Written Testimony of Andrew D.B. Leakey

Before the U.S. House Committee on Science, Space, and Technology Subcommittee on Energy

Hearing on "Bioenergy Research and Development for the Fuels and Chemicals of Tomorrow"

March 16, 2022

Chairman Casten, Ranking Member Weber, and other distinguished members of the Subcommittee, thank you for the opportunity to participate in this important discussion on the research and development needed to secure U.S. leadership in bioenergy. Also, thank you for your strong and consistent support for science and discovery, including your commitment to developing future generations of scientists, engineers, and educators.

I am a professor, and Head of the Department of Plant Biology, at the University of Illinois Urbana-Champaign. I am also affiliated with our Department of Crop Sciences, Institute for Genomic Biology, and Center for Digital Agriculture. Originally from Great Britain, I came to the United States in 2002 as a Fulbright Scholar to study crop responses to climate change. Today, my individual research group takes a multidisciplinary approach to study how plants interact with their growing environment and how we can develop crops that use less water, thereby protecting them from yield loss in times and places of drought. This is important for today's discussion because it would help us to produce bioenergy and bioproducts on marginal quality land, where farmers currently struggle to make a profit because growing conditions are not ideal, and where we could avoid competition between production of food and fuel. Since 2020, I have also had the privilege to lead the Center for Advanced Bioenergy and Bioproducts Innovation, or CABBI, which is the newest of four Bioenergy Research Centers (BRCs) that the Department of Energy is funding. CABBI is comprised of over 300 professors, federal scientists, postdoctoral fellows, technical staff and students from 23 institutions in 17 states. The diverse expertise of our team allows us to take a holistic approach to the study of bioenergy and bioproducts. Today, I was asked to discuss the current status of bioenergy research. Based on my personal experience, I aim to convey to you: (1) the need for next-generation bioenergy and bioproducts as part of a decarbonized economy; (2) the broad goals of the BRC program funded by the Department of Energy; (3) the scientific progress made specifically by CABBI since its inception just over four years ago; (4) the cutting-edge tools we have developed to create new opportunities for discovery and innovation in the future; and (5) the opportunities to train a diverse workforce to be leaders in a new industry that can have a positive impact in every corner of the country.

The need for next-generation bioenergy and bioproducts as part of a decarbonized economy

The transportation fuels and petrochemicals sector has become a global, multi-trillion dollar per year industry. There is enormous potential to produce abundant supplies of renewable bioenergy and bioproducts from plant biomass. This would: (1) develop a more just economy in which additional individuals and communities receive economic benefit from the production of fuels and chemicals, including in rural areas; (2) reduce reliance on foreign sources of energy and improve resilience in the face of international conflicts or natural disasters; (3) support farming communities in developing a more diverse, sustainable and resilient agricultural system; and (4) counteract the progression of climate change.

Liquid biofuels have special potential to replace fossil fuels for modes of transportation where batteries are too heavy to store sufficient power, or in times and places where charging infrastructure is not easily connected to sources of clean electricity. Sustainable biofuels for aviation, marine freight, and heavy-duty long-distance trucking are notable examples. In addition, the scarcity of raw materials used in batteries, along with the social and environmental problems associated with sourcing them, is likely to limit the full electrification of the passenger vehicle fleet. Decarbonizing the transportation sector of the economy is important because it currently accounts for the largest fraction of U.S. CO_2 emissions. And, crude oil price fluctuations resulting from natural or human disasters are felt very directly by consumers at the gas pump or airport ticket counter.

However, further research and innovation is needed for biofuels and bioproducts to meet their full potential as a renewable solution to our collectively growing demand for energy and chemical commodities.

DOE Bioenergy Research Center program goals

CABBI and the three other BRCs collectively aim to provide the fundamental scientific discoveries and technologies needed to support an economically successful and ecologically sustainable domestic biofuels and bioproducts industry. This requires improved cropping systems that produce more biomass per acre, produce biomass of greater value, and do so while achieving sustainable greenhouse gas balances. It also includes more efficient technologies to deconstruct biomass and convert it into valuable fuels and chemicals that decarbonize our energy systems and products. Since the BRC program's inception in 2007, the BRCs made numerous significant contributions to the sustainable production of valuable chemicals and transportation fuels. These advances, made by thousands of past and current researchers, are part of over 4000 publications that have been cited 200,000 times, and more than 670 patent applications that have led to 280 licenses and helped form 15 start-up companies. The strong focus on technology transfer and commercialization is a notable feature of the BRC program relative to most government grants. For example, CABBI has partnerships with 11 companies. Those relationships allow us to learn the most pressing challenges faced by industry and provide solutions to problems that we are best placed to address. I believe these efforts are greatly aided by sustained funding from DOE for our research that spans the entire value chain. This sustained support is allowing the BRCs to first identify, and then address, a series of barriers and opportunities for transitioning to a sustainable and strong U.S. bioeconomy.

CABBI's scientific approach and progress

Now in its fifth year, CABBI is organized around three themes. First, the *Feedstock Production* team develops dedicated energy crops to produce biomass and novel bioproducts including liquid fuels. Second, the *Conversion* team develops catalysts and engineers advanced microbes that can be fed plant products to produce more fuel and high value chemicals. Third, the *Sustainability* team assesses and guides the economic and environmental viability of the entire value-chain from farm field to processing plant to fuel tank. Below, I highlight examples of key discoveries made by each theme before discussing some of the cutting-edge tools that the team has established to enable future breakthroughs.

We pursue a vision of "plants as factories", in which biofuels and other chemicals are synthesized directly in grass crops. This capability can greatly increase the value of biomass, providing a strong foundation for the entire bioenergy enterprise, and directly benefiting the farming communities who produce it. It also

complements the vital work being done by the other BRCs to convert the lignin and cellulose in plant biomass into fuels and bioproducts with maximum efficiency. Our *Feedstock Production* team has already engineered a 50-fold increase in the oil content of the vegetative tissues of grass crops. Minimal processing would be needed to squeeze the oil out of the plants after harvest and purify it to be a drop-in transportation fuel. Crucially, we have established an R&D pipeline that goes beyond initial proof-of-concept in greenhouse-grown plants and tests the performance of our best crops in field trials across multiple states. When combined with operation of our bioprocessing pilot plant, this demonstrated that the early versions of our "oil-grasses" can already produce as much oil per acre of land as soybean, with the potential for significant further gains in the future. In addition, our team has identified approaches to make our crops more resilient to heat, drought, cold and air pollution through both breeding and biotechnology. This will aid their deployment in locations with poor growing conditions.

Continuing along the value chain, our *Conversion* team takes plant-derived oils and sugars and upgrades them by using highly engineered microbes to produce a suite of high-value chemicals. These chemicals are the key ingredients needed to produce decarbonized plastics, adhesives, polishes, lubricants, detergents and more. For example, their engineering has modified the metabolic pathways of a specialized yeast, allowing it to produce greater amounts of a compound called triacetic acid lactone, or TAL, than ever before. TAL is a platform chemical that can be upgraded to a variety of market-relevant end products currently derived from fossil fuels, and techno-economic analysis and life cycle assessment indicates that we are already very close to making this low-carbon production system for TAL a financially viable opportunity.

That techno-economic analysis and life-cycle assessment was performed by our *Sustainability* team, as they assess and guide the economic and ecological sustainability of the production systems we develop. Their work starts with cutting-edge measurements of greenhouse gas emissions from fields of our feedstock crops. For example, they have developed new understanding of how different bioenergy feedstock crops and the soil they grow in influence the efficiency of fertilizer application and production of nitrous oxide, an unwanted and very potent greenhouse gas. They have also leveraged high-resolution satellite imaging to identify land that has historically oscillated in and out of agricultural production due to marginal profitability. This provides a new approach to identify locations that might be prioritized for bioenergy production because they are not consistently viable for profitable production of current crops. This will help avoid competition for production of food versus fuel. The team uses their unique datasets to drive simulation models of crop and agroecosystem function across the diverse growing regions of the United States. And, they have developed a ground-breaking ability to combine their predictions of crop production and greenhouse gas emissions with economic models to determine which bioenergy crops should be grown where in order to maximize farmer profits and environmental benefits. This synthesis is delivering new insights on the complex interactions among bioenergy policies, feedstock attributes, conversion technology and market conditions that will affect the both the economic and ecological sustainability of a bioeconomy.

CABBI's toolkit for further discovery and innovation

A key additional element of our mission is the development of new tools and knowledge that can solve previously intractable problems and accelerate the pace of discovery and innovation. In addition to tailor-making tools to solve challenges in bioenergy research, this work frequently has much broader impact, providing breakthroughs that have many potential applications.

Our *Conversion* team is pioneering the development of automated laboratory research with the Illinois Biological Foundry for Advanced Biomanufacturing (iBioFAB). It uses robotics and Artificial Intelligence (AI) to accelerate - by at least an order of magnitude - the scientific and engineering process for bioenergy – including designing, building, testing and learning steps. It can house tens of thousands of individual samples and use its robotics to rapidly access more than 20 instruments on the platform - including a microscope and DNA fragment analyzer - to maintain, sample and analyze them. In addition, the team has developed new AI methods that allow computers to assess myriad options for engineering an enzyme and successfully pick out only the best options for real-world testing – a huge time saver. Perhaps most radical of all, the *Conversion* team has demonstrated the ability to design enzymes that catalyze entirely new chemical reactions. This opens up extraordinary opportunities to build high-value chemicals from plant products using engineered microbes. These new tools are being directly targeted towards our bioenergy research, but have many potential spin-off applications for other elements of the bioeconomy.

Developing new feedstock crops and improving existing crops depends heavily on knowledge of the plant's genome and the ability to modify it through breeding and biotechnology. Our *Feedstocks* team has sequenced the genome of Miscanthus, one of the most promising bioenergy feedstock species in terms of greenhouse gas balance. While genome sequencing has become increasingly common, this is significant because Miscanthus is one example of a number of key crops that have exceeding genomes much more complex than humans and many other species. This made it much harder to assemble the DNA sequence into the correct order. This is crucial in the same way that the pages and chapters of a book must be in the correct order for the story to make sense. But, the team overcame that challenge, learning valuable lessons that can be applied in other important species. And, having the genome in hand opens up a suite of high-tech approaches to crop improvement that previously were unavailable. In parallel, the team has also demonstrated new capabilities in genome editing of our target crops – again a more challenging task in grasses with complex genomes, but one that creates new opportunities for producing larger quantities and a broader range of bioproducts in the plant. This work poises CABBI, and the rest of the bioenergy research community in the U.S. and around the world, to engineer bioenergy feedstocks more quickly and effectively.

The *Sustainability* team has developed a robust software platform, BioSTEAM, for conducting agile techno-economic analysis and life-cycle assessment. BioSTEAM allows for rapid evaluation of different feedstocks entering the processing plant, different conversion processes being used to produce different biofuels and bioproducts, and different configurations of the processing plant to identify financially viable opportunities, a major advance over prior, less flexible platforms. Crucially, with federal funding it is made freely available, with open-source code, unlike the less powerful commercial products that mainly preceded it. As a result, it is being widely adopted by researchers and industry. We have applied BioSTEAM to characterize the viability of liquid fuel production from CABBI feedstocks and to set research and development targets for both feedstock composition and conversion technologies, targeting the financially viable, environmentally sustainable production of a range of bioproducts.

Cutting across research in all three research themes, CABBI is developing and applying AI methods to a diverse portfolio of problems. This includes designing new enzymes and metabolic pathways, automating normally laborious and inefficient steps in genome editing, and automatically analyzing images from microscopes, drones, or satellites to much more rapidly identify which crops and locations perform best. The University of Illinois at Urbana-Champaign also recently started to lead AI Institutes funded by the U.S. Department of Agriculture and the National Science Foundation. Synergies between their work and CABBI's research will be increasingly valuable moving forward and highlights the benefits

of the complementarity among federal funding agencies in the U.S.. Vitally, the same spirit of cooperation is clearly event across the research assets of the Department of Energy. The BRCs have always acted in support of one another, and over last two years we have invested significant time to identify and map out research projects that we can tackle more quickly, efficiently, and effectively through even closer collaboration. Our research is also enabled by the world-class facilities and services made available to us at DOE's National Labs, Joint Genome Institute, and Environmental Molecular Sciences Laboratory.

Training a diverse bioenergy workforce

Along with the other BRCs, CABBI is committed to training a diverse bioenergy workforce. Our scientists at all career stages contribute to this effort through participation in a wide range of outreach and educational activities. I am especially excited about our new internship program that provides summer research experiences for undergraduate students from traditionally under-represented groups. In addition to a research project, a series of seminars expose participants to career options and develop their skills in science communication and the process of applying to graduate school. We hope that these experiences, and the relationships participants build in the process, will attract help attract the students into graduate school and onto careers in bioenergy.

In conclusion, I came to America because I believed it provided the greatest opportunity of any country in the world for a scientist to help tackle the grand challenges of clean energy, climate change, and sustainable agriculture. Twenty years later, my experiences working at a top land-grant university that partners with other academic institutions, federal agencies, diverse industries, and farmers have greatly bolstered that belief. The privilege of leading a Department of Energy BRC is arguably the most complete expression of this opportunity. Everyday involves learning something new and it is impossible not to be inspired by the work of the team around me. I hope I have helped you understand why we all have reason to be proud of this country's bioenergy research enterprise and to be optimistic about what it can deliver in the future for the benefit of everyone in our society.

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I. NARRATIVE BIOGRAPHY

Dr. Leakey received his B.Sc. in Plant Sciences in 1998 and his Ph.D. in Tropical Tree Physiology and Ecology in 2003, both from the University of Sheffield, UK. He moved to the University of Illinois at Urbana-Champaign, USA as a Fulbright Scholar in 2002. Staying at Illinois he was a post-doctoral scientist in the Department of Plant Biology and then Research Fellow at the Institute for Genomic Biology, before joining the faculty as an Assistant Professor in 2007. He was promoted to Associate Professor in 2013 and Professor in 2018. He has received the Calvin-Benson Prize for excellence in early-career research on photosynthesis and been elected as a Fellow of the American Association for the Advancement of Science. He is currently the Director of the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) and the Head of the Department of Plant Biology.

Dr. Leakey's research group at the University of Illinois aims to help improve the productivity, resource use efficiency and stress resilience of food and fuel crops. To do this we integrate genetic, molecular, biochemical, physiological, agronomic, imaging and machine learning tools. Our current focus is to holistically understand the mechanisms controlling stomata, rooting and water use efficiency. Our work to develop crops that use less water aims to protect them from yield loss in times and places of drought. This is important because drought already limits agricultural production in many parts of the world and will do so increasingly as the climate continues to change. In addition, water use efficient crops would help us to produce bioenergy and bioproducts on marginal quality land, where farmers currently struggle to make a profit because growing conditions are not ideal, and where we could avoid competition between production of food and fuel.

II. PERSONAL HISTORY AND PROFESSIONAL EXPERIENCE

A. Educational Background

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

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
2013-2018	Associate Professor, Department of Plant Biology, UIUC
2013-2018	Associate Professor, Institute for Genomic Biology, UIUC
2013-2018	Associate Professor, Department of Crop Sciences, UIUC
2016-2017	Visiting Scientist, Carnegie Institute for Plant Biology, Stanford, CA
2018-	Professor, Department of Plant Biology, UIUC

2018- Professor, Institute for Genomic Biology, UIUC
2018- Professor, Department of Crop Sciences, UIUC
2019-2020 Acting Head of Department, Department of Plant Biology, UIUC
2019-2020 Theme Leader, Feedstock Production, CABBI
2019- Professor, Center for Digital Agriculture, UIUC
2020- Head of Department, Department of Plant Biology, UIUC
2020- Director, Center for Advanced Bioenergy & Bioproducts Innovation, UIUC

C. Other Professional Employment

2013 Consultant to Koch Fertilizer

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
2002 Fulbright Scholar
2007 Teacher Ranked Excellent by Students (*Plants & Global Change*)
2008 Dean's Teaching Fellow, College of Liberal Arts & Sciences, UIUC
2008 Teacher Ranked Excellent by Students (*Global Warming, Biofuels, Food*)
2009 Teacher Ranked Excellent by Students (*Plants & Global Change*)
2010 Faculty Fellow, Environmental Change Institute, UIUC
2011 Beckman Fellow, Center for Advanced Studies, UIUC
2011 Teacher Ranked Excellent by Students (*Plants & Global Change*)
2013 I.C. Gunsalus Fellow, College of Liberal Arts and Sciences, UIUC
2013 Arnold O. Beckman Research Award
2015 Teacher Ranked Excellent by Students (*Plants & Global Change*)
2016 Calvin-Benson Award for outstanding early career research, International Society of Photosynthesis Research
2017 University Scholar, Office of the President, University of Illinois System
2018 Teacher Ranked Excellent by Students (*Plants & Global Change*)
2019 Elected Fellow of the American Association for the Advancement of Science (AAAS)
2020 Martin & Ruth Massengale Lecturer, Crop Science Society of America Annual Meeting.
2020 Teacher Ranked Excellent by Students (*Plants & Global Change*)
2021 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 at elevated CO_2 be hung out to dry? (March 2014) *MEPS Symposium, Texas A&M, College Station, TX.*

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

83. Targets for improving simulation of plant carbon-water interactions in earth system models (April 2014) *New Phytologist Workshop on Representation of Photosynthesis in Earth System Models, Montauk, NY.*

84. Crop Adaptation & High-Throughput Field Phenotyping (June 2014) *Monsanto-Illinois Meeting on Crop Nutrient Management, Institute for Genomic Biology, UIUC.*

85. Elevated CO_2 ameliorates stress under mild drought but exacerbates stress under severe drought in soybean (July 2014) *Society for Experimental Biology Annual Meeting, Manchester, UK.*

86. A universal playbook for stomata in C_3 plants: fact or fiction? (July 2014) *American Society of Plant Biologists Annual Meeting, Portland, OR.*

87. Using genomic tools to understand crop responses to a future, elevated [CO_2] world (July 2014) *Genomics for Teachers Workshop, Institute for Genomic Biology, UIUC.*

88. Measurement, analysis and interpretation of A/c_i curves to evaluate the factors limiting photosynthetic CO_2 fixation (Sept 2014) *SEB Plant Environmental Physiology Group, Ecophysiology Techniques Workshop, Lisbon, Portugal.*

89. Crop responses and adaptation to climate change (Oct 2014) *UK-US Taskforce on Resilience of the Global Food Supply Chain to Extreme Events, Willis Tower, Chicago, IL.*

90. The future of crops with global environmental change (Dec 2014) *Chambana Science Café, Pizza M, Urbana, IL.*

91. How much will elevated CO_2 offset crop yield losses in a hotter, drier future? (December 2014) *Departmental Seminar, Penn State University, PA.*

92. Genomic Solutions for Adapting Crops to Global Change (Feb 2015) *Osher Life Long Learning Institute, Champaign, IL.*

93. SoyFACE: A field laboratory for study of crop global change biology (March 2015) *Visit of ARPA-E panel managers to UIUC, Institute for Genomic Biology, UIUC.*

94. My teaching and research with LAS students (repeated 3 times, March and April 2015) *Admitted Students Day, LAS, UIUC.*

95. How much will elevated CO_2 offset crop yield losses in a hotter, drier future? (May 2015) *UGA Plant Center Symposium, University of Georgia, GA.*

96. Modification of the response of photosynthetic productivity to drought by elevated CO2 concentrations – has its significance been misunderstood? (June 2015) *School of Biological Sciences, University of Essex, UK.*

97. Measurement, analysis and interpretation of leaf gas exchange (July 2015) *The Flux Course, Rocky Mountain Research Station, CO.*

98. Genetic and genomic approaches to understand and improve maize responses to ozone (Sept 2015) *NSF Plant Genome Research Program PIs Meeting, Washington DC.*

99. Adapting crops to climate change – a 21st century science problem (Sept 2015) *LAS Recruitment Event, UIUC.*

100. Adapting crops to climate change – a 21st century science problem (Sept 2015) *Looking in the Right Direction: Carl Woese and the New Biology, IGB, UIUC.*

101. A rapid optical profilometry and computer vision method for phenotyping leaf epidermal structure applied to genetic and environmental control of stomatal patterning in the model C4 species maize and setaria (Nov 2015) *Workshop on Plant Development and Drought Stress, Asilomar, CA.*

102. Adapting Crops to Climate Change (Nov 2015) *The IGB Fellows Alumni lecture, IGB, UIUC.*

103. Rapid optical profilometry and computer vision of leaf epidermal structure applied to genetic and environmental control of stomatal patterning in model C_4 species (Jan 2016) *The Plant and Animal Genome Conference, San Diego, CA.*

104. High fidelity-rapid phenotyping in field experiments to advance adaptation of crops to global change (Apr 2016) *Collaboration Symposium, Donald Danforth Plant Science Center, St Louis, MO.*

105. High fidelity-rapid phenotyping in field experiments to advance adaptation of crops to global change (Apr 2016) *Department of Plant Biology Colloquium, UIUC.*

106. Targets for Crop Adaptation Discovered in Free-Air CO_2 Enrichment (FACE) Field Experiments (May 2016) *Adaptation Futures 2016 – practices and solutions, Rotterdam, The Netherlands.*

107. SoyFACE: A field laboratory for study of crop global change biology (May 2016) *Visit of Provost Delegation from Birmingham University, UK to UIUC.*

108. High fidelity detection of QTL for biomass production from rapid imaging of a C4 grass crop in the field (July 2016) *American Society of Plant Biologists Annual Meeting, Austin, TX.*

109. Improving drought tolerance and water use efficiency in C4 crops (Aug 2016) *Agronomy Day, Illinois Experimental Research Farm, UIUC.*

110. Rising [CO_2] as a benefit and challenge to improving crop photosynthesis (Aug 2016) *Plenary lecture for Calvin Award, International Congress on Photosynthesis Research, Maastricht, The Netherlands.*

111. Vertically integrating analyses of plant carbon, water and nutrient relations to understand and improve crop performance (Oct 2016) *Seminar, Department of Global Ecology, Carnegie Institute for Science, Stanford, CA.*

112. Water Efficient Sorghum Technologies (Nov 2016) *ARPA-E TERRA and OPEN program PIs meeting, Phoenix, AZ.*

113. High fidelity phenotyping of productivity, WUE and drought traits in the model C4 grasses maize, sorghum and setaria (March 2017) *Seminar, International Rice Research Institute, Philippines.*

114. Development and application of novel phenotyping techniques to understand the genetic control of productivity and drought traits in the model C4 grass Setaria (Feb 2017) *Plenary talk, 2nd International Genetics Conference, Donald Danforth Plant Science Center, St Louis, MO.*

115. Stomata and water use efficiency at the core of plant-environment interactions (Apr 2017) *Seminar, School of Plant Sciences, University of Arizona, AZ.*

116. Water Efficient Crop Technologies (Sept 2017) *Value Proposition, Ag Innovation Showcase, St Louis, MO.*

117. Phenomics of stomata and water use efficiency in model C4 crops (Feb 2018). *Phenome 2018, Tucson, AZ.*

118. Phenomics of stomata and water use efficiency in model C4 crops (March 2018). *UIUC Department of Plant Biology Departmental Colloquium.*

119. High-throughput Phenotyping of Leaf Traits to Understand Plant Carbon, Water and Nitrogen Relations (April 2018). *Plant Phenomics Symposium, University of Nebraska.*

120. Academic Highlights – The Illinois campus as an inventor's workshop for the crops of the future (Sept 2018). *University of Illinois Board of Trustees Meeting.*

121. Stress tolerant crops for the future (Oct 2018) *Presentation to UIUC Alumni and Donors, World of Genomics, St Louis Science Center.*

122. Phenomics of stomata and water use efficiency in model C4 crops (June 2018). *American Society for Plant Biology Annual Meeting, Montreal, Canada.*

123. Plant science for sustainability and resilience to climate change (April 2018) Agriculture and Consumer Economics Library, UIUC.

124. Water Efficient Sorghum Technologies (Oct 2018) *ARPA-E TERRA and OPEN program PIs meeting, San Francisco, CA.*

125. Studying climate change on the farm: free-air CO_2 enrichment experiments (Oct 2018) *ARPA-E TERRA and OPEN program PIs meeting, San Francisco, CA.*

126. Phenomics of stomata and water use efficiency in model C4 crops (September 2018). *Bayer Crop Science Seminar, St Louis, MO.*

127. 25 years of FACE experiments – evidence for or against elevated CO_2 reducing evapotranspiration and ameliorating plant drought stress? (August 2018) *Ecological Society of America Annual Meeting, New Orleans, LA.*

128. Phenomics of stomata and water use efficiency in model C4 crops (August 2018). *University of New Mexico Department of Biology Departmental Colloquium.*

129. High-throughput Phenotyping of Leaf Traits to Understand Plant Carbon, Water and Nitrogen Relations (September 2018). *SEB Plant Environmental Physiology Group, Ecophysiology Techniques Workshop, Lisbon, Portugal.*

130. Phenomics of stomata and water use efficiency in model C4 crops (March 2019). *UIUC Center for Digital Agriculture Kickoff Event.*

131. Phenomics of stomata and water use efficiency in model C4 crops (May 2019). *UIUC Physiological and Molecular Plant Biology Seminar.*

132. Addressing the challenge of climate change for crops (June 2019). *Bayer Crop Science Fellows Colloquium, St Louis, MO.*

133. Phenomics of stomata and water use efficiency in model C4 crops (November 2019). *Purdue University Seminar.*

134. Using computer vision to relieve the crop phenotyping bottleneck (February 2020). *UIUC Center for Digital Agriculture Symposium*

135. Progress toward the "plants as factories" paradigm for bioenergy in grasses (February 2020). *DOE Genomic Science Program Annual PIs meeting*

136. The Phenomics of Stomata and Water Use Efficiency in C4 crops (December 2020). *ARPA-E TERRA Program PIs Meeting*

137. The Phenomics of Stomata and Water Use Efficiency in C4 crops (October 2020). *Martin and Ruth Massengale Lecture to the Annual Meeting of the Crop Science Society of America*

138. The Phenomics of Stomata and Water Use Efficiency in C4 crops (Feb 2021). *University of Missouri Interdisciplinary Plant Group seminar*

139. The Phenomics of Stomata and Water Use Efficiency in C4 crops (March 2021). *UIUC Department of Plant Biology colloquium*

140. The Phenomics of Stomata and Water Use Efficiency in C4 crops (April 2021). *DOE BRC Sorghum workshop*

141. Overcoming bottlenecks in field-based root phenotyping using thousands of minirhizotrons (May 2021). *11th Symposium of the International Society of Root Research and Rooting 2021*

142. Phenotyping stomatal anatomy and function (Sept 2021) *Society for Experimental Biology Environmental Physiology Group, Virtual Workshop on Field and Laboratory Techniques*

143. Lessons on G x E from a phenomics approach to studying stomata and water use efficiency in C4 crops (Oct 2021) *Purdue Graduate Student Plant Science Symposium*

F. Offices Held in Professional Societies

2018 – 2019	Convener, Crop Molecular Genetics Group, Society for Experimental Biology, UK
2019 – present	Convener, Photosynthesis Group, Society for Experimental Biology, UK

G. Editorship of Journals or Other Learned Publications

2009 – 2017	Editor, *Photosynthesis Research*
2012 – 2016	Editor, *Food and Energy Security*
2013 – 2018	Editorial Review Board, *Plant Cell & Environment*
2017 – 2020	Guest Editor, *The Plant Cell*
2017 – 2020	Academic Editor, *Plant Direct*
2019 – present	Associate Editor, *Plant Cell & Environment*

H. Grants Received

CURRENT PROJECTS

I Baxter, A Cousins, J Dinneny, A Kausch, **ADB Leakey**, T Mockler, S Rhee, D Voytas; *Using systems approaches to improve photosynthesis and water use efficiency in sorghum*, DOE Biosystems Design, 09/2017 – 09/2022, $ 16,067,714 ($2,127,099 to UIUC).

ADB Leakey, EH DeLucia, SP Long, S Moose, H Zhao, M Khanna, ME Hudson, C Rao, W Yang, V Singh, *et al.*; Center for Advanced Bioenergy and Bioproducts Innovation, DOE Bioenergy Research Center, 12/2017 – 11/2022, $104M.

ADB Leakey, I Baxter, J Dinneny C Pignon; *Transcriptomics of water use efficiency traits in sorghum and setaria*, Joint Genome Institute Community Sequencing Project, 2018-2024.

JC Mortimer, F Brandizzi, **ADB Leakey**, H Scheller, D Ware, Z Xin; *Sequencing of sorghum EMS mutants*, Joint Genome Institute Community Sequencing Project, 2018-2021.

ADB Leakey, W Yang; *Revealing root system interactions with shoots and microbes as drivers of bioenergy feedstock productivity and sustainability*, CABBI Postdoc Integration Project, 2019-2021, $250,000.

ADB Leakey, EA Ainsworth; *Using high throughput phenotyping to assess the leaf economics spectrum of C4 bioenergy crops*. Arnold O. Beckman Research Award, UIUC, 2021, $29.848.

A Jones, **ADB Leakey**, C Jones; *Collaborative Research: RoL – Rules for Dynamic-Light Environmental Sculpting of Genomes*. NSF Rules of Life, Integrative Organismal Systems; 06/2021 - 06/2025, $1,212,609 to UIUC.

PAST PROJECTS

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

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.

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.

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

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.

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

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

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

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

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

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

ADB Leakey; *Sustainability of Woody Biofuel Feedstocks*, Energy Biosciences Institute, 1/2015 – 12/2015, $101,401.

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 Biosystems Design, 10/2012 – 8/2018, $ 12,140,437 ($1,997,547 to UIUC).

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 – 12/2019, $5,733,823.

EA Ainsworth, **ADB Leakey**, D Bush; *Phloem Loading as a Driver of Plant Photosynthetic Responses to Carbon Supply*, USDA-AFRI, 1/2015-12/2018, $474,099.

ADB Leakey; *Student Ambassadors of System Biology for Sustainable Food and Energy*, Department of Ed. Title VI National Resource Center in Global Studies, 2014-2018 $40,000.

ADB Leakey, CJ Bernacchi, PJ Brown, E Buckler, J Burke, T Clemente, M Gore, SP Long, DR Ort, E Spalding ; *Novel Technologies to Solve the Water Use Problem of High Yielding C4 Bioenergy and Bioproduct Feedstocks*, Advanced Research Projects Agency – Energy, 4/2016-9/2019, $4,995,967.

C Topp, I Baxter, N Goldenfeld, **ADB Leakey**; *An integrated phenomics approach to identifying the genetic basis for maize root structure and control of plant nutrient relations*, NSF Plant Genome, 2016-2020, $3,930,496. ($1,768,240 to UIUC)

ADB Leakey, TAM Pugh; Leading the way to a new global consensus on carbon dioxide impacts on crops and forests, BRIDGE Seed Fund Grant, 2017-2018, $4,400.

ADB Leakey, N Ahuja, J Hart; *Using Computer Vision to Relieve the Crop Phenotyping Bottleneck*, UIUC Center for Digital Agriculture Seed Grant, 2019-2020, $50,000.

Manuel Garcia, **ADB Leakey**; *Novel Deep Learning Methods for In Situ Fine Roots Measurements*, DOE SBIR Phase I Grant in collaboration with UHV Technologies, Inc., 2/18/2020 - 10/18/2020 ($60,000 to Leakey)

Andrea Pearce, **ADB Leakey**; *Progressive Automation of Minirhizotron Root Image Analysis through Advanced Contextualization and Machine Learning*, DOE SBIR Phase I Grant in collaboration with Transcend Engineering, 2/18/2020 - 10/18/2020 ($29,991 to Leakey)

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.

2014 Panel member evaluating proposals to UC Davis' *Signature Research in Genomics* program.

2015 Panel member evaluating proposals to NSF's *Integrated Environmental Physiology* program.

III. PUBLICATIONS AND CREATIVE WORKS

A. Doctoral Thesis Title

Photosynthetic and growth responses of dipterocarp tree seedlings to dynamic irradiance

B. Chapters in Books

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

C. Articles in Journals

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* 508:517-520.

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.* 37:2542-2552.

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*. 510:139-143

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*. 3:33-45.

50. D Wang, D Jaiswal, DS LeBauer, TM Wertin, **ADB Leakey**, SP Long (2015) 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* 38:1850-1865.

51. SH Siebers, CR Yendrek, D Drag, AM Locke, L Rios Acosta, **ADB Leakey**, EA Ainsworth, CJ Bernacchi, DR Ort (2015) Heat waves imposed during early pod development in soybean (Glycine max) cause significant yield loss despite a rapid recovery from oxidative stress. *Global Change Biology* 21:3114-3125.

52. LH Dietterich, A Zanobetti, I Kloog, P Huybers, **ADB Leakey**, AJ Bloom, E Carlisle, N Fernando, G Fitzgerald, T Hasegawa, NM Holbrook, RL Nelson, R Norton, MJ Ottman, V Raboy, H Sakai, KA Sartor, J Schwartz, S Seneweera, Y Usui, S Yoshinaga, SS Myers (2015) Impacts of elevated atmospheric CO_2 on nutrient content of important food crops. *Scientific Data* 2:150036, 10.1038/sdata.2015.36

53. RJ Webster, SM Driever, J Krondijk, J McGrath, **ADB Leakey**, K Siebke, T Demetriades-Shah, S Bonnage, T Peloe, T Lawson, SP Long (2016) High C3 photosynthetic capacity and high intrinsic water use efficiency underlies the high productivity of the bioenergy grass Arundo donax. *Scientific Reports* 6:20694.

54. H Flores-Moreno, PB Reich, EM Lind, LL Sullivan, EW Seabloom, L Yahdjian, AS MacDougall, L Reichmann, J Alberti, S Baez, JD Bakker, MW Cadotte, MC Caldeira, EJ Chaneton, C D'Antoniio, PA Fay, J Firn, N Hagenah, WS Harpole, O Iribarne, KP Kirkman, JMH Knops, KJ La Pierre, R Laungani, **ADB Leakey**, RL McCulley, JL Moore, J Pascual, ET Borer (2016) Climate modifies response of non-native and native species richness to nutrient enrichment. Philosophical Transactions of the Royal Society B 371(1694):20150273.

55. SB Gray, O Dermody, SP Klein, AM Locke, JM McGrath, RE Paul, DM Rosenthal, UM Ruiz-Vera, MH Siebers, R Strellner, EA Ainsworth, CJ Bernacchi, SP Long, DR Ort, **ADB Leakey** (2016) Intensifying drought eliminates the expected benefits of elevated [CO_2] for soybean. *Nature Plants* doi:10.1038/nplants.2016.132

56. CR Yendrek, T Tomaz, CM Montes, Y Cao, AM Morse, PJ Brown, LM McIntyre, **ADB Leakey**, EA Ainsworth (2017) High-throughput phenotyping of maize leaf physiological and biochemical traits using hyperspectral reflectance. *Plant Physiology* 173:614-626.

57. A Rogers, BE Medlyn, JS Dukes, G Bonan, S von Caemmerer, MC Dietze, J Kattge, **ADB Leakey**, LM Mercado, U Niinemets, IC Prentice, SP Serbin, S Sitch, DA Way, S Zaehle (2017) A roadmap for improving the representation of photosynthesis in Earth system models. *New Phytologist* 213:22-42.

58. KJ Wolz, TM Wertin, M Abordo, D Wang, **ADB Leakey** (2017) Variation in stomatal function is integral to modeling plant carbon and water fluxes. *Nature Ecology & Evolution* 1:1292-1298

59. MJ Feldman, RE Paul, D Banan, JF Barrett, J Sebastian, MC Yee, H Jiang, AE Lipka, TP Brutnell, JR Dinneny, **ADB Leakey**, I Baxter (2017) Time dependent genetic analysis links field and controlled environment phenotypes in the model C4 grass Setaria. *PLoS Genetics* 13(6): e1006841.

60. P Wang, E Marsh, EA Ainsworth, **ADB Leakey**, Sheflin AM, D Schachtman (2017) Shifts in microbial diversity in agricultural soils, rhizosphere and roots in two major cropping systems under elevated CO_2 and O_3. *Scientific Reports* 7: 15019 DOI:10.1038/s41598-017-14936-2

61. CR Yendrek, G Erice, CM Montes, T Tomaz, C Sorgini, PJ Brown, LM McIntyre, **ADB Leakey**, EA Ainsworth (2017) Elevated ozone reduces photosynthetic carbon gain by accelerating leaf senescence of inbred and hybrid maize in a genotype-specific manner. *Plant Cell & Environment* 40:3088-3100.

62. Z Jin, EA Ainsworth, **ADB Leakey**, DB Lobell (2018) Increasing drought will diminish the benefits of elevated carbon dioxide for soybean yields across the US Midwest. *Global Change Biology* 24:E522-E533.

63. D Banan, RE Paul, MJ Feldman, M Holmes, H Schlake, H Jiang, I Baxter, **ADB Leakey** (2018) High fidelity detection of QTL hotspots for crop biomass production from low cost imaging in the field. *Plant Direct* 2(2): DOI: 10.1002/pld3.41

64. K Głowacka, J Kromdijk, K Kucera, J Xie, AP Cavanagh, L Leonelli, **ADB Leakey**, DR Ort, KK Niyogi, SP Long (2018). PsbS Overexpression Increases the Efficiency of Water Use in a Field-Grown Crop. *Nature Communications* 9:868

65. KA Bishop, P Lemonnier, JC Quebedeaux, CM Montes, **ADB Leakey**, EA Ainsworth (2018) Similar photosynthetic response to elevated carbon dioxide concentration in species with

different phloem loading strategies. *Photosynthesis Research* https://doi.org/10.1007/s11120-018-0524-x

66. R Valluru, EE Gazave, SB Fernandes, JN Ferguson, R Lozano, P Hirannaiah, T Zuo, PJ Brown, **ADB Leakey**, MA Gore, ES Buckler, N Bandillo (2019) Deleterious Mutation Burden and Its Association with Complex Traits in Sorghum (Sorghum bicolor). *Genetics* 211(3): 1075-1087.
67. **ADB Leakey**, JN Ferguson, CP Pignon, A Wu, Z Jin, GL Hammer, DB Lobell (2019) Water use efficiency as a constraint and target for improving the resilience and productivity of C3 and C4 crops. *Annual Review of Plant Biology* 70:781-808. https://doi.org/10.1146/annurev-arplant-042817-040305.
68. NE Choquette, F Ogut, TM Wertin, CM Montes, CA Sorgini, AM Morse, PJ Brown, **ADB Leakey**, LM McIntyre, EA Ainsworth (2019) Uncovering hidden genetic variation in photosynthesis of field-grown maize under ozone pollution. *Global Change Biology* 25, 4327-4338.
69. JPR dos Santos, SB Fernandes, S McCoy, R Lozano, PJ Brown, **ADB Leakey**, ES Buckler, AAF Garcia and MA Gore (2020) Novel Bayesian Networks for Genomic Prediction of Developmental Traits in Biomass Sorghum. *G3 – Genes Genomes Genetics* 10(2):769-781.
70. S Bharath, ET Borer, LA Biederman, DM Blumemthal, PA Fay, LA Gherardi, JMH Knops, **ADB Leakey**, L Yahdjian, EW Seabloom (2020) Nutrient addition increases grassland sensitivity to droughts. *Ecology* https://doi.org/10.1002/ecy.2981
71. JM Wedow, C Burroughs, L Rios Acosta, **ADB Leakey**, Ainsworth EA (2021) Age-dependent increase in a-tocopherol and phytosterols in maize leaves exposed to elevated ozone pollution. *Plant Direct* 5, e00307.
72. CP Pignon, **ADB Leakey**, SP Long, J Kromdijk (2021) Drivers of natural variation in water-use efficiency under fluctuating light are promising targets for improvement in sorghum. *Frontiers in Plant Science* 12:627432.
73. KS Ely, A Rogers, DA Agarwa, EA Ainswort, L Albert, A Ali, J Anderson , MJ Aspinwall, C Bellasio, CJ Bernacchi, S Bonnage, TN Buckley, J Bunce, AC Burnett, FA Busch, A Cavanagh, LA Cernusak, R Crystal-Orenelas, J Damerow, KJ Davidson, MG De Kauwe, MC Dietze, TF Domingues, ME Dusenge, DS Ellsworth, JR Evans, PPG Gauthier, BO Gimenez, EP Gordon, CM Gough, AH Halbritter, DT Hanson, M Heskel, JA Hogan, JR. Hupp, K Jardine, JKattge, T Keenan, J Kromdijk, DP Kumarathunge, J Lamour, **ADB Leakey**, DS LeBauer, Q Li, MR Lundgren, N McDowell, K Meacham-Hensold, BE Medlyn, DJP Moore, R Negron-Juarez, Ü Niinemets, CP Osborne, AL Pivovaroff, HPoorter, SC Reed, Y Ryu, A Sanz-Saez, SC Schmiege, SP Serbin, TD Sharkey, M Slot, NG Smith, BV Sonawane, PF South, DC Souza, JR Stinziano, E Stuart-Haentjens, SH Taylor, MD Tejera, J Uddling, V Vandvik, C Varadharajan, AP Walker, BJ Walker, JM Warren, DA Way, BT Wolfe, J Wu, SD Wullschleger, C Xu, Z Yan, D Yang (2021) A reporting format for leaf-level gas exchange data and metadata. *Ecological Informatics*, doi.org/10.1016/j.ecoinf.2021.101232
74. S Varela, T Pederson, CJ Bernacchi, **ADB Leakey** (2021) Understanding Growth Dynamics and Yield Prediction of Sorghum Using High Temporal Resolution UAV Imagery Time Series and Machine Learning. *Remote Sensing* 13:1763. https://doi.org/10.3390/rs13091763
75. PT Prakash, D Banan, RE Paul, MJ Feldman, D Xie, L Freyfogle, I Baxter, **ADB Leakey** (2021) Correlation and co-localization of QTL for stomatal density and canopy temperature under drought stress in Setaria. *Journal of Experimental Botany* 72(13): 5024-5037.

76. NS Jaikumar, SS Stutz, SB Fernandes, **ADB Leakey**, CJ Bernacchi, PJ Brown, SP Long (2021) Can improved canopy light transmission ameliorate loss of photosynthetic efficiency in the shade? An investigation of natural variation in *Sorghum bicolor*. *Journal of Experimental Botany* 72(13):4965-4980.

77. J Xie, SB Fernandes, D Mayfield-Jones, G Erice, M Choi, AE Lipka, **ADB Leakey** (2021) Optical topometry and machine learning to rapidly phenotype stomatal patterning traits for maize QTL mapping. *Plant Physiology* 187:1462-1480.

78. JF Ferguson, SB Fernandes, B Monier, ND Miller, D Allen, A Dmitrieva, P Schmuker, R Lozano, R Valluru, ES Buckler, MA Gore, PJ Brown, EP Spalding, **ADB Leakey** (2020) Machine learning enabled phenotyping for GWAS and TWAS of WUE traits in 869 field-grown sorghum accessions. *Plant Physiology* 187:1481-1500.

79. CP Pignon, SB Fernandes, R Valluru, N Bandillo, R Lozano, ES Buckler, MA Gore, SP Long, PJ Brown, **ADB Leakey** (2021) Phenotyping stomatal closure by thermal imaging for GWAS and TWAS of water use efficiency-related genes. *Plant Physiology* 187:2544-2562.

80. AB Keller, E Borer, S Collins, P Fay, LC Delancey, KS Hofmockel, **ADB Leakey**, MA Mayes, E Seabloom, CA Walter, Y Wang, Q Zhao, SE Hobbie (2022) Soil carbon stocks in temperate grasslands differ strongly across sites but are insensitive to decade-long fertilization. *Global Change Biology* 28(4):1659-1677.

81. S Varela, TL Pederson, **ADB Leakey** (2022) Implementing Spatio-Temporal 3D-Convolution Neural Networks and UAV Time Series Imagery to Better Predict Lodging Damage in Sorghum. *Remote Sensing* 14(3):733.

82. J Lamour, KJ Davidson, KS Ely, G Le Moguedec, **ADB Leakey**, QY Li, SP Serbin, A Rogers (2022) An improved representation of the relationship between photosynthesis and stomatal conductance leads to more stable estimation of conductance parameters and improves the goodness-of-fit across diverse data sets. *Global Change Biology* early access 10.1111/gcb.16103.

83. AB Rajurkar, SM McCoy, J Ruhter, J Mulcrone, L Freyfogle, **ADB Leakey** (2021) Installation and imaging of thousands of minirhizotrons to phenotype root systems of field-grown plants. BioRXiv https://doi.org/10.1101/2021.09.13.460133

84. R Ding, J Xie, D Mayfield-Jones, Y Zhang, S Kang, ADB Leakey (2021) Plasticity in stomatal behavior across a gradient of water supply is consistent among field-grown maize inbred lines with varying stomatal patterning. BioRXiv https://www.biorxiv.org/content/10.1101/2021.10.28.466255v1

85. AV Nanni, AM Morse, JRB Newman, NE Choquette, JM Wedow, Z Liu, **ADB Leakey**, A Conesa, EA Ainsworth, LM McIntyre (2022) Ozone sensitivity of diverse maize genotypes is associated with differences in gene regulation, not gene content. *Genome Research*, under review.

D. 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, **ADB 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.

3. †R Bailey, TG Benton, A Challinor, J Elliott, D Gustafson, B Hiller, A Jones, M Jahn, C Kent, K Lewis, T Meacham, M Rivington, D Robson, R Tiffin, D Wuebbles, J Beghin, J Buttriss, R Bhunnoo, C Brown, K Carlson, E Chavez, N deVore, K Donaldson, R Douglas, G Friend, O Gray, J Gulledge, J Hjelle, J Horrell, K Huddah, D Krohn, **ADB Leakey**, M Levy, V Loughlan, B Phillipson, G Prpich, S Robinson, S Sharpe, L Stanbrough, J Westwood (2015) *Extreme weather and resilience of the global food system*. Final Project Report from the UK-US Taskforce on Extreme Weather and Global Food System Resilience, The Global Food Security Programme, UK.

4. D Wubbles, J Angel, K Petersen, M Lemke, D Abrams, J Allen, A Ballinger, J Coppess, S Czesny, Q Dai, S Dorevitch, J Ellis, T Ford, B Gramig, E Grossman, A hager, C Harbach, L Iverson, A Jain, W Kelly, M Khanna, P Kumar, K Kunkel, ADB Leakey, TS Lin, M Markus, J Matthews, S McConkey, G McIssac, J Miller, W Miller, A Packman, J Quebedeaux, C Roswell, S Saha, S Sanyal, N Seiter, A Sharma, T Steckler, C Stone, C Suski, J Taft, E Wahle, M Ward, Z Zhang (2021) *An assessment of the impacts of climate change in Illinois*. The Nature Conservancy, Illinois, https://doi.org/10.13012/B2IDB-1260194_V1.

IV. UNIVERSITY TEACHING

A. Classroom teaching

2007-present	Undergraduate and graduate class – "Plants and Global Change"
2008-2013	Undergraduate class – "Global Warming, Biofuels and Food"
2015	Undergraduate and graduate class – "Ecosystem Ecology"
2016	Undergraduate class – "Environmental Biology"
2017-2019	Undergraduate class – "Ecology"

B. Research Mentorship

Supervisor to 2 M.Sc. students

Supervisor to 11 Ph.D. students

Supervisor to 15 postdoctoral scholars

Supervisor to 4 international visiting scientists

Member of examination committee for 17 graduate students

Mentor to >50 undergraduate researchers