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# Curriculum Vitae

## Graham Douglas FARQUHAR AO, FAA, FRS, NAS

Research School of Biology  
College of Medicine, Biology and Environment  
Australian National University

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**Address:** 702 Burra Road  
Burra NSW 2620

**Date of Birth:** 8 December 1947

### Academic Qualifications

1968 BSc Australian National University  
1969 BSc University of Queensland Honours in Biophysics  
1973 PhD Australian National University  
- Supervisors: IR Cowan and RO Slatyer  
2006 Doctor Honoris Causa, Universiteit Antwerpen  
2013 Doctor Honoris Causa, University of Wageningen

### Academic Awards and Distinctions

1968 Biophysics Scholarship  
1970 -73 Commonwealth Post-graduate Scholarship  
1980 P.L. Goldacre Award from the Australian Society of Plant Physiologists  
1981 Senior Scientist Award under the Japan/Australia Science and Technology Agreement for collaborative research at RIKEN  
1982 Australian American Educational Foundation (FULBRIGHT) Senior Scientist Fellowship for research at Carnegie Institution of Washington, Stanford  
1983 Gottschalk Medal from the Australian Academy of Science  
1984 British Council Academic Links and Interchange Scheme Award  
1986 Australia - Royal Society Exchange Award  
1987 Bourse de haut niveau du Ministère de la Recherche et de l'Enseignement Supérieur de France  
1988 Elected to Fellowship of the Australian Academy of Science  
1991 Elected to Corresponding Membership of the American Society of Plant Physiologists  
1991 CSIRO Medal for research achievement  
1995 Elected to Fellowship of Royal Society (of London)  
2001 Leading Australian Citation Laureate  
2001 CSIRO Medal for team research  
2004 Top100 Award  
2005 JG Wood Lecturer (Australian Society of Plant Scientists)  
2005 Gary Comer Climate Change Mentor Award  
2006 Honorary Doctorate, Universiteit Antwerpen  
2009 Land & Water Senior Research Fellowship  
2011 Alexander von Humboldt Research Award  
2013 Einstein Professor of Chinese Academy of Sciences  
2013 Honorary Doctorate, University of Wageningen  
2013 Elected Foreign Associate of the U.S. National Academy of Sciences  
2013 Honorary Professorship, Centre for Agricultural Resources Research Shijiazhuang, Chinese Academy of Sciences  
2015 Carnegie Centenary Professorship (Universities of Scotland)

2015 Elected to Life Membership of the Australian Society of Plant Scientists  
2016 Macfarlane Burnet Medal and Lecture

### **Other Awards and Distinctions**

2003 Centenary Medal: Citation '*For service to Australian society and science in plant physiology*'.  
2006 Royal Society of Tasmania R.M. Johnston Memorial Medal. Awarded to "a scholar of great distinction in any field within the Society's purview."  
2007 Shared Nobel Prize: Inter-governmental Panel on Climate Change  
2011 Peter Baume Award: The Australian National University's highest award  
2013 Order of Australia Officer (AO) in the General Division  
2014 Rank Prize (U.K.) (Nutrition, animal & crop husbandry - shared with RA Richards)  
2015 Prime Minister's Prize for Science

### **Membership of Learned Societies**

- Australian Society of Plant Scientists
- Australian Academy of Science
- American Society of Plant Biologists
- Royal Society of London
- American Geophysical Union
- European Geosciences Union
- U.S. National Academy of Sciences

### **Fields of Interest**

- Integration of photosynthesis and growth with nitrogen and water use of plants
- Stomatal physiology
- Isotopic composition of plants
- Global change science

### **Present Position**

Distinguished Professor at The Australian National University (ANU) since 2003

### **Other Posts**

1973 - 75 Research Associate, DOE Plant Research Laboratory, MSU  
1975 - 76 Research Specialist, DOE Plant Research Laboratory, MSU  
1976 - 80 Research Fellow, ANU  
1980 Senior Research Fellow, ANU  
1980 - 83 Fellow, ANU  
1983 - 88 Senior Fellow, ANU  
1988 - 2003 Professor, ANU  
1988 - 89 Group Leader of Plant Environmental Biology, RSBS, ANU  
1998 - 2001 Deputy CEO and Program Leader, CRC for Greenhouse Accounting  
1994 - 2009 Group Leader of Environmental Biology Group, RSBS, ANU  
2005 - 2008 Associate Director, Research School of Biological Sciences (RSBS)

### **Other Activities**

#### **The Australian National University**

1980 - 90 Member, ANU Arts Centre Committee of Management  
1994 - 97 Chairman, ANU Global Change Confederation  
1998 - 99 Member, Board of the Institute of Advanced Studies, ANU  
2001 Member, Steering Committee for the National Institute of Bioscience  
2002 - 05 Member, Academic Board, ANU

- 2002 - 05 Member, National Institute for the Environment  
2002 Member, Advisory Board of the ANU Centre for Complex Systems  
2003 - 04 Chair, Board of Institute of Advanced Studies [from Sept 2003]  
2004 - 05 Chair, Institute of Advanced Studies Forum  
2005 Member, Board of the Faculties  
2005 Member ANU-CSIRO Alliance Steering Committee and ANU Focus Group for Changing Research Practices  
2005 Member, ANU Relationships and Funding Planning Groups  
2005 Member, ANU Research Development Working Group  
2005 - 2008 Board Member, Australian National University Institute for Environment  
2006 – 2009 ANU Person Designated to Receive Formal Complaints in Science  
2007 - 2009 Member, Senior Advisory Board, BioSolar Project  
2009 - 2010 Member, Institute of Advanced Studies sub-committee of the University Research Committee  
2010-current ANU Research Misconduct Assessor for Science  
2013- Member Selection Committee for JG Crawford Prize

### Australian Academy of Science

- 1990 - 94 Member, Sectional Committee 5,  
1993 Member, National Primary School Project Advisory Committee  
1993 Chairman, Gottschalk Award Committee  
1994 - 97 Member, Council  
1996 - 97 Chairman, AAS National Committee on Climate and Global Change  
1996 - 97 Vice President  
2007 – 2011 Member, Video Histories Committee  
2007 - 2011 Vice President and Secretary (Biological), member of Executive Committee and of Council

### Royal Society

- 2007 – current Member, Theo Murphy Fund Advisory Board  
2010 -2011 Member, Organising Committee, Reducing Greenhouse Gas Emissions from Agriculture: Meeting the Challenges of Food Security and Climate Change. London 28Feb-1 Mar 2011  
2014 – 2016 Member of Sectional Committee 9

### Journal Editorial and Advisory Boards

- 1984 - 89 Member, Advisory Committee for the *Australian Journal of Plant Physiology*  
1985 - 93 Member, Editorial Board of *Planta*  
1986 - 89 Member, Editorial Advisory Panel of *Tree Physiology*  
1986 - Member, Editorial Board of *Functional Ecology* (British Ecological Society)  
1987 - Current Member, Review Board of *Plant, Cell and Environment*  
1990 - 94 Chairman, Advisory Committee for the *Australian Journal of Plant Physiology*  
Member, Board of the Australian Journals of Scientific Research  
1993 - 96 Member, Editorial Board, *Plant and Soil*  
1993 - 99 Member, Editorial Review Board, *Tree Physiology*  
1994 - 98 Member, Editorial Board, *Oecologia*  
1997 - 2001 Subject Editor, *Plant, Cell and Environment*  
2002 - Editorial Board – *Mitigation and Adaptation Strategies for Global Change*  
2005 - Associate Editor, *Plant Cell & Environment*  
2005 -2008 Chair, *Functional Plant Biology* Editorial Advisory Committee  
2005 -2008 Member Board of Standards for CSIRO/AAS Journals  
2008 - Associate Editor, *Ecohydrology*  
2008 - Associate Editor – *Water Resources Research*  
2011 - Member Advisory Board *Environment Control in Biology* (Japan)  
2013- Associate Editor *Plant Physiology*

### Other Professional Bodies Activities

- 2003 -2008 Board Member, Federation of Australian Scientific and Technological Societies

2004 -2010 Board Member, Australian Society of Plant Biologists

### **Institute/Organisation Reviews and Scientific Advisory Boards**

1992 Member, INRE Review Committee on CSIRO Division of Atmospheric Research  
1998 Reviewer, with Ray Walker, of Australian Biological Resources Study (ABRS) for Environment Australia  
2002 Reviewer, University of Western Australia's Institute of Advanced Studies  
2004 - Current Member, Scientific Advisory Board for the Max-Planck-Institute for Biogeochemistry  
2005 - 2007 Member of Review Panel, Australian Nuclear Science and Technology Organisation (ANSTO) "Isotopic Tracers in Atmospheric Transport" (*IsoTrans*) project  
2005 Member Expert Advisory Board of Impacts Centre for Southeast Asia (ICSEA)  
2008 Reviewer UK Biotechnology and Biological Research Council (BBSRC) Climate Change Strategic Review of Climate Change Research  
2009 Panellist for NSF/Gates Foundation *BREAD* Program  
2010 Mentor for NSF/BBSRC Photosynthesis Ideas Lab  
2012 Member, Max Planck Research Field Commission  
2013 - current Member, Singapore National Research Foundation Competitive Research Program Panel  
2015 Member, Griffith University Environmental Futures Research Institute Advisory Committee.

### **Co-founder Cooperative Research Centre for Greenhouse Accounting**

1998-2000 Deputy CEO and Program Leader,  
2001-2006 Board alternate  
2002-2006 Member, Management Team

### **Government Service**

1994 - 98 Chairman, National Greenhouse Gases Inventory Working Group on Carbon Dioxide from the Biosphere  
1997 Science adviser and Australian delegate to Framework Convention on Climate Change, Conference of Parties, Kyoto  
1997 - 2000 Member, Greenhouse Science Advisory Committee  
1997 - 1999 Member, Reference Group for Greenhouse Challenge Sinks Workbook  
1998 - Member, High Level Steering Committee, National Carbon Accounting System, Australian Greenhouse Office  
2002 Member, Minister's Consultative Panel on National Research Priorities  
2002 Member of Minister's Reference Group on Mapping Australia's Science and Innovation System  
2007 - 2008 Member, Climate Change Research Strategy for Primary Industries. Joint Federal, State & Territory governments, CSIRO, Rural Research & Development Corporation; managed by Land & Water Australia

### **Australian Research Council**

1990 - 1993 Member, Biological Panel, Research Grants Committee  
2005 - 2008 Australian Reader  
2014- PI ARC Centre of Excellence on Translational Photosynthesis

### **International Committees**

1983 Australian organiser of US/Australia Science and Technology Agreement Workshop on Stomatal Function  
1986 - 93 Elected to International Photosynthesis Committee  
1986 - 96 Member, Australian Committee for International Geosphere - Biosphere Programme (IGBP)  
1989 - 90 Member, International Coordinating Panel on Biospheric Aspects of the Hydrological Cycle (IGBP)  
1990 - 93 Member, Scientific Steering Committee, International Global Atmospheric Chemistry Project (IGAC/IGBP)  
1994 - 96 Member, South-East Asian Regional Committee for START  
1994 - 96 Chairman, Australian Committee for IGBP.

- 2006 – 2007 Member, Scientific Advisory Committee for Isotopes 2007 conference, Benicassim, Spain.
- 2008 - 2011 Member, Scientific Committee for International Botanical Congress, Melbourne 2011
- 2009 Member, Scientific Steering Committee for the International Carbon Dioxide Conference 2009, Jena, Germany.
- 2010–2013 Member International Organizing Committee for the fourth InterDrought congress (ID4), Perth (Australia) in September 2013
- 2010-2012 Member of the International Scientific Board (ISB) of the joint FESPB/EPSO Plant Biology Congress (July 29th to August 3rd, 2012. Freiburg, Germany).

### **Inter-governmental Panel on Climate Change**

- 1994 - 96 Lead Author on Second Assessment Report
- 1994 Member, Australian Academy of Technology Sciences and Engineering Steering Committee on Climate Change
- 1998 - 2001 Lead Author on Third Assessment Report
- 1988 – 2000 Convening Lead Author on Special Report on Land Use, Land Use Change and Forestry
- 2006 – 2007 Reviewer for Fourth Assessment Report

### **Patents**

Masle J, Gilmore SR and Farquhar GD. "The use of the ERECTA gene to control water use efficiency in plants": International Patent Application, number WO 2004/005555 A1 (priority date 02 July 2002). Granted Aug 7, 2008 in Australia AU 2003/236580 B2, in Germany DE 60336328 D1 Apr 21, 2011, in Spain ES 2362903 T3 Jul 14, 2011.

### **Publications**

321 research publications (see below)

### **Books**

- Stomatal Function. 1987. EF Zeiger, GD Farquhar, IR Cowan (eds). Stanford University Press. Stanford, California
- Perspectives of Plant Carbon and Water Relations from Stable Isotopes. 1993. J Ehleringer, AE Hall, GD Farquhar (eds). Academic Press, NY
- Plants in Action: Adaptation in Nature, Performance in Cultivation. 1999. B Atwell, P Kriedemann, C Turnbull (eds). D. Eamus, R. Bielecki (Co-eds.) G. Farquhar (Consulting ed.). Macmillan

### **Lectures**

#### **Invited lectures given at the following International and Australian Symposia**

2015 Water-use efficiency and water use effectiveness, a stomatal perspective using stable isotopes. University of Edinburgh, Scotland, July 23.

Predicted and observed multi-decadal changes in climate, with particular reference to precipitation and crop demand for water. University of Aberdeen, Scotland. July 15.

Water-use efficiency and water use effectiveness, a stomatal perspective using stable isotopes. Glasgow University, Scotland, June 15.

Predicted and observed multi-decadal changes in climate, with particular reference to precipitation and crop demand for water. Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, June 6.

Predicted and observed multi-decadal changes in climate, with particular reference to precipitation and crop demand for water. Opening address to Water and Food Security under

Changing Environments Center for Agricultural Water Research in China, China Agricultural University (CAU) Beijing June 1 – 7

Climate Change Effects on Vegetation, and *Vice Versa*. From leaves to ecosystems: Plants in a changing world. 10<sup>th</sup> Annual Harvard Plant Biology Symposium. Harvard University, May 6

Water-use efficiency and water use effectiveness, a stomatal perspective using stable isotopes. Umeå University, Sweden, 22 January.

2014 Global dimming, stilling, evaporative demand and transpiration. American Society of Agronomy AGM. Long Beach, CA, USA 4 November

Heavy water fractionation during transpiration. Daintree meeting, James Cook University 15 September

Water-use efficiency and water use effectiveness, a stomatal perspective using stable isotopes. Princeton University 12 August

High VPD & rapid transpiration rate: a direct source of stress. Salt & Water Stress in Plants. Gordon Research Conference, Newry, Maine 5 August

Predicted and observed multi-decadal changes in climate, with particular reference to precipitation and crop demand for water *Breeding Plants to Cope with Future Climate Change* University of Leeds 17 June

Some Effects of Atmospheric and Climate Change on Photosynthesis and Transpiration at Various Scales, (and *vice versa*). Gordon Research Conference. CO<sub>2</sub> Assimilation in Plants: Genome to Biome. Waterville Valley, NH 9 June

Modeling carbon uptake and water use by plants: Evaluation of the assumptions included in gas exchange measurements (Ubierna *et al.*) Gordon Research Conference. CO<sub>2</sub> Assimilation in Plants: Genome to Biome. Waterville Valley, NH 12 June

Scaling leaf level photosynthetic models from the leaf to the canopy. Joint CAS-CSIRO Workshop “*Improving Photosynthesis and Yield Potential in Cereal Crops : Modelling, Mechanisms and Methods*” 1 June

Water-use efficiency and water use effectiveness, a stomatal perspective using stable isotopes. University of South Australia, Mawson Lakes 19 May

Wheat and climate change. Borlaug Summit on Wheat for Food Security. CIMMYT, Obregon, Mexico, 27 March

Water-use efficiency and water use effectiveness, a stomatal perspective using stable isotopes. East Malling Research February 11; Plant Sciences, Cambridge University Feb 12; Plant Science, Glasgow University Feb 14; WSL ETH Zürich Switzerland April 3.

Water-use efficiency in wheat (with Richard Richards). 2014 Rank Prize Presentation, February 10, London

2013 Water-use efficiency and water use effectiveness, a stomatal perspective using stable isotopes. Opening Address: Water & Agriculture Forum. Chinese Academy of Sciences, Shijiazhuang. June 17.

Opportunities for improving plant water-use efficiency PIARN Symposium – Farm Profitability in a Food Insecure World. University of Melbourne, June 3

Relating variations in runoff to variations in climatic conditions and catchment properties. Opening hydrological talk. European Geophysical Union, April 8, Vienna, Austria.

Climate change and some likely effects on photosynthesis, evaporation and food production. Dies Natalis. March 15. University of Wageningen.

- Integrating photosynthetic carbon assimilation from the leaf to the canopy. March 13. University of Wageningen.
- Some thoughts on responses of vegetation to increased [CO<sub>2</sub>]. March 13. University of Wageningen.
- 2012 Concepts and models of stomatal function and functioning. Opening address. *Stomatal conductance through time: towards accurate estimates of physiological CO<sub>2</sub> –forcing of the climate*. September 17. Royal Netherlands Academy of Science, Amsterdam.
- Several lectures, July-August. Chinese Academy of Science, Beijing & Xinjiang, China
- From Guard Cell to Globe. INRA Nancy, June 22, France
- From Guard Cell to Globe. Universiteit Würzburg, June 4, Germany
- Linking plant physiology to landscape issues using stable isotope technology. January 5, ZALF, Berlin, Germany.
- 2011 Some Thoughts on Isoscapes. Keynote address. *Isoscapes 2011*. September 26, Purdue, USA.
- Modelling of photosynthesis and stomatal conductance; global isotope modeling. *Workshop on Forest sensitivity to CO<sub>2</sub>*. August 1. Sydney University.
- Integrating photosynthetic carbon assimilation from the leaf to the canopy in the context of global change. Major Speaker, *Annual General Meeting, American Society of Plant Biology* August 9, Minneapolis, USA
- Water-use efficiency and Water-use effectiveness. *Australia-US Science and Technology Joint Commission Meeting*. February 14, Washington, USA
- 2010 Global change, soil water content, stomatal behavior and the statistics of rainfall. American Geophysical Union AGM. December, San Francisco, USA
- Climate change and its likely effects on photosynthesis, evaporation and food production. International Photosynthesis Congress August 27, Beijing, China.
- Photosynthesis: a litany of limitations *NSF Photosynthesis Ideas Lab Planning Meeting* June 30, Washington, USA
- 2009 Plant Water Use Effectiveness. Keynote Address, *10th Australasian Environmental Isotope Conference & 3rd Australasian Hydrogeology Research Conference* 1-3 December 2009, Perth, WA
- Climate change and its likely effects on food production. Opening Plenary Address, *The 3rd International Conference on Integrated Approaches to Improve Crop Production Under Drought Prone Environments (Interdrought III)*, October 12, Shanghai, China
- Evaporative demand, transpiration, and photosynthesis: How are they changing? Atmosphere and Climate Colloquium, April 27, IACETH (Institute for Atmospheric and Climate Science, Swiss Federal Institute of Technology), Zurich, Switzerland.
- Evaporative demand, transpiration, and photosynthesis: How are they changing? EGU (European Geosciences Union) General Assembly, *Land-climate interactions from models and observations: Implications from past to future climate* session, April 19-24, Vienna, Austria.
- 2008 Carbon isotope discrimination, water-use efficiency and water-use effectiveness. *Resource Capture by Crops: Integrated Approaches*, September 10-12, University of

Nottingham, Sutton Bonington, United Kingdom.

Carbon Isotope discrimination by leaves.

*Joint European Stable Isotopes User Group (JESIUM)* August 31 – September 5, Presqu'île de Giens, France.

Carbon isotope discrimination, water-use efficiency and water-use effectiveness.

*International Workshop on Soil-Plant Interactions and Sustainable Agriculture in Arid Environments*, July 11-18, Shihezi University, Xinjiang, China.

Pan Evaporation – wind speed.

*Miniconference on Relative Humidity, Earth Temperature and Climate Change*, June 23-24; Lamont-Doherty Earth Observatory of Columbia University, New York USA

Opening Address

Uni Sydney Faculty of Agriculture, Food and Natural Resources Symposium *Facing climate change: Research on adaption of agro-ecosystems*, June 13, University of Sydney.

CO<sub>2</sub>, climate change, and agriculture: it's more or less about water.

and,

Carbon isotope discrimination and plant water-use effectiveness.

*Distinguished Ecologist Lecture Series*, April 11-15, University of Wyoming, Laramie, US.

2007 PenPan: A general tool for the attribution of changing pan evaporation.  
AGU Meeting, San Francisco, USA.

The economics of plant water loss and photosynthetic carbon gain.  
Guangzhou, China

The economics of plant water loss and carbon gain.

Evaporative demand and the hydrological cycle.

Université Paris Sud XI, Paris, France.

Implications of climate change for water use by agriculture and natural ecosystems.

Treasury Seminar Series, Canberra.

Carbon isotope discrimination and water-use effectiveness.

LaTrobe University, Melbourne.

CO<sub>2</sub> climate change, and agriculture: it's more or less about water.

LaTrobe University, Melbourne.

Terrestrial carbon sequestration and impacts on global greenhouse gas emissions.

Australian Bureau of Agricultural and Resource Economics (ABARE) Boathouse IV Meeting "Climate Change Impacts: Adaption and Mitigation Policy Responses".

The evaporation paradox, and the roles of global dimming and stilling.

Comer Science and Education Foundation "Gary C. Comer Abrupt Climate Change Fellowship Conference", New York, US.

Climate change, temperature changes and plant responses.

International Rice Research Institute (IRRI) workshop on "Cool rice for a warmer world", Wuhan, China.

CO<sub>2</sub>, climate change, and agriculture: it's more or less about water.

Australian Bureau of Agricultural and Resource Economics (ABARE) Outlook 2007 Conference, Canberra.

Plant physiological responses to environmental forcing - How do stable isotopes behave?

European Science Foundation (ESF) Stable Isotopes in Biospheric-Atmospheric Exchange (SIBAE) Workshop on: "Stable Isotopes in Dendroclimatology - Current Status and Future Prospects." GeoForschungszentrum Potsdam (GFZ), Germany.

2006 Revisiting optimisation theory and transpiration efficiency.  
The Biology of Transpiration: From Guard Cells To Globe. American Society of Plant



Biologists Conference, Snowbird, Utah, US.

Carbon isotope discrimination by Rubisco and diffusion in leaves: applications to plant water-use efficiency and finding a gene.

The 5<sup>th</sup> International Conference on Applications of Stable Isotope Techniques to Ecological Studies, Queens University, Belfast, Ireland

Plant water-use efficiency and carbon isotope discrimination  
Monash University, Melbourne.

The ACCESS Initiative: Understanding the Future Functioning of Australia's Landscapes.  
Australian Academy of Science, Canberra

Carbon isotope discrimination and plant water-use efficiency: ideas, agricultural uptake and now a gene.

Royal Society of Tasmania, Tasmania.

Increasing Atmospheric CO<sub>2</sub> and its Implications

Global Change And The Earth System Symposium on ANU Research, Canberra

Worldwide Changes in Atmospheric Composition and Evaporative Demand and their Effects on Plant Growth and Water Use.

Carbon isotope discrimination and plant water-use efficiency: ideas, agricultural uptake and now a gene.

Peking University, Beijing, China.

Carbon isotope discrimination and plant water-use efficiency.

Universiteit Antwerpen, Belgium.

Plant water-use efficiency and carbon isotope discrimination.

South African Plant Breeders Association 6<sup>th</sup> Annual Symposium, Langebaan, South Africa.

Climate change and the carbon cycle: Nonlinearities & uncertainties. British Council

Workshop International Networking for Young Scientists. Australian National University

2005

Carbon isotope discrimination and water-use effectiveness.

Melbourne University, Melbourne.

Worldwide Changes in Evaporative Demand. Working Group on 'Water and the Environment'. Vatican City.

Evaporative Demand and Climate Change.

Abrupt Climate Change Fellowship Roundtable 2005. Palisades, New York.

Carbon isotope discrimination and water-use efficiency.

J G Wood Lecture, ComBio2005. Adelaide

From Pan Evaporation to Pinatubo.

Energy Modelling Forum, Climate Change Impacts and Integrated Assessment Meeting, Snowmass, Colorado, USA

From the chloroplast via stomata to the atmosphere and back.

Isotopes 2005 Bath. University of Bath, UK.

Trends in Pan Evaporation, Global Dimming and Brightening: Theory, Observations and Implications for the Terrestrial Water Balance

Carbon Gain and Water use by Plants, and Their Interpretation Using Stable Isotopes Are Estimates of the Terrestrial Water Balance All Wet?

2005 Distinguished Ecologist Lecture Series. Colorado State University, USA

Trends in Pan Evaporation, Global Dimming and Brightening: Theory, Observations and Implications for the Terrestrial Water Balance

Institute for Multi-disciplinary Earth Studies, National Centre for Atmospheric

Research. Boulder, USA

Drier or Wetter Under Climate Change?

Science Meets Parliament Forum "Climate Change: what is the scientific consensus?", Canberra, ACT.

2004

The pan evaporation paradox – an overview of the scope of the problem. Australian Academy of Science Pan Evaporation Workshop. Canberra, ACT

Trends in Pan Evaporation: Theory, Observations and Implications for the Terrestrial Water Balance.

16<sup>th</sup> Australian and New Zealand Climate Forum, Lorne, Victoria

Modelling leaf water enrichment.

Biosphere-Atmosphere Stable Isotope Network (BASIN) and Stable Isotopes in Biospheric-Atmospheric Exchange (SIBAE) "Oxygen isotopes as a tracer linking global O<sub>2</sub>, CO<sub>2</sub>, and H<sub>2</sub>O cycles" joint meeting. Marshall, USA.

Carbon Gain and Water Use by Plants.

Gordon Research Conference, The Metabolic Basis of Ecology, Maine, USA

Pan Evaporation in the Southern Hemisphere: What is Happening?

AGU-CGU Union Joint Assembly, Magnitudes and causes of declining solar radiation at the surface: Montreal, Canada

Oxygen isotopes in leaf water, and CO<sub>2</sub> – remember the gross fluxes.

Stable Isotopes in Biospheric-Atmospheric Exchange (SIBAE) and Biosphere-Atmosphere Stable Isotope Network (BASIN) joint conference. Interlaken, Switzerland.

Entropy production during plant gas exchange.

Maximum Entropy Production Workshop: INRA Bordeaux-Aquitaine, France

2003

Oxygen isotope enrichment of leaf water and organic matter

SIBAE BASIN Workshop: Orvieto, Italy

Why is pan evaporation rate going down in the northern hemisphere if there is global warming?

The Climate Centre Fall 2003 Lecturer : Columbia University, USA LDEO Campus

Pan evaporation rate in the southern hemisphere: implications for greenhouse vs aerosols.

The Climate Centre Fall 2003 Lecturer: Columbia University, USA NASA/GISS Campus

Oxygen isotopes in leaf organic material.

NETCARB Third Summer School: Germany.

The cause of decreased pan evaporation over the past 50 years.

EGS-AGU-EU6 Joint Assembly: Nice, France.

The cause of decreased pan evaporation over the past 50 years

MEP Workshop: Bordeaux, France

Incorporating the effects of diffuse light in simple models of photosynthesis and evaporation: implications for a canopy and the globe.

Monsi & Saeki Symposium: Kyoto, Japan

- 2002 Processes affecting the  $^{18}\text{O}$  composition of leaf water. Stable Isotopes and Biosphere-Atmosphere Interactions. Banff, Canada
- On the spatial variation of the isotopic composition of leaf water. Stable isotope Techniques for the Analysis of Plant Metabolism, Nantes, France
- 2001 Unanswered questions about stomatal functioning. Forests at the Land-Atmosphere Interface, Edinburgh
- Biological questions on the Dole effect. Fourth International Symposium on Inorganic Carbon Utilization, Cairns
- Role of terrestrial sequestration in meeting Kyoto targets. Australian Petroleum Production and Exploration Association Ltd Conference, Hobart
- Honouring research in Australia: A Scientists Perspective. ISI Honouring Research in Australia, Canberra
- Applications of stable isotopes in palaeoecology. Spring Meeting American Geophysical Union, Boston
- Forests, Forest Industry and Greenhouse Effect. 14<sup>th</sup> Convocation of the International Council of Academics of Engineering and Technological Sciences – World Forests and Technology, Finland
- 2000 Forest, forest industry and greenhouse effect. Fourteenth CAETS Convocation, World Forests and Technology, Espoo, Finland
- Transpiration efficiency and carbon isotope discrimination. Water and Plants in the Landscape, CSIRO, Canberra
- 1999 Carbon dynamics: a major driver of global change. The Global Change Transects Workshop, Darwin
- Oxygen isotope composition of organic matter. International Conference on Stable Isotopes and Isotope Effects, Carry le Rouet, France
- Oxygen isotope composition of organic matter. Fifth European Symposium on Food Authenticity, La Baule, France
- Global change: a plant perspective using carbon and oxygen isotope ratios. Australian and New Zealand Society for Mass Spectrometry Conference, Thredbo
- Global change: a plant perspective using carbon and oxygen isotope ratios. Stable Isotope Techniques Workshop, University of Western Australia, Perth
- 1998 Kyoto – The Impact on Australia, APEC Centre, Melbourne
- Where could Australia's forests move with change in atmospheric composition: some ideas from plant physiology and the paleo-record. CSIRO and Bureau of Resource Science, Canberra
- Global change: a plant perspective. Yale University, Connecticut, USA
- Australian Quaternary Palaeoecology and Palaeoclimatology Workshop, Academy of Science, Canberra

- National Association of Forest Industries (NAFI), presentation at Greenhouse Stakeholders meeting, Canberra
- 1997 What are Stomates For? Journal of Experimental Botany Symposium, University of Kent, Canterbury, UK  
Vegetation-Climate-Atmospheric Interactions: Past, Present and Future. Royal Society Symposium, London, UK
- 1996 Design of a Carbon Cycle Observing System, Boulder, Colorado, USA  
Stable Isotopes and the Integration of Biological, Ecological and Geochemical Processes Conference, Newcastle, UK  
NCAR Summer Colloquium, Terrestrial Ecosystems and the Atmosphere, Boulder, Colorado, USA
- 1995 Global Change: a plant perspective, IGBP/ICSU Forum on Earth System Research, Beijing, China  
Plant response to CO<sub>2</sub>: Is plant growth being stimulated by increasing atmospheric CO<sub>2</sub>? US National Academy of Sciences, Colloquium on Carbon Dioxide and Climate Change, Irvine, California, USA
- 1994 Signals from plants seen in atmospheric CO<sub>2</sub> and its isotopes, 5th Australian Environmental Isotopes Conference, Brisbane  
Biosphere 2 - a plant perspective, Space Biosphere Ventures, Oracle, Arizona, USA  
The global carbon budget, Greenhouse '94, Wellington, New Zealand
- 1993 Ecophysiology and Genetics of Trees and Forests in a Changing Environment, Viterbo, Italy  
Genetic and environmental effects on carbon and oxygen isotope discrimination during CO<sub>2</sub> assimilation, International Botanical Congress, Yokohama, Japan  
Optimisation of stomatal behaviour and water-use efficiency at elevated CO<sub>2</sub> concentration and temperature, International Botanical Congress, Yokohama  
<sup>18</sup>O effects during CO<sub>2</sub> assimilation, International CO<sub>2</sub> Conference, Carqueiranne, France
- 1992 International Symposium on Perspectives of Plant Carbon and Water Relations from Stable Isotopes, Riverside, California, USA  
Photosynthetic Responses to the Environment, Kona, Hawaii  
IPCC meeting on Biotic Feedbacks in the Global Carbon Cycle, Wood's Hole, Massachusetts, USA
- 1991 International Global Atmospheric Chemistry, San Jose dos Campos, Brazil  
International Symposium: Physiology and Determination of Crop Yield, Gainesville, Florida, USA
- 1990 Degradation of Vegetation in Semi-Arid Regions: Climate Impact and Implications, Sydney  
Mathematical and Statistical Modelling of Global Change Processes, Canberra  
Water and Life: Comparative Analysis of Water Relationships at the organismic, Cellular and Molecular Levels, Crans-sur-Sierre, Switzerland  
Trends in Photosynthetic Research, Palma de Mallorca, Spain  
FAO/IAEA International Symposium on the Use of Stable Isotopes in Plant Nutrition, Soil Fertility and Environmental Studies, Vienna, Austria  
Scaling Processes between Leaf and Landscape Levels, Snowbird, Utah, USA
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- 1989 International Geosphere-Biosphere Workshop: Global Change - A Plant Perspective, Brisbane  
Symposium on Perspectives in Biochemical and Genetic Regulation of Photosynthesis, New Haven, USA  
Symposium on Stomatal Resistance, University Park, Pa, USA  
Rockefeller Foundation Meeting on the Potentials of Biotechnology for Improving Grain Yield of Rice under Water Limited Conditions, Bellagio, Italy
- 1988 International Geosphere-Biosphere Programme on Global Change, Canberra  
Society for Experimental Biology, Symposium on Plants under Stress, Lancaster, UK  
Royal Society meeting on Measurement of Photosynthesis, London, UK  
Photosynthesis Symposium, Stanford, USA  
US-Australia Workshop on Remote Sensing of Biosphere Functioning, Honolulu, USA
- 1987 6th Annual Plant Biochemistry and Physiology Symposium, Columbia, Missouri, USA  
Rubisco 87, Tucson, USA  
Vth International Conference on Mediterranean-Climate Ecosystems, Montpellier, France  
XIV International Botanical Congress, Berlin, West Germany  
Society for Experimental Biology Meeting on Plants and Temperature, Colchester, UK  
Second German-French Colloquium on advances in research and use of stable isotopes, Maria Laach, West Germany  
NATO Advanced Research Workshop, Forest Biomass for Fiber and Energy, Obidos, Portugal  
International Symposium on Improving Winter Cereals Affected by Temperature and Salinity Stresses, Cordoba, Spain
- 1986 NASA Conference on Climate-Vegetation Interactions, Goddard Space Applications of Stable Isotope Ratios to Ecological Research, UCLA Lake Arrowhead Conference Center, USA  
VII International Congress on Photosynthesis, Brown University, Providence, RI, USA
- 1985 The Changing Earth: an Australian Perspective, Canberra  
Regulation of CO<sub>2</sub> assimilation, Gordon Conference on CO<sub>2</sub> fixation by green plants, New Hampshire, USA  
BP Venture Research Conference, London, UK
- 1984 British Plant Growth Regulator Group Meeting, York, UK  
Conference on Coasts and Tidal Wetlands of the Australian Monsoon Region, Darwin
- 1983 Gordon Conference on the Chemistry and Physics of Isotopes, Santa Barbara, California, USA  
US-Australia Workshop on Stomatal Function, Honolulu, USA  
International Congress on Photosynthesis, Brussels, Belgium  
Symposium on the Kinetics of C<sub>3</sub> Photosynthesis, Tallinn, Estonia, USSR
- 1982 AAAS Conference on Plant Responses to Rising CO<sub>2</sub> concentration, Athens, Ga, USA

Ewing Symposium. Climate Processes: Sensitivity to Solar Irradiance and CO<sub>2</sub>, New York, USA

**PhD Students supervised [with graduation date]**

1979	SC Wong
1981	MC Ball
1981	S von Caemmerer
1981	G Constable
1984	SF Ledgard
1984	JR Evans
1986	A Brooks
1986	MUF Kirschbaum
1988	AG Condon
1990	D Bagnall
1992	S Henderson
1992	J Virgona
1992	C López-Castañeda
1993	H Gomez-Macpherson
1996	D de Pury
1996	G Beemster
1996	A van Herwaarden
1997	PJ Franks
1998	M Barbour
2001	J Yong
2001	M Böhm
2002	T June
2003	J Styles
	K Gan
	J Miller
	I Tremmel
2004	L Cernusak
2005	Y Zhou
2006	S. Gilmore [co-supervisor with Dr J. Masle]
2007	X. Sirault

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### ★ *Most significant publications*

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College of Medicine, Biology and Environment. All Departments. 94 Documents. 18 Researchers. Young people and intentional informal voting in Australia. Compared to most other advanced democracies, Australia experiences fairly high levels of both intentional and unintentional informal (or invalid) voting. Using survey data obtained predominantly from the Australian Election Study and more. Compared to most other advanced democracies, Australia experiences fairly high levels of both intentional and unintentional informal (or invalid) voting. Using survey data obtained predominantly from the A... MOLECULAR BIOLOGY. Faculty of Health and Medicine. About us. Faculty research overview. School of Biomedical Sciences and Pharmacy. About us. School research.Â To address this major Australian health problem, the laboratory has been working on translational melanoma research with a focused theme of "overcoming resistance of metastatic melanoma to treatment". Specifically, the group are working on overcoming resistance of melanoma cells to programmed cell death induced by newly developed targeted therapeutic drugs and immunotherapeutic agents.