Statutes as published August 10th, 2000 including Amendments of the ISHS Council of 2006 and 2010, subject to amendments.

Presented with amendments (in red) in Articles 8.6.1. and 15.2.

8.6.1. The quorum for a Council meeting is reached:
- if one third of the Country/region representatives, entitled to vote, are present or represented
- and if at least one representative of each of the geographical regions (i) Africa-Oceania, (ii) The Americas, (iii) Asia, and (iv) Europe (i) Europe, (ii) North and South America, (iii) Oceania-Asia-Africa is present or represented.

9.1. The Board consists of not less than five, nor more than nine, members who are elected by the Council and confirmed by the General Assembly. In addition, the Executive Director and the Congress President are ex officio, non-voting members.

15.2. At that Council meeting there must be 50% of the voting member countries present, or by proxy, in accordance with the geographical divisions specified in the Rules of Procedure. There must be a two-thirds majority of the votes of this Council in making the recommendations. In addition, the amendments will only be adopted with the support of:
- either twenty individual members
- or six institutional members distributed over the four three geographical regions (i) Africa-Oceania, (ii) The Americas, (iii) Asia, and (iv) Europe (i) Europe, (ii) North and South America, (iii) Oceania-Africa-Asia.

Exciting Future for Graduates in the Food Industry – From Agroecosystem to Consumer Health

Colin J. Birch, Lawrence Bonney and Sandra Murray

The emergence of food and nutrition security as a matter of public consciousness brings into sharp focus the productive capacity and performance of all parts of the agri-food industry from production to nutrition and health as related to food supply and quality. It also brings to the fore the supply and skill sets of professionals servicing agri-food industries and the environment in which they operate. This paper addresses the second of these in view of the ageing of the professional horticulturists and agriculturalists and emerging needs for new and additional skill sets to support dynamic and increasingly sophisticated agri-food industries. It provides a brief overview of future challenges, and then examines the changing physical, economic and intellectual environments of the agri-food industry professional, production and resource management, postharvest losses and how these might be addressed, and finally the types of professionals and skills needed for the future. It takes an agro-ecological systems approach, and concludes that the emerging trends in the agri-food industry will create new opportunities for a wide range of professionals to deliver improved environmental, production, value chain, economic and health outcomes, and asserts that education and training providers will need to regularly update programs to meet these demands.

INTRODUCTION

On the website of Foundations in African and Afro-American Studies at Washington University, St-Louis, there is a quote:

‘In Africa, when an old man dies, a whole library disappears’ – attributed to A.H. Ba

The quote reminds us of the vital role played by older persons in linking the past, the present and the future, and that society and social structures transcend generations. It was used by the United Nations in the International Year of the Older Person in 1999 (UNSG, 1999) in an address on the role of education in society, asserting that “without the knowledge and wisdom of the old, the young would never know where they come from or where they belong”.

How is this African quote relevant to this paper? In the context of the ageing of the population, and especially of the agricultural/horticultural professional workforce, it can be paraphrased to: “When a horticulture professional retires, a whole library walks out the door”. Though obvious to many, this fact has yet to permeate the wider community consciousness. New opportunities and new areas of professional endeavour are built on existing knowledge, and benefit from guidance of experience gained in long professional careers. In the broader context, it might be rephrased: “When an experienced person departs, corporate memory disappears”, an often heard lament over decades of organisational restructuring.
The community as a whole, especially in industrialized countries, have lost sight of these underlying “laws” in relation to professional and corporate succession, just as many have lost connection with the ecology of food production.

In an address to the National Agricultural Outlook Conference in Australia, Donald (1987) argued that Australian agriculture was a “sunrise industry” – one in which many new opportunities will emerge to meet food requirements. Yet, during the late 20th century and early 21st century, interest in horticultural and agricultural production and research has declined. However, food security has long been a concern to the United Nations (FAO, 1996), and is becoming a matter of public interest even in countries with plentiful food supply (PMSEIC, 2010; DAFF, 2012).

The Emerging Critical Challenges

There are two critical challenges with the ageing of the professional agricultural workforce. Firstly, a lot of “living libraries” full of corporate and professional memory will literally walk out the door in the very near future. Secondly, we face the challenge of preparing the next generation for horticultural and agricultural careers in the agri-food supply and value chain and information sectors that complement those in production and resource management.

Further, with the world’s population predicted to be 9 billion people within 40 years and rapid economic rise in developing countries, demand for a diversity of quality food will increase. In addition, emerging concern about wastage (loss of product between harvest and consumption) will drive efficiency of the agri-food system after harvest in areas such as transport, storage, preservation, marketing and retail. Consumer preferences and health benefits (food effectiveness, food value) will shape new agri-food industry careers.

The Changing Physical, Economic and Intellectual Environments of the Horticulture Industry Professional – from Crop Management to Consumer Health

Horticulture and agriculture face many challenges, but also have many opportunities. Complacency in the community will wane as food security, food quality, environmental consciousness, and sophistication of food choice in developing countries become mainstream issues. Horticultural and agricultural industries need to address agro-ecosystem challenges in production, productivity, resource use and environmental management, and engage with the value chain using systems thinking to understand inter-connectedness of food production, transport, storage, marketing and consumption. Such understanding will be imperative to address emerging concerns with food supply and food security.

Food security is multifaceted with many definitions (FAO, 2003; WHO, 2013). FAO (1996) proposed that real food security exists, at the individual, household, national, regional and global levels, when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. In Australia, food security has been identified as a key outcome in these terms: “sustainable, globally competitive, resilient food supply, supporting access to a nutritious and affordable food” (PMSEIC, 2010; DAFF, 2012). This proposition thus takes an international perspective reflecting the interdependence of food producing and food importing countries.

Food security related commercial opportunities for Australia and New Zealand were explored by the economic consultants, Port Jackson Partners (Port Jackson Partners, 2012) and Campbell (2013), who argued that they would be found in agro-ecosystem knowledge and scientific services, as well as in traditional areas of bulk and processed food products.

Food security is affected by total food production, nutritive value and wastage along the supply chain. It is agreed that 25-50% of the world’s food production is wasted after harvest (IME, 2013; Moomaw et al., 2012). Meanwhile, estimates are that humanity will have to produce as much as 70% more food per year by 2050 to feed everyone (Moomaw et al., 2012). Coupled with future adequacy of food supply is the challenging issue of nutritional value. This has been addressed from a production standpoint with fertilisers and breeding to improve nutritional properties of food (Bruulsema et al., 2012). From a consumption viewpoint, prioritising nutrition and shifting away from over-consumption of nutrient-poor foods (high fat, sugar and salt) (Gryka et al., 2012; Edwards and Roberts, 2009) and reducing household food waste (Gustavsson et al., 2011; Moomaw et al., 2012) should contribute positively to adequacy and security of food supplies.

A number of questions arise from these premises. Do we need to increase production by 70%? How much can we reduce waste? How can we use what we do produce more efficiently and effectively? Can the relatively high consumption of energy and protein in developed countries as described by Moomaw et al. (2012) continue? How much postharvest processing and packaging can be afforded in an energy-constrained world? Then, of course, there are questions related to over-use of resources and environmental degradation. Examples of areas of concern include adaptation to and mitigation of climate change, land and water supply, land and water resource degradation, phosphorus supply, ‘Peak Oil’ supply, desertification, ecological impacts of...
food production and, resource recovery and reuse. Furthermore, there is the underlying problem of ecosystem degradation to support the human population, and the need for strategies to avoid future famines (UNEP, 2012). This report clearly explains how population growth is degrading ecological resources and will inevitably result in drastically reduced standards of living. The challenge for humanity is therefore to “live in harmony” with the environment or in other words, “be part of ecology” rather than “living apart from or above ecology”. These questions represent opportunities for horticultural, agricultural food science and technology and health professionals, and are emerging at a time when the professional horticultural and agricultural workforce has contracted. Of course, few if any of the questions can now be addressed by horticultural and agricultural scientists in isolation. Large multidisciplinary teams made up of professionals in horticulture, agriculture, natural resources, value chain innovation, environment, economics, information technology, health and human nutrition will be needed to address what are inherently difficult challenges (Rittel and Webber, 1973).

PRODUCTION AND RESOURCE MANAGEMENT – IMPROVED AGRICULTURAL ECOLoGY

Since World War II, agricultural ecosystems have been heavily modified, largely because of the availability of inexpensive fossil fuels and the widespread development and use of agricultural chemicals. There have been two major and interrelated trends: simplification through monoculture and intensification of food production systems. However, these have given rise to inevitable ecological responses necessitating additional inputs to manage ecologically unbalanced systems to overcome the natural tendency to complexity and diversity. Also, vast quantities of energy are consumed directly and indirectly in the agri-food industry (Woods et al., 2010). Changes are needed to improve energy efficiency and make food production systems more sustainable.

Resource management in horticulture and agriculture increasingly focuses on mitigating climate change and improving long term sustainability of production under increasing concerns about ecological responsibility (capacity of environment to meet human needs, avoidance of ecological degradation and maintenance of biodiversity). Therefore, production systems will need to accommodate expectations of good environmental stewardship and positive environmental outcomes, while meeting food and nutrition security demands. Almost certainly, horticultural and agricultural systems (agro-ecology) will become more complex as the simplification and uniformity associated with high input agriculture is challenged. The pressures to change food production practices will create opportunities for horticultural, agricultural and environmental scientists and for managers in understanding the changes and creating or adapting systems to meet emerging expectations. They will need support from a revitalised extension sector to facilitate adoption of new practices and provide enhanced linkages between food producers and the research community (Hunt et al., 2012).

Agri-food systems are becoming more “information dense” along the chain from the earliest stages of producing the raw materials (the crops or animals) to the consumer table. Applications of information and communication technology include controlled traffic farming, variable rate technology, precision agriculture, modelling, remote sensing, real-time data capture, target specific application of chemicals, marketing and consumer information and product tracing. The rapid advance in environmental and crop sensing and information technology means more precise matching of inputs to crop needs and delivering them when and where needed, guiding equipment and recording crop performance during harvest are now possible. Modelling to assess risk profiles is likely to impact on the use of specific inputs. Moreover, prediction of outcomes is increasingly important in addressing horticultural and agricultural challenges. Field automation, e.g. driverless equipment, and robotics also emerge as new technologies focussing on efficiency, precision and repeatability in production practices. The motivations for introducing new technologies include cost control and production efficiency, but may also arise from the community at large as it seeks more information on the way food is produced, causing changes in production practices and data collection to meet expectations in areas such as food safety, public health and environmental stewardship.

These advanced technologies will require people with a holistic understanding of horticultural and agricultural systems and their functioning, and skills to optimise the performance of advanced technologies under field conditions and in protected cropping environments. Their use in crop production and for assessing impact on the environment will bring exciting opportunities for horticultural and agricultural scientists, crop physiologists, soil scientists, crop modellers, irrigation specialists, information technologists and robotics and mechatronics specialists.

MINIMISING POSTHARVEST LOSSES, NEW PRODUCTS, NEW PROCESSES

Food wastage arises from rejection of off-specification product, degradation and spoilage in transit and during storage along the value chains between farm gate to consumer and at consumer’s premises itself. Regardless of where waste occurs, it represents a significant inefficiency in resource use. Opportunities exist to reduce wastage through improved practices that mitigate loss and improve utilisation of off-specification products through developing new and innovative products for existing and new markets. Examples could include...
dehydrated fruits and vegetables for distant markets, sliced or diced fruits and vegetables in vacuum seal packs for markets such as caterers and institutions including hospitals and the military. Ultra high pressure treatment might also be used for long term preservation of foods. Increasing population and associated resource constraints will intensify pressures for efficiencies in production and transport, and along the value chain. As a contributor to these efficiencies, waste reduction will be dependent on technical solutions, socio-economic forces, and changes in attitude of consumers, which often break down to questions of peoples’ likes and dislikes, preferences, prejudices and food literacy (Vidgen and Gallegos, 2011).

The complexity of questions to be confronted means that in addition to career opportunities in production and resource management research, new careers are emerging in value chain innovation, food quality, consumer behaviour and related socio-economic research. There will also be openings in what might be termed “food extension” and “health extension” in educating industry stakeholders and consumers. Importantly, this renewed interest will not focus on crop production as such (Mintzberg and Westley, 1992) and we will not return to the research and extension paradigms of the post-World War 2 green revolution, but rather will focus much more on solving the systemic and strategic challenges of the food system. Perhaps the starting point is focusing Research, Development and Extension (RD&E) on making better use of what is now produced, rather than concentrating mostly, as previously, on producing more, and leaving the post-farm gate components of the agri-food system relatively untouched. For example, in developed countries with sophisticated supply chains, producing more for domestic consumption may not be realistic, but improving production efficiency and reducing waste between harvest and consumption and thus enhancing export availability and competitiveness, might be the most appropriate strategy to contribute to world food supplies. Conversely, in many developing countries, both increased production through use of well-established cropping practices (e.g. increased fertiliser use, improved land and water management, reduction of waste by improved storage systems, control of storage pests) could well be the most appropriate strategy.

**WHO WILL PROVIDE PROFESSIONAL SUPPORT TO THE AGRI-FOOD INDUSTRY? AND HOW?**

The questions then are: who will support the agri-food sector for the next generations? Which disciplines will take up the challenge? How will this support be provided? There are no quick and easy answers to these questions. One can expect, however, that traditional horticultural and agricultural disciplines, including resource sciences, land and rural management and agricultural extension, will remain critical in response to the emerging twin challenges of food demand and ecosystem degradation. A systems approach (understanding of relationships and their integration) will become essential and will be supported by information technology scientists and technologists to solve biophysical, environmental and resource management challenges. From the start of harvest to consumption by the consumer, postharvest physiologists, refrigeration, value chain analysts, storage and transport specialists, and a new field of food extension and allied to health promotions, for instance in nutrition, will take centre stage. The challenge for educational and training providers is to identify future needs and incorporate them in innovative curricula. The revised and new curricula would be expected to incorporate material from well beyond the traditional courses associated with specific degrees and be more accommodating, integrative and inclusive. Multi-skilling and capacity for holistic thinking will be essential for many emerging tasks within the environment, agri-food and health continuum.

**CONCLUSION**

The future has many opportunities. Providing professional support to the agri-food industry, with links to environment and health will emerge as the new paradigm of the future. To ignore this shift would be to invite irrelevance. To build the necessary professional supports will mean utilising the experience, knowledge, perception and innovation of existing horticultural, agricultural and food professionals – at a time when a significant proportion of horticultural and agricultural professionals are approaching the end of their working lives. Renewal of the horticultural and agricultural curricula must incorporate and contribute to enhanced educational outcomes in the environment, agri-food and health continuum. Not adapting the curricula would be to ignore the unchallengeable truth of the quote of A.H. Ba and recent lessons from the loss of corporate memory. Making use of the “libraries that walk” through their mentoring (transmission of wisdom) of the young, emeritus positions, and advisory roles as the professions adapt and grow, will be an essential strategy in creating the professionals for the changing, challenging future, with its many opportunities.
About the Authors

Colin Birch

Lawrence Bonney

Sandra Murray

Associate Professor Colin J. Birch is Leader of the Vegetable Centre in the Tasmanian Institute of Agriculture, University of Tasmania, Burnie, 7320, Tasmania, Australia. He was previously Senior Lecturer in Agronomy and Director of Studies in the then Faculty of Natural Resources, Agriculture and Veterinary Science in The University of Tasmania, and is a Fellow of the Queensland Academy of Arts and Sciences.

Email: colin.birch@utas.edu.au

Dr. Lawrence Bonney is a Senior Research Fellow at the Tasmanian Institute of Agriculture (TIA), University of Tasmania, Sandy Bay, 7005, Tasmania, Australia. He is the Convenor of TIA’s Value Chain Program, and also chairs the Australasian AgriFood Value Chain Research Group at the University of Tasmania.

Email: laurie.bonney@utas.edu.au

Sandra Murray is an accredited practicing dietitian and is currently a lecturer in food, nutrition and public health in the School of Health Sciences, University of Tasmania, Launceston, 7250, Tasmania, Australia. Her research interests include food security, nutrition, sustainability and local food systems.

Email: sandra.murray@utas.edu.au

References


Conductivity

WET Sensor

Rapid monitoring of growing conditions in substrates and soils

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