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## XIA ZHU BARKER

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### Current Position

Assistant Project Scientist  
Department of Land, Air and Water Resources  
University of California-Davis, Davis, CA 95616

### General Information

Maiden name: Xia Zhu  
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### EDUCATION

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#### **Ph.D. in Soil Biogeochemistry and Nutrient Cycling, Botany, June 2013**

*Chengdu Institute of Biology, Chinese Academy of Sciences, Chengdu, China*

*Study at University of California Davis, Davis, CA, U.S.A*

*Dissertation: Factors and Mechanisms Controlling Emission of Nitrous oxide from Soil*

#### **M.S. in Agro-ecology, June 2009**

*Northeast Institute of Geography and Agro-ecology, Chinese Academy of Sciences, China*

*Thesis: Study on Nitrogen cycling in Long-term Fertilization of Soils under  
Different Thermal Zones*

#### **B.S. in Agricultural Resources and Environment, Jun 2006**

*Northeast Agricultural University, Harbin, China*

### PROFESSIONAL EXPERIENCE

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July 2015 - Present **Assistant Project Scientist.** *Dept. of Land, Air and Water Resources,  
University of California, Davis, CA.*

May 2013 – June 2015 **Postdoctoral Researcher.** *Dept. of Land, Air and Water Resources,  
University of California, Davis, CA*

- Research in evaluating agricultural waste management practices that control nutrient cycling, nutrient use efficiency, carbon sequestration, and GHG. Responsible for field and lab work in the project “*Research to Evaluate Environmental Impacts of Direct Land Application of Uncomposted Green and Woody Wastes on Air and Water Quality*”.
- Research in developing the mechanistic understanding of how fertilizer application increases nitrous oxide (N<sub>2</sub>O) emissions from agricultural systems. Responsible for lab work in the project “*Investigate the Effect of Nitrogen Fertilizer Concentration on Soil O<sub>2</sub> Consumption and N<sub>2</sub>O Production Pathways*”.
- Research in exploring the mechanisms of how iron increases N<sub>2</sub>O production under anoxic conditions. Responsible for the project “*The Role of Iron on the Nitrogen and Carbon Biogeochemistry Cycling in Agricultural Soil*”.
- Advise graduate and undergraduate students in these projects.

2010-2013 Junior **Specialist & Visiting Scholar.** *Dept. of Land, Air and Water Resources,*

*University of California, Davis, CA*

- Research in quantify the contribution of biotic-abiotic processes to N<sub>2</sub>O production through different pathways. Responsible for field and lab work in the project “*Assessment of Baseline Nitrous Oxide Emissions in California Cropping Systems*”.
- Research in evaluating the strategies to mitigate N<sub>2</sub>O through iron management such as the application of biosolids, compost in soils. Responsible for field and lab work in the project “*Research to Evaluate Nitrous Oxide (N<sub>2</sub>O) Emissions from Compost*”.
- Research in investigation of the role of Feammox in the nitrogen cycle.
- Responsible for statistical analyses of data, report writing and manuscript writing.
- Advise undergraduate students in these projects.

**2009-2010 Graduate students Researcher.** *Chengdu Institute of Biology, Chinese Academy of Sciences, China*

- Designed the experiment to test the hypothesis that global warming and nitrogen deposition promote soil carbon decomposition in wetland ecosystems.
- Research in elucidating the response of greenhouse gas emissions as affected by N deposition in Tibet. Responsible for research on soil N pools and greenhouse gas emissions from a wetland-grassland ecotone.

**2006-2009 Researcher Assistant.** *Northeast Institute of Geography and Agro-ecology, Chinese Academy of Sciences, China*

- Research in the N cycling in agricultural soils as influenced by long-term fertilization practices. Responsible for field work, lab work and report writing in the project “*Nitrogen Fertility Characteristics of Long-term Fertilization Soils under Different Thermal Zones*”.

**2005-2006 Lab Technician.** *Northeast Institute of Geography and Agro-ecology, Chinese Academy of Sciences, China*

- Instrument (TOC, element analyzer, GC) maintenance and operation
- Prepared samples and analyzed chemistry (plant tissue and soils)

**RESEARCH INTEREST**

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My research is to discover the processes that affect agricultural system sustainability, including crop productivity, plant-soil interactions, fates of diffuse sources of pollutants in agricultural land, and the potential of agricultural systems to act as source and sink for greenhouse gases (GHG). Specific research I am working on is to evaluate agricultural management practices (e.g. fertility management, irrigation, tillage) that control nutrient cycling, nutrient use efficiency, carbon sequestration, and GHG. The major contribution of my research is to develop the mechanistic understanding of nitrogen cycling and nitrogen use efficiency in diverse agricultural systems by using tracer and natural abundance stable isotope techniques in order to identify management practices that minimize GHG emissions and energy consumption while maintaining crop yields. Novel research on topics such as

the strategies of agricultural systems to adapt global climate change, processes in soil that influence GHGs production and consumption, the role of metals (e.g. iron, copper, manganese) in nitrogen and carbon biochemistry under aerobic and anaerobic conditions are needed. Other, related research is to investigate the effects of biosolids and organic fertilizer applications on soil carbon sequestration and agricultural GHG emissions.

## PUBLICATION PUBLISHED

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1. **Xia Zhu-Barker\***, William R. Horwath, Martin Burger. Knife-injected anhydrous ammonia increases yield-scaled N<sub>2</sub>O emissions compared to broadcast or band-applied ammonium sulfate in wheat. *Agriculture, Ecosystems and Environment*. 2015, 212: 148-157..
2. **Xia Zhu-Barker\***, Timothy A Doane, William R Horwath. The role of green waste compost on N<sub>2</sub>O production pathways in agricultural soil. *Soil Biology & Biochemistry*. 2015, 83, 57-65.
3. Yunfa Qiao, Shujie Miao, **Xia Zhu\***, et al. The effect of N fertilizer practices on N balance and global warming potential of maize-soybean-wheat rotation system as affected by long-term fertilization in Northeast of China. *Field crops research*. 2014, 161: 98-106. doi: 10.1016/j.fcr.2014.03.005.
4. **Xia Zhu\***, Martin Burger, Timothy A Doane, William R Horwath. Ammonia oxidation pathways and nitrifier denitrification are significant sources of N<sub>2</sub>O and NO under low oxygen availability. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*. 2013, 110 (16):6328-6333.doi: 10.1073/pnas.1219993110.
5. **Xia Zhu\***, Timothy A Doane, Lucas C. R. Silva, William R Horwath. Iron: The Forgotten Driver of Nitrous Oxide Production in Soil. *Plos One*. 2013, 8(3): e60146. doi:10.1371/journal.pone.0060146.
6. **Xia Zhu\***, Lucas C. R. Silva, Timothy A Doane, Ning Wu, William R Horwath. Quantifying the effects of compost application, water content and nitrogen fertilization on N<sub>2</sub>O emissions in ten agricultural soils. *Journal of Environmental Quality*. 2013, 42(3): 912-918. doi: 10.2134/jeq2012.0445.
7. Liu Lin, **Xia Zhu**, Geng Sun, Peng Luo. Effects of simulated warming and fertilization on activities of soil enzymes in alpine meadow. *Pratacultural Science*. 2011, 28 (8):1405-1410
8. **Xia Zhu**, Han Xiaozeng, Wang Fengju. The Characteristics of Nitrogen Use Efficiency and Soil Nitrogen supplying after Long-term Fertilization in Black Soil. *System Sciences and Comprehensive Studies in Agriculture*, 2010, 26(5)
9. **Xia Zhu**, Han Xiaozeng, Qiao Yunfa. Influence of Soluble Carbon and Nitrogen on N<sub>2</sub>O Emission from Different Thermal Zones Soil. *Journal of Agro-environment Science*, 2009, 28(6): 2637-2644

10. Han Xiaozeng, **Xia Zhu**, Qiao Yunfa. Influence of Long-term Fertilization on Nitrogen Supply Capacity in Different Thermal Zones Soil. *Acta Agriculture Boreali-Sinica*, 2009, 24(5):1-5
11. **Xia Zhu**, Han Xiaozeng, Qiao Yunfa. Influence of Soluble Carbon and Nitrogen on Ammonia Volatilization from Different Thermal Zones Soil. *Environment Science*, 2009, 30 (12): 25-30
12. **Xia Zhu**, Han Xiaozeng. Effects of Land Use on Nitrogen Content in Black Soil. *Jiangsu Journal of Agricultural Sciences*, 2008, 24(6):843-847

## PUBLICATIONS IN REVIEW & PREPARATION

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1. Lucas C.R. Silva, Sun Geng, **Xia Zhu-Barker**, William R. Horwath. Recent unprecedented tree growth and the expansion of Tibetan forests: a process regulated by soil-plant-atmosphere interactions. *Nature plants*. Revised.
2. Miao, S., R. Ye, **X. Zhu-Barker**, Y. Qiao, T. A. Doane, and W.R. Horwath, Decomposition and priming effect of plant organic carbons in soils with contrasting organic matter contents. *Soil Biology & Biochemistry*. Revised.
3. **Xia Zhu-Barker**, Amanda R. Cavazos, Nathaniel E. Ostrom, William R. Horwath, Jennifer B. Glass. Role of iron and manganese in the production of nitrous oxide in soil and aquatic ecosystems: how important are abiotic processes? *Biogeochemistry*. Revised.
4. Lujun Li, Rongzhong Ye, Mengyang You, **Xia Zhu-Barker**. Effects of temperature and carbon inputs on soil organic matter mineralization depend on soil organic carbon content. *Soil Science Society of America*. In Review.
5. Feng Wang, Si Chen, Ke-qiang Zhang, Xia Zhu-Barker. Impact of Nitrogen fertilizer source on N<sub>2</sub>O emissions from three agricultural soils during freezing process. *European Journal of Soil Sciences*. Revised.
6. **Xia Zhu-Barker\***, Martin Burger, Peter Green, William R Horwath. The influence of direct green waste land application on greenhouse gas emission and nitrate leaching. *Environmental Science of Technology*. In Review.
7. **Xia Zhu-Barker\***, Timothy A Doane, William R Horwath. The impact of iron on soil N<sub>2</sub>O production depends on O<sub>2</sub> availability. *Preparing for Nature Geoscience*.
8. **Xia Zhu-Barker\***, Martin Burger, William R Horwath. Does inorganic N concentration affect soil N<sub>2</sub>O production? Why? *Preparing for Proceedings of the National Academy of Sciences*.
9. **Xia Zhu-Barker\***, Shannon Bailey, Kyaw Tha Paw U, William R Horwath. Greenhouse gas emissions from compost pile. *Preparing for Environmental Science of Technology*.
10. Eric R. Kent, **Xia Zhu-Barker**, Shannon K. Bailey, Jilmarie Stephensa William R. Horwath, and Kyaw Tha Paw U Measurements of greenhouse gas flux from composting green-waste

using micrometeorological mass balance and flow-through chambers. *Preparing for Waste Management*.

## ORAL/KEYNOTE PRESENTATIONS

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1. **Xia Zhu-Barker**. The role of iron in the production of N<sub>2</sub>O in soils. *Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing, China*, Sept. 11, 2015. **Invited Talk**
2. **Xia Zhu-Barker**. The contribution of agriculture to greenhouse gas N<sub>2</sub>O emissions and mitigation strategies. Mollisols Utilization and Conservation Workshop (Harbin, China, September 7-9, 2015). **Invited Talk**
3. **Xia Zhu-Barker**, William R. Horwath. The role of iron and manganese in abiotic nitrous oxide production in soil and aquatic ecosystems. International Conference of Nitrification (Edmonton, Alberta, Canada, June 2015). **Invited Plenary Talk**
4. **Xia Zhu**, Martin Burger, William R. Horwath. How to optimize the management of organic waste materials in sustainable agricultural system: a study on soil N<sub>2</sub>O emissions. *Institute of Genetics and Developmental Biology, Chinese Academy of Sciences, Shijiazhuang, China*, Dec. 30, 2014. **Invited Talk**
5. **Xia Zhu**, Martin Burger, William R. Horwath. The sources and mechanisms of soil N<sub>2</sub>O emission: implications for the use of organic waste materials in sustainable nitrogen management. *Agro-Environmental Protection Institute, Ministry of Agriculture, Tianjing, China*, Dec. 24, 2014. **Invited Talk**
6. **Xia Zhu**, Martin Burger, William R. Horwath. Implications for the use of organic waste materials in sustainable nitrogen management in agricultural systems. *Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing, China*, Dec. 21, 2014. **Invited Talk**
7. **Xia Zhu**, Martin Burger, Hannah Waterhouse, William R. Horwath. The Effect of N fertilizer concentration on Soil O<sub>2</sub> Consumption and N<sub>2</sub>O Production. *Soil Science Society of America* (Long Beach, CA, November 2014)
8. **Xia Zhu**, Timothy Doane, Lucas Silva, William R. Horwath. Iron: The Forgotten Driver of Nitrous Oxide Production in Agricultural Soil. *SSSA Ecosystem Services Conference* (Sacramento, CA, March 2014)
9. **Xia Zhu**, Martin Burger, William R. Horwath. Factors and Mechanisms Controlling Emission of Nitrous oxide from Soil. *Northwest A&F University, China*, June 17<sup>th</sup>, 2013. **Invited Talk**
10. **Xia Zhu**, Martin Burger, William R. Horwath. A new perspective of nitrogen cycling: The future of organic fertilizer and biosolids. *Agro-Environmental Protection Institute, Ministry of Agriculture, China*, June 13<sup>th</sup>, 2013. **Invited Talk**
11. **Xia Zhu**, William R. Horwath. Investigate nitrogen cycling and nitrogen use efficiency in diverse agricultural systems by using tracer and natural abundance stable isotope techniques. *Northeast Institute of Geography and Agro-ecology, Chinese Academy of Sciences, China*, June 11<sup>th</sup>, 2013. **Invited Talk**
12. **Xia Zhu**, Martin Burger, William R Horwath. N<sub>2</sub>O production via nitrifier denitrification

under low oxygen availability. *Soil Science Society of America* (Cincinnati, OH, October 2012).

13. **Xia Zhu**, Xiaozeng Han. Influence of Soluble Carbon and Nitrogen on Ammonia Volatilization from Different Thermal Zones Soil. *National conference of academicians delegates of Chinese Society of Soil Science* (Beijing, China, Sep 2008).
14. **Xia Zhu**, Xiaozeng Han. The Characteristics of Nitrogen Use Efficiency and Soil Nitrogen supplying after Long-term Fertilization in Black Soil. International Conference on Long-Term Ecological Research (Harbin, China, August 2007).
15. **Xia Zhu**, Xiaozeng Han. Effects of Land Use on Nitrogen Content in Black Soil. International workshop on understanding of ecological processes and functions in soil (Nanjing, China, June 2006).

## POSTER PRESENTATIONS

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16. **Xia Zhu**, Timothy A. Doane, Martin Burger, William R. Horwath. The impact of iron on soil N<sub>2</sub>O production depends on O<sub>2</sub> availability. *American Geophysical Union* (San Francisco, CA December 2014)
17. **Xia Zhu**, Martin Burger, Peter G. Green, William R. Horwath. Greenwaste: How to Reduce its Impacts on Greenhouse Gas Emissions and Nitrate Leaching Potential? *Soil Science Society of America* (Long Beach, CA, November 2014)
18. **Xia Zhu**, Martin Burger, Hanna Waterhouse, William R. Horwath. The effect of ammonical N fertilizer Concentration on soil O<sub>2</sub> consumption and N<sub>2</sub>O production pathways. *Complex Soil System conference* (Lawrence National Lab & UC Berkeley, September 2014, POSTER)
19. **Xia Zhu**, Martin Burger, William R Horwath. Ammonia oxidation pathways and nitrifier denitrification are significant sources of N<sub>2</sub>O and NO under low oxygen availability. *Climate-Smart Agriculture Conference* (UC Davis, Davis, CA, March 2013, POSTER)
20. **Xia Zhu**, Martin Burger, William R Horwath. Nitrifier denitrification as a main pathway of N<sub>2</sub>O under limiting O<sub>2</sub> concentration. *American Geophysical Union* (San Francisco, CA, Dec 2012, POSTER).
21. **Xia Zhu**, Martin Burger, Timothy A Doane, William R Horwath. Influence of oxygen availability on N<sub>2</sub>O pathways. *Ecological Society of America* (Portland, Oregon, August 2012, POSTER).
22. **Xia Zhu**, Martin Burger, William R Horwath. N<sub>2</sub>O production pathways and its factor. *Western of Soil Science Society of America* (Davis, CA, Jun 2012, POSTER).
23. **Xia Zhu**, Martin Burger, Timothy A Doane, William R Horwath. The effect of nitrogen fertilizer and O<sub>2</sub> on N<sub>2</sub>O emission. *Soil Science Society of America* (San Antonio, TX, October 2011, POSTER).

## FELLOWSHIPS & AWARDS

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- Ministry of Agriculture China Talents Travel Award, 2014. \$10,000.
- Chinese Academy of Sciences President Award, July 2013. \$ 1000.
- Outstanding Student Paper Award in *American Geophysical Union*, December 2012.

- The first place winner of poster competition in *Western Soil Science Society of America, June 2012.*
- Chinese Oversea Scholarship, June 2010.

## GRANTS

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- Rice culture in the Sacramento-San Joaquin Delta to mitigate past agricultural impacts, improve water quality and sequester carbon. National Institute of Food and Agriculture. June 1, 2012-May 31, 2016. William R. Horwath, Jacob Fleck, Phil Bachand, Steve Deverel... **Xia Zhu** (Participation). \$2,000,000.
- Evaluating mitigation options of N<sub>2</sub>O emissions in CA cropping systems. CA Air Resources Board. May 1, 2012-Nov. 30, 2015. William R. Horwath, Martin Burger, **Xia Zhu** (Participation). \$ 400,000.
- Research to Evaluate Nitrous Oxide (N<sub>2</sub>O) Emissions from Compost In Support Of AB 32 Scoping Plan Composting Measure. California Dept. of Resources Recycling and Recovery. Oct. 1, 2010- Dec. 2014. William R. Horwath, Kyaw Tha Paw U, **Xia Zhu** (Participation). \$680,000.
- Defining and implementing agricultural management practices to mitigate and adapt to climate change. Institute of Food and Agriculture. Nov. 1, 2012-Oct. 31, 2016. William R. Horwath, Martin Burger, Putnam, **Xia Zhu** (Participation). \$744,000.
- Research to evaluate environmental impacts of direct land application of uncomposted green and woody wastes on air and water quality. California Dept. of Resources Recycling and Recovery. June 21, 2012- March 31, 2014. Martin Burger, **Xia Zhu**, Peter G. Green. \$175,000.
- Improving fertilizer and water use in tomatoes through the combined use of organic amendment and controlled soil aeration. California Department Fertilizer Agency Special Crops Block Grants. William R. Horwath, **Xia Zhu-Barker** (Co-PI &PM), Martin Burger, Rongzhong Ye. \$ 399,430. *Pending*
- Mitigation of greenhouse gas emissions from soils by use of biosolids. National Science Foundation of China. Feng Wang, **Xia Zhu-Barker** (Co-PI), Keqiang Zhang. \$130,000, *Pending*

## TEACHING EXPERIENCE & INTEREST

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### Teaching Experience

2009-2010 **Teaching Assistant.** *Sichuan University & Chengdu Institute of Biology, Chinese Academy of Sciences, China*

- Taught background concepts and led discussions in the course of alpine ecology, including hour-long session per week with fifty 3<sup>rd</sup> and 4<sup>th</sup> year undergraduate students each.
- Assisted in writing and administering exams

2007-2009 **Teaching Assistant.** *Northeast Agricultural University & Northeast Institute of Geography and Agro-ecology, Chinese Academy of Sciences, China*

- Taught background concepts and led discussions in the course of soil fertility, including hour-long sessions per week with thirty 2<sup>nd</sup> and 4<sup>th</sup> year undergraduate students each.
- Assisted in writing and administering exams

### Teaching Interests

Sustainable Agroecosystem Management; Plant Nutriology; Soil Science; Soil Fertility; Carbon and Nitrogen Biogeochemistry Cycling; Isotopes and Their Ecological Application.

### SERVICE

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- Reviewer of *Biogeochemistry, Soil Science Society of America Journal, Applied and Environmental Soil Science, Environmental Management, Journal of Dairy Science, PlosOne, Environmental Science of Technology, Science of the total Environment, Scientific Report.*
- Co-organizer and session chair, Oral Session on “Molecular, genomic and isotopic approaches to resolving biotic and abiotic pathways of nitrous oxide production in terrestrial and marine ecosystems”, American Geophysical Union Annual Meeting, 2014. San Francisco, CA.
- Judge for the student presentation competition in Soil Science Society of America Annual Meetings, 2014 and American Geophysical Union Annual Meeting, 2014
- Presider for an oral session on “the Role of Soil Management in Influencing Nitrous Oxide Emissions and Microbial Processes”, Soil Science Society of America Annual Meetings, 2012. Cincinnati, OH.

### PROFESSIONAL AFFILIATIONS

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- ❖ Soil Science Society of America (SSSA)
- ❖ American Geophysical Union (AGU)
- ❖ Ecological Society of America (ESA)
- ❖ American Chemical Society (ACS)

### PROFESSIONAL DEVELOPMENT

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- Writing in the Sciences, Stanford University, online course, September 2014.
- National Science Foundation Day at University of California Davis, Davis, CA, April 2013.
- Grant Writers' Seminars and Workshop: How to Submit Successful Proposals to Any Agency, sponsored by National Science Foundation, Davis, CA, 2012.