Following the recent significant rain in the southern wheat belt we are facing this season with optimism for crop, pasture and livestock production.

Capacity building continues to be a key focus for the Graham Centre in terms of undergraduate, post-graduate and post-doctoral training, with undergraduate numbers for 2014 strong for CSU. The Centre has awarded five Internships, two University Research Centre PhD Scholarships, five Honours Scholarships and four Summer Scholarships in 2014. Congratulations to the scholarship recipients.

We have had a number of international visiting scientists over the past few months working closely with our researchers on a range of projects. Fostering these international links enhances research collaboration and the development of large and collaborative research programs.

On 22 August, 2014 the Graham Centre is facilitating an industry wide ‘think tank’ at CSU, Wagga Wagga, on potential scenarios for securing the future of Mixed Farming Systems in the region. ‘Future-Proofing Mixed Farming Systems’ will identify critical internal and external drivers of systems viability and sustainability and develop recommendations for future research. The forum will explore challenges and opportunities along the value chain by focusing discussion around three key themes:

1. Key drivers of resilient mixed farming systems;
2. Value adding; and
3. Post-farm gate.

The day prior, the Centre will lead a number of industry tours across the region to view a range of agricultural businesses, including viticulture, aquaculture, horticulture, cropping and livestock production. We look forward to your participation in the forum.

Other important dates for your diary include the Centre’s Sheep Forum (4 July), Beef Forum (15 August) and Crop and Pasture Systems Field Forum (3 September).

We welcome Mr Scott Hansen, Director General NSW DPI to our Board of Management and look forward to working with him in the future.

Congratulations to Ms Lucinda Corrigan, Industry Advisory Committee Chairperson, on winning the Women In Australian Agribusiness ‘Outstanding leader in agribusiness’ award.

Enjoy reading this edition of the Innovator.

Professor Deirdre Lemerle
Fond memories of a farmers’ friend

There would be few farmers in the Border region unfamiliar with “Sykesy’s Time”.

Hours and minutes became irrelevant if John Sykes was at your door - the Albury agronomist would be there for as long as it took to get the job done, and the next, and the next.

“Farming is a tough business to be in - you have got to love it and it is such a part of my life,” he told The Border Mail in October last year.

And love it he did - so determined was he to keep working while he was ill that he had a friend, Greg Vonthien, act as his driver for the past 12 months in order for him to keep visiting his clients.

“No matter what was on his schedule, he would listen to a farmer’s concerns and try and help until the farmer was satisfied,” Mr Vonthien said.

“He’d end up being late to his next job, but everyone knew it was because he would give everyone his full attention.”

Born in 1950, John Anthony Sykes grew up on his family farm at Goulburn, where his love of the land was sparked. He went on to study agriculture at Sydney University and then worked for the NSW Department of Agriculture in offices across the state before joining the Albury office in 1975 - the same year he became a founding member of his other great passion, the Albury Steamers rugby team.

After 20 years as a public servant he decided in 1992 to start his own business, becoming one of the first private farm consultants in the country.

Rand farmer Angus Macneil first met Mr Sykes as a client of his more than 20 years ago but, like many farmers who had the chance to work with him, the pair soon became friends.

“Farming systems changed a lot during his period and he was certainly very much a part of that,” he said.

“He was prepared to recommend doing things differently and encouraged us to take risks - and by and large it was always good, sound advice.”

Among the measures he helped introduce were progressive weed control and crop management, as well as encouraging farmers to diversify.

But Mr Vonthien said it was more than his professionalism that endeared him to many - he genuinely cared about everyone he met.

“He was someone you would turn to when the days were dark,” he said.

“If you’d been through a tough year, he was a man who would give you support - he took more than just a business interest in what you were doing, he cared about how your life was going.”

Mr Sykes’ son Nicholas said his family was overwhelmed by the support they had received from the community. He described his dad as committed, devoted and someone who “stuck his head down and worked hard till the end”.

“In 25 years I never saw him consult a book, he seemed to know everything there was to know,” he said.

“He inspired us to be our best.

“None of us followed in his agricultural footsteps but it was always important that we could be as great as we could.”

Mr Sykes, 63, passed away in January after a long battle with a rare form of skin cancer. He is survived by his wife Virginia and four children - Victoria, Nicholas, Alexander and Isabella.

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Improving scientists animal health capacity in Papua New Guinea

Four science graduates from Papua New Guinea (PNG) arrived on 20 January as part of a three-month training program aimed at developing their understanding of animal health and diagnostic skills.

The program involves field sampling as part of surveillance for significant wildlife diseases, laboratory processing of samples and the subsequent analysis and publication of results. This training, supported by the Graham Centre and the Commonwealth’s Wildlife Exotic Disease Preparedness Program, is designed to address the very low capacity in animal health in PNG. Despite having a population of six
Science graduates from Papua New Guinea are participating in a training program at CSU to better understand animal health and improve their diagnostic skills. Photo: Toni Nugent

million people, many of whom are highly dependent on wild and domestic animals for food and other materials, PNG has only three national vets. Professor Shane Raidal and Dr Andrew Peters of the Graham Centre are attempting to improve this situation by developing the animal health capacity of scientists already working in PNG.

The four graduates come from different regions of PNG and have a range of interests.

Tania Areori is from Madang and has studied a Bachelor of Science at the University of PNG (UPNG), with her Honours project looking at nesting range and characteristics of Silky Cuscus (a type of possum). Her interest is in doing veterinary science.

Heather Taitibe is from Milne Bay and has studied a Bachelor of Science at UPNG, focusing on frog ecology and the impact of climate change on Manus Island. She is particularly interested in herpetology and is looking at doing a Masters degree.

Daniel Solomon is from the Eastern Highlands and, having completed a Bachelor of Science (Forestry) at the University of Technology in Lae, is currently undertaking a Bachelor of Science Honours program at UPNG, focusing on anthropogenic threats and traditional use of Long-beaked Echidnas in the Highlands of PNG. Daniel would like to further investigate the biogeography of the various Long-beaked Echidna species of New Guinea.

Wallace Takendu works as an intern biologist for the Wildlife Conservation Society and is currently studying the factors affecting the abundance of the Admiralty Cuscus in three villages of Manus Island. He has also completed a Bachelor of Science at UPNG.

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Farmers and AWI gather to set R&D priorities for the wool industry

Gus Manatsa from Australian Wool Innovation visited Wagga Wagga along with leading farmers from southern NSW to determine major R&D priorities for the region. The day was facilitated by the Graham Centre and NSW DPI to help align the needs of farmers and the investment from AWI on issues of common interest.

Several themes emerged from the day covering topics such as the feedbase, sheep genetics, animal health, on-farm management for labour efficiencies and the need to maintain R&D expertise in these key areas.

Feed gaps vary across the region from summer and autumn deficits in the cropping zone, to autumn and winter deficits in the tablelands. Farmers indicated that improving the on-farm capacity to cope with feed gaps would require better integration of technologies, including the use of grazing crops in winter and late spring, and integrating these methods better with other options including the use of new alternative species such as biserrula and new species like Tedera. Fitting these examples of different technologies together also requires the development of information for improved scenario modelling in packages like GrassGro.

Farmers highlighted another important feedbase issue focused on having more phosphorus (P) efficient pasture systems, including more P efficient species to reduce on-farm input costs and better placement of P in variable landscapes to maximise returns.

The animal genetics discussions primarily focused on Estimated Breeding Values (EBVs) and making this technology cheaper with improved confidence around predictions, as well as introducing new criteria to EBVs such as lamb survival from conception to weaning, and extending EBVs to include new genomics approaches.

Discussions on animal health focused on labour savings including remotely activated capsules for worm control to reduce labour costs, new strategies to manage worm resistance such as genetic selection for resistant livestock and forages that impact adversely of worm populations. Animal welfare discussions focussed on flystrike management using new forms of mulesing and selection methods in young sheep that allow the likelihood of future strikes to be predicted as the animal ages.

Graeme Sandral, NSW DPI, helped facilitate the day and said the key objectives were well covered, including the direct interaction between farmers and AWI, with a list of R&D priorities for key areas developed that could potentially bring about significant improvements to on-farm profits, in a framework that is in keeping with animal welfare and environmental considerations.

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Visual Learning - Agricultural Plants of the Riverina

Can’t tell the difference between barrel medic and burr medic? Or the difference between triticale and cereal rye? Then Visual Learning - Agricultural Plants of the Riverina might be the program for you!

Most (over 80 percent) on-campus students enrolling in CSU’s agriculture degree have a rural upbringing, (i.e. live on farms or similar). However, testing has shown that these students have acquired only a limited ability to recognise plants of agricultural importance from their time on the farm. Quizzes in 2011 and 2012 indicated that in their first year at CSU, students could only recognise, on average, around 30% of 25 species of agricultural importance (crops, pasture species, weeds, shelter belt species). Species such as cocksfoot, phalaris, lupins and subterranean clover were recognised by less than 20% of students. This indicates that plant identification and recognition classes are an important part of the curriculum.

For this article, ‘recognition’ means the ability to recall the name of a species almost instantaneously, based on an overall assessment of a species’ features. ‘Identification’ means the step-wise determination of a species name by using a key or similar tool. In the field, recognition is far more useful than identification, which requires the use of books or similar tools.

Practical classes that focus on crop and pasture plants and their recognition are held in the second year of the agriculture degree. It is useful if students can continue to work on their recognition skills outside of class hours. There are numerous books and apps (e.g. Weeds - the Ute Guide) that are useful for identification, but there are essentially no resources that allow for recognition training.

To this end, Dr Bruce Kirchoff, University of North Carolina, and Associate Professor Geoff Burrows, CSU, have recently developed Visual Learning - Agricultural Plants of the Riverina (VL-APR) (Figure 1).

Currently VL-APR covers more than 150 species and has more than 1400 images. The species covered include crops, pasture species, weeds of crops and pastures and native plants used in shelter belts. On average nine images are available per species (far more than the one or two images per species found in most books), including images of whole crops, individual plants and close-ups of leaves, flowers and fruits. This allows a wide range of variation (morphological, developmental, seasonal) to be shown so that users develop a more complete understanding of a species.

The main screen for VL-APR features eight buttons in two groups of four (Figure 2). The upper buttons control the selection of species to study and the lower four select different study routines. Once a study set has been selected (upper set of buttons), the students use ‘Study Plants’ (from the lower set of four buttons) to view the images and become familiar with the range of variation. The most demanding of the examination modes is ‘Take a Quiz’, with ‘Name Image Without Prompt’. In this mode an image is automatically selected at random from the pool of images previously selected. The image is shown for a short period (selectable for up to four seconds), the image disappears, then the species name (scientific name or common name is selectable) is typed into a response box, the answer submitted and feedback given. Spelling sensitivity is selectable (60-100% accuracy) to help at the start of the learning process and to avoid issues with common names such as ‘St Johns Wart’ and ‘St John’s Wort’.

Figure 1. Visual Learning - Agricultural Plants of the Riverina.

Figure 2. The main screen for Visual Learning – Agricultural Plants of the Riverina. The upper four buttons are used for selecting taxa, while the lower four are used for studying and learning the selected species.
Testing has shown VL-APR is a highly effective tool in helping students to recognise plants of agricultural importance. Custom-made study sets of species of interest can easily be created and thus VL-APR can be tailored for specific purposes (e.g. recognising poisonous plants, native trees, clovers and medics).

While primarily designed for CSU students, VL-APR should also be of use to agronomists and farmers who would like to improve their ability to recognise local agricultural plants. VL-APR is available as a no cost download from ‘Metis Learning’ ([http://metisllc.com/plant-identification-in-australia-agricultural-plants-of-the-riverina/](http://metisllc.com/plant-identification-in-australia-agricultural-plants-of-the-riverina/)). If you encounter problems with downloading please contact Geoff Burrows and he will look at other ways of making a copy available. A mobile version of VL-APR is currently being developed, taking the program to where the plants are growing.

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Strengthening industry partnerships

Visits to the Centre during February by Meat and Livestock Australia and The Crawford Fund, allowed for strategic exploration of a model for RD&E in our region and discussion around future capacity building. PhD students and researchers spoke about their research during a tour of the facilities, showcasing the Centre’s RD&E capacity.

Grower Groups are a critical link in the RD&E model and the Centre has strong partnerships with a number of grower groups across southern Australia. FarmLink, Central West Farming Systems and Holbrook Landcare Network participated in the recent meetings.

We welcome the opportunity for industry to visit the Centre to further strengthen existing partnerships and develop new ones.

Pictured below: Professor Deirdre Lemerle, Associate Professor, Helen Scott-Orr (NSW Coordinator, The Crawford Fund) and Professor Leslie Weston.
Photo: Sharon Fuller

Save the Date
Agribusiness Today Forum:
Beef Profitability Challenge

Thursday 7 August 2014, Blayney Community Hall

Comprehensive discussion by professional speakers on:

- Australian beef production and profitability in a global market
- Future of Australian beef markets
- Retailers and processors perspectives on the challenges in a competitive market
- Strategies and technologies for producers to improve profitability

To express your interest in attending contact the:
Graham Centre, E: grahamcentre@csu.edu.au, or CWRDA (02) 6369 1600, E: events@rdacentralwest.org.au
Strengthening international research partnerships

Two International researchers funded by Endeavour Research Fellowships are currently visiting the Graham Centre, strengthening research partnerships with International Universities.

Professor Jeff Weidenhamer

Professor Weidenhamer is Trustees’ Distinguished Professor of Chemistry at Ashland University (Ohio, USA) where he has taught for the past 25 years.

He is visiting the Graham Centre through to the end of July, where he is being hosted by Professor Leslie Weston.

The common thread in Jeff’s educational background is a deep and abiding interest in the chemical aspects of plant-plant interactions.

During his Master’s work at Ohio State he worked with Glover Triplett, who had done some of the pioneering research on no-tillage agriculture, and developed an interest in the question of whether the use of chemicals for weed control in this system could be reduced by using crops or cover crops to provide natural weed control. His PhD and postdoctoral research focused on understanding how allelopathy works in a natural community (the Florida Scrub) to prevent invasion. Through that work he recognised the need for new methods to study allelopathy, which has been his major research objective over the past 25 years.

He has contributed both new bioassay methods based on density-dependent phytotoxicity effects and most recently new soil analysis methods based on silicone materials to measure the dynamics of allelochemicals in the rhizosphere. His research in chemical ecology has been funded by the US National Science Foundation.

Professor Weidenhamer has previously visited Charles Sturt University for six weeks in 2011 as a Fulbright Senior Science Specialist in Agriculture.

While at the Graham Centre, Jeff will participate in studies to evaluate the root exudates of wheat cultivars, in particular, undertaking experiments to examine the impact of climate change on wheat productivity. These studies will be done in collaboration with Dr Weston, CSU and researchers at CSIRO Plant Industries to understand the factors involved in improved wheat performance in Australia, in light of a changing climate.

Root exudation can account for up to 20% or more of the loss of photosynthate from a plant root system. Recent findings suggest that more carbon actually exits the roots through exudation in response to climate change, which impacts activity of soil microbes, and also impacts the rate of C turnover in soil. Root exudates can be biologically active against competitors as well, so a better understanding of root exudation is crucial to understanding how crops such as wheat may respond to climate change.

Professor Weidenhamer will also be assisting Drs Weston and Quinn with isolation and identification of active compounds in biserrula, an annual legume associated with photosensitisation in grazing livestock.

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Professor Minggang Xu

Professor Minggang Xu, Deputy Director General of the Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences visited the Graham Centre for two months (February-March) hosted by Professor Deirdre Lemerle.

The main aims during his visit were to better understand the research and development of agriculture in Australia; to develop skills for administrative and leadership capabilities to manage research on an institute scale; and develop collaborative linkages between China and Australia, particularly in the field of agricultural resources and utilisation.

During his two month stay, he accessed new facilities at the Graham Centre including the rhizolysimeter, controlled environment facilities, field experimental sites, and spoke with researchers and farmers.

Professor Xu will visit and talk with scientists and groups involved in soil and plant nutrition, climate change and adaption, crop production, pastures and weeds, to learn new and engaging practices such as soil organic carbon sequestration practices and modelling, soil improvement and lime application practices and weed control practices. He will also do presentations and attend scientific workshops, meetings and forums.

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Boosting weed population dynamics modelling

Associate Professor Jianmin Lin has recently joined the Graham Centre as a visiting scientist working on weed modelling. He will spend three months in the Centre under the supervision of Dr Hanwen Wu.

Associate Professor Lin is the Deputy Director of the Institute of Applied Research, College of Mathematical Sciences, Hua Qiao University, Fujian, China. He has extensive experience in computer programming, software development and tertiary teaching.

He will construct simulation models on existing data collected under laboratory and glasshouse conditions and from field experiments. Hydrothermal time models will be used to predict the emergence of a number of weed species such as fleabane, barley grass, wild radish and silverleaf nightshade. His short visit will greatly facilitate international collaborations and enhance the weed research capability of the Weed Group in the Centre.

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2014 Graham Centre scholarships

Congratulations to the following students on being awarded Graham Centre scholarships for 2014.

University Research Centre PhD Scholarships
- Clare Flakelar
- Alice Bunyan

Internships for Undergraduate Research Training
- Jessica Verwey, Bachelor of Veterinary Science/Veterinary Biology
  Mentor: Dr Rob Woodgate
- Rowan Alden, Bachelor of Science
  Mentor: Dr Belinda Hackney
- Chloe Roberts, Bachelor of Agricultural Science
  Mentor: Dr Bree Wilson
- Emma Knight, Bachelor of Animal Science
  Mentor: Dr Susan Robertson
- Lucy Darragh, Bachelor of Agricultural Science
  Mentor: Dr Hanwen Wu

Keep up to date with the Graham Centre on social media…

Don't forget to follow the Graham Centre on Twitter @GrahamCentre and like us on Facebook https://www.facebook.com/GrahamCentreForAgriculturalInnovation?ref=hl
What’s the relationship between soil biology and carbon?

Soil carbon can be significantly increased by retaining crop stubble after harvest; however adoption is constrained by difficulties of sowing into subsequent crops, with up to 50 percent of farmers’ still burning stubble across southeast Australia in autumn.

Research by Graham Centre member and CSIRO researcher Dr Clive Kirkby shows that stubble incorporated with added nutrients increases carbon sequestration by 3-10 times in the top 30 centimetres of soil.

The Graham Centre’s Stubble Research Forum was held in conjunction with Riverine Plains at Corowa on Wednesday 5 March. The Forum is part of the Graham Centre’s stubble project, ‘Enabling landholders to adopt profitable and sustainable carbon cropping practices’.

It provided a platform for the 42 growers, researchers and industry experts who attended to engage and network, building knowledge and understanding about the use of stubble for carbon sequestration.

Dr Pauline Mele and Dr Lori Phillips, Victorian Department of Environment and Primary Industries, delivered the keynote address looking at soil biology and its relationship to carbon.

One of the biggest issues/hot topics farmers face is around the conversion of stubble into nitrogen available for plant growth (i.e. nitrification and denitrification). As part of their presentation, Drs Mele and Phillips discussed the process of nitrification and denitrification; microbes involved in the breakdown process; do our soils contain the appropriate mix of microbes; and the ‘materials’ required by the microbes for the breakdown process (i.e. food sources for microbes and nitrogen supply).

Dr Iain Hume, NSW DPI and Associate Professor Vaughan Higgins, CSU presented research results for the paddock trials and social science components of the Graham Centre’s project, while Dr Bill Slattery presented results for the Riverine Plains project.

Acknowledgement: This project is supported by funding from the Australian Government Department of Agriculture as part of its Action on the Ground program.

Project partners include: Central West Farming Systems, FarmLink Research Limited, Holbrook Landcare Network, Rice Research Australia Pty Ltd, Rural Management Strategies Pty Ltd, Southern Farming Systems, the Murrumbidgee and Murray Local Land Services, and Murrumbidgee Landcare.
Developing a DNA barcode system for identifying Conyza spp.

The genus Conyza includes numerous species of invasive annual weeds that are a threat to the cropping regions of Australia. There are eight recorded species of Conyza in Australia, the most prevalent and invasive being *C. bonariensis* (flax leaf fleabane), *C. sumatrensis* (tall fleabane) and *C. canadensis* (Canadian fleabane). These species exhibit differential susceptibility to commonly applied post emergent herbicides and herbicide resistance has been confirmed in flax leaf fleabane in NSW and other eastern states of Australia. Herbicide application is most effective at an early stage of plant growth before flowering but identification of Conyza spp. using morphological characters at these early stages is often only achievable to the genus level. Researchers attempted to develop a DNA barcode method for accurate and timely species identification of Conyza spp. in Australia to facilitate weed identification and subsequent management.

A DNA barcode is a short, standardised DNA region that is sufficiently variable to separate different species. A single gene region (mitochondrial CO1 gene) has been established as the standard DNA barcode for species identification in animals but the discovery of a similar single gene DNA barcode for plants has proved more challenging. Multiple gene regions are almost always required. The chloroplastic gene regions of *rbcl* and *matK* are the standard DNA barcode for plants but for some genera, these gene regions are not powerful species discriminators and additional gene regions must be utilised.

This study assessed the ability of one nuclear (ITS) and three chloroplast gene regions (*rbcl*, *matK*, and *trnL-trnF*) to discriminate between Conyza spp. from populations of each species collected across Australia. The samples were sourced primarily from herbarium specimens. DNA was extracted from fresh and dried plant tissue and amplified at each of the four gene regions of interest using polymerase chain reaction (PCR). DNA samples were sent to the Australian Genome Research Facility (AGRF) for sequencing. The sample sequences were matched against (aligned to) each other and a number of methods were used to determine which, if any, of the four gene regions were able to discriminate among the species. The results showed that a combination of ITS and *rbcl* DNA barcode regions generally provided a suitable platform for potential identification of Conyza at the species level. This proposed DNA barcode provides a quick, accurate and inexpensive scientific method of species identification at an early stage of plant growth when separation of the species by morphological means is difficult. It provides a molecular tool for further taxonomic studies of the Conyza genus and may potentially aid in the understanding and management of this invasive weed.

Karen Alpen, CSU, has undertaken this study as part of her Honours Degree with the financial support of the Graham Centre of Agricultural Innovation.

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DNA barcoding unlocks ‘Adults Only’ species identification

Ground-breaking research has lifted the historical ‘adults only’ restriction on the identification of sap-sucking insects. NSW Department of Primary Industries Scientist, Dr David Gopurenko said recent research has found that DNA barcoding is an accurate way of identifying immature insect specimens.

“We’ve concentrated this work on sap-sucking insects including leafhopper, treehoppers and planthoppers, a group that can spread disease among plants off which they feed,” Dr Gopurenko said.

“Traditionally identification of species in this group of insects can be very difficult as features used to reliably distinguish species are often only found in adult specimens.

“We have now engaged DNA barcoding, which looks at the gene sequence of the insect, to successfully identify juvenile specimens.

“This approach has been successful for species identification across a broad range of fauna, but has rarely been applied to leafhoppers and other sap-sucking insects.”

Dr Gopurenko, with a team of DPI and Australian Museum scientists made the discovery whilst studying leafhoppers and related insects at Barrow Island, Western Australia.

“This island has a near pristine environment, containing diverse native fauna largely undisturbed by people or exotic pests,” Dr Gopurenko said.

“We found that the DNA barcoding not only accurately identified adult and juvenile specimens within this group of insects, but it also provided new information on hidden diversity among otherwise identical looking insects.

“As a result we’ve detected some species of insects that have likely not been recorded previously and remain to be fully described.

“By using DNA barcoding in parallel with traditional methods, new information can now be gathered from adult, juvenile and even degraded specimens,” Dr Gopurenko said.

Dr Gopurenko said further investigations into the diversity of the species will also look at the potential for carry and spread of disease.

“Now that we know DNA barcoding is an accurate identification tool, insect researchers requiring accurate species identification of immature specimens have a reliable method to engage,” Dr Gopurenko said.

A PDF copy of this published article is available by contacting David.

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Acknowledgement: The study was funded by the NSW BioFirst Initiative grant to the NSW Agricultural Genomics Centre, and involved researchers from NSW Department of Primary Industries, the Australian Museum and the Graham Centre for Agricultural Innovation.

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Figure 1. Genetic distance tree of DNA barcodes for a subset of adult leaf hopper species sampled from Barrow Island, WA. Two morphologically similar nymphs included in the analysis are identified to different species by their DNA barcodes.
Training workshop improves pest Midge identifications in India

NSW DPI researcher Dr David Gopurenko recently attended the International Training Programme on Bluetongue Vector Identification held at the Tamil Nadu Veterinary and Agricultural Science University (TANUVAS), Chennai, India, as a guest speaker and workshop presenter.

The workshop, organised by researchers from diverse centres such as The Pirbright Institute (UK), Lala Lajpat Rai University of Veterinary and Animal Sciences (LLRVASU) (India) and TANUVAS (India), brought a panel of six international experts on midge taxonomy, ecology and molecular systematics to provide first hand training to over 40 midge researchers stationed in India.

The workshop aimed to provide Indian researchers with a knowledge and practical understanding of contemporary taxonomic and molecular methods used to identify and describe *Culicoides* midges.

This midge genus is species rich and many species harbour pathogens, acting as vectors for the spread of devastating livestock disease such as Bluetongue. Currently little is known on the diversity of *Culicoides* in India, but the continent is likely to contain both cosmopolitan and rare pest midges that require description.

The workshop provided an avenue to bring midge researchers from across India together as in impetus to increase knowledge and stimulate research on the Indian midge fauna. Dr Gopurenko contributed both theoretical and applied knowledge/training to the workshop attendees on the use DNA barcoding for midge identifications. DNA barcoding is an efficient means of identifying species based on nucleotide content at a sequenced gene, and has been used extensively by Dr Gopurenko in collaboration with expert midge taxonomists to report descriptions of midge taxa in the Australasian region. This integrative taxonomic work marries morphological description, ecological data and molecular analysis/systematic. It is expanding researcher’s knowledge of the important midges in Australasia, and can be equally applied to assist in descriptions of the fauna present in the Indian subcontinent.

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Establishing pastures - the trade-off between crop and livestock

A recent survey by the EverCrop™ project indicates that 83% of farmers in the mixed farming zone of southern NSW, regularly under-sow their pastures. In other words they use a cover crop. This practice goes against traditional research and extension advice that recommends pastures be sown straight sown, because under-sown pasture is at greater risk of poor establishment and less productive over the pasture phase. However, most previous research focused primarily on pasture density and biomass production. It did not quantify the financial implications of the cover crop or the potential effect on livestock productivity.

The Decision Support Tool (DST) operates under the premise that a pasture is to be sown in a particular paddock the next year. The user is able to consider the costs and income from grain and livestock production during the pasture phase.

The underlying calculation for the DST is the net income from under-sowing (US) pasture minus the net income from straight-sowing (SS) pasture for the length of the pasture phase:

\[
\text{Net income} = (\text{Crop income} + \text{US livestock income} - \text{US variable cost}) - (\text{SS livestock income} - \text{SS variable cost})
\]

An important component of the model is the capacity for the user to change a range of inputs to match their enterprise. The inputs in the DST include expected grain price, grain yield, stocking rate and livestock gross margin ($/DSE), establishment costs, the length of the pasture phase and relative effect that under-sowing has on pasture production (see Figure 1).

Livestock Gross Margin has been derived from NSW DPI budgets and is the net income from livestock, including the costs for stock and pasture management. The length of the pasture phase is the length of the intended pasture phase minus the establishment year when grazing is limited. The DST does not calculate pasture production *per se* but instead calculates the differences in stocking rates for the different establishment options, which we assume is related to pasture production. The user is asked to estimate on the basis of their experience the under-sowing relative effect,
which is the proportion of production from an under-sown pasture relative to a straight sown pasture. For example, 0.5 being half the production of the straight-sown method. The DST provides a single number in the Outputs to estimate which method of pasture establishment is more profitable. If the value is positive then greater profitability is obtained from under-sowing. By contrast, if the value is negative, straight sowing the pasture would be more profitable. The model produces sensitivity graphs to demonstrate how factors change the result, such as crop yield and grain price.

Using the values in Figure 1, the DST produces a value of -$5.00/ha which indicates that straight sowing the pasture is marginally more profitable for the nominated length of the pasture phase. The DST comments that this value is ‘too close to call’ and that under these set of conditions the decision to under-sow or not might need to be made by the user on the basis of other ‘non-financial’ considerations.

The DST can produce a number of sensitivity graphs, with length of the pasture phase (Figure 1) indicating that straight sown pasture is the best option (a greater cumulative profit) with phases greater than four years. However, a minimum six year pasture phase is required when the under-sowing relative effect is 0.7 (Figure 2a), increases to eight years with a grain value of $240 (2b) and nine years with a 3.0 t/ha grain yield (2c).

Increases in livestock enterprise gross margin or stocking rate will favour establishment of pastures by straight sowing (Figure 3a, b). In this case an increase from $25 to $30/DSE reduces the minimum length of the pasture phase to five years, and when combined with a stocking rate increase to 15 DSE/ha the minimum length is four years. Conversely, a decrease in gross margin and stocking rate to $20/DSE at 6 DSE/ha increases the minimum pasture rotation using straight sowing to 11 years (Figure 3c).

The primary purpose of the DST is to enable users to include important inputs into the decision making process. There is limited data on the relative effect that under-sowing has on pasture production, however it is likely to fall between 0.5-0.8 in normal years. It is likely there will be different perceptions of the ‘relative effect’ due to differences in climate and soil. The DST relies on the users experience.
in establishing pastures to set their ‘under-sown relative effect’ and their potential crop yield.

The user should also remember that the DST does not substitute for good agronomy. A major reason for poor establishment of pastures is likely to be because many pastures that are under-sown in southern NSW are sown towards the end of the crop sowing window. Pastures should be sown earlier in the sowing window to maximise establishment to counter their poorer seedling vigour relative to most crop species. If the DST suggests it is more profitable in a given set of circumstances to establish a pasture under a cover-crop, sowing should occur earlier in the sowing window.

The EverCrop™ project team continues to test and refine this DST with both advisors and farmers. The tool is compatible with most common computer systems and anyone wishing to trial it is encouraged to access the tool at www.grahamcentre.net

Contact: Mr Geoff Casburn  
E: geoff.casburn@dpi.nsw.gov.au; T: 02 6938 1630

**Cutting women’s workloads on Pakistani farms**

If you add up the duties performed by the traditional wife of a small-holder farmer in the tribal regions of North West Pakistan, you will wonder how they exist. The collection of feed, feeding and hand milking the family herd of 2-4 animals, together with calf rearing, you would think was enough, but add this to the normal routines of cooking, washing and cleaning the household, which are all part of the life of a Pakistan housewife. Imagine then being asked to watch the cow or buffalo herd around the clock for signs of oestrus activity, and you would imagine this would be enough to push any normal housewife over the edge.

Our ever innovative Masters student Md Riaz Khan has suggested a solution to the problem following on from his masters studies conducted in Punjab with small-holder farmers, under the direction of CSU Adjunct lecturer Hassan Warriach. It is well recognised in scientific literature that the insertion of a progesterone implant or CIDR into the vagina of the animal will allow for the synchronization of oestrus behaviour of the animal once the implant is removed. Riaz reasoned that if women could be taught this simplest of technologies, then they would only have to keep track of oestrus behaviour for 48-72 hours each time the animal cycles.

This leaves the women more time on most days to complete their other chores and perhaps indulge in an additional entrepreneurial activity like converting milk into value added products such as butter, ghee, lassi, yoghurt or sweets which helps with the family budget.

Of his own volition, he sent his ideas off to the Bill and Melinda Gates Foundation, who embraced them and awarded him a phase one grant of US$100,000 over 18 months. Riaz is now leading this extension program as a Lecturer in Animal Health at the University of Agriculture Peshawar under the guidance of Graham Centre researchers Hassan Warriach (based in Lahore), David McGill, Subhan Qureshi, Head of the University Dairy Park in Peshawar and CSU Adjunct Professor, Scott Norman and Peter Wynn.

Riaz and his team will spend the next 18 months training women’s groups in bovine reproductive management in villages along isolated mountain tracks in which can only be described as a challenging environment. Let’s hope this leads to more calves, more milk and a better standard of living.

Contact: Professor Peter Wynn  
E: pwynn@csu.edu.au; T: 02 6933 2938

Learning about cattle reproduction management and synchronizing oestrus allows Pakistani women more time to complete their daily chores. Photo: Peter Wynn

Riaz Khan has been successful in obtaining funding from the Bill and Melinda Gates Foundation to train women in Pakistan about cattle reproduction. Photo: Peter Wynn
Dr Chris Blanchard has recently taken on the position of Director, ARC Functional Grains Centre.
Saira Hussain, PhD Student

Supervisors
Associate Professor Christopher Blanchard, Dr Ata Rehman and Dr David Luckett

Thesis title
Bioactive Compounds in Canola Meal

Funding body
Faculty of Science Research Higher Degree Scholarship

Relevant Current Employment
Student

Career and studies till now
Research Associate, Visiting Lecturer (Molecular Biology, Cell and Tissue Culture, Biotechnology, and Cell biology), Demonstrator (Clinical Biochemistry, General Biochemistry, and Advanced Haematology).

I completed my Masters in Biochemistry, and also successfully completed one year of a PhD in immunology and virology from the National University of Science and Technology (NUST), Pakistan.

Currently studying
PhD at Charles Sturt University (CSU), Australia

Research Interests
Measuring bioactivities compounds, Molecular Biology, Tissue culture and Bioinformatics

Professional Links
Australian Institute of Food Science and Technology (AIFST)

A typical day for me includes
Getting up early in the morning, being thankful for having a new day in my life. Start my work doing experiments, achieving my dreams and having time with friends and family.

My main project at the moment is
Research to find novel compounds for therapeutic purposes.

My favourite part of my studies is
Proteomics

When I am not studying I like to
Watch movies, play badminton and having fun with friends

When I am driving I like to listen to

Winter Edition of the Innovator


Please email articles to Toni Nugent or Sharon Fuller.
## Events Calendar

<table>
<thead>
<tr>
<th>Date</th>
<th>What</th>
<th>Where</th>
<th>More Information</th>
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</thead>
<tbody>
<tr>
<td>13 June</td>
<td>Science &amp; Agriculture Enrichment Day</td>
<td>Graham Centre Wagga Wagga</td>
<td>Toni Nugent</td>
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<tr>
<td>4 July</td>
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<td>Agribusiness Today Forum: Beef Profitability Challenge</td>
<td>Blayney Community Hall</td>
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<td>10 Sept</td>
<td>Farmlink Expo</td>
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<td>2 Dec</td>
<td>Graham Centre End of Year Function</td>
<td>Convention Centre Charles Sturt University Wagga Wagga</td>
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*Layout & Design: Sharon Kiss*