PHYTOGEN

A NEWSLETTER FOR

AUSTRALIAN SOCIETY
OF PLANT SCIENTISTS

Volume 16 2014
Compiled April 2015

PHYTOGEN

==========Volume 16

In This Issue

Thanks to all the contributors for being prepared to give their time to provide informative articles for this issue of Phytogen

It makes a difference

AUSTRALIAN SOCIETY
OF PLANT SCIENTISTS

President's Report 2014

Background

The Australian Society of Plant Scientists (ASPS) promotes the discipline of Plant Science and provides professional contact and networking for plant scientists and University-level educators in Australia. Information on ASPS is available at: http://www.asps.org.au/ Key objectives of the Society are to:

- Facilitate the dissemination of new research.
- Provide a forum for sharing of knowledge so that the membership can build both the depth and breadth of knowledge of plant functions.
- Provide mutual support and collective mentorship.
- Recognise and reward excellence in plant science research and teaching.
- Nurture the next generation of plant scientists.

ASPS works in partnership with other relevant Australian (and New Zealand) Societies to jointly organise the national conference ComBio (for 2014: Australian Society for Biochemistry and Molecular Biology & Australia and New Zealand Society for Cell and Developmental Biology). The ComBio conference is one of the activities by which ASPS delivers several of the Society's objectives to the membership. Other activities are described below and/or are listed on the ASPS web-site.

ComBio 2014

The ASPS representatives on the 2014 Organising Committee were Ulrike Mathesius (ANU) and Yong-Ling Ruan (University of Newcastle). On behalf of ASPS I thank Uli and Yong-Ling for all their work to make ComBio 2014 such a success. Sally Jay and her team, as well as the Committee Members from the partner Societies, are also thanked. The symposium chairs, invited international Plenary Speakers, presenters that delivered Society Award Lectures (see below), all other speakers, poster presenters and all attendees, are thanked for their contributions and participation.

ComBio 2015

ComBio 2015 will be held at the Melbourne Convention and Exhibition Centre, Melbourne, 27 September to 1 October. I thank Ed Newbigin (University of Melbourne) and Ros Gleadow (Monash University) for serving as the ASPS Representatives on the ComBio 2015 Organising Committee. Ed is the Deputy Convenor of the Conference, with Marie Bogoyevitch (ASBMB & University of Melbourne) as the Convenor. The provisional plant streams (i.e. organised by ASPS) are: Plant Cell Biology and Plant Ecophysiology.

Other ASPS supported Conferences and Workshops during the past 12 months

The 6th Asia and Oceania Conference on Photobiology 2013 was held in Sydney, 10-13 Novenber, 2013. The Conference was co-chaired by Scott Byrne and Min Chen (both The University of Sydney). Further details at: http://www.aocp2013.org.au/ ASPS provided seed funds of $2,500 – and the conference was very successful so these funds have been returned to the Society. The co-chairs noted: "The seed fund of $2,500 was very important for us. We thank ASPS and the success of the conferences means we can return these funds". In addition, a small surplus from the conference was also sent to ASPS – with a proposal to support one PhD Student and one ECR travel grant (open to all

ASPS members, to be awarded on a competitive basis) to the next Photobiology Conference in Taiwan 2015 (to be discussed during the AGM).

All members are reminded of the availability of seed funding from ASPS for relevant plant conferences – this is also an important way that ASPS promotes plant science in Australia and benefits groups of members. Please contact the ASPS Secretary for further information.

ASPS Awards to Recognise Excellence (2014)

Congratulations to:

• **Brett Ferguson (University of Queensland)** on winning the Peter Goldacre Award for his research 'Discovery of new factors involved in the development and autoregulation of legume nodules'. This award recognises research achievement in the past 3 years by an early-career member of the Society (within 10 years of PhD). The Award honours the memory and attainments of Peter Goldacre, a young scientist and foundation member of this Society who was held in great respect by his peers, but passed away from cancer at the early age of 34 (in 1960). The award of a medal plus $2,000 is sponsored by Functional Plant Biology.

• **Marilyn Ball (Australian National University)** for being selected to deliver the 2014 R.N. Robertson Lecture 'A salty tale: the ups and downs of water use in mangroves'. The RN Robertson Lecture occurs every second year, alternating with the JG Wood Lecture. Sir Rutherford N (Bob) Robertson was our second President in 1958. In recognition of his formative influence on plant science in Australia, the Society began the biennial 'Robertson Lectures' in 1994. 'Sir Bob' was an inspiration to Australian plant scientists both young and old. A biographical memoir of 'Sir Bob' is available on the ASPS web-site.

• **Christine Böttcher (CSIRO, Adelaide)** for winning the ASPS-FPB Best Paper Award for an Early-Career Scientist published in Functional Plant Biology in 2013. The prize includes a personal one-year print+online subscription to FPB, a $250 book voucher from CSIRO PUBLISHING, and a certificate. The award-winning paper was: Böttcher et al. (2013). Ripening of grape berries can be advanced or delayed by reagents that either reduce or increase ethylene levels. Functional Plant Biology 40(6):566-581.

• **Stephanie Watts-Williams (Monash University)** won the R.N. Robertson Travelling Fellowship to visit Prof. Matthias Wissuwa at the JIRCAS (Tsukuba, Japan) in mid-2014, for her project: What role do arbuscular mycorrhizas and other soil microbes have in rice P-uptake efficiency? Stephanie's report, as well as reports from previous winners, is available at: http://www.asps.org.au/awards/robertson-fellowship

• There was no ASPS Teaching Award in 2014. The award recognises excellence, innovation and/or contributions to teaching of plant science at University level. Members are encouraged to consider nominations for this important award for 2015.

• Winners (3 students) of Student Poster Prizes at ComBio 2014 (announced at the closing ceremony).

• Recipients (26 students) of 2014 ASPS ComBio Student Travel Awards.

ASPS Communication

Phytogen (our newsletter) is a historically important avenue of communication within the Society. We are very grateful to Tina Offler for again being the Phytogen editor in 2014 – which was (during the second half of 2014) a year of transition to a new format using the ASPS web-site (thanks to Janet Wheeler) and FaceBook and Twitter to communicate with members (thanks to Gonzalo Estavillo). Tina will step down as Phytogen editor after many years of service; on behalf of ASPS members I thank you Tina. Tina will kindly provide advice and help to the new Phytogen/Web editor – which is highly appreciated as a small team/sub-committee will work under the leadership of Gonzalo Estavillo (with assistance from Janet Wheeler) to further improve the web-site and use of social media to communicate with members and to further raise the profile of ASPS.

Plants in Action 2

Progress on Plants in Action 2 has been gaining momentum, with six chapters now uploaded onto the web. Three other chapters are in the final stages of being completed. Updates are provided on the

ASPS web-site (http://www.asps.org.au/publications/plants-in-action) and the link to the new edition is: http://plantsinaction.science.uq.edu.au

Rana Munns has been the driving force behind this important project, with support from Susanne Schmidt; thank you Rana and Susanne. Thank you also to authors of chapters and especially to the chapter coordinators (i.e. lead authors/chapter editors). ASPS members have also helped by reviewing the submitted chapters.

Functional Plant Biology

ASPS has a special relationship with FPB. We thank FPB/CSIRO Publishing for continuing to sponsor the Goldacre Award and ASPS-FPB Early Career Scientist Best Paper Award. We also thank CSIRO Publishing Managing Editor, Dr Chris Anderson, for his support for the Society. In addition, several members of ASPS are Associate Editors for FPB or members of the Editorial Advisory Board and many other people act as reviewers – thank you all for your contributions to the peer review process for FPB. Rana Munns stepped down as Editor-in-Chief in April 2014, with the appointment of Sergey Shabala as the new Editor-in-Chief. Thank you Rana for your work over the years. Congratulations to Sergey for his appointment.

Executive Committee & Administration

ASPS is a lean operation with no secretariat. I thank the Executive Committee for their contributions: Martha Ludwig (Honorary Secretary), Brent Kaiser (Honorary Treasurer), John Evans (President-elect). I also thank all ASPS Discipline Representatives; for the current list see:
http://www.asps.org.au/about/discipline
Thank you also to: (i) John Evans - our Public Officer (the role relates to our registration as a legal entity in the ACT); (ii) Barry Pogson - our representative for 2014 & 2015 on both the GPC and Science Technology Australia; (iii) Ros Gleadow our ASPS representative for 2014 & 2015 on the AAS National Committee for Agriculture, Fisheries and Food; (iv) Christine Beveridge our ASPS representative for 2014 & 2015 on the AAS National Committee for Cellular and Developmental Biology. (Information on the AAS National Committees that represent different scientific disciplines is available at: http://science.org.au/natcoms I also thank Janet Wheeler for her help as a casual with the web-site and sending of ASPS e-mail).

ASPS – a Progressive & Inclusive Society for Australian Plant Scientists

ASPS promotes plant sciences in Australia and provides professional opportunities (e.g. conferences, lectures, workshops, teaching resources, awards for excellence in research and teaching, conference travel awards for postgraduate students, research collaboration travel award for a postgraduate student). ASPS plays a key role to enhance opportunities for early-career plant scientists in Australia and to enhance networks of our members in Australia and beyond. ComBio, our annual scientific meeting in collaboration with other Societies, is a key activity of the Society. ASPS supports, and members organise, various other workshops and scientific meetings.

All members are thanked for their support to continue the tradition and good functioning of our inclusive Society, which is of importance for the continued strength and excellence of plant science in Australia. Feedback and suggestions to the Executive Committee and Discipline Representative is welcome.

Lastly, I thank members, discipline representatives and the executive group for their help and support during my tenure as President. I warmly welcome John Evans as President-elect and look forward to continuing to work as immediate Past-president with John, Martha & Brent in 2015.

Tim Colmer, President of ASPS September 2014

A message from the editor -- Phytogen was due for a change

Dear Fellow ASPS Members,

As foreshadowed in my message in the July 2013 issue of Phytogen, yes it was time for a change of format and editor for our ASPS Newsletter. In his president's report at the 2014 Annual General Meeting, Tim Colmer expressed the view of the Executive Committee that Phytogen had been, and would continue to be, an important vehicle for communication within ASPS. However, the con-census was that the Website, Facebook and Twitter should now all be used to enhance communication. Thus, the Website & Communications Sub-Committee was formed. This group chaired by Gonzalo Estavillo and assisted by Janet Wheeler, Chris Cazzonelli, Christina Delay as student representative and myself has been working towards Website improvement and posting of new articles, conference information, scholarship opportunities and job vacancies at least monthly.

So why am I putting an issue of Phytogen together? It was agreed that articles posted during each year should be compiled into a Phytogen issue thus retaining the Society's Newsletter and providing a format for archiving. This is the 2014 issue for which I take responsibility as editor, a role now shared with Chris Cazzonelli. Chris and I encourage you all to consider providing articles, short snippets or more substantial articles that would be of interest to society members.

Tina Offler

Inspiring Science

Inspiring Science is presented by Inspiring Australia (NSW) in partnership with City of Sydney. it is a monthly talk program that was launched during National Science Week. An account of the first meeting and a program of ongoing activities has been written by Jackie Randles, The University of Sydney (see article below). As a means of bringing this new initiative to the attention of Plant Scientists, Chris Cazzonelli, University of Western Sydney, has sent me this article for inclusion in Phytogen.

Tina Offler

What keeps scientists up at night?

The launch of the Inspiring Science monthly talks program attracted a full house in the Reading Room at Customs House during National Science Week. A frank discussion between four early career researchers and John Connor, CEO of the Climate Institute about what keeps them up at night revealed much about the highs and lows of life as a professional scientist.

The event was opened by NSW Chief Scientist & Engineer Professor Mary O'Kane who spoke about the need to foster understanding in the community of why science and engineering are crucial to the development of our society. Professor O'Kane said that hearing directly from researchers is a great way for people to discover what scientists do and why it matters. She also spoke of the need to support emerging researchers at the beginning of their careers, particularly women who enter science and engineering fields.

Interestingly, Professor O'Kane actually coined the term 'early career researcher' some twenty years ago at a high level meeting when wanting to discuss particular issues faced by women in science and engineering without necessarily highlighting their gender.

While each of the four early career researchers on the panel was positive about their career choice and passionate about the difference that their scientific research could potentially make to the community, all argued that the short-term nature of support for research scientists in general was a major setback. All were aware of other scientists who, after long careers, chose to eventually abandon the lab and pursue other employment options.

Securing research funding is one of the most difficult challenges scientists must face. Finding ways to ensure sustainable funding that allows research to come to fruition, potentially leading to market application, is a pressure shared by scientists at all stages of their career, but one that is particularly difficult for early career researchers who are still vying for status and recognition in competitive environments where funds are scarce.

The huge amount of work involved in preparing grant submissions not only detracts from time in the lab, but rarely leads to lasting support for research projects. In many cases, submissions that have taken months to write do not even lead to successful funding outcomes. The panel strongly argued that Australia needs a sustainable science funding model and backed calls from Australia's Chief Scientist Professor Ian Chubb for a national science strategy that would address this issue.

Dr Cameron Clark, a senior research fellow within the Faculty of Veterinary Science at the University of Sydney, said that current research funding models prevent scientists from being able to effectively innovate and create for the future because few projects can be progressed within a few short years. Clark, who applies technology to dairy farming systems to reduce repetitive tasks, monitor animal health and welfare and increase farmer profit, warned that without a strategic long-term investment directed towards the early career researcher the best and most talented students may abandon research as a career altogether. As a result, Australia may miss the innovation and opportunities created by these individuals and the associated jobs growth, economic prosperity and standard of living that we have come to almost take for granted.

Dr. Chris Cazzonelli, a Senior Lecturer and Researcher at the University of Western Sydney's (UWS) - Hawkesbury Institute for the Environment, said that in addition to research funding worries, basic job insecurity is a constant pressure. Cazzonelli, who is passionate about understanding the molecular nature by which plants acclimate and adapt to environmental change, has only recently secured a permanent role at the Hawkesbury Institute of the Environment at UWS after years of short-term appointments. His entertaining observations about the "good, the bad and the ugly" of life as a scientist shed light on the pitfalls of working in hierarchical institutions, where competitiveness can exacerbate the constant stress of meeting deadlines while juggling lab research with teaching, writing papers and attending to administrative tasks.

Dr Amy Reichelt, an ARC DECRA postdoctoral research fellow at the School of Psychology UNSW who is interested in memory, addiction and behaviour control, stressed how important it is for young scientists to have mentors to guide them through the complex dynamics in universities that can sometimes appear to be unsupportive. Reichelt's image of the serene duck gliding across the surface

while their legs were furiously paddling beneath was instructive: in order to succeed professionally, others cannot perceive you to be out of your depth or unable to cope with the stress that comes with research. She also pointed out that the pressures for young women in science were intense, with the need to juggle many and varied tasks as a professional researcher making the choice to take time out to have a family daunting.

For researchers like Reichelt, who are supported with short-term grants that are likely to come to an end well before a research project is completed, the decision to have a family is complex. Without ongoing employment or access to funds to appoint a lab technician who could care for her rats and keep the research going, Reichelt fears starting a family may damage her career. Reichelt wants to see more support for women in her position so that motherhood does not impact upon their career ambitions.

Dr Vanessa Moss, a CAASTRO postdoctoral researcher in astrophysics at the University of Sydney who has only recently attained her PhD, is yet to face many of these pressures firsthand, but she is well aware of what's in store. Moss, whose work looks at the gas that makes up galaxies billions of years in the past, is up all night using radio telescopes to listen to faint cosmic signals. By studying the hydrogen in galaxies far away from us, it is possible to see how the universe has changed on incredibly large timescales. Moss hopes to uncover what distant galaxies can tell us about the path our universe has taken and how this relates to our home galaxy, the Milky Way. But this can only happen if the field of astrophysics, particularly radio astronomy, continues to be a valued part of the Australian scientific landscape – and this is where science communication comes in. Moss, like the other panelists, sees huge value in engaging with the community about her work. But time taken preparing speeches and presentations in the context of outreach is generally heavily undervalued in the current academic system, where only research and publication are typically rewarded. Nevertheless, being able to communicate well with non-scientists remains a priority for Moss. She and the other researchers agreed that convincing decision makers of the worth and value of your research is a critical skill that all scientists need to actively develop. Even more so, it is vital that scientists are encouraged by funding bodies and employers to value their outreach, communication and teaching activities alongside their pioneering research.

Following the lively Customs House discussion, the panelists have decided to take their concerns directly to Australia's Chief Scientist in a bid to assist him to secure better futures for today's early careers researchers so that they can still be researching and innovating in years to come.

From L-R: Dr Chris Cazzonelli, Dr Amy Reichelt, Dr Cameron Clark, Dr Vanessa Moss and John Connor at Customs House, Sydney.

Following the first meeting Inspiring Science talks were held at City of Sydney Libraries each month to connect Sydney's up and coming scientists with the community. The program was:

6pm, Wednesday 10 September, Ultimo Library
Parasitology and Quantum Mechanics
Parasitologist Dr Joel Barratt from UTS takes us inside the fascinating world of parasites to explore the worms, ectoparasites and other organisms that live in our bodies while Dr Gang Zheng, a chemistry lecturer at the University of Western Sydney, explains how quantum mechanics-based techniques to manipulate and detect macroscopic magnetization can be used to reveal the major chemical components in any sample, from rum to animal tissue.
Bookings and further information: What's On City of Sydney Library

12.30 pm 15 October, Customs House Reading Room
Wildlife forensics and amphibians
Discover how scientists Dr Greta Frankham and Dr Jodi Rowley are fighting wildlife crime on threatened species and championing the global plight of amphibians at the Australian Museum Research Institute.

6pm Wednesday 5 November, Ultimo Library
Carotenoids and cosmic timescales
Vegetables are good for us - but why? Dr Christopher Cazzonelli shares the secretes of carotenoids and if you've ever looked up at the night sky and wondered how we got to where we are today, Dr Vanessa Moss' work examining gas from galaxies billions of years in the past will spark your interest.

Inspiring Science is presented by Inspiring Australia (NSW) in partnership with City of Sydney. Expressions of interest from researchers who would like to present in 2015 are welcome. Please email Jackie.randles@sydney.edu.au

RN Robertson Fellowship Report

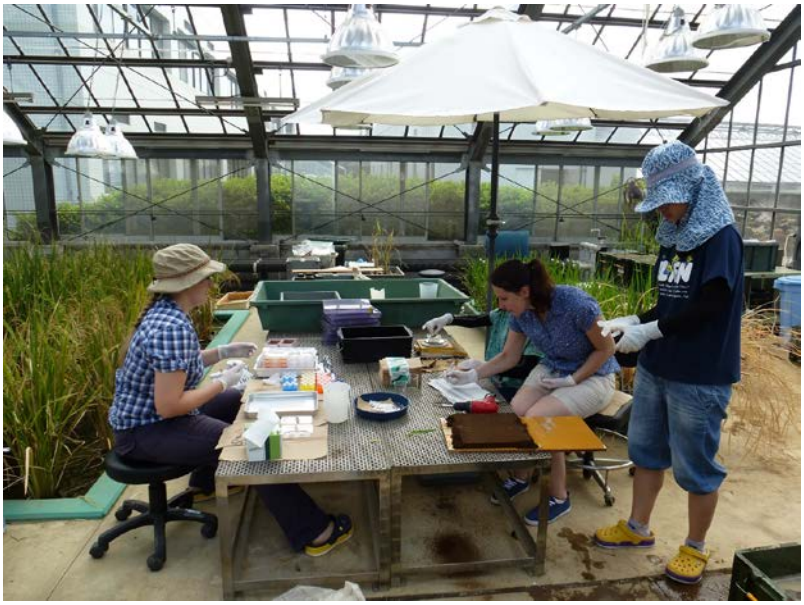
Stephanie Watts-Williams

Visit to the Japan International Research Center for Agricultural Sciences (JIRCAS)

I arrived in Japan in late June, and it was already beginning to heat up, with relentless humidity and frequent rain. When I arrived on the express train into Tsukuba from Tokyo though, the weather seemed to fit nicely with the scene before my eyes – fields of rice paddies as far as the eye could see. All of them growing luscious, green, heathy rice plants. Rice was the reason I came to Tsukuba, in fact. Through the generosity of the ASPS and the R.N. Robertson travelling fellowship, I was able to visit the lab of Prof. Matthias Wissuwa at the Japan International Research Center for Agricultural Sciences (JIRCAS, for short). JIRCAS is located a short bike ride out of central Tsukuba, dubbed the 'Science City' of Japan, which is home to countless research institutions and its own University. It is located 65 km out of Tokyo, and is a buzzing hub of science, technology, and home to many foreign researchers.

Prof. Wissuwa is an expert in phosphorus (P) and zinc (Zn) nutrition in crop plants, working primarily with rice. My PhD research so far has focused on arbuscular mycorrhizas (AM) and plant P and Zn nutrition, so it fit nicely with what was already being done at JIRCAS - except with the added factor of AM. While at JIRCAS, I sampled roots of different rice genotypes growing in Low P and High P fields, that ranged widely in their root morphology, biomass, and P uptake. Barely any work with regards to AM had been done on any of Prof. Wissuwa's rice genotypes, although there were some preliminary data on extent of mycorrhizal colonization that helped us to select four varieties to focus on. With just a couple of weeks to analyse my root samples, I focused on two main tasks – staining roots to visually quantify the extent that they were colonized by AM, and quantifying the expression of the mycorrhizal-induced P transporter – *OsPT11*, by qPCR. I also spent a lot of time helping other people with their work, whether it be harvesting plants, sampling in the field, or maintaining the field sites (weeding).

The results were interesting, and demonstrated that the different rice genotypes varied greatly in their expression of *OsPT11* and also in percentage of root colonised. This may point to the potential for AM to improve the P nutrition of rice, and further exploration into AM enhancement of rice nutrition will be of interest. Thank-you to the ASPS for bestowing the RN Robertson fellowship upon me so I could make the most of my visit to JIRCAS.



In the glasshouse harvesting rhizo-boxes (I am second from the right)

A long ditch was dug to observe root architecture of many different rice varieties

Different rice varieties in the field

Reports from Recipients of 2013 Plant Nutrition Trust Travel Scholarship Awards

Julie Hayes

17th International Plant Nutrition Colloquium (IPNC) and Boron Meeting 2013

The 17th International Plant Nutrition Colloquium (IPNC'13) was held in August of this year in Istanbul, Turkey. With support from the Plant Nutrition Trust, I was able to attend this meeting, as well as a small satellite meeting on boron held immediately prior to IPNC'13.

I work at the Australian Centre for Plant Functional Genomics, and study aspects of plant nutrition and nutritional stresses. For the last twelve years, I have focussed my research efforts on tolerance to high soil boron in wheat and barley. Thus, I relished the opportunity to participate in a small, specialist meeting discussing boron toxicity and deficiency in agriculture internationally. In attendance were around 80 delegates from across the world, including countries that encounter problems associated with soil boron deficiency (China, India, Bangladesh, Pakistan) and boron toxicity (Turkey, USA). Australia was also well represented, with researchers from both the University of Adelaide and the University of Western Australia – large areas across the southern cereal growing regions of our country have toxic levels of boron in the subsoil. In addition to presenting my own research, I heard talks on a wide variety of research topics, from soil science to molecular studies of boron transport in Arabidopsis. Highlights included a report of a new, slow-release boron fertiliser that should reduce the risk of boron toxicity arising as a consequence of fertiliser application. A number of papers were also presented from research groups in Japan, who were the first to identify and describe boron transporters in plants.

The theme for IPNC'13 was nutrient and food security, and a number of excellent talks were given around nutritional aspects of food security. Walter Horst (Germany) identified critical gaps in our knowledge of plant nutrition, including the physiology behind nitrogen use efficiency and the role of plant growth promoting microorganisms. Phillip White (United Kingdom) and Michael Grusack (USA) outlined the challenges of manipulating whole-plant nutrient transport to increase the accumulation of mineral elements in edible plant parts. An economist with HarvestPlus, Howarth Bouis (USA), discussed the ever-increasing severity of micronutrient malnutrition ("hidden hunger") for humans in the developing world, and demonstrated the potential for biofortification to have a positive impact.

After listening to and viewing the many other oral presentations and posters on topics relating to plant nutrition, I realised the importance of a united effort to identify critical areas of plant nutrition research and to make real progress towards meeting quantity and quality targets for world food production into the future.

Julie Hayes *-- (ACPFG, Adelaide)*

Lachlan Palmer

17th International Plant Colloquium (IPNC) in Istanbul, Turkey

The Plant Nutrition Trust travel award gave me the opportunity to attend the 17th International Plant Colloquium (IPNC) in Istanbul, Turkey from 19th to 22nd of August. The main theme for this colloquium was "Plant nutrition for nutrient and food security". There were many excellent talks and informative posters that covered a broad spectrum of plant science and in particular, plant nutrition.

The keynote presentations were varied and full of amazing results. I particularly enjoyed the talk by Howarth Bouis, "Biofortification: A new tool to reduce micronutrient malnutrition" detailing the successes of the Harvest Plus breeding programs to improve the Zn, Fe or pro-Vitamin A status of staple food crops, and their plans for release into the developing world over the next few years. Results of feed trials using some of these varieties were also presented along with the adoption of these crops within target communities. This talk demonstrated that the increase of nutrients in the grain really can help communities at risk of nutrient deficiency and so improve health and quality of life.

The talk by Prof Jan Schjoerring titled, "Molecular speciation of micronutrients in plants: consequences for transport and storage" demonstrated some of the methods at the cutting edge for identifying and examining nutrient storage compounds by using an array of interconnected, separation and detection systems. The talk detailed work being done on isolating and identifying the compounds involved in binding and storing Zn in the endosperm of rice. This talk gave a fascinating insight into the type of work that can be done when making full use of analytical tools.

The closing plenary presentation by Jian-Feng Ma titled, "Mineral transport from soil to seed" was of great interest as my PhD research is in this area. The work his group is doing on the nodal interface was extremely interesting. The role of this area of research in improving knowledge surrounding the flow of minerals through the plant transport stream cannot be underestimated. I believe that the information presented in this talk and the further reading I have done since will have a great impact on the writing of my thesis and the deciphering of the data I have collected.

Apart from the plenary and key-note presentations there was a great variety of short talks with some very interesting work being presented that is outside of my area of interest, but indeed, still stimulating.

In particular, I was fascinated by the work being done in Japan using radioactive isotopes to image plant wide uptake (Tomoko M. Nakanishi "Development of real-time radioisotope imaging system to study plant nutrition") with some amazing real time videos of the uptake and distribution of several elements being presented. I also found the work being done in the far north of the UK, examining the role of root phytases in managing manganese deficiency on calcareous soils of interest (Timothy S. George "Genotypic variation in the ability of plants to tolerate manganese deficiency in cereals grown in calcareous systems: the role of root phytases"). Phytate is normally considered an anti-nutrient but in this instance it may play a role in ameliorating manganese deficiency in some cases.

I was also given the opportunity to present work from my PhD research as a short talk "Micronutrient variability in phloem: changes in zinc concentration during grain loading". This talk demonstrated our success at developing a method for measuring K, Mg, Zn and Fe in nano-litre phloem volumes and maturity related differences in elemental phloem concentration over the course of grain loading. I also presented tissue analysis from plants harvested immediately after phloem collection showing interesting relationships between grain and phloem elemental content. This talk was well received and I had some excellent discussions with academics that will help me in further refining the work for my thesis. We have also had enquiries into possible collaboration to make use of the techniques we have developed from my PhD.

I am truly honoured for the opportunity provided to me by the Plant Nutrition Trust. To have the chance to travel to a major international conference and present my work was a wonderful opportunity for me; one which has expanded and added to my experience as a PhD student and increased my knowledge and understanding in the area of plant nutrition. I look forward to making use of this knowledge in future research opportunities.

Lachlan Palmer

Stephanie Watts-Williams

17th International Plant Nutrition Colloquium 2013 in Istanbul, Turkey

I was fortunate enough to be granted a Plant Nutrition Trust award, in order to attend the International Plant Nutrition Colloquium 2013 in Istanbul, Turkey, in August. After a long journey from Melbourne, I arrived into the amazing city that I had heard so much about.

On the first day, we were welcomed to Istanbul and the IPNC by the colloquium's chairman, and esteemed plant nutritionist, Prof. Ismail Cakmak, before settling down to hear the plenary presentation by Prof. Walter J Horst. Throughout the day, we heard talks from some of the world's brightest and

best young plant scientists in the Marschner session, dedicated to early career researchers, as well as some wonderful keynote presentations from researchers around the world.

Early on the second day of the colloquium, I was given the opportunity to present a talk in one of the parallel sessions under the topic of 'rhizosphere process, root biology and nutrient acquisition'. I presented my PhD work to date, which involved a number of glasshouse experiments investigating the role of arbuscular mycorrhizas on plant zinc and phosphorus nutrition, and preliminary data from a meta-analysis. I was glad to find that other delegates approached me with questions, both in the designated discussion time, and also in break times during the rest of the colloquium. I thought it was wonderful of the colloquium's committee to have offered oral presentations to so many PhD students, as it gave us the opportunity to expose our research to an audience who may not have encountered it otherwise.

Later that day, I heard some motivating talks in the keynote presentation that centered on the theme of biofortification - a topic that interests me greatly. Speakers included the director of Harvest Plus, Dr. Howarth Bouis, and Prof. Philip White, from the James Hutton Institute. Of particular interest were the new breeds of staple crops that have been genetically engineered to be biofortified with one of iron, vitamin A or zinc, and were in different stages of implementation into agricultural practices in various countries. The three most common micronutrient deficiencies worldwide are represented here, and are thus the focus of Harvest Plus' research. The next challenge for these researchers is to investigate the biofortification of multiple essential micronutrients into one crop. I left this session feeling particularly inspired to take part in research of this nature in the future.

The rest of the week was spent attending various sessions, viewing posters, and networking with other delegates. In particular, there were many talks discussing or utilising imaging techniques that allowed for the visual localisation of nutrients within plant tissues, which many delegates would find useful in their own research. I left the colloquium contemplating how I could improve the design of my future experiments, based on the techniques I had seen presented over the last four days.

Lastly, Prof Jan Schjoerring presented us with information on the next IPNC, to be held in Copenhagen in 2017. I was leaving for Copenhagen the next day, to embark on a research visit with an esteemed researcher in the study of mycorrhizas, and so left the colloquium feeling even more inspired.

I would like to sincerely thank the Plant Nutrition Trust for this award, which gave me the opportunity to attend my first international conference. While listening to talks gave me an insight into recent advances in plant nutrition, the colloquium also allowed me to meet an interesting and diverse range of researchers in my field.

Stephanie Watts-Williams -- *Monash University*

Lydia Guja

Seed Ecology IV, Shenyang, Liaoning Province, China

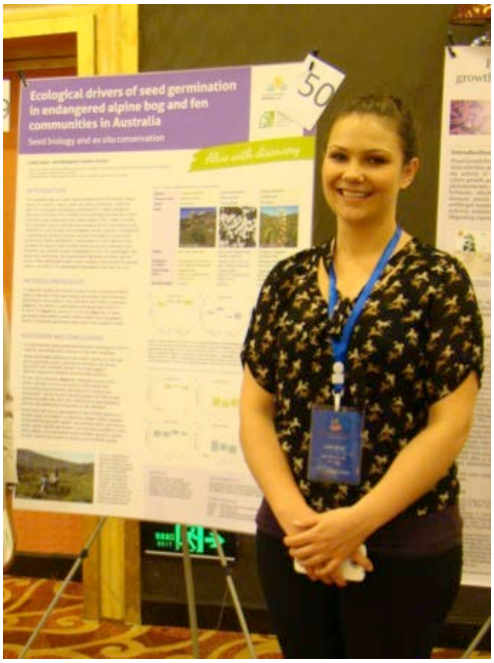
In June 2013, with financial support from the Plant Nutrition Trust, I travelled to Shenyang, Liaoning Province, China to attend the Seed Ecology IV conference. The theme of the conference was 'Seeds and the Future' and the program addressed evolutionary seed ecology, seed dispersal, soil seed banks, seed germination and dormancy, seed longevity and storage, and biodiversity conservation and restoration. The conference program was intense, with 60 oral presentations over 3 days and no parallel sessions. A diverse range of engaging and current seed research was presented.

I gave an oral presentation about my PhD research entitled '*Full spectrum X-ray mapping reveals differential localisation of salt in germinating seeds of differing salt tolerance*'. This research brought together seed scientists and materials scientists from across Australia (with assistance from the R. N Robertson Travelling Fellowship) and investigated how germinating seeds either avoid or tolerate stress from mineral salts in saline environments. This research represents the first investigation of ionic uptake and salt movement in plant seeds using a multi-detector X-ray mapping SEM developed by my collaborators. We demonstrated that damaging ions were compartmentalised in the endosperm of salt-tolerant seeds, but absorbed by the embryo of salt-sensitive seeds. The manuscript describing this research will shortly be available in the Botanical Journal of the Linnean Society. I enjoyed being able to present this research to the Seed Ecology audience and it was well received and generated some engaging discussion and future opportunities for collaboration.

I also presented a poster '*Ecological drivers of seed germination in endangered alpine bog and fen communities in Australia.*' This new research is being undertaken in my role as the Seed Conservation Biologist at the Australian National Botanic Gardens (ANBG) and the Centre for Australian National Biodiversity Research (CANBR). This research focuses on conservation and seed ecology of species that define a nationally listed endangered ecological community, 'Alpine *Sphagnum* bogs and associated fens,' recognised under the Environment Protection and Biodiversity Act 1999. In particular, I am interested in seed germination thresholds in acidic, waterlogged, and cool conditions and how this drives recruitment patterns in such a fragile environment. By presenting the poster I was fortunate to discuss preliminary results and future directions with other researchers working internationally in alpine environments.

This was my first time travelling to China and I was also fortunate to join the post conference field trip to Inner Mongolia to explore the natural beauty and history of this region. Without the assistance of the Plant Nutrition Trust I would not have been able to attend this conference. I'm very thankful for the opportunity to present my work and keep up to date with the latest seed research, professional subject matter, and communicate with leading seed researchers. The knowledge and networks gained are beneficial both for the completion of my thesis and in my new position as Seed Conservation Biologist at ANBG and CANBR.

Lydia Guja



Lydia Guja presenting her X-ray mapping paper and at her poster session. Spectacular scenery in Inner Mongolia **Left:** An ovoo serves as both a religious site and landmark in the flat open grasslands. **Right:** Mongolian gers are still used in grasslands and are scattered between large modern Chinese cities.

Clayton Butterly

International Union of Soil Sciences, Global Soil Carbon Conference, Wisconsin, USA

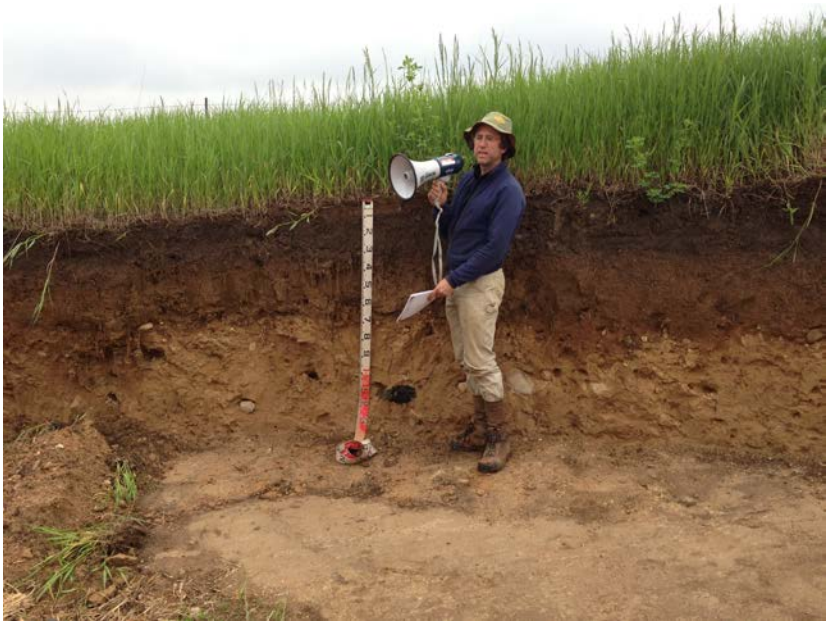
The International Union of Soil Sciences (IUSS) Global Soil Carbon Conference was held on the 3-6th June 2013 at the University of Wisconsin-Madison. The conference brought together soil carbon (C) researchers from a wide range of disciplines. The 85+ presentations were arranged according to IUSS Divisions (Soil C in space and time; Soil C properties and processes, Soil use and C management, Role of soil C in sustaining society) covering 14 of the IUSS commissions.

Alex McBratney (The University of Sydney), Don Sparks (University of Delaware) and Rattan Lal (The Ohio State University) gave the keynote presentations. It was interesting to revisit the explosion of papers on soil C published in the last decade. As pointed out, many papers have focused on soil C as a sink for atmospheric CO_2, however interest in soil organic C for its role in maintaining or increasing soil fertility, plant growth and food production is equally as important. In either case, the idea that soils have the capacity to store additional C exists, since soil organic C has been largely depleted due to intensive agricultural production or degraded via other types of land-use. However, determining the C storage potential of soils and whether this can be attained while maintaining agricultural productivity are still open for debate. New technologies, such as the combination of X-ray microscopy and spectroscopy with existing ones (NMR and FTIR) offer new insights into the composition and spatial distribution of soil C at the fine scale. These tools can provide a greater understanding of the mechanisms of C retention and the potential for C stabilization in soil. Also highlighted was the increased demand for spatial and temporal quantification of soil C at the landscape scale. This information is fundamental to verify current soil C levels, assess changes in soil C as affected by land-use or management and provide empirical data for mechanistic models to further predict soil organic C dynamics. Measurement of C stocks and scaling-up from soil profiles to a catchment or regional level imposes a number of challenges. Issues aside, the recent interest in and efforts to increase soil C are of great benefit to the productivity and sustainability of agricultural systems.

My presentation 'Elevated CO_2 and rhizosphere C priming affect the decomposition of crop residues' was in Division 2 – Soil C properties and processes (Soil Biology Commission). I outlined some recent work investigating C and N cycling under elevated atmospheric CO_2 (eCO_2). Using free-air CO_2 enrichment (FACE) we have observed greater biomass production of wheat and field pea under eCO_2 than ambient CO_2 (aCO_2) and increases in the C:N ratio of wheat residues irrespective of the soil N status. These changes in the amount and quality of soil organic matter inputs are likely to affect the

overall soil C and N balance. Similarly, we have observed greater flow of C to the rhizosphere under eCO_2 using $^{13}CO_2$ pulse-labelling. In a glasshouse experiment the interaction between rhizosphere priming and residue quality (C:N ratio) was investigated. Field pea and wheat were planted in soil columns containing dual-labelled ($^{13}C/^{15}N$) crop residues and grown under eCO_2 or aCO_2 concentrations. We found that the effect of eCO_2 of on plant growth and rhizosphere activity depended on the C and N status of the soil-plant system. For example, greater activity (CO_2 production) occurred for field pea in soil with high C:N residues and for wheat in soil with low C:N residues. Furthermore, this experiment showed that enhanced rhizosphere activity under eCO_2 increased residue decomposition.

A field tour was organized for the final day of the conference. We visited three of the 12 research stations of the College of Agricultural & Life Sciences at the University of Wisconsin-Madison. At the first stop (West Madison Agricultural Research Station) we observed a catena of soil pits. It was interesting to observe the dominant influence of glaciation on Wisconsin soils. The field guide indicated that Wisconsin was under glaciers as recent as 12 000 years ago and only 20% of the soils have been developed from weathering of underlying rock or formed *insitu*. The glacial deposits and loess formations have resulted in deep, fertile, well-structured soils. At the second stop (O.J. Noer Turfgrass Research and Education Facility) we observed a series of research projects related to the turf industry. These investigated various facets of the soil-plant system under turf in both commercial and domestic contexts. At the final stop (Arlington Agricultural Research Station) we visited the Wisconsin Integrated Cropping System Trial (WICST Project), Great Lakes Bioenergy Research Centre (GLBRC) cropping trial and a field trail investigating the impact of cellulosic feedstock (biofuel) production on runoff and soil erosion. It was great to visit a range of diverse landscapes, soils and observe different land-uses.



Overall, it was a fantastic conference and is tribute to Alfred Hartemink and the organizing committee and the Department of Soil Science at the University of Wisconsin-Madison. Abstracts and presentations from the conference can be found at http://iuss-c-conference.org/

I am extremely grateful to The Plant Nutrition Trust for their support to attend this meeting. I would also like to acknowledge the support of my co-authors, Caixian Tang (La Trobe University), Deli Chen (The University of Melbourne) and Roger Armstrong (Department of Environment & Primary Industries, Victoria) and the Australian Research Council's *Linkage Projects* scheme (LP 100200757).

Dr. Clayton Butterly C.Butterly@latrobe.edu.au AgriBio, Centre for AgriBioscience, Department of Agricultural Sciences La Trobe University Victoria 3086

Mineral nutrition of native plants in our Biodiversity Hotspot in a global context

Hans Lambers

School of Plant Biology, The University of Western Australia, Australia

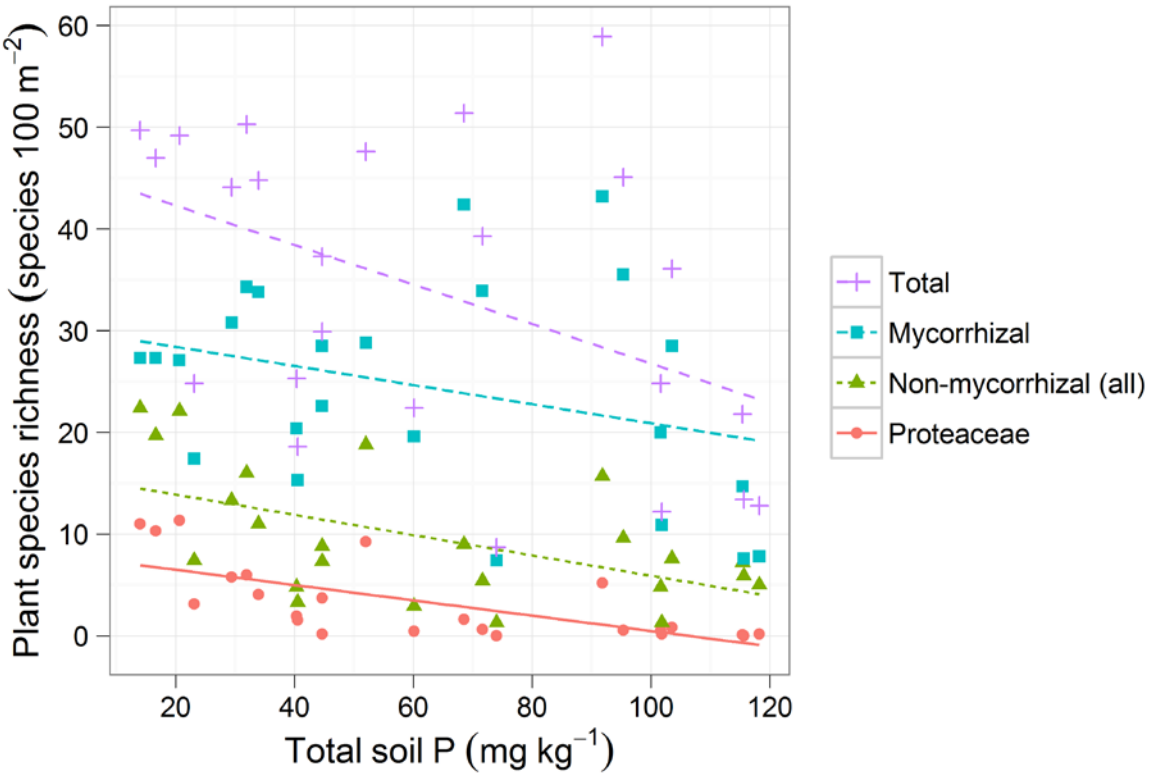
South-western Australia was a part of Gondwanaland, and some of the most ancient parts of the Earth' crust can be found here. Other parts of the landscape originated more recently from calcareous marine deposits. Therefore, the soils of Western Australia are amongst the most heavily leached and nutrient-impoverished in the world. Moreover, the soils on lateritic profiles tightly bind phosphate, so that, phosphorus (P) is also poorly available to plants that are not adapted to these conditions. The old, climatically buffered ancient landscapes of south-western Australia also comprise one of the world's hotspots of higher plant species diversity. Therefore, this environment offers a unique opportunity to study plant adaptations to nutrient-poor conditions.

What is most intriguing is that the greatest higher plant species diversity is found on the most P-impoverished soils on the south-western Australian sandplains (kwongan), as shown in Figure 1. What is even more intriguing is that those species that lack mycorrhizal associations, which are considered to help the plant acquire P from nutrient-poor soils, are found predominantly on the poorest soils. When soil P increases, the Proteaceae peter out. There is an important message for managers here: don't mess with soil P, or you will lose your precious Proteaceae!

What might be the causes of increased soil P which represents a threat to an iconic component of our kwongan flora? Increased fire frequency is one of them, because burning the vegetation returns P to soil that was originally locked up in the vegetation. Run-off from farmland or urban activities is another source. Some fire retardants contain P, and these should be avoided in severely P-impoverished bushland in WA. There are other that can be included, but the only one I want to add to the list here is the use of phosphite. This chemical is used to combat *Phytophthora cinnamomi* (dieback). In soil, microorganisms quickly convert it into phosphate. Since phosphite is used at a rate similar to what farmers use in the wheatbelt, the fertilising effect of phosphite spraying is significant. We cannot simply stop spraying phosphite and let dieback proceed. However, using phosphite cannot be a long-term solution and phosphite must be replaced by something that suits our P-impoverished landscapes

much better. This is the subject of ongoing research efforts at UWA and Murdoch, supported by DEC and several partners.

A relatively large proportion of species from the P-poor environments in south-western Australia cannot produce an association with mycorrhizal fungi, but, instead, produce cluster roots (in most Proteaceae and in some Fabaceae) or dauciform roots (in Cyperaceae). These specialised roots are an adaptation both in structure and in functioning. Cluster-root-bearing Proteaceae in south-western



Australia occur on the most P-impoverished soils (Fig. 1), whereas the mycorrhizal Myrtaceae tend to inhabit the less P-impoverished soils in this region.

Figure 1. Plant diversity and soil phosphorus status in south-western Australia's global biodiversity hotspot. Note the relative abundance of non-mycorrhizal species on soils with the lowest phosphorus (P) content.

The functioning of cluster roots in Proteaceae and Fabaceae has received considerable attention. Dauciform roots in Cyperaceae have been explored less, but they appear to function in a very similar manner. The growth of specialised cluster roots or dauciform roots in species of the Cyperaceae, Fabaceae and Proteaceae is stimulated when plants are grown at a very low P supply, and suppressed when leaf P concentrations increase. These specialised roots are all short-lived structures, and they release large amounts of carboxylates during an 'exudative burst' at rates that are considerably faster than reported for non-specialised roots of a wide range of species. Carboxylates are organic anions as

found in citric acid and malic acid. The carboxylates play a pivotal role in 'mining' P that is sorbed onto soil particles.

Because the world P reserves are being depleted whilst vast amounts of P are stored in fertilised soils, there is a growing need for crops with a high efficiency of P acquisition. Some Australian native species have traits that would be highly desirable for future crops. The possibilities of introducing P-acquisition efficient species in new cropping and pasture systems are currently being explored. Western Australian *Banksia* species are also the most efficient species studied so far when it comes to using the P they have acquired for their photosynthesis. Therefore, possible strategies to introduce traits associated with a high P-use efficiency into future crop species are also considered promising.

High P-use efficiency in Proteaceae includes a highly efficient mobilisation of P from senescing leaves. In addition, many species operate at extremely low leaf P concentrations exhibiting rates of photosynthesis similar to crop plants; expressed per unit leaf P, their rates of photosynthesis are extraordinarily high.

The Global Plant Council - An International Voice for Plant Science

2013 Report by Barry Pogson

The world is facing a number of major challenges including feeding a growing population, mitigating the effects of climate change, identifying alternative energy sources and minimising biodiversity and habitat loss. To effectively solve or mitigate these current global problems will require plant science. However to effectively achieve these solutions will require an increase in the understanding of how plant research can contribute to global issues, such as food security, amongst our policy makers and funders.

In 2009 several national plant and crop science organizations around the world met for the first time to discuss world problems and how their scientists and organizations could help by increasing the impact of plant research and raising awareness about opportunities for crop improvement and sustainable agriculture. This was the birth of the Global Plant Council (GPC), which is now a coalition of over 20 plant and crop science societies from across the globe. The central focus of the GPC is to define and engage in coordinated strategies that impact the most critical global issues; world hunger, energy, climate change, health and well-being, sustainability and environmental protection. By working together to formulate a shared vision and allowing distribution of effort the GPC aims to:-

- Increase awareness of the central importance of plant science
- Accelerate progress in solving pressing global problems via plant science based approaches
- Facilitate new research programs to address global challenges
- Enable more effective use of knowledge and resources
- Provide a focus and contact point for plant science across the globe

Since 2009 the GPC has established itself as a non-profit organization and held annual meetings in Montréal Canada (2010), Qingdao China (2011), Jeju S. Korea (2012). These annual meetings have allowed the council to identify a number of strategic initiatives that will help provide plant based solutions to the global challenges we currently face including

- Biofortification of Crops - Improving the nutritional quality of current and new crops
- Digital Seed Bank - Maintaining, understanding and preserving the wealth of crop diversity for

future generations

- Diversity and Yield Stability - Identifying strategies for sustainable agriculture such as perennial crops
- Sustainable adaptation to changing environments - Identifying strategies for crop improvement to deal with a changing climate

The GPC has also been working hard to establish a formal organisational structure within council. In May 2013 Dr Ruth Bastow was appointed as the new Executive Director of the GPC and she joins a recently elected executive board consisting of; Prof. Wilhelm Gruissem (European Plant Science Organisation) - Acting President, Prof. Henry Nguyen (American Society of Agronomy and Crop Science Society of America) - Vice President, Prof. Gustavo Habermann (Brazilian Society of Plant Physiology) - Treasurer, Prof. Kasem Ahmed (African Crop Science Society) and Prof. Zhihong Xu (Chinese Society of Plant Biologists).

By exploiting the expertise of this new management structure and working together with other key organisations in this global arena, the GPC is looking forward to fulfilling its role as a strong advocate of plant science at the international level.

For further information on GPC please contact Ruth Bastow, ruth@globalplantcouncil.org