

Robert J. Erhardt

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Employment

Wake Forest University, Winston-Salem NC

Associate Professor, Department of Mathematics and Statistics, 2018 -

Associate Chair, Department of Mathematics and Statistics, 2018 -

Co-Director, Data Science Graduate Certificate 2020 -

Faculty, Sustainability Graduate Programs, CEES, 2016 - 2019

Sterge Faculty Fellow, 2016 - 2019

Assistant Professor, Department of Mathematics and Statistics, 2012 - 2018

University of North Carolina at Chapel Hill, Chapel Hill NC

Teaching/Research Fellow, Dept. of Statistics and Operations Research, 2008 - 2012

American Family Mutual Insurance Company, Madison WI

Senior Actuarial Analyst, 2007 - 2008

Actuarial Analyst, 2005 - 2007

Education

Ph.D. in Statistics, University of North Carolina at Chapel Hill, 2012

Thesis: Approximate Bayesian Computing for Spatial Extremes. Advisor Richard L. Smith.

M.S. in Statistics, University of Wisconsin-Madison, 2006

B.A. in Physics, *Summa Cum Laude*, State University of New York College at Geneseo, 2003

A.C.A.S. (Associate of the Casualty Actuarial Society), 2010

Honors

Wake Forest University 2019 Reid-Doyle Prize for Excellence in Teaching

Society of Actuaries Outstanding Session Award, 2019 Annual Meeting, Toronto, ON

American Risk and Insurance Association (ARIA) 2016 Patrick Brockett & Arnold Shapiro Actuarial Journal Award. (Awarded for Erhardt, R., Smith, R. (2014). Weather derivative risk measures for extreme events. *North American Actuarial Journal* 18:3, 379-393.)

Wake Forest Teaching and Learning Center Teaching Innovation Award, 2016

Wake Forest University Student Government Faculty Appreciation Award, 2013 (one given annually)

University of North Carolina Statistics and Operations Research Excellence in Teaching Award, 2011

Society of Actuaries James C. Hickman Scholar (2009 - 2012; \$60,000)

Best Graduate Student Presentation, 46th Actuarial Research Conference, 2011

Jerry D. Reber Outstanding Teaching Assistant Award, SUNY Geneseo, 2003

SUNY Geneseo Physics Alumnae Award (highest physics GPA in class of 2003)

Research

Research Interests

Environmental risk measurement, climate statistics, computational statistics, extreme values, statistical ecology, and the connections between environmental risk and actuarial science.

Working Papers

Erhardt, R. and Nutter, F. Can insurance achieve its full potential for climate adaptation? (*submitted*).

Anderson, T., Hepler, S., Holdo, R., Donaldson, J., **Erhardt, R.**, Hopcraft, G., Hutchinson, M., Huebner, S., Morrison, T., Muday, J., Palmer, M., Pansu, J., Pringle, R., Sketch[†], R., Packer, C. Fire modulates annual variation in the grazing succession of migratory herbivores in the Serengeti ecosystem. (*in preparation, manuscript available upon request*).

Refereed Journal Articles

Erhardt, R. and Meiburg, S. (2020). Sustainable Insurance, a Changing International and National Landscape. Society of Actuaries, (accepted).

Carter, J., **Erhardt, R.**, Jones B. and Donati, G. (2020+) Survey of lead in drinking water from schools and child care centers operating as public water suppliers in North Carolina, USA: Implications for future legislation *Environmental Science and Technology* (accepted).

Erhardt, R. and Wang[†], Y. (2020+). Influence of teleconnections on night-time minimum temperature variability in the Southwestern U.S. (*Stochastic Environmental Research and Risk Assessment*) (accepted).

Hepler, S. and **Erhardt, R.** (2020+). A Spatio-temporal Model for Multivariate Occupancy Data. *Environmetrics* (accepted).

Jin[†], Z. and **Erhardt, R.** (2020). Incorporating climate change projections into risk measures of index-based insurance. *North American Actuarial Journal*, 1-15.

Erhardt, R. (2019). Some Statistical Considerations for Assessing Model Value when Estimating Greenhouse Gas Emissions. *Journal of Environmental Investing*, 9:1.

Erhardt, R., Bell, J., Blanton, B., Nutter, F., Robinson, M. and Smith, R. (2019). Stronger Climate Resilience with Insurance. *Bulletin of the American Meteorological Society*, 100:8, 1549-1552.

Hepler, S. A., **Erhardt, R.**, Anderson, T. M. (2018). Identifying Drivers of Spatial Variation in Occupancy with Limited Replication Camera Trap Data. *Ecology*, 99:10, 2152-2158.

Erhardt, R., Engler, D. (2018). An extension of spatial dependence models for estimating short-term temperature portfolio risk. *North American Actuarial Journal*, 22:3, 472-490.

Anderson, T.M., White, S., Davis[†], B., **Erhardt, R.**, Palmer, M., Swanson, A., Kosmala, M., and Packer, C. (2016). The spatial distribution of African savannah herbivores: species associations and habitat occupancy in a landscape context. *Philosophical Transactions of the Royal Society B*, 371:1702.

Johnson*, D., **Erhardt, R.** (2016). Projected impacts of climate change on wind energy density in the United States. *Renewable Energy*, 85, 66-73.

Erhardt, R. (2015). Incorporating spatial dependence and climate change trends for measuring long-term temperature derivative risk. *Variance* 9:2, pp. 213-226.

Erhardt, R., Shuman, M. (2015). Assistive technologies for second-year statistics students who are blind. *Journal of Statistics Education* 23:2, 1-28.

Steel*, A., **Erhardt, R.**, Phelps, R, Upham, P. (2015). Estimates of enhanced outcomes in employment, income, health and volunteerism for the association of boarding schools member school graduates. *Journal of Advanced Academics* 26.3, 227-245.

Erhardt, R., Smith, R., Lopes, B., Band, L. (2015). Statistical downscaling of precipitation on a spatially dependent network using regional climate models. *Stochastic Environmental Research and Risk Assessment* 29:7, 1835-1849.

Erhardt, R. (2015). Mid-twenty-first-century projected trends in North American heating and cooling degree days. *Environmetrics* 26(2), 133-144.

Erhardt, R., Smith, R. (2014). Weather derivative risk measures for extreme events. *North American Actuarial Journal* 18:3, 379-393.

Cooley, D., Cisewski, J., **Erhardt, R.**, Jeon, S., Mannshardt, E., Omolo, B., Ying, S. (2012). A survey of spatial extremes: measuring spatial dependence and modeling spatial effects. *REVSTAT* 10:1, 135-165.

Erhardt, R., Smith, R. (2012). Approximate Bayesian computing for spatial extremes. *Computational Statistics and Data Analysis* 56:6, 1468-1481.

Stupar, R., Bhaskar, P., Yandell, B., Rensink, W., Hart, A., Ouyang, S., Veilleux, R., Busse, J., **Erhardt, R.**, Buell, C., Jiang, J. (2007). Phenotypic and transcriptomic changes associated with potato autopolyploidization. *Genetics* 176, 2055-2067.

De Stasio, G., Rajesh, D., Ford, J., Daniels, M., **Erhardt, R.**, Frazer, B., Tyliczszak, T., Gilles, M., Conhaim, R., Howard, S., Fowler, J., Esteve, F., Mehta, M. (2006), Motexafin-gadolinium taken up in vitro by at least 90% of glioblastoma cell nuclei, *Clinical Cancer Research* 12, 206.

De Stasio, G., Rajesh, D., Casalbore, P., Daniels, M., **Erhardt, R.**, Frazer, B., Wiese, L., Richter, K., Sonderegger, B., Gilbert, B., Schaub, S., Cannara, R., Crawford, J., Gilles, M., Tyliczszak, T., Fowler, J., Larocca, L., Howard, S., Mercanti, D., Mehta, M., Pallini, R. (2005). Are gadolinium contrast agents suitable for gadolinium neutron capture therapy? *Neurological Research* 27:4, 387-398.

Freeman, C., Burke, D., **Erhardt, R.**, DeCiantis, J., Padalino, S., Knauer, J. (2003). Thin foil calorimeter calibration using a 2 MV Van de Graaff accelerator. *Rev. Sci. Instrum.* 74, 1921

Other Refereed Publications

Erhardt, R and Von Burg, R. (2018). How do they know and what could we do? The science of 21st century climate projections and opportunities for actuaries. The Society of Actuaries. A 44 page white paper on climate model projections.

<https://www.soa.org/Files/resources/research-report/2018/21st-century-climate-projections.pdf>

Erhardt, R. (2017). Climate, Weather and Environmental Sources for Actuaries. The Society of Actuaries. A 78 page white paper on sources for actuarial environmental risk measurement. <https://www.soa.org/research-reports/2017/climate-weather-environmental-sources/>.

Erhardt, R., Sisson, S. (2015). Modelling extremes using approximate Bayesian Computation. Book chapter in *Extreme Value Modeling and Risk Analysis: Methods and Applications*. Edited by Dey, D. and Yan, J. Chapman Hall/CRC.

Godfrey, A.J.R., **Erhardt, R.** (2014). Addendum to statistical software from a blind person's perspective. *The R Journal* 5(1), 73–80.

*Undergraduate student

† Master's degree student

Grants

Funded

2019-20 “Sustainable Insurance in the Twenty-first Century: From Government Guidelines to Actuarial Practice” Society of Actuaries Climate & Environmental Sustainability Research Committee. Role: PI; WFU amount \$12,000.

2019-21 “Flood Risk and Spatial Diversification” Casualty Actuarial Society. Role: PI; WFU Amount \$33,551.

2018-19 NSF SES DRMS 1824394 WORKSHOP: The Nexus of Climate Data, Insurance, and Adaptive Capacity. Role: PI; WFU Amount \$44,190.

2016-18 “How Do They Know, and What Could We Do? The Science of 21st Century Climate Projections and Opportunities for Actuaries” Society of Actuaries Research Executive Committee under the Research Expansion (REX) Pool. Role: PI; WFU Amount \$41,196

2016-17 “Climate, Weather and Environmental Sources for Actuaries” Society of Actuaries Climate & Environmental Sustainability Research Committee. Role: PI; WFU amount \$17,217

2014-15 “Spatial Dependence and Climate Change Impacts on Weather Risk Pricing” Society of Actuaries and Casualty Actuarial Society. Role: PI; WFU amount \$14,442

2013-14 Casualty Actuaries of the Southeast;
WFU amount \$1,500

Pending

“Scalable Models, Fast Computation and Predictability for Spatio-temporal Ordinal Data” submitted to NSF. Role: PI; WFU amount \$362,264

Teaching

Wake Forest University

STA 712 Generalized Linear Models: Fa17, Fa18, Fa19, Fa20

STA 379/679 Time Series and Forecasting: Fa16
 STA 312/612 Linear Models: Sp15, Sp17, Fa17, Sp21
 STA 362/662 Multivariate Statistics: Sp16, Fa16, Sp18, Sp19
 STA 212 Statistical Models: Fa13, Sp14, Sp15, Fa15, Fa18, Fa19
 STA 311/611 Statistical Inference: Sp13, Sp14, Sp17, Fa18, Fa20
 STA 353 Probability Models: Sp13, Sp16
 STA 111 Introduction to Probability and Statistics: Fa12, Fa15
 SUS 602 Scientific Literacy (co-taught): Ja15, Ja16, Su16, Su17, Su18

University of North Carolina at Chapel Hill

STOR 155 Introduction to Statistics: Fa11, Fa10, Sp10

Presentations

Invited Seminars and Colloquia

An Extension of Spatial Dependence Models for Estimating Short-Term Temperature Portfolio Risk, Appalachian State University, 10/2018

An Extension of Spatial Dependence Models for Estimating Short-Term Temperature Portfolio Risk, Purdue University, 2/2018

Insurance as Adaptive Capacity, SAMSI Working Group on Risk, 9/2017.

An Extension of Spatial Dependence Models for Estimating Short-Term Temperature Portfolio Risk. NC State Environmental Seminar, 10/2016.

An Extension of Spatial Dependence Models for Estimating Short-Term Temperature Portfolio Risk. University of Montreal, 10/2016.

Assistive Technologies for Second-Year Statistics Students who are Blind, *CAUSE* Webinar, 09/2015
<https://www.causeweb.org/webinar/jse/2015-09/index.php>

Was 2014 the Hottest Year on Record? Wofford College Mathematics, 02/2015

Weather Derivatives and Degree Day Trends. Middlebury College Mathematics, 04/2014

Weather Derivatives and Degree Day Trends. Brigham Young University Statistics, 03/2014

Regional Climate Models and Mid-Twenty-First-Century North American Projected Energy Impacts. WFU Biology Department, 09/2013

Weather Derivative Risk Measures for Extreme Events. SAMSI, 04/2013

Measuring Climate Change. Davidson College Mathematics, 04/2013

Measuring Climate Change. St. Olaf College Mathematics, 04/2013

Weather Derivative Risk Measures for Extreme Events. NC State University Statistics, 03/2013

Measuring Climate Change. WFU Ecolunch, 03/2013

Measuring Climate Change. WFU Math Club, 03/2013

Approximate Bayesian Computing for Spatial Extremes. Bowdoin College Mathematics, 01/2012

Approximate Bayesian Computing for Spatial Extremes. Wake Forest University Mathematics, 01/2012

Approximate Bayesian Computing for Spatial Extremes. Clemson University Mathematical Sciences, 01/2012

Approximate Bayesian Computing for Spatial Extremes. Penn State University Statistics, 01/2012

Approximate Bayesian Computing for Spatial Extremes. University of Illinois Urbana Champaign Mathematics, 01/2012

Conferences (keynote, invited, contributed, poster)

Society of Actuaries 2019 Annual Meeting, Toronto, ON, 10/2019 (invited)

2019 Joint Statistical Meetings, Denver, CO, 08/2019 (poster)

Southern Regional Council on Statistics 2019 Summer Research Conference, Carrolton, KY, 06/2019 (poster)

SAMSI Coupling Uncertain Geophysical Hazards Workshop, Research Triangle Park, NC, 03/2019 (invited)

2018 Joint Statistical Meetings, Vancouver, BC, 08/2018 (invited)

SAMSI Transition Workshop on Climate, Research Triangle Park, NC, 05/2018 (contributed)

52nd Actuarial Research Conference, Atlanta, GA, 08/2017 (contributed)

The 2017 Casualty Actuarial Society Spring Meeting, Toronto, ON, 5/2017 (invited)

International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Greensboro, NC, 10/2016 (invited)

51st Actuarial Research Conference, Minneapolis, MN, 7/2016 (contributed)

The 26th International Environmetrics Society Annual Meeting, Edinburgh, U.K., 7/2016 (invited)

Southern Regional Council of Statistics Summer Conference, Wilmington, NC 2015 (contributed)

2014 Joint Statistical Meetings, Boston, MA, 8/2014 (invited)

TechXploration, Wake Forest University, 4/2014 (contributed)

2013 Joint Statistical Meetings, Montreal, QC, 8/2013 (invited)

The 23rd International Environmetrics Society Annual Meeting, Anchorage, AK, 6/2013 (contributed)

US Conference on Teaching Statistics, Raleigh, NC, 5/2013 (poster)

Workshop on Environmentrics, Raleigh, NC, 10/2012 (poster)

Joint Statistical Meetings, San Diego, CA, 7/2012 (topic-contributed)

46th Actuarial Research Conference, Storrs, CT, 8/2011 (contributed, won conference best graduate student presentation award)

SAMSI Transition Workshop of Space-Time Processes, Research Triangle Park, NC, 10/2010 (poster)

Joint Statistical Meetings, Vancouver, BC, 8/2010 (contributed)

Spatial Extremes Working Group, Research Triangle Park, NC, 4/2010 (contributed)

SAMSI Workshop of Climate Change, Research Triangle Park, NC, 2/2010 (poster)

Public and Media

Insurance Experts Rank Climate Change as Top Risk for 2019. Grist.org, May 3, 2019.

<https://grist.org/article/insurance-experts-rank-climate-change-as-top-risk-for-2019/>

Climate is the Distribution of Weather. Public lecture at the Youth Convention for Climate Change Prevention, Winston-Salem, 04/2019.

Society of Actuaries Research Insights Podcast, October 2017

<https://www.soa.org/research-reports/2017/climate-weather-environmental-sources/>

Warming May Boost Wind Energy in Plains States. Climate Central, July 29, 2015

<http://www.climatecentral.org/news/warming-may-boost-wind-energy-19290>

Was 2014 the Hottest Year on Record? North Carolina Governor's School, 7/2015

North Carolina Sea Level Rise. Public lecture at Temple Emanuel, Winston-Salem, 10/2014

Measuring Climate Change. North Carolina Governor's School, 6/2014

Economics of Climate and Weather Risk. Public lecture at Temple Emanuel, Winston-Salem, 4/2014

Senate candidates in denial about climate change. Charlotte Observer Op/Ed, April 29, 2014

<http://www.charlotteobserver.com/opinion/op-ed/article9117962.html>

Advising and Theses

Graduate Theses

Thesis Advisor:

Kejia Yu, M.A. Mathematical Statistics 2020. Flood Occurrence and Intensity Prediction in North America (Consulting position at Accenture)

Yiwei Wang, M.A. Mathematical Statistics, 2019. Influence of Teleconnections on Night-time Minimum Temperature Variability and Extremes in the Southwestern U.S. (Quantitative Analytics, T.D. Bank)

Zhuoli Jin, M.A. Mathematical Statistics, 2018. Incorporating Climate Change Projections into Risk Measures of Index-Based Insurance (enrolled PhD Statistics, UC Santa Barbara)

Leland Kent, M.A. Mathematical Statistics, 2017. Incorporating the Southern Oscillation Index into Weather Risk Models. (Data Analyst, Agilent Technologies)

Bryant Davis, M.A. Mathematics, 2016. Constructing a Bayesian Spatial Presence-Absence Model for Animals in the Serengeti National Park. (enrolled PhD Statistics, University of Florida)

Committees: Nick Corak (2020 M.A. Mathematics), Biqing Yang (2020 M.A. Mathematical Statistics), Xinyu Zhang (2020 M.A. Mathematical Statistics), Robert Baldwin (2019 M.S. Biology), Yixuan Ji (2019 M.A. Mathematical Statistics), Jessica Zanatell (2018 M.A. Mathematics), Richard Harris

(2018 M.A. Mathematical Statistics) M. J. Carmichael (2017 Ph.D. Biology), Rebecca Kotsonis (2017 M.A. Mathematical Statistics), Nicole Schiro (2016 M.A. Sustainability), Teng Zhang (2016 M.A. Mathematics), Shouwen Wei (2013 M.A. Mathematics), Joe Paat (2013 M.A. Mathematics), Ixavier Higgins (2013 M.A. Mathematics)

Undergraduate Theses

2020 Dan Nealon, Baseball Analytics.

2019 Simin Ma, Computational Efficiency for Fitting EGARCH Models. (enrolled Ph.D. Computer Science, Georgia Tech)

2018 Hunter Hale, Estimating Elevation Shift of Andean Trees. (enrolled Ph.D. Statistics, Baylor)

2018 Meghan Bayne, Victims of Violence and Their Punitive Attitudes Towards Capital Punishment. (Legal Analyst, Mathematica)

2018 Abigail Coelho, The Heated Distribution of Weather. (Business Analyst, Deloitte)

2018 Lindsay Ricciardelli, The Importance of Air Quality to Human Health: A Statistical Analysis. (Business Intelligence Analyst, KEMET Electronics)

2017 Joyce Chen, Pokii and Risk and Ruin. (enrolled M.S. Financial Engineering, Cornell)

2017 Mitch Tague, Comparing Professional and Casual Play Character Selection Trends in League of Legends. (enrolled M.A. Mathematical Statistics, Wake Forest)

2016 Alan Underhill, Applying the Generalized Extreme Value Distribution to Reinsurance of Catastrophic Hurricanes. (Actuary, Lincoln Financial Group)

2016 Alison Zinsli, Multiple Logistic Regression Models in the Serengeti National Park. (enrolled MS Biostatistics, Emory University)

2015 Dana Johnson, Projected impacts of climate change on wind energy density in the United States. (enrolled PhD in Statistics, NC State)

2015 Amy Pushman, Longevity predictions based on health biomarkers. (enrolled MS Statistics, Villanova)

2015 Nick Sterge, Forecasting methods for degree days. (enrolled PhD Statistics, Penn State)

2014 Megan Quinn, Dependence models in actuarial science. (enrolled MS Statistics, UNC-Chapel Hill)

2014 Allison Steel, Statistical modeling for The Association of Boarding Schools. (enrolled MS Statistics, Virginia Tech)

Independent Studies

2020 Anna Flowers (URECA Wake Forest Research Fellowship) US Drought Monitor Predictive Power

2019 - 2020 Anna Flowers, National Flood Insurance Program Loss Analytics.

2019 -2020 Reyna Wu, Climate Model Compression and Predictability.

2019 Charlotte Fanning, Fooled by randomness.

2019 Reyna Wu (URECA Wake Forest Research Fellowship) High dimensional climate model data

compression.

2018 Yutong Yang, Visualizing southeastern precipitation data

2017 Kathryn Webster, Programming and Statistical Software in Industry

2016 Hunter Denham (URECA Wake Forest Research Fellowship) Climate, Weather and Environmental Sources for Actuaries

2016 Julia Haines, Cooling Tower Efficiency Measurements using the Aquanomix Symphony Water Sensor

2015 - 2016 Will Boyles, Statistical relationship between the El Niño southern oscillation index and North American degree days

2015 Khiry Sutton, Behavioral changes for energy savings at Carolina HealthCare
<http://fmj.ifma.org/publication/?i=280956&p=24>

2015 - 2016 Celine Olcott, Analyzing the National Center for Education Statistics tri-annual Schools and Staffing Survey

2014 Celine Olcott, Analyzing Calculus I success rates at Wake Forest University

2014 Dana Johnson (URECA Wake Forest Research Fellowship, Interdisciplinary Environmental Program Fellowship), Projected impacts of climate change on wind energy density in the United States

2013 and Spring 2014 Dana Johnson, R programming and data visualization

2013 Kaylee Llewellyn (high school student at Phillips Andover), Data visualization

2012 Ann Rogers, Society of Actuaries exam FM

2012 Xiaochen Hu, Consulting for The Association of Boarding Schools

Service

Refereeing Journals:

Annals of Applied Statistics, Applied Energy, ASTIN Bulletin, Computational Statistics and Data Analysis, Environmetrics, International Journal of Climatology, International Journal of Computer Mathematics, Journal of Applied Statistics, Journal of Climate, Journal of Geophysical Research, Journal of Hydrology, Journal of the Royal Statistical Society Series C, Journal of Statistics Education, North American Actuarial Journal, Stochastic Environmental Research and Risk Assessment, Technometrics, Transactions in GIS

Refereeing Books: *The Basic Practice of Statistics 8e Moore/Notz/Fligner, Predictive Modeling in Actuarial Science, Loss Data Analytics, Extreme Value Modeling and Risk Analysis: Methods and Applications, STAT2: Building Models for a World of Data.*

Professional Service External to Wake Forest:

The International Environmetrics Society Liason and Outreach Committee
 Member 2020 - 2022

Society of Actuaries Climate and Catastrophes Steering Committee

Member 2019 - 2022

Workshop Chairperson for “The Nexus of Insurance, Climate Data, and Adaptive Capacity”
Asheville, NC, November 8-9, 2018.

Society of Actuaries James C. Hickman Scholarship Selection Committee
Chair 2017-2018, Member 2015 - 2018

Non-departmental service at Wake Forest:

Capital Projects Advisory Committee, Member 2020 - present

Science Curriculum Development Committee, Environment and Sustainability Programs, Member
2020 - present.

WFU CEES Research committee, Chair 2016 - present

WFU M.A. Sustainability Curriculum committee, Member 2014 - 2019

Major Departmental Service at Wake Forest:

Associate Chair of the Department, 2018 - present

Head of Statistics Section, 2018 - 2020

Chair of Statistics Curriculum Committee 2013 - 2017

Chair of Statistics Hiring Committee, 2019 - 2020

Memberships

Casualty Actuarial Society

The International Environmetrics Society

American Statistical Association

Last updated: November 23, 2020