofs combine the thermally stabilizing influence of a layer of soil with evaporation from its irrigated surface and shading by the plants growing in it, but transpiration from leaves has been found to be relatively inefficient for cooling the building itself. Thus a system with low-maintenance shading elements in place of actual vegetation was tested (27), and it was found that while evaporative cooling from the wet soil surface lowered ceiling temperatures substantially when unshaded, these reductions were indeed insufficient for comfort cooling – whereas two different shading treatments both allowed low ceiling temperatures to be maintained at all hours.

In earlier work, a detailed accounting of the energy "embodied" in the production of building materials (22,26) revealed that the initial energy savings achievable through the use of alternatives to reinforced concrete wall construction were equivalent to 25-30 years of operational (heating and cooling) energy. It was also found that the bulk of embodied energy in a typical residential building may be attributed to the horizontal spanning elements of its concrete structure – suggesting that a significant untapped potential lies in improving the energy efficiency of the building's structural form. The exploitation of non-planar roof forms with reduced reinforcing and thinner sections was investigated through a combination of structural and thermal energy analysis, integrated within a novel optimization framework for life-cycle energy assessment (46), and results showed embodied energy savings of up to 40% relative to flat-slab structures. While energy savings were greatest for larger spans (6-10

meters), they were significant (approximately 25%) even when including operational energy use over a 50-year life cycle. Life-cycle energy assessment was also used to examine the extent to which energy efficiency can be meaningfully augmented by the integration of renewable energy production sources (42). This study found that the energy payback time for solar photovoltaic systems could be significantly shortened by integrating them with existing structures both on a building and a local scale, due to the high embodied energy of concrete foundations and supporting structures required for field arrays.

Social and governance aspects of sustainability in the built environment

Earlier research (4,9,13,14) addressed the sustainability of development in peripheral desert regions like the Negev in terms of national policy and locally appropriate planning solutions, and began to examine the various barriers to implementation of sustainable design practices. An analysis of stakeholder attitudes surveyed the knowledge, attitudes and practices of home owners as well as public and private-sector actors involved in housing construction in the city of Beer-Sheva, concluding that none of the parties had both the short-term interest and influence necessary to initiate energy-efficient building practices. In a comparative analysis of policy tools for promoting building energy-efficiency in Israel and abroad, implementation of the newly adopted local "green building" standard was documented and evaluated with reference to similar mechanisms in the U.S. and elsewhere. The influence of individual and collective decision-making on patterns of energy use was examined in a quantitative study of electricity consumption in a series of Israeli kibbutzim in the Arava region (33), with each community having reached a different stage in the transition from a collective to a more privatized socioeconomic organization. This study revealed that economic signals may indeed exert a strong influence on consumptive behavior, but that over the long-term, information feedback and societal expectations also play a decisive role. The kibbutz experience was further utilized as a "natural experiment" in a study examining the role of transport energy costs in the success of enterprises in remote and isolated communities (38,39), and a series of "transport strategies" including high value density (including information-based services) and localization were identified as especially effective coping mechanisms in an era of increasing energy and climate vulnerability. Additional studies have looked at the roles and interests of various stakeholders in "green" environmental policy (47,48) and the way that policy tools such as green building standards represent socio-technical actors in their own right – taking on different types of significance as they are transferred in scale (from the level of a building to a neighborhood or locality) and in context (from the voluntary realm to to the regulatory).