FARMING IN THE FUTURE
Some Ways Forward

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A sustainable farming system is central and key to natural resource management, yet it is a demanding journey to build an agriculture that works for the climate and soils of the great south land. Our pioneers were confronted by an ancient Gondwana landscape driven by a dry, extremely variable climate that generated extremes of droughts and flooding rains quite different from anything experienced in Europe or North America.

These pioneer farmers and scientists and their descendents were challenged continuously to search out new ways to harvest the water, nutrient and carbon as food and fibre from ancient soils, in a very flat continent vegetated by a great diversity of forests and woodlands, woody shrubs and perennial grasses. Over millions of years the landscapes had accumulated, from atmospheric deposition and weathering, enormous amounts of salts in the soils and groundwater. Most of our rivers and groundwater systems are sluggish, with only a small capacity to move salt and sediment from the continent.

Consequently a sustainable Australian agriculture must be able to work in this old, flat, salty land, driven by a highly variable climate, and modulated by native vegetation that leaks water to the landscape’s internal drainage systems at rates approximately equal to the drainage or discharge rates of water from the landscape. Further the agriculture had to work with surface movement of wind and water under a highly variable climate that drove episodic erosion, loss of soil and deposition of sediments in rivers and floodplains.

This is a tough call. Unfortunately farming based around annual crops and pastures does not work well in such a landscape. These annual crops and pastures leak far too much water past the roots so that much more water enters the landscape than can leave the landscape via the sluggish drainage system. Groundwater rise as the landscape fills causing the abundant salt stores to be moved to valley floors, rivers, and wetlands. The increased leaching associated with water leakage carries valuable nutrients past the root zone and drives accelerated rates of soil acidification as well as soil nutrient depletion and delivery of increased nutrient loading to groundwater, streams and wetlands.

The challenge is to build agro-ecosystems that generate wealth from food and fibre products and which have within them flows of water, nutrient and carbon that are
well matched to the flows that can be accommodated in hydro-geochemical cycles of the ancient continent.

The way forward has required scientific capacity to measure, model and predict the flows of water, nutrient, and carbon in our agro-ecosystems and relate these to the flows occurring in the landscape. This coupling of paddock to catchments and ultimately river basin continues to stretch scientific knowledge and capacity, but progress has been made. There is sufficient knowledge now to shape the re-thinking of our farming systems.

This re-thinking will require radical change to current land use incorporating:

- development of commercially driven tree production systems and/or novel tree species for large areas of the current crop and pasture zones. These would include trees to produce fruits, nuts, oils, pharmaceuticals, bush foods and forestry products such as specialty timbers, charcoal, and biomass energy;
- new farming systems made up of novel mixes of all the best current annual and perennial plants, the best agronomy, companion plantings, rotations and combinations;
- new forms of cereals, pulses, oilseeds and forages selected or bred for characteristics that substantially reduce deep drainage and nitrogen leakage; and
- new land assessment tools that
  - best locate trees, other perennial plants, high-value annuals, and native vegetation to meet water quantity and quality targets, and biodiversity goals, and
  - facilitate identification and re-assignment of land so that on some parts of the landscape, productivity is greatly enhanced (double yield) and other parts are removed from production to provide a range of ecosystem services and protect the native biota.

The future will also require a new vision for the role of agriculture in the landscape. The future form of sustainable agriculture can be discerned to require a mosaic of new and old agricultural enterprises that yield food and fibre coupled with native ecosystems that provide a suite of ecosystem services which are valued and paid for by stakeholders and beneficiaries.

A farm of the future might look something like the figure below.
Figure 1: A Farm of the Future from *Scientific American*, September 2005, p91.

**A Farm of the Future**

Ecosystem services previously taken for free could generate perhaps half the income of a farm, if markets for various kinds of environmental credits take off as hoped. Farmlands in the future may have a diverse portfolio of ecosystem services to offer to a wide range of customers.

**Biodiversity Credits**

Conservation organizations are leasing development rights from the owners of undisturbed forests and other habitats that host threatened endemic species and fast-vanishing ecosystems.

**CO₂ Offset Credits**

When landowners plant new forests and promise never to cut or burn the trees, they can receive carbon dioxide offset credits that industries will buy to help them comply with restrictions on greenhouse gas emissions.

**Renewable Electricity**

Wind farms generate nonpolluting electricity that commands premium prices in deregulated power markets. The turbines can also garner tax credits that subsidize their capital and operating costs.

**Certified Sustainable Timber**

Sustainably harvested timber is now one of numerous "eco-labeled" products that are certified as ecologically sound and sold at a premium in specialty markets.

**Water Credits**

Careful management of water and wetlands is economically valuable for many reasons. Urban water authorities purchase water filtration credits to protect the quality of their watersheds; wetland owners can also receive compensation from government agencies for flood-control services, from conservation organizations for the preservation of migratory waterfowl breeding areas, and from agricultural cooperatives for the prevention of soil salinity increases caused by overdrawn groundwater aquifers.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Percent of Farm's Income</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity credits</td>
<td>5</td>
<td>Conservation trust</td>
</tr>
<tr>
<td>CO₂ offset credits</td>
<td>10</td>
<td>Steelmaker</td>
</tr>
<tr>
<td>Renewable electricity</td>
<td>15</td>
<td>Power market</td>
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<tr>
<td>Certified sustainable timber</td>
<td>20</td>
<td>Specialty market</td>
</tr>
<tr>
<td>Water credits</td>
<td>20</td>
<td>Urban water market</td>
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<tr>
<td>Wheat</td>
<td>15</td>
<td>World market</td>
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<tr>
<td>Wool</td>
<td>15</td>
<td>World market</td>
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For this to happen we will need to develop innovative and inclusive approaches that permit fair comparison of market and non-market values. Developing the concept of valuing and paying for ecosystem services as part of this process is will be increasingly important.

A key function of agriculture in the future will be to manage the landscape, its rivers, wetlands and estuaries, in ways that produce ecosystem services for our urban societies. The agricultural community continues to be caught with declining terms of trade and can no longer be expected to produce cheap, clean food and fibre, as well as provide a free service to maintain all the ecological functions of the landscape that provide ecosystem services essential to urban societies. The services will need to be paid for and be recognized as a fundamental part of the economy.

The agriculture of the future will be paid not only for the goods it produces but will receive increasing remuneration for the services delivered through its management of healthy landscapes, rivers, wetlands and estuaries. Agriculture will broaden its perspective to be seen by society as the custodian and manger of the life support systems for society as a whole.

Key References


