

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

- 2022- Faculty, Program in Biophysics
- 2022- Affiliated Faculty, Center for Health and Wellbeing
- 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- Affiliated 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 2022 BBVA Foundation Frontiers of Knowledge Award in Ecology and Conservation Biology, 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 and 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

- 2022 BBVA Foundation Frontiers of Knowledge Award in Ecology and Conservation Biology
- 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.

Honorary & Distinguished Fellowships

- 2022 Distinguished Senior Fellow, Intercollegiate Biomathematics Alliance
- 2022 Fellow, Academia Europaea
- 2021 Distinguished Fellow, Luohan Academy
- 2020 Research Fellow, Gruter Institute for Law and Behavioral Research
- 2018 Science Board Lifetime Fellow, Santa Fe Institute
- 2017 Fellow, Society for Mathematical Biology
- 2014 Distinguished Visiting Fellow, IIASA
- 2009 Fellow, SIAM
- 2007 Beijer Fellow, Beijer Institute of Ecological Economics
- 2008 University Fellow, Resources for the Future

Other Honors & Awards

- 2021 Highly Cited Researcher, Web of Science Group
- 2020 Highly Cited Researcher, Web of Science Group
- 2020-23 Affiliate, MIT Laboratory for Financial Engineering (LFE)
- 2019 Lifetime Achievement Award, Who's Who
- 2019 Highly Cited Researcher, Web of Science Group
- 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
- 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

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

Science/Advisory Boards

Science Advisory Board, Santa Fe Institute, NM, (1991-99; 2001-05; 2011-17; 2018-23); Co-Chair (2007-10)

Advisory Board, Institute for Medical BioMathematics, Bene Ataroth, Israel (1999-)

Abroad Advisor, Arab Healthy Water Association (2007-)

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 (2016-)

Advisory Board, SIAM Activity Group on Mathematics of Planet Earth (2017-)

Advisor, Special Initiatives Program, James S. McDonnell Foundation (2018-)

Initial Advisory Board, Institute for the Mathematical Sciences of the Americas, University of Miami (Funded by the Simons Foundation) (2018-)

Scientific Advisory Council, Stockholm Resilience Centre (2019-)

Scientific Advisory Board, Instituto Serrapilheira, Brazil (2019-); SAB, Serrapilheira: Training Program in Biology and Ecology (Serrapilheira with ICTP-SAIFR (2020-)

Advisory Board, Approaches to Causation in the Social and Natural Sciences and their Implications for Theory Building in Sustainability Science (CauSES) (2021-)

Scientific Advisory Board, The Future of the Greater Venice: Toward Seven Transition Scenarios to a Thriving Venice 2100, Istituto Veneto di Scienze, Lettere ed Arti, Venice (2022-)

Advisory Board, UVA's Global Biothreats T32 Training Program (2022-)

Advisory Committees

Advisory Committee, Program at the Isaac Newton Institute for Mathematical Sciences on "The Mathematics of Movement" (2021-)

Steering Committees

Scientific Steering Committee, Institute for Global Change Studies, Tsinghua University

Advisor (Expert Reviewer), Steering Committee for Pilot Research into Complexity Measures for Ecoacoustics, University of Sussex (2022-)

Other Committees

ESA Past Presidents Committee

Review Committee, NAS, Review of Board on Mathematical Sciences and Analytics

Scientific and Strategic Partnerships Committee, Global South AI4PEP, York University, Canada (2022-)

Memberships

Pandemic Research for Preparedness and Resilience (PREPARE), University of Virginia, Biocomplexity Institute (2021-)

Corona Economics Research Network (CERN), Stockholm School of Economics (2020-)

Other Service

SparcS Fellow, Synergy Program on Resilience and Critical TransitionS (from Echteled Workshops) (2012-)

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

PRINCETON UNIVERSITY SERVICE:

Directorships

Founder, Director, and Faculty Organizer, Theoretical Ecology Lab Tea (1992-2022); Co-Director & Co-Faculty Organizer, Theoretical Ecology Tea (Fall 2022-)

Advisory Boards

Faculty Advisory Board/Faculty Review Board, Princeton Undergraduate Research Journal, Princeton University (2016-)

Faculty Advisory Group, Center for Jewish Life, Princeton University (2021-)

Committees

Faculty Advisory Committee, High Meadows Environmental Institute (formerly Princeton Environmental Institute) (1993-)

Innovation Fund for the Campus as a Lab, Office of the Dean of Research

Executive Committee of the Sustainable Energy (SE) Program, Andlinger Center (2019-25)

Advisory Committee, Electoral Innovation Lab, Princeton University (2021-)

EEB Graduate Student Admissions Committee (Dec. 2022-)

Memberships

Research Community on Global Systemic Risk, PIIRS

Other

Participant, Princeton's Chapter of EWB (Engineers Without Borders with SEADS (Sustainable Engineering and Development Scholars) Program

Coordinator, MBI-Princeton Institute Partner Program (2015-)

Lead Organizer, Stockholm Resilience Center-Potsdam Institute for Climate Impact Research-Princeton University Resilience in Social and Environmental Systems Project

Co-Organizer of Humboldt University-Princeton University Strategic Partnership

Co-Organizer of Social Norms Research Group, Princeton University

Core Participant in the Rapid Switch Program

EDITORIAL:

Editor-in-Chief/Managing Editor

Monographs in Population Biology (with Corina Tarnita and Rob Pringle), Princeton University Press (1992-)

Complexity Series (with co-editor Stephen Strogatz), Princeton University Press (1997-)

Princeton Series in Theoretical and Computational Biology, Princeton University Press (2003-)

Honorary Editor

Journal of Mathematical Biology (Co-Managing Ed. 1976-95; Advisory Ed., 1973-76; Honorary Ed. 1995-)

Bulletin for Mathematical Biology (1996-)

Theoretical Ecology (2006-)

Editor

Founding Associate Editor, Collective Intelligence (2020-)

Editorial Boards

Mathematical and Computer Modelling (1979-)

Applied Mathematics Letters (1987-)

Mathematical Biosciences (1987-)

Papers on Mathematical Ecology (1987-)

Faculty of 1000, Co-Section Head, Theoretical Ecology (2004-)

Journal of Biomathematics (Series B, English) (2006-)
 Princeton University Press, Primers in Complexity (2007-)
 Princeton University Press, Science Essential Series (2007-)
 PNAS (2011-)
 PeerJ (2012-)
 Movement Ecology (2012-)
 Experiments in Engagement (EiE), part of PNAS (2015-)

Advisory Boards

Mathematical Biosciences and Engineering (2004-)
 Journal of Biological Dynamics (2006-)
 Landscape Ecology (2006-)
 PLoS Computational Biology (2007-)
 Section Head of Theoretical Biology, Faculty Opinions (Formerly F1000Prime) (2013-)
 Collective Intelligence (ACM and Sage) (2020-)
 Ecology, Economy and Society (2021-)
 Mathematical Biosciences (2023-)

SELECT CURRENT PROFESSIONAL ACTIVITIES

- Academic Fellow, Boston Consulting Group
- Director and Co-Organizer, Princeton University-Arizona State University Partnership, Dialogues in Complexity
- 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

PUBLICATIONS

Google Scholar

<https://scholar.google.com/citations?user=7PeekG0AAAAJ&hl=en>

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* 25: 697–711.
- 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): 20210175.

- 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*: 372(6540): 363–370.
- 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). <https://doi.org/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.
- Xu, L., Wang, J., Patterson, D., and **S.A. Levin**. 2023. Early-warning signals for critical transitions in ecological systems. *PNAS* 120(5): e2218663120.