Andrew David Bazett Leakey
Outline of Promotion Dossier

A. PERSONAL HISTORY AND PROFESSIONAL EXPERIENCE

NOTE: In each section, list items in chronological order from past to present.

A. Educational Background
(Provide the name of institution; degree, field of study; date of degree.)

University of Sheffield, U.K., B.Sc., Department of Animal and Plant Sciences, 1998
University of Sheffield, U.K., Ph.D., Department of Animal and Plant Sciences, 2003

B. Academic Positions
(For each position held, list inclusive dates, title, and location for each -- University of Illinois and elsewhere.)

2002-2003	Fulbright Scholar, Department of Plant Biology, UIUC
2002-2004	Postdoctoral Research Associate, Department of Plant Biology, UIUC
2004-2007	Research Fellow, Institute for Genomic Biology, UIUC
2007-2013	Assistant Professor, Department of Plant Biology, UIUC
2007-2013	Assistant Professor, Institute for Genomic Biology, UIUC
2013-	Associate Professor, Department of Plant Biology, UIUC
2013-	Associate Professor, Institute for Genomic Biology, UIUC
2013-	Associate Professor, Department of Crop Sciences, UIUC

C. Other Professional Employment
(Previous and current.)

D. Honors, Recognitions, and Outstanding Achievements

1998	J.G. Boswell Prize for B.Sc. in Plant Sciences, University of Sheffield
1999	Scurfield Bursary for Overseas Ph.D. Research, University of Sheffield
2001	Institute of Chartered Foresters Scientific Trust Grant
2001	Australian Academy of Science Travel Grant
2001	Society for Experimental Biology Travel Grant
2002	Smithsonian Institute Post-doctoral Fellowship (declined)
2002	**Fulbright Scholar**
2006	College of ACES Team Award for Research Excellence, UIUC
2006	Poster Award, American Society for Plant Biology Symposium on Transpiration
2007	Spring. List of Teachers Ranked Excellent by Students, *Plants & Global Change*
2008	Dean's Teaching Fellow, College of Liberal Arts & Sciences, UIUC
2008	Fall. List of Teachers Ranked Excellent by Students, *Global Warming, Biofuels & Food*
2009	Spring. List of Teachers Ranked Excellent by Students, *Plants & Global Change*
2010	Faculty Fellow, Environmental Change Institute, UIUC
2011	Spring. List of Teachers Ranked Excellent by Students, *Plants & Global Change*

2011 **Beckman Fellow, Center for Advanced Studies, UIUC**
2013 **I.C. Gunsalus Fellow, College of Liberal Arts and Sciences, UIUC**
2013 Spring. List of Teachers Ranked Excellent by Students, *Plants & Global Change*
2013 Arnold O. Beckman Research Award

E. Invited Lectures and Invited Conference Presentations

1. How will the major agricultural ecosystem of the U.S. respond to global climate change in 2050? (2003) *Fulbright Commission Lecture, Astra-Zeneca HQ, UK.*
2. How will leaf respiration respond to future CO_2-rich atmospheres? (2004) *Department of Ecology and Evolutionary Biology, University of Kansas.*
3. How will leaf respiration respond to future CO_2-rich atmospheres? (2004) *Department of Crop Sciences, UIUC.*
4. Measuring diurnal courses of gas exchange and chlorophyll fluorescence in the field. (2005) *International Workshop on Photosynthetic Gas Exchange and Chlorophyll Fluorescence Measurement, Universidad Autonoma de Nuevo Leon, Mexico*.
5. Microarray analysis of gene expression responses in soybean to growth at elevated [O_3]. (2006) *USDA NE1013 National Program Workshop, UIUC.*
6. Food for thought: crop responses to climate change in the 21st century. (2006) *Natural Science Colloquia, Illinois Wesleyan University.*
7. Ecological genomics: new insights from microarray analysis of soybean responses to elevated CO_2 and O_3 under Free-Air Concentration Enrichment. (2006) *Department of Ecology and Evolutionary Biology, University of Colorado.*
8. Food for thought: Crop responses to climate change in the 21st century. (2006) *International Education Symposium, Hathaway Brown School, Shaker Heights, OH.*
9. Plant responses to global change and a new genomic ecology approach.(2006) *Department of Plant Biology, UIUC.*
10. Elevated CO_2 does not stimulate C_4 photosynthesis directly, but impacts water relations and indirectly enhances carbon gain during drought stress in maize (*Zea mays*) grown under free-air CO_2 enrichment (FACE). (2006) *Crop Science Society of America Annual Meeting, Indianapolis, IN.*
11. Ecological genomics: new insights from microarray analysis of soybean responses to elevated CO_2 and O_3 under Free-Air Concentration Enrichment. (2006) *Department of Molecular Genetics and Microbiology, University of Florida.*
12. Plant responses to global change and a new genomic ecology approach. (2007) *Division of Biology, Imperial College, London, UK.*
13. How will the gene expression profile, biochemistry and physiology of soybean leaves respond to growth at elevated [CO_2] under open-air field conditions? (2007) *Institute for Genomic Biology Fellows Symposium, UIUC.*

14. Using microarrays to reveal the mechanism of crop responses to global climate change under field conditions. (2007) *International Rice Research Institute Workshop – Cool Rice for a Warmer World, Huazhong Agricultural University, Wuhan, China.*

15. Functional genomics and field ecology: Mechanistic insights from microarray analysis of soybean responses to elevated [CO_2]. (2007) *Ecological Society of America Annual Meeting, San Jose, CA.*

16. Design and analysis of microarray experiments for global change research. (2007) *Workshop on Statistical Analysis and Data Integration in Plant Genomic Ecology Research, UIUC.*

17. Physiological, biochemical and molecular analysis of the coordinated up-regulation of photosynthetic, respiratory and biosynthetic metabolism in soybean leaves under Free-Air CO_2 Enrichment. (2007) *14th International Congress of Photosynthesis, Glasgow, UK.*

18. Food (and fuel) for thought: Plant responses to climate change. (2008) *National Climate Change Teach-In, Urbana Free Library, Urbana, IL.*

19. Genomic Ecology of soybean responses to elevated [CO_2] and drought. (2008) *Facing the future, International Joint Workshop of AspenFACE, SoyFACE and SFB projects, Rhinelander, WI.*

20. Food (and fuel) for thought: Plant responses to climate change. (May 2008) *Earth Day Lecture, Students for Environmental Concerns, UIUC.*

21. Corn and soybean responses to climate change (May 2008) *Monsanto Headquarters, St Louis.*

22. Lecture to High School Science Teachers conference on The Global Demand for Biofuel (June 2008), titled, "*The Ecology of Biofuels*".

23. Lecture to Middle School Girls attending summer science camp, Girls Adventures in Math, Engineering and Science (GAMES; July 2008), titled *Climate Change and Food*.

24. The Genomic Basis of stimulated respiration by plants growing under elevated carbon dioxide. (Aug 2008) *Gordon Research Conference, Photosynthesis: from genome to biome.*

25. Lecture to visiting delegation from AAPRESID, the Argentinean No-Till Farmers Association (Sept 2008), titled *Food (and fuel) for thought: plant responses to climate change*.

26. Genomic ecology of soybean responses to elevated [CO_2]. (Nov 2008) *UIUC Keck Center for Comparative and Functional Genomics Microarray Workshop*.

27. Crop responses to climate change (March 2009) *A New Green Revolution Meeting Global Food and Energy Demands. A Joint Area Centers Symposium*.

28. Genomic, Physiological & Ecological Responses of Soybeans to Elevated [CO_2]: A Case Study from SoyFACE (March 2009) *Ecological Society of Japan, Annual Meeting.*

29. Genomic, physiological and ecological responses of soybean to free-air CO_2 enrichment (March 2009) *500th seminar at National Institute for Agro-Environmental Sciences, Tsukuba, Japan*.

30. Genomic, physiological and ecological responses of soybean to free-air CO_2 enrichment (March 2009) *National Agricultural Research Center for Tohoku Region, Morioka, Japan*.

31. Genomic Ecology of Global Change (April 2009) *National Evolutionary Synthesis Center Workshop, Toward A New Synthesis of the Evolutionary History and Ecology of C_4 Grasses, Durham, NC.*

32. Transcriptional reprogramming of leaf metabolism under elevated CO_2 stimulates respiration in soybean (May 2009) *International Conference for Plant Mitochondrial Biology.*

33. Lecture to Middle School Girls attending, Girls Adventures in Math, Engineering and Science summer science camp at UIUC (July 2009), titled *Climate Change and Food*.

34. Lecture to visiting delegation from AAPRESID, the Argentinean No-Till Farmers Association (Sept 2009), titled *Food (and fuel) for thought: plant responses to climate change*.

35. Food for thought – crop responses to climate change (October 2009) Meeting of *Students for Environmental Concerns, UIUC.*

36. How will elevated CO_2 impact photosynthesis of tropical plants? (November 2009) *23rd New Phytologist Symposium Carbon Cycling in Tropical Ecosystems, Guangzhou, China.*

37. The Environmental Change Biology Podcast Project (December 2009) *Environmental Change Institute Annual Symposium, UIUC.*

38. Transcriptional reprogramming of leaf carbon metabolism in plants growing at elevated [CO_2] (March 2010) *Kansas State Functional Genomics Consortium Symposium, Manhattan, KS.*

39. Global environmental change impacts on plant function and agroecosystem services (April 2010) *Geography Department Seminar, King's College London, UK.*

40. The elevated CO_2 by drought interaction: a saviour or false hope for future food production? (April 2010) *Stockholm Environmental Institute Seminar, University of York, UK.*

41. The elevated CO_2 by drought interaction: a saviour or false hope for future food production? (April 2010) *Department of Animal and Plant Sciences Seminar, University of Sheffield, UK.*

42. Rising atmospheric CO_2 and the future of C_4 crops for food and fuel (August 2010) *Symposium on C_4 Plant Biology, CAS-MPG Partner Institute for Computational Biology, Chinese Academy of Sciences, Shanghai, China.*

43. Crop adaptation for an elevated [CO_2] world (August 2010) *Royal Society International Scientific Seminar, Atmospheric CO_2 and green evolution, Kavli Royal Society Center, UK.*

44. Genomic ecology of plant responses to global environmental change (November 2010) *Using Functional Genomics to Harness Adaptive Traits in Australian Native Plants Workshop, University of Western Australia, Australia.*

45. What will be the effect of the climate change on crop production (November 2010) *Environmental Change Institute Annual Symposium, UIUC.*

46. Do we really need more experiments to understand how vegetation change is driven by rising atmospheric CO_2 concentrations? (January 2011) *South African CO_2 and Vegetation Consortium Workshop, Grahamstown, South Africa.*

47. Soybean and maize responses to global environmental change at SoyFACE (March 2011) *CO_2 Symposium, Smithsonian Tropical Research Institute, Panama.*

48. Transcriptional reprogramming of respiration to optimize plant metabolism in response to stress and resource availability (May 2011) *Institute for Genomic Biology Fellow's Symposium, UIUC.*

49. Transcriptional reprogramming of respiration in response to global environmental change (May 2011) *Penn State Plant Biology Symposium.*

50. Rising atmospheric CO_2 and the future of c4 crops for food and fuel (July 2011) *International Botanical Congress, Melbourne, Australia*.

51. Transcriptional reprogramming of respiration under elevated CO_2 and elevated O_3 (July 2011) *International Botanical Congress, Melbourne, Australia*.

52. Non-optimal responses to drought stress of soybean grown at elevated CO_2 in the field (July 2011) *International Botanical Congress, Melbourne, Australia*.

53. New rice for an elevated CO_2 future (Nov 2011) *International Rice Research Institute, Philippines.*

54. Climate-proofing rice for farmers in the tropics (December 2011) *Environmental Change Institute Annual Symposium, UIUC.*

55. Environmental change impacts on soybean rooting, food production and ecosystem function (Dec 2011) *Environmental Change Institute Annual Symposium, UIUC.*

56. Climate change and crops (Jan 2012) Lecture to Mahomet Junior High School Students

57. Transcriptional reprogramming of respiration in response to global environmental change (March 2012) *Okazaki Biology Conference 8, Japan.*

58. Plant interactions with the atmospheric CO_2 pool – a phytocentric view of the global carbon cycle (April 2012) *Department of Geology, UIUC.*

59. Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? (May 2012) *Lancaster Environment Center, University of Lancaster, UK.*

60. Data and models for predicting water processes in rainfed agriculture – the plant scale (June 2012) *Water in Bioenergy Agroecosystems Workshop, Chicago, Energy Biosciences Institute.*

61. Next-generation elevated CO_2 experiments for climate-proofing crops (July 2012) *World Crop FACE Workshop, Tsukuba, Japan.*

62. SoyFACE overview (July 2012) *World Crop FACE Workshop, Tsukuba, Japan.*

63. Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? (July 2012) *World Crop FACE Workshop, Tsukuba, Japan.*

64. Integration of physiology, genomics and genetics to understand nad improve crop productivity in a changing world (July 2012) *CSIRO, Canberra, Australia.*

65. Integrating transcriptomics and physiology (September 2012) *SEB Plant Environmental Physiology Group, Ecophysiology Techniques Workshop, Lisbon, Portugal.*

66. Acclimation of stomatal function to elevated O_3 (September 2012) *White Rose Workshop on Regional Scale Ecosystem Model Development, University of York, UK* (presentation via video conference)

67. Plants iView: a plug-n-play outreach program for Plant Biology (March 2013) *Department of Plant Biology Colloquium, UIUC.*

68. A universal playbook for stomata in C_3 plants: fact or fiction? (April 2013) *Department of Plant Biology Colloquium, UIUC.*

69. Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? (May 2013) *Interdisciplinary Plant Group Symposium on Roots, University of Missouri, Columbia, MO.*

70. Transcriptional reprogramming of plant metabolism in response to global environmental change (May 2013) *Beijing Genome Institute-Institute for Genomic Biology Workshop, UIUC.*

71. Corn (June 2013) *Workshop on for Champaign Unit 4 High School Teachers.*

72. Elevated CO_2 ameliorates stress under mild drought but exacerbates stress under severe drought in soybean (July 2013) *American Society of Plant Biologists Annual Meeting, Providence, RI.*

73. SoyFACE: a field laboratory for adaptation of C_4 (and C_3) crops to global environmental change (August 2013) *International Symposium for C_4 and CAM Plant Biology, UIUC.*

74. Have we been ignoring physiological plasticity and genetic variation in stomatal function as a significant source of error in models of water and carbon fluxes? (August 2013) *International Photosynthesis Congress, St Louis, MO.*

75. A universal playbook for stomata in C_3 plants: fact or fiction? (August 2013) ATMS571 *Department of Atmospheric Science, UIUC.*

76. Plants iView: a plug-n-play outreach program for Plant Biology (September 2013) *Purdue University.*

77. Elevated CO_2 ameliorates stress under mild drought but exacerbates stress under severe drought in soybean (October 2013) *Physiological and Molecular Plant Biology Seminar, UIUC.*

78. Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? (January 2014) *Department of Plant Biology Seminar, Carnegie Institute, Palo Alto, CA.*

79. Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? (February 2014) *Department of Plant Sciences Seminar, UC Davis, CA.*

80. Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? (February 2014) *Hydrosystems Group Seminar, UIUC.*

81. Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? (April 2014) *Monsanto, St Louis, MO.*

F. Offices Held in Professional Societies

G. Editorship of Journals or Other Learned Publications

2009 – present Editor, Photosynthesis Research
2012 – present Editor, Food and Energy Security

H. Grants Received
(List principal investigator first, any co-PI's, granting agency, dates of grant, and dollar amount.)

ADB Leakey; *Astra-Zeneca Fulbright Scholar*, Fulbright Commission, 07/2002 - 07/2003, $22,000.

SP Long, **ADB Leakey**, EH DeLucia, DR Ort; *How will productivity, evapotranspiration & insect herbivory of the Midwest agroecosystem respond to the combined drought and elevated [CO2] anticipated for 2050?* DOE National Institute for Climate Change Research, 07/2007 - 06/2010, $368,648.

TE Twine and **ADB Leakey**; *Agroecosystems: Effects of changes in climate, carbon dioxide, and ozone over the central United States*, DOE National Institute for Climate Change Research, 05/2008 - 04/2011, $360,717.

EH Delucia, EA Ainsworth, M Berenbaum, **ADB Leakey**, DR Ort, A Zangrel; *Genomic Regulation of the Response of an Agroecosystem to Elements of Global Change*, Department of Energy, 01/2009 – 12/2009, $250,000.

ADB Leakey, EA Ainsworth; *Integrated Enhancement of Global Change Biology Classes*, Environmental Change Institute - UIUC, 06/2009 – 05/2010, $4,880.

EA Ainsworth, CJ Bernacchi, EH Delucia, **ADB Leakey**, DR Ort; *ECI Student Ambassadors for SoyFACE*, Environmental Change Institute - UIUC, 06/2009 – 05/2011, $25,000.

ADB Leakey, DR Ort; *Altered Root-To-Shoot Signaling and Osmotic Adjustment as Key Determinants of Soybean Stress Tolerance Under Drought and Elevated [CO_2]*, USDA NIFA, 01/2010 – 12/2012, $349,266.

ADB Leakey; *ECI Faculty Fellowship*, Environmental Change Institute - UIUC, 06/2010 – 05/2011, $10,000.

ADB Leakey; *Environmental Change Impacts on Crop Rooting, Food Production and Ecosystem Function,* Environmental Change Institute - UIUC, 06/2010 – 05/2012, $24,790.

ADB Leakey; *Plants iView – An After School Program in Plant Biology*, American Society of Plant Biologists Education Foundation, 10/2011 – 9/2012, $19,919.

ADB Leakey; *Testing Setaria drought response under Midwest U.S. field conditions*, Donald Danforth Plant Science Center, 10/2011 – 12/2012, $99,828.

ADB Leakey; *Plants iView – An After School Program in Plant Biology,* Office for Public Engagement, UIUC, 01/2012 – 12/2012, $19,744.

ADB Leakey; *EBI 2011: Sustainability of Woody Biofuel Feedstocks*, Energy Biosciences Institute, 1/2012 – 12/2014, $602,931.

T Brutnell, I Baxter, A Cousins, J Dinneny, **ADB Leakey**, T Mockler, S Rhee, Voytas; *A systems-level analysis of drought and density response in the model C4 grass Setaria viridis*, DOE Biofuel Genomics, 10/2012 – 9/2017, $ 12,140,437.

EA Ainsworth, **ADB Leakey**, P Brown, L McIntyre; *Genetic and Genomic Approaches to Understand and Improve Maize Responses to Ozone* , NSF Plant Genome, 1/2013 – 12/2017, $5,733,823.

ADB Leakey; *Meeting: C4 + CAM Plant Biology 2013*, NSF IOS, 4/2013 – 3/2014, $12,800.

ADB Leakey; *Global Environmental Change Outreach Project*, UIUC Center for Global Studies, 1/2013 – 12/2013. $3000.

ADB Leakey; C_4 and CAM Plant Biology Symposium 2013, DOE, 6/2013-5/2014, $9,420.

ADB Leakey; Arnold O. Beckman Research Award, UIUC, 2013, $30,000.

I. Review Panels (e.g., for Governmental Agencies, Educational Institutions)

2008 Panel member evaluating proposals to the Midwest Region of DOE's National Institute for Climate Change Research.

2009 Panel member evaluating proposals to the European Commission's 7th Framework program on *Forest Ecosystem Genomics*.

2012 Panel member evaluating proposals to the American Society of Plant Biologists Summer Undergraduate Research Fellowship (SURF) program.

II. PUBLICATIONS AND CREATIVE WORKS

\# Denotes any publication derived from the candidate's thesis.
* Denotes publication that has undergone stringent editorial review by peers
\+ Denotes publication that was invited and carries special prestige and recognition.

A. Doctoral Thesis Title

Photosynthetic and growth responses of dipterocarp tree seedlings to dynamic irradiance

B. Books Authored or Co-Authored (in print or accepted.)

C. Books Edited or Co-Edited (in print or accepted)

D. Chapters in Books (in print or accepted)

1. +DR Ort, EA Ainsworth, M Aldea, DJ Allen, CJ Bernacchi, MR Berenbaum, GA Bollero, G Cornic, PA Davey, O Dermody, FG Dohleman, JG Hamilton, EA Heaton, **ADB Leakey**, J Mahoney, TA Mies, PB Morgan, RL Nelson, A Rogers, AR Zangerl, X-G Zhu, EH DeLucia & SP Long (2006) SoyFACE: The effects and interactions of elevated [CO_2] and [O_3] on soybean. In: *Managed ecosystems and CO_2: Case studies, processes and perspectives* Ed: J Nösberger *et al.* Ecological Studies Series. Springer Verlag, pp. 71-86.

2. +SP Long, EA Ainsworth, CJ Bernacchi, PA Davey, GJ Hymus, **ADB Leakey**, PB Morgan & CP Osborne (2006) Long term responses of photosynthesis and stomata to elevated [CO_2] in managed systems. In: *Managed ecosystems and CO_2: Case studies, processes and perspectives* Ed: J Nösberger *et al.* Ecological Studies Series. Springer Verlag, pp. 253-270.

3. **+ADB Leakey**, EA Ainsworth, CJ Bernacchi, X Zhu, SP Long & DR Ort (2012) Photosynthesis in a CO_2 rich atmosphere. In: *Photosynthesis: A Comprehensive Treatise Physiology, Biochemistry, Biophysics and Molecular Biology.* 34: 733-768. Eds: JJ Eaton-Rye and BC Tripathy. Springer.

4. **+ADB Leakey** (2012) Biogeochemical cycles and the flow of energy in the earth system. *Sustainability: A comprehensive foundation* Eds. T Thesis and J Tomkin. Online, open source textbook - http://cnx.org/content/col11325/latest/

5. +ADB Leakey (2014) The Anthropocene: Plants in a New Environmental Domain. In: *The Plant Sciences*. In press. Ed: RK Monson. Springer. DOI 10.1007/978-1-4614-7612-2_6_1

E. Monographs (in print or accepted)

F. Articles in Journals (in print or accepted)

1. *#**ADB Leakey**, MC Press, JD Scholes & JR Watling (2002) Relative enhancement of photosynthesis and growth at elevated CO_2 is greater under sunflecks than uniform irradiance in a tropical rain forest tree seedling. *Plant, Cell & Environment* 25: 1701-1714.
2. *#**ADB Leakey**, MC Press & JD Scholes (2003) Patterns of dynamic irradiance affect the photosynthetic capacity and growth of dipterocarp tree seedlings. *Oecologia* 135: 184-193.

3. *#**ADB Leakey**, JD Scholes & MC Press (2003) High temperature inhibition of photosynthesis is greater under sunflecks than uniform irradiance in a tropical rain forest tree seedling. *Plant, Cell & Environment* 26: 1681-1690.
4. ***ADB Leakey**, CJ Bernacchi, FG Dohleman, DR Ort & SP Long (2004) Will photosynthesis of maize (*Zea mays*) in the U.S. Corn Belt increase in future [CO_2] rich atmospheres? An analysis of diurnal courses of CO_2 uptake under Free-Air Concentration Enrichment (FACE). *Global Change Biology* 10: 951-962.
5. *#**ADB Leakey**, JD Scholes & MC Press (2005) Physiological and ecological significance of sunflecks for dipterocarp seedlings. *Journal of Experimental Botany* 56: 469-482.
6. *+SP Long, EA Ainsworth, **ADB Leakey** & PB Morgan (2005) Global food insecurity. Treatment of major food crops with elevated carbon dioxide and ozone under large-scale fully open-air conditions suggests models may seriously overestimate future yields. *Philosophical Transactions of the Royal Society* 360: 2011-2020.
7. ***ADB Leakey**, M Uribelarrea, EA Ainsworth, SL Naidu, A Rogers, DR Ort & SP Long (2006) Photosynthesis, productivity and yield of *Zea mays* are not affected by open-air elevation of CO_2 concentration in the absence of drought. *Plant Physiology* 140: 779-790.
8. *+SP Long, EA Ainsworth, **ADB Leakey**, J Nosberger & DR Ort (2006) Food for thought: Lower than expected crop yield stimulation with rising carbon dioxide concentrations. *Science* 312: 1918-1921.
9. ***ADB Leakey**, CJ Bernacchi, DR Ort & SP Long (2006) Long-term growth of soybean at elevated [CO_2] does not cause acclimation of stomatal conductance under fully open-air conditions. *Plant, Cell & Environment* 29: 1794-1800.
10. *CJ Bernacchi, **ADB Leakey**, LE Heady, PB Morgan, A Rogers, SP Long & DR Ort (2006) Hourly and seasonal variation in photosynthesis and stomatal conductance of soybean grown at future CO_2 and ozone concentrations for three years under fully open air conditions. *Plant, Cell & Environment* 29: 2077-2090.
11. SP Long, EA Ainsworth, **ADB Leakey**, DR Ort, J Nosberger & D Schimel (2007) Crop models, CO_2, and climate change – Response. *Science* 315: 460-460.
12. *EA Ainsworth, A Rogers, **ADB Leakey**, LE Heady, Y Gibon, M Stitt & U Schurr (2007) Does elevated [CO_2] alter diurnal C uptake and the balance of C and N metabolites in sink and source soybean leaves? *Journal of Experimental Botany* 58: 579-591.
13. *SD Wullschleger, **ADB Leakey** & SB St Clair (2007) Functional genomics and ecology – a tale of two scales. *New Phytologist* 176: 735-739.
14. *EA Ainsworth, **ADB Leakey**, DR Ort, SP Long. (2008) FACE-ing the facts: Inconsistencies and interdependence among field, chamber and modeling studies of elevated [CO_2] impacts on crop yield and food supply. *New Phytologist* 179: 1-5.
15. *+EA Ainsworth[¶], A Rogers[¶], **ADB Leakey**[¶] (2008) Targets for crop biotechnology in a future high-CO_2 and high-O_3 world. *Plant Physiology* 147: 13-19. [¶]these authors contributed equally to this work. *** This paper was amongst the top 10 "most read" articles in *Plant Physiology* in November and December 2008 ***

16. *EA Ainsworth, C Beier, C Calfapietra, R Ceulemans, M Durand-Tardif, GD Farquhar, DL Godbold, GR Hendrey, T Hickler, J Kaduk, DR Karnosky, BA Kimball, C Korner, M Koornneef, T Larfarge, **ADB Leakey**, KF Lewin, SP Long, R Manderscheid, DL McNeil, TA Mies, F Miglietta, JA Morgan, J Nagy, RJ Norby, RM Norton, KE Percy, A Rogers, J-F Soussana, M Stitt, H-J Weigel and JW White (2008) Next Generation of elevated [CO_2] experiments with crops: a critical investment for feeding the future world. *Plant, Cell and Environment* 31: 1317-1324

17. *P Li, EA Ainsworth, **ADB Leakey**, A Ulanov, V Lozovaya, DR Ort, HJ Bohnert (2008) Arabidopsis transcript and metabolite profiles: ecotype-specific responses to open-air elevated [CO_2]. *Plant, Cell and Environment* 31: 1673-1687

18. *QS Qiu, JL Huber, FL Booker, V Jain, **ADB Leakey**, EL Fiscus, PM Yau, DR Ort & SC Huber (2008) Increased protein carbonylation in leaves of *Arabidopsis* and soybean in response to elevated [CO_2] and [O_3]. *Photosynthesis Research* 97: 155-166.

19. ***ADB Leakey**, F-Xu, K Gillespie, J McGrath, EA Ainsworth, DR Ort (2009) Genomic basis for stimulated respiration by plants growing under elevated carbon dioxide. *Proceedings of the National Academy of Sciences* 106: 3597-3602 *** This paper was highlighted on F1000***

20. ***ADB Leakey**, EA Ainsworth, SM Bernard, RJC Markelz, DR Ort, S Placella, A Rogers, MD Smith, E Sudderth, DJ Weston, SD Wullschleger, S Yuan (2009) Gene expression profiling – opening the black box of plant ecosystem responses to global change *Global Change Biology* 15: 1201-1213.

21. +***ADB Leakey** (2009) Rising atmospheric carbon dioxide concentration and the future of C_4 crops for food and fuel. *Proceedings of the Royal Society B: Biological Sciences* 276: 2333-2343.

22. +***ADB Leakey**, EA Ainsworth, CJ Bernacchi, A Rogers, SP Long & DR Ort (2009) Elevated CO_2 effects on plant carbon, nitrogen and water relations: six important lessons from FACE. *Journal of Experimental Botany* 60: 2859-2876.

23. *FG Dohleman, EA Heaton, **ADB Leakey**, SP Long (2009) Does greater leaf-level photosynthesis explain the larger solar energy conversion efficiency of Miscanthus relative to switchgrass? *Plant, Cell & Environment* 32: 1525-1537.

24. +*A Rogers, EA Ainsworth, **ADB Leakey** (2009) Will elevated carbon dioxide concentration amplify the benefits of nitrogen fixation by legumes? *Plant Physiology* 151: 1009-1016.

25. *C Calfapietra, EA Ainsworth, C Beier, P De Angelis, DS Ellsworth, DL Godbold, GR Hendrey, T Hickler, MR Hoosbeek, DF Karnosky, J King, C Körner, **ADB Leakey**, KF Lewin, M Liberloo, SP Long, M Lukac, R Matyssek, F Miglietta, J Nagy, RJ Norby, R Oren, KE Percy, A Rogers, G Scarascia Mugnozza, M Stitt, G Taylor, R Ceulemans (2010) Challenges in elevated CO_2 experiments on forests. *Trends in Plant Science* 15: 5-10.

26. *C Stohr, RG Darmody, B Wimmer, I Krapac, K Hackley, A Iranmanesh, **ADB Leakey** (2010) Detecting carbon dioxide emissions in soybeans by aerial thermal infrared imagery. *Photogrammetric Engineering and Remote Sensing* 76: 735-741.

27. *EJ Edwards, CP Osborne, CAE Stromberg, SA Smith, WJ Bond, PA Christin, AB Cousins, MR Duvall, DL Fox, RP Freckleton, O Ghannoum, J Hartwell, Y Huang, CM Janis, JE Keeley, EA Kellogg, AK Knapp, **ADB Leakey**, DM Nelson, BH Passey, JM Saarela, RF Sage, OE Sala, N Salamin, CJ Still, B Tipple (2010) The Origins of C_4 Grasslands: Integrating Evolutionary and Ecosystem Science. *Science* 328: 587-591.

28. *U Rascher, B Biskup, **ADB Leakey**, JM McGrath, EA Ainsworth (2010) Altered physiological function, not structure, drives increased radiation use efficiency of soybean grown at elevated CO_2. *Photosynthesis Research* 105: 15-25.

29. *J Firn, JL Moore, AS MacDougall, ET Borer, EW Seabloom, J HilleRisLambers, WS Harpole, EE Cleland, CS Brown, JMH Knops, SM Prober, DA Pyke, KA Farrell, JD Bakker, LR O'Halloran, PB Adler, SL Collins, CM D'Antonio, MJ Crawley, EM Wolkovich, KJ La Pierre, BA Melbourne, Y Hautier, JW Morgan, **ADB Leakey**, A Kay, R McCulley, KF Davies, CJ Stevens, CJ Chu, KD Holl, JA Klein, PA Fay, N Hagenah, KP Kirkman, YM Buckley (2011) Abundance of introduced species at home predicts abundance away in herbaceous communities. *Ecology Letters* 14: 274-281. *** This paper was highlighted on F1000***

30. *RJC Markelz, RS Strellner, **ADB Leakey** (2011) Impairment of C_4 photosynthesis by drought is exacerbated by limiting nitrogen and ameliorated by elevated [CO_2] in maize. *Journal of Experimental Botany* 62:3235-3246.

31. *CJ Bernacchi, **ADB Leakey**, BA Kimball, DR Ort (2011) Growth of soybean at future tropospheric ozone concentrations decreases canopy evapotranspiration and soil water depletion. *Environmental Pollution* 159: 1464-1472.

32. +***ADB Leakey**, JA Lau (2012) Evolutionary context for understanding and manipulating plant responses to past, present and future atmospheric [CO_2]. *Philosophical Transactions of the Royal Society B* 367: 613-629.

33. *KM Gillespie, F Xu, KT Richter, JM McGrath, RJC Markelz, DR Ort, **ADB Leakey**, EA Ainsworth (2012) Greater antioxidant and respiratory metabolism in field-grown soybean exposed to elevated O_3 under both ambient and elevated CO_2 concentrations. *Plant, Cell & Environment* 35: 169-184.

34. +***ADB Leakey**, KA Bishop, EA Ainsworth (2012) A multi-biome gap in understanding of crop and ecosystem responses to elevated CO_2. *Current Opinion in Plant Biology* 15: 228-236.

35. *C Decock, H Chung, R Venterea, SB Gray, **ADB Leakey**, J Six (2012) Elevated CO_2 and O_3 modify N turnover rates, but not N_2O emissions in a soybean agroecosystem. *Soil Biology and Biochemistry* 51: 104-114.

36. *S Vicca, AK Gilgen, S Camino,FE Dreesen, JS Dukes, M Estiarte, SB Gray, G Guidolotti, **ADB Leakey**, R Ogaya, DR Ort, M Ostrogovic, S Rambal J Sardans, M Schmitt, M Siebers, L van der Linden,O van Straaten, A Granier (2012) Urgent need for basic treatment data to make precipitation manipulation experiments comparable. *New Phytologist* 195:518-522.

37. *KR Walters, SI Rupassara, RJC Markelz, **ADB Leakey**, W Muir, BR Pittendrigh (2012) Methamphetamine causes anorexia in *Drosophila melanogaster*, exhausting metabolic reserves and contributing to mortality. *The Journal of Toxicological Sciences* 37:773-790.

38. *CL Casteel, OK Niziolek, **ADB Leakey**, MR Berenbaum, EH DeLucia (2012) Effects of elevated CO_2 and soil water content on phytohormone transcript induction in *Glycine max* after *Popillia japonica* feeding. *Environmental Entomology* 6:439-447.

39. *SB Gray, RS Strellner, KK Puthuval, R Shulman, MH Siebers, A Rogers, **ADB Leakey** (2013) Minirhizotron imaging reveals nodulation of field-grown soybean is enhanced by Free-Air CO_2 Enrichment only when combined with drought stress. *Functional Plant Biology* 40:137-147.

40. *MZ Hussain, A Vanloocke, MH Siebers, UM Ruiz-Vera, RJC Markelz, **ADB Leakey**, DR Ort, CJ Bernacchi (2013) Future carbon dioxide concentration decreases canopy evapotranspiration and soil water depletion by field-grown maize. *Global Change Biology* 19:1572-1584.

41. *LA Cernusak, K Winter, JW Dalling, JAM Holtum, C Jaramillo, C Korner, **ADB Leakey**, RJ Norby, B Poulter, BL Turner, SJ Wright (2013) Tropical forest responses to elevated [CO_2]: current knowledge and opporunitties for future research. *Functional Plant Biology* 40:531-551.

42. *TE Twine, JJ Bryant, K Richter, CJ Bernacchi, K McConnaughay, S Morris, **ADB Leakey** (2013) Impacts of elevated CO_2 concentration on the productivity and surface energy budget of the soybean and maize agroecosystem in the Midwest U.S. *Global Change Biology* 19:2838-2852.

43. *EW Seabloom, ET Borer, Y Buckley, EE Cleland, K Davies, J Firn, WS Harpole, Y Hautier, E Lind, A Macdougall, JL Orrock, SM Prober, P Adler, J Alberti, TM Anderson, JD Bakker, LA Biederman, D Blumenthal, CS Brown, LA Brudvig, M Caldeira, C Chu, MJ Crawley, P Daleo, EI Damschen, CM D'Antonio, NM DeCrappeo, CR Dickman, G Du, PA Fay, P Frater, DS Gruner, N Hagenah, A Hector, A Helm, H Hillebrand, KS Hofmockel, HC Humphries, O Iribarne, VL Jin, A Kay, KP Kirkman, JA Klein, JMH Knops, KJ LA Pierre, LM Ladwig, JG Lambrinos, **ADB Leakey**, Q Li, W Li, R Mcculley, B Melbourne, CE Mitchell, JL Moore, J Morgan, B Mortensen, LR O'Halloran, M Partel, J Pascul, DA Pyke, AC Risch, R Salguero-Gomez, M Sankaran, M Schuetz, A Simonsen, M Smith, C Stevens, L Sullivan, GM Wardle, EM Wolkovich, PD Wragg, J Wright, L Yang (2013) Predicting invasion in grassland ecosystems: is exotic dominance the real embarrassment of richness? *Global Change Biology* 19:3677-3687.

44. *AB Cousins, M Johnson, **ADB Leakey** (2014) Photosynthesis and the environment. *Photosynthesis Research* 119:1-2.

45. *RJC Markelz, LX Lai, LN Vossler, **ADB Leakey** (2014) Transcriptional reprogramming and stimulation of leaf respiration by elevated CO_2 concentration is diminished, but not eliminated, under limiting nitrogen supply. *Plant, Cell & Environment* 37:886-898.

46. *ET Borer, EW Seabloom, DS Gruner, WS Harpole, H Hillebrand, E Lind, PB Adler, J Alberti, TM Anderson, JD Bakker, LA Biederman, D Blumenthal, CS Brown, LA Brudvig, Y Buckley, M Cadotte, C Chu, EE Cleland, MJ Crawley, P Daleo, EI Damschen, K Davies, NM DeCrappeo, G Du, J Firn, Y Hautier, RW Heckman, A Hector, A Helm, J HilleRisLambers, O Iribarne, JA Klein, JMH Knops, KJ LA Pierre, **ADB Leakey**, W Li, A Macdougall, R Mcculley, B Melbourne, CE Mitchell, JL Moore, B Mortensen, LR O'Halloran, JL Orrock, J Pascul, SM Prober, DA Pyke, AC Risch, M Schuetz, MD Smith, C

Stevens, L Sullivan, RJ Williams, PD Wragg, J Wright, L Yang (2014) Herbivores and nutrients control grassland plant diversity via light limitation *Nature* in press doi:10.1038/nature13144

47. *RJC Markelz, LN Vossler, **ADB Leakey** (2014) Developmental stage specificity of transcriptional, biochemical and CO_2 efflux responses of leaf dark respiration to growth of *Arabidopsis thaliana* at elevated [CO_2]. *Plant, Cell & Environment.* In press.
48. *SS Myers, A Zanobetti, I Kloog, P Huybers, **ADB Leakey**, A Bloom, E Carlisle, LH Dietterich, G Fitzgerald, T Hasegawa, NM Holbrook, RL Nelson, MJ Ottman, V Raboy, H Sakai, KA Sartor, J Schwartz, S Seneweera, M Tausz, Y Usui (2014) Rising concentration of atmospheric CO_2 threatens human nutrition. *Nature*. In press.
49. *KA Bishop, **ADB Leakey**, EA Ainsworth (2014) Do seasonal temperature and water inputs predict the relative response of C_3 crops to elevated carbon dioxide concentration? An analysis of open top chamber and Free Air CO_2 Enrichment (FACE) studies. *Food & Energy Security*. in press.
50. *D Wang, D Jaiswal, DS LeBauer, TM Wertin, **ADB Leakey**, SP Long (in review) A physiological and biophysical model of coppice willow (Salix spp.) production and predicted yields for the contiguous USA in current and future climate scenarios. *Plant, Cell & Environment.*

G. Creative Works – not applicable

H. Bulletins, Reports, or Conference Proceedings (in print or accepted)

1. Leakey RRB, Kranjac-Berisavljevic G, Caron P, Craufurd P, Martin A, McDonald A, Abedini W, Afiff S, Bakurin N, Bass S, Hilbeck A, Jansen T, Lhaloui S, Lock K, Newman J, Primavesi O, Sengooba T, Ahmed M, Ainsworth L, Ali M, Antona M, Avato P, Barker D, Bazile D, Bosc P-M, Bricas N, Burnod P, Cohen J, Coudel E., Dulcire M, Dugué P, Faysse N, Farolfi S, Faure G, Goli T, Grzywacz D, Hocdé H, Imbernon J, Ishii-Eiteman M, **Leakey ADB**, Leakey C, Lowe A, Marr A, Maxted N, Mears A, Molden D, Muller JP, Padgham J, Perret S, Place F, Reid R, Riches C, Scherr S, Sibelet N, Simm G, Temple L, Tonneau JP, Trebuil G, Twomlow, S., Voituriez T, Wack AL, Abate T, Butler LM. (2008) Impacts of AKST on development and sustainability goals. In: *International Assessment of Agricultural Science and Technology for Development: Global Report*, Chapter 3. Eds: Watson R, Herren H, Wakhungu J. Island Press , New York , USA.
2. C Walthall, J Hatfield, L Lengnick, E Marshall, P Backlund, M Walsh, S Adkins, M Aillery, E Ainsworth, C Ammann, C Anderson, I Bartomeus, L Baumgard, D Blumenthal, F Booker, B Bradley, J Bunce, K Burkey, S Dabney, J Delgado, J Dukes, A Funk, K Garrett, M Glenn, D Grantz, D Goodrich, S Hu, C Izaurralde, R Jones, S-H Kim, **A Leakey**, K Lewers, T Mader, A. McClung, J. Morgan, L. Morton, D. Muth, M. Nearing, D. Oosterhuis, D Ort, C Parmesan, W Pettigrew, W Polley, R Rader, C Rice, M Rivington, E Rosskopf, W Salas, L Sollenberger, R Srygley, C Stöckle, E Takle, D Timlin, J White, R Winfree, L Wright-Morton, and L Ziska 2012. *Climate Change and Agriculture: Effects and Adaptation.* USDA Technical Bulletin 1935. Washington, D.C.

I. Abstracts (in print or accepted)

1. **ADB Leakey**, JR Watling, JD Scholes, MC Press. Elevated CO_2 and sunflecks interact to increase photosynthesis and growth in the dipterocarp rain forest seedling *Shorea leprosula*. *British Ecological Society Winter Meeting, Birmingham, UK, 2001.*
2. **ADB Leakey**, JR Watling, JD Scholes, MC Press. Elevated CO_2 and sunflecks interact to increase photosynthesis and growth in the dipterocarp rain forest seedling Shorea leprosula. *Society for Experimental Biology Annual Meeting, Canterbury, UK, 2001.*
3. **ADB Leakey**, JR Watling, JD Scholes, MC Press. Elevated CO_2 and sunflecks interact to increase photosynthesis and growth in the dipterocarp rain forest seedling Shorea leprosula. *International Congress on Photosynthesis, Brisbane, Australia, 2001.*
4. **ADB Leakey**, JD Scholes, MC Press. Sunfleck patterns and light quality impact on the photosynthesis and growth of dipterocarp seedlings. *British Ecological Society Winter Meeting, Warwick, UK, 2001.*
5. **ADB Leakey**, P Davey, A Rogers, EH DeLucia, B Drake, R Murthy, DF Karnosky, SP Long. How will leaf respiration in the dark respond to growth under elevated [CO_2]? *Ecological Society of America Annual Meeting, Savannah, GA, 2003.*
6. **ADB Leakey**, CJ Bernacchi, FG Dohleman, DR Ort, SP Long (2003) Will photosynthesis of maize (*Zea mays*) in the U.S. Corn Belt increase in future [CO_2]-rich atmospheres? *American Society of Plant Biologists Annual Meeting, Honolulu, HI, 2003.*
7. **ADB Leakey**, CJ Bernacchi, FG Dohleman, DR Ort, SP Long. How will crops in the Midwest U.S. respond to drought under future CO_2 rich atmospheres? *Crop Science Society of America Annual Meeting, Denver, CO, 2003*.
8. **ADB Leakey**, CJ Bernacchi, F Below, R Bordigno, T Mies, PB Morgan, R Nelson, DR Ort, M Uribelarrea, O Dermody, SP Long. How will the major agricultural ecosystem of the U.S. respond to atmospheric change? *American Association for the Advancement of Science Annual Meeting, Seattle, WA, 2004.*
9. **ADB Leakey**, JD Scholes, MC Press. Physiological and ecological significance of sunflecks for dipterocarp seedlings. *Society of Experimental Biology Annual Meeting, Heriot-Watt University, Edinburgh, UK, 2004.*
10. S Van Bloem, **ADB Leakey**, M Gonzalez-Meler, SP Long, R Thomas. Effects of CO_2 and drought on N_2 fixation in field-grown soybean plants. *Ecological Society of America Annual Meeting, Montreal, Canada, 2005.*
11. **ADB Leakey**, CJ Bernacchi, SP Long, DR Ort. Elevated CO_2 does not stimulate C_4 photosynthesis directly, but impacts water relations and indirectly enhances carbon gain during drought stress in maize (*Zea mays*) grown under free-air CO_2 enrichment (FACE). *Society of Experimental Biology Symposium, Barcelona, Spain, 2005.*
12. SP Long, EA Ainsworth, CJ Bernacchi, **ADB Leakey**, PB Morgan, S Naidu, A Rogers, HJ Bohnert, DR Ort, R Nelson. Mechanisms of plant responses to global atmospheric change. *International Botanical Congress, Vienna, Austria, 2005.*

13. KM Gillespie, JM Chae, **ADB Leakey**, EA Ainsworth. How will future levels of CO_2 and O_3 affect antioxidant metabolism in soybean? *American Society of Plant Biologists Annual Meeting, Boston, MA, 2006.*

14. **ADB Leakey**, M Uribelarrea, EA Ainsworth, SL Naidu, A Rogers, DR Ort, SP Long. Photosynthesis, productivity and yield of maize are not affected by open-air elevated of CO_2 concentration in the absence of drought. *American Society of Plant Biologists Annual Meeting, Boston, MA, 2006*.

15. F Xu, **ADB Leakey**, KM Gillespie, EA Ainsworth, DR Ort. Gene expression profiles of soybean from FACE exposure to elevated tropospheric [O_3] and [CO_2]. *American Society of Plant Biologists Annual Meeting, Boston, MA, 2006*.

16. FG Dohleman, EA Heaton, **ADB Leakey**, SP Long. Can increased daily carbon assimilation coupled with a longer growing season explain the difference in biomass accumulation between two potential bioenergy crops? *American Society for Plant Biologists Annual Meeting, Boston, MA, 2006.*

17. **ADB Leakey**, F Xu, KM Gillespie, EA Ainsworth, SP Long, DR Ort. How will the gene expression profile, biochemistry and physiology of soybean leaves respond to growth at elevated [CO_2] under open-air field conditions? *American Society for Plant Biologists Annual Meeting, Boston, MA, 2006.*

18. **ADB Leakey**, EAA Ainsworth, CJ Bernacchi, FG Dohleman, S Naidu, A Rogers, M Uribelarrea, DR Ort, SP Long. Elevated CO_2 does not stimulate C_4 photosynthesis directly, but impacts water relations and indirectly enhances carbon gain during drought stress in maize (*Zea mays*) grown under free-air CO_2 enrichment (FACE). *Crop Science Society of America Annual Meeting, Indianapolis, IN, 2006*.

19. **ADB Leakey,** SP Long, DR Ort. Characterizing changes in soil moisture due to reduced transpiration of soybean and maize at elevated [CO_2] over 3-years of free-air concentration enrichment (FACE). *American Society for Plant Biologists Symposium on Transpiration, Snowbird, UT, 2006.*

20. **ADB Leakey**, CJ Bernacchi, DR Ort, SP Long. Long-term growth of soybean at elevated [CO_2] does not cause acclimation of stomatal conductance under fully open-air conditions. *American Society for Plant Biologists Symposium on Transpiration, Snowbird, UT, 2006.*

21. FG Dohleman, E Heaton, ADB **Leakey**, SP Long. Does increased daily carbon assimilation coupled with a higher Leaf Area Index and longer growing season explain the difference in productivity between two potential bioenergy crops? *American Society of Plant Biologists Annual Meeting, Chicago, IL, 2007*.

22. F Xu, **ADB Leakey**, KM Gillespie, EA Ainsworth, DR Ort. Response of soybean gene expression to growth at chronic elevated ozone levels. *The Arabidopsis Meeting, Beijing, 2007.*

23. KM Gillespie, JM Chae, **ADB Leakey**, EA Ainsworth**.** Integration of metabolite with transcript and enzyme activity profiles of the antioxidant system in soybeans when grown at elevated levels carbon dioxide and ozone. *American Society of Plant Biologists Annual Meeting, Chicago, IL, 2007.*

24. **ADB Leakey**, F Xu, KM Gillespie, EA Ainsworth, SP Long, DR Ort. Physiological, biochemical and molecular analysis of the coordinated up-regulation of photosynthetic, respiratory and biosynthetic metabolism in soybean leaves under Free-Air CO_2 Enrichment. *14th International Congress of Photosynthesis, Glasgow, Scotland, 2007.*

25. KM Gillespie, F Xu, A Rogers, **ADB Leakey**, DR Ort, EA Ainsworth. Integrated analysis pf the genomic, biochemical and physiological responses of a model ecosystem to global change. *Ecological Society of America Annual Meeting, San Jose, CA, 2007.*

26. **ADB Leakey**, F Xu, KM Gillespie, EA Ainsworth, SP Long, DR Ort. Functional genomics and field ecology: Mechanistic insights from microarray analysis of soybean responses to elevated [CO_2]. *Ecological Society of America Annual Meeting, San Jose, CA, 2007.*

27. EA Ainsworth, **ADB Leakey**, SP Long, DR Ort, A Rogers. (Nov 2007) FACE Experiments with Crops: A Quantitative Review of Results and Discussion of Future Opportunities. *Crop Science Society of America Annual Meeting.*

28. **ADB Leakey**, J Sun, RJC Markelz & DR Ort (July 2008) Stimulated photosynthesis alters sugar and amino-acid profiles, lowers osmotic potential and improves water status of soybean leaves under free-air CO_2 enrichment. *American Society for Plant Biologists Annual Meeting.*

29. **ADB Leakey**, CJ Bernacchi, DR Ort & SP Long (2008) Long-term growth of soybean at elevated [CO_2] does not cause acclimation of stomatal conductance under fully open-air conditions. *American Geophysical Union Winter Meeting.*

30. RJC Markelz, R Strellner, **ADB Leakey** (2009) How will limiting N availability alter the response of C_4 photosynthesis in maize to elevated [CO_2] and drought under open-air field conditions? *American Society for Plant Biologists Annual Meeting.*

31. SB Gray, JM McGrath, O Dermody, EA Ainsworth, DR Ort, **ADB Leakey** (2009) Temperature and precipitation interactions eliminate benefits of free-air CO_2 enrichment to soil moisture availability for soybean in 2 out of 5 years. *American Society for Plant Biologists Annual Meeting.*

32. J Bryant, K Richter, **ADB Leakey**, TE Twine (2009) Biophysical impact from increasing carbon dioxide on U.S. Agroecosystems. *American Geophysical Union Winter Meeting.*

33. J Bryant, K Richter, **ADB Leakey**, TE Twine (2010) Biophysical effects on U.S. soybean agroecosystems from increasing carbon dioxide concentration. *American Meteorological Society Annual Meeting.*

34. SB Gray, RS Strellner, **ADB Leakey** (2010) Free-air CO_2 enrichment does not lessen the impact of drought on soybean photosynthesis under field conditions. *Ecological Society of America Annual Meeting, Pittsburgh, PA.*

35. TE Twine, J Bryant, SB Gray, **ADB Leakey** (2010) Simulating the response of soybean to elevated CO_2 across the Midwest United States: effects on the surface energy and water budgets. *Ecological Society of America Annual Meeting, Pittsburgh, PA.*

36. P Schmitz, SB Gray, CJ Bernacchi, **ADB Leakey**, P Kumar, SP Long (2010) Water extraction and hydraulic redistribution by soybean at daily time scales under elevated CO_2 and drought. *American Geophysical Union Winter Meeting, San Francisco, CA.*

37. **ADB Leakey** (2011) Transcriptional reprogramming of carbon metabolism in soybean grown at elevated CO_2 and elevated O_3. *South African Association of Botany Annual Meeting, Grahamstown, South Africa.*
38. **ADB Leakey** (2011) Rising atmospheric CO_2 and the future of c4 crops for food and fuel. *International Botanical Congress, Melbourne, Australia*.
39. **ADB Leakey** (2011) Transcriptional reprogramming of respiration under elevated CO_2 and elevated O_3. *International Botanical Congress, Melbourne, Australia*.
40. **ADB Leakey** (2011) Non-optimal responses to drought stress of soybean grown at elevated CO_2 in the field. *International Botanical Congress, Melbourne, Australia*.
41. SB Gray, RS Strellner, KK Puthuval, **ADB Leakey** (2011) Elevated CO_2 increases stomatal closure under reduced soil moisture in soybean (Glycine max). *American Society for Plant Biologists Annual Meeting.*
42. KT Richter, AM Betzelberger, **ADB Leakey** (2011) Growth of soybean at elevated ozone concentrations leads to stomatal acclimation that can be incorporated into ecosystem models by reparameterization of the Ball-Berry function. *American Society for Plant Biologists Annual Meeting.*
43. KA Bishop, **ADB Leakey**, EA Ainsworth (2012) Quantifying gaps in understanding crop and ecosystem responses to elevated CO_2. *American Society for Plant Biologists Annual Meeting.*
44. RM Peery, B Hug, RJC Markelz, R Kelly, M Segura, SB Gray, C Leisner, B Slattery, J Han, **ADB Leakey** (2012) Plants iView - an outreach program in plant biology for middle school students. *American Society for Plant Biologists Annual Meeting.*
45. SB Gray, KK Puthuval, RS Strellner, **ADB Leakey** (2012) Elevated atmospheric CO2 impacts on root depth distribution, abscisic acid signaling and stomatal response to drought in field grown soybean. *American Society for Plant Biologists Annual Meeting.*
46. RJC Markelz, LX Lai, **ADB Leakey** (2012) Limiting nitrogen availability diminishes, but does not eliminate, the stimulation of leaf respiration by elevated carbon dioxide concentration. *American Society for Plant Biologists Annual Meeting.*
47. MZ Hussain, A VanLoocke, ADB Leakey, CJ Bernacchi (2012) Future carbon dioxide concentration decreases canopy evapotranspiration and soil water depletion by field grown maize. *American Meteorological Society's 30th Conference on Agricultural and Forest Meteorology.*
48. SB Gray, M Sierbers, CJ Bernacchi, S Klein, C Ng, DR Ort, RE Paul, KK Puthaval, A Rogers, RE Shulman, RS Strellner, M Suguitan, **ADB Leakey** (2013) Should the paradigm of reduced plant drought stress at elevated CO_2 be hung out to dry? *American Society for Plant Biologists Annual Meeting.*
49. KJ Wolz, K Richter, TM Wertin, M Abordo, A Betzelberger, **ADB Leakey** (2013) Have we been ignoring physiological plasticity and genetic variation in stomatal function as a significant source of error in models of water and carbon fluxes? *International Photosynthesis Congress.*
50. TM Wertin, KJ Wolz, M Adorbo, **ADB Leakey** (2013) Have we been ignoring interspecific variation in stomatal function as a significant source of error in models of carbon and water fluxes? *American Geophysical Union Annual Meeting*.

51. E.A. Ainsworth, PJ Brown, **ADB Leakey**, LM McIntyre, I Barrios-Perez, B Dalsing, G Erice, C Leisner, C Montes, A Morse, L Rios-Acosta, S-I Shim, C Sorgini, C Yendrek (2014) Sites of sensitivity to ozone in diverse maize inbred lines. *Plant and Animal Genome*.

J. Book Reviews (in print or accepted)

K. Other: Meeting Presentations Without Published Abstracts

1. **ADB Leakey.** Dipterocarp regeneration ecology and sustainable forest management. *Management and Environmental Education Program, Danum Valley Field Centre, Malaysia, 2001.*
2. **ADB Leakey.** How will crops in the Midwest U.S. respond to drought under future CO_2 rich atmospheres? *University of Illinois Agronomy Extension Day, 2003.*
3. **ADB Leakey**, EA Ainsworth, P Davey, SP Long. How does elevated [CO_2] affect plant performance? Photosynthetic, respiratory and growth responses from ecosystem fumigation experiments. *US Department of Energy - Terrestrial Carbon Program Investigators Meeting, Boulder, CO, 2003.*
4. C Goss, **ADB Leakey**, A Rogers. Indirect effects of elevated CO_2 on dark respiration in cottonwood. *U.S. Department of Energy, Office of Science, Summer Undergraduate Laboratory Internship program symposium, 2003.*
5. **ADB Leakey**, CJ Bernacchi, FG Dohleman, DR Ort, SP Long. Will photosynthesis of maize (*Zea mays*) in the U.S. Corn Belt increase in future [CO_2]-rich atmospheres? *US Department of Energy Terrestrial Carbon Programme Synthesis Meeting, 2003.*
6. C Goss, **ADB Leakey**, A Rogers. The effect of elevated [CO_2] and water stress on carbon and nitrogen metabolism in field-grown soybean. *U.S. Department of Energy, Office of Science, Summer Undergraduate Laboratory Internship program symposium, 2004.*
7. K Sullivan, **ADB Leakey**, SP Long & DR Ort (2004) How will drought affect photosynthesis of soybean in future CO_2-rich atmospheres? *Environmental Horizons Meeting, UIUC.*
8. C Williams, **ADB Leakey**, SP Long & Lowell (2004) Soil moisture under soybean growing at elevated CO_2 and elevated O_3. *Ohio Academy of Sciences Science Day.*
9. K Sullivan, **ADB Leakey**, SP Long & DR Ort (2004) How will drought affect photosynthesis of soybean in future CO_2-rich atmospheres? *University of Maryland Undergraduate Research Symposium.*
10. A Peterson, D Marshak, **ADB Leakey**, L Heady, J Szarejko, DR Ort & SP Long (2005) How will maize (*Zea mays*) in the U.S. Corn Belt respond to future [CO_2]-rich atmospheres? *Environmental Horizons Meeting, UIUC.*
11. L Heady, ADB **Leakey**, S Naidu & SP Long (2005) Does climate change impact the primary carboxylase of the atmosphere? *Environmental Horizons Meeting, UIUC.*
12. **ADB Leakey**, M Uribelarrea, EA Ainsworth, S Naidu, A Rogers, DR Ort & SP Long, Photosynthesis, productivity and yield of *Zea mays* are not affected by open-air elevation

of CO_2 concentration in the absence of drought. *Gordon Research Conference, Photosynthesis: from genome to biome, Aussois, France, 2005.*

13. SP Long, EA Ainsworth, CJ Bernacchi, **ADB Leakey**, PB Morgan, DR Ort, R Nelson. The direct responses of crop photosynthesis and production to atmospheric change. *Royal Society Meeting – Food crops in a changing climate, London, UK, 2005.*
14. KM Gillespie, JM Chae, **ADB Leakey**, EA Ainsworth**.** How will future elevated levels of CO_2 and O_3 affect antioxidant metabolism in soybean? *American Society of Plant Biologists Midwest Meeting, Chicago, 2006.*
15. LX Lai, **ADB Leakey**, EA Ainsworth. How will future CO_2-rich atmospheres affect photosynthetic biochemistry in soybean leaves? *Midwest Section American Society of Plant Biologists, Chicago, 2006.*
16. LX Lai, **ADB Leakey** & EA Ainsworth (2006) How will future CO_2-rich atmospheres affect photosynthetic biochemistry in soybean leaves? *Environmental Horizons meeting, UIUC.*
17. **ADB Leakey**, EA Ainsworth, DR Ort, EH DeLucia. Genomic regulation of the response of an agroecosystem to elements of global change. *US Department of Energy – Program in Ecosystem Research Investigators Meeting, Rhinelander, WI, 2007.*
18. **ADB Leakey**, F Xu, KM Gillespie, L Lai, EA Ainsworth, SP Long, DR Ort. Transcript abundance, biochemistry and physiology of carbon metabolism in soybean leaves grown at elevated CO_2 under Free-Air CO_2 Enrichment. *Institute for Genomic Biology Symposium on The Future of Biology, UIUC, 2007.*
19. **ADB Leakey**, F Xu, KM Gillespie, L Lai, EA Ainsworth, DR Ort. Using microarrays to reveal the mechanism of crop responses to global climate change under field conditions. *International Rice Research Institute Workshop – Cool Rice for a Warmer World, Huazhong Agricultural University, Wuhan, China, 2007.*
20. B Hapeman, AM Santos, **ADB Leakey** & DR Ort (2007) Changes in stomatal aperture, not stomatal frequency, drive reduced stomatal conductance and transpiration by corn (*Zea mays*) at elevated CO_2. *Environmental Horizons meeting, UIUC.*
21. RJC Markelz, **ADB Leakey** & DR Ort (2007) Elevated [CO_2] directly impacts leaf water potential in C_3 soybean but not C_4 maize. *Environmental Horizons meeting, UIUC.*
22. **ADB Leakey**. Design and analysis of microarray experiments for global change research. *Workshop on Statistical Analysis and Data Integration in Plant Genomic Ecology Research, UIUC, 2007.*
23. **ADB Leakey** Genomic regulation of the response of an agroecosystem to elements of global change. (2007) *US Department of Energy – Program in Ecosystem Research Investigators Meeting, Rhinelander, WI.*
24. **ADB Leakey**, F Xu, KM Gillespie, L Lai, EA Ainsworth, DR Ort. Genomic Ecology of soybean responses to elevated [CO_2] and drought. *Facing the future, International Joint Workshop of AspenFACE, SoyFACE and SFB projects, Rhinelander, WI, 2008.*

25. **ADB Leakey**, F Xu, KM Gillespie, L Lai, EA Ainsworth, DR Ort. The Genomic Basis of stimulated respiration by plants growing under elevated carbon dioxide. (2008) *Gordon Research Conference, Photosynthesis: from genome to biome, Biddeford, ME.*

26. **ADB Leakey** Crop responses to climate change (2009) *A New Green Revolution Meeting Global Food and Energy Demands. A Joint Area Centers Symposium, UIUC.*

27. **ADB Leakey**, F Xu, KM Gillespie, L Lai, EA Ainsworth, DR Ort. Transcriptional reprogramming of leaf metabolism under elevated CO_2 stimulates respiration in soybean (2009) *International Conference for Plant Mitochondrial Biology, Lake Tahoe.*

28. **ADB Leakey**, R Boyd, RJC Markelz. Adapting crops to global climate change (2009) *DARWIN 200: a South American Celebration, Punta del Este, Uruguay*.

29. **ADB Leakey** How will elevated CO_2 impact photosynthesis of tropical plants? (2009) *23rd New Phytologist Symposium Carbon Cycling in Tropical Ecosystems, Guangzhou, China.*

30. **ADB Leakey** The Environmental Change Biology Podcast Project (2009) *Environmental Change Institute Annual Symposium, UIUC.*

31. SB Gray, RS Strellner, **ADB Leakey** (2010) Free-air CO_2 enrichment does not lessen the impact of drought on soybean photosynthesis under field conditions. *GEEB Symposium, UIUC.*

32. KJ Richter, **ADB Leakey** (2010) Stomatal acclimation to rising O_3 concentrations: an important but missing element in models of global carbon and water cycling. G*EEB Symposium, UIUC.*

33. RA Boyd, **ADB Leakey** (2010) Are there genes essential for the stimulation of respiration and growth when plants are grown at elevated CO_2 concentrations? *GEEB Symposium, UIUC.*

34. RJC Markelz, RS Strellner, **ADB Leakey** (2010) Stomatal and non-stomatal limitations to C_4 photosynthesis in maize induced by drought are relieved by elevated CO_2. *GEEB Symposium, UIUC.*

35. RA Boyd, **ADB Leakey** (2010) Are there genes essential for the stimulation of respiration and growth when plants are grown at elevated CO_2 concentrations? *DOE Global Change Education Program Summer Meeting, Knoxville, TN.*

36. L Rios, **ADB Leakey** (2010) Response of soybean agroecosystem water relations to future heatwaves. *DOE Global Change Education Program Summer Meeting, Knoxville, TN.*

37. **ADB Leakey**, F Xu, KM Gillespie, JM McGrath, EA Ainsworth, DR Ort, RA Boyd (2010) Transcriptional reprogramming of leaf respiratory metabolism in plants grown at elevated [CO_2] *New Phytologist Symposium, Oxford, UK.*

38. RA Boyd, RJC Markelz, **ADB Leakey** (2010) Are there genes essential for the stimulation of respiration and growth when plants are grown at elevated CO_2 concentrations? *New Phytologist Symposium, Oxford, UK.*

39. **ADB Leakey** (2010) Transcriptional reprogramming of leaf carbon metabolism in plants growing at elevated [CO_2] *Kansas State Functional Genomics Consortium Symposium, Manhattan, KS.*

40. **ADB Leakey** (2010) Rising atmospheric CO_2 and the future of C_4 crops for food and fuel *Symposium on C_4 Plant Biology, CAS-MPG Partner Institute for Computational Biology, Chinese Academy of Sciences, Shanghai, China.*

41. **ADB Leakey** (2010) Crop adaptation for an elevated [CO_2] world *Royal Society International Scientific Seminar, Atmospheric CO_2 and green evolution, Kavli Royal Society Center, UK.*

42. **ADB Leakey** (2010) What will be the effect of the climate change on crop production *Environmental Change Institute Annual Symposium, UIUC.*

43. **ADB Leakey** (2011) Soybean and maize responses to global environmental change at SoyFACE *CO_2 Symposium, Smithsonian Tropical Research Institute, Panama.*

44. J Pride, S Gray, **ADB Leakey** (2011) Elevated CO_2 increases lateral root branching in Medicago Truncatula. *Osher Life Long Learning Institute Citizen Scientist Program meeting, Champaign, IL.*

45. **ADB Leakey** (2011) Transcriptional reprogramming of respiration to optimize plant metabolism in response to stress and resource availability *Institute for Genomic Biology Fellow's Symposium, UIUC.*

46. **ADB Leakey** (2011) Transcriptional reprogramming of respiration in response to global environmental change *Penn State Plant Biology Symposium.*

47. **ADB Leakey** (2011) Climate-proofing rice for farmers in the tropics *Change Institute Annual Symposium, UIUC.*

48. **ADB Leakey** (2011) Environmental change impacts on soybean rooting, food production and ecosystem function *Environmental Change Institute Annual Symposium, UIUC.*

49. SB Gray, RS Strellner, KK Puthuval, R Shulman, MH Siebers, A Rogers, **ADB Leakey** (2012) Minirhizotron imaging reveals nodulation of field-grown soybean is enhanced by Free-Air CO_2 Enrichment only when combined with drought stress. *GEEB Symposium, UIUC.*

50. **ADB Leakey** (2012) Transcriptional reprogramming of respiration in response to global environmental change *Okazaki Biology Conference 8, Japan.*

51. **ADB Leakey** (2012) Data and models for predicting water processes in rainfed agriculture – the plant scale *Water in Bioenergy Agroecosystems Workshop, Chicago, Energy Biosciences Institute.*

52. **ADB Leakey** (2012) Next-generation elevated CO_2 experiments for climate-proofing crops *World Crop FACE Workshop, Tsukuba, Japan.*

53. **ADB Leakey** (2012) SoyFACE overview *World Crop FACE Workshop, Tsukuba, Japan.*

54. **ADB Leakey** (2012) Should the paradigm of reduced plant drought stress under elevated [CO_2] be hung out to dry? *World Crop FACE Workshop, Tsukuba, Japan.*

55. R Peery, M Segura, RJC Markelz, R Kelly, SB Gray, C Leisner, J Han, B Slattery, B Hug, **ADB Leakey** (2012) Plants iView: an outreach program in plant biology for middle school students. *UIUC Public Engagement Symposium*.

56. RJC Markelz, **ADB Leakey** (2013) Elevated CO_2 induced transcriptional reprogramming of respiration and a stimulation of dark respiration as *Arabidopsis thaliana* leaves transition from sinks to sources. *Keystone Symposia on Plant Abiotic Stress and Sustainable Agriculture: Translating Basic Understanding to Food Production*.

57. S Gray, KK Puthuval, RS Strellner, RE Paul, SP Klein, **ADB Leakey** (2013) Elevated atmospheric CO_2 alteres root depth distribution, enhancing abscisic acid signaling and stomatal closure under drought in field-grown soybean. *Keystone Symposia on Plant Abiotic Stress and Sustainable Agriculture: Translating Basic Understanding to Food Production*.

58. T Wertin, K Wolz, M Adorbo, **ADB Leakey** (2013) Replacing generic parameterizations of stomatal function in temperate trees with specific-specific functions allows modeling to resolve interspecific variation in carbon and water fluxes. *Beckman Post-Doctoral Scientists Symposium*, *UIUC.*

59. ADB Leakey (2013) SoyFACE: a field laboratory for adaptation of C_4 (and C_3) crops to global environmental change. *International Symposium for C_4 and CAM Plant Biology, UIUC.*

60. G Erice, M Segura, M Kendzior, ADB Leakey (2013) Rapid phenotyping platform for stomatal patterning research in grasses. *Donald Danforth Plant Science Center Fall Symposium.*

61. ADB Leakey and SB Gray (2013) Elevated CO_2 alters root distribution, ABA signals and enhances stomatal closure in response to drought in field-grown soybean. *Interdisciplinary Plant Group Symposium on Root Biology, University of Missouri.*

III. RESIDENT INSTRUCTION

A. Summary of Instruction

1. Descriptive Data

Spring 2007	50% of *Plants and Global Change* (IB 440) with 29 students.
Fall 2007	2 lectures in *Photosynthesis* (IB 421) with 15 students.
Fall 2008	100% of *Global Warming, Biofuels & Food* (IB107) with 55 students.
Fall 2008	Participant in LAS Reflective Teaching Seminar.
Spring 2009	50% of *Plants and Global Change* (IB 440) with 44 students.
Fall 2009	100% of *Global Warming, Biofuels & Food* (IB107) with 149 students.
Fall 2010	100% of *Global Warming, Biofuels & Food* (IB107) with 112 students.
Spring 2011	50% of *Plants and Global Change* (IB 440) with 46 students.
Spring 2011	2 lectures and research supervision of 1 student in *Introduction to Research in Integrative Biology* (IB199).
Spring 2012	1 lecture and research supervision of 2 students in *Biomath* (IB429).

Fall 2012	100% of *Global Warming, Biofuels & Food* (IB107) with 66 students.
Spring 2013	50% of *Plants and Global Change* (IB 440) with 47 students.
Spring 2013	Research supervision of 1 student completing IB 490 senior thesis
Spring 2013	100% of Plant Molecular and Physiological Biology seminar series (IB 513) with 60 students
Fall 2013	100% of *Global Warming, Biofuels & Food* (IB107) with 66 students.
Spring 2014	100% of Plant Molecular and Physiological Biology seminar series (IB 513) with 52 students

2. Supervision of Graduate Students

Ph.D. candidates:

2007 – 2012	RJ Cody Markelz, **NSF GRF Fellow**, "*Interactive effects of elevated carbon dioxide concentration with nutrient availability and leaf development on plant carbon metabolism*"
2008 – present	Sharon Gray, **DOE Graduate Fellow**
2011 – 2011	Lisa Lai
2012 – present	Lorena Rios Acosta, **NSF IGERT Fellow, NSF GRF Fellow**
2012 – present	Darshi Banan
2013 – present	Rachel Paul

M.Sc. students:

2008 – 2011	Katherine Richter, "*Stomatal sensitivity to photosynthetic and environmental signals in Glycine max grown at elevated atmospheric concentrations of CO_2 and O_3*"
2013 – 2013	Juan Quijano

Member of preliminary examination committee:

2008	Paul Nabity, Ph.D. candidate, Plant Biology.
2010	Anna Locke, Ph.D. candidate, Plant Biology.
2010	Pimonrat Tiansawat, Ph.D. candidate, PEEC.
2010	Daniel Scholes, Ph.D. candidate, PEEC.
2011	Juan Quijano, Ph. D. candidate, Civil & Environmental Engineering.
2011	Michael Urban, Ph.D. candidate, PEEC.
2012	Venkatraman Srinivasan, Ph. D. candidate, Civil & Environmental Engineering.
2012	Katie Heineman, Ph.D. candidate, PEEC.
2014	Yi Lou, Ph. D. candidate, NRES.

Member of Ph.D. thesis examination committee:

2012 Paul Nabity, Ph.D. candidate, Plant Biology.
2013 Daniel Scholes, Ph.D. candidate, PEEC.
2013 Juan Quijano, Ph. D. candidate, Civil & Environmental Engineering.
2013 Pim Tiansawat, Ph. D. candidate, Plant Biology.
2013 Venkat Srinivasan, Ph. D. candidate, Civil & Environmental Engineering.
2013 Anna Locke, Ph. D. candidate, Plant Biology.

Post-doctoral Scientists

2012 – present Dr. Timothy Wertin
2012 – present Dr. Scott Woolbright
2013 – present Dr. Gorka Erice

Visiting graduate students:

Joana Zaragoza Castells, University of York, UK

Visiting Postdoctoral Associates

Anna Armstrong, University of York, UK

Visiting Scientists

Tiago Tomaz, Fulbright Scholar, Australia
Hongyan Guo, Nanjing University of China

3. Other Contributions to Instructional Programs

I have mentored the following undergraduate and high school students doing research projects:

2014 Mark Holmes (*ASPB SURF fellowship*), Matt Kendzior, Hannah Schlake, Andrew Chancellor, Amanda Youseff, Marshal Allston-Yeagle, Jonny Yokey, Finey Ruan, Shivaliben Patel.

2013 George Gunter, Mark Holmes, Matt Kendzior, Mitch Dickey, Audrey Rouse, Matt Kmet, Andrew Chancellor, Amanda Youseff, Marshal Allston-Yeagle, Jonny Yokey, Eileen Campbell, Amanda Jacobs, Alex Hathcock, Charly Ilunga.

2012 Lauren Vossel, Stephanie Klein (*ASPB SURF fellowship*), Rachel Paul, Chris Ng, Kevin Wolz (*NSF Biomath fellowship)*, David Haffey, Dan Berger, Mark Adorbo (*NSF Biomath fellowship*)

2011 Brian Zehr, Mike Suguitan, Lauren Vossel, Rodrigo Ramirez, Steven Waltersdorf, Stephanie Klein, Rachel Paul

2010 Geoff Boise, Ryan Boyd (*DOE Global Change Education Program fellowship*), Brian Zehr, Mike Suguitan, Lauren Vossel, Brianna Usdrowski (*Environmental Change Institute SoyFACE Ambassadors fellowship*), Lorena Rios Costa (*DOE Global Change Education Program fellowship*)

2009 Reid Strellner (*Environmental Change Institute SoyFACE Ambassadors fellowship*), Ryan Boyd, Mike Suguitan, Kevin Dommer, Kannan Puthaval

2008 Reid Strellner, Ryan Boyd, Brian Chae, Chris Kwan, Derek Haselhorst

2007 Chris Rudisill, Matt Nantie, Alex Cahill, Sara Sligar, Michael Boyd, Erik Connelly, Katie Richter, Grace Harriett

2006 Cody Markelz, Anne-Marie Santos, Brett Hapeman

2005 Lisa Lai (*Distinction for Honors Thesis*)

2004 David Marshak

2004 Amy Peterson (*NSF Undergraduate Mentoring in Environmental Biology fellowship*)

2003 Kate Sullivan (*Environmental Council Summer Undergraduate Research Experience fellowship)*

2003 Chalance Williams (*Minority Undergraduates Research Experience fellowship*)

B. Evaluation of Instruction

1. Student ICES Course Evaluation Results

I was on the List of Teachers Ranked Excellent by Students for:

IB440 *Plants & Global Change* in Spring 2007
IB107 *Global Warming, Biofuels, Food* in Fall 2008
IB440 *Plants & Global Change* in Spring 2009
IB440 *Plants & Global Change* in Spring 2011
IB440 *Plants & Global Change* in Spring 2013

2. Candidate's Teaching Activities Report and Self-Review (last updated 2013)

Why do I teach?

My role as an educator of students at UIUC centers around the need for everyone to understand: (1) how we are causing global climate change; (2) how climate change will impact nature and our society; and (3) how we can respond in order to protect future human well-being. Helping students at UIUC recognize, understand and respond to this challenge involves improving their scientific literacy and knowledge to better inform their lifestyle choices, politics and civic engagement. More broadly, I work to improve their skills in information gathering, synthesis of complex concepts, quantitative analysis and research, traditional and IT-enabled communication, as well as teamwork. The combination of knowledge, skills and sense of responsibility I teach hopefully helps every student tackle the 21st-century challenges waiting for them when they graduate from UIUC.

What do I teach?

I designed and teach 100% of an introductory biology course called *Global Warming, Biofuels & Food*, which meets the general education requirement for life sciences. I also teach 50% of an advanced course called *Plants & Global Change*. This course was originally designed by my colleague Dr. Stephen Long but I have heavily revised it and taught it with Dr. Elizabeth Ainsworth since 2007. My teaching of these classes is detailed in the following table:

Class title	*Global Warming, Biofuels, Food*			*Plants and Global Change*		
Rubric	IB107			IB440, CPSC431, NRES431		
Years	2008*	2009	2010	2007*	2009*	2011*

Enrollment	55	149	112	29	44	46
Class members	Diverse group coming from almost every college on campus, including a balanced mix of freshmen, sophomores, juniors and seniors.			Upper division undergraduates and graduate students in Plant Biology, Crop Science, and Natural Resources and Environmental Sciences		
Objectives	Building the student's scientific literacy, transferable skills and sense of civic responsibility while teaching introductory biology in the context of a contemporary challenge to human society.			Providing detailed knowledge of plant and ecosystem responses to global change along with training in diverse skills necessary for biological careers including research, teaching and outreach.		
*included on list of UIUC teachers ranked as excellent by their students						

In addition to these classes, I train students doing research. Since starting my faculty position, eleven students have earned credit for independent research projects and twenty five students have had paid research positions in the lab. I integrate the students fully into the work of my lab, encouraging them to work with my graduate students and participate in lab meetings. I support them in: (1) writing proposals for research fellowships (seven of them have been successful in winning funding from NSF, DOE, ASPB, and ECI); (2) taking their independent projects to completion by giving presentations at scientific meetings and contributing to papers as co-authors. Nine of the students I have mentored have already started graduate research degrees, encouraging me in the belief that they find their time in my lab an enjoyable and valuable experience.

How does learning happen and what is my role?

Most contemporary experts in educational research advocate constructivism as a model to understand how people learn. This notion is based on the idea that we learn by taking our initial knowledge and understanding of a subject, no matter how correct it may be, and revising it based on new information we receive and process. This is an iterative process that starts as a subconscious activity when we are very young, but by college it is a process that is primarily self-directed. One consequence of self-directed learning in adults is that it is important to want to learn and this motivation can take several forms. We can be motivated by a desire for knowledge and/or the need to solve a problem. We learn more successfully by applying information rather than simply reviewing it. I find this a useful framework. It suggests my role as a teacher is to help students: (1) develop a fundamental curiosity about science and nature; (2) consider global climate change a challenge to society they can help to solve; (3) ask questions related to these issues; and (4) develop new knowledge, understanding and opinions based on accessing and processing the most up-to-date information on the topic that is available.

How do I teach?

The teacher-student relationship

Colleagues and students who have attended my classes have most often commented on the enthusiastic and supportive classroom atmosphere, as well as my broad knowledge of the subject matter. I believe establishing good teacher-student relationships is an essential pre-requisite for successful teaching and one of my greatest strengths as a teacher. Being engaging and enthusiastic engenders a corresponding attitude from the students. Being well prepared and knowledgeable on the subject matter gains the students respect and encourages them to ask questions and work harder to master skills or concepts. Building a dialogue with my students by asking and answering questions is a large part of how I establish my relationship with them. I start with questions that are easy but not trivial. Having got an answer from one student I often then take it to their neighbor and ask them to build on it. During a sequence of three or more contributions from different students I can build up the dialogue to develop quite complex concepts or emphasize different points of view on a topic. When things are going well the students take over and I will be saying little and only playing the role of chairperson. I'm active in praising student contributions. When students make mistakes I correct them, but with a conscious effort to be supportive and constructive. I use a remote device to advance my powerpoint slides so that I can stand amongst the students and engage them. Approaching a student to listen as they ask or answer a question creates a

connection I can't establish in a large room from behind the lectern, and they really appreciate my efforts to learn all of their names. Several guest lecturers I have invited to class have commented on how willing my students have been to ask them unsolicited questions as well as provide high quality answers when called upon. This, and the reaction from my students, encourages me that I am having success with my approach.

Diverse learning and assessment activities

My courses are designed with particular emphasis on using a wide variety of teaching activities and assessments, and tailoring my selection to meet the different needs and abilities of the students both within and between my two classes. In both classes I augment standard lecture slides in powerpoint with movie clips and animations whenever possible. For example, the expression of a gene through the process of transcription is vastly more engaging and easy to understand when viewed as an animation showing the polymerase enzyme zooming along a strand of DNA like a monorail train trailing a lengthening ribbon of RNA. In addition to standard exam papers, my students participate in a diverse set of learning and assessment activities, for which they earn a significant fraction of the total course credit. Some examples of these activities are described below.

In my introductory biology course, one third of the student's contact teaching time is spent in small group "discussion" classes (20 students and a graduate teaching assistant). The curriculum I have developed includes: watching documentary movies; playing games about carbon sequestration strategies and DNA sequencing; laboratory sessions giving the students exposure to research methods and techniques (understanding rates of photosynthesis in terms of CO_2 uptake by a leaf are much more tangible when you yourself have measured it); a computer lab using a mathematical model to estimate carbon storage in urban trees; a on-line learning module on biofuels; and exam review sessions in the style of the Jeopardy game show. In each case, the students' learning is aided by the need to use the new information they are presented with, rather than simply try to memorize and recall it.

In my advanced course, we emphasize higher order intellectual activities that require the students to synthesize and critically evaluate information. One example is our in-class debates, each of which fills an 80-minute double class period. Each student participates in one of the six debates held over the semester, arguing as a team of three or four individuals either for or against motions such as, "*This house believes that world food supply will be secure under global change throughout the 21st century*" and "*This house believes that biofuels will allow the US to become energy independent and reverse the trend in atmospheric [CO_2] in the 21st century*". This activity improves the students' information gathering and synthesis skills, awareness of assumptions and uncertainty in scientific knowledge, public speaking, and their ability to work in a team. In 2011, this activity was further enriched when I invited Justin Gillis, a senior writer for the New York Times, to come for a question and answer session with the class on climate change.

I have secured funding from the *LAS Dean's Teaching Fellow* program and the *Environmental Climate Institute* (ECI) on campus for an education enhancement project involving both my classes. The project aimed to develop the use of environmental change biology podcasts in my teaching. First, in my introductory biology course, I have students listen and review publically available podcasts and build a searchable on-line database. The students benefit by developing their skills in information gathering and synthesis, writing and IT. In addition they enjoy having developed an educational resource. Second, in my advanced course, the students produce podcasts. The benefits to the students include: focus on topics of particular personal interest; improved skills in synthesis of information and writing; having in-depth interactions with experts in their field; training in communication of science to a public audience; development of IT and teamwork skills; and the legacy of producing an outreach project. Third, I use the database and student's podcasts as sources of material for "required listening" to replace "required reading" in both courses.

All of these activities and materials I use are available on-line and organized for the students using Moodle virtual learning environments. From these, the students have on-line access to all the material we use in class as well as links to additional sources of supporting information. This provides maximum flexibility and access for the students. In addition, it is proving invaluable as I work hard to

minimize the time I spend administering the courses and maximize the fraction of my teaching time I spend on interactions with students and improvements in course materials and activities.

How do I improve as a teacher?

When I started teaching the approach I described above was largely a consequence of my own personality (I love to learn, and put me in a group discussion and I won't be able to resist offering an opinion and asking questions). Like many others have done before me, I was also subconsciously drawing on the many good teachers I have been lucky to learn from. However, since starting my faculty position I have searched out opportunities for training and added a conscious consideration of pedagogy to preparation for my classes. I believe my teaching has improved as a result.

The process of learning more about teaching started for me when I attended the LAS reflective teaching seminar and School of Integrative Biology teaching retreats. I have also benefited from group meetings of eight faculty and teaching professionals who are involved in teaching gen-ed classes within the School of Integrative Biology. These have been an invaluable opportunity to learn about the techniques used by much more experienced staff, as well as new ideas coming from my fellow assistant professors.

I have established an informal network of people I go to for advice and help. These include senior faculty in my department, but extend to IT specialists at ATLAS and the American Society of Plant Biologists. Developing this network also involves sharing my teaching techniques with others. To do this I have given presentations to the LAS Reflective Teaching Seminar as well as the Environmental Change Institute Annual Symposium. I have also had new assistant professors from our department attend my classes to watch me teach and then discuss it afterward.

I consider my graduate teaching assistants an invaluable resource. They have a unique perspective since they are in the position of being students that take courses and simultaneously teachers, which makes them very well placed to give opinions on what does and doesn't work in a classroom. I have benefited hugely from getting their feedback on ideas about all aspects of course development and teaching. They are smart, inventive individuals who in many cases are excellent teachers in their own right. Recognizing this, I have been rewarded by giving them specific teaching activities and resources to develop independently. For example, this year the teaching assistant in my advanced course tested all the recording equipment and software used for the production of podcasts, developed a written guide on their use for the students, and met with each student team individually to help get them started. The results were very educational and entertaining, high production quality podcasts. This approach means they have a well developed sense of ownership over the course and we teach as an effective team.

3. Departmental Evaluation of Teaching and Course Documentation

(Author of evaluation: _____)

IV. SERVICE (PUBLIC, PROFESSIONAL/DISCIPLINARY, AND UNIVERSITY)

A. Summary of Service

1. Public Service

My primary public service activity has been the development of the *Plants iView* educational program for middle school students. This was done in conjunction with the Plant Biology Association of Graduate Students. Supported by almost $40,000 from the ASPB Educational Foundation and UIUC Office for Public Engagement, *Plants iView* has three overlapping missions: (1) to engage middle school students (grades 6-8) in science through interactive, plant biology-themed activities as part of an after-school enrichment program at Urbana Middle

School; (2) nationally disseminate to educators materials developed through work with participating middle school students, including lesson plans and web-based media that meet national science education standards; and (3) provide a long-term platform for graduate students and faculty in the UIUC Department of Plant Biology to interact with and mentor middle school students to build science self-efficacy. More than a dozen graduate students participated in the program in 2011/2012, and four members of faculty have included the development of new modules for *Plants iView* in broader impacts statements of NSF proposals this year. *Plants iView* maximizes its impact by focusing on students at an age critical to whether their interest in science will continue through the university level (Jensen & McMullen, 1995). Education professor, Dr Barbara hug is part of the Plants iView team and is providing assessment of its efficacy for the middle school students as well as graduate student teachers. Our project website (http://www.igb.illinois.edu/plants iview/) will be fully functional by winter 2012.

A list of my other public service activities is below:

1. Interviewed by Nature News for story *Climate change could boost cash crops* (2004)
2. Invited teacher to 45 Mexican scientists at the International Workshop on Photosynthetic Gas Exchange and Chlorophyll Fluorescence Measurements. Monterrey, Mexico (2005)
3. Lecture at Hathaway Brown School, (Shaker Heights, OH) titled *Food for thought: crop responses to climate change in the 21st century*. (2006)
4. Interviewed by Australian Broadcast Corporation for story *Rising CO_2 less of a boost to food crops*. (2006)
5. Interviewed by Chicago Tribune for story *Global Warming perk disputed* (2006)
6. Interviewed by Daily Illini for story *Crops ready for 2050 climate* (2006)
7. Invited consultant to Monsanto Fellows Climate Change Workshop, St Louis, MO. (2007)
8. Public lecture at Urbana Free Library for a National Climate Change Teach-In, titled *Food (and fuel) for thought: plant responses to climate change*. (2008)
9. Public lecture at Urbana YMCA organized by Students for Environmental Concerns for Earth Day, titled *Food (and fuel) for thought: plant responses to climate change*. (2008)
10. Lecture to Middle School Girls attending summer science camp, Girls Adventures in Math, Engineering and Science (GAMES), titled *Climate Change and Food*. (2008)
11. Lecture to visiting delegation from AAPRESID, the Argentinean No-Till Farmers Association, titled *Food (and fuel) for thought: plant responses to climate change*. (2008)
12. Mentor to a disabled high school student getting research experience in my lab as a participant in the Midwest Alliance for Science, Technology, Engineering and Mathematics Education and Careers (http://stemmidwest.org/). (2008)
13. Interviewed on Deutsche Radio, Germany (2009) - Kohlendioxid-Zunahme forciert Zucker-Stoffwechsel von Sojabohnen (*Carbon dioxide increase forces sugar metabolism of soybeans*). http://www.dradio.de/dlf/sendungen/forschak/917106/
14. Public lecture and webinar to *A New Green Revolution Meeting Global Food and Energy Demands. A Joint Area Centers Symposium*. (2009)

15. Interviewed on Sunrise on the Farm, WICD TV, Champaign.(2009)
16. Lecture to Middle School Girls attending, Girls Adventures in Math, Engineering and Science summer science camp at UIUC (July 2009), titled *Climate Change and Food*. (2009)
17. Lecture and tour of SoyFACE facility to 90 undergraduates from UIC Ecology course (2009)
18. Lecture to visiting delegation from AAPRESID, the Argentinean No-Till Farmers Association (Sept 2009), titled *Food (and fuel) for thought: plant responses to climate change*. (2009)
19. Food for thought – crop responses to climate change (October 2009) Meeting of *Students for Environmental Concerns, UIUC.* (2009)
20. Mentor in DOE *Graduate Research for the Environment Fellowship* program (2009-)
21. Mentor in DOE *Summer Undergraduate Research Experience* fellowship program (2009-)
22. Lecture and tour of SoyFACE facility to 90 undergraduates from UIC Ecology course (2010)
23. Lecture to Training Workshop for High School Teachers, titled *Modeling plant and ecosystem responses to global change.* (2010)
24. Consultant to LI-COR Biosciences company on equipment design (2011-)
25. Invited Member of International Advisory Committee to South African CO_2 and Vegetation Consortium (2011-)
26. **Interviewed for front page story in *New York Times* (2011)**
27. Mentor in Osher Life Long Learning Institute Citizen Scientist Program (2011-)
28. Lecture on "Climate Change" to Mahomet Junior High School Students (2012)
29. Chair of committee for Institute for Genomic Biology "Genome Day" at Orpheum Children's Museum, Champaign (2012)
30. **Interviewed by Earth Sky on NPR radio (2012)**
31. Interviewed by Channel 15 news, Champaign, IL (2012)
32. Taught class on "Plant responses to Global Environmental Change" for Science Club at Mahomet Junior High (2012)
33. Lecture on "Climate Change and Food" to First Presbyterian Church, Champaign (2013)
34. Lecture on "Corn" to Champaign Unit 4 High School Teachers Workshop (2013)
35. Lecture on "Climate Change, Crops and Pollen in the 21st Century" to Pollen Power! Science Camp for Middle School Girls, UIUC (2013)
36. Organizer, week-long Pollen Power! Science Camp for Middle School Girls, UIUC (2013)

2. Service to Disciplinary and Professional Societies or Associations

Referee of more than 160 manuscripts for the following journals: *Agricultural and Forest Meteorology, Conservation Physiology, Crop Science, Ecology, Environmental and*

Experimental Botany, Experimental Agriculture, Field Crops Research, Functional Ecology, Functional Plant Biology, ***Global Change Biology****, Global Ecology & Biogeography, Holocene, International Journal of Biometeorology, Journal of Ecology, Journal of Environmental Quality, Journal of Experimental Botany, Journal of Plant Physiology, Journal of Tropical Ecology, Methods in Ecology and Evolution,* ***Nature Climate Change****,* ***Nature Communications****, New Phytologist, Oecologia, Photosynthesis Research, Photosynthetica, Physiologia Plantarum, Planta, Plant and Soil, Plant Biology, Plant Biotechnology Journal,* ***Plant Cell****, Plant Cell & Environment, Plant Ecology, Plant Functional Biology, Plant Physiology, Plant Science, PLOS Genetics,* ***Proceedings of the National Academy of Sciences USA****, Proceedings of the Royal Society B, Science of the Total Environment, Tree Physiology, Trees-Structure & Function*

2001	Session Chairman of *Forest tree seedling ecology* at British Ecological Society Annual Meeting
2003	Judge of graduate student presentation competition at Ecological Society of America Annual Meeting
2003	Session Chairman of *Physiological Ecology* at Ecological Society of America Annual Meeting
2003	Referee of grant proposals for Binational (US-Israel) Agricultural Research and Development Fund
2004-2005	Editorial review board: *Tree Physiology*
2006	External examiner for B.A. Honors thesis defense at Knox College, Galesburg, IL
2006	Referee for South African National Research Foundation faculty excellence program
2007	Organizer of workshop on *Methods in Genomic Ecology* for scientists funded by the Department of Energy Program in Ecosystem Research Genes to Ecosystems Initiative.
2007	Invited contributor to European Science Foundation workshop *FACEing the future: planning the next generation of elevated CO_2 experiments on crops and ecosystems,* Rome, Italy.
2007	Invited contributor to Royal Society Workshop *The Impacts of Ground Level Ozone in the 21st Century*, London, UK
2008	Invited contributor to World Universities Network workshop *Global Challenges and Opportunities*, Pennsylvania State University.
2008	Invited contributor to Department of Energy workshop *Exploring science needs for the next generation of climatic change and elevated CO_2 experiments in terrestrial ecosystems, Washington DC.*
2008	Invited member of ASA-CSSA-SSSA Climate Change Working Group to provide comments and feedback on USDA's Climate Change Strategic Plan.
2008	Panel member evaluating proposals to the Midwest Region of DOE's National Institute for Climate Change Research.

2009 Reviewer of 2 proposals to Integrative Organismal Systems, NSF

2009 Panel member evaluating proposals to the European Commission's 7th Framework program on *Forest Ecosystem Genomics*.

2009 Invited participant in National Evolutionary Synthesis Center Catalysis meeting on *The Evolution of C4 Grasses*

2009 Referee for "Introduction to Ecological Genomics", Oxford University Press.

2009 Reviewer of proposal for the Midwest Region of DOE's National Institute for Climate Change Research.

2009 Reviewer of proposal for National Environmental Research Council, UK

2010 Reviewer of proposal for NSF Plant Genome

2010 Reviewer of proposal for Minnesota Agricultural Station

2010 Reviewer of proposal for DOE EPSCOR

2010 Reviewer of proposal for U.S. Civilian Research and Development Foundation

2010 Session Chair at New Phytologist Symposium on Respiration and Global Change

2011 Reviewer of proposal for NSF Plant Genome

2011 Reviewer of proposal for Murdoch Charitable Trusts

2012 Reviewer of proposal for DFG (German Research Foundation)

2012 Reviewer of proposal for Dutch Research Foundation

2013 **Local Chair, International C_4-CAM Symposium**

2013 Program Committee, 16th International Congress on Photosynthesis

2013 Reviewer of proposal for Fulbright Commission

2014 Reviewer of proposal for Israel Science foundation

2014 Reviewer of proposal for USDA-NFA

3. University/Campus Service

University/Campus Service

2005 Member, search committee for Director of Core Facilities at the Institute for Genomic Biology

2007 Lead organizer, Inaugural Institute for Genomic Biology Annual Fellows Symposium, titled *The Future of Biology*.

2009-2010 Member, Proctor & Gamble Co. award selection committee, UIUC

2010-2013 Member, Steering Committee for Program in Evolution, Ecology and Conservation Biology

2011 Chair, Proctor & Gamble Co. award selection committee, UIUC

2011 Member, Interview panel for IGB Director of Communications

2012 Member, LAS Courses and Curriculum Committee

2012 Invited panel member, Visioning Future Excellence Initiative on Energy and the Environment

2013 Member, Plant Care Advisory Committee

2013 Member, LAS Courses and Curriculum Committee

School

2006 Judge, Student presentations at the Graduate Students in Ecology and Evolutionary Biology Annual Symposium

2008 Member, Search committee for Director of the School of Integrative Biology

2011 Chair, SIB Courses and Curriculum Committee

2012 Judge, Student presentations at the Graduate Students in Ecology and Evolutionary Biology Annual Symposium

2012 Member, SIB Courses and Curriculum Committee

2013 Member of SIB Distinction Committee

2013 Member, Search committee for Director of the School of Integrative Biology

2013 Member, Transforming The Curriculum team

Departmental

2007-2009 Member, Instruction Committee

2007- Faculty advisor, Student organized Department of Plant Biology Colloquium

2008-2009 Member, Advisory Committee for Department of Plant Biology

2009 Judge, Student poster competition at Fall Student Symposium.

2010 Member, Committee to select Outstanding TAs in Plant Biology

2011 Member, Instruction Committee

2013 Chair, Instructional Committee

2013 Chair, Search Committee for Assistant Professor of Plant Metabolic Systems

2013 Member, Advisory Committee for Department of Plant Biology

B. Evaluation of Service

V. RESEARCH (LAST UPDATED 2013)

A. Candidate's Statement of Research Goals and Accomplishments

UN Secretary General Ban Ki-moon describes global environmental change as the "defining challenge of our time." My research investigates the mechanisms of plant responses to global environmental change; specifically the three key factors of rising atmospheric CO_2 & O_3 concentrations, & drought stress. This work is important because it advances efforts to: (1) predict the impact of global environmental change on plants in agricultural & natural ecosystems, along with the goods & services they provide, & (2) identify targets for crop breeding & biotechnology that will improve food & biofuel crop productivity in future, altered environmental conditions. I take an integrative approach that combines established physiological & ecological techniques with genomic tools & the use of genetically tractable model species. These are applied in field & controlled environment experiments to address key knowledge gaps about plant responses to global change[1]. My current research program & how it builds on my key discoveries to date are described in the following sections.

Interactions between drought & atmospheric change

The consequences of global change for ecosystem function & food production will be heavily influenced by how greater drought stress in the future combines with elevated CO_2 & elevated O_3 to impact plants. I am exploring these relationships in a series of coordinated projects.

My post-doctoral work at SoyFACE revealed that growth at elevated CO_2 does not directly stimulate photosynthesis & productivity of maize (a model C_4 species) grown in the Midwest U.S.[2]. This is the highest impact original research paper to come out of the SoyFACE project & is important because predictions of future food supply currently assume that the photosynthesis & productivity of C_4 crops will be consistently stimulated by elevated CO_2, albeit to a lesser degree than C_3 species. I also showed that drought stress in maize can be ameliorated at elevated CO_2 as a result of lower stomatal conductance, which reduces plant water use & conserves soil moisture[3]. This means elevated CO_2 will only be a benefit for C_4 crops in times & places of drought stress. This finding is globally relevant because 40 % of the world's maize crop is produced in the Midwest U.S. In a recent invited review of these issues I concluded that, in light of my findings, predictions of future food production & carbon cycling are overoptimistic & should be revised[4]. New work with a graduate student in my research group, Cody Markelz, allowed us to refute the hypothesis that elevated CO_2 will ameliorate drought stress in maize more when it is growing with a limited nitrogen supply[5]. I believe this paper will have particular impact because C_4 crops grown in low nutrient conditions are major sources of food in many developing countries of Africa & the Americas[4]. My work on maize led to an invitation for me to join a working group at the National Evolutionary Synthesis Center (NESC). This led to us publishing a paper in *Science* advocating a new, more holistic, approach to understanding the evolution of C_4 grasses, which considers traits that combine with photosynthetic adaptations to promote dominance in grassland systems[6].

The interaction between elevated CO_2 & drought will also heavily influence food supply & ecosystem services from C_3 species, such as soybean, in the coming century. The current paradigm, which can be found in almost every major study of the topic in the last 20 years[7,8,9], is that elevated CO_2 will consistently ameliorate drought stress. I recognized that while there is very substantive evidence for this paradigm at the leaf-level, it had not been thoroughly tested in the field where soil wetting & drying dynamics are very different from many experimental settings. To tackle this challenge I have collaborated with Prof. Donald Ort & Dr. Carl Bernacchi (USDA-ARS, Urbana, IL) to develop a new rain interception technique for imposing drought treatments within FACE plots. This was developed & applied over the last 4 years with funds I was awarded by DOE NICCR & USDA AFRI. We have discovered that the paradigm of elevated CO_2 ameliorating drought stress occurs under conditions of mild stress. But, as drought stress intensifies, the stimulation of productivity & yield by elevated CO_2 declines & ultimately disappears. In conjunction with a graduate student in my research group, Sharon Gray, I have identified three mechanisms that underpin the observed effects on biomass production & yield. First, growth of soybean at elevated CO_2 does not consistently lead to conservation of soil moisture resources, as was previously thought[10]. Second, stomatal closure in response to soil drying was greater at elevated CO_2 compared to ambient CO_2[11]. We are currently testing whether changes in root distribution at elevated CO_2 increased contact of the root system with drying soil resulting in a greater hormone signal for stomatal

closure from the roots. This also led to a third mechanism, in which an unfavorable distribution of root nodules in shallow, dry soil under elevated CO_2 impaired nitrogen fixation[12]. My paper on the nodulation response was just accepted for publication in a special issue on crops for the future[12] & in the last year I have been invited to present our results to groups in Australia, Japan, UK & USA. Our findings are significant not just because they contradict the current paradigm, but also because they identify greater lateral root & nodule initiation under elevated CO_2 as processes that could be targeted by traditional breeding or biotechnology to produce soybean varieties that are more drought tolerant in the future.

This year, I published a meta-analysis of the inference space of all field CO_2 experiments using FACE & open-top chambers, which emphasizes the bias of current data toward moderate conditions within the temperate zone[13]. I concluded that there is an urgent need for new elevated CO_2 experiments across a wider range of environmental conditions – especially at low & high latitudes. In pursuit of this goal, I am PI of a pre-proposal accepted by NSF to establish a new field site in Panama, where I would collaborate with colleagues at UIUC, Boston Univ & the Smithsonian Institute to study the physiological mechanisms underlying the interaction between elevated CO_2, phosphorus availability & water status on tropical tree seedlings & forest regeneration processes. The full proposal will be submitted August 2012.

Modeling physiological plasticity & genetic variation in stomatal function

A former M.S. student, Katie Richter, & I worked on a grant from DOE's NICCR program to evaluate the consequences of global environmental change on stomatal function, & thereby on carbon & water cycling of the Midwest U.S. agroecosystem with an ecosystem modeler, Dr. Tracy Twine (Univ Minnesota). We have demonstrated that, with some improvements to algorithms coding phenology & allometry, the AGRO-IBIS model can reliably simulate the impacts of elevated CO_2 on carbon & water dynamics of both maize & soybean[14]. As with most dynamic global vegetation models, leaf gas exchange is estimated by iteratively solving the Farquhar model of photosynthesis[15] & the Ball & Berry model of stomatal conductance[16]. My work with Katie indicates that these models will only function to predict the impacts of global environmental change correctly if they are re-parameterized to take account of rising ozone concentrations. Katie's data indicates that the slope (or m parameter) of the Ball & Berry relationship increases with rising growth O_3 & that this is partially ameliorated by elevated CO_2[17]. These studies provide mechanistic explanations for canopy-scale measurements at SoyFACE[18,19], & are novel in demonstrating the potential for physiological plasticity in response to certain elements of environmental change that influence the slope parameter of the Ball-Berry model. This year I built on this initial success and was awarded funding from the Energy Biosciences Institute for a 3-year project to evaluate interspecific variation in the slope parameter of the Ball-Berry model & to explore how new parameterizations impact predictions of carbon & water cycling by the potential woody biofuel feedstocks poplar, willow & pine at field sites in North Carolina, New York & Minnesota.

Application of genomic & genetic tools to "climate-proofing" food & biofuel crops

I have been transitioning from exclusively studying the likely impact of global environmental change on plants to also trying to discover genes & processes that can be targeted in efforts to produce improved crops that are adapted to future growing conditions. This has involved expanding my research program into the areas of genomics & genetics.

Initially, I recognized that the impact of global change factors on plant performance are mediated by direct effects at the molecular, biochemical & physiological scales. Gene expression analysis promises important advances in understanding factors that have previously been consigned to the "black box" of unknown mechanism[20]. I have used this approach, in collaboration with Donald Ort (USDA), to discover that the main feature of the altered gene expression at elevated [CO_2] in soybean is greater transcript abundance for enzymes of the respiratory pathway. This transcriptional reprogramming of respiration had important physiological implications because it supported stimulation of nighttime, foliar respiration[21]. Greater foliar respiration at elevated CO_2 will reduce carbon balance of an individual leaf, but could be facilitating greater growth & yield at the whole plant scale through enhanced energy production for photoassimilate export to sink tissues. Subsequently, I & others have reported that the transcriptional reprogramming of respiration at elevated CO_2 is conserved across the major groups of herbaceous plants

(legumes, non-legume dicot, grass)[22,23]. However, in all cases the plants had access to significant N supply. A graduate student in my lab, Cody Markelz, tested whether a significant interaction between elevated CO_2 & N supply could explain some of the considerable variation in respiration responses to elevated CO_2 that have been previously reported[24, 25, 26]. He found that under limiting N supply, when stimulation of photosynthesis by elevated CO_2 is lower that at ample N, the stimulation of respiration was moderated – but it did occur & was again associated with greater expression of genes encoding the respiratory machinery[23]. Cody was invited to speak about these findings as the American Society of Plant Biologist's Annual Meeting this summer.

I have also led publications assessing the evolutionary context for understanding & manipulating plant responses to atmospheric CO_2[27] as well as describing the first generation of genomic ecology studies & a "roadmap" than can help others tackle the challenges of successfully adopting this strategy[20].

My research program is now poised to combine integrated investigation of molecular, biochemical & physiological process (i.e. systems phenotyping) with quantitative genetics techniques. I am part of two separate teams that will use this strategy to discover the genetic basis for drought & oxidative stress tolerance in model C_4 grasses over the next five years. First, I will collaborate with colleagues at the Danforth Center, Carnegie Institute, Washington State & University of Minnesota to study *Setaria viridis* – a new model C_4 grass which is closely related to maize, sorghum, & miscanthus. I am receiving the largest fraction of the DOE funding among the individual PIs ($1.8 million of $12.1 million) because my group will perform the field experiments where drought & plant density treatments will be applied to 200 recombinant inbred lines. This directly builds on the drought x elevated CO_2 experiments I have performed over the last 4 years. Second, I developed a proposal with Pat Brown (UIUC), Lauren McIntyre (Univ Florida) and Elizabeth Ainsworth (USDA), which has been recommended for funding by NSF's Plant Genome Program ($5.7 million) to study oxidative stress responses to ozone in maize. Elucidating the genomic basis for O_3 tolerance in maize has broad implications for understanding of oxidative stress & signalling due to cross talk between gene networks responsive to O_3, abiotic stress & biotic stress. The project is part of a new mid-career retraining initiative providing physiologists like myself with specific training in genomic & genetic techniques. I will therefore direct responsibility for next-generation sequencing analysis of gene expression profiles, quantitative trait loci identification & other molecular genetic analyses under the guidance of co-PIs with training in those areas (Pat Brown, UIUC & Lauren MacIntyre, University of Florida). Combined with my Setaria project, I believe this will give me a rare combination of expertise in integrating a diverse range of techniques - with which I can tackle societal problems associated with food & fuel supply.

Integration of Research, Teaching & Service

The post-docs & graduate students in my research group are being trained in practical skills at many scales of biological organization and to interpret complex datasets in order to tackle important questions in global change biology. Three of my graduate students have been awarded fellowships from NSF & DOE, respectively, to support their work. I have also mentored 31 undergraduate & high school students, with seven of them being successful in winning funding from NSF, DOE, ASPB, & UIUC's Environmental Change Institute. The breadth of my research has allowed me many opportunities to incorporate it into the two classes on global change biology that I teach. Likewise, I have been asked to referee integrative biology grant proposals for NSF & DOE, as well as programs in the UK, Netherlands, Germany & the European Commission. I am an editor for *Photosynthesis Research* & I have reviewed >160 manuscripts for publication in 38 different journals ranging from *Plant Cell* to *Ecology*, *Nature Climate Change* & *Proceedings of the National Academy of Sciences*. My research has formed the basis of invited lectures on a broad range of subjects to school children & teachers, college students & the general public. Most recently, I have developed the *Plants iView* program in conjunction with our Graduate Students Association – a platform allowing UIUC plant biologists at all career stages, from graduate student to faculty, to provide outreach activities to middle school students in Urbana, while also disseminating lesson plans to other educators via our website.

References cited

1. **ADB Leakey**, EA Ainsworth, CJ Bernacchi, A Rogers, SP Long, DR Ort (2009) Elevated CO_2 effects on plant carbon, nitrogen and water relations: six important lessons from FACE. *Journal of Experimental Botany* 60: 2859-2876.
2. **ADB Leakey**, M Uribelarrea, EA Ainsworth, SL Naidu, A Rogers, DR Ort, SP Long (2006) Photosynthesis, productivity and yield of *Zea mays* are not affected by open-air elevation of CO_2 concentration in the absence of drought. *Plant Physiology* 140:779-790.
3. **ADB Leakey**, CJ Bernacchi, FG Dohleman, DR Ort, SP Long (2004) Will photosynthesis of maize (*Zea mays*) in the U.S. Corn Belt increase in future [CO_2] rich atmospheres? An analysis of diurnal courses of CO_2 uptake under Free-Air Concentration Enrichment (FACE). *Global Change Biology* 10:951-962.
4. **ADB Leakey** (2009) Rising atmospheric carbon dioxide concentration and the future of C_4 crops for food and fuel. *Proceedings of the Royal Society B: Biological Sciences* 276: 2333-2343.
5. RJC Markelz, RS Strellner, **ADB Leakey** (2011) Impairment of C_4 photosynthesis by drought is exacerbated by limiting nitrogen and ameliorated by elevated [CO_2] in maize. *Journal of Experimental Botany* 62:3235-3246.
6. EJ Edwards, CP Osborne, CAE Stromberg, SA Smith, WJ Bond, PA Christin, AB Cousins, MR Duvall, DL Fox, RP Freckleton, O Ghannoum, J Hartwell, Y Huang, CM Janis, JE Keeley, EA Kellogg, AK Knapp, **ADB Leakey**, DM Nelson, BH Passey, JM Saarela, RF Sage, OE Sala, N Salamin, CJ Still, B Tipple (2010) The Origins of C_4 Grasslands: Integrating Evolutionary and Ecosystem Science. *Science* 328: 587-591.
7. EA Ainsworth & SP Long (2005) What have we learned from 15 years of free-air CO_2 enrichment (FACE)? A meta-analytic review of the responses of photosynthesis, canopy. *New Phytologist* 165: 351-371.
8. R Ceulemans & M Mousseau (1994) Tansley Review No 71 – effects of elevated atmospheric CO_2 on woody plants. *New Phytologist* 127: 425-446.
9. JM McGrath & DB Lobell (2011) An independent method of deriving the carbon dioxide fertilization effect in dry conditions using historical yield data from wet and dry years. *Global Change Biology* 17: 2689-2696.
10. **ADB Leakey** (2011) Non-optimal responses to drought stress of soybean grown at elevated CO_2 in the field. *International Botanical Congress, Melbourne, Australia*.
11. SB Gray, KK Puthuval, RS Strellner, **ADB Leakey** (2012) Elevated atmospheric CO_2 impacts on root depth distribution, abscisic acid signaling and stomatal response to drought in field grown soybean. *American Society for Plant Biologists Annual Meeting.*
12. SB Gray, RS Strellner, KK Puthuval, R Shulman, MH Siebers, A Rogers, **ADB Leakey** (accepted for publication) Minirhizotron imaging reveals nodulation of field-grown soybean is enhanced by Free-Air CO_2 Enrichment only when combined with drought stress. *Functional Plant Biology*
13. **ADB Leakey**, KA Bishop, EA Ainsworth (2012) A multi-biome gap in understanding of crop and ecosystem responses to elevated CO_2. *Current Opinion in Plant Biology* 15: 228-236.
14. TE Twine, J Bryant, K Richter, CJ Bernacchi, **ADB Leakey** (in prep) Impacts of elevated CO_2 concentration on the productivity and surface energy budget of the soybean and maize agroecosystem in the Midwest U.S. *Global Biogeochemical Cycles*
15. GD Farquhar, S von Caemmerer, JA Berry (1980) A biochemical model of photosynthetic CO_2 assimilation in leaves of C_3 species. *Planta* 149: 78-90.
16. JT Ball, IE Woodrow, JA Berry (1987) A model predicting stomatal conductance and its contribution to the control of photosynthesis under different environmental conditions. In: *Progress in Photosynthesis Research* (ed J. Biggens), pp. 221-224. Martinus Nijhoff Publishers, Dordrecht.
17. KT Richter, AM Betzelberger, **ADB Leakey** (2011) Growth of soybean at elevated ozone concentrations leads to stomatal acclimation that can be incorporated into ecosystem models by reparameterization of the Ball-Berry function. *American Society for Plant Biologists Annual Meeting.*
18. CJ Bernacchi, **ADB Leakey**, BA Kimball, DR Ort (2011) Growth of soybean at future tropospheric ozone concentrations decreases canopy evapotranspiration and soil water depletion. *Environmental Pollution* 159: 1464-1472.
19. A VanLoocke, AM Betzelberger, EA Ainsworth, CJ Bernacchi (2012) Rising ozone concentrations decrease soybean evapotranspiration and water use efficiency whilst increasing canopy temperature. *New Phytologist* 195: 164-171.
20. **ADB Leakey**, EA Ainsworth, SM Bernard, RJC Markelz, DR Ort, S Placella, A Rogers, MD Smith, E Sudderth, DJ Weston, SD Wullschleger, S Yuan (2009) Gene expression profiling – opening the black box of plant ecosystem responses to global change *Global Change Biology* 15: 1201-1213.
21. **ADB Leakey**, F Xu, K Gillespie, J McGrath, EA Ainsworth, DR Ort (2009) Genomic basis for stimulated respiration by plants growing under elevated carbon dioxide. *Proceedings of the National Academy of Sciences* 106: 3597-3602

22. RJC Markelz, LX Lai, **ADB Leakey** (2012) Limiting nitrogen availability diminishes, but does not eliminate, the stimulation of leaf respiration by elevated carbon dioxide concentration. *American Society for Plant Biologists Annual Meeting.*
23. H Fukayama, M Sugino, T Fukuda, C Masumoto, Y Taniguchi, M Okada, R Sameshima, T Hatanaka, S Misoo, T Hasegawa, M Miyao (2011) Gene expression profiling of rice grown in free air CO_2 enrichment (FACE) and elevated soil temperature. *Field Crops Research* 121: 195-199.
24. XZ Wang, P Curtis (2002) A meta-analytical test of elevated CO_2 effects on plant respiration. *Plant Ecology* 161: 251-261.
25. RM Gifford (2003) Plant respiration in productivity models: conceptualisation, representation and issues for global terrestrial carbon-cycle research. *Functional Plant Biology* 30: 171-186.
26. PA Davey, S Hunt, GJ Hymus, EH DeLucia, BG Drake, DF Karnosky, SP Long (2004) Respiratory oxygen uptake is not decreased by an instantaneous elevation of CO_2, but is increased with long-term growth in the field at elevated CO_2. *Plant Physiology* 134: 520-527.
27. **ADB Leakey**, JA Lau (2012) Evolutionary context for understanding and manipulating plant responses to past, present and future atmospheric [CO_2]. *Philosophical Transactions of the Royal Society B* 367:613-629.

B. Departmental Evaluation of Research Accomplishments

C. Departmental Evaluation and Future Potential

VI. EXTERNAL EVALUATIONS

A. Sample Letter to External Reviewers

B. Qualifications of External Reviewers

C. External Letters

VII. SPECIAL COMMENTS BY THE EXECUTIVE OFFICER

NOTE: Please start this section on a new page.