
Leonardo Calle

College of Forestry, University of Montana
<https://github.com/lcalle>

EDUCATION

Montana State University, Bozeman, Montana

2014-2019 Ph.D. Ecology and Environmental Sciences

Florida Atlantic University, Boca Raton, Florida

2012-2014 M.S. Environmental Sciences, and GIS Certificate

2006-2010 B.S. Biological Sciences

PROFESSIONAL EXPERIENCE

May 2019 - **Post-Doctoral Researcher**, College of Forestry, University of Montana (UM)

present Advisor: Solomon Dobrowski (Professor, College of Forestry, UM)

Advisor: Marco P. Maneta (Associate Professor, Dept. Geoscience, UM)

- Development of ech2o, spatially-distributed and physically-based eco-hydrologic model

Aug 2014 - **Graduate Research Assistant (PhD)**, Montana State University (MSU)

May 2019 Committee Chair: Benjamin Poulter, Research Scientist, NASA GSFC

- Developed a representation of forest age-class stand dynamics at global scales, fully coupled with land use change, land management (wood harvest) and fire dynamics in the Lund-Potsdam-Jena (LPJ) Dynamic Global Vegetation Model (DGVM)
- Developed and incorporated alternate mathematical models of plant phenology and autotrophic respiration to evaluate model structural uncertainty in the LPJ DGVM
- Processed U.S. Forest Inventory Data, eddy-covariance flux tower data, and satellite data to evaluate the structure and function of forest age-class simulations
- Analyzed satellite retrievals of atmospheric CO₂ from multiple satellites
- Developed a statistical algorithm for signal decomposition of CO₂ seasonal cycles for purposes of ecosystem model evaluation; algorithm made available as an R package
- Used high-performance computing clusters for analyzing big data (~0.5 Terabyte) and conducting simulations of global terrestrial ecosystems
- Programming was conducted in C, Fortran, and R.

Jan 2014 - **Primary Research Investigator**, Florida Atlantic University (FAU)

May 2014 Collaborators: C. Callaghan, M. Denton, P. Klamann, J. Klassen, and D. E. Gawlik

- Developed a resource prioritization tool for conservation organizations using Multi-Criteria Decision Analysis (MCDA), a hierarchical weighting scheme of qualitative/quantitative data
- A flexible-input software tool was coded in C#, fit with a graphical front-end
- A breakout session was held at The Wildlife Society of Florida's annual conference to improve decision criteria, model weights, and integrate the tool into decision making

- Jan 2012 - **Graduate Research Assistant (MSc), FAU**
 May 2014 Committee Chair: Dale E. Gawlik, Professor, FAU
- Developed a spatially-explicit predictive model of habitat availability
 - Coded the proposed model in C# (.NET), fit with a graphical front-end
 - Modeled habitat selection using a conditional logistic regression model (a resource selection function); Used R (package: survival) for statistical analyses
 - Used Python, R and VBA code to manipulate and manage large datasets
 - Developed new field techniques to gather data necessary for determining foraging habitat preferences of two wading bird species
 - Bird surveys: Spot-mapping and River transects, by boat
 - Aquatic prey sampling (pop-nets), nestling wading bird bolus sampling
 - Snorkeling transects and quadrat method to estimate seagrass density and spp. composition
 - Sediment coring and analysis of benthic substrate
 - Used R (package: ggplot2), SigmaPlot v10, and ArcGIS for figure production
 - Supervised technicians and volunteers
 - Captained a small boat in remote backcountry (100+ hrs boating)
- Dec 2010 - **Research Assistant, FAU**
 Dec 2011 Supervisor: Dale E. Gawlik, Professor, FAU
- Developed a spatio-temporal hydrologic model of tides to evaluate effects from tidal dynamics (short-term) and sea level rise (long-term) on wading bird foraging habitat
 - Coupled the tidal model to a Sea Level Affecting Marshes Model (SLAMM) to evaluate long-term changes in accretion and sedimentation processes and wetland conversion
 - Used C# (.NET) for model development and a graphical front-end
 - Used Python, R and VBA code to manipulate and manage large datasets
 - Conducted a model-based meta-analysis using large datasets (BBS and CBC) to evaluate differential population trends
 - Utilized a Bayesian hierarchical model in WinBUGS to conduct population analyses
 - Bird surveys: Spot-mapping and River Transects, by boat
 - Used R (package: ggplot2), SigmaPlot v10, and ArcGIS for figure production
 - Supervised technicians and volunteers
 - Captained a small boat in remote backcountry in sometimes inclement weather
- Dec 2010 - **Field Technician, Avian Ecology Laboratory, FAU**
 June 2011 Supervisor: Bryan B. Botson, Laboratory Supervisor
- Throw-trap (1mX1m) sampling of aquatic fauna in the Greater Florida Everglades, data logging using mobile mapping software, vegetation transects, species identification, and field hydrology measurements
 - Aquatic fauna species-identification and measurements and QAQC
 - Field sites accessed by helicopter or airboat, and were conducted in hot, humid, and sometimes in inclement weather
- June 2010 - **Research Assistant, FAU**
 Dec 2010 Supervisor: Dale E. Gawlik, Professor, FAU
- Coded a spatio-temporal Landscape Quality Index model for endangered Wood Storks
 - Coded the model in C# and Python, statistical analyses using GIS, Python, and R.
 - Developed a stochastic model for explicit inclusion of model uncertainty
 - Conducted model validation, and sensitivity analyses
 - Data management using SAS, Microsoft Excel VBA script; figures produced in SigmaPlot

- Aug 2009 - **Founder: Citizen Science and Undergraduate Research Conservation Program**, FAU
 June 2011 Supervisor: Evelyn Frazier, Instructor, FAU
- Developed a conservation initiative, based in citizen science and research, to protect a threatened Gopher Tortoise population and pine-oak scrub habitat
 - Developed research methods and mentored undergraduates in field-based research
 - Successes from this program include an annual Bioblitz (outreach), \$3000 in grants as well as courses in Field Methods in Ecology & Terrestrial Ecology Research for undergraduates.
 - The budget for the program was increased from \$800 in the inaugural year to over \$18000 in the second year, due to outside and in-house grants awarded
- Aug 2009 - **Undergraduate Research**, National Science Foundation, FAU
 Dec 2009 Supervisor: Dale E. Gawlik, Professor, FAU
- Conducted dissections, diet analysis, and morphometrics on 22 Sacred Ibis carcasses
 - Quantified effects of anthropogenic biomass on ecology of the species
 - Conducted cluster and discriminant analyses in Primer v6; Used SAS to conduct statistical tests and SigmaPlot for figure production
 - Research published (2011) in the Florida Field Naturalist peer- reviewed journal.
- May 2009 - **Paleoecology Internship**, South Florida Water Management District (SFWMD)
 Aug 2009 Supervisor: Colin Saunders, Research Scientist, SFWMD
- Macrofossil (seed) identification under microscope from soil core samples
 - Constructed field sampling stations of leaf litter deposition in remote wetlands
 - Conducted literature reviews pertaining to hydrology, primary productivity and accretion, sea-level rise impacts on accretion using macrofossils from soil cores
- Sept 2008 **Data Analysis**, Avian Ecology Laboratory, FAU Supervisor:
 Supervisor: Dale E. Gawlik, Professor, FAU
- Microsoft Excel for data analysis & table production, SigmaPlot for figure production
- Feb 2008 - **Field Technician**, Avian Ecology Laboratory, FAU
 June 2008 Supervisor: Bryan B. Botson, Laboratory Supervisor
- Throw-trap (1mX1m) sampling of aquatic fauna, data logging using mobile mapping software, vegetation transects and species identification, field hydrology measurements
 - QAQC, management of large datasets and statistical analyses in SAS

PUBLICATIONS

In Review, Submitted or In Preparation

1. (*in review*) K. C. Heim, T. E. McMahon, **L. Calle**, M. S. Wipfli, and J. A. Falke. (2018). Phenology of water as a life-history filter for fishes in temporary aquatic habitats. *In review at Frontiers in Ecology and the Environment*.
2. (*in prep.*) **Calle, L.**, P. K. Patra, T. A. M. Pugh, and B. Poulter. Autotrophic respiration temperature sensitivity switches the North American temperate biome from a source to a sink. *In prep. for Biogeosciences as a Technical Note*.
3. (*in prep.*) **Calle, L.**, and B. Poulter. Ecosystem age-class dynamics and distribution in a global ecosystem model. *In prep. for Biogeosciences*.

4. **Calle, L.**, B. Poulter, and P. K. Patra. (2019). A segmentation algorithm for characterizing Rise and Fall segments in seasonal cycles: an application to XCO₂ to estimate benchmarks and assess model bias. *In review at Atmospheric Measurement Techniques*, doi: 10.5194/amt-12-2611-2019.
5. T. A. M. Pugh, M. Lindeskog, B. Smith, B. Poulter, A. Arneth, V. Haverd, and **L. Calle**. (2019). The role of forest regrowth in global carbon sink dynamics. *Proceedings of the National Academy of Sciences of the United States of America*, doi:10.1073/pnas.1810512116.
6. **Calle, L.**, L. Green, A. Strong, and D. E. Gawlik. (2018). Time-integrated habitat availability is a resource attribute that informs patterns of use in intertidal areas. *Ecological Monographs*, doi: 10.1002/ecm.1305.
7. Zhang, Z., N. E. Zimmermann, **L. Calle**, G. Hurtt, A. Chatterjee, and B. Poulter. (2018). Enhanced response of global wetland methane emissions to recent El Niño-Southern Oscillation events. *Environmental Research Letters*, doi:10.1088/1748-9326/aac939.
8. Kondo, M., K. Ichii, P. K. Patra, B. Poulter, **L. Calle**, C. Koven, T. A. M. Pugh, E. Kato, A. Harper, S. Zaehle, and A. Wiltshire. (2018). Plant regrowth as a driver of recent enhancement of terrestrial CO₂ uptake. *Geophysical Research Letters*, doi:10.1029/2018GL077633.
9. Kondo, M., K. Ichi, P. Patra, J. G. Canadell, B. Poulter, T. Saeki, **Calle, L.**, T. Saeki, N. Saigusa, S. Sitch, P. Friedlingstein, A. Arneth, A. Harper, A. K. Jain, E. Kato, C. Koven, F. Li, T. A. M. Pugh, S. Zaehle, A. Wiltshire, F. Chevallier, T. Maki, T. Nakamura, Y. Niwa, C. Rödenbeck. (2018). Land use change and El Niño-Southern Oscillation drive decadal carbon balance shifts in Southeast Asia. *Nature Communications*, doi:/10.1088/1748-9326/aa63fa.
10. Hansen, W. D., J. P. Scholl, A. E. Sorensen, K. E. Fisher, J. A. Klassen, **L. Calle**, G. S. Kandlikar, N. Kortessis, D. Kucera, D. E. Marias, D. L. Narango, K. R. O’Keeffe, W. Recart, E. Ridolfi, and M. E. Shea. (2018). Student reflections on careers and culture of 21st century ecology. *Ecosphere* 9(2).
11. Arneth, A., S. Sitch, J. Pongratz, B. D. Stocker, P. Ciais, B. Poulter, A. D. Bayer, A. Bondeau, **L. Calle**, L. P. Chini, T. Gasser, M. Fader, P. Friedlingstein, E. Kato, W. Li, M. Lindeskog, J. E. M. S. Nabel, T. A. M. Pugh, E. Robertson, N. Viovy, C. Yue and S. Zaehle. (2017). Historical carbon dioxide emissions caused by land-use changes are possibly larger than assumed. *Nature Geoscience* 10:79-86.
12. Zscheischler, J., M. D. Mahecha, V. Avitabile, **L. Calle**, N. Carvalhais, P. Ciais, F. Gans, N. Gruber, J. Hartmann, M. Herold, K. Ichii, M. Jung, P. Landschützer, G. G. Laruelle, R. Lauerwald, D. Papale, Philippe Peylin, B. Poulter, D. Ray, P. Regnier, C. Rödenbeck, R. M. (2017). Reviews and Syntheses: An empirical spatiotemporal description of the global surface-atmosphere carbon fluxes: opportunities and data limitations. *Biogeosciences* 15:3685.
13. **Calle, L.**, J. G. Canadell, P. Patra, P. Ciais, K. Ichii, H. Tian, M. Kondo, S. Piao, A. Arneth, A. B. Harper, A. Ito, E. Kato, C. Koven, S. Sitch, B. D. Stocker, N. Viovy, A. Wiltshire, S. Zaehle, and B. Poulter. (2016). Regional carbon fluxes from land use and land cover change in Asia, 1980-2009. *Environmental Research Letters* 11:074011.
14. **Calle, L.**, D. E. Gawlik, Z. Xie, L. Green, B. Lapointe, and A. Strong. (2016). Effects of tidal periodicities and diurnal foraging constraints on the density of foraging wading birds. *The Auk: Ornithological Advances* 133:378-396.
15. Green, L., D. E. Gawlik, **L. Calle**, and B. Lapointe. (2014). Relative effects of physical and small-scale factors on the distribution of tropical seagrasses in the Great White Heron National Wildlife Refuge, Lower Florida Keys. *Aquatic Botany* 124:45-53.
16. **Calle, L.**, L. Green, D. E. Gawlik, and B. E. Lapointe. (2014). Feasibility of evaluating the impacts of sea level rise on foraging habitat of the Little Blue Heron in the Great White Heron National Wildlife Refuge: Phase II, factors affecting habitat. Final report to the USFS, Big Pine Key, Florida.
17. **Calle, L.**, D. E. Gawlik, Z. Xie, and B. Johnson. (2012). Feasibility of evaluating the impacts of sea level rise on foraging habitat of the Little Blue Heron in the Great White Heron National Wildlife Refuge. Final report to the U.S. Fish and Wildlife Service, Big Pine Key, Florida.

18. **Calle, L.** and D.E. Gawlik. (2011). Anthropogenic food in the diet of the Sacred Ibis, *Threskiornis aethiopicus*, a non-native wading bird in southeastern Florida, USA. *Florida Field Naturalist* 39:1-15.

INVITED TALKS

- The Global Carbon Cycle – impact on plants, animals, and ecosystems. Guest lecture in an undergraduate ecology course, Montana State University (2018).
- History of the land – challenges of modeling the effects of land use change and land management on the global carbon cycle. Invited Speaker for an Ignite Session at the Ecological Society of America Annual Conference, USA (2017).
- Modeling the Global Carbon Cycle with Dynamic Global Vegetation Models. Hokkaido University, Japan (2015).

CONFERENCE ACTIVITY

Papers

- An Integrated framework greenhouse gas satellites and forest structure remote sensing to estimate emissions from land use, land use change and forestry (LULUCF). (**co-author**) Presented by Dr. Benjamin Poulter at the ForestSAT conference, Washington, D.C. (2018).
- Segment-based signal characteristics of satellite-derived XCO₂ seasonal cycles. Asia Oceania Geosciences Society 15th Annual meeting, Honolulu, Hawaii (2018).
- Plant regrowth as a driver of recent enhancement of terrestrial carbon uptake. (**co-author**) Presented by Dr. Masayuki Kondo at the Asia Oceania Geosci. Society 15th Annual meeting, Honolulu, Hawaii (2018).
- Investigating the potential role of evergreen and deciduous forests in the increasing trend in atmospheric CO₂ seasonal amplitude. (**co-author**) Presented by Dr. Lisa Welp at the American Geophysical Union Annual Conference (2017).
- Process attribution of observation-model error via time-series segmentation analysis. 10th Intl. Carbon Dioxide Conference, Bern, Switzerland (2017).
- Process attribution of observation-model error via time-series segmentation analysis. Japan Geoscience Union – American Geophysical Union Joint Annual Conference, Chiba, Japan (2017).
- Epistemic uncertainties in global-scale modeling of secondary forest dynamics. Special Session on Mathematical Modeling of Forest and Landscape Change, American Mathematical Society Regional Conference, Pullman, WA (2017).
- Enabling teleconnection-based seasonal forecasts of global terrestrial carbon cycle dynamics. (**co-author**) Presented by Dr. Benjamin Poulter at the 10th Intl. Carbon Dioxide Conference, Bern, Switzerland (2017).
- An empirical spatiotemporal description of the global surface-atmosphere carbon fluxes: opportunities and data limitations. (**co-author**) Presented by Dr. Jakob Zscheischler at the 10th Intl. Carbon Dioxide Conference, Bern, Switzerland (2017).
- Decadal carbon balance shifts controlled by land use change and ENSO in Southeast Asia. (**co-author**) Presented by Dr. Masayuki Kondo at the 10th Intl. Carbon Dioxide Conference, Bern, Switzerland (2017).
- Regional trends in land use and land cover change emissions in Asia. (**co-author**) Presented by Dr. Prabir K. Patra at the NASA Land Cover and Land Use Change meeting, Yangon, Burma (2016).
- A litter perspective on ecosystem demography in a dynamic global vegetation model. Ecological Society of America Annual Conference, USA (2016).
- Changes in atmospheric composition and land-atmosphere interactions across the Asian Region. (**co-author**) Presented by Dr. Stephen Sitch at the AsiaFlux Intl. Conference in Pune, India (2015).
- Moon phase and habitat availability drives the foraging abundance of wading birds in intertidal zones. AFO-WOS annual conference (2014), Everglades National Park (2014).
- Predicted changes in foraging habitat of the Little Blue Heron (*Egretta caerulea*) in the Great White Heron

National Wildlife Refuge, FL, USA, as a function of sea level rise. Ecological Society of America (2012), North American Ornithological Conference Vancouver (2012).

Professional workshops organized and co-organized

- The lefts, rights, ups, and downs that created a successful career in ecology. Ecological Society of America Annual Conference, New Orleans (2018).
- Demystifying the media: communicating your science with the press. Ecological Society of America Annual Conference, New Orleans (2018).
- Maximize your 2018 meeting experience: orientation and networking for student attendees. Ecological Society of America Annual Conference, New Orleans (2018).
- Preparation for a career in ecology with career panel. Dept. of Ecology, Montana State University (2017).
- A Multi-criteria decision analysis tool for resource prioritization. Breakout Session at The Wildlife Society of Florida spring conference (2014).
- A Tidal Model of Shallow-water Availability (TiMSA) for coastal-foraging wading birds. Wading Bird Modeling Workshop. Everglades National Park (2013).

AWARDS & GRANTS

- NASA Earth and Space Science **Fellowship** (NESSF, 2016-2019), \$125,000
- NSF East Asia Pacific Summer Institute **Graduate Fellowship**, (NSF-EAPSI, Jun. – Aug. 2015), \$5,000
- Outstanding Student Presentation **Award**, Japan Geoscience Union – American Geophys. Union (2017)
- Japan Society for the Promotion of Science, **Fellowship**, (JSPS-EAPSI, Jun. – Aug. 2015), \$5,000
- Japan Agency for Marine Earth Science and Technology, International Travel **Grant** (2017), \$2,000
- MSU College of Letters and Science Student Research Travel **Grant** (2017), \$700
- Japan Geoscience Union & American Geophysical Union, Student Presentation **Award** (2017)
- Montana Institute on Ecosystems Graduate Enhancement **Award** (2016), \$500
- NIMBios Graduate Workshop – Current Issues in Statistical Ecology, **Award**, (Apr. 2015), ~\$1,000
- MICMoR Technical Short Course on Land Use Change, **Award**, (Mar. 2015)
- Presentation Award, Assc. of Field Ornithologists, North Amer. Ornithological Conf. (2012)
- NSF Undergraduate Research & Mentoring, **Fellowship**, (2-years; 2009-2010), \$24,000
- FAU Start-Up Research **Grant**, FAU (2012), \$8,000
- Research **Grant** PADI Foundation (2012), \$5,000
- The Future of Environmental Decisions, **Award**, ESA & NEON Workshop, (2010), ~\$700
- Outstanding Achievement Award & Leadership Conference, **Award**, SEEDS-ESA (2010)

PROFESSIONAL SERVICE & ASSOCIATIONS

- **Committee on Diversity and Education**, Ecological Society of America (2017-present)
- **Spanish Editor**, Journal of Field Ornithology (2014 - Present)
- **Webmaster**, Ecological Society of America Student Section (2016 – 2018)
- **Reviewer**, Earth's Future, Ecological Modelling, Estuaries and Coasts, Global Change Biology, IEEE Transactions on Geoscience and Remote Sensing, Journal of Environmental Management, PLoS ONE, The Auk: Ornithological Advances.
- **Ecological Society of America**, member since 2009
- **Association of Field Ornithologists**, member since 2012
- **Japan Geoscience Union**, member since 2017
- **American Geophysical Union**, member since 2017

MENTORING AND CAREER DEVELOPMENT

- Organized workshops on non-academic career development for graduate student ecologists (2017)
- Primary instructor, Undergraduate Biodiversity Lab (2013)
- Developed a conservation-based research program for undergraduates and graduate students. Mentored undergraduate and high school students in field research. Program was formalized into permanent undergraduate courses in Terrestrial Ecology and Field Methods in Ecology at Florida Atlantic University.
- Science Olympiad Judge and Event Organizer (Ornithology), FAU (2010, 2011)

RESEARCH PERMITTING

FFWCC (2010,2012), USFWS (2012), NOAA (2012), IACUC (2012)

COMPUTER PROFICIENCIES

Programming Lang. & Pkgs: C, C# (.Net), Fortran, Python, R, VBA, Bash, CDO, NCO
High-performance Computing: Slurm (Linux/Unix), R (pkgs: foreach, parallel, openmpi)
Data and Code Management: Github (git), R package production (roxygen).
Statistical Software: R, SAS, MS Excel (spreadsheet modeling), Primer v6, WinBUGS
Statistical Graphics: R, GrADS
GIS Software: ArcGIS, ArcPad, Erdas Imagine, Grass (GDAL), QGIS, R
Graphical Design: Adobe Photoshop, Adobe Browse, Adobe Illustrator

REFERENCES

Upon Request.