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.

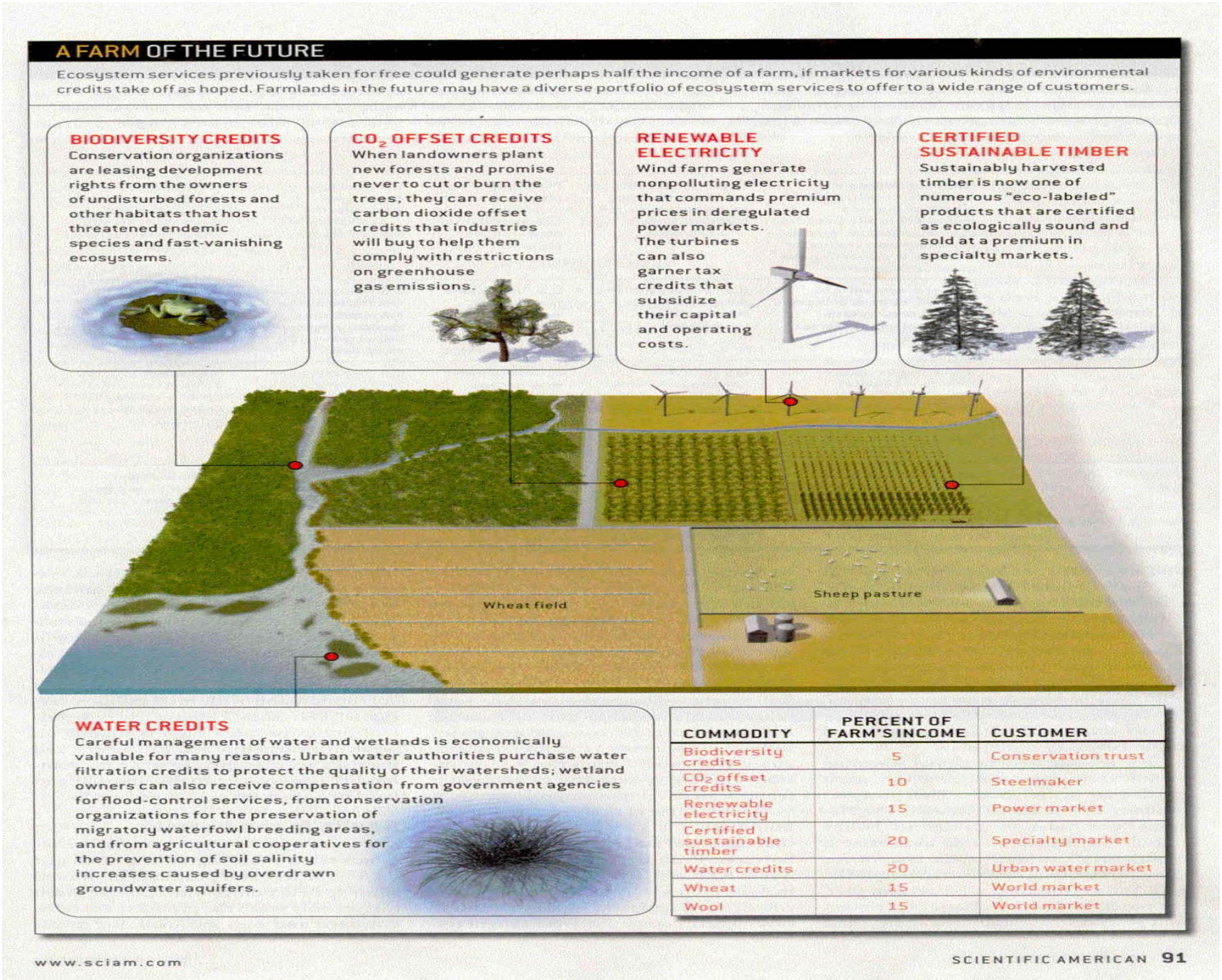
This re-thinking will require radical change to current land use incorporating:

- 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.



COMMODITY	PERCENT OF FARM'S INCOME	CUSTOMER
Biodiversity credits	5	Conservation trust
CO_2 offset credits	10	Steelmaker
Renewable electricity	15	Power market
Certified sustainable timber	20	Specialty market
Water credits	20	Urban water market
Wheat	15	World market
Wool	15	World market

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

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