

AgScience

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WELCOME TO THE LATEST edition of AgScience, this time with a focus on members who are involved in international support projects. Brent Clothier, our 2013 Sir Arthur Ward Awardee, leads a tree physiology team involved in intensive data collection and modelling to develop irrigation tools for that oldest of challenges, greening the desert. James McWha reports on the encouraging progress made in education and development in Rwanda – could there be any nation for which such a need is greater, given our vivid memories of its troubled past? Past president Tony Brenton-Rule widens the lens for a global view of the benefits and stumblings of international development aid, begging questions about the role to be played by the “small advanced economy” that is New Zealand.

In the past few months two significant documents have emerged from the policy cauldron, Environment Aotearoa 2015, www.mfe.govt.nz/publications/environmental-reporting/environment-aotearoa-2015, the long-awaited state of the environment update report, and the National Statement of Science Investment (NSSI) www.mbie.govt.nz/info-services/science-innovation/pdf-library. The overall sense one gets from EA2015 is of small wins and big losses across the headline domains. The highlighting of the problem of soil compaction under livestock was somewhat surprising to me, the implication being that it was related to increasing stocking rates, particularly following dairy conversions. Digging a bit deeper into the hyperlinks there appears to be a connection with declines in soil organic matter, which I would regard as a more fundamental long-term problem, not just for soil productivity but with implications for our greenhouse gas accountability. I suggest you also look at a recent series of collaborative reports from the National Land Resource Centre on the

future of soil monitoring.

There are lots of encouraging indications in the National Statement of Science Investment, most particularly placing front and centre the goal to raise business expenditure on R&D to 1% of GDP. The gap between this fairly modest goal (by international standards) and current levels has long been a drag on New Zealand’s sustainable growth. The principles underpinning the NSSI vision – transparency, high performance, simplicity and stability – are also laudable. I believe at least three of them are wanting as things stand. The matrix of investment pools (NSSI p 26), each with their own internal sub-structures and diverse bidding formats, does not convey a sense of transparency, simplicity or stability. Add to this the increasing expectations for intensive pre-bidding negotiations with a raft of stakeholders and we have a system with heavy transactional costs and delays in securing investment that are not supportive of high performance. I agree fully with the theme that excellent science must be measured by its impact, which I have always found to be the world view prevalent among agricultural researchers. The challenge is to come up with more convincing indicators of impact than those currently available (indices of publications, collaborations and investment levels) and I look forward to the ministry’s efforts in this regard.

Looking to our own house, I am pleased to note that Council has recently been paying more attention to a strategy for the Institute. We have long been murmuring about declining and ageing membership and the risk this presents to our viability and relevance. Last year Council had some useful discussions with the Royal Society of New Zealand around engagement with the emerging cohorts of scientists and shortly we hope to look at the reports on two projects from the Integrated Studies programme at

Massey University. Two groups of students were charged with developing a strategy for the Institute, and from the presentations I attended last month there are some interesting ideas on the table, including a refresh of our online presence, consideration of how to best use associate memberships and even a name change.

I’d like to formally thank David Lewis for his extended tenure as NZIAHS president over the past three years, culminating in a superb leadership effort ensuring that the Institute had a high profile role in the International Horticultural Congress in Brisbane last year. Thanks also to Jon Hickford, who is finishing his role as immediate past president. Jon is always engagingly outspoken in support of our sector’s interests. We now welcome Jeanne Jacobs to Council, so please take the time to become familiar with her background by reading her citation as a new Fellow of the NZIAHS, which you can find in our recent newsletter or online.

Finally, a word of respect to the memory of John Lancashire, a towering figure in the agricultural science sector for so long, whose impact went far beyond his compact “hardy perennial” growth form. It was especially pleasing to see his contribution to local community in the area of biodiversity conservation was well recognised at the funeral service, since as a fellow plant ecologist I share the same affinity for both agronomy and restoration. In my correspondence archives I have a performance letter from John as my GM, dated 1997 and thanking me for my efforts during that year. Here in public I return a word of appreciation, for his persistent efforts over many years in the advancement of primary sector research.

Mike Dodd
President

Professor Emeritus James McWha
Vice Chancellor, University of Rwanda

Letter from Rwanda

I AM WRITING THIS from Kigali in Rwanda as I prepare to complete my two-year term setting up the University of Rwanda, a country of about 12 million people in the heart of Africa. Kigali, the capital, is a city of about 1.5 million people at an altitude of about 1500m in what is accurately referred to as “the land of a thousand hills”. These hills range from the mighty volcanoes in the north, on the border with Uganda and the Democratic Republic of Congo and home to the famed mountain gorillas, to the more rolling hills in the east where cattle farming is dominant and where on the border with Tanzania there is a large safari park with savannah, swamp and lakes and where the wildlife can be ‘a bit scary’!

Rwanda and its southern neighbour, Burundi, are remembered for the horrifying genocide 21 years ago in which almost one million Tutsi and moderate Hutu were slaughtered in a matter of weeks. These events are commemorated annually at an event called Kwibuka.

As a generalisation, the Tutsi are or were cattle herders (with more than 13 animals) while the Hutu grow crops ranging from beans (the major protein source) to bananas and Irish potatoes (the major carbohydrate source) together with rice, maize, passion fruit and just about anything you can think of. The temperatures are around 26°C-31°C daytime with the night-time low of perhaps 18°C. So long as the plant doesn't need a winter chill, you can grow it. Water is readily available with short thunder storms most afternoons except in the dry season of June to September and in January.

The main challenge is the “thousand hills”. There are substantial hills of a few thousand feet, terraced top to bottom with crops selected according to soil type, water availability and climate factors. Advice is available from the Rwanda Agriculture Board and growers are expected to plant according to the advice given.

The major export crops are tea, coffee and pyrethrum. For best quality they have to be grown in the correct conditions. Tea is generally in large corporate plantations with an adjacent processing plant while coffee and pyrethrum, like most other crops, are family ventures although frequently they combine as co-operatives for drying and processing facilities to be shared. Frequently in rural areas sheets will be spread out in front of houses with coffee beans, peanuts, peas and pyrethrum flowers, laid out to dry in the sun but close to the house so they can be wrapped up and taken indoors if rain threatens.

Bananas, beans, maize and potatoes abound as staple foods and the valleys accommodate crops needing more water. Thus rice, fish ponds (tilapia) and papyrus dominate the wetter valleys with vegetables of all kinds in small plots, usually with drainage/irrigation channels serving a dual purpose, depending on the season.

Farming is generally at peasant farming level with virtually no mechanisation, not even hand-held

rotary hoes. Around two-thirds of the working population are engaged in farming. Someone explained to me that “farmer” is another word for unemployed. This is untrue but a revolution is on the brink of happening in farming with mechanisation, new plant varieties, crop nutrition, improved irrigation and food processing all playing a part. Dairy farming is prospering especially in the east, and milk collection and processing facilities are springing up, often as co-operatives or, in a few instances, run by the University of Rwanda.

There is much to do if we are to continue feeding a rapidly growing population in an already densely populated country. Half the population is under the age of 18 years; together with consolidation and mechanisation in agriculture this will result in a massive demand for jobs. These can be past farm gate or in entirely different industries such as mining, hospitality and tourism, financial services and ICT. The country has a fibre-optic network and an impressive level of education.

All schooling is in English and all children attend primary school. The majority complete secondary school. The demand for university and technical and vocational education at post-secondary level is growing rapidly and expectations are high. The national objective is to rapidly become a middle-income country with food, health and education designated as priority areas.

The University of Rwanda, set up in October 2013 after a major international review of higher education, was to be created by merging the seven public institutions which were offering degree programmes. A high priority would be placed on research and public service. Thus we are the only public university in Rwanda with over 30,000 students on 14 campuses around the country and the expectation of exceeding 50,000 students within 5 to 10 years (this may be a conservative estimate). Ultimately we merged 12 institutions offering almost any subject you can imagine.

James McWha and the King's long horn cattle



Tea plantation



The emphases, however, is on STEM (Science, Technology, Engineering and Mathematics) and agriculture and food feature prominently. They are being offered on five campuses with specialisms suited to their regions and food science and technology is co-located with engineering, physical science and health science here in Kigali. We are expected to provide the next generation of educated agriculture, horticulture and food scientists as well as generate knowledge needed through research. The challenges are enormous because only 18% of our staff have PhD's and we call on our friends to assist with staff development.

Rwanda has enormous ambitions. Given the progress it is making – for example, over 7% economic growth every year for the past 14 years – it will achieve these. I am privileged to have played a part by setting up and establishing the University of Rwanda. ☺

Minimising the irrigation of desert forests

IN THE 1970S, the late Sheikh Zayed bin Sultan Al Nahyan, founding father of the United Arab Emirates (UAE), embarked on a programme of greening of the desert through afforestation. The forests planted provide a variety of benefits including amenity value, sand stabilisation, prevention of further desertification, plus valuable food and shelter for the desert's unique biodiversity. The forests also deliver valuable cultural services – but they need to be irrigated. They are in a hyper-arid environment where annual evapotranspiration exceeds 1900 millimetres a year and annual rainfall is less than 60mm.

The source of the water for irrigation is currently groundwater. For the UAE, the recharge of their aquifers is so low that some 76% of the groundwater currently extracted for irrigation comes directly from the depletion of the extant groundwater reserves. With a mandate to preserve groundwater, as well as to maintain the forests, the Environment Agency – Abu Dhabi (EAD) has set a target to reduce by 80% the use of groundwater to irrigate the desert forests within the emirate.

The Secretary General of EAD, Her Excellency Razan Khalifa Al Mubarak, in a press release from the 2015 International Water Summit (IWS) in Abu Dhabi, commented: "...our objective is to ensure that only recycled water is used for irrigation, while conserving groundwater resources. We are working with other agencies and are developing distribution infrastructure to capture recycled water at treatment plants and deliver it to forests throughout the emirate".

Plant & Food Research's knowledge of the factors controlling tree water-use, and its ability to measure and model the irrigation requirements of perennial trees, led Steve Green and Brent Clothier to work with EAD to minimise the irrigation of desert forests. Brent and Steve are now assessing the use of treated sewage effluent (TSE) from cities, instead of groundwater (GW), to irrigate the desert forests. The project is managed by Steve Dixon, of Maven Consultants from Wellington. This research involves EAD scientist Wafa Al Yamani, whose work on this project is part of her PhD programme, through

the Joint Graduate School of Massey University and Plant & Food Research. Wafa's supervisors are Brent Clothier, Peter Kemp (Massey University) and Shabbir Shahid of the International Center for Biosaline Agriculture (ICBA) in Dubai.

During the first year of the project, we have set-up experimental plots at Madinat Zayed in the western desert of Abu Dhabi. Field experiments have already been set up on Al Ghaf (*Prosopis cineraria*)



Figure 2. Wafa Al Yamani drilling holes into one of the many stems of a Sidr (*Ziziphus spina-christi*) tree to enable insertion of heat-pulse probes and a heater to permit continuous monitoring of the tree's transpiration. Four stems per tree are being monitored, and four trees per treatments have instruments installed.

and Sidr (*Ziziphus spina-christi*) trees. There are 12 trees in each plot, six of them irrigated with GW and six with TSE. The GW has a salinity of around 8-10 deci Siemens per meter, whereas the TSE is less than 1 deci Siemens per meter. The Sidr site is shown in Figure 1.

We have installed heat-pulse devices in eight trees per treatment to provide continuous monitoring of the trees' transpiration (T) (Figure 2). Three-wire time domain reflectometry rods of length 1.2 metres have been installed in the drip zone, and nearby, to monitor the soil's changing water content. Because of the high salinity of the GW treatment, we have found it necessary to sleeve the core rod to enable detection of the "echo" at the end of the rods in order to compute the soil's water content (Θ). Solar panels are used to charge 12-volt batteries so that we have been able to obtain continuous 30-minute records of T and Θ , as well as a range of weather variables and biophysical conditions.

Sidr trees undergo an interesting annual phenological cycle. After flowering and fruit development in February, the Sidr trees begin to shed existing leaves during April/May before entering a new leaf growth phase. Our irrigation treatments were imposed in May just as the new leaf growth cycle was beginning.

Some five months later, the impact of the TSE on tree performance is evident (Figure 1). We are currently analysing our T data from our heat pulse devices, and the Θ results from our TDR measurements. An extract of T data is shown in Figure 3. Six months of hourly transpiration results from two Sidr trees from the GW treatment are



Figure 1. Our experimental plot of Sidr (*Ziziphus spina-christi*) trees near Madinat Zayed in the western desert of Abu Dhabi in November 2015. Steve Dixon (left, middle-ground) and Wafa Al Yamani (right, middle-ground) are assessing the impact of the experimental treatments: groundwater is used to irrigate the trees on the left, and treated sewage effluent is applied to the trees on the right. Treatment differences are evident, just some five months after the imposition of the treatments.

Wafa Al Yamani¹, Steve Green², Rommel Pangilinan¹, Steve Dixon³ & Brent Clothier²

¹Environment Agency - Abu Dhabi, UAE

²Plant & Food Research, Palmerston North

³Maven Consultants, Wellington

shown. These data highlight the impact that the variable tree sizes, especially the different total leaf area, has on tree water use (T). Further, the loss of leaves during April/May can be seen as T declines, as can the impact of the new cycle of leaf growth beginning in late May as leaf area increases result in the rise in T.

To interpret these data on tree water use, root water extraction and tree performance, we have developed a "light-stick" to monitor the changing patterns of total tree leaf area (Figure 4).

Our regular monitoring with this "light stick" of the changing pattern of trees' leaf area will enable us to model the link between

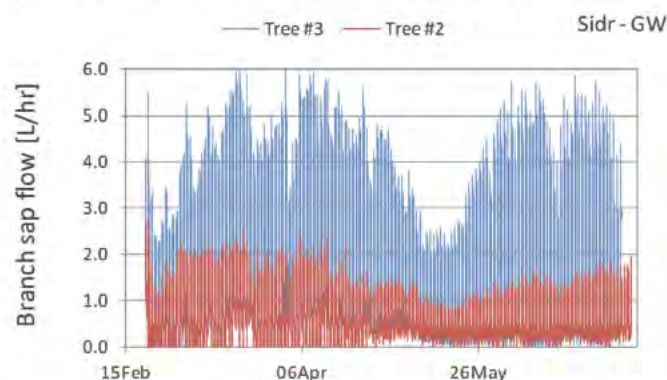


Figure 3. Heat-pulse measurements of tree transpiration (T, L/hr) for two Sidr trees of different leaf areas from the groundwater treatment during six months of 2015. Weather conditions over this period were comparatively similar, and the changed pattern of T reflects the pattern of decline and growth of the trees' total leaf area.

prevailing weather and the trees' transpiration. From these data, and the knowledge we will gain, we will develop a biophysical model of tree transpiration, the impact of the use of TSE, and need for a given leaching fraction to remove salts from the rootzone. These factors will all be incorporated into an irrigation management tool.

In a press release from the 2015 IWS, Wafa Al Yamani noted that the goal of this collaborative work and her PhD research is to develop this "...forest irrigation management tool that will allow EAD to tailor irrigation approaches for specific forests based on tree species, local climate and soil properties, and to forecast growth rates and productivity indices of these trees grown with recycled water and sometimes saline water." 📷



Figure 4. Wafa Al Yamani using the "light stick" to determine the shadow pattern of Sidr trees. From this measured pattern of shadow, light interception by the trees' leaves of the incident radiation can be inferred by inverse modelling of the penetration of light beams through the canopy. This light interception measure can be used to connect tree transpiration (T) to the prevailing weather conditions.

LOSS OF AGRESEARCH JOBS WILL HAVE A HUGE RIPPLE EFFECT THROUGH THE FARMING SECTOR

The proposed loss of up to 33 scientists and 50 technical positions at AgResearch, will have a huge ripple effect throughout the New Zealand farming sector, according to Dr Jill Stanley, Vice President of the New Zealand Institute of Agricultural and Horticultural Science (NZIAHS). The primary industries account for over 50% of New Zealand's export earnings and agriculture is a big contributor to this. The rundown of research capability will impede New Zealand's efforts to stay competitive in the international market.

The 2015 OECD report places New Zealand 27th out of 34 OECD countries in terms of total spending on R&D as a percentage of GDP. Our poor performance is acknowledged in the National Statement of Science Investment, released this week. In this statement, the Government outlines plans to increase both public and private sector investment to reach the OECD average by the 2020s. This sounds admirable, but we recall Simon Upton as Minister of Science expressing the same desire during the science reforms of the 1990s, and failing to bring about the necessary step-change in science funding. The Government is also reviewing CRI core funding, which has not been inflation-adjusted since its inception. But will this be a case of too little, too late?

"Obviously, the affected staff will be feeling undervalued and vulnerable," says Dr Stanley.

Of those who lose their jobs, it's likely only a few will find other jobs in agriculture within New Zealand. Many of the others will likely be lost to our competitors overseas, whilst some will find jobs outside the sector. These redundancies will further discourage bright young New Zealanders from entering a career in the primary sector, at a time when we desperately need an increase in our skill base.

The heart of the problem appears to be lack of funding to retain this capability, says Dr Stanley. AgResearch has predicted a gap in revenue of more than \$5m this financial year. They have identified new areas that need 27 new staff, resulting in a net reduction of 56 positions. Dr Stanley agrees that AgResearch should be responding to industry needs. But she says New Zealand needs a science system that is adequately buffered to allow for capability retention when shorter-term industry priorities change.

This press release from NZIAHS was sent to New Zealand media on 8th October 2015. Since then AgResearch has confirmed its proposal with a slight revision to the staff reductions originally proposed.

International agricultural

Most readers of this article, as New Zealanders, are the fortunate winners of a genetic and geographic lottery that has given them advantages unavailable to the majority of the world's people. This enables them to enjoy wealth that ranks them in the top 1% - 5% of global citizens. Development aid can help to redress the imbalance between advantaged and disadvantaged people but it's a complicated and fast-changing business.

TURBULENT FORCES ARE AT WORK

Countries and peoples are no longer easily categorised as developed and undeveloped. Social and economic disparities often are greater within than between countries and some formerly rich countries are becoming relatively poorer. The adoption of recent technical innovations by emergent economies has enabled them to leapfrog past older and more costly technologies and infrastructure used by countries that have already industrialised. Wealthier countries face high healthcare and welfare costs for their aging populations while poorer countries may harvest the benefits of a youth-dominated population pyramid.

Television news, the internet and social media provide a plethora of information which can sway public opinion and influence government policies. Evidence-based scientific research can be lost or ignored, however, when it's not what people want to believe. For example, some countries with starving people have chosen not to take advantage of genetically modified crops that could have been beneficial. The opponents of genetically modified organisms who have sought to prevent its use in these places are sometimes from wealthy countries with plentiful food. It is yet to be seen if new gene editing technologies arouse the same antipathy.

THERE'S BEEN SUCCESS, BUT WHAT'S CAUSED IT?

Successful aid programmes have lifted many people out of poverty – about 1 billion in the past 25 years – but there's debate about where the credit should lie. Should it go to development organisations or market-led economic growth? Or have the people we are trying to help been much more capable than we think and are they highly entrepreneurial, as evidenced by the dynamic, uncounted and unregulated grey economies in poor countries? What is the importance of empowered women who, given the chance, work hard

and make excellent social and financial decisions?

THERE ARE FEW SIMPLISTIC SOLUTIONS

About 1 billion people live in the border zone between survival and death. These people are often smallholders, reliant on livestock as a store of wealth and food. Western research indicates that livestock contribute 11% - 18% of global anthropogenic greenhouse gas emissions and this has led to strong anti-livestock criticism. Recent work in Africa, however, suggests that emissions estimates from developed countries are inapplicable to Africa's climatic and environmental conditions.

Ancient systems such as nomadic pastoralism in arid regions are well adapted to local conditions and highly productive. Critics point to the environmental damage of pastoralism, but it is often caused by the loss of grazing lands to politically powerful interests and over-grazing caused by the enforcement of country borders on peoples who have ranged freely for centuries.

WE KNOW WHAT WE KNOW, BUT CAN MISS THE REST

New Zealanders are familiar with the tiger economies of South-east Asia, whose rapid economic progress has been much applauded. Myanmar has the potential to join the other tigers.

We are less well-informed and more ambivalent about Africa, a continent seemingly afflicted by drought and politics, with people who are somewhat tribal and distinctly non-tigerish. The reality can be very different. While Western economies have been languishing since 2008 some African countries, such as Ethiopia and Tanzania, have recorded economic growth greater than the Asian tigers.

Africa has the largest undeveloped land reserve in the world, a fact not lost on non-African countries seeking food security. It is predicted

By Tony Brenton-Rule, a past president of the NZIAHS, who has worked in business, government and international agricultural development. Tony now lives in Texas.

development

that by 2050 Africa will hold about 25% of the world's people and about 40% of its children. Is this a disaster in the making or a large potential workforce in an industrialising region?

African politics can be much better than we know about too. Rwanda in 1994 was divided by brutal genocide that killed about 20% of its population. But its GDP growth was 7% in 2014 and is projected to be 7.5% in 2015 and 2016. The 2014 Transparency International corruption perceptions index ranks it as the 55th least corrupt country in the world, well ahead of countries with which we are more familiar such as Thailand (85th), Myanmar and Cambodia (156th).

THE DONOR LANDSCAPE IS CHANGING

Traditional funding countries are becoming poorer, relative to emerging economies. How long will the taxpayers of these countries continue to support donations on the scale of the past? Some countries' aid budgets are declining in real terms. Some, including Australia and New Zealand, are focusing their aid efforts in geographic regions of significance to them for policy reasons. Others, such as China, are new to funding and do so within an aid paradigm that is different from the traditional model. Likewise, large private aid foundations, such as The Bill & Melinda Gates Foundation, are becoming significant funders and are influencing funding and aid strategies.

DONORS ARE BECOMING INVESTORS

Free money, given with charitable hope to worthy aid organisations, is diminishing. Instead the people providing money are investing. As investors they expect a high return on their investment – successful development. Accordingly, aid organisations must monitor and evaluate their programmes carefully and regularly report outcomes to their investors with metrics that are meaningful to them. Investors may test new strategies with pilots, requiring programme flexibility that enables fast learning and fast failure.

INVESTORS WANT BUSINESS INVOLVED

There is growing belief among some funding entities that reducing global poverty and hunger requires rapid scale-up and accelerated growth in the agriculture sector by engagement with business. The



logic is that strategic alliances with the private sector address critical development objectives while fitting business interests, and that businesses will have incentives to scale much faster than others in the development arena. This perspective is controversial and unwelcome to many who believe "business" is the antithesis of what development is about. Are they right, or do they not see the lesson of the Asian tigers and the high quality of some people in emerging economies? Have the advocates of business involvement not sufficiently explained that "business" does not necessarily mean external large corporates, but often, instead, indigenous business with tiger capabilities?

CAN NEW ZEALAND HELP?

New Zealand can help, thanks to advantages such as excellent agricultural research capability, a pasture-based production system with elements suited to many development geographies and good phyto-sanitary standards. Its agricultural universities are world-class with a strong history of training overseas students. New Zealand farmers are fast adopters of new technologies and some of its agri-businesses have international capability. But New Zealand is constrained financially and has limited resources, so is unable to throw money or people at offshore development challenges. We must instead pick our targets with care, leverage our capabilities by partnering with others, and be smart in evolving a strategy that works in the complicated and uncertain aid business. 🐯



John Lancashire

1935-2015

JOHN LANCASHIRE, an Honorary Fellow and former President of the Institute, has died after a distinguished career as an ecologist and agronomist.

He oversaw work on grass, forage herbs, white clover breeding, basic plant science and sustainable farming systems and was responsible for extensive and immensely valuable additions

of seeds and cultivars being made to collections at the Fitzherbert Centre.

He will be remembered, too, as a highly articulate scientist who wrote many challenging articles and spoke on the radio with great clarity and often courage.

John arrived in New Zealand from London in his early 20's, completed an MSc degree at Massey University in 1960-62 and began work as a scientist at DSIR Grasslands Division in Palmerston North in 1965. He was appointed general manager of the division in 1985.

When government science was restructured in 1992, John was appointed general manager of the Grasslands Division of the newly formed AgResearch, one of the five general managers leading pastoral agricultural science in New Zealand. By then he had produced 60-70 scientific publications, an output that undoubtedly helped him foster top-class research.

The formation of AgResearch required John to work with his long-time rivals in what had been the Ministry of Agriculture and Fisheries and to merge two office cultures. The enhanced capability that resulted from this accounted for a large component of the country's pasture weed and pest management science. At the same time John was instrumental in moving away from solely government-funded plant breeding to forge close connections to the forage seed industry thereby commercialising Grassland's research under the Plant Variety Rights Act. Initially, this was done through the Cultivar Development and Management Unit which in turn became Grasslanz Technology Ltd.

The value of the resultant research remains of great importance to this country's all-important pastoral sector.

John left AgResearch in 1998 to set up his own strategic science consultancy business, consulting for the Ministry of Research, Science and Technology, the Foundation for Research, Science and Technology, the Crown Company Monitoring Advisory Unit, the Ministry of Agriculture and Forestry, The Royal Society (on the CORE selection panel), AgResearch Ltd; the Institute of Environmental Science and Research Ltd, Cropmark Ltd and the NZ Plant Breeders Association Inc.

He served as a member of the council of the Royal Society of New Zealand and was the representative of the Constituent Organisations of the society.

In his retirement he organised many highly effective conferences to highlight the need to properly support New Zealand agricultural and environmental science. Related to this, in 2006 he was appointed to the Royal Society National Science Panel, contributing to the publication of "A Science Manifesto" published in May 2008, which has been described as the most significant review of New Zealand science in the past 25 years.

Increasingly he involved himself in environmental conservation as a trustee of Nga Manu Trust, chair of the Friends of Queen Elizabeth Park (2004-2014) and chair of the Guardians of Whareroa Farm (2009-2014).

Arguably, he has been the single-most consistent and effective voice for science in both public and professional media in recent years, championing the betterment of New Zealand agricultural and horticultural science and highlighting its immense economic benefits.

He will be sorely missed. ☹

New members We welcome

Gareth Hill (Auckland)
Tianchi Wang (Auckland)
Rachel Gardner (Manawatu)
Hamish Blackberry (Hawkes Bay)
Matt Oliver (Nelson)
Jessica Dohmen-Vereijssen (Canterbury)
Karen Petersen (Canterbury)

Corporate members

- AGMARDT
- AgResearch
- Ballance Agri-Nutrients
- Catalyst R&D
- Plant & Food Research
- DairyNZ
- Federated Farmers of New Zealand
- Horticulture New Zealand
- Lincoln University
- Massey University
- PGG Wrightson Seeds
- Ravensdown Fertiliser Co-op
- Zespri International

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