There is convincing evidence that intensive, sustainable farming systems can bring economic as well as environmental benefits through minimising external inputs, regenerating local resources, adding value to agricultural production and maintaining the surplus within the local community. If more sustainable land use is to make an impact on global needs, it is necessary to scale-up and extend these islands of success.

This is not just a matter of transfer of technology. Successful systems have developed on the terms of the local people. They are characterised by interactive participation in goal-setting, planning and implementation. Sustainability also requires the capacity to adapt to change: biophysical, economical and social.

Adaptation to changes has profound implications for policy, institutions and natural resources professionals. Policy reforms have been under way in many countries. Some initiatives support some elements of sustainable land use but few strategies integrate policy goals in a coherent way. Sustainable land use has been defined as a process of learning. This requires educational institutions that are communities of participatory learners - not simply distributors of ready-made technologies. Not least, it poses a challenge to professionals: new concepts, values, methods, behaviour - in short, a new professionalism.

1 CURRENT CHALLENGES FOR AGRICULTURAL DEVELOPMENT

As this century draws to a close, agricultural development faces some unprecedented challenges. By the year 2020, the world will have to support some 8.4 billion people. Even today, though enough food is produced in aggregate to feed everyone, some 800 million people still do not have access to sufficient food, and the gap between the wealthy and poor has widened. Despite a doubling in global income in the past three decades, the number of people living in poverty has continued to rise, from 944 million to 1300 million.

Recent models to investigate changes in agricultural production and food security changes over the next quarter to half century all conclude that food production will have to increase substantially (FAO 1993, 1995b, IFPRI 1995, Crosson and Anderson 1995, Leach 1995). But views on how to proceed vary hugely. Some are optimistic, even complacent; others are darkly pessimistic. Some indicate that not much needs to change; others argue for fundamental reforms to agricultural and food systems. Some indicate that a significant growth in food production will only occur if new lands are taken under the plough; others suggest that there are feasible social and technical solutions for increasing yields on existing farmland.

2 CONTRASTING SCHOOLS OF THOUGHT

2.1 Business-as-usual optimists

The business-as-usual optimists, with a strong belief in the power of the market, say supply will always meet increasing demand, and so growth in world food production will continue alongside expected reductions in population growth (Mitchell and Ingco 1993, FAO 1993, Rosegrant and Agcaolli 1994).

As food prices are falling (down 50% in the past decade for most commodities), this indicates that there is no current crunch over demand. Food production will continue as the fruits of biotechnology research ripen and as the area under cultivation expands, probably by some 20-40% by 2020 (this means an extra 79 million ha of uncultivated land converted To agriculture in Sub-Saharan Africa alone). It is also expected that population growth will slow, and that developing countries will substantially increase food imports from industrialised countries (perhaps S-fold by 2050).

2.2 Environmental pessimists

The environmental pessimists contend that ecological limits to growth are being approached or have already been reached (Ehrlich 1968, Kendall and Pimentel 1994, Harris 1995). They claim that populations continue to grow too rapidly while yield growth of the major cereals will slow or even fall, particularly because of resource degradation (soil erosion, forest loss, pesticide overuse, over-exploitation of fisheries). Dietary shifts are an emerging threat, especially increasing consumption of livestock products that require a greater share of cereal production. They do not believe that new technological breakthroughs are likely: solving these problems means putting population control as the first priority.

2.3 Industrialised world to the rescue

The industrialised world to the rescue lobby believes that Third World countries will never be able to feed themselves, for a wide range of ecological, institutional and infrastructural reasons, and so the food gap will have to be filled by agriculture in the industrialised countries (Knutson et al. 1990, Carruthers 1993, DowElanco 1994, Avery 1995, Wirth 1995). Increasing production in large, mechanised operations will force smaller and more "marginal" farmers out of business, so taking the pressure off natural resources. These can then be conserved in protected areas. The larger producers will then be able to trade their food with those who need it, or have it distributed by famine relief or food aid. It is also vigorously argued that any adverse health and environmental consequences of chemically-based agricultural systems are minor in comparison with those wrought by the expansion of agriculture into new lands. External inputs (especially pesticides and fertilizers) and free trade are said to represent a crucial part of any strategy for feeding the world.

2.4 New modernists


This group asserts that farmers simply use too few agrochemicals which are said to be the only way to improve yields and so keep the pressure off natural habitats. It is also argued that high-input agriculture is more environmentally sustainable than low-input agriculture, as the latter represents the intensive use of local resources which may be degraded in the process.

2.5 Sustainable intensification

Another group, though, is making the case for sustainable intensification on the grounds that substantial growth is possible in currently unimproved or degraded areas whilst at the same time, protecting or even regenerating natural resources (McCalla 1994, 1995, NAF 1994, Scoones and Thompson 1994, Pretty 1995a, b, Hazell 1995, Hewitt and Smith 1995). There is empirical evidence that regenerative and low-input (but not necessarily zero-input) agriculture can be highly productive, provided farmers participate fully in all stages of technology development and extension. This evidence also suggests that productivity of agricultural and pastoral land is as much a function of human capacity as it is of biological and physical processes.

Such sustainable agriculture seeks the integrated use of a wide range of pest, nutrient, soil and water management technologies; and increased diversity of enterprises within farms combined with increased linkages and flows between them. By-products from one component or enterprise become inputs to another.
As natural processes increasingly substitute for external inputs, so the impact on the environment is reduced.

3 WHAT IS AND WHAT IS NOT SUSTAINABLE AGRICULTURE?

3.1 Defining sustainability

Since the Brundtland Commission put sustainable development on the map in the mid 1980s, some 100 definitions of sustainability have been published. Clearly no reasonable person is opposed to the idea, but what does it mean? To some it implies the capacity of something to continue unchanged for a long time. To others, it implies not damaging natural resources. To others still, it is just accounting for the environment whilst continuing on a business-as-usual track.

Has the notion of sustainable agriculture contributed to better farm practices, or is the term too easily hijacked? First, it is important to clarify what is being sustained, for how long, for whose benefit and whose cost, over what area and measured by what criteria. Therefore, we should not prescribe a concretely defined package of technologies, practices or policies. As conditions change and as knowledge changes, so must farmers and communities be encouraged and allowed to change and adapt too. Sustainable agriculture is, therefore, a process for learning (Röling 1994, Pretty 1995b).

3.2 Goals for sustainable agriculture

During the past fifty years, agricultural and rural development policies have emphasised external inputs as the means to increase food production. This has produced remarkable growth in global consumption of pesticides, inorganic fertilizer, animal feedstuffs, and other machinery. These external inputs have substituted for natural control processes and resources. Pesticides have replaced biological, cultural and mechanical methods for controlling pests, weeds and diseases; inorganic fertilizers have substituted for livestock manures, composts, nitrogen-fixing crops and fertile soils; information for management decisions comes from input suppliers, researchers and extensionists rather than from local sources; and fossil fuels have substituted for locally-generated energy sources. What were once valued local resources have often now become waste products. Production has often been increased greatly but is, at the same time, more vulnerable.

The challenge for sustainable agriculture is to make better use of available physical and human resources. This can be done by minimizing the use of external inputs, by regenerating internal resources more effectively, or by combinations of both. This ensures the efficient and effective use of what is available, and ensures that any dependencies on external systems are kept to a reasonable minimum. As natural processes increasingly substitute for external inputs, so the negative impacts on the environment are reduced, and positive contributions made to regenerate natural resources (Table 1).

Table 1: Goals for sustainable agriculture

- A thorough integration of natural processes such as nutrient cycling, nitrogen fixation, and pest-predator relationships into agricultural production processes, so ensuring profitable and efficient food production
- A minimisation of the use of those external and non-renewable inputs with the potential to damage the environment or harm the health of farmers and consumers, and a targeted use of the remaining inputs used with a view to minimising costs
- The full participation of farmers and other rural people in all processes of problem analysis, and technology development, adaptation and extension
- A more equitable access to productive resources and opportunities, and progress towards more socially-just forms of agriculture
- A greater productive use of local knowledge and practices, including innovative approaches not yet fully understood by scientists or widely adopted by farmers
- The enhancement of wildlife and other public goods of the countryside
- An increase in self-reliance amongst farmers and rural people
- An improvement in the March between cropping patterns and the productive potential and environmental constraints of climate and landscape to ensure long-term sustainability, of current production levels

Source: Pretty 1995a
4 CURRENT EXTENT AND IMPACT OF SUSTAINABLE AGRICULTURE

4.1 Documented evidence


In the high-input and generally irrigated lands, farmers adopting regenerative technologies have also maintained or improved yields whilst substantially reducing their use of inputs (Bagadion and Korten 1991, Kenmore 1991, van der Werf and de Jager 1992, UNDP 1992, Kamp et al. 1993, Pretty 1995a). And in the industrialised countries, farmers have been able to maintain profitability, even though input use has been cut dramatically, such as in the USA (Liebhart et al. 1989, NRC 1989, Hanson et al. 1990, Faeth 1993, NAF 1994, Hewitt and Smith 1995) and in Europe (El Titi and Landes 1990, Vereijken 1990, Jordan et al. 1993, Pretty and Howes 1993, Reus et al. 1994, Somers 1997).

4.2 Current extent

The International Institute for Environment and Development has examined the extent and impact of sustainable agriculture in selected countries (Pretty et al. 1996). The government and non-government projects included in this analysis share important common characteristics. They have:

- Made use of resource-conserving technologies in conjunction with group or collective approaches to agricultural improvement and natural resource management.
- Put participatory approaches and farmer-centred activities at the centre of their agenda, so these activities take place on local people’s terms and are more likely to persist after the projects have ended.
- Not used subsidies or food-for-work to buy the participation of local people, or to encourage them to adopt particular technologies and, thus, improvements are unlikely to fade away or simply disappear at the end of the projects.
- Supported the active involvement of women as key producers and facilitators.
- Emphasised adding value to agricultural products through agro-processing, marketing, and other off-farm activities, thus creating employment, income-generating opportunities and retention of surplus in the rural economy.

Two types of transition to sustainable agriculture were assessed: from modern or conventional high-external input agriculture (such as farming in Green Revolution lands or in the industrialised countries); and from traditional, rainfed agriculture where cereal yields have largely remained constant over centuries.

In the 20 countries of the South (and the total of 63 projects) examined there are some 2 million households farming 4 million ha with sustainable technologies and practices (Table 2). These data do not represent a comprehensive survey of sustainable agriculture in each of the countries. However, they do illustrate what has been achieved by specific projects and what could be replicated elsewhere. Most of these improvements have occurred in the past 10 years, many in the past 2-5 years. The assumption is that these are representative of what is possible on a wider scale. It might be argued that they are successful only because they have occurred where there is a combination of the least resistance and most opportunity, although the sheer diversity of approaches and contexts make this unlikely. Moreover, many of the improvements are occurring in remote and resource-poor areas that have commonly been assumed to be incapable of producing food surpluses.
Table 2: Examples of the extend and impact of sustainable and people-centred agriculture in different agricultural systems (see Pretty et al. 1996 for details of data sources and surveys)

<table>
<thead>
<tr>
<th>Countries</th>
<th>Number of farming households reported</th>
<th>Number of hectares reported</th>
<th>Dominant crop</th>
<th>Yield improvement factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAINFED SYSTEMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>223,000</td>
<td>1,330,000</td>
<td>Maize, Wheat</td>
<td>198 to 246</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>22,500</td>
<td>37,360</td>
<td>Sorghum/Millet</td>
<td>250</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>24,175</td>
<td>21,850</td>
<td>Maize</td>
<td>154</td>
</tr>
<tr>
<td>Guatemala</td>
<td>17,000</td>
<td>17,000</td>
<td>Maize</td>
<td>250</td>
</tr>
<tr>
<td>Honduras</td>
<td>27,000</td>
<td>42,000</td>
<td>Maize</td>
<td>250</td>
</tr>
<tr>
<td>India</td>
<td>307,910</td>
<td>993,410</td>
<td>Sorghum/Millet</td>
<td>288</td>
</tr>
<tr>
<td>Kenya</td>
<td>222,550</td>
<td>250,000</td>
<td>Maize</td>
<td>200</td>
</tr>
<tr>
<td>Mexico</td>
<td>7400</td>
<td>23,500</td>
<td>Coffee</td>
<td>140</td>
</tr>
<tr>
<td>Nepal</td>
<td>3000</td>
<td>1300</td>
<td>Maize, Wheat</td>
<td>164 to 307</td>
</tr>
<tr>
<td>Philippines</td>
<td>850</td>
<td>920</td>
<td>Upland rice</td>
<td>214</td>
</tr>
<tr>
<td>Senegal</td>
<td>200,000</td>
<td>400,000</td>
<td>Sorghum/Millet</td>
<td>300</td>
</tr>
<tr>
<td>Uganda</td>
<td>9426</td>
<td>21,379</td>
<td>Maize</td>
<td>150</td>
</tr>
<tr>
<td>Zambia</td>
<td>6300</td>
<td>6300</td>
<td>Sorghum/Millet</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,146,111</strong></td>
<td><strong>3,255,519</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **IRRIGATED SYSTEM** | | | |
| Bangladesh         | 11,025                               | 4772                        | Rice                   | 110                          |
| China              | 47,000                               | 12,000                      | Rice                   | 111                          |
| India              | 50,000                               | 71,300                      | Rice                   | 108                          |
| Indonesia          | 400,000                              | 267,000                     | Rice                   | 107                          |
| Malaysia           | 25,000                               | 3925                        | Rice                   | 108                          |
| Philippines        | 175,000                              | 385,000                     | Rice                   | 112                          |
| Sri Lanka          | 100,000                              | 95,350                      | Rice                   | 117                          |
| Thailand           | 500                                  | 2040                        | Rice                   | 109                          |
| Vietnam            | 6600                                 | 3540                        | Rice                   | 108                          |
Note: Improvements are measured against non-sustainable farming equivalents, which are taken to be 100%. Thus an improvement of 200% implies a doubling of yields; one of 90% implies a fall in yields of 10%. The time frame for these improvements is during the life of project activities, usually less than 5 years.

4.3 Contested views

This empirical evidence is still contested. In the USA, some 80% of conventional farmers believe that low-input agriculture will always be low-output. Influential politicians continue to reinforce these beliefs. In 1991, the Secretary of State, Earl Butz, said:

‘we can go back to organic agriculture in this country if we must - we once farmed that way 75 years ago. However, before we move in that direction, someone must decide which 50 million of our people will starve. We simply cannot feed, even at subsistence levels, our 250 million Americans without a large production input of chemicals, antibiotics and growth hormones.’

In 1996, Under-Secretary for Agriculture, Eugene Moos, said:

‘The prospective increase in world population will double food aid needs in the next decade... and it will be necessary for agricultural producing nations to use biotechnology and hormones to meet growing demand.’

Yet some 40,000 farmers in 32 states are using sustainable agriculture technologies and have cut their use of external substantially. In the USA, the top quarter of sustainable farms achieve better yields and gross margins than average conventional farms. This includes 2800 sustainable agriculture farmers in the North Western States, who grow twice as many crops compared with conventional farmers, use 60-70% less fertilizer, pesticide and energy, and their yields are roughly comparable; they also spend more money on local goods and services (Hewitt and Smith 1995, NAF 1994).

5 THE SPREAD AND SCALING UP OF SUSTAINABLE AGRICULTURE

5.1 Why we should be concerned with spread?

Sustainability is more than just agricultural activities that arc environmentally neutral or positive; it implies the capacity for activities to spread beyond the project in both space and time. Despite the increasing number of successful sustainable agriculture initiatives in different parts of the world, it is clear that most of these are still only islands of success. There remains a huge challenge to find ways to spread or scale up the processes which have brought about these transitions.
When the recent record of development assistance is considered, it is clear that sustainability has been poor. There is a widespread perception that agricultural development is difficult, that agricultural projects perform badly, and that resources may best be spent in other sectors. Reviews by the World Bank, the European Commission, Danida and the British ODA have all shown that agricultural and natural resource projects both performed worse in the 1990s than in the 1970s-1980s and worse than projects from other sectors (World Bank 1993, Pohl and Mihaljek 1992, EC 1994, Danida 1994, Dyer and Barthotomew 1995). Their achievements are also less likely to continue beyond the provision of aid inputs.

A recent analysis of 95 agricultural project evaluations recorded on the OECD Development Assistance Committee database shows a disturbing rate of failure, with at least 27% of projects having non-sustainable structures, practices or institutions, and 10% causing significant negative environmental impact (Pretty and Thompson 1996). The cited reasons for failure included an emphasis on only external technologies; no participation by local people; ineffective training of professionals; and institutions working with no orientation towards the diversity of local conditions and needs of local people. This evidence suggests four important principles for sustainability and spread:

- **Imposed technologies do not persist.** If coercion or financial incentives are used to encourage people to adopt sustainable agriculture technologies (such as soil conservation, alley cropping, IPM), then these practices are not likely to persist.

- **Imposed institutions do not persist.** If new institutional structures are imposed (such as cooperatives or other groups at local level, or Project Management Units and other institutions at project level), then these rarely persist beyond the project.

- **Expensive technologies do not persist.** If expensive external inputs (including subsidised inputs, machinery or high-technology hardware) are introduced with no thought to how they will be paid for, they too will not persist beyond the project.

- **Sustainability does not equal fossilisation or continuation of a thing or practice forever.** Rather it implies an enhanced capacity to adapt in the face of unexpected changes and emerging uncertainties.

### 5.2 Problems with comprehensive technology packages

Modernist agricultural development has begun with the notion that there are technologies that work, and it is just a matter of inducing or persuading farmers to adopt them. Yet few farmers are able to adopt whole packages of conservation technologies without considerable adjustments in their own practices and livelihood systems.

Alley cropping, an agroforestry system comprising rows of nitrogen-fixing trees of bushes separated by rows of cereals, has long been a focus of research (Kang et al., 1984, and many others). Many productive systems, needing few or no external inputs, have been developed. They stop erosion, produce food and wood, and can be cropped over long periods. But very few, if any, farmers have adopted these systems as designed. Despite millions of dollars of research expenditure over many years, systems have been produced suitable only for research stations (Carter 1995).

Sometimes farmers have been able to take one or two components of alley cropping and adapt them to their own farms. In Kenya, for example, farmers planted rows or leguminous trees next to field boundaries, or single rows through their fields; and in Rwanda, alleys planted by extension workers soon became dispersed through fields (Kerkof 1990). But the prevailing view seems to be that farmers should adapt to the technology. Of the Agroforestry Outreach Project in Haiti, the evaluators said that:

> "Farmer management of hedgerows does not conform to the extension program…Some farmers prune the hedgerows too early, others too late. Some hedges are not yet pruned by two years of age, when they have already reached heights of 4-5 metres. Other hedges are pruned too early, mainly because animals are let in or the tops are cut and carried to animals…Finally, it is very common for farmers to allow some of the trees in the hedgerow to grow to pole size" (Bannister and Nair 1990)

This could be read as a great success - farmers were adapting the technology to their own special needs. But it was not. The language of the evaluators is quite clear - this was considered a failure.
What does this mean for sustainable agriculture? How should we proceed so as to ensure farmers are fully involved in developing and adapting sustainable and productive technologies?

6 THE MANY INTERPRETATIONS OF PARTICIPATION

There is a long history of participation in agricultural development, and many development agencies have attempted to involve people in some aspect of planning and implementation. Two overlapping schools of thought and practice have evolved. One views participation as a means to increase efficiency: the central notion being that if people are involved, then they are more likely to agree with and support the new development or service. The other sees participation as a fundamental right, and its main aim is to initiate mobilization for collective action, empowerment and institution building.

More and more comparative studies of development projects show that participation is one of the critical components of success. It has been associated with increased stakeholder ownership of policies and projects; greater efficiency, understanding and social cohesion; more cost-effective services; greater transparency and accountability; increased empowerment of (the poor and disadvantaged; and strengthened capacity of people to learn and act (Reij 1988, Finsterbusch and van Wicken 1989, Bagadion and Korten 1991, Cernea 1991, Uphoff 1992, Narayan 1993, World Bank 1994, Pretty 1995a, b).

As a result, "people's participation" is such a fashion that almost everyone says that participation is part of their work. This has created many paradoxes. The term "participation" has been used to justify the extension of control of the state as well as to build local capacity and self-reliance; it has been used to justify external decisions as well as to devolve power and decision-making away from external agencies; it has been used for data collection as well as for interactive analysis.

In conventional rural development, participation has commonly centred on encouraging local people to sell their labour in return for food, cash or materials. Yet these material incentives create dependencies, give the misleading impression that local people are supportive of externally-driven initiatives, and produce impacts which rarely persist once the project ceases (Bunch 1983, Reij 1988, Pretty and Shah 1994). Despite this, development programmes continue to justify subsidies and incentives, on the grounds that they are faster, that they can win over more people, or they provide a mechanism for disbursing food to poor people. As little effort is made to build local skills, interests and capacity, local people have no stake in maintaining structures or practices once the flow of incentives stops.

One of the objectives of agricultural support institutions must be greater involvement with diverse groups of people, as sustainable agriculture is threatened without it. The dilemma for many authorities is they both need and fear people's participation. They need people's agreement and support, but they fear that this wider involvement is less controllable and likely to stow down planning processes. But if this fear permits only stage-managed forms of participation, then distrust and greater alienation arc the most likely outcomes. This makes it all the more crucial that judgements can be made on the type of participation in use.

The many ways that development organisations interpret and use the term participation can be resolved into seven clear types. These range from manipulative and passive participation, where people are told what is to happen and act out predetermined roles, to self-mobilization, where people take initiatives largely independent of external institutions (Table 3). This typology suggests that the term ‘participation’ should not be accepted without appropriate clarification.
Table 3: A typology of participation

<table>
<thead>
<tr>
<th>Typology</th>
<th>Characteristics of Each Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Manipulative Participation</td>
<td>Participation is simply a pretence</td>
</tr>
<tr>
<td>2. Passive Participation</td>
<td>People participate by being told what has been decided or has already happened. Information being shared belongs only to external professionals</td>
</tr>
<tr>
<td>3. Participation by Consultation</td>
<td>People participate by being consulted or by answering questions. Process does not concede any share in decision-making, and professionals are under no obligation to take on board people’s views</td>
</tr>
<tr>
<td>4. Participation by Material Incentives</td>
<td>People participate in return for food, cash or other material incentives. Local people have no stake in prolonging technologies or practices when the incentives end</td>
</tr>
<tr>
<td>5. Functional Participation</td>
<td>Participation seen by external agencies as a means to achieve project goals, especially reduced costs. People may participate by forming groups to meet predetermined objectives related to the project</td>
</tr>
<tr>
<td>6. Interactive Participation</td>
<td>People participate in joint analysis, development of action plans and formation or strengthening of local groups or institutions. Learning methodologies used to seek multiple perspectives, and groups determine how available resources are used</td>
</tr>
<tr>
<td>7. Self-Mobilization</td>
<td>People participate by taking initiatives independently of external institutions. They develop contracts with external institutions for resources and technical advice they need, but retain control over how resources are used</td>
</tr>
</tbody>
</table>

One study of 121 rural water supply projects in 49 countries of Africa, Asia and Latin America found that participation was the most significant factor contributing to project effectiveness (Narayan 1993). Most of the projects referred to community participation or made it a specific project component but only 21% scored high on interactive participation. Clearly, intentions did not translate into practice. It was when people were involved in decision-making during all stages of the project, from design to maintenance, that the best results occurred. If they were just involved in information sharing and consultations, then results were much poorer. According to the analysis, moving down the typology moved a project to a more highly effective category.

The term participation can be used, knowing it will not lead to action. Indeed, some suggest that the manipulation that is often central to types one to four mean they should be seen as types of not-participation (Hart 1992).

Care must, therefore, be taken over both using and interpreting the term participation. What will be important is for institutions and individuals to find better ways of shifting from the more common passive, consultative and incentive-driven participation towards the interactive end of the spectrum.

7 TOWARDS A NEW PROFESSIONALISM FOR LAND HUSBANDRY

Land users cannot rely on routine, calendar-based activities over the long term. Interventions must be based on observation and anticipation which requires instruments and indicators which make more visible the ecological relationships on and between management units. Technology for sustainable land use must emphasise measurement and observation equipment, or set-vice that help individual farmers assess their situations, such as soil analysis, manure analysis, pest identification (Röling 1994). It also has to focus on higher system levels. Predators and parasitoids to control pests often require a larger habitat than that of a small farm. Likewise erosion control, water harvesting, biodiversity, access to biomass, recycling waste between town and countryside and between animal and crop production, all require local cooperation and
What becomes important is the new learning path that land users and communities must take to support sustainable land use. This involves a transformation in the fundamental objectives, strategies, theories, skills, labour organisation, and professionalism of farming, forestry and all other aspects of land and water development.

But learning should not be confused with leaching. Teaching implies the transfer of knowledge from someone who knows to someone who does not know. Teaching is the normal mode of educational curricula, and is also central to many organisational structures (Argyris et al. 1985, Bawden 1992, Pretty and Chambers 1993). Universities and other professional institutions reinforce the teaching paradigm by giving the impression that they are custodians of knowledge which can be dispensed (usually by lecture) to a recipient (a student). Where these institutions do not include a focus on self-development and enhancing the ability to learn, then *teaching threatens sustainable agriculture* (Ison 1990).

A fundamental requirement for sustainable agriculture is for educational institutions to evolve into communities of participatory learners. Such changes are very rare, an exception being Hawkesbury College, which is now part of the University of Western Sydney, Australia. However, a regional consortium of NGOs in Latin America concerned with agroecology and low-input agriculture recently signed an agreement with eleven colleges of agriculture from Argentina, Bolivia, Chile, Mexico, Peru, and Uruguay to help in the joint reorientation of curriculum and research agendas towards sustainability and poverty concerns (Altieri and Yuryevic 1992, Yuryevic 1994). The agreement defines collaboration to develop more systemic and integrated curricula, professional training and internship programmes, collaborative research efforts and the development of training materials.
A move from a caching to a learning style has profound implications for agricultural development institutions. The focus is less on what we learn, and more on how we learnt and with whom. This implies new roles for development professionals, leading to a whole new professionalism with new concepts, values, methods and behaviour (Table 4). Conventional professionals are single-disciplinary, work largely in ways remote from people, are insensitive to diversity of context, and are concerned with themselves generating and transferring technologies. Their beliefs about people’s conditions and priorities often differ from people’s own views. The new professionals, by contrast, make explicit their underlying values, select methodologies to suit needs, are more multidisciplinary and work closely with other disciplines, and are not intimidated by the complexities and uncertainties of dialogue and action with a wide range of non-scientific people (Pretty and Chambers 1993).

It would be wrong to depict a simple polarisation between old and new professionalism, implying in some way the bad and the good. Professionals will need to be able to select appropriate methodologies for particular tasks. Where the problem situation is well defined, system uncertainties are low, and decision stakes are low, then positivist and reductionist science will work well. But where the problems are poorly defined and there are great uncertainties potentially involving many actors and interests, then the methodology will have to comprise these alternative methods of learning. Many existing agricultural professionals will see this as a depprofessionalisation of research but Hart (1992) has put it differently: ‘I see it as a “re-professionalisation”,

<table>
<thead>
<tr>
<th>Elements</th>
<th>Components of the new professionalism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumptions about reality</td>
<td>The assumption is that realities are socially constructed, and so participatory methods are required to relate these many and varied perspectives one to another</td>
</tr>
<tr>
<td>Underlying values</td>
<td>Underlying values at-e not presupposed but are made explicit; old dichotomies of facts and values, and knowledge and ignorance, are transcended</td>
</tr>
<tr>
<td>Scientific method(s)</td>
<td>The many scientific methods are accepted as complementary; with reductionist science for well-defined problems and when system uncertainties are low, and constructivist science when situations are complex and uncertain</td>
</tr>
<tr>
<td>Who sets priorities and whose criteria count? Context of researching process</td>
<td>A wide range of stakeholders and professionals set priorities together; local people’s criteria and perceptions are emphasised. Investigators accept that they do not know where research will lend; it has to be an open-ended learning process; historical and spatial context of inquiry is fundamentally important</td>
</tr>
<tr>
<td>Relationship between actors and groups in the process</td>
<td>Professionals shift from controlling to enabling mode; they attempt to build trust through joint analyses and negotiation; understanding arises through this interaction</td>
</tr>
<tr>
<td>Mode of professional working</td>
<td>More multidisciplinary than single disciplinary when problems are difficult to define; so attention is needed on the interactions between members of groups working together</td>
</tr>
<tr>
<td>Institutional involvement</td>
<td>No longer just scientific or higher-level institutions involved; process inevitably comprises a broad range of societal institutions and associations at all levels</td>
</tr>
<tr>
<td>Quality assurance and evaluation</td>
<td>There are no simple, objective criteria for quality assurance: criteria for trustworthiness replace internal validity, external validity, objectivity, and reliability when methods is non-reductionist; evaluation is no longer by professionals or scientists alone, but by a wide range of affected and interested parties</td>
</tr>
</tbody>
</table>

Source: adapted from Pretty and Chambers (1993)
A systematic challenge for agricultural institutions is to institutionalise these approaches and structures that encourage learning. Most organisations have mechanisms for identifying departures from normal operating procedures. But most institutions are very resistant to the questioning of, and possible changes in, the wider values and procedures under which they operate. For organisations to become learning organisations, they must ensure that people become aware of the way they learn, both from mistakes and from successes.

Institutions can, therefore, improve learning by encouraging systems that develop a better awareness of information. The best way to do this is to be in close touch with the outside world and to have a genuine commitment to participative ‘decision-making, combined with participatory analysis of performance. Learning organisations will, therefore, have to be more decentralised, with an open multidisciplinarity, and heterogeneous outputs responding to the demands and needs of land users, multiple linkages and alliances, and with regular participation between professionals and the wider public.

8 POLICIES FOR SUSTAINABILITY AND LEARNING

Policy reform has been under way in many countries, with some new initiatives supporting elements of more sustainable land use. Most of these have focused on input-reduction strategies, because of concerns over foreign exchange expenditure or environmental damage. Only a few, as yet, represent coherent plans and processes that clearly demonstrate the value of integrating policy goals.

The first action that governments can take is to declare a national policy for sustainable land use. This would raise the profile of these processes and needs, as well as giving explicit value to alternative societal goals. New policies must create the conditions for development based more on locally-available resources and local skills and knowledge. Policy makers will have to find ways of establishing dialogues and alliances with other actors, and land users’ own analyses could be facilitated and their organised needs articulated. Dialogue and interaction would give rapid feedback, allowing policies to be adapted iteratively. Land use policies could then focus on enabling people and professionals to learn together so as to make the most of available social and biological resources.

It is important to be clear about just how policies should be trying to address the issues of sustainability and learning. As has been suggested, precise and absolute definitions of sustainability are impossible. Sustainable land management should not, therefore, be seen as a set of practices to be fixed in time and space. It implies the capacity to adapt and change as external and internal conditions change. Yet there is a danger that policy, as it has tended to do in the past, will prescribe the practices that farmers should use rather than create the enabling conditions for locally-generated and adapted technologies.

Throughout the world, environmental policy has tended to take the view that rural people are mismanagers of natural resources. The history of soil and water conservation, rangeland management, protected area management, irrigation development, and modern crop dissemination shows a common pattern: technical prescriptions are derived from controlled and uniform conditions, supported by limited cases of success, and then applied widely with little or no regard for diverse local needs and conditions (Benhke and Scoones, 1992; Pretty and Shah, 1994; Pimbert and Pretty, 1994). Differences in receiving environments and livelihoods then often make the technologies unworkable and unacceptable. When they are rejected locally, policies shift to seeking success through the manipulation of social, economic and ecological environments, and eventually through outright enforcement.

For sustainable land husbandry to spread widely, policy formulation must not repeat these mistakes. Policies will have to arise in a new way. Achieving this will be difficult. In practice, policy is the net result of the actions of different interest groups pulling in complementary and opposing directions. It is not just the normative expression of governments. Effective’ policy will have to recognise this, and seek to bring together a range of actors and institutions for creative interaction and joint learning.

REFERENCE

Altieri M.A. and A. Yurjevic 1992
Changing the agenda of the universities. ILEIA Newsletter 2/92, 39pp

Argyris C. R. Putnam and D.M. Smith 1985


Avery D. 1995

Saving the planet with pesticides and plastic. The Hudson Institute, Indianapolis

Bagadion B.U. and F.F. Korten 1991


Balbarino, E.A. and D.L. Alcober 1994


Bannister M.E. and P.K.R. Nair 1990

Alley cropping as a sustainable agriculture technology for the hillsides of Haiti: experience of an agroforestry outreach project. Amer: J. Alternative Agric. 5(2), 51-59

Bawden R. 1992


Borlaug N. 1992

Small-scale agriculture in Africa: the myths and realities. Feeding the Future (Newsletter of the Sasakawa Africa Association), 4: 2pp

Borlaug N. 1994

Chemical fertilizer "essential". Letter to International Agricultural Development (Nov-Dee), 23pp

Brown L.R. and Il. Kane 1994

Full house: reassessing the Earth's population carrying capacity. W W Norton and Co, New York

Bunch R. 1983

Two Ears of Corn. World Neighbors, Oklahoma City

Bunch R. 1990


Bunch R.1993

EPAGRI's work in the State of Santa Catarina, Brazil: major new possibilities for resource-poor farmers. COSECHA, Tegucigalpa, Honduras.

Carruthers I. 1993
Going, going, gone! Tropical agriculture as WC knew it. Tropical Agriculture Association Newsletter, 13 (3), 1-5

Carter J. 1995

Alley cropping: have resource poor farmers benefited? ODI Natural Resource Perspectives No 3, London

Cernea M.M. 1991

Putting People First. Oxford University Press, Oxford

Crosson P. and J.R. Anderson 1995


Danida 1994

Agricultural sector evaluation. Lessons learned. Ministry of Foreign Affairs, Copenhagen

de Freitas H.V. 1994

EPAGRI in Santa Catarina, Brazil: the micro-catchment approach. IIED New Horizons conference, Bangalore. IIED, London

DowElanco 1994

The bottom line. DowElanco, Indianapolis, USA

Dyer N. and A. Bartholomew 1995


EC 1994

Evaluation des project de development rural finaces duran les conventions de Lome I, II, et III. European Commission, Brussels

Ehlich P. 1968

The population bomb. Ballantine, New York

El Titi A. and H. Landes 1990


FAO 1993

Strategies for sustainable agriculture and rural development (SARD): the role of agriculture, forestry and fisheries. FAO, Rome

FAO 1995

The state of food and agriculture. FAO, Rome

Finsterbusch K. and W.A. van Wicklen 1989
Beneficiary participation in development projects: empirical tests of popular theories. *Econ. Development and Cultural Change* 37 (3) 573-593

GTZ 1992

*The spark has jumped the gap.* Deutsche Gesellschaft fuer Technisches Zusammenarbeit, Eschborn

Hanson J.C., D.M. Johnson, S.E. Peters and R.R. Janke 1990


Harris J.M. 1995

*World agriculture: regional sustainability and ecological limits.* Discussion Paper No.1 Center for Agriculture, Food and Environment, Tufts University, MA

Hart R.A. 1992

*Children's participation: from tokenism to citizenship.* UNICEF Innocenti Essays No 4. UNICEF, Florence

Hazell P. 1995

*Managing agricultural intensification.* IFPRI 2020 Brief 11. IFBRI, Washington DC


*Intensive agriculture and environmental quality: examining the newest agricultural myth.* Henry Wallace Institute for Alternative Agriculture, Greenbelt MD

Hichcliffe F., J. Thompson and J.N. Pretty 1996

*Sustainable agriculture and food security in East and Southern Africa.* Report for the Committee on Food Security in East and Southern Africa, Swedish International Agency for International Cooperation, Stockholm

IFPRI 1995

*A 2020 Vision for food, agriculture and the environment.* International Food Policy Research Institute, Washington DC

Ison R. 1990

*Teaching threatens sustainable agriculture.* Gatekeeper Series SA21 IIED, London

Jordan V.W.L., J.A. Hutcheon and D.M. Glen 1993

*Studies in technology transfer of integrated farming systems. Considerations and principles for development.* AFRC Institute of Arable Crops Research, Long Ashton Research Station, Bristol

Kamp K., R. Gregory and G. Chowhan 1993

Fish cutting pesticide use. *ILEIA Newsletter* 2/93, 22-23


*Alley cropping: a stable alternative to shifting agriculture.* IITA, Ibadan
Kenmore P. 1991

How rice farmers clean up the environment, conserve biodiversity, raise more food, make higher profits. Indonesia's IPM - A model for Asia. FAO, Manila

Kerkhof P. 1990

Agroforestry in Africa, a survey of project experience. Panos Institute, London

Knutson R.D., J.B. Taylor, J.B. Penson and E.G. Smith 1990

Economic Impact of Reduced Chemical Use. Texas A&M University

Krishna A. 1994


Leach G. 1995

Global land and food in the 21st century. Polestar Series Report No.5, Stockholm Environment Institute, Stockholm


Crop production during conversion from conventional to low-input methods. Agronomy Journal 81 (2), 150-159

McCalla A. 1994

Agriculture and food needs to 2025: why we should be concerned. Sir John Crawford Memorial Lecture, October 27. CGIAR Secretariat, The World Bank, Washington DC

McCalla A. 1995


Mitchell D.O. and M.D. Ingco 1993

The world food outlook. International Economics Department. World Bank, Washington DC

NAF 1994

A Better row to hoe: the economic, environmental and social impact of sustainable agriculture. Northwest Area Foundation, St. Paul MIN

NRC 1989


Narayan D. 1993

Focus on participation: Evidence from 121 rural water supply projects. UNDP-World Bank Water Supply and Sanitation Program, World Bank, Washington DC

Paarlberg R.L. 1994
Sustainable farming: a political geography. IFPRI 2020 Brief 4. IFPRI, Washington DC

Pimbert M. and J.N. Pretty 1995


Pohl G. and D. Mihaljek 1992


Pretty J.N. 1995a


Pretty J.N. 1995b

Participatory learning for sustainable agriculture. World Development 23(8), 1247-1263

Pretty J.N. and R. Chambers 1993

Towards a learning paradigm: new professionalism and institutions for sustainable agriculture. IDS Discussion Paper 334, Institute for Development Studies, Brighton, UK

Pretty J.N. and R. Howes 1993

Sustainable agriculture in Britain: recent achievements and new policy challenges. IIED Research Series Vol 3, No 1, IIED, London

Pretty J.N. and P. Shah 1994

Soil and water conservation in the 20th century: A history of coercion and control. Rural History Centre Papers No.1, University of Reading, Reading

Pretty J.N. and J. Thompson 1996

Sustainable agriculture and the Overseas Development Administration. Report for Natural Resources Policy Advisory Department, ODA, London


Sustainable agriculture: Impacts on food production and challenges for food security. Gatekeeper Series SA60, IIED, London

Reji C. 1991

Indigenous soil and water conservation in Africa. Sustainable Agriculture Programme Gatekeeper Series No 27, Sustainable Agriculture Programme, IIED, London

Röling N. 1994


Rosegrant M.W. and M. Agcaoili 1994

Global and regional food demand, supply and trade prospects to 2010. IFPRI, Washington DC

Annual Reports. Sasakawa Africa Association, Tokyo

Scoones I. and J. Thompson 1994


Shah P. 1994


Somers B.M. 1997


SWCB 1994


UNDP 1992


Uphoff N. 1992


Vereijken P. 1990


Werf, E. van der and A. de Jager 1992

Ecological agriculture in South India: An agro-economic comparison and study of transition. Landbouw-Economisch Institut, The Hague and ETC-Foundation, Leusden

Winrock International 1994

Assisting sustainable food production: apathy or action? Winrock International, Arlington VA

World Bank 1993

Agriculture sector review. Agriculture and Natural Resources Department, Washington DC