

SIMON ASHER LEVIN

James S. McDonnell Distinguished University Professor in Ecology and Evolutionary Biology
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EDUCATION

1964-65 Postdoctoral Research Fellow, University of California, Berkeley, CA
1964 Ph.D. in Mathematics, University of Maryland, College Park, MD
1961 B.A. in Mathematics, The Johns Hopkins University, Baltimore, MD

PROFESSIONAL EXPERIENCE

Princeton University

2019- Associated Faculty, Andlinger Center for Energy and the Environment
2017- Associated Faculty, Princeton University Center for Human Values
2016- Associated Faculty, Program in Global Health and Health Policy, Princeton School of Public and International Affairs
2016- James S. McDonnell Distinguished University Professor in Ecology and Evolutionary Biology
2014- Associated Faculty, Center for Policy Research on Energy and the Environment (C-PREE)
2012- Faculty Associate, Graduate Certificate in Computational and Information Science (PICSciE)
2012- Faculty Associate, Princeton Institute for International and Regional Studies (PIIRS)
2009- Faculty, Quantitative and Computational Biology Program, Princeton University
2001- Director, Center for BioComplexity
1994- Affiliated Faculty, High Meadows Environmental Institute
1993-98 Founding Director, Princeton Environmental Institute (now High Meadows Environmental Institute)
1992- Affiliated Faculty, Program in Applied and Computational Mathematics
1992-2016 George M. Moffett Professor of Biology

Cornell University

1992- Adjunct Professor, Ecology & Evolutionary Biology
1992- Adjunct Professor, Center for Applied Mathematics
1985-92 Charles A. Alexander Professor, Section of Ecology and Systematics, Division of Biological Sciences
1990-92 Director, Program on Theoretical and Computational Biology
1987-90 Director, Center for Environmental Research
1980-87 Director, Ecosystems Research Center
1977-92 Professor of Applied Mathematics and Ecology, Section of Ecology and Systematics, Division of Biological Sciences
1974-79 Chair, Section of Ecology and Systematics, Division of Biological Sciences
1971-77 Associate Professor, Section of Ecology and Systematics and Department of Theoretical and Applied Mechanics
1965-70 Assistant Professor, Department of Mathematics

Select Visiting & Honorary Positions

2021- Honorary Professor, Tsinghua University, Beijing, China
2018- Distinguished Visiting Professor, Arizona State University

ACHIEVEMENTS IN RESEARCH

Simon Levin is an applied mathematician and ecologist, noted especially for his contributions to the development of the foundations of spatial ecology, for his work on pattern and scale, and more recently for his research at the interface between ecology and economics, especially problems of public goods, common pool resources, and the global commons. His book, *Fragile Dominion*, along with his subsequent research, weaves these themes together, invoking ecological and evolutionary theory to inform principles for management practice. He has won numerous awards, including the 2014 National Medal of Science, 2014 Tyler Prize for Environmental Achievement, 2010 Ramon Margalef Prize in Ecology and Environmental Sciences, 2005 Kyoto Prize in Basic Sciences, and the 2004 A.H. Heineken Prize for Environmental Sciences. Levin's research has been devoted to understanding the dynamics of biological diversity at all levels, from the molecular diversity of diseases to the diversity of global ecological and cultural systems. It is furthermore concerned with exploring the importance of that diversity for humans, and socioeconomic mechanisms for sustaining diversity. He has combined mathematical modeling with empirical investigations to explore the dynamics of biodiversity and biocomplexity, including infectious diseases and the interactions between ecological systems and socioeconomic systems, with attention to the management of natural resources. Throughout, a central thread has been the development of rules for scaling from the microscopic to the macroscopic, from individuals to collectives, from small scales to large, from short time scales to long. He has built interfaces between theoretical investigations and their application to the management of natural resources, used those applications to stimulate theoretical investigations and the elucidation of general principles for the management of ecological systems.

HONORS AND AWARDS

Major International Prizes

- 2016 National Medal of Science (2014, announced 2015, awarded 2016)
- 2014 Tyler Prize for Environmental Achievement
- 2014 Luca Pacioli Prize, Ca' Foscari University of Venice, Italy
- 2010 Ramon Margalef Prize in Ecology and Environmental Sciences, Government of Catalonia
- 2005 Kyoto Prize in Basic Sciences, Inamori Foundation, Japan
- 2004 A.H. Heineken Prize for Environmental Sciences, Royal Netherlands Academy of Arts and Sciences

Major Honorary Societies

- 2014 Foreign Member, Istituto Lombardo di Scienze e Lettere, Milan, Italy
- 2008 Foreign Member, Istituto Veneto di Scienze, Lettere ed Arti, Venice, Italy
- 2003 Member, American Philosophical Society
- 2000 Member, National Academy of Sciences
- 1992 Fellow, American Academy of Arts and Sciences

Major Society Awards

- 2021 Fellow, American Mathematical Society (AMS)
- 2012 Fellow, Ecological Society of America
- 2011 National Associate, National Research Council of the National Academies
- 2010 Eminent Ecologist Award, Ecological Society of America
- 2009 Fellow, Society for Industrial and Applied Mathematics
- 2007 Distinguished Scientist Award, American Institute of Biological Sciences
- 2006 I.E. Block Community Lecture Award, Society for Industrial and Applied Mathematics
- 2003 Distinguished Landscape Ecologist Award, U.S. Regional Association of the International Association for Landscape Ecology (US-IALE)
- 2001 The First Okubo Lifetime Achievement Award, Society for Mathematical Biology and Japanese Society for Theoretical Biology
- 1998 Distinguished Service Citation of the Ecological Society of America
- 1994 Distinguished Statistical Ecologist Award, International Association for Ecology (INTECOL)
- 1992 Fellow, American Association for the Advancement of Science (AAAS)
- 1988 MacArthur Award, Ecological Society of America

Honorary Degrees

- 2019 Honorary Doctor of Science, University of Victoria
- 2015 Honorary Doctor of Science, McMaster University
- 2009 Honorary Doctor of Science, Michigan State University
- 2004 Honorary Doctor of Humane Letters Honoris Causa, Whittier College
- 1990 Honorary Doctor of Science, Eastern Michigan University

Fellowships

- 1983-84 Japan Society for the Promotion of Science Fellowship, Kyoto, Japan
- 1979-80 Fellowship, Applied Mathematics, John Simon Guggenheim Memorial Foundation
- 1964-65 NSF Postdoctoral Fellow, University of California, Berkeley
- 1962-64 NSF Predoctoral Fellow, University of Maryland, College Park

Publication Awards

- 2021 Co-author of ESA Outstanding Paper (Theory Section) for: Goel, N., Guttal, V., Levin, S.A., and A.C. Staver. 2020. Dispersal increases the resilience of tropical and savanna and forest distributions. *The American Naturalist* 195(5): 833–850.
- 2020 Co-author of ESA Outstanding Paper Prize 2020 (Theory Section) for: Tekwa, E., Fenichel, E.P., Levin, S.A., and M. Pinsky. 2019. Path-dependent institutions drive alternative stable states in conservation. *PNAS* 116(2): 689–694.
- 2018 Co-author of One of the Most-Cited 2018 *PNAS* Papers for: Klein, E.Y., Van Boeckel, T.P., Martinez, E.M., Pant, S., Gandra, S., Levin, S.A., Goossens, H., and R. Laxminarayan. 2018. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *PNAS* 115(15): E3463–E3470.
- 2018 International Consortium of Chinese Mathematicians (Beijing) Best Paper Award 2018 for: Lei, J., Levin, S.A., and Nie, Q. 2014. Mathematical model of adult stem cell regeneration with cross-talk between genetic and epigenetic regulation. *PNAS* 111(10): E880–887.
- 2014 Co-author of President's Award for best paper in *The American Naturalist* for: Farrior, C.E., Dybzinski, R., Levin, S., and S. Pacala. Competition for water and light in closed-canopy forests: A tractable model carbon of allocation with implications for carbon sinks. *The American Naturalist* 181(3): 314–330
- 2012 Co-author of George Mercer Award 2012 for: Staver, A.C., Archibald, S. and S. Levin. 2011. Tree cover in sub-Saharan Africa: Rainfall and fire constrain forest and savanna as alternative stable states. *Ecology* 92(5): 1063–1072.
- 2010 A Most Cited Paper(s) 2005-2009, Elsevier's Economic and Finance Journals for: Durrett, R. and S.A. Levin. 2005. Can stable social groups be maintained by homophilous imitation alone? *Journal of Economic Behavior and Organization* 57(3): 267–286.

- 2002 Most Cited Paper in the Field of Ecology and Environment for the 1990s (Institute for Scientific Information, Philadelphia, PA) for: Levin, S.A. 1992. The problem of pattern and scale in ecology. *Ecology* 73(6): 1943–1967.
- 2001 Outstanding Paper in the Discipline of Landscape Ecology Award for 2001 (U.S. Chapter, International Association for Landscape Ecology) for: Keymer, J.E., Marquet, P.A., Velasco-Hernandez, J.X. and S.A. Levin. 2000. Extinction thresholds and metapopulation persistence in dynamic landscapes. *The American Naturalist* 156(5): 478–494.

Other Honors & Awards

- 2021 Highly-Cited Researcher, Web of Science Group
- 2021 Luohun Academy Distinguished Fellow, Hangzhou, China
- 2020 Highly-Cited Researcher, Web of Science Group
- 2020 Research Fellow, Gruter Institute for Law and Behavioral Research
- 2020-23 Affiliate, MIT Laboratory for Financial Engineering (LFE)
- 2019 Highly-Cited Researcher, Web of Science Group
- 2018 Lifetime Fellow, Santa Fe Institute, Santa Fe, NM
- 2017 Society for Mathematical Biology Fellow
- 2014 IIASA Distinguished Visiting Fellow
- 2014 The Mathematical, Computational and Modeling Sciences Center at Arizona State University Relunched in Honor of Simon A. Levin as The Simon A. Levin Mathematical, Computational, and Modeling Sciences Center
- 2012 IIASA Honorary Scholar
- 2011 Distinguished Alumnus of the Year Award, University of Maryland, College of Computer, Mathematical and Natural Sciences
- 2009 SIAM Fellow
- 2007 Beijer Fellow, Beijer Institute of Ecological Economics, Stockholm, Sweden
- 2008 University Fellow, Resources for the Future
- 2004 Medallion of the Université de Montpellier
- 2004-05 Clay Mathematics Institute Senior Scholar
- 1991 The Honor Society of Phi Kappa Phi Biology Colloquium Award, Oregon State University

CURRENT PROFESSIONAL ACTIVITIES

SCIENCE ADVISORY

Board of Directors

- 1979- Vice Chair (Mathematics), Committee of Concerned Scientists,

Science/Advisory Boards

- 2020- Science Advisory Board, Serraphilheira: Training Program in Biology and Ecology (with ICTP-SAI FR)
- 2019 - Scientific Advisory Board, Instituto Serrapilheira, Brazil
- 2019- Scientific Advisory Council, Stockholm Resilience Centre
- 2019- Advisory Board, Institute of Mathematical Sciences, University of Miami
- 2018- Initial Advisory Board, Institute for the Mathematical Sciences of the Americas (Funded by the Simons Foundation)
- 2018- Advisor, Special Initiatives Program, James S. McDonnell Foundation
- 2016- Science Advisory Board, Complexity Sciences Hub of Vienna, Austria
- 2016- Science Advisory Board, EcoPotential: Improving Future Ecosystem Benefits through Earth Observations, Politecnico Di Milano, Italy
- 2015- International Advisory Board, Graduate Education and Research Training Program in Decision Science for a Sustainable Society of the Program for Leading Graduate School of the Japan Society for the Promotion of Science, Kyushu University
- 2007- Abroad Advisor, Arab Healthy Water Association
- 1999- Advisory Board, Institute for Medical BioMathematics, Bene Ataroth, Israel

Planning/Organizing Committees

- 2017- Lead for Application Area on Life History Theory for Selected and Self-Organizing Systems Workshops and Working Groups, Santa Fe Institute, NM (2017-)

Other Service

- 2018- Member, Sabin-Aspen Vaccine Science and Policy Strategy Group, Sabin Vaccine Institute, Washington, D.C.

Princeton University Service

- 2021 - Core Participant, Rapid Switch Program
- 2021- Advisory Committee, Electoral Innovation Lab
- 2019-22 Executive Committee of the Sustainable Energy (SE) Program, Andlinger Center
- 2016- Faculty Advisory Board/Faculty Review Board, Princeton Undergraduate Research Journal
- 2015- Program Coordinator, MBI-Princeton Institute Partner Program
- 2012- Faculty Fellows Program, Butler College
- 1993- Faculty Advisory Committee, High Meadows Environmental Institute
- 1992- Director and Faculty Organizer, Theoretical Ecology Lab Tea

PREVIOUS PROFESSIONAL ACTIVITIES

- 2018-21 Science Advisory Board, Santa Fe Institute, NM (*Also previously:* SAB 1991-99, 2001-05, 2011-17)
- 2017-18 Chair, Committee to Select the Gibbs Lecturer for 2018 and 2019, American Mathematical Society
- 2015-18 Member, Board on Mathematical Sciences and Analytics, National Research Council, The National Academies
- 2014-19 Science Advisory Board, Stockholm Resilience Centre
- 2009-12 Vice-Chair, Governing Council, IIASA, Austria
- 2008-14 Advisory Board, DIMACS, Rutgers University
- 2007-10 Co-Chair, Science Advisory Board, Santa Fe Institute, NM
- 2004-05 First Chair, Steering Committee for Models of Infectious Disease Agent Study (MIDAS)
- 2003-09 Chair, Governing Council, IIASA, Austria
- 1997-99 Chair, Beijer Institute of Ecological Economics, Sweden
- 1994-99 Board of Directors, Beijer Institute of Ecological Economics, Sweden

CURRENT EDITORIAL ACTIVITIES

Editor-in-Chief/Managing Editor

- 2003- Princeton Series in Theoretical and Computational Biology, Princeton University Press
- 1997- Complexity Series (w/co-editor Stephen Strogatz), Princeton University Press
- 1992- Monographs in Population Biology (w/Rob Pringle and Corina Tarnita), Princeton University Press

Honorary Editor

- 2006- Theoretical Ecology
- 1996- Bulletin for Mathematical Biology
- 1995- Journal of Mathematical Biology

Editor

Founding Associate Editor, Collective Intelligence (2020-)

Editorial Boards

- 2015- Experiments in Engagement (EiE), part of PNAS
- 2012- PeerJ
- 2012- Movement Ecology
- 2011- PNAS
- 2007- Princeton University Press, Primers in Complexity
- 2007- Princeton University Press, Science Essential Series
- 2006- Journal of Biomathematics (Series B, English)
- 2004- Faculty of 1000, Co-Section Head Theoretical Ecology
- 1999- Journal of Biomathematics (China)
- 1987- Applied Mathematics Letters
- 1987- Mathematical Biosciences
- 1987- Papers on Mathematical Ecology
- 1979- Mathematical and Computer Modelling

Advisory Boards

- 2021- Ecology, Economy, and Society
- 2020- Collective Intelligence (ACM and Sage)
- 2013- F1000 Prime, Head of Section for Theoretical Biology
- 2007- PLoS Computational Biology
- 2006- Journal of Biological Dynamics
- 2006- Landscape Ecology
- 2004- Mathematical Biosciences and Engineering
- 2002- Frontiers in Ecology and the Environment

PREVIOUS EDITORIAL ACTIVITIES

Editor-in-Chief/ Managing Editor

- Lecture Notes in Biomathematics, Springer-Verlag (1973-95)
- Biomathematics, Springer-Verlag (1976-95)
- Journal of Mathematical Biology (1976-1995)
- Founding Editor, Ecological Applications (1988-95)
- Series in Mathematical and Computational Biology, John Wiley & Sons (1997-00)
- Encyclopedia of Biodiversity, Academic Press (1997-00); Online Editor, Elsevier (2005); Second edition, 2013

Honorary Editor

The Scientist (2006-19)

Co-Managing Editor

SIAM Journal on Applied Mathematics (1975-79)

Editor

- Ecology and Ecological Monographs/ESA (1975-77; Associate Editor, 1973-75)
- Lectures on Mathematics in the Life Sciences: American Mathematical Society (1974-79)

Princeton Guide to Ecology, Princeton University Press (published 2009)
 PLoS Biology, Challenges Series

SELECT OTHER PROFESSIONAL ACTIVITIES – CURRENT

- Academic Fellow, Boston Consulting Group
- Director and Co-Organizer, Princeton University-Arizona State University Partnership, Dialogues in Complexity Workshops: Series I (Challenges in Cybersecurity: Lessons from Biological Defense Systems) & Series II (Political Polarization)
- Co-Director of J.S. McDonnell Foundation Project of Individual Behavior and Infectious Disease
- Princeton Director of Partnership with Stockholm Resilience Centre and Potsdam Institute for Climate Impact Research, Resilience in Social and Environmental Systems Project, Princeton University
- Co-Director of Humboldt University-Princeton University Strategic Partnership, Princeton University
- Member, Research Community on Global Systemic Risk, PIIRS, Princeton University

SELECT PUBLICATIONS

- Flierl, G., Grünbaum, D., **Levin, S.A.**, and D. Olson. 1999. From individuals to aggregations: The interplay between behavior and physics. *Journal of Theoretical Biology* 196: 397–454.
- Kempes, C.P., Follows, M.J., Smith, H., Graham, H., House, C.H., and **S.A. Levin**. 2021. Generalized stoichiometry and biogeochemistry for astrobiological applications. *Special Issue of Bulletin of Mathematical Biology in honor of Jim Murray* 83: 73.
- Levin, S.A.** 2003. Complex adaptive systems: Exploring the known, the unknown and the unknowable. *Bulletin of the American Mathematical Society* 40: 3–19.
- Levin, S.A.** 1992. The problem of pattern and scale in ecology. *Ecology* 73(6): 1943–1967. Reprinted in *Ecological Time Series*, eds. J. Steele and T. Powell, 277–326. New York: Chapman & Hall: 1995.
- Levin, S.A.**, Anderies, J.M., Adger, N., Barrett, S. Bennett, E.M., Cardenas, J.C., Carpenter, S.R., Crépin, A.-S., Ehrlich, P., Fischer, J., Folke, C., Kautsky, N., Kling, C., Nyborg, K., Polasky, S., Scheffer, M., Segerson, K., Shogren, J., van den Bergh, J., Walker, B., Weber, E.U., and J. Wilen. 2021. Governance in the face of extreme events: Lessons from evolutionary processes for structuring interventions, and the need to go beyond. *Ecosystems*: doi:10.1007/s10021-021-00680-2.
- Levin, S.A.**, and A.W. Lo, eds. 2021. *PNAS Special Feature on Evolutionary Models of Financial Markets*. *PNAS* 118(26). Available from: <https://www.pnas.org/content/118/26>.
- Levin, S.A.**, Milner, H.V., and C. Perrings, eds. 2021. *PNAS Special Feature on Political Polarization*. *PNAS* 118(50). Available from: <https://www.pnas.org/content/118/50>.
- Morris, D.H., Rossine, F.W., Plotkin, J.B., and **S.A. Levin**. 2021. Optimal, near-optimal, and robust epidemic control. *Communications Physics* 4(1): 1–8.
- Okubo, A. and **S.A. Levin**, eds. 2001. *Diffusion and Ecological Problems: Modern Perspectives. Interdisciplinary Applied Mathematics*, Vol. 14. New York, NY: Springer.
- Patterson, D.D., **Levin, S.A.**, Staver, A.C., and J.D. Touboul. 2020. Probabilistic foundations of the spatial mean-field models in ecology and applications. *SIAM Journal on Applied Dynamical Systems* 19(4): 2682–2719.
- Romano, R. and **S. Levin**. 2021. Sunsetting as an adaptive strategy. *PNAS Special Feature on Evolutionary Models of Financial Markets*. *PNAS* 118(26): e2015258118.
- Saad-Roy, C.M., Grenfell, B.T., **Levin, S.A.**, Pellis, L., Stage, H.B., van den Driessche, P., and N.S. Wingreen. 2021. Superinfection and the evolution of an initial asymptomatic stage. *Royal Society Open Science* 8: 202212.
- Saad-Roy, C.M., Grenfell, B.T., **Levin, S.A.**, van den Driessche, P., and N.S. Wingreen. 2021. Evolution of an asymptomatic first stage of infection in a heterogeneous population. *Journal of the Royal Society Interface* 18(179): doi: <https://doi.org/10.1098/rsif.2021.0175>.
- Saad-Roy, C.M., Morris, S.E., Metcalf, C.J.E., Mina, M.J., Baker, R.E., Farrar, J., Holmes, E.C., Pybus, O.G., Rambaut, A., Graham, A.L., **Levin, S.A.**, Grenfell, B.T., and C.E. Wagner. 2021. Epidemiological and evolutionary considerations of SARS-CoV-2 vaccine dosing regimes. *Science*: doi: 10.1126/science.abg8663.
- Saad-Roy, C.M., Wagner, C.E., Baker, R.E., Morris, S.E., Farrar, J., Graham, A.L., **Levin, S.A.**, Metcalf, C.E., and B.T. Grenfell. 2020. Immune life-history, vaccination and the dynamics of SARS-CoV-2 over the next five years. *Science* 10: 1126.
- Saad-Roy, C.M., Wingreen, N.S., **Levin, S.A.**, and B.T. Grenfell. 2020. Dynamics in a simple evolutionary-epidemiological model for the evolution of an initial asymptomatic infection stage. *PNAS* 117(21): 11541–11550.
- Touboul, J.D., Staver, A.C., and **S.A. Levin**. 2018. On the complex dynamics of savanna landscapes. *PNAS* 115(7): E1336–E1345.
- Wagner, C.E., Saad-Roy, C.M., Morris, S.E., Baker, R.E., Mina, M.J., Farrar, J., Holmes, E.C., Pybus, O.G., Graham, A.L., Emanuel, E.J., **Levin, S.A.**, Metcalf, C.J.E., and B.T. Grenfell. 2021. Vaccine nationalism and the dynamics and control of SARS-CoV-2. *Science* 373(6562): doi: 10.1126/science.abj7364.
- Xu, L., Patterson, D., Staver, A.C., **Levin, S.A.**, and J. Wang. 2021. Unifying deterministic and stochastic ecological dynamics via a landscape-flux approach. *PNAS* 118(24): e2103779118.