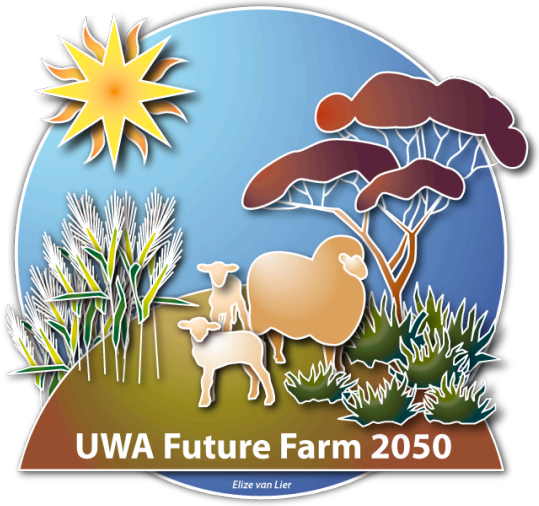
UWA Future Farm – An Ideal Farm for 2050, but Do it Now

Graeme Martin BSc (Agric) PhD

UWA Institute of Agriculture M082
The University of Western Australia, Crawley, 6009 WA, Australia



http://www.ioa.uwa.edu.au/future-farm-2050
http://www.abc.net.au/catalyst/stories/3685256.htm

Summary

Why 2050? That's when we will have to feed 50% more people without destroying the planet, arguably the biggest issue facing humanity. Rather than wait for problems to arise, the UWA Future Farm Project aims to define and implement the 'ideal' farm: it must be profitable through the production of food and fibre; it must practice ‘clean, green and ethical’ management of livestock; it must demonstrate the commitment to conservation of biodiversity; it must take into account the needs of the people on the farm and in the local community.
As a project based in an international university, *UWA Future Farm* will also make positive contributions to state, national and international spheres of agricultural research and development. This means confronting major issues such as climate change, food security, food safety, and sustainability.
Finally, in the local environment, *UWA Future Farm* also aims to strengthen links between food producers and food consumers (primarily city inhabitants), and between the university and the community and industries that it serves. This means engagement with producers, local authorities and, most important, schools in the city and the country.

Background

In 2007, The University of Western Australia (UWA) decided to purchase *Ridgefield*, an operational commercial farm, near Pingelly (Google Earth: S 32° 30' 23" – E 116° 59' 31"). This 1588 ha farm is in the main agricultural region of Western Australia, variously known as the 'wheat belt' or the 'grain belt', and where typical farms run a mix of livestock and cropping enterprises. The average annual rainfall is about 425 mm so, in this region, by definition, we have 'dryland agriculture'.

From the beginning, it was important that the new facility not be seen as a classical research station that hosted a 'patchwork' of small trials. Rather, *Ridgefield* was to be a profitable farming enterprise that also accommodated and inspired the *UWA Future Farm 2050 Project*, a major university project that directly deals with one of the biggest issues facing humanity – feeding 50% more people by 2050 without destroying the planet. Hence the vision and mission of the Project:

Vision: Imagine the best-practice farm for 2050, but do it now, and show that it is profitable.

Mission: Facilitate local, national and international multidisciplinary research into future dryland farming systems.

UWA Future Farm 2050 is therefore a focal point for research, education and outreach in agriculture, locally, nationally and internationally. The investment reflected UWA's commitment to international excellence and research leadership. Importantly, *UWA Future Farm 2050* is more than agriculture – it embraces conservation of ecosystem and biodiversity, water and soil management, habitats for people, and community development. Thus, in addition to the traditional agricultural disciplines, researchers and educators in a variety of other fields are involved, including architecture, landscape architecture, engineering, hydrology, rural development, sports science, and health science.

Finally, profit is a critical indicator of performance. *Ridgefield* must show a profit typical of similar enterprises in the area in order to maintain credibility in the industry. We cannot expect other farmers to follow our lead if the outcome is a significant loss of income. Thus, to cover all of the costs for maintenance, development and salaries, the farm will only be able to use its profit. We therefore have a management team focussing on this issue, with an external farm business consultant providing guidance and 'reality checks'.

1) Natural Resources – Assessment and Management

Natural resource assessment

Quantification of land resources through GIS and related technologies is essential for decision-making on the farm. We have installed our own GIS transmitter and mapped the farm to 2x2 cm squares. This detailed map is being matched to documentation for the landscape of Ridgefield, as well as for the surrounding areas, including the neighbouring national park (*Boyagin Nature Reserve*). This work will continue to involve field trips and practical classes for undergraduate students.

Soil management

A complete survey and analysis of the soils of Ridgefield was essential and thus begun immediately the farm was acquired. Much of this work involved students in soil science

classes. We also plan to connect Ridgefield with the *Critical Zone Exploration Network* (CZEN), an international trans-disciplinary project that would lead to the UWA Future Farm becoming the first CZ Observatory in Australia. Baseline soil data will allow us to manage fertility, emissions, and leaching. In addition, by repeating the measurements in the coming years, we will be able to assess outcomes of our management of the local ecosystem.

Subdivision and Resource Allocation
Armed with data on the hydrology, geography, soil profiles and crop yields, we will devise a plan for the subdivision of the farm. Land will be allocated to enterprises based on suitability for cropping, grazing, rotation, and permanent reserves (water courses, biodiversity corridors). A major aspect of this planning is the need to invest in new fencing. Clearly, some of the fences will need to be permanent (eg, boundary fence, livestock corridors, water courses), but internal subdivisions might need to be more flexible.

Water Management
We are totally dependent on rainfall for water. Within that context, our goal is to avoid business decisions about the livestock enterprises being controlled by water availability. A water management plan for the farm is being developed, and a state-of-the-art dam has been built to provide sufficient water during a once in a 100-year drought. Equally importantly, buildings are being designed for rainwater catchment. We will establish a system for monitoring hydrological processes and the way they respond to changes in farm management.

2) 'No-Till' Cropping

Crops (wheat, barley, canola) are the most important source of income for the farm and an important component of normal farm practice in the agricultural regions of south-western Australia. The cropping practices will need to be future-focused, with a view to testing and demonstrating the benefits of alternative management systems. Initially, about a third of the arable land at *Ridgefield* will be devoted to cropping enterprises, with about half of that area in a cropping-only rotation and the other half in crop-pasture rotation. Major areas of research interest will be focussed on the development of strategies to cope with developing problems: the drying climate that is predicted for this region; the management of weeds in the face of rapidly developing resistance to chemical herbicides (a foundation of 'no-till' cropping); insect pests (integrated pest management); competition within the farm for land resources by other enterprises, particularly livestock.

3) 'Clean, Green and Ethical' (CGE) Livestock Production

Livestock is the second major commercial enterprise for *Ridgefield*. Around the world, there is an increasing demand for animal products that are 'clean, green and ethical'. 'Clean' involves minimising the use of drugs, chemicals and hormones; 'green' involves minimising the impact of the industry on the environment, including the production of greenhouse gases by ruminants; 'ethical' has an obvious focus on animal welfare, but ethical judgement needs to be applied to all practices in the rest of the supply chain, not just the farmers. CGE principles are relevant to all forms of animal production, from low-input extensive grazing systems to high-input intensive systems involving confinement of the animals.

The Future Sheep Flock
Using the power of quantitative and molecular genetics, we will develop a flock of sheep to produce animals that are suited to future production systems. The main drivers for genetic selection will be temperament, resistance to internal parasites, avoidance of the need for 'mulesing'. Genetic gain will be accelerated through reproductive technology (AI, embryo transfer), providing input for undergraduate practical classes.

Grazing Systems; Forage Management
http://www.youtube.com/watch?v=TocKk2RsGvg&feature=plcp
We will develop grazing systems that include concepts such as self-medication, reduced methane emissions, and improved lamb survival (edible shelter). This will be a major collaborative program involving our *UWA-CSIRO Alliance for Versatile Livestock Systems*.

Cashmere goats
The long-term aim will be to develop the Australian cashmere industry through rapid genetic gain, as well as revealing the ability of alternative animals to manage the farm ecosystem, including the management of weeds. In addition, these animals generate income for the farm through capretto market, and provide research opportunities for students from SE Asia where goats are more important than sheep.

4) Buildings, Infrastructure, Community

For all buildings, the aim will be to use the latest in affordable materials and design, demonstrating what can be done in a commercial rural setting. There will be serious efforts to maximise the efficiency of management of water and energy. The lead in this project is the *UWA Faculty of Architecture, Landscape & Visual Arts (ALVA)*, with the design of new buildings being exercises in undergraduate classes.

Farm Manager's Home ('ALVA House')
A demonstration project has been relocated to *Ridgefield* as the home for the farm manager. The design of the house fits perfectly the broad objectives of the Future Farm 2050 project – it is functional, ecologically sensitive, and affordable. The original farmhouse is used for visiting researchers.

Electricity
Through the *UWA School of Electrical, Electronic & Computer Engineering*, Ridgefield is host to a research project, *Performance assessment of solar photovoltaic technologies in warm and sunny climates*, investigating the effects of high operating temperatures and high solar irradiation levels on the output performance of state-of-the-art thin-film and bulk crystalline silicon solar photovoltaic technologies. This has involved the establishment of a solar electricity generating system (10 kWh) with state-of-the-art batteries and monitoring to support the *ALVA House*.

5) Ecosystem Management and Restoration

Farmers are responsible for as much as 60% of Australia's landscape so they must be part of the solution for ecosystem management of biodiversity conservation. When we purchased *Ridgefield*, it had very little of the original native vegetation except for a few

prominent rocky outcrops. We are acutely aware of our need to demonstrate to the community the highest principles of ecosystem management, including the impact of all of our commercial enterprises as well as our responsibilities for the natural environment in the surrounding areas (the natural water resources; our relationship to the nearby national park). The implementation of our ecosystem plan is being led by UWA's *Ecosystem Restoration & Intervention Ecology Research Group* (ERIE) who are using the *Future Farm* as an opportunity for long-term studies. In future, we are planning to collect data to assess the impact of this plan on wildlife biodiversity.

Carbon Farming Initiative (CFI)
Ridgefield will participate in this national initiative that aims to encourage changes in land use to increase carbon sequestration and long-term storage.

6) Linkages to Local, Research and Industry Communities

A very important goal for our management is to be a good neighbour in the local community. The activities on *Ridgefield* will have a major impact on the local economy, so we will develop student projects to measure the outcomes. As far as possible, we are placing our business through local enterprises, contributed community activities, and entertain the community on our farm. Links have been made with the District High Schools in local towns, and presentations given to the local shires.

Townships – Students of landscape architecture (Faculty of ALVA) have spent a week in Pingelly and exhibited concepts for town development in the Pingelly town hall; they will work on developing these projects for the local community.

In addition, the *UWA School of Population Health* sees the Future Farm project an opportunity for staff and students in the discipline of social work to develop their knowledge and skills in rural and regional settings and contribute to the development of projects in regional communities. This is particularly important in light of the predicted shortages in the health workforce.

7) International Networking

The *UWA Future Farm 2050 Project* is the cornerstone of our participation in a series of international workshops on future farming systems with several partners in the *Worldwide Universities Network (WUN)*: Bristol University (project leader), Leeds University, Penn State University, Zhejiang University, and Kerala Veterinary & Animal Science University. The WUN Development Fund has supported a project on *Ensuring sustainable and responsible production of healthy food from healthy animals* that addresses the WUN Global Challenge: *Adapting to Climate Chang*e with the immediate strategic objective of safeguarding food security for the growing human population. The first workshop was held in Kerala in May 2013, the second in Bristol in October 2013, and the third will be in WA in September 2014.