LEVIN LAB MEMBERS 2024–2025

CONTENTS

Director & Administrator (p. 2–4)

Visiting Research Collaborators/Scholars (p. 5–11)

Postdoctoral Research Associates & Fellows (p. 12–22)

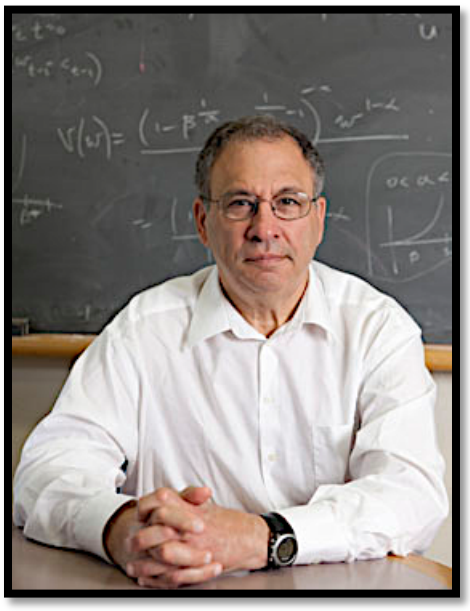
Graduate Students (p. 23–32)

Visiting Research Student Collaborators (p. 33–35)

Updated: 09/02/24

DIRECTOR & ADMINISTRATOR

Simon A. Levin
Kara Rock



Simon A. Levin

Director, Levin Lab
James S. McDonnell Distinguished University Professor in Ecology & Evolutionary Biology
Director, Center for BioComplexity in the High Meadows Environmental Institute

Simon A. Levin is the James S. McDonnell Distinguished University Professor in Ecology and Evolutionary Biology at Princeton University. He received his B.A. from Johns Hopkins University and his Ph.D. in Mathematics from the University of Maryland. Levin is a Fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science, a Member of the National Academy of Sciences and the American Philosophical Society, and a Foreign Member of the Istituto Veneto and the Istituto Lombardo. He is a University Fellow of Resources for the Future, a Fellow of the Beijer Institute of Ecological Economics, a Fellow of the Society for Industrial and Applied Mathematics, a Fellow of the Society for Mathematical Biology, a Fellow of the American Mathematical Association, a Distinguished Fellow of the Luohan Academy, and a Fellow of the Academia Europaea. He is a former President of the Ecological Society of America and the Society for Mathematical Biology, Chair of the Council of IIASA, Chair of the Board of the Beijer Institute, and Chair of the Science Board of the Santa Fe Institute. He has received numerous awards including the Kyoto Prize in Basic Sciences, Heineken Prize for Environmental Sciences, Margalef Prize for Ecology, Tyler Prize for Environmental Achievement, the U.S. National Medal of Science, and the BBVA Foundation Frontiers of Knowledge Award in Ecology and Conservation Biology. He has mentored more than 150 Ph.D. students and Postdoctoral Research Associates and Fellows.



Kara Rock

Levin Lab Administrator

Kara Rock is the new Levin Lab Administrator at the Department of Ecology and Evolutionary Biology. With a strong foundation in physics and education, Kara brings a unique perspective to the role. She previously completed her undergraduate degree in Education: Physics at the University of South Florida, where she engaged in research focused on developing broader impact strategies for biological physics.

Through her involvement with the L'Space program at Arizona State University, Kara gained invaluable experience in NASA mission design, proposal writing, and public outreach. Her passion for space exploration led her to pursue an Executive Master's degree in Space Leadership, Business, and Policy, solidifying her leadership and management skills.

Kara is driven by a desire to apply research on biological systems and their environments to practical solutions for Earth and future space habitats. She is dedicated to advancing our understanding of these interactions to promote sustainable practices and ensure the well-being of our planet and potential future homes beyond.

Beyond her professional pursuits, Kara enjoys exploring new places, listening to music, and dancing.

VISITING RESEARCH SCHOLARS

Stanca Ciupe
Stefani Crabtree
George Hagstrom
Aanjaneya Kumar
Denis Patterson
Xiao Sun



Stanca M. Ciupe

Professor, Virginia Tech
Visiting Research Scholar, Levin Lab

Stanca Ciupe will join the Levin Lab as a Visiting Research Scholar in the Fall of 2024. She is a Professor in the Mathematics Department at Virginia Tech, a Faculty Fellow in the College of Science, and the Director of the Center for the Mathematics of Biosystems at Virginia Tech. She received a Ph.D. in Applied and Interdisciplinary Mathematics from the University of Michigan and was a postdoctoral fellow at the Santa Fe Institute and Duke University Medical Center. Her work focuses on developing within-host mathematical models of viral infections, understanding the immune responses to disease by validating model with single cell and population data, and quantifying drug efficacies through pharmacokinetic-pharmacodynamic modeling.

Stanca's current focus is on developing multiscale models of infectious diseases in several virus infection systems and incorporating data at various scales to make predictions. She is working with virologists, immunologists, and medical professionals to bridge the gaps between scales of resolutions. An important part of her research, is investigating model identifiability and using that theoretical framework to suggest optimal experimental design.



Stefani Crabtree

Assistant Professor, Utah State University
Visiting Research Scholar, Levin Lab

Stefani Crabtree is a Visiting Research Scholar to the Levin Lab, having joined in spring of 2020. She is currently Assistant Professor of Social-Environmental Modeling at Utah State University and External Faculty at the Santa Fe Institute. She completed a Ph.D. in Anthropology from Washington State University (2016) and a Ph.D. in Archéologie, Territoires et Environnements from the Université de Franche-Comté (2017). Her work uses complex adaptive systems modeling, such as agent-based models and network models, to understand the archaeological past and to leverage the archaeological record as a calibration dataset for sustainability challenges in the present and future.

Crabtree's recent work weaves together disparate strands of science to found a new field of 'archaeoecology' that acts as a bridge between paleoecology and modern ecology and explicitly includes humans as described in detail by her recent paper "Towards a Science of Archaeoecology" in the journal *Trends in Ecology and Evolution*. While studies of the abiotic environment are well established in archaeology (e.g., climate reconstruction from tree rings) examining full ecosystems from the archaeological past in a comprehensive and quantitative way—and assessing the human place within those ecosystems— is novel. She leads research projects in Western Australia, Northern Mongolia, and the American Southwest that combine fieldwork and computational modeling to query the past to be able to advance questions on sustainability into the future. Her work has impacted governmental policy on environmental management in arid ecosystems. She holds additional positions at the Australian Research Council Centre of Excellence for Australian Biodiversity and Heritage and at Crow Canyon Archaeological Center.



George Hagstrom

Doctoral Lecturer, CUNY
Visiting Research Scholar, Levin Lab

George Hagstrom studies emergent properties in complex adaptive systems, with particular focus on marine ecosystem function, biogeochemical cycles, and collective behavior in biological, social, and economic systems. One of Hagstrom's primary goals is to develop marine ecosystem models that capture biodiversity and adaptation, and to use these models to improve our understanding of key macroscale features of marine ecosystems and to predict how these ecosystem functions will respond to climate change and other anthropogenic perturbations. He uses a trait-space based description, rather than one based on species, to find a reduced-dimensionality representation of highly diverse marine ecosystems. He developed the trait-based ATOM model of marine phytoplankton and used it to show how dynamics in the elemental stoichiometry of phytoplankton induce novel couplings and feedbacks in marine biogeochemical cycles. He has implemented ATOM within an IPCC, CMIP6 grade Earth System Model, and is actively studying dynamic stoichiometry impacts nutrient limitation, primary productivity and carbon export, and nitrogen fixation. Hagstrom is working to extend the ATOM framework to incorporate genetic data, using quantitative systems biology, with the aim of better understanding the trade-offs between heterotrophic metabolic strategies and the relevance of genetic differences in *Prochlorococcus* and *Synechococcus* genetic differences across oligotroiphic ecosystems. Hagstrom is also actively working on a project to better understand how the microscopic dynamics of complex systems can be used to better anticipate or to manage critical transitions, using an approach directly inspired by statistical physics.



Aanjaneya Kumar

Complexity Postdoctoral Fellow, Sante Fe Institute
Visiting Research Scholar, Levin Lab

Aanjaneya (Aanj) Kumar will join Princeton and the Levin Lab in Fall 2024 as a Visting Research Scholar and member of the Earth Resilience and Sustainability Initiative. He will also hold a joint position at the Santa Fe Institute as a Complexity Postdoctoral Fellow. His research interests lie in the study of stochastic models of complex systems. Over the last few years, his primary aim has been to obtain insight into practically relevant problems by first formulating suitable mathematical models and then analyzing them using tools from statistical physics, network science, and evolutionary game theory. His research projects thus far can be broadly classified into the following themes: (i) extremal statistics and rare events, (ii) social dynamics and cultural evolution, and lastly, (iii) partially observed stochastic processes, which is also the theme of his Ph.D. research being carried out at the Indian Institute of Science Education and Research (IISER) Pune, India.

Going forward, he is excited by the prospect of exploring the theme of *Designing Resilient Institutions.* The society we live in is structured by several formal and informal rules. These rules are shaped by cultural influences and social processes with the objective of producing desirable socio-economic outcomes. We refer to these rules as "institutions." In addition to being efficient in promoting collective action on important societal issues, we require our institutions to be able to deal with and adapt to change. Aanj aims to understand the characteristics that make an institution resilient by exploring the coevolutionary dynamics of institutions and socio-ecological systems.

Outside of academic research, he is passionate about writing, social justice, and horror movies.

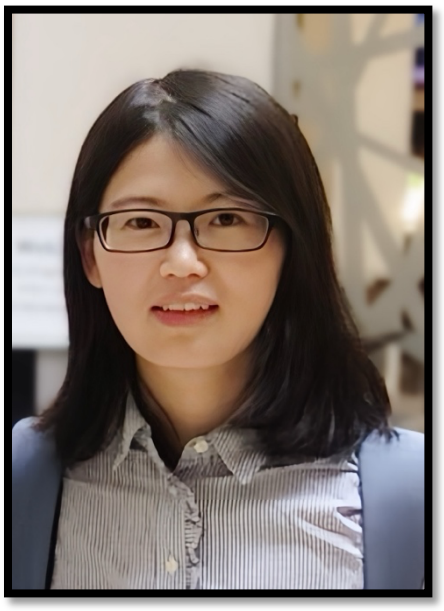


Denis Patterson

Assistant Professor, Durham University, UK
Visiting Research Scholar, Levin Lab

Denis Patterson joined the Levin Lab in November 2020 as a Postdoctoral Researcher and is now an Assistant Professor in Applied Mathematics at Durham University. He previously received a Ph.D. in Applied Mathematics from Dublin City University under the supervision of Prof. John Appleby. His thesis employed techniques from nonlinear and stochastic analysis to study functional differential equations subject to random forcing. He then joined Professor Jonathan Touboul's group at Brandeis University where he began applying his mathematical training to problems in biology, ecology, and neuroscience.

Denis has worked extensively on spatially explicit models of forest-savanna ecosystems, including rigorously deriving such models from microscale interaction rules and studying their dynamics in detail. The goal of this work is a better understanding of the implications of empirically observed forest-savanna bistability and of the resilience of these ecosystems more generally. He is also interested in mathematical models of malaria, both at the population and within-host scales, as well as problems in biological development. Dynamical systems, stochastic analysis and (nonlocal) PDEs, are common tools across his various projects.



Xiao Sun

Associate Professor, Chinese Academy of Agricultural Sciences, China
Visiting Fellow, HMEI, Levin & Rubenstein Labs

Xiao Sun joined the Levin Lab as a Visiting Fellow in August 2024. She is an Associate Professor of Landscape Ecology at Chinese Academy of Agricultural Sciences. She earned her Ph.D. in Ecosystem Services and Urban Complex Ecosystem at Chinese Academy of Sciences. Her research interest lies at ecosystem services modelling and optimization, landscape multi-scale planning, and water-food-carbon nexus. Specifically, she focused on analyzing the impacts of land use changes, human socioeconomic activities, and policy making on biodiversity and ecosystem services by employing GIS and remote sensing techniques, field investigations, statistical analysis, and other biophysical methods. She has developed optimization algorithms and models to address the regulation of food flows and mitigate trade-offs between ecological benefits and agricultural production.

She plans to work on network analysis, multi-objective optimization algorithm, alternative scenarios simulation to (1) explore the mechanisms of how urban-rural transitions affect environmental equity and sustainability, including various aspects such as resource consumption, climate regulation, water purification, heat island regulation, soil and water conservation, cultural recreation, biodiversity protection, eta. (2) find the spatially optimized ecological restoration or land management solutions aimed at mitigating or reducing the deficits and trade-offs of ecosystem services supply and demand, and adjusting the flow paths of food, water, and carbon at multiple scales to promote the resilience of complex socio-ecological systems.

POSTDOCTORAL RESEARCH ASSOCIATES & FELLOWS

Emerson Arehart
Talia Borofsky
Abigail Croker
Guillaume Falmagne
Giuseppe Ferro
Xander Huggins
Harman Jaggi
Aanjaneya Kumar
Nusrat Molla
Annie Stephenson
Emma Zajdela



Emerson Arehart

Postdoctoral Research Associate, University of Pennsylvania;
Levin Lab

Emerson Arehart will join the Levin Lab in the Fall of 2024. He will hold a split position between the Levin Lab and the Akçay/Plotkin labs at the University of Pennsylvania.

He received his Ph.D. in 2021 from the University of Utah (advised by Fred Adler), where he studied the fitness effects of learning and decision-making in foragers experiencing changing environments.

He is currently extending approaches from behavioral ecology and collective decision-making and applying them to social and cultural evolution in humans. In particular, he is interested in human decision making related to land use change and conservation. He also works on integrating scientific machine learning into the scientific discovery process.



Talia Borofsky

Postdoctoral Research Fellow, High Meadows Environmental Institute

Talia Borofsky joined the High Meadows Environmental Institute as a postdoctoral research fellow in August 2023 and is also affiliated with Hebrew University University's Ecology, Evolution, and Behavior Department. She received her Ph.D. in Biology from Stanford University, where she researched the evolution of social learning and cooperation by predators with advisor Professor Marcus Feldman.

She is now researching reciprocal niche construction between ecologically distinct types of cooperative traits. Her research will be conducted in collaboration with Princeton Professors Simon Levin, Daniel Rubenstein, and Naomi Leonard (Mechanical and Aerospace Engineering), as well as with Professor Erol Akçay (University of Pennsylvania) and Professor Gili Greenbaum (Hebrew University). Through this collaboration, she will use both theoretical modeling and data analysis to untangle the connections between ecology and the evolution of cooperation.



Abigail Croker

Ph.D. Candidate, Centre for Environmental Policy, Imperial College London; Leverhulme Centre for Wildfires, Environment and Society

Abigail Croker will be joining the High Meadows Environmental Institute and the Levin Lab in the Fall of 2024 within the Earth Resilience and Sustainability Initiative, developing collaborations with the Stockholm Resilience Center and the Potsdam Institute for Climate Impact Research. She is completing her Ph.D. at the Centre for Environmental Policy, Imperial College London, funded by Grantham Institute's Science and Solutions for Changing Planet Doctoral Training Partnership (SSCP DTP). She is also affiliated with the Leverhulme Centre for Wildfires, Environment and Society. Abigail's research applies a social-ecological systems framework to explore the opportunities for and challenges of decentralizing fire management across East and Southern African savanna-protected areas under future climate-socioeconomic change. Her research takes a historical institutionalist and ecological approach to understand how multiple systems variables interact to affect resilience in complex adaptive savanna ecosystems, integrating fieldwork, empirical research approaches, and systems modelling.

Her research will explore the relationships between the introduction of carbon market mechanisms aiming to mitigate wildfires and increase natural carbon sequestration, and the expansion of agricultural frontiers across highly biodiverse tropical mesic savanna-forest transition zones. Three interrelated challenges occurring in these ecosystems are central to this investigation: (i) the emergence of a 'wildfire paradox' across conservation landscapes where delineated land use boundaries separate human and livestock populations and fire suppression operations have been implemented; (ii) an increase in carbon-oriented results-based payment schemes in wildfire and conservation management interventions which often prioritize carbon revenue generation at the national level; (iii) the rapid expansion of agri-business frontiers where annual rainfall supports crop production. Abigail will be working with Professor Simon Levin, Professor Daniel Rubenstein, Professor Jonathan Levine, and others, to investigate how these challenges play out in local agrarian contexts and their long-term impacts on savanna health and biodiversity, natural carbon capture, and social-ecological resilience.



Guillaume Falmagne

Postdoctoral Research Associate, High Meadows Environmental Institute

Guillaume Falmagne joined Princeton's High Meadows Environmental Institute (HMEI) in September 2022. Before that, he worked at LLR (École Polytechnique, Palaiseau/Paris) where he received a Ph.D. in Physics. He investigated properties of the quark-gluon plasma using data from heavy ion collisions in the CMS detector at LHC (the 27-km particle accelerator at CERN, Geneva). In particular, he led the first observation of the Bc particle in that peculiar state of matter.

He is now interested in collective phenomena in large groups through the lens of critical transitions and big data analysis. One project, together with postdoc Annie Stephenson, is based on data from a 10-million-user collaborative game on Reddit. He used machine learning techniques to build performant early warning signals for local transitions in the game. The collaborative nature of the game also allows to gain understanding of the organizational structures that favor cooperation at large scales, and of the dynamics of conflicts and group formation. In another project, he determines how the structure of the moisture network affects cascading transitions in the Amazon rainforest. He is also interested in complex systems that show feedback between their social and ecological components.



Giuseppe M. Ferro

Postdoctoral Research Fellow, High Meadows Environmental Institute

Giuseppe Ferro joined the High Meadows Environmental Institute in October 2022. Before that, he worked at ETH Zürich where he received a Ph.D. in Economics. He analyzed how real human beings make decisions under uncertainty, as opposed to what they should do. Specifically, he focused on developing operational models of individual decision-making in risky and ambiguous setups, representing the decision activity as a stochastic process, and working at different levels of abstraction (axiomatic models, low-dimensional stochastic processes, and computational models).

He is now interested in incorporating behavioral economics into climate models, adopting a complex systems approach. One of his projects aims to understand how recommendation algorithms on social media affect opinion dynamics on controversial issues such as climate change, analyzing the unintended consequences of an unregulated "attention" market. Another project involves studying how intra-firm multi-authority structures impact the pursuit of multiple conflicting goals (e.g., being profitable while being environmentally responsible).



Xander Huggins

Ph.D. Candidate, University of Victoria

Xander Huggins will join the Levin Lab in Fall of 2024. His Ph.D. research, conducted under the supervision of Tom Gleeson (University of Victoria) and James S. Famiglietti (Arizona State University), combined groundwater science, data science, and sustainability science to study large-scale groundwater systems as social-ecological systems. His work centers a relational approach to groundwater, focusing on groundwater system interactions with socioeconomic, ecological, and Earth systems rather than on the resource itself. Global-scale applications of this "groundwater-connected systems" approach have supported the identification of groundwaterscapes (novel landscape units of groundwater's social-ecological function), hotspot basins for social-ecological vulnerability to the linked threats of freshwater stress and storage loss, and the role of groundwater flow systems in supporting international area-based conservation initiatives. During his Ph.D., he participated in the Young Scientist Summer Program at the International Institute for Applied Systems Analysis and there received the Mikhalevich Award. He was a visiting Ph.D. researcher at the Stockholm Resilience Centre, which continues to support his role co-leading an international water resilience research collective.

His postdoctoral work will be conducted primarily at the Institute for Resources, Environment and Sustainability at the University of British Columbia (UBC), and supported through an NSERC Postdoctoral Fellowship, a UBC Killam Postdoctoral Research Fellowship, and a Canadian Space Agency Postdoctoral award. Building on work he has led and co-authored to globally map groundwater-dependent ecosystems (GDEs), his post-doctoral research will investigate the resilience of GDEs worldwide to changes in groundwater storage dynamics across land use and socioeconomic contexts. This work will combine Earth observation data on groundwater storage dynamics and vegetation indices to detect symptoms of resilience loss. These process-based insights will be combined with dynamic socioeconomic and land use archetype analysis to generate hypotheses on middle-range theories of change for groundwater-dependent ecosystem resilience. His overarching goal is to reveal groundwater sustainability as an overlooked tool to support wider social, economic, and ecological goals.



Harman Jaggi

Postdoctoral Research Associate, High Meadows Environmental Institute

Harman Jaggi joined the High Meadows Environmental Institute and the Levin Lab in August 2024, after completing her Ph.D. in biology at Stanford University, working on life-history dynamics and socio-ecological systems advised by Professor Shripad Tuljapurkar. During her graduate studies, she has worked on the evolution of migration in heterogenous environments, the role of density-dependence in food-limited ungulate populations, and the biocultural vulnerability of indigenous crops in the Indian Trans Himalaya (with the Nature Conservation Foundation, India). At Princeton, she will be mentored by Professors Simon Levin and Daniel Rubenstein and will work in collaboration with the Stockholm Resilience Centre. She is broadly interested in working on problems in population dynamics, agroecology, and wildlife conservation. Outside of work, she loves going to concerts and discovering new music.



Nusrat Molla

Distinguished Postdoctoral Research Fellow, The Andlinger Center

Nusrat Molla joined Simon A. Levin and Elke U. Weber's Labs in July 2023 as a Distinguished Postdoctoral Research Fellow at the Andlinger Center. She completed her Ph.D. at University of California, Davis, in which she focused on using dynamical systems modeling, sometimes coupled with qualitative analysis, to understand the social dynamics of resource extraction and governance. This work included, for example, exploring stabilizing and destabilizing factors in governance systems, and conducting a case study in California's San Joaquin Valley to understand how different water governance structures and management strategies shape different actors' influence and sensitivity to changes.

She plans to build on this work by modeling the conditions under which rural communities reliant on extractive industries can transition to other livelihoods and forms of production, with a focus on understanding the roles of institutions, attitudes towards adaptation, and building of social capital within communities. She will use coal mining-reliant communities in Appalachia as a case study, using surveys and interviews with stakeholders to inform model development.



Annie Stephenson

Postdoctoral Research Associate, High Meadows Environmental Institute

Annie Stephenson joined the High Meadows Environmental Institute in September 2022 and is also affiliated with the Stockholm Resilience Center and the Potsdam Institute for Climate Impact Research. She completed her Ph.D. at Harvard University in Applied Physics. Her Ph.D. work combined experimental measurements and theoretical models to understand and tune light scattering in correlated, disordered systems for applications in structural color. Through her work with agent-based models for light scattering and data-informed model-building, she developed an interest in understanding other complex systems with large numbers of interacting components.

As a postdoctoral researcher at Princeton, Annie is studying human collective behavior. In particular, she is interested in the dynamics of cooperation and conflict and collective action. In one project, in collaboration with postdoc Guillaume Falmagne, she is working to characterize patterns, including critical transitions and early warning signals of those transitions, using data from a collaborative game on the discussion website Reddit. In this same Reddit dataset, she is also investigating scaling laws in organizations using techniques borrowed from urban scaling theory, aiming to develop an understanding of why some communities can successfully mobilize individuals to reach a common goal, while others cannot. Annie and Guillaume have begun collaborating with a group of researchers at the Santa Fe Institute to further study the Reddit community structure. In another project, Annie is using social media data to understand the dynamics of fashion trends—why some spread quickly but are soon forgotten and why others can remain popular for much longer. In a project in collaboration with Professors Naomi Leonard (Princeton, Mechanical and Aerospace Engineering) and Scott Althaus (University of Illinois, Urbana-Champaign), she plans to examine data collected as part of the Social, Political, and Economic Event Database Project (SPEED) to understand the growth dynamics of social movements. Additionally, Annie attended the Complex Systems Summer School at the Santa Fe Institute, where she formed several group projects that are still active, and she has since been back to the Santa Fe Institute for two other workshops.



Emma Zajdela

Postdoctoral Research Associate, High Meadows Environmental Institute, C-PREE; ORISE IC Postdoctoral Research Fellowship at Princeton University for Modeling the Dynamics of Complex Socio-Ecological Systems at the Nexus of Environmental Challenges, Scientific Collaboration, and Conflict

Emma Zajdela joined the Levin Lab in October 2023. Previously, she completed her Ph.D. in the Department of Engineering Sciences and Applied Mathematics at Northwestern University, where she was a recipient of the National Science Foundation Graduate Research Fellowship, Buffett Institute Global Impacts Fellowship, and NICO Intersection Science Fellowship. Her research focuses on developing mathematical models to understand and predict complex social phenomena with real-world applications. She has worked on topics ranging from the mathematics of poker, autonomous vehicles, scientific collaboration at virtual and in-person conferences, and fashion trends. Since 2015, she has worked with the Malta Conferences Foundation, a non-profit organization that uses science diplomacy in the Middle East and currently serves as Treasurer and Member of the Board of Directors.

At Princeton, Emma is focusing on modeling the dynamics of complex socio-ecological systems at the nexus of environmental challenges, scientific collaboration, and conflict. In human societies, environmental, historical, and cultural factors interplay to drive conflict. Therefore, to understand the dynamics of human systems, we must understand the environment in which they reside. A goal of the project will be to apply and test the model in the context of water scarcity, conflict, and science diplomacy in the Middle East. In collaboration with Professor Michael Oppenheimer (Princeton, School of Public and International Affairs, Department of Geosciences and HMEI), she will investigate the role of scientists in creating change in the public sphere, particularly on shared environmental challenges including climate change.

GRADUATE STUDENTS

Matthew Cheung
Jacob Chisausky
Ari Freedman
Theo Gibbs
Anna Jacobson
Jiayu Li
Yimei Li
Victor V. Odouard
Marcela Ordorica Arango



Matthew Cheung

Ph.D. Student, Program in Applied and Computational Mathematics (PACM)

Matthew Cheung is a fifth-year Ph.D. student in the Levin Lab and the Program for Applied and Computational Mathematics at Princeton University. Before starting graduate school, he graduated from the University of California, Los Angeles with a B.S. in Applied Mathematics and a Specialization in Computing.

Matthew is interested in the interplay between human behavior/opinions and the dynamics of wealth in socioeconomic systems. This involves incorporating heterogeneity and aspects of human behavior, such as pro-social preferences and discounting, into models in ecological economics. His current research explores a dynastic model for intergenerational resource transfers under uncertain conditions, and the implications for inequality. Future work will look to integrate the dynamics of information and opinions regarding redistribution and pro-sociality, and the feedback from the dynamics of wealth.

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Jacob Chisausky

Ph.D. Student, Department of Ecology & Evolutionary Biology

Jacob Chisausky started the Ecology and Evolutionary Biology Ph.D. program in the summer of 2024. He is advised by Professors Simon A. Levin and Corina Tarnita.

He is interested broadly in social behavior, life history, and adaptation from an evolutionary perspective, utilizing both mathematical modelling and computational approaches. Before joining Princeton EEB, he earned an M.S. in the MEME (Erasmus Mundus Master's Program in Evolutionary Biology) program, during which he developed models to address the diversification of mating type loci in mushrooms, the evolution of individual and social learning, and costly signaling theory. Before this, he completed a B.S. in Plant Biology at Southern Illinois University, Carbondale, where he investigated plant-pollinator interaction networks in the region.



Ari Freedman

Ph.D. Student, Department of Ecology & Evolutionary Biology

Ari Freedman joined the Levin group in 2020 as a Ph.D. student in the Ecology and Evolutionary Biology Department. He is primarily interested in developing new ways to measure and model the effects of various human behaviors on disease transmission dynamics, through both data-driven and theoretical approaches. Before joining the group, he worked in the Dwyer group at the University of Chicago studying the disease ecology of the Douglas fir tussock moth. He continues to work on problems in disease ecology centered around anthropogenic disturbance and the evolution of virulence.



Theo Gibbs

Ph.D. Student, Program in Quantitative and Computational Biology (QCB)

Theo Gibbs received a B.S. in Mathematics with Honors from the University of Chicago, where he characterized how population abundances affect the stability of large random ecosystems. He then spent a year at the University of Illinois at Urbana-Champaign, working on theory for microbial communities.

As a QCB graduate student at Princeton advised by Simon Levin and Jonathan Levine, Theo is interested in how higher-order interactions affect species coexistence in diverse ecological communities. Higher-order interactions emerge when the direct effect of one species on other changes in the presence of a third species. Although these kinds of interactions are likely frequent in nature, they are missing from most classical ecological models. Theo combines ecological theory and experimental data from annual plant communities to understand whether or not higher-order interactions can explain the coexistence we observe in nature. Aside from research, Theo likes to play soccer and discover new music.



Anna Jacobson

Ph.D. Student, Program in Quantitative and Computational Biology (QCB)

Anna Jacobson is a graduate student with the program in Quantitative and Computational Biology. She joined the Levin Lab in 2020. A New York native, Anna attended Tufts University for her undergraduate degree, where she got a joint B.S. in Computer Science and Biology.

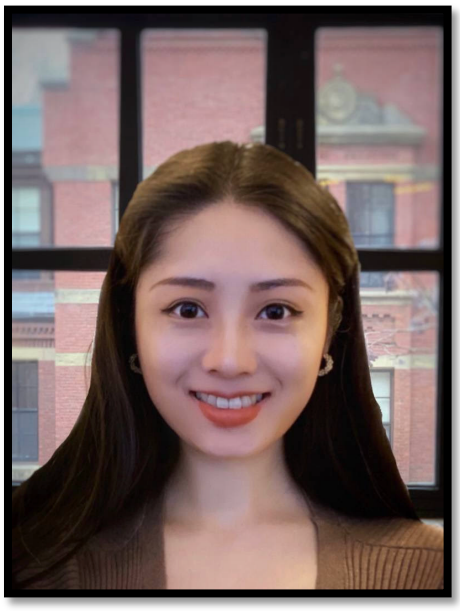
Anna's primary research interests involve climate and environmental policy. How can scientists perform meaningful work that maximally supports decisionmakers in D.C. and beyond? The start of her thesis work involved using mathematical decomposition to improve the runtime and accuracy of models used to inform capacity expansion decisions for energy systems in the continental United States. For the remainder of her work, she aims to study how abstraction and model design decisions impact real-world investment decisions and policy recommendations.



Jiayu Li

Ph.D. Student, Program in Applied and Computational Mathematics (PACM)

Jiayu Li is a second-year graduate student in Applied Math (PACM) at Princeton. She graduated from U.C.L.A. with a B.S. degree in Applied Math and Computational and Systems Biology. She is interested in understanding ecosystems with mathematical models. She is currently exploring various research possibilities to decide what she would like to focus on in the next few years.



Yimei Li

Ph.D. Student, Program in Quantitative and Computational Biology (QCB)

Yimei Li is a third-year Ph.D. student in Quantitative and Computational Biology at Princeton University. She joined Levin Lab in May 2022, where she studied mathematical models for the ecology and evolution of infectious diseases, especially the dynamics at cross-scales. Before that, she worked on the dynamical modeling of dengue incidence.

Now, she works at the interface between theoretical models and empirical data, focusing on the population dynamics of infectious diseases. She is particularly interested in examining pathogens across multiple scales, from individual host interactions to broader population-level dynamics, with a special focus on the influence of human behavior. Additionally, she investigates in vivo biological data to deepen her understanding of disease mechanisms.



Victor Vikram Odouard

Ph.D. Student, Program in Applied and Computational Mathematics (PACM)

Victor V. Odouard is a first-year student in PACM and the Levin Lab.

Two main thrusts animate Victor's research. The first is an impulse to integrate knowledge, to see how observations that seem different might be instances of the same process. The second is an aspiration to understand how human society changes, not just so we can predict what might happen, but so we can actively change it.

It is in light of these stimuli that Victor's eclectic set of interests (in math, evolution, ethics, et al.) makes sense. Regarding the first motive, Victor studied math in his bachelor's at Cornell because he thinks of it as a sort of formalized creativity; in specifying a mathematical definition of a process, we often see how it shares many qualities with other processes we might not have known were related. And Victor has researched the evolution of cooperation because he believes that evolution by natural selection is a powerful abstract framework for understanding change in many systems, including in economies and political systems. This begins to show why the first motive is not so divorced from the second: Victor believes that a set of mathematical lenses, including evolutionary theory, will prove very helpful in understanding societal change. But even detailed, descriptive account of societal evolution will not tell us how to make society better. For that, we need ethics — what does it even mean to be "better"?

Right now, Victor is working on (the long project of) bringing together these three components — mathematics, evolutionary theory, and ethics — to understand societal evolution. What parallels might it have in the evolution of other systems? And what interventions might make us better off?



Marcela Ordorica Arango

Ph.D. Student, Mechanical and Aerospace Engineering Department

Marcela Ordorica Arango is a third-year Ph.D. student in the Princeton Mechanical and Aerospace Engineering Department, co-advised by Professors Naomi Leonard and Simon Levin. Her research centers on understanding how human behavior and information transmission influence the spread of epidemics and other contagion phenomena in networks. By developing and analyzing mathematical models, she explores the impact of individual behaviors on these dynamics.

Before arriving at Princeton, Marcela earned both a B.S. and M.S. in Mathematics from the National Autonomous University of Mexico (UNAM). For her master's thesis, she worked on a mathematical model that explored how post-transcriptional regulation network structures contribute to the robustness of neural homeostatic regulation.

VISITING RESEARCH STUDENT COLLABORATORS

Giorgio Dini
Dhruv Mittal



Giorgio Dini

Ph.D. Student at the Università di Bologna, IT
Visiting Research Student Collaborator, Levin & Weber Labs

Giorgio Dini is Ph.D. student of the European Doctorate in Law and Economics at the Università di Bologna in Italy. He is expected to defend his thesis in 2025. Beginning in September 2024, he will be a Visiting Research Student Collaborator at Princeton University. At Princeton, Giorgio will join the Levin Lab and the Behavioral Science for Policy Lab at the Andlinger Center for Energy and the Environment under the joint supervision of Professors Simon A. Levin, Elke Weber, and Sara Constantino, an Assistant Professor at Northeastern University and a Visiting Researcher at Princeton's SPIA. Additionally, he will be part of Earth Resilience and Sustainability Initiative.

Giorgio is interested in the interplay between human behavior and economic, social and behavioral incentives to drive cooperation and behavior change under different shades of environmental sustainability. The main methodology adopted is experimental, mostly but not exclusively in laboratory settings, supported by both established and novel frameworks and models. His main work addresses the role of stronger enforcement policies against misleading green claims and its consequences on consumer behavior. Other works aim to establish behavior response to social pressure in dietary and labor choices.

In May 2024 he joined the Beijer Institute of Ecological Economics as a Beijer Young Scholar to address the topic of "Interacting shocks in the Biosphere."



Dhruv Mittal

Ph.D. Student, University of Amsterdam
Visiting Research Student Collaborator,
Department of Ecology & Evolutionary Biology, Levin Lab

Dhruv Mittal joined the Computational Science Lab at the University of Amsterdam as a Ph.D. candidate in 2021. He completed his B.S.-M.S. with a major in Physics from IISER Mohali in 2020, during which he worked on fabricating and characterizing devices based on novel materials. After getting his master's, he has worked on more socially relevant problems including estimating population exposure to heatwaves in the 21st century from climate projections and understanding the dynamics of polarization using opinion dynamics models.

His current research focuses on the complexity of collective behavior and cultural evolution in changing environments. Drawing insights from fields domains like dynamical systems, network science, evolutionary game theory and social psychology he aims to work towards informing policy interventions in social systems.

At Princeton, Dhruv will be studying the role of socio-cultural determinants like conformity in determining behavioral response of a population in response to a changing environment and institutional signals. Specifically, he would be looking at global mask-wearing behavior during the COVID-19 pandemic in a data integrated study.