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Teaching Threatens Sustainable Agriculture

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This Gatekeeper Series is produced by the International Institute for Environment and Development to highlight key topics in the field of sustainable agriculture. Each paper reviews a selected issue of contemporary importance and draws preliminary conclusions of relevance to development activities. References are provided to important sources and background material.

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TEACHING THREATENS SUSTAINABLE AGRICULTURE

Raymond L. Ison

> "*Development is primarily a learning process - one group cannot develop another; the only type of development possible is self-development*" - R.L. Ackoff, 1990.

Over recent years the term sustainability has begun to mean all things to all people. There are now, for example, more than 60 definitions of sustainable development (Winpenny, 1990). But a central flaw is that sustainability is too often seen as an outcome - as something that exists, such as a sustainable farming system - rather than a process of change.

Such a process should involve the building of sustainable relationships between people and people, and between people and their environment. And to do this requires the development of learning societies, in which learning becomes an active verb, not an adjective. The problem is that a pre-occupation with teaching has left us largely ignorant of learning. As Graham Sibbs (1981) recently put it:

> *"This pre-occupation with teaching has... actually constrained the effectiveness of higher education and limited its abilities to meet society's demands...We might say that we are now beginning to perceive that the purpose of education is learning. And we are beginning to realise that frequently teaching interferes with learning."*

Yet society puts little premium on learning. It does not necessarily result from teaching, which is, of course, pervasive in all institutions associated with agriculture. It is the normal mode in many formal curricula; it underpins the transfer of technology model of agricultural research and development; and is central to many organisational structures. To my mind the teaching paradigm[1] so differs from learning paradigms that it constrains our attempts to engage in a sustainable agriculture. Indeed, teaching appears to threaten sustainable agriculture.

Problems with Agricultural Education

Universities and other agricultural education institutions reinforce the teaching paradigm by describing their purpose and function as 'custodians' and 'preservers' of knowledge. This creates the image of knowledge as a 'commodity' that can be 'stored' or 'warehoused' and then dispensed' or 'given' (usually by a lecture) to a recipient (a student). All this is further reinforced by the functional breakdown of teaching and research - often with different departments, administrators and rewards - and the way in which individual academics

1. A paradigm can be defined as a coherent and mutually supporting pattern of concepts, values, methods and action.

describe, usually in terms of conflicting interests, these roles.

Agricultural educators, both natural and social scientists, are frequently wedded to the belief that the building blocks of 'knowledge', taken from say chemistry, physics, economics, biology, must first be laid down before students can hope to grasp the complexities of an emergent science such as agriculture. This contrasts with a view which takes knowledge as a social product that cannot be isolated from the process by which it is generated - a dialectic. It is thus the product of learning which is, hopefully, an ongoing, life-long process.

Some of the components and symptoms of the teaching paradigm have serious implications for sustainable agriculture.

Lecturing

Teaching frequently relies on lecturing and structured practical sessions. Yet there is no simple relationship between what is taught and what is learnt. Meaning cannot simply be transferred to students: in lectures *"there is simply too little scope for the negotiation and construction of meaning"* (Gibbs, 1989).

Problem Solving and Creativity

Teaching frequently results in surface or achieving approaches to learning by students (Table 1). Surface learning is a characteristic outcome of the teaching paradigm - it is enforced by overload, poor feedback, inappropriate teaching strategies, by offering tasks and material that can be learned by rote, and by assessment procedures. Most academics would argue that they desire students to develop deep approaches to their learning, yet curricula based on lecturing and examinations promote and reward regurgitation alone. Teaching that promotes or maintains dependence also stifles creativity and initiative.

Table 1 Three approaches to learning, identified from research (Biggs, 1989)

	Approach	**Motive**	**Strategy**
Surface	extrinsic	avoid failure but don't work too hard	focus on selected details
Deep	intrinsic	satisfy curiosity about topic	maximise understanding: read, discuss, reflect
Achieving	achievement	compete for highest grades	optimise organisation of time ('study skills')

Too little account is given to method or the process of learning - how to learn. Criticism is the essence of the scientific method: education must now rediscover opportunities for students to be critical and to use criticism.

Educational Assessment

Assessment is the tail that wags the dog; an education based mainly on lectures and examinations teaches students to solve just one problem - how to transfer the content of lectures to examinations and essays, and so pass. Under this system students know their interests lie in good grades, not in education. Few of the wide range of available assessment instruments are used (Table 2).

Table 2 A matrix of assessment methods which places examinations in context (Kilty, 1978)

	Unilateral Assessment	**Assessment with one other (one to one)**	**Assessment in a Group (one to a group)**
Self Assessments	Ongoing self-monitoring and self-assessment	Facilitated self-assessment and self appreciation; Mutual interviews; Negotiated appraisal	Self and peer assessment and accreditation; Peer audit
Assessment by Others	Appraisal (non-negotiated); Progress reports (non-negotiated);References (non- negotiated); Traditional exams	Feedback on behaviour validation; Negotiated appraisal; Mutual interviews; Oral interviews; Job interviews	Peer feedback; Devil's advocate procedure; Validation case conferences; Tribunals

Individual Learning Histories

Teaching takes little account of individual differences in learning abilities or styles. There is an interesting paradox in formal education systems: before going to school, the learning environment of children is rich in messages, which are received by touch, use of pictures, mime, stories and metaphor. But this range declines over time to be eventually dominated by messages from the lecture. For non-formal short courses many trainers have started to reverse this trend by adopting creative learning strategies, but these styles rarely penetrate formal agricultural curricula.

Content and Context

Finally, teaching fails to recognise two things: that the problems facing sustainable agriculture are multidimensional, and that agreement on what constitutes a problem in the first place must be a continuing process between people. Curricula based on a series of discrete, taught, disciplinary subjects assume, as if by osmosis, students will be capable of developing the necessary integrative and interpersonal skills by the end of their degree. Teaching is rarely contextual, so responsibility for content remains with a curriculum committee or individual lecturer. This, of course, maintains power in the hands of the teacher rather than giving to the learner.

Problems in Agricultural Extension

Agricultural extension, like education, is suffering from inertia: the term extension and much of what it has come to mean is rapidly losing its value. To begin with, extension meant extending knowledge from a centre of learning to those in need of this knowledge. Researchers have the prestigious role of being the source of new technology, whilst farmers are the passive recipients. But this, too, is putting problems in the way of achieving a sustainable agriculture.

The Transfer of Technology (TOT) model of extension has long been underpinned by erroneous assumptions, placing it firmly within the teaching paradigm (Drew, 1974; Chambers, 1983; Chambers et al., 1989; Russell et al., 1989). These are that:

- 'real' knowledge is the sole domain of the researcher;
- the gap between research and farming practice is 'bad' and so reduction of the gap is 'good';
- the farmer is an inert, passive, malleable and reactive recipient of the information;
- the initiative for dissemination of information rests exclusively with the communicator - research worker or extension worker;
- increased production is the main criterion by which farm practices should be viewed;
- the information needs of the farmer are in the area of technical research results, rather than in the area of the farmer's own management or livelihood system.

Many of these assumptions have become firmly institutionalised in the extension and research professions. Almost everything is weighted towards TOT, including textbooks, curricula, teachers, trainers, professional groups, journal editors and incentives and rewards in professions and bureaucracies. Thus the traditional notion of agricultural advisory work is based on the handing out of advice by an expert to a farmer who is then expected to follow this advice to his (rarely her) own best interest. It is an entirely one-sided operation, similar to lecturing or teaching in formal education.

The Structure of Organisations

The way that organisations contributing to agricultural knowledge systems function constrains innovation and change, yet they themselves have only recently become the focus of investigation (see ISNAR, 1989; Rhoades, 1989). This is because of the increasing recognition that organisational constraints to agricultural research and development are often of major significance. Agricultural organisations, particularly in the public sector, are conservative and have been slow to adopt innovative ideas, tools and staff development activities from the rapidly developing field of management science (J. Howell pers. comm., 1990). This is in marked contrast to many private sector businesses and organisations. Universities and their agricultural faculties are often the most conservative. These

institutions are in a conceptual strait-jacket, arising largely out of the functional and practical demarcation of research and teaching, and the loss of focus on learning (Pearson and Ison, 1990).

Again components of the teaching paradigm surface, this time in the structure of organisations:

- they are frequently hierarchically organised along authoritarian rather than participatory management lines.
- management positions are often held on the basis of seniority or research abilities rather than management skills;
- eccentric, or creative, innovation is rarely tolerated;
- institutional rewards, particularly senior authorship of published papers, promotes individual, often isolated research - many institutions are lonely places, in which people sit in their office all day, rarely looking happy;
- as resource pressures increase on institutions servicing agriculture there can be a rapid decline in the critical mass needed to maintain creativity and learning - institutional memory declines as people retire, leave or move to more rewarding positions;
- organisations become introspective and resistant to new ideas, process and changing environmental circumstances;
- content - new facts - is the primary input, rather than a balance between content and development of new skills, often in the area of management, or in group work skills;
- explicit or implicit status divisions become set in stone, for example, researcher versus extensionist, natural versus social scientist;
- traditional meeting procedures frequently stifle innovation, change and creativity rather than enhancing it, and are used to achieve ends for which they are not suitable.

Flaws in New Paradigms

Academic and research institutions change slowly - but there are some signs of movement. The experience of failures has fuelled the search for new and more appropriate approaches to deal with the complexity of sustainable agriculture, and has resulted in the development of approaches such as integrated rural development, the appropriate technology movement, FSR, FSR&D, FSR&E^2, Farmer First and Last, and participatory research. Placed in a historical context these approaches will undoubtedly be seen as part of an emerging discourse, with variations provided by the cultural, historical and institutional frameworks from which they emerged. But all of these have three interrelated flaws in common:

- the conceptual innovations, the theory which is expected to derive from practice from other areas of enquiry, appear to have reached a plateau;

- much of the practice does not appear to be grounded in good theory - approaches, techniques and tools are grabbed as potential panaceas to complex, long term issues. The paradigm shift, necessary to guide successful on-going action, has frequently been ignored;
- there has been too much attention paid to the quest for certainty, solving theoretical as opposed to real problems, leading to too great a dependence on techniques, models and mathematical criteria, especially cost-benefit analysis, than on rational forms of co-operative human enquiry.

One example concerns FSR: much of the FSR work, in its conceptualisation of systems approaches, has failed to distinguish between the 'systemic' and 'systematic', such as occurred in the engineering and operations research disciplines (Checkland, 1985). These represent important paradigm differences (Table 3). And the new paradigms are only now beginning to have an impact on the way in which agricultural research and development in western countries is viewed. This means that development agriculturalists from industrialised countries are discussing and promoting institutional and structural issues only outside their countries, whilst at home, institutions remain rooted in orthodoxy (Dahlburg, 1988).

Learning Paradigms

To meet the needs of a changing, sustainable agriculture some radical rethinking about agricultural education is urgently required. Most fundamental is the need to re-establish universities as communities of learners. Academics must become involved in learning, learning about learning, facilitating the development of learners, and in exploring new ways of understanding their own and others' realities. The Carnegie Forum Task Force examining teaching as a profession in the USA has put the challenge like this: *"...students must be active learners busily engaged in the process of bringing new knowledge and ways of knowing to bear on a widening range of increasingly difficult problems. The focus of schooling must shift from teaching to learning, from the passive acquisition of facts and routines to the active application of ideas to problems"* (Carnegie Forum on Education and the Economy, 1986). With regard to the USA they added: *"We do not believe the educational system needs repairing; we believe it must be rebuilt..."*.

Rethinking Education

In rethinking education, attention must be paid to three important areas. First students must be given greater learning autonomy, so that their responsibility, leadership, innovation and creativity skills are enhanced rather than stifled. This necessitates the development of flexible, learner-centred curricula as opposed to teacher-centred curricula.

2. Farming Systems Research, FSR and Development, FSR and Extension

Table 3 The 'hard' (systematic) and 'soft' (systemic) traditions of thinking compared (Checkland, 1985)

The 'hard' systems thinking of the 1950s and 1960s	The 'soft' systems thinking for the 1980s and 1990s
PRINCIPLES	
Oriented to goal seeking	Oriented to learning
Assumes the world contains systems which can be 'engineered'	Assumes the world is problematic but can be explored by using system models
Assumes system models to be models for the world (ontologies) Talks the language of 'problem' and 'solutions'	Assumes system models to be intellectual constructs (epistemologies) Talks the language of 'issues' and 'accommodations'
ADVANTAGES	
Allows the use of powerful techniques	Is available to both problem owners and professional practitioners Keeps in touch with the human content of problem situations
DISADVANTAGES	
May need professional practitioners	Does not produce final answers
May lose touch with aspects beyond the logic of the problem situation	Accepts that enquiry is never-ending

Second, more focus must be placed on the application of concepts or knowledge to real problem situations, say industrial, developmental, environmental or organisational problems, and in working with people to reach agreement about the existence and nature of the problem. This is a problem-determined learning system - the nature of the problem and the needs of the client or clients, including the learner, determine the content. Learning is a lifelong process and learners will be well served if they first know how to learn and discover something about their own learning styles.

Third, assessment procedures must be altered to give greater responsibility and power to the students, and to encourage them to understand the real world better rather than solely how to pass examinations

Change Curricula

The most fundamental reform involves changing curricula. In recent reviews of agricultural science and sustainable agriculture, MacRae et al. (1989) and Gary Hansen (1990) have shown how agricultural universities and colleges have lost their way, and call for both

changes in curricula and the way in which people are taught. Future scientists of sustainable agriculture should possess a new pedagogical philosophy and associated techniques to be used in their training. As a result, it is necessary to "*think about things in quite a different way - for what we **do** in the world reflects what we **know** about it, and what we **know** depends on how we go about **knowing**, or in other words when thinking about change we should start by thinking about thinking*" (Bawden and Macadam, 1988). There are different processes of acquiring knowledge which are important to the issues of reform in university function and curriculum development (Table 4). Curricula must focus more on 'praxis': practice informed by critical theories and achieved through the conscious commitment to methodological enquiry, to serve the needs of a sustainable agriculture.

But one key problem still exists: despite growing experience there is no blueprint for making change. Existing models should not be transferred to new institutional contexts. Each situation will be different and will require commitment to managing the process of change - the development of learning systems. But much can be learnt from case studies, especially from the concepts employed and the management of the change process.

Table 4 Some distinctions between different traditions of knowledge and knowing which may aid curriculum development (Bawden & Macadam, 1988)

	Scientia	**Techne**	**Praxis**
Focus	Learning for Knowing	Learning for Doing	Learning for Being
Knowledge produced	Propositional	Practical	Experiential
Structure	Subject Disciplines	Crafts	Issues
Teacher's Role	Expert	Master	Facilitator
Teaching Strategies	Lectures on Theory	Practical Demonstrations	Real World Projects
Research Style	Basic (Experimental)	Applied (Developmental)	Action (Participative)
Role of Researcher	Producer of Knowledge	Producer of Solutions	Co-creator of Improvements
Research Goal	Abstract Knowledge	Workplace Solutions	Local Theory and Action for Change
Basic Philosophy	Positivism	Utilitarianism	Constructivism
Focus of Reflection	What do I now KNOW?	What can I now DO?	Who am I BECOMING?

Two Case Studies of Learning Systems

Systems Agriculture at Hawkesbury College

In the late 1970s Hawkesbury College in New South Wales, Australia reorganised to put praxis as the central focus for agricultural education. The intervening years of experience in designing and presenting experimental curricula have led to the development of a systems agriculture (Bawden et al., 1984; Macadam and Packham, 1989). The strategy to train systems agriculturalists fits within the new people-centred framework described by Reason and Rowan (1981) and Reason (1988). Five key concepts dominate curriculum development:

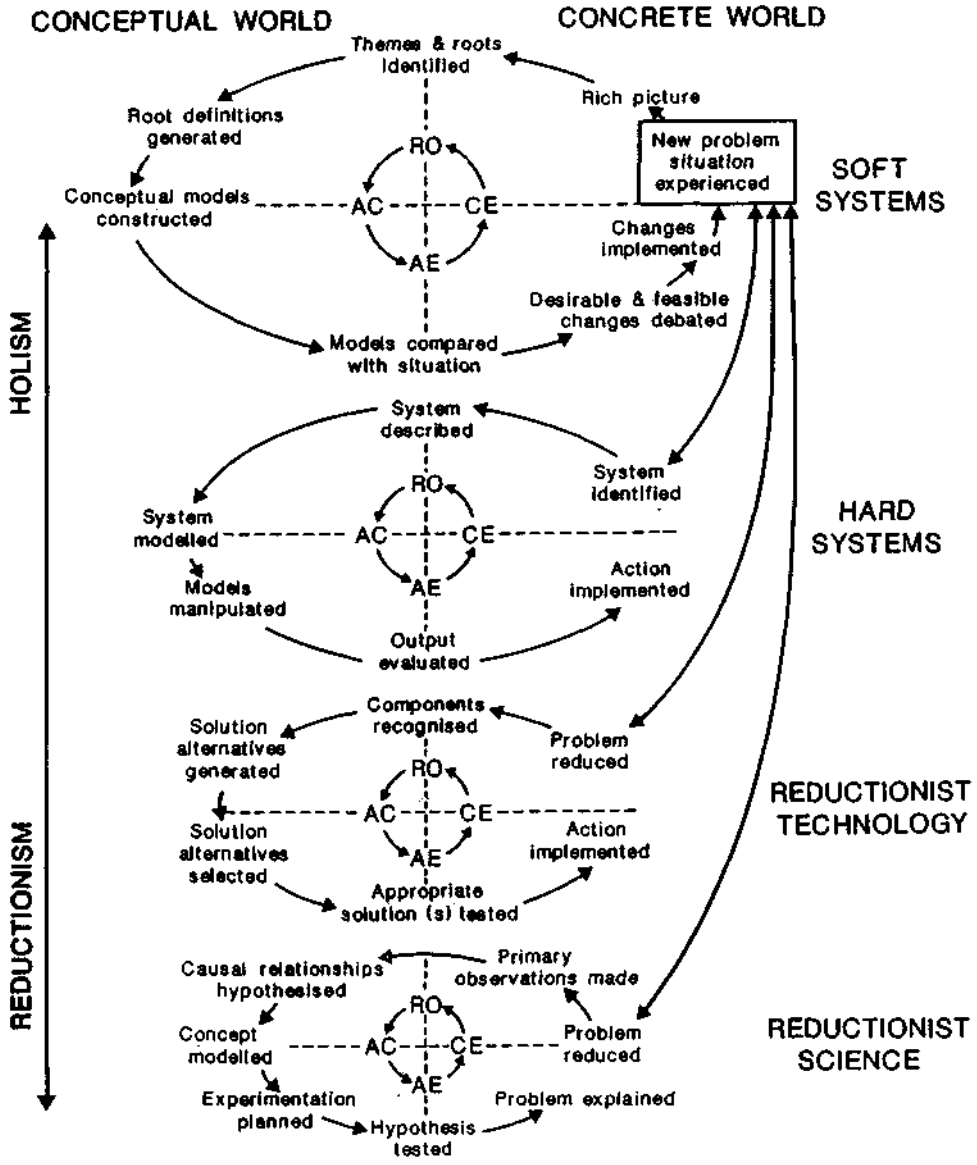
- adult learning;
- experiential learning;
- systemic and contingency approaches to problem solving;
- action research;
- scientific method and group theory.

Systems agriculture is concerned with the identification of problem situations by the participants in which the researcher acts as a facilitator of the learning process. It focusses on agriculture as a human activity system and employs one or more of the problem solving or situation improving methodologies depicted in a spiral of methods (Figure 1). The methods chosen are contingent on the nature and shared perceptions of the problem. The spiral links systemic, systematic and the powerful reductionist approaches to problem solving. Rarely, though, is reductionist experimentation the starting point in the problem solving process. The process of experiential learning, a core and central concept in the systems agriculture which has its roots in K. Lewin's (1946) concept of action research, involves a series of similar stages through which a learner may pass just as can occur in the soft, hard, and reductionist problem solving methods of the spiral.

Figure 1 depicts the relationship of learning, problem solving and research and sees them as the same process. The equation: problem solving = research = learning is thus proposed, and I would argue there is little place for extension or teaching as currently conceptualised. We need to abandon extension and the hierarchical organisational structures of which it is a part and which preserve the teaching paradigm. The learning paradigm increasingly apparent in Farmer First and Last and participatory approaches has an important place for people who view themselves as researchers in accordance with the above relationship.

Learning about the situation thus becomes the primary outcome rather than the often fruitless search for optimal solutions to poorly formulated problems. This shared learning provides a framework for subsequent action or 'situation improvement'. For example the conceptual strengths of problem formulating approaches such as Rapid Rural Appraisal

Figure 1. The 'Spiral' of problem-solving methodologies and their relationship to a common learning cycle for improving field-crop ecosystem situations; C.E., Concrete Experience; R. O., Reflective Observation; A.C., Abstract Conceptualisation; A.E., Active Experimentation. Source: adapted from Kolb (1984) and Bawden (1985).



(RRA) are their focus on learning as a primary outcome and the fact that they are inherently systematic (McCracken et al., 1988; KKU, 1987). RRA is thus a useful starting method for structuring debate in the spiral of problem solving or situation improving methods (see Ampt & Ison, 1989).

Enterprise in Higher Education in the UK

Another example may be drawn from higher education in the UK, where two hitherto opposing interest groups - the Department of Trade and Industry and those who were once termed radical educators - have recently found common ground to promote the same discourse. The ministry made available grants for 'Enterprise in Higher Education', where the main objectives are that "every person seeking a higher education qualification should be able to develop competencies and attitudes relevant to enterprise" and that "these competencies and attitudes should be acquired, at least in part, through project work, designed to be undertaken in a real economic setting and they should be jointly assessed by employers and higher education institutions". In this context enterprise means:

- encouraging students to have increased responsibility for their own learning;
- encouraging competencies in students such as flexible, transferable skills, learning how to learn rather than absorbing facts and being able to work co-operatively and constructively;
- encouraging such approaches as negotiated contracts of learning and team work as well as flexible forms of accreditation and qualification;
- encouraging a more flexible, open system of entry to higher education.

The most striking example of the learning paradigm in action, of learner-managed learning, is at the School for Independent Study, in the Polytechnic of East London, which has educational objectives very similar to those described in the Enterprise scheme (Stephenson, 1990). Yet despite their acknowledged success they have remained politically and organisationally on the fringe, even in their own Polytechnic. The introduction of Enterprise grants could change this, thus paving the way for curriculum change in the institutions which have been successful in obtaining the grants. To date, very few of these have been agricultural faculties.

Agenda for Action: Changes to Organisational Structure and Function

We should now look at organisations as if they were learning systems; agriculturalists are rarely without an organisational context whether it is a formalised institutional structure, or as members of more or less permanent organisational units such as professional associations, family units etc, or as a member of transient organisations such as a conference, workshop or consultancy team. Farms or farm households are also organisations managed for some purpose (Bawden and Ison, 1990). It is thus surprising that

there has, to date, been so little emphasis on organisations in the debate on sustainable agriculture.

MacRae et al. (1989) call for new institutional frameworks which facilitate *"working together"*. Dahlberg (1988, 1989) has recognised that conventional research approaches tend to use complicated hierarchical bureaucracies; accept existing trade, aid and institutional patterns; and accept that individual organisations are structurally neutral – that is, their scale and structure does not directly affect their capabilities or the directions of their operations.

Robert Rhoades (1989) recognises the emerging importance of the debate about institutions by his prediction that agricultural research will enter a fourth or institutional phase in the 1990's. Yet many of the institutional concerns to date, as reflected in many ISNAR[3] studies, have been within the teaching paradigm as opposed to the learning paradigm. The move to matrix management models at IRRI[4] and in the British NRI[5] may reflect movement away from the institutional teaching paradigm.

In much of the writing on participatory research and Farmer First and Last there is only minimal attention, if at all, to formal and non-formal educational processes and institutions and, as argued above, the constraints these impose.

Radical change of the type involved in the emergence of systems agriculture naturally places pressures on orthodox organisational structures and processes. The action research processes which resulted in major organisational changes to accompany the associated curriculum developments vary according to the institution (Macadam and Packham, 1989; Packham et al., 1988). But it is possible to make some generalisations regarding the conditions necessary for the achievement of sustainable change:

1 Academic leadership and those in power are both supportive of change and ensure the change process is not undermined.
2 At least a critical mass of people are dissatisfied with the existing situation.
3 Information is available about alternative systems of management and learning.
4 Relevant concepts are understood and shared, such as those relating to competence, curricula, learning/research, assessment and so on before engaging in debate on possible 'hows' of change.
5 Necessary resources are available - often overestimated in my experience with a frequent failure of those involved to differentiate between value and cost.
6 Means to define personal goals in the changing organisation - for example an active programme of staff development.
7 An organisational climate exists to facilitate development of group energy and enthusiasm by providing both challenge and support, thus providing a context in which it is safe to fail (T. Burgess, pers. comm., 1990).

3. ISNAR is the International Service for National Agricultural Research
4. IRRI is the International Rice Research Institute '
5. NRI is the National Resources Institute, formerly the Overseas Development Natural Resources Institute

Institutions which reconceptualise their organisational structures and social processes in this way to encompass a learning paradigm may avoid what Rhoades (1989) cautions about, namely that institutions and individuals may become frozen in any stage of their development, *"refusing to become open to the enriching process of interdisciplinarity"*. Change and stability are inextricably linked in any open system; the challenge for sustainable agriculture is to facilitate the emergence of new ways of knowing and behaving so as to manage change creatively. This will go some way to offset growing concerns over the co-opting of the term 'sustainable' by those with short time horizons who may be promoting stasis and the status quo rather than change and evolution.

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