

Crawford Fund 2012 Parliamentary Conference

Overview by DG Blight¹

The Crawford Fund's 2012 Parliamentary Conference, *the Scramble for Natural Resources*, addressed a question of fundamental importance to Australia and to the international community: how to feed, adequately, an extra 2 or 3 billion people within a few decades without irretrievably damaging the planet. In short, the consensus response - from the panel of speakers and the extended question and answer session - was that 'the world probably has enough land, nutrients and water' and, one might infer ingenuity, in aggregate, to do so. But a food secure world will only be possible if 'major distributional and degradation problems' are addressed with efforts to close the gap between achievable and actual yields as well as increased investment in research to raise yield potential. Increased production based on a better understanding of interactions between agriculture and natural ecosystems and urban and rural development enables, at least theoretically, increased yields, lower costs and reduced erosion and water degradation. Even with all of this, however, food price spikes and horrifying episodes of famine seem likely to recur, requiring specific policy interventions and emergency responses - including to changing climate and weather patterns.

Australia can contribute to a food secure world by growing and exporting as much food as is possible within constraints formed by our natural resource base and by market demand and prices. Within these limits, and with increased allocations to research, Australia could become one of a number of food bowls. But by itself it cannot feed more than a fraction of the world. Its contribution through research, however, could be globally significant and contribute beneficially to the diets of 100 million or more.

In opening the Conference, the Hon. Bob Carr, Foreign Minister for Australia, defined a food secure world as one in which there is sufficient nutritious food for all. He stressed, in particular, the need to avoid stunting in children due to inadequate nutrition, a problem which if left unattended would seriously impact the capacity of a generation to contribute to society, constraining individual as well as national growth. The Minister also announced that the first Conference of the newly established Australian International Food Security Centre would be held in late November 2012 in Sydney.

In the opening session, 3 keynote speakers² painted a global world food scenario characterised on the one hand with a burgeoning demand for food from a growing global population that was living longer and consuming more, not always sensibly, especially as a global middle class of 4 billion became a reality. Further, there were now real signs of stress in the global biosphere: biophysical realities could no longer be ignored and it was the task of conferences such as this one to bring that cold reality to the fore of public discourse. On the other hand, revolutions in the life sciences and information technology meant that biology and physics could now work in harmony to increase food production and distribution in ways that reduced pressures on the environment. Given absolute limits on the availability of land (that were spelt out with authority in the session), more intensive agriculture on better lands already under cultivation, based on new and existing higher yield technologies could reduce degradation of marginal lands. Precision agriculture could fine-tune use of water and other essential inputs. Mobile phones, now widely available, could ensure farmers could have access to the latest information including on weather.

¹ This summary is partially based on a review by Andrew Campbell in 'The Conversation', 18 October 2012 (available at <https://theconversation.edu.au/Australia-and-the-global-scramble-for-natural-resources>). Direct extracts from the review and other speakers are shown within quotation marks. In some cases speakers remarks have been paraphrased.

² Professor Jonathan Foley, Dr Frank Rijsberman, and Dr Derek Byerlee.

Land, Lots of Land?

According to the review by Derek Byerlee, additional land is available for cultivation (about 450 million hectares) especially in Sub-Saharan Africa and parts of Eastern Europe, Latin America and Australia. Strong commodity prices and relatively higher returns from farming, together with the availability of cheap land in some countries, have translated into a sharp rise in foreign and domestic investment into farmland, the so-called land rush. Where land governance is poor and institutional capacity weak, there have been many failures especially in Sub-Saharan Africa and parts of Asia. Australia, on the other hand, has skilled farmers and strong institutions so that with advent of a transparent land register it has little reason to be concerned about foreign investment in farmland. Moreover, Australia has much to gain from freer agricultural trade and its corollary unrestricted (but monitored) foreign investment in farm land. It could continue to lead the world in advocacy for these policies.

Whilst new lands could make a contribution to increased food production, as Foley and Rijsberman pointed out, most increased food production (probably more than 75 per cent) will have to be derived from increased productivity - from raising the achievable yield ceiling and by closing the gap between actual and achievable yields. Speakers argued that both were possible.

Increased production targets have to be calibrated against increased and changing demands for foodstuffs. Whilst demand per capita for rice, for example, was not increasing in emerging economies, demand for meat and dairy products and for fruit and vegetables is growing as diets change with prosperity and information-based choices but not always for the better. Changing diets especially towards meat and dairy production based on grain feed can increase pressure on the earth's resource base; a trend compounded by the use of grains for biofuels.

Raising the Yield Ceilings

A revolution in the life sciences, linked to dramatic changes in information and communication technologies, provide the scope for growth in both achievable and actual yields according to Rijsberman. He referred in particular, to the lowering cost of DNA sequencing, which opens the way for identification of beneficial plant and animal traits that could facilitate and enrich conventional approaches to crop and livestock breeding³. The IT revolution had introduced the practicality of laser and GPS based land levelling, satellite information to predict crop growth and relatively cheap sensors of such factors as soil moisture and weather. In addition, in a point emphasized later by Dr Trevor Nicholls, mobile telephony – a technology from private sector investment in R&D – opens avenues for extension services and market information. Nicholls also pointed to the 'promise of biotechnology' adding to a list of potential breakthrough research, work being undertaken by the Australian National University on transforming photosynthetic efficiency.

Closing the Gap in Nutrient and Water Use and in Natural Ecosystem Management

As Foley made clear, global yield variability is heavily controlled by fertiliser use, irrigation and climate. Elimination of nutrient overuse in parts of the globe, and encouraging increased use where it is needed, can potentially deliver the holy grail of increased production without adverse environmental consequences. In a similar vein, Dr Andrew Noble argued that new approaches to sustainable agriculture could have a major and beneficial impact on global land and water irrigation: a better understanding of interactions between

³ The Conference largely avoided debate on GMOs and organic farming except that Foley cited figures of contributions to food production globally of ten and one percent respectively. He stressed that he was not arguing against either; but he urged that policy attention distracted from the main issues by aspects of the debate between their relative benefits. There was also a discussion on the need for balance between 'research and 'agronomy' in the Q&A session, which is reported below.

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As Campbell comments in [The Conversation](#) we need ‘more sophisticated land use planning and integration tools to help us work out how best to fit competing land and water uses.’

Dr Nyerana Sanginga also believed that production system intensification is key to achieving system level outcomes in Africa especially through increasing agricultural production per unit land area; reduced environmental externalities; improved resources use efficiency and increased supply of ecosystem services. A key issue was the restoration of soil fertility in Africa because of limited returns to crop breeding, high nutrient depletion rates (Africa has old and degraded soils) and crop/soil management challenges. Its importance had been ignored until around 1997. So-called low input sustainable agriculture had failed due to lack of adoption of technologies by farmers no doubt for good reason. He argued that soil fertility and organic matter restoration should partly be regarded as a social cost with environmental benefits – carbon sequestration in African soils is, he said, ‘almost tantamount to soil fertility conservation.’ Conservation agriculture was an essential component of reform in agricultural practice.

Forest Lands – More than Just Trees

Many developing countries face the dilemma: should forests be cleared and cut for higher incomes and to ensure food security. Or does forest conservation and food security really present a zero-sum trade off? Echoing a point made by Foley, Dr Christine Padoch argued not. In reality, she said forest resources are essential to the daily livelihoods and a substantial portion of the diet of ‘a billion people.’ In two case studies in West Africa, CIFOR had shown that women derive 53 and 46 per cent of their income respectively; in a third study the figure was only 12 per cent.

Human Activities Pushing Earth systems Beyond Stability

But to date, uptake of new approaches in nutrient delivery, sustainable agriculture (and land use planning) has been disappointing. According to Noble, human activities have ‘pushed earth systems beyond the stable state of the Holocene into the Anthropocene’. Greater policy and media attention to these issues is vital.

Somehow forests, said Padoch, need to be ‘valued’ by defining food security as more than just calories. Studies show a positive correlation between forest cover and dietary diversity and vitamin A and iron are among micronutrients supplied by forest products; 5 to 6 million tons of bush-meat are eaten annually in the Congo Basin. But forests do much more than provide food through water filtration and regulation, pollination, temperature regulation, aquatic resources and as a genetic resource. Whilst there was no single silver bullet to resolve this dilemma, forest governance was key and decisions to convert forests should include the interests of people who depend on them and take into account the environmental services that forests provide. Decisions to keep ‘forests as forests’ could be hard headed based on sound planning of functional landscapes and direct and indirect contributions to food security.

Foley also reflected on the impact of agriculture on climate change – the single biggest impact on atmospheric carbon due mainly to clearing of forests for agriculture with only limited gains in terms of food production in a global context, especially when the potential impact of climate change is taken into account: Nicholls illustrated some of the impacts of human activities by drawing on summaries of 69 IPCC studies showing the impact of higher temperatures on yield growth with a greater deleterious impact in the tropics compared to temperate zones⁴.

⁴ Further information on the impact of climate change on agriculture and vice versa can be found in the proceedings of the Crawford Fund’s Parliamentary Conference on *Agriculture in a Changing Climate* available at www.crawfordfund.org.

Lose Less, Feed More

Tracing 'build or buy' options to make more food available, Nicholls added two sets of actions: reducing competition for resources from weeds, lessening the impact of pests and diseases, cutting losses in transit and storage; and moving farmers from subsistence to surplus or earning more through productivity gains, higher value crops and higher market values. He compared gains of 2.4 metric tonnes that could be won by halving pest and disease loss, which along current production levels and increased production through the use of hybrid varieties could convert the Philippines from a net rice importer to an exporter. He presented case studies of seed health videos in the Philippines through which increased the number of women in rural communities using new techniques to enhance seed quality; and expanded on successful agro-advisory services in India and Africa involving 3 million users receiving 5 free "push" messages by mobile phone each day and development of GSMA in Kenya and Ghana. He promoted integrated pest management as one means to reduce costs to farmers and damage to the environment.

The Urban Dimension

National food plans or land use planning have to engage with urban development. More than half of the Earth's population are urban dwellers and whilst growth of urban conglomerates might slow, urbanization will continue to interact both favourably and unfavourably on food production. Professor Xuemei Bai illustrated the 'land grab' effect of urbanization with dramatic before and after photographs of the expansion of Shenzhen City in China between the years 1980 and 2005. Whilst the absolute amount of land dedicated to urban development is modest (roughly one percent of the earth's surface is urban; this might grow to two percent by 2030), the interactions are rich with potential and risk. Urbanization, in one sense a consequence of the civilizing impact of agricultural societies, could drive economic growth, national prosperity and demand for more and better foods – there are opportunities for growth and in social and economic capital for agriculture in peri-urban areas. But urbanization can increase social vulnerability in traditional farming communities in the same areas and cities can accelerate for better or worse dietary changes.

Bai called for an 'integrated approach, rather than a dichotomized one in the urban development and food production debate', a sentiment echoed by Campbell who claims that if 'the [Australian] National Food Plan fails to engage urban dwellers and the health system, a major opportunity to reposition Australian agriculture will be lost'.

Minerals, Energy and Agriculture

The need for an integrated approach was also a feature of a presentation by Professor Chris Moran that challenged some popular 'factoids' about the so-called trade-off between mining and agriculture. Land occupancy by mining is relatively small for each mine although wider impacts of dust and water transport and pollution need careful management; but mining is a minor competitor for land and water and a minor contributor to land degradation compared to poorly managed agriculture. The relative contribution of agriculture and mining to national incomes varied between countries and over time – cotton for example has been a major factor in Australian trade with China, Japan and Thailand, mining has assumed importance in exports in the last decade. He decried over-generalisation and alarmist communication of potential impacts that were not science-based; nor were they likely to lead to good governance and practical outcomes. There were, he said, co-resource exploitation opportunities where for example soil and gas resources could convert marginal entities into economically successful ones. The challenge for the political capability and

social maturity of societies is to find ways through knowledge and sound policy to manage multiple resource extracting activities in parallel⁵.

Institutional and Policy Innovations

The predictions of Thomas Malthus, two centuries ago, that food production would eventually fall short of population growth, leading to 'misery vice, sickness and starvation' did not eventuate in full due to technological, institutional and policy innovations.' But to 'free the world of Malthus's shadow', Dr Shengan Fan called for an integrated approach to enhance global food security. Technological innovations were well described by other speakers and rehearsed by Fan but he emphasised the importance of institutional and policy innovations with a mix of broad-based agricultural development such as had been seen in China, India and Vietnam and pragmatic and evolutionary trial and error practices in China. He gave an overview of total factor productivity growth pointing to the changing impact of capital, fertilizer, oil price increases, irrigation and land; the variability of productivity growth across countries; the uneven improvement of land and labour productivity across regions; and substantial variations in the ratio of actual and potential yields. He highlighted the global loss of primary production due to degradation of natural resources; physical and economic water scarcity – a business as usual approach he said would by 2050 put at risk 52 per cent of the population, 49 per cent of global production and 45 per cent of GDP. His solutions embraced accelerated investments in agriculture, especially in smallholder productivity; a scaling up of social safety nets for the poor and vulnerable; improved global coordination to reduce food price volatility (including through global and regional grain reserves), transparent and free global trade, a halting of grain-based biofuel production, and monitoring of food prices and speculation; investments in agricultural climate change mitigation and adaptation; promotion of low carbon agriculture where he illustrated potential synergies between productivity, climate change adaptation and green house gas mitigation through a case study in Kenya; support for enhanced developing country capacity to originate policy that would maximise the local impact of a global reform agenda; and research to provide evidence of policies that have worked and those that have not. Finally, he said Australia, a long-term player in advancing global food and nutrition policies through AusAID and ACIAR and the leadership of Sir John Crawford, has an active role to play especially if it continues to engage in broader, more innovative and productive partnerships.

Conclusion and Question and Answer Session

Dr Denis Blight facilitated an extended question and answer (Q&A) session at the conclusion of the Conference. Questions and or comments had been texted to the Fund during the course of the day and during the Q&A, a cross-section of these was posed to the panel by the originators. Questions covered:

The social, cultural, institutional and political constraints to the implementation of science-based strategies for food security, including the uptake of new technologies and farming practices

Whilst we cannot give short shrift to the challenges of 'changing society' it was the duty of biophysical scientists to establish the 'non-negotiable' biophysical realities; realities which otherwise might be ignored by society's political leadership. Fortunately, biology and physics are now working together on a narrative on constraints and opportunities that might 'point the way' on feeding the world without irretrievably damaging the biosphere.

The contrast between crop yields on research stations and on farms

⁵ A further discussion on this question is available in brief two of the Emerging Priorities Series published by the Crawford Fund.

In their analyses, Jonathan Foley and Sanginga had made much of the gap between achievable and actual yields. Several questions related to this gap. One questioner from the floor asked given the claimed relative efficiency, through uptake of new technologies by large corporate farms compared to small-scale farmers, one questioner asked whether governments 'should get out of the way of big investors' who are more likely to introduce new technologies. In response, panel members said that to encourage private investment governments need to 'do their homework to provide an enabling environment' for example to ensure that small holders have secure title to their lands so that they will not be compromised by foreign investment; government investment in rural infrastructure, and extensions were crucial to the generation of win-win outcomes – government cannot simply get out of the way: it had an important role to perform. Policies or programs to encourage fertiliser use where it was needed and to discourage it where it was being over-used were also suggested.

One presentation had shown that yield outcomes on research stations might be very high, but actual returns on farms were sometimes orders of magnitude lower. One questioner asked whether this was a failure of research or extension? In response panel members said uptake of new technologies was 'one of the most intractable and complicated issues'. Farmers often don't use technologies for very good reasons and they needed to be convinced through sound top-down and bottom up communication from trusted sources such as plant clinics and fellow, successful farmers or 'local champions'. Farmers had to have 'a real reason as to why they should adopt' a new technology or farming practice.

The same applied to adoption of recommended policies: policy makers needed to understand and be convinced of the benefits of new policy approaches through research, consultation and advocacy (but not with a loud hailer). IFPRI had some success in enabling policy change in China, Vietnam (where the program had been supported by AusAID), Bangladesh and Ethiopia.

A related issue was how we measured the performance of researchers - whether by the number of research publications in peer reviewed journals – an important measure of quality – or by eventual development outcomes including through an integration of '[new, higher yielding] varieties, agronomy and reaching farmers at scale.' In the CGIAR the emphasis changing from the former to the latter, although definition of expected development outcomes needs more work.

Perhaps the answer rests, one questioner from the floor suggested, in a greater emphasis on agronomy and farming systems or crop management research rather than 'genetic and genomic research'. He asked whether there was an imbalance in the international agricultural research system between genetics and crop management. Rijsberman rehearsed changes that were taking place within the CGIAR that was now built around 15 programs. Of these, seven focused on crop or livestock improvement and three focused on farming systems. The CGIAR had been recalibrated away from what some saw as an excessive focus in the past on crop improvement to a more balanced set of research programs today.

Impact Assessment

Impact assessment is critical to continued investment in international agricultural research and healthy debate around returns – such as takes place within ACIAR - was to be welcomed. The rates of return to investment in international agricultural research are high but were they 'too good to be true'? There could be 'no doubt' that there are high rates of return from investment in research projects, as evidenced by a lot of analyses of impact; but these might have to be moderated by the costs of 'dry wells of research' that did not yield such easily measurable returns or no apparent returns at all. Similarly, technical issues such as the appropriate discount rate used and full costing could moderate return estimates.

A mix of high and lower (or absence of) success was in the nature of research so that we should be cautious in any claims of blanket success and evaluations should be done 'at the portfolio level'. Venture capital investors work on a success ratio of one in ten. Nevertheless, specific interventions, even if they were few in number, could often yield benefits at the level of 'billions of dollars' that easily justified investment in the system as a whole, even if unsuccessful projects outnumbered successful ones. Research that identified and led to the control of the cassava mealy bug was cited as an example of a project that yielded massive returns. Another was the return to IRRI's estimated \$30 million investment in semi dwarf varieties of wheat and rice research in India and China, which in the recollection of one delegate, generated returns of a billion dollars a year. Benefits to other countries including the United States and Australia – the so called 'hidden harvest' - added to the value of the returns.

Valuing the Environment

What values might be placed on benefits to the environment, wildlife habitat, and water quality and so on in any portfolio evaluation? There were mixed views on this question.

On the one hand, if evaluations are focused more strictly on those 'areas where benefits might be more easily measured' – and the broader social and environmental benefits heavily discounted - the resulting impact assessments are more reliable and defensible. An example put before the panel of efforts to put a value on the environment or eco-systems services 'came up with such huge numbers [of the order of] \$80 billion' which made any comparison with 'the value of irrigated agriculture and all the communities that depend on it, meaningless.' The Natural Capital Project started by Gretchen Daly at Stanford University and involving the Nature Conservancy and the World Wild Life Fund might provide a model.

Another approach was to place a value at least on certain things and arrange payment from the beneficiaries – for example the payment of people 'up river' to maintain forests to aid agriculture or to enhance supply for urban water users downstream.

On the other hand, it is arguable that we should not worry so much about the dollar value of ecosystem services but place greater emphasis on *values* and the value that people place on the landscape that is essential to all things: the numbers of people who benefit, the volumes of water not being mined out of a watershed and so on without attempting to monetise the benefit. Various parts of the landscape contribute to more than one thing: not just the commodity throughput but also to human welfare and to the planet's well being.

A practical way forward would be to take eco-system services into account in landscape planning. Releases from dams, which were often designed without taking into account wetland or fisheries values, can, it turns out, through re-engineering or management practice help sustain fisheries or maintain ecosystem values. CIFOR, for example, has started looking seriously beyond the 'direct provisioning services of forests such as fruits and bush meat' to what might be described as ecosystem services – water filtration, pollination and so on.

By considering landscapes, including urban components and areas under mining exploitation, in an integrated way but not necessarily comprehensively, it may be possible to recognise that parts of the whole fed off and rendered services to each other. This approach might not come up with 'one grand number' or value but it might work.

The balance is difficult to strike. Overall, an integrated or selective systems approach commends itself. Finally, however, there is another dilemma: by placing too high a value on ecosystem services, which might

be a tendency amongst the rich, you face the risk of undervaluing food, upon which the poor and hungry place a very high value.

Urban-Rural Interaction

Noting that many speakers had touched on the theme of integration, one questioner asked about the question of funding: where would you go to gain funding for a research proposition that crossed sectoral or silo boundaries? The question has general application but was particularly relevant to the urban/rural interface.

The problem is, one panel member responded, that funding of such research was ‘nobody’s business.’ How do we preserve agricultural land and at the same time take advantage of urbanisation, which is a fundamental driver of focused demand for food production that can enhance the profitability of peri-urban or nearby agriculture. The same considerations might apply to agriculture and mining. Another driver of urbanisation is the relatively high prices that farmers or communities can gain from the sale of farmland. The Chinese Government

But the issue is critical. By 2040, the majority of the world’s people will live in urban areas. Any food system has to reflect the increased demand of an urbanised world for healthy, nutritious and safe food.

Nutrient Recycling

Another dimension of the rural/urban interaction is that people are ‘living and consuming’ in the cities. As a consequence, nutrients in harvested products are being transported from rural or peri-urban domains through these consumers into the formal or informal sewers of the cities and are accumulated or flow out into freshwater systems. Can nutrient recycling, in some way, reverse this lose-lose phenomenon into a win-win one? Should we be placing a value on sewerage?

One panel member responded by reminding participants that ‘by far the most challenging millennium goal is the one on sanitation. His primary goal when he worked with the Gates Foundation was to try to come up with a way to deal with waste that recovers the energy and nutrients within it, and return them to agriculture. In response to a question he said he had funded several projects at the Gates Foundation that looked at the role of biochar as a means of burning sewerage and generating energy but in the process generating a stable carbon ‘with the nutrients embodied, particularly Phosphorus and Potassium.’

Increased Food Prices – A good or bad thing?

A questioner from the floor recalled that food prices had kept low for two or three decades towards the end of the 20th century. Farms in food exporting countries had remained viable only because through increasing the efficiency of production. But farmers will respond to increased demand and to higher prices for their produce and from that perspective an increase in grain prices in particular was overdue. Increased prices would lead to increased production.

A panel member agreed that higher food prices could also be good for smallholders in Africa and in South Asia to increase their incomes but only to the extent that they could gain access to seeds, agricultural services and to markets. Exports from the major grain producers such as Australia, the United States and Brazil could contribute to only a fraction of the world’s food needs and an increase in the global price would not be unevenly good for all.

Oil Price Increases

One questioner, whilst complimentary of most of the presentations at the Conference, said ‘just about everyone had ignored the question of rising oil prices.’ If as was forecast the price of oil reached \$180 a barrel, the consequences for agriculture could be very serious. A farmer in Australia can spend \$180,000 on diesel alone ‘getting a crop in and transported.’

Shengan Fan agreed. Increases in energy costs ‘kept agricultural economists awake in the evening.’ He referred to a correlation of figures in his presentation, which showed that as oil prices go up food prices do the same. One factor in this correlation was subsidised biofuel production because of the biofuel mandate in Europe and the United States. But even without the mandate and the accompanying subsidy (which would not be needed once oil prices pass a certain point), biofuel production will become economically profitable. Farmers in developed and developing countries who have available land will benefit but the impact on the poor of higher prices, driven in part by the demand for grain for biofuel stock, will impact badly on poor consumers, especially those who spend some 60 to 70 per cent of their income on food? This was an area where we needed to think of potential government intervention.

Population

One questioner challenged the panel to discuss the question, too often ignored in his view in public forums, of population growth. Panel members responded by suggesting that population per se was no longer the key problem for food security at all but the four billion people already on the planet who were living longer and a proportion of them were trying to emulate our diets. As one panel member said ‘two thirds of the problem of future food production comes from increasing waistlines of people who look like you and me.’ He went to say ‘a whole bunch of other people were trying to do the same and it might be unfair to point to the developing world and say that their population growth is the problem’. In the view of at least one panel member ‘it is not.’

There was, however, still a lot of work to do on family without question. But the big question we now face is not the population bomb but the prosperity and consumption bombs and in some cases the concomitant growth of diseases such as type-two diabetes.

Market Failure

In a question which he self-characterised as ‘outrageous’ the facilitator asked: given the numerous failures of administrations to translate fine policy intentions into effective interventions, would it not be better to leave much more to the market? Responses from the floor and from the panel included the slow impact of market corrections; the view that the market cannot operate without an appropriate set of conditions (or a policy framework) – for example without conditions under which you can have private seed companies there wont be a market in seed companies; and getting seed companies to replace government extension systems requires intervention. A key reason for market failure, or the inability for markets to act freely or perfectly is the absence of perfect knowledge. To think through the value chain and ‘how farmers can be connected to the market’ is also key.

Conclusion – Is there cause for ‘Malthusian’ Optimism?

Perhaps the last word might be left to Jonathan Foley. In his final comments on the day he said: I came out of this meeting with a renewed sense of optimism. Seeing evidence at the event of the incredible array of work happening in a diversity of areas; a breakdown of the old dichotomies between agriculture and the environment; between crop genetics and crop management; between forests and surrounding landscapes; between urban and rural interests; and that there is an encouraging recognition of a continuum across a lot of different sectors.

He saw that the participants had created opportunities for leveraging a very big global problem and some of the biggest challenges civilisation has ever faced; and we saw many new opportunities by bringing together different disciplines, than ever we have had before. We have come up with potential solutions and that makes me very happy and hopeful today.