THE UNIVERSITY OF ARIZONA
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Faculty Employment Application

Human Resources
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Job Number:	Job Title:	Date:
44727	**Assistant or Associate Professor**	**Mar 23 2010 6:10PM**

Personal Information

Last Name:	First Name:	Middle Name:	Email Address:
Lichstein	**Jeremy**		**jwl@princeton.edu**

Address:	City:	State:	Zip Code:	International Postal Code:	Country:
Princeton University, EEB Department	**Princeton**	**NJ**	**08544**		**USA**

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		(205) 454-0441

References

Name:	Institution/Organization	Address	Title:	Phone:	Email Address:
Stephen Pacala	**Princeton University**	**Department of Ecology and Evolutionary Biology Princeton, NJ 08544**	**Professor**	**(609) 258-6885**	**pacala@princeton.edu**
Simon Levin	**Princeton University**	**Department of Ecology and Evolutionary Biology Princeton, NJ 08544**	**Professor**	**(609) 258-6880**	**slevin@princeton.edu**
Ted Simons	**North Carolina State University**	**Cooperative Fish and Wildlife Research Unit Department of Zoology Box 7617 Raleigh, NC 27695-7617**	**Professor**	**(919) 515-2689**	**tsimons@ncsu.edu**

Other Information

Are you legally authorized to work in the U.S.?

Yes

What is your current employment status with the University of Arizona?

Not a University of Arizona employee

If you are a current employee enter your Employee Identification Number (EID) in the space to the right. If you never worked for the University, worked as a student, or terminated your employment prior to July of 2001 enter N/A. Note: Please do not enter hyphens in the EID field. Your 9-digit EID number (Ex: 120001234) may be found by logging into the Employee Link website.

Your EID number is located in the "Current Employment" tab. You may also find your EID number on your pay stub. Note: Your Employee ID number is NOT your Social Security Number.

N/A

Supplemental Questions

Where did you first learn about this position?

Referred by UA Employee

Enter the specific name of any referral source, or the code printed on the business card you received from The University of Arizona career fair booth:

Have you ever been convicted of or plea bargained to a misdemeanor offense?

No

If yes, you must provide criminal conviction information and dates: (*You are responsible for knowing if traffic violations or other citations received were classified as a misdemeanor*).

Have you ever been convicted of or plea bargained to a felony offense?

No

If yes, you must provide criminal conviction information and dates: (*You are responsible for knowing if traffic violations or other citations received were classified as a felony*).

By indicating 'Yes' below, I affirm that my responses above are true, complete and accurate. I understand that if I accept a job offer, I will be asked to give my written consent for the University of Arizona to conduct a check of my criminal conviction history, motor vehicle record, educational credentials and work history.

I further understand that a 'yes' response will not automatically disqualify me from consideration. However, falsifying, misrepresenting, or omitting criminal conviction information on any application document will likely result in a withdrawal of any job offer and termination of any subsequent employment with the University.

Yes, I affirm that my responses above are true, accurate and complete to the best of my knowledge.

Can you perform the essential functions (job duties) of this position with or without accommodation?

Yes

What is your current employment status with The University of Arizona?

Not a University of Arizona employee

If you have never worked for the University or terminated your employment prior to July 2001, please enter N/A in the space to the right. If you are a current, former, or retired UA employee and were issued an EmplID please enter your number in the space to the right. Your EmplID can be found by logging in to UAccess Employee and viewing your paycheck. Please do not enter hyphens in the EmplID field. Note: Your EmplID is not your Social Security Number.

N/A

Agreement

I certify the statements made by me in this application are true and complete to the best of my knowledge and belief and are made in good faith. I understand that any false statement made herein will void this application and any actions based upon it, and I agree to revise this application should any of the information change. I understand that this application and all attachments are the property of The University of Arizona. I authorize The University of Arizona or any of its agents to make reference checks relating to my employment and I also authorize all prior employers to provide full details concerning my past employment. I authorize the University of Arizona to request and obtain records to determine the accuracy of my responses. I understand that employment in certain positions may be conditional upon a background verification including but not limited to criminal records. I certify that I am or will be legally authorized to work in the United States at the time of hire.

BY SIGNING BELOW, I certify that I have read and agree with these statements.

Jeremy Lichstein _____ _____

Applicant's Name | Applicant's Signature | Date

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Jeremy Lichstein

Research statement

Overview

I am interested in understanding the causes of variation in plant biomass, productivity, and diversity, and the consequences of this variation for local and global ecosystems. My current research focuses on feedbacks between climate and vegetation. Due to vegetation's impact on carbon sequestration, evapotranspiration, and the earth's surface albedo, our capacity to predict future climate depends critically on our understanding of vegetation dynamics. My research aims to (*i*) improve existing dynamic global vegetation models (DGVMs) that are key components of coupled climate-carbon cycle models, and (*ii*) develop a new generation of DGVMs that include realistic representations of biodiversity and individual-level competitive interactions.

Improving current global vegetation models

Coupled climate-carbon cycle models produce a cornucopia of predictions about the future state of global ecosystems. This uncertainty is largely due to differences among models in how vegetation responds to climate. One criterion for assigning confidence to different models is how well they reproduce observed vegetation patterns across geographic gradients. Surprisingly, however, DGVMs have rarely been confronted with data using formal, quantitative methods. I am collaborating with NOAA's Geophysical Fluid Dynamics Laboratory (GFDL) to fit their DGVM to inventory observations of forest biomass, productivity, and mortality using an iterative optimization algorithm. Our current work focuses on the temperature sensitivity of photosynthesis, which is one of the key uncertainties in global models.

Global vegetation models allow for two primary mechanisms by which plant productivity can respond to temperature: climatically-induced shifts in plant functional types, and the fast time-scale physiological response of leaves. Thus, the models ignore a number of ecological and evolutionary processes – such as local adaptation within species, and species turnover within functional types – that could affect the temperature sensitivity of real forests. By fitting the GFDL model to inventory data (a systematic

sample of real forests), these diverse processes will all be allowed to leverage the model's parameters. This effort will provide one of the few examples of data-model integration in global vegetation modeling, and should help pave the way towards a more data-rich era in this critical field of environmental science.

Towards a new generation of global vegetation models

The technology I am developing to assimilate forest inventories and other data sources (e.g., eddy covariance towers) will be a major advance in the field of global vegetation modeling, but other problems will also need to be addressed if DGVMs are to eventually fulfill their promise. First, most DGVMs ignore the individual-level interactions that drive forest dynamics. Second, all DGVMs represent biodiversity with a small number of arbitrary plant functional types (coniferous trees, temperate deciduous trees, C_3 and C_4 grasses, etc.). Below, I summarize my ongoing efforts to address these shortcomings.

Individual-level processes. Foresters and forest ecologists have long recognized the importance of individual-level interactions (e.g., height-structured competition for light). Unfortunately, the community- and ecosystem-level dynamics that emerge from

spatially explicit, individual-based forest models are mathematically intractable, and the models are computationally too demanding for global applications. Recently, I and coauthors developed a forest dynamics model that explicitly accounts for heightstructured competition, yet is both mathematically and computationally tractable. The model is based on an assumption of optimal space-filling by canopy trees, which we refer to as the perfect plasticity approximation (PPA).

We tested the PPA's ability to predict the dynamics of real forest communities using U.S. Forest Service inventory data. The model was parameterized from hundreds of thousands of records of individual growth, mortality, and allometry. Model predictions were then compared to observed 100-year chronosequences of biomass and species composition. Importantly, the model was parameterized only at the level of individual trees; i.e., the model was not fit to the ecosystem-level chronosequences. Nevertheless, model predictions corresponded closely to the chronosequences. The capacity to scale from individuals to ecosystems (with no free tuning parameters) implies

that the PPA captures the key mechanisms operating in nature, and that it could lead to a new global forest model that accounts for individual-level interactions.

An important near-term goal of my research is to incorporate the physiological mechanisms needed to couple the PPA model to global ecosystem models. For example, I recently collected a suite of measurements across a soil moisture gradient in northern Wisconsin to better understand how plant allocation to stems, leaves, and roots varies across environmental gradients, and how allocation and other plant traits combine to determine individual growth and mortality rates. These data, along with forest inventories and plant trait databases, will be used to inform sub-models that scale from physiology to whole-plant performance.

Biodiversity and ecosystem functioning. There is more variation in some functionally important traits (e.g., photosynthetic parameters) within than between the arbitrary plant functional types used in DGVMs. Thus, the range of responses that real ecosystems may have to climate change and disturbance are severely restricted in these models. For example, consider the temperature sensitivity of photosynthesis, which − in current DGVMs − is governed by a single parameter within each functional type. This implies that each functional type will respond in unison to climate warming. In reality, each functional type includes many populations that exhibit a continuum of responses to environmental perturbations. Accurately representing this diversity in models requires a quantitative understanding of (*i*) the primary life-history axes responsible for plant functional diversity, and (*ii*) the rules that govern community assembly along environmental gradients. The PPA provides an elegant means to determine these assembly rules, but describing the multivariate space that would define a continuum of plant strategies (as opposed to discrete types) remains a formidable challenge.

Forest inventories include on the order of 10^7 individual growth and mortality records spanning all major forest types, and these data could − in principle − be used to quantify how plant strategies vary across environmental gradients. However, using inventory data to understand the physiological basis of plant strategies is not straightforward, because individual-level measurements of resources (e.g., light and water) are typically lacking. To overcome this obstacle, I developed a hierarchical

Bayesian approach to integrate over uncertainty in resource availability. I tested the

method using data on sapling growth and light availability that I collected in a variety of North American forest types. Future work will focus on applying the method to large inventory datasets to characterize a continuum of plant strategies, whose competitive dynamics can be studied within a PPA metacommunity framework that I developed. For example, I have derived expressions that predict the degree of local mixing among species that are adapted to different soil conditions. This type of analysis can help identify the critical details to include in a biodiversity-rich global vegetation model.

Summary of research and potential collaborations at the University of Arizona

My primary research goals for the next five years are to (*i*) improve existing global vegetation models by assimilating forest inventory and eddy covariance data, and (*ii*) make tangible progress towards a new global model that includes realistic levels of biodiversity and accounts for individual-level competitive interactions. Achieving the latter goal will require a multifaceted approach involving data mining, novel field measurements, and both statistical and mathematical modeling.

In addition to my work on global vegetation models, I am engaged in a variety of other basic and applied research projects, including (*i*) theoretical work on species coexistence mechanisms; (*ii*) interactions between climate, fire, and vegetation in Siberia and Alaska; (*iii*) quantifying potential carbon sequestration in U.S. forests; and (*iv*) developing U.S. Forest Service protocols to quantify carbon mitigation on National Forests. Previous research topics include (*i*) landscape-scale effects of forest management on songbird communities (M.S. thesis) and (*ii*) impacts of an invasive tree on forest dynamics in a fragmented landscape (Fulbright scholarship in Argentina).

I would be excited to pursue my diverse research interests in The School of Earth and Environmental Sciences. My core research on climate-vegetation interactions spans a number of disciplines − including plant physiology, hydrology, and climatology − that are well-represented at the University of Arizona. More generally, my field experience and expertise in statistical and mathematical modeling could lead to collaborations in many areas of ecology and environmental science, and I am excited about the prospect of exploring these opportunities at the Laboratory of Tree-Ring Research.

Jeremy Lichstein

Teaching statement

Interactions with students rank among the most challenging yet rewarding experiences I have had in academia. My positive teaching evaluations reflect my commitment to teaching, as well as my openness to feedback from students and mentors.

Teaching interests

I would be excited to teach a variety of courses in basic and applied ecology, including global-change biology, ecosystem ecology, plant ecology, forest ecology and management, modeling ecological systems, and introductory or advanced statistics.

A number of scientific and political controversies could provide engaging material for classroom discussions and student projects in applied courses. Some examples include: tradeoffs between carbon sequestration and other ecosystem services (e.g., water and biodiversity), carbon costs of biofuel plantations, and fire-management

policy on U.S. federal lands.
Topics that I could cover in an advanced statistics course include: multivariate and spatial statistics, likelihood, Bayesian hierarchical analysis, and Markov chain Monte Carlo methods.

Teaching philosophy

Through my commitment to teaching, I hope to (*i*) foster curiosity and interest in basic and applied ecology, (*ii*) empower students to teach themselves, and (*iii*) improve students' writing and speaking skills. Below, I briefly elaborate on each of these goals.

• *Foster curiosity*. Natural history and the diversity of organismal form and function are inherently fascinating topics. As an educator, much of my job is simply to expose students to these topics in a lively manner, both in and out of the classroom. My experiences as a teacher and student on field courses have convinced me that getting students out into the field is one of the best ways to pique their interest in natural and managed ecosystems.

• *Empower students*. I believe it is more valuable for students to learn how to find, critically evaluate, and synthesize information than it is for them to memorize a set of facts. While I view traditional, textbook-oriented learning as an important part of introductory courses, I believe that research-oriented learning can be incorporated into all levels of undergraduate education. This makes the material more engaging for students and teaches them the skills they need to excel in our information-rich society.

• *Writing and speaking*. Effective communication skills are critical aspects of professional development. In addition, these skills assist students in communicating scientific knowledge to non-scientists in their daily lives. I favor using research papers and take-home essay exams to evaluate student performance, and I am committed to providing students with feedback on their writing. When class size permits, I believe in having students give oral presentations on independent projects or course-related topics of their choosing. This allows students to practice their public speaking skills and challenges them to develop a thorough understanding of the material they present.

Teaching experience

I have had a variety of teaching experiences in the field, laboratory, and lecture hall. Currently, I am leading a seminar for graduate students and post-docs based on Ben Bolker's book, *Ecological Models and Data in R*. Previously, I co-developed and cotaught a one-week field course on the Ecology and Conservation of Tropical Dry Forests as part of Princeton's semester abroad in Panama. I have worked as a teaching assistant on four courses: Cell and Animal Physiology, Animal Diversity, Ecology of Fields and Woodlands, and Biology of Coral Reefs (field course in Panama). I have presented lectures on a variety of topics, including adaptations for avian flight, conservation of Neotropical migratory songbirds, and the origin and maintenance of plant diversity. While at North Carolina State University, I developed a workshop on multivariate statistics that was attended by both graduate students and faculty members. I have mentored several undergraduate senior theses at Princeton, and I have advised numerous graduate students, post-docs, and professors on statistical and mathematical modeling. I am confident that these diverse experiences have prepared me for the challenges ofdeveloping my own courses and supervising student research.

Curriculum vitae

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Education

2007 Ph.D. Ecology and Evolutionary Biology, Princeton University
2000 M.S. Zoology (Statistics minor), North Carolina State University
1995 B.A. Liberal Arts Honors Program, University of Texas at Austin

Professional experience

2007- Postdoctoral Research Fellow, Princeton University, Department of Ecology and Evolutionary Biology
2003, 2005 Graduate Teaching Assistant, Princeton University, Department of Ecology and Evolutionary Biology
1997-1998 Graduate Teaching Assistant, North Carolina State University, Department of Zoology
1993-1997 Research Technician, University of Texas at Austin, Department of Zoology

Major awards

2006-2007 Princeton University Honorific Fellowship
2002-2007 Princeton University Centennial Fellowship in Sciences and Engineering
2000-2001 Fulbright Scholarship, Argentina
1998-2000 National Science Foundation Graduate Research Fellowship

Research and teaching interests

Global change biology, climate-vegetation feedbacks, forest ecology and management, population and community ecology, biodiversity, Bayesian and likelihood methods

Publications

Malizia, A., H.R. Grau, **J.W. Lichstein**. 2010. Soil phosphorus and disturbances influence liana communities in a subtropical montane forest. Journal of Vegetation Science *in press*

Lichstein, J.W., J. Dushoff, K. Ogle, A. Chen, D.W. Purves, J.P. Caspersen, and S.W. Pacala. 2010. Unlocking the forest inventory data: relating individual-tree performance to unmeasured environmental factors. Ecological Applications *in press*

Chisholm, R.A, and **J.W. Lichstein**. 2009. Linking dispersal, immigration and scale in the neutral theory of biodiversity. Ecology Letters 12:1385-1393.

Lichstein, J.W., C. Wirth, H.S. Horn, and S.W. Pacala. 2009. Biomass chronosequences of United States forests: implications for carbon storage and forest management. Pages 301-341 *in* C. Wirth, G. Gleixner, and M. Heimann, eds. Old-growth forests: function, fate and value. Ecological Studies vol. 207, Springer-Verlag, Berlin, Heidelberg.

Wirth, C. and **J.W. Lichstein**. 2009. The imprint of succession on old-growth forest carbon balances: insights from a trait-based model of forest dynamics. Pages 81-113

in C. Wirth, G. Gleixner, and M. Heimann, eds. Old-growth forests: function, fate and value. Ecological Studies, Springer, Berlin, Heidelberg.

Purves, D.W., **J.W. Lichstein**, N. Strigul, and S.W. Pacala. 2008. Predicting and understanding forest dynamics using a simple, tractable model. PNAS 105(44):17018-17022.
Wirth C., **J.W. Lichstein**, J. Dushoff, A. Chen, and F.S. Chapin III. 2008. White spruce meets black spruce: dispersal, postfire establishment, and growth in a warming climate. Ecological Monographs 78(4):489-505.
Lichstein, J.W., J. Dushoff, S.A. Levin, and S.W. Pacala. 2007. Intraspecific variation and species coexistence. American Naturalist 170(6):807-818.
Purves, D.W., **J.W. Lichstein**, and S.W. Pacala. 2007. Crown plasticity and competition for canopy space: a new spatially implicit model parameterized for 250 North American tree species. PLoS ONE 2(9):e870.
Lichstein, J.W. 2007. Multiple regression on distance matrices: a multivariate spatial analysis tool. Plant Ecology 188(2):117-131.
Jetz, W., C. Rahbek, and **J.W. Lichstein**. 2005. Local and global approaches to spatial data analysis in ecology. Global Ecology and Biogeography, 14(1): 97-98.
Roy, S.B., P.D. Walsh, and **J.W. Lichstein**. 2005. Can logging in equatorial Africa affect adjacent parks? Ecology and Society 10(1):article 6.
Lichstein, J.W., H.R. Grau, and R. Aragón. 2004. Recruitment limitation in secondary forests dominated by an exotic tree. Journal of Vegetation Science 15(6):721-728.
Lichstein, J.W., T.R. Simons, and K.E. Franzreb. 2002. Landscape effects on breeding songbird abundance in managed forests. Ecological Applications 12(3):836-857.
Lichstein, J.W., T.R. Simons, S.A. Shriner, and K.E. Franzreb. 2002. Spatial autocorrelation and autoregressive models in ecology. Ecological Monographs 72(3):445-463.
Lichstein, J.W., M.L. Ballinger, A.R. Blanchette, H.M. Fishman, and G.D. Bittner. 2000. Structural changes at cut ends of earthworm giant axons in the interval between dye barrier formation and neuritic outgrowth. Journal of Comparative Neurology 416(2):143-157.

Manuscripts in review

Menge, D.N.L., J.L. DeNoyer, J.W. Lichstein. Phylogenetic constraints do not explain the rarity of nitrogen-fixing trees in late-successional temperate forests. Journal of Ecology

Service

Reviewer for journals: Biodiversity and Conservation, Diversity and Distributions, Ecography, Ecological Applications, Ecology, Ecology Letters, Ecosystems, Global Ecology and Biogeography, Journal of Biogeography, Journal of Applied Ecology, Journal of Vegetation Science, Landscape Ecology, Oikos, PNAS
Reviewer for grant agencies: NSF, NOAA
Reviewer for U.S. National Park Service, Forest Health Monitoring Protocol
Advisory committee for U.S. Forest Service National Forests Climate Change Workshop: A workshop to develop protocols for an assessment of the climate mitigation capacity of National Forests. Washington DC, 2010.

Other awards, activities

2010 Led modeling seminar for graduate students and post-docs based on Ben Bolker's book, *Ecological Models and Data in R*
2008 Designed and taught one-week field course in Panama for Princeton undergrads (with Dr. Stephanie Bohlman): Ecology and conservation of tropical dry forests
2004, 2006 Association of Princeton Graduate Alumni Summer Travel Fellowship
2000 Organization for Tropical Studies, Tropical Biology course, Costa Rica
2000 Marcia Brady Tucker Travel Award, American Ornithologists' Union
1997-1999 Andrews Graduate Fellowship, North Carolina State University
1994- Phi Beta Kappa
1994 Howard Hughes Fellowship, Summer Undergraduate Research Program in Molecular Biology, University of Texas at Austin
1992-1995 Plan II Honors Program, University of Texas at Austin, College of Liberal Arts
1991-1995 Dean's Scholars Program, University of Texas at Austin, College of Natural Sciences
1991-1995 Dedman Scholarship, University of Texas at Austin
1991 National Merit Scholar

Presentations at national conferences (only first-authored presentations are listed)

Lichstein, J.W., E. Shevliakova, S. Malyshev, Y. Pan, R.A. Birdsey, and S.W. Pacala. 2008. Temperature sensitivity of forest biomass and productivity: comparing the GFDL-LM3V land model to FIA data. Forest Inventory and Analysis Symposium, Park City, Utah.

Lichstein, J.W., S.W. Pacala, D.W. Purves, J. Dushoff, and K. Ogle. 2006. A resourcebased neighborhood competition model of sapling growth. Ecological Society of America, Memphis, Tennessee.

Lichstein, J.W., S.W. Pacala, D.W. Purves, J.P. Caspersen, and K. Ogle. 2004. Parameterizing sapling growth-light models from forest inventory data. Ecological Society of America, Portland, Oregon.

Lichstein, J.W. 2000. Autoregressive models of songbird habitat use in managed southern Appalachian forests: landscape effects and spatial autocorrelation. American and British Ornithologists' Unions, St. John's, Newfoundland.

Lichstein, J.W., T.R. Simons, and K.E. Franzreb. 2000. Comparison of normal, Poisson, and negative binomial regression models for analyzing count data: an example with southern Appalachian songbirds. American and British Ornithologists' Unions, St. John's, Newfoundland.

Lichstein, J.W., T.R. Simons, and K.E. Franzreb. 1999. A multi-scale assessment of the effects of landscape composition on breeding birds in southern Appalachian forests. Predicting species occurrences: issues of scale and accuracy. Snowbird, Utah.

Lichstein, J.W., T.R. Simons, and K.E. Franzreb. 1998. Patterns of breeding bird diversity and abundance across land use gradients in the southern Appalachians. North American Ornithological Conference, St. Louis, Missouri.