A Profit in Our Own Country

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Saving the Soil

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Land or Soil? That is the question! Soil has never been a sexy subject in science or in commerce, but *land*—the larger-scale spatial extension of soil—is a different matter. Whether it is as the territorial expression of nationalism, or in the identification of landowners as the ruling class, or in using 'new land' development to fuel the engine of economic growth, land has always represented the most basic form of power, wealth and belonging.

It is therefore ironic that governments and investors have proved hard to convince that investment in R & D for soil and land management should be taken seriously. Perhaps we did indeed need the paradigm shift which has only been seriously articulated in the last few years by the politicising of 'sustainable development' through Agenda 21 to realise the truth of the old Yankee saying 'Put yer money in land lad, they aint making any more of that stuff'.

More seriously, we have to recognise that adverse changes to land have long-lasting, financially as well as physically, harmful effects. While we are all able to recognise this when viewing the historical deforestation or salinisation of the eastern Mediterranean or Mesopotamia, it is harder to accept that we are involved in the same processes today through our inability to balance long-term needs against short-term gains.

- One of the problems scientists have in convincing policy makers of the need for such investment is the long-term nature of change in land-related properties, compared with the short-term financial and political goals of modern societies.

Successful application of soil research to 'saving the soil' *has* provided agronomists and farm managers with well-tested management practices that ensure sustainable farming systems by:

- using crop and pasture rotations, retaining surface residues, minimising cultivation, using alley and shelter-crop systems, and the like.

However, cynics may feel there is a credibility gap between the claims of scientists and the catalogue of land degradation ills that are documented for many parts of both the industrialised and developing world.

Compared with the obvious achievements to food production that have occurred through applying the findings of soil chemistry via the continuing expansion of the world fertiliser industry, or the application of civil engineering to irrigation and dam construction securing food supplies in many of the semi-arid and arid regions, the achievements of natural resource scientists in obtaining sustainable land management and minimising soil loss appear small.

It is now common in high-income countries to criticise the widespread heavy use of fertilisers and irrigation in developing countries' food production. However, real criticism should be confined to inefficiencies of use, through government policies of inappropriate subsidisation, rather than to the use of such inputs. Without their use, there would be no luxury of adequate food supply for the majority of the world's population today, or in the future.

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Nevertheless, criticism and concern for excessive use leading to eutrophic waterways, rising ground waters and salinisation are justified.

- Much of the value of Australian-aided scientific work in this area is directed to identifying appropriate management systems to correct historical forms of land and water deterioration, which stem from exploitive and overly optimistic past attitudes on the inexhaustibility of land area and capacity.

The Socio-political Dimension

Experience in Australia, just as much as in developing countries, has also taught us that it is very difficult to implement good management practices effectively across whole rural communities and landscapes, rather than just among small groups of leading farmers.

- Movements such as 'Landcare' in Australia, or farmer cooperatives and grower associations in many countries, reflect the efforts of rural communities and governments to provide farmers with the organisational and informational tools they need to manage their land and production sustainably.

Farming systems are the product of socioeconomic as well as technological and biophysical factors, and the units of production are small, dispersed, mainly family groupings widely varying in literacy and skills, goals and perceptions.

- The recent spate of discussion papers assessing the sustainability of agriculture in various parts of the world has recognised the influence of the policy framework, the infrastructural status, social groupings and economic system of each region to a far greater extent than earlier discussions which focused largely on how to raise productivity by technical means.

One of the most active groups in appraising the measures needed to achieve more integration between rural industries and the environment has been that bastion of economic rectitude, the OECD. Spurred on by the implications of the changes which the new GATT agreements will bring to European and North American agriculture, and faced with the costs which subsidising over-production has brought to urban communities and the environment, OECD working groups on agriculture and the environment have been energetically seeking ways to match rural landscape preservation with production.

New Ways of Doing Business

The international scientific community has also energetically developed a number of conceptual frameworks to assess and monitor whether land management systems are more or less sustainable.

- In many instances, they are finding that we simply do not know whether a particular practice is safe, maintains soil and water quality or has undesired side-effects, because the system has not been in operation for sufficient time.

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Do we have the right structures, methods and people to succeed? In common with many of our developing country neighbours, Australia has been reassessing the status of rural soils and water in recent years and, in view of the catalogue of severe land degradation and water quality problems, has developed significant Federal and State programs for tackling these issues.

Although 'Landcare' is probably the most widely known, other government-backed schemes such as vegetation replanting schemes, legislation to control clearing, national strategies for improved water quality, the formation of the

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Murray–Darling Basin Commission, all reflect a strong commitment to redressing the damage done.

- Internationally, Australian scientists have been equally active in developing new initiatives towards landcare. Some years ago an International Board for Soil Research and Management (IBSRAM) was established largely through Australian initiative.

This CGIAR-affiliated organisation has its headquarters in Thailand, and uses a ***network approach*** to test and implement the principles of sustainable soil management in some 22 developing countries of the Asia–Pacific and sub-Saharan African regions. Its work complements the research and development done by the International Agricultural 'Regional' Centres such as ICRISAT, ICARDA and CIAT, by using coordinators to liaise between national agricultural agencies and the international scientific community. Common experiments, testing principles and processes of soil management are interpreted to suit local cultural and environmental conditions, and experimental results are then pooled and compared among the collaborators.

Successes from Forming International Networks

One of the great advantages that Australia has over other developed countries working in soil and land management with the tropical and subtropical regions is the similarity of our home environment with theirs. Most of Australia's rural industries are carried out in similar climates, characterised by erratic rainfall, risk of drought and erosion, and using similarly old, fragile and infertile soils. This has produced a close understanding between resource scientists and government agencies who understand each other and have common goals.

By using collaborators in developing countries Australia is able to take advantage of a range of low-cost, well-run experimental sites that greatly augment the information we can gain from higher-cost field research in Australia. The feedback of information and techniques to Australian land managers is much faster than it would otherwise be, because results can be verified over many site-years. These are the indirect benefits from such investment.

Using this method Australian scientists have tested the effectiveness of small amounts of soil amendments such as lime, in combination with residue retention and low-level fertiliser additions to slow or halt acidification in wet environments in Asia and Africa. Australia's low-input agriculture is in

fact little different to the *low-input* farming found in much of upland Asia and Africa in terms of tillage, fertiliser and agro-chemicals.

Direct benefits can occur through 'serendipity' situations as the following shows.

- ACIAR has supported research aimed at halting the drop in ground-waters in northern China that has occurred through tube-well pumping for irrigated fruit trees. Deliberate under-irrigation combined with denser stands prunes the root system. While up to 80% savings on water consumption have been achieved in China, an unlooked-for benefit has occurred in Australian fruit production as well. The same technique applied in Victoria has worked to reduce rising saline groundwaters in the Shepparton district. The quantity and quality of fruit has not been affected—if anything, it has increased.

In other instances the return to Australia has been more dispersed, but still direct benefit.

- Salt presently affects over 1.5 million ha of agricultural land in Australia and the area affected is found larger after every survey. (This is a relatively small problem compared with countries such as Pakistan and Thailand with 6 and 3 million ha of salted land, respectively.) Western Australian research on salt-tolerant shrubs, such as the saltbush *Atriplex,* has been mutually beneficial to both Australian and Asian rural development programs, through screening and testing superior performing lines in the severity of Asian environments.
- These shrubs have an important role for stock grazing. Forage shrubs and trees also provide much-needed fuelwood, household timber and shade in developing countries. In an recent study in Western Australia the financial benefit from using saltbush for feed during periods of low pasture production has been demonstrated with a bio-economic model to be highly profitable on a whole-farm basis.

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An IBSRAM-coordinated network operating in Asia has been developing systems of sustainable land management for steeply sloping lands—those that are somewhat euphemistically termed 'less-favoured'. Such lands are coming under increasing environmental pressure from expansion of rural populations into previously uncultivated regions. They include steeply sloping, rocky hillsides, highly leached, acidifying soils in very wet regions, and black-clay soil lands which have been traditionally too heavy to cultivate easily.

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The principles of how to manage steeply sloping land are clear; they should always have a vegetative cover, be cultivated across slope not up and down, have some form of terracing or drainage to remove excess water, and be planted to perennial tree crops.

This sounds fine, but is not easy to implement when food crops such as maize yield a higher short-term profit, and when weeds threaten to smother all perennial crops. Contouring and terracing are very labour-intensive and have no immediate financial gain. The solutions tested by the IBSRAM network are to identify plant species that can be used as vegetative contours, trapping any soil between the strips, but providing some form of additional income.

The key to success is to find the right species to act as hedgerows or contour banks. IBSRAM's experience is that farmers, working with local agricultural agencies and international scientists, find the right types together better than any one group working alone.

This network has has some significant successes in adoption. Farmers in Loudian province of southwest China, where rocky slopes comprise over 80% of the land surface, have adopted a strip cropping pattern of improved land-use in which maize is grown on small patches of hillside between hedges of a cane-bearing legume shrub, that can be used for basket manufacture as well as forage. This has proved popular with village women as a supplementary source of income. There are 30 million rural people in this province of China alone. The impact of such a change in land-use in the upstream portion of catchments potentially may have profound effect downstream in the crowded floodplains.

The same principle of stabilising the upper reaches of catchments so that the lower reaches remain environmentally intact is also being promoted in Australia, through such initiatives as Total Catchment Management, and the activities of the Murray–Darling Basin Commission. The technical expertise gained in controlling the highly erosive, rapidly degrading environments in Africa, Asia and Latin America through the cross-fertilisation of scientists' expertise is paying off in developing better management systems to conserve and restore our rural resources.

This two-way channel of technical communication can also be a valuable conduit to the introduction of small-scale technological products suited to the Asian or African smallholding operation. Examples from existing ACIAR-supported projects include introduction of sulfur-coated fertilisers for use in sulfur-deficient soils in Southeast Asia, through a process

developed in the University of New England, and the development of small-scale tillage implements for cropland surface management in semi-arid areas, through collaboration between ICRISAT and Australian groups.

When we consider the effort which has already been undertaken by the international research organisations to develop diplomatic links with their host countries, this valuable source of local knowledge of rural conditions should not be overlooked by potential Australian investing interests.

The Last Word

With increasing life-expectancy and a maturing political identity Australians should extend their investment horizons to match the long-term nature of the benefits that accrue from supporting international agricultural research.

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