18
The Process of Change to Sustainable Farming Practices

J. Park and J.D.H. Keatinge

Abstract

The sustainability of agricultural systems is under scrutiny in many parts of the world. In the European Union farming systems are increasingly subject to legislation aimed at controlling production or the environment. Against this background a wide range of research is being undertaken into new or alternative land use systems. In this paper it is argued that sustainability in effect provides parameters for this process of change. Therefore, one of the roles of researchers is to highlight the options for change available to farmers and to suggest to policy makers the likelihood and ways of improving the uptake of desirable farming practices. Examples are drawn from a variety of research being undertaken in Agricultural Systems at the University of Reading. It is concluded that a systems approach must be an integral part of progress towards increasingly sustainable farming practices and to achieve this agricultural universities must maintain a strong systems research and teaching commitment.

Introduction

Sustainability is a complex concept which is generally seen as human centred, long-term and involving interaction with natural systems. Many previous attempts have been made to define sustainability in the context of global issues (Liverman *et al.*, 1988; Brown *et al.*, 1987, O'Riordan 1985). Despite the ambiguity associated with definition there appears to be global consensus about the need for human actions to be sustainable, (Earth Summit, 1992; Bruntland report, 1987). The sustainability of agriculture is inexorably linked with processes of change and is closely associated with the dynamics of ecological and socio-economic change. However, there is concern that the farming methods used today are having a negative impact on our ability to farm and produce food in the future, reducing the options available for following generations to utilise the land for productive purposes. This does not necessarily mean that they will not be able to produce food at any given point in time, only that their options for selecting different futures at a given instant may be reduced. This suggests that whether or not a change is deemed to be increasing the degree of sustainability of a system will depend largely on the current state of the system, reducing considerably the generalisations that can be made from one site/region to another and complicating decision making processes. Decision making is complicated further because the results of research in a variety of disciplines cannot often be easily interpreted at a decision making level, and therefore cannot sufficiently inform the change process.

Sustainable Pathways

An assessment framework can be envisaged that draws on the concept of sustainability so long as criteria can be put in place to assess possible short and long-term repercussions of change. On the basis of these criteria and knowledge of the current situation questions need asking about the effects of a given change in land use on the options available for food production in the future, and whether this change is following broadly desirable dynamic pathways.

These dynamic pathways should maintain, and hopefully increase the adaptability within a given production system, maintaining a direction which can fulfil both short term needs, (i.e. be viable), and long term objectives, (i.e. be sustainable). To develop along sustainable pathways, changes in land based production need to be assessed and monitored to provide policy makers with information upon which to base their decisions. This requires research approaches which vertically integrate both physical and natural systems investigation with social and economic enquiry which identify

1. The nature of sustainable pathways
2. Mechanisms which may be used to encourage change along these pathways

Sustainable Systems Research

To aid development along these pathways requires a holistic philosophy, particularly the ability of research groups to apply a systems approach effectively. In some instances this can be difficult as it can require rapid assimilation of information and a degree of humility when "experts" are required to be consulted. It can also mean that individuals and teams must have the confidence and skills to tackle new problems and to be realistic about their likelihood of success and completion. The projects described below give some idea of the range of projects in which the Agricultural Systems section here at Reading is involved. Within the descriptions some indication of the relevance and position of the projects to the process of change to sustainable systems is given.

Mapping carbon flows in poplar-arable systems

Poplar trees are receiving increased interest from both foresters and farmers in the UK following the introduction of improved clones from Belgium. These are capable of producing a high quality log suitable for peeling at 20 to 25 years of age, or alternatively can be cut on short rotation as energy coppice. The aim of this research project is to provide a better understanding of the effects of tree/ annual crop mixtures on the distribution and flows of carbon in the agro-ecosystem which is viewed as an important component in the design of sustainable farming systems. The research described is based upon a silvoarable agro-forestry trial established in March 1988 at Wolverton, Milton Keynes in North Buckinghamshire, UK. The soil on the 4ha site is a river alluvium, clayey silt classified grade 3 which has been subject to a conventional arable rotation. Poplar trees *(P. trichocarpa x deltoides)* belonging to the clones Boelare and Beaupre are planted in rows at 14m intervals across the field. This research hopes to promote an understanding of the benefits deriving from tree/annual crop mixtures in productive agro-ecosystems an the impacts this has the adaptability of farming systems. In treating the agro-ecosystem as a structure through which carbon is distributed and

flows it is envisaged that an ecological assessment of changes in farming systems will be formulated that can be used in conjunction with more traditional economically oriented models.

Providing alternatives to continuous cereal production in the rainfed areas of Pakistan and Nepal

Continuity of the wheat-sorghum cropping sequences practised in the rainfed Pothwar plateau area of the northern Punjab presently threaten the long term sustainability of agricultural production as farmers frequently do not have the resources to maintain soil fertility with inorganic fertiliser. Additionally, they experience an acute period of feed deficit for their livestock in the winter and spring period when wheat is the principal crop being grown. Efforts to extend current cropping options for farmers include the potential introduction of vetch-barley mixtures as forage crops in substitution for a proportion of farmer's wheat crops. Evidence is being collected that the potential for this intervention being viable is substantial. It would provide farmers with additional options for improved quality and timeliness of livestock feeding and for more effective integrated fertiliser management capitalising on the beneficial residual effects of cropping sequences involving legumes.

In the mid Hills area of Nepal continuous Rice-Wheat sequences similarly severely threaten small-holder production through reduced soil fertility and through the greater vulnerability of the soil to erosion through the forced abandonment of hillslope terraces. The introduction of dual purpose food/green manure legume crops, in substitution for wheat, and the re-incorporation of all their straw after harvesting is an intervention designed to improve system sustainability. Ongoing efforts to develop better strategies for integrated fertiliser management must be beneficial to sustainability pathways in such an environment where not only poverty but also poorly developed road infrastructure largely precludes interventions based solely on inorganic fertiliser application.

The Optimisation Of Upland Perennial And Annual Intercropping Systems In Malaysia

This is a collaborative project between the Universiti Pertanian Malaysia (UPM), The University of Reading and the Rubber Research Institute of Malaysia (RRIM). The aim of the research is to explore the intercropping possibilities during the establishment of new rubber trees on smallholder farms, thus allowing them to sustain incomes during the re-establishment phase. Within this broad aim several specific research activities are being initiated: Firstly, the estimation of the variation in financial income of the farmers during rubber establishment, secondly the exploration and modelling of resource competition during the establishment phase and finally the quantification of potential soil movement and erosion under a range of crop con Figurations.

Experiments are being undertaken on both RRIM and UPM land and also on that owned by a group of smallholders. The rubber trees are planted in alleys and intercropped with a range of perennial and annual crops. Current configurations include banana, pineapple, durian and groundnuts although it is likely that these will be simplified in response to farmer’s experiences and attitudes toward the systems. Research is currently exploring mechanisms for linking soil, growth and financial models to provide a framework in which future cropping

options can be explored. In providing these examples it is hoped to demonstrate that a common thread of sustainable systems research runs through what at first sight appears to be a diverse range of projects. Although the projects work across several vertical levels, (from experiments, modelling, technology transfer and decision making and policy) a key criterion is the impact of potential change upon options available in the future.

Discussion and conclusions

The identification of, and progression along sustainable pathways relies on the monitoring of change processes. This closely relates to the notions of adaptability and flexibility within a system, challenging research across a variety of disciplines to illustrate how these system attributes can be assessed at a variety of levels. In this context it is the methods through which the information pertaining from a number of research activities is integrated and used to inform the decision making process that is of importance. However, it may be that the overall picture produced from this approach may actually complicate the decision making process.

For instance the experimental work and theoretical analysis of silvoarable agroforestry suggested that it could increase the ecological diversity, and maintain options into the future with respect to soil productivity and energy interception. However, at an operational level the farmers themselves thought these systems could actually reduce flexibility because of the longer term production cycles associated with trees, making it difficult for them to adapt sufficiently rapidly to an ever changing policy environment. This scepticism was not voiced simply because the farmers thought planning over the long-term was inherently wrong, only that the current policy regime, based on short-term economic criteria and a very volatile support framework made any long-term commitment extremely risky. This example stresses the need for an approach which can accommodate information drawn from a number of perspectives and which is capable of presenting output in a manner useful to the decision maker (whether they be a farmer or a policy maker). This requires research teams and individuals who are capable of "making linkages and building bridges". The manner in which such skills develop in younger students and researchers needs exploring. To conclude, we believe that progress along sustainable pathways requires the sound application of the systems approach. To achieve this goal it is essential that systems skills are developed by young researchers. This is less likely to happen unless we maintain the quality of both the systems research and teaching at Higher Education Institutions.

References

Brown, J.B., Hanson, M.E., Liverman, D.M. and Merideth R.W. (1987): Global Sustainability: Towards Definition. *Environmental Management*, 11(6) 713-719.

Bruntland Commission (World Commission on Environment and Development) (1987): Our Common Future. Oxford University Press, Oxford.

Earth Summit (1992): The UN conference on Environment and Development. Rio de Janeiro, 1992.

Liverman, D.M., Hanson, M.E., Brown, B.J. and Merideth, R.W. (1988): Global sustainability: Towards measurement. *Environmental management*, 12(2) 133-143.

O'Riordan, T. (1985): What does sustainability really mean? In: Sustainable development in an industrial economy, CEED Report, 1985.