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A PARTICIPATORY MODEL OF AGRICULTURAL RESEARCH AND EXTENSION: THE CASE OF VLEIS, TREES AND GRAZING SCHEMES IN THE DRY SOUTH OF ZIMBABWE

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WHY HAVE PEASANT farmers in Africa not adopted modern agricultural technology more readily? In the past the most common diagnosis was peasant ignorance or cultural conservatism. The answer then 'obviously' lay in programmes of education and extension — hence the major investments in improving extension services in the 1950s and 1960s. The oft-repeated exhortation to 'educate the farmers' can still be heard today in some quarters.

In the 1970s and 1980s a new trend of thought emerged amongst agricultural economists and development planners which proclaimed the rationality of decision-making in rural farm-households. Obstacles to improved production were seen to be mainly external constraints on decision-makers —constraints such as restricted access to resources and the need of such farm-households to minimize risk. Thus improved understanding of the nature of these constraints by agricultural research scientists and extension agents became important, so that more appropriate technologies and more adaptable extension recommendations would be passed on to the farmers. Other suggested interventions were: better prices for agricultural produce, upgraded transport and other infrastructures, the wider provision of credit, improved inputs, supply and marketing systems, and so on.

THE NEED FOR A NEW MODEL OF AGRICULTURAL RESEARCH AND EXTENSION

The results of these kinds of diagnoses and prescriptions have, however, generally been disappointing. Significant improvements in 'practice-adoption' and increases in production have generally been achieved by only a minority of resource-rich farmers. The bulk of the rural population of Africa is made up of resource-poor farmers, defined as those 'whose resources of land, water, labour and capital do not currently permit a decent and secure family livelihood' (Chambers and Ghildyal, 1985, 3), and here success has been much more elusive.

As a result, attention is being shifted to the deficiencies of the technology itself and, even more importantly, to the process by which the technology is generated. In the older models the roles of research scientist, extension agent and farmer were well defined and seen as unproblematic: researchers generated the technology, extension officers communicated it, and farmers adopted (or failed to adopt) the solutions to their problems.

In some versions of this model, such as the Training and Visit system of extension, the problems that farmers faced were communicated to research scientists by field extension staff, who also assisted in the adaptation of standard recommendations (e.g. for fertilizer application) to suit particular conditions. Farmers, however, remained essentially passive recipients of the 'medicine' prescribed for them by development experts. It is these roles that are now increasingly being brought into question, and the active participation of farmers in the whole process of technology generation is at the heart of the search for a new paradigm for agricultural research and extension.

The Transfer-of-Technology Model

One of the most influential voices in this debate is that of Chambers. Chambers and his co-authors have typified the dominant paradigm, as described briefly above, as the Transfer-of-Technology model. In their analysis the main reason why this model has not been effective with regard to resource-poor farmers is because 'technologies . . . bear the imprint of the conditions in which they are generated. They are then adoptable in similar conditions, but often not adoptable where conditions differ' (Chambers and Ghildyal, 1985, 6). Because conditions on research stations, where most agricultural research has been carried out in the past, are often similar to those on resource-rich farms, and usually very different from those on resource-poor farms, it is hardly surprising that the technology generated through this process does not meet the latter's needs. The contrasts in conditions which give rise to this phenomenon are summarized in Table I.

In the Zimbabwean context the model fits reality most closely if we equate resource-rich farmers with large-scale commercial farmers, and indeed this would have been entirely apposite before Independence. But even within the major reorientation towards communal area farmers by research and extension that has taken place since 1980 the same kinds of contrasts may be found. If we see 'resource-rich' as a relative term, then the bulk of current agricultural research programmes are still servicing farmers in the high-potential regions of the country and, within these regions, those farmers who are either users of purchased inputs or cash-crop growers.

An Alternative Model: Farmer-First-and-Last

Chambers and his colleagues have suggested an alternative model of agricultural research which entails fundamental reversals of learning and location. In their

Table I

TYPICAL CONTRASTS IN PHYSICAL, SOCIAL AND ECONOMIC CONDITIONS*

	Research stations	*Resource-rich farm*	*Resource-poor farm*
Physical conditions			
Soil	Deep, fertile	Deep, fertile	Shallow, infertile
Topography	Flat or terraced	Flat or terraced	Often undulating, sloping
Nutrient deficiency	Rare	Occasional	Common
Plot size and nature	Large, square	Large	Small, irregular
Hazards	Nil or few	Few, usually controllable	Common: floods, droughts etc.
Size of management unit	Large, contiguous	Large or medium, contiguous	Small, often fragmented
Social and economic conditions			
Access to inputs	Unlimited, reliable	High, reliable	Low, unreliable
Access to credit	Unlimited	Good access	Poor access
Prices	Irrelevant	Lower than resource-poor farmers for inputs, higher than resource-poor farmers for outputs	Higher than resource-rich farmers for inputs, lower than resource-rich farmers for outputs
Priority for food production	Neutral	Low	High

*Not all factors apply all the time, but most apply most of the time.

Source: Adapted from Chambers and Ghildyal, 1985, and Chambers and Jiggins, 1986.

Farmer-First-and-Last model one starts with the perceptions and priorities of families of resource-poor farmers rather than those of scientists. Research and learning are located on the resource-poor farm rather than on the research station and in the laboratory. Problems in need of research are identified by reference to the needs and opportunities of the farmer, and the research station has a referral and consultancy role serving the resource-poor family. Success is judged not by the rigour of research or by yields in resource-rich conditions, but by the spread of technology among the resource poor. These reversals are summarized in Table II. Thus the three major components of the Farmer-First-and-Last model are:

(i) a *distinctive diagnostic procedure*, learning from farmers;
(ii) generating technology on the farm and with the farmers; and
(iii) evaluation of technology by adoption or non-adoption.

Is this not the same as the now widespread practice of Farming Systems Research? It is clear that in a number of ways Farming Systems Research has departed from a conventional Transfer-of-Technology approach. It seeks to understand the complexity of farm-household systems, including the needs and objectives of farmers and their families, and does so by means of multi-disciplinary teams which encompass biological, social and economic dimensions. In the diagnosis phase Farming Systems Research involves consultation with farmers on their problems. Relatively homogeneous groups of farmers who are likely to encounter similar problems and opportunities are identified as 'recommendation domains'. On-farm trials are often farmer-managed, and farmers assist in the evaluation of research results.

But does this go far enough? Chambers and Jiggins (1986) consider Farming Systems Research an adaptation of the Transfer-of-Technology model rather than as a fundamental break with it. They claim that in Farming Systems Research the power of choice remains primarily with the scientists, who make the important decisions about what to try and what to do. The linear sequence of classical Transfer-of-Technology has been modified by building in feedback loops and cycles of referral and evaluation; but, 'in the absence of farmers' determination of research agendas, the process remains Transfer-of-Technology, with the scientist first and the farmer last' (Chambers and Jiggins, 1986, 19).

These views have been criticized recently by Farrington and Martin (1987), who see a need for participatory approaches which complement Farming Systems Research rather than attempt to replace it. In their view Chambers and Jiggins's misgivings relate more to the application of Farming Systems Research than to the basic concepts involved, and the extreme farmer-centric stance of Farmer-First-and-Last is unjustified: scientists and the scientific method do have an important role to play. The critical component is the partnership between researchers and farmers.

Table II

CONTRASTS IN LEARNING AND LOCATION

	Transfer-of-Technology	*Farmer-First-and-Last*
Research priorities determined by . . .	Needs, problems, perceptions and environment of scientists	Needs, problems, etc., of farmers
Crucial learning is that of . . .	Farmers from scientists	Scientists from farmers
Role of farmer:	Beneficiary	Client and professional colleague
Role of scientist:	Generator of technology	Consultant and collaborator
Location of research and development:	Research station, laboratory, glasshouse	Farmers' fields and conditions
Features of research and development determined by . . .	Scientists' needs and preferences Research station resources	Farmers' needs and preferences Farm-level resources
Non-adoption explained by . . .	Failure of farmer to learn Farm-level constraints	Failure of scientist to learn Research station constraints
Evaluation by . . .	Publications, scientists' peers	Adoption, farmers

Source: Adapted from Chambers and Ghildyal, 1985.

AGRICULTURAL RESEARCH AND FARMERS IN THE SEMI-ARID AREAS OF ZIMBABWE

In Zimbabwe two-thirds of the communal area population live in Natural Regions IV and V, both of which are characterized by low and erratic rainfall. They are recommended for extensive and semi-extensive livestock production, although drought-resistant cash crops can be grown in favourable localities. Yet communal area farmers do not own enough cattle or indeed have sufficient land to engage in commercial ranching, and hence all grow food crops for subsistence and occasional sale as well as cash crops such as cotton and sunflowers. The hazards of crop production in these semi-arid areas are emphasized when one considers the probability of a 'normal' season (one in which rainfall is adequate to sustain plant growth without adverse dry spells) occurring in these regions is of the order of 40 per cent in Natural Region V and 35 per cent in Natural Region IV (Hussein, 1987).

Since Zimbabwe attained Independence in 1980 communal area farmers, with the help of increased levels of credit and improved supplies of inputs, have begun to purchase significantly larger amounts of fertilizers and chemicals, and marketed surpluses from this sub-sector have risen dramatically. Zimbabwe has been hailed as a rare success story in respect of peasant production for the market.

However, these increases in production and sales have not occurred 'across the board' but rather reflect an increasing differentiation of the communal area population which is based both on agro-ecological differences and on inequalities in the means of production. Thus in 1983/4, 63,1 per cent of the maize marketed by communal area farmers came from Natural Regions I and II where only 15 per cent of the communal area population lives (Moyo, 1986, 189). A survey conducted in 1984 found that rural households in the drier regions are much more likely than those in the higher rainfall zones to experience food scarcity in most years, and that the great majority of households in Regions IV and V received drought-relief food in 1983 (see Table III).

Class-based differentiation is indicated by the marked differences between rural farm-households in all communal areas in respect of land holdings, livestock, availability of draught power, access to off-farm income and access to credit. It is suggested by many researchers currently investigating this issue that the increases in marketed surplus are benefiting only a minority of better-off families (Moyo, 1986; Jackson *et al.*, 1987; Adams, 1987; Weiner, 1988).

How has agricultural research and extension attempted to meet the needs of the majority of communal area farmers who live mostly in the dry south and west of Zimbabwe? For many years, of course, this was not even recognized as a problem, let alone seriously addressed. From the point of view of large-scale commercial farmers these regions have no dryland cropping potential, and hence the attention of researchers was focused mostly on beef ranching or irrigated crops such as sugar cane. Since Independence this attitude has begun to change, and the Farming Systems Research Unit within the Department of Research and Specialist Services in particular has attempted to test potential technological interventions aimed at overcoming or alleviating the powerful constraints on mixed crop–livestock farming in the semi-arid areas.

Table III

FOOD SCARCITY AND DROUGHT VULNERABILITY BY NATURAL REGION

Natural Region	*'Food is scarce in most years'*	*Received drought relief food in 1983*
	(Percentage of households)	
II	13,9	1,0
III	16,0	41,3
IV	20,4	67,4
V	57,1	87,5

Thus trials involving the traditional drought-resistant small grains (sorghum and the millets) have been initiated on both research station and on-farm sites (Farming Systems Research Unit, 1985). The Lowveld Research Station in Chiredzi has been working on techniques of water conservation and concentration, appropriate fertilizer regimes, relay cropping, variety selection and sowing dates (Jones, Nyamudza and Nyati, 1987). Attention has also been turned to research aimed at improving the productivity of communal area livestock, which have been almost completely ignored and hence almost nothing is known about them (Mombeshora, 1985).

However, few reliable recommendations have yet resulted from this research programme and it may be many years before they do. Some of the results of the Communal Area Research Trials programme have thrown researchers into confusion, with a senior scientist revealing in 1986 that there was now a need to reduce the total number of trials in order to make the programme more manageable, and also to concentrate on understanding basic soil–plant–climate interactions in the sandy soils which predominate in the Communal Lands.*

*E. Whingwiri, remarks at an Agritex Senior Officers Conference held at the University of Zimbabwe, January 1986.

In the meantime, extension field staff in the semi-arid areas have continued to promote 'packages' of improved farming practices which include hybrid seed, fertilizers, pesticides and knapsack sprayers. Indeed, in the absence of any more appropriate knowledge, what else could they be expected to do?

Research in Chirumanzu (which is in Natural Region III) has shown that the few farmers who do make a profit on crops such as maize do so by applying much less than the recommended amounts of fertilizer (Drinkwater, 1987, 21). A recent analysis of the economics of fertilizer-use on maize in Natural Regions III and IV suggests that the most economic level of application is around half of that contained in the present Agricultural Finance Corporation package on offer, and around a quarter to a half of the recommendations based on soil analysis (Whingwiri *et al.*, 1987).

A few extension officials do listen to farmers and attempt to modify standard recommendations on the basis of local experience. Dialogue at the extension agent–farmer interface has even led to innovations being developed, as in Maranda, where farmers are advised to plough twice in every second or third furrow to achieve the same effect as a ripper tine. These are the exceptions, for on the whole extension practice still reflects a 'top-down, message-oriented approach', even though many Agritex staff recognize that 'the research that has backed them until now looks neither at the generation of sustainable yield levels nor the viability of communal area production' (Drinkwater, 1987, 2). The dominant mode of agricultural research and extension is still Transfer-of-Technology, and the result is a dearth of appropriate technical recommendations for peasant farmers in the semi-arid areas of Zimbabwe.

EXPERIENCES OF FARMER PARTICIPATORY RESEARCH AND EXTENSION IN ZVISHAVANE DISTRICT

Participation is the central theme of two projects being developed in Mazvihwa Communal Land in Zvishavane District, which is located in Natural Regions IV and V. Both projects have resulted from local demands generated as a consequence of research work being carried out in the area. The Oxfam-supported community water resources project is investigating the potential of vlei utilization, and the ENDA-Zimbabwe trees project is concerned with the development of community forestry initiatives. Both projects tackle individual farm potentials (arable production on vleis; agroforestry in fields and around homes), as well as communal resource issues (vleis in grazing land; indigenous woodland development). Both involve the close interaction of research and extension activities. Neither aspect is currently addressed by government policy on dryland agriculture or forestry. It is the general contention of this article that this policy gap on crucial issues (at least as perceived by farmers) can be attributed in part to the lack of appropriate research and extension techniques that can effectively address these types of problems.

The Vlei Project

Close contact with farmers and a continuing dialogue resulting from research being carried out in Mazvihwa has highlighted vlei areas as being 'key resources' crucial to the sustainability of the dryland agropastoral system (Wilson, 1986; Scoones, 1987). However, very little is known about vlei systems, especially in the drylands. A more detailed appraisal of their functioning and potential for sustainable use is called for.

The aims of this focused appraisal have been

(i) the characterization of dryland vlei systems in terms of their potential for use and constraints to sustainable development;
(ii) the investigation of local innovations for testing; and
(iii) the identification of key issues for policy, further research, institutional development and extension.

The appraisal techniques used have been simple and rapid, aimed at encouraging a close alliance between farmer, extension worker and researcher at all stages.

Initial characterization: Historical surveys

Historical precedents are often central to highlighting development constraints and potentials. Recollections of past experience can point to local sources of knowledge of earlier technologies or management practices and institutions that may assist current development attempts. Historical surveys can also show up the shortcomings of previous policies and help to avoid the simple resurrection of former (failed) approaches. The value of a historical survey has been particularly significant in the vlei project, since nineteenth- and early twentieth-century production in the dryland hilly areas of Zimbabwe is thought to have been largely reliant on vlei land (Wilson, 1986). As a consequence a number of production techniques (e.g. ridging, intercropping) were developed and are still remembered. Historical surveys are best carried out on the basis of a selection of key informant interviews to derive a locally specific view of major changes and recollections of particular practices. Older, long-term residents, both men and women, are obviously the best source of such information.

Classification and typologies

Initial investigations require a preliminary categorization of system types. This is the initial phase of defining relevant 'recommendation domains'. These need to be flexible and iteratively redefined. In the vlei research project a number of different vlei types, differentiated according to environmental characteristics, have been recognized:

(i) Wet vleis: central marshy area; waterlogged in wet years; highly concentrated drainage; multiple catchments; sandy soils surrounding vlei.

(ii) Dry vleis: shallow sloping catchments; no year-round surface water; vegetation distinct from wet vleis; sandy soils surrounding vlei.
(iii) Red soil vleis: heavy red soil catchments; rarely waterlogged; variable catchment types.
(iv) Eroded vleis: gully erosion often stopped; normally in grazing areas.

These vlei types can be located either in grazing areas or in arable blocks. In arable area vleis there is usually a seasonal grazing component of unfarmed portions. A working typology, that needs constant revision, can be derived only from a number of visits to different areas; it is developed through direct observation and discussion with farmers. Farmers often have useful local classifications with associated terminologies that can form the basis of further elaboration.

Agro-ecosystem functioning
A focused appraisal of system functioning requires the investigation of a number of interrelated aspects which can be subsequently analysed. The context we have found most useful for this appraisal is a group workshop. The workshop is facilitated by the extension worker and researcher together, who encourage the open discussion of selected issues. In the vlei research project these have been vlei production and use, environmental determinants, intervention potential and institutional issues.

Vlei production and use: The parameters of economic sustainability: Discussion of production and use is aimed at assessing the constraints and potentials of the existing production system. An attempt is made to get a picture of the range of practices rather than a description of the ideal. A useful technique for qualitative and rapid description is the construction of a flow diagram of production activities. This can incorporate both agricultural and economic factors in the same framework and can be constructed while in the process of discussion with farmers. A flow diagram can be a useful tool in identifying problems and opportunities that may involve interactions of agronomic issues, management practices and economic factors.

Seasonality has a great impact in dryland agro-ecosystems and an appropriate way of looking at this is through the construction of a seasonal calendar. Again interactions and trade-offs (e.g. between arable and livestock use) are highlighted.

Environmental determinants and ecological sustainability: A full understanding of the production system requires an investigation of the environmental factors that underlie it. In vlei workshops we discuss in detail soil structures, hydrological patterns, vegetation ecology and the problems of environmental degradation. This is based on farmers' often very detailed local observations and impression of causality.

Institutional issues: Issues of conflict, for instance between grazing and arable use of the land or between technical development and local beliefs surrounding the sacredness of wetlands, sometimes arise (usually obliquely) in discussion. These need to be carefully investigated, and we have used interviews with selected informants to gain a better understanding of the issues before raising the question of community management of resources in open discussion.

Development potential: Innovator exchange workshops: A discussion of farmers' experiences in their own development efforts is a useful starting-point for prioritizing development options and testing/adapting farmer-designed interventions. The exchange of ideas among local innovators is a good way of encouraging the dynamics of farmer-controlled development. These discussions can serve as an entry point for 'outsider' suggestions that can be incorporated into local attempts without imposing solutions. In the vlei project the Oxfam extension worker has attempted to form farmer groups with a common interest in vlei development and it is hoped that these can be the focus for the design and testing of vlei cultivation techniques, low-cost irrigation technologies, vlei wells and ponds and fish farming systems in the future.

Sustainability analysis

A vast array of often disparate, apparently unconnected information and ideas can be generated through a single farmers' workshop. The aim, however, is to generate useful questions for research and development, and flow diagrams and seasonal calendars help to distil out the ecological and economic problems and opportunities. One example from the vlei project illustrates the results of their 'sustainability analysis'. The phenomenon of dry-season (August–September) water-rise, is central to the production success of vleis, allowing relay cropping, diversification of crops and early marketing. The key questions now become: What are the determinants of this phenomenon? What aspects of watershed management are necessary to ensure its continuation? How can late dry-season water be more fully exploited in the development of vlei production?

Defining the action/research agenda

The process of appraisal involves taking an interdisciplinary view based on farmers' perspectives and local knowledge. Hopefully what is generated is a set of useful questions for further attention, some of which will need to be addressed by different components of the administration, extension and research structure. Some examples are:

(i) Policy questions: vlei cultivation is officially discouraged for conservation reasons.

(ii) On-farm research questions: some farmer-derived technologies can be tested immediately, but other trials may need to be more structured and be either farmer- or researcher-managed.

(iii) Basic research questions: can be referred to appropriate institutions such as research stations (e.g. the causal factors in the rise of dry-season water tables).
(iv) Extension or implementation questions: practical issues of what further action needs to be taken.

The Tree Resources Project

Tree resources have been another problem area pointed to by farmers in Zvishavane District. Farmers argue that trees are needed for a wide range of uses — as firewood, timber and browse in the communal woodlands; for fruit, shade and windbreaks around homes; and for fertility inputs and fencing in arable lands. This calls for a multispecies approach to rural afforestation. In dry areas trees adapted to the local environment can help to meet this need. People in different areas point to different problems. For some, firewood or poles may be in critical shortage; others want to increase trees in fields or to establish fruit trees around homes. The resource problems require a locally focused planning approach and an adaptive strategy of extension using a variety of tree species. Current policy which essentially offers just the gum tree/woodlot package has failed to consult farmers in the dryland areas about their priorities.

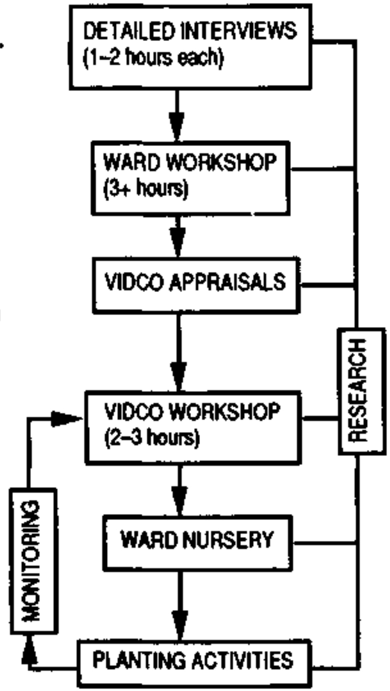
The trees project is evolving a local planning approach to extension that is aimed at providing locally-appropriate community forestry options. The techniques used are basically the same as those used in the vlei project described earlier: a combination of group and individual interactions between extension worker, researcher and local communities that are aimed at encouraging participatory planning and involvement in natural resource development.

An outline of the procedure being followed is given in Figure 1. It is managed by a locally resident extension worker and is closely supported by a small research effort. In contrast to the vlei project which has been focused on problem and opportunity identification, the trees project is implementation oriented. This leads to different requirements. Discussion workshops, especially when held at ward level when the project is being introduced, are preferably large groups since the project is aimed at whole community involvement at the outset rather than at encouraging participation of a representative sample in the research and design process.

However, there is still a need for focused appraisal, concentrating on particular 'user groups' (e.g. women and the firewood question) and a continuing requirement for a research input to study the historical context, to investigate local suggestions and monitor progress. The extension worker does much of this investigation in the course of extension activities, but is supported by the project co-ordinator.

The project aims to assist tree planting in fields and around homes, but also aims to encourage planting and community management initiatives in the

Figure 1: **PROCEDURES IN THE TREE RESOURCES PROJECT**



	Procedure	Aims
Key informants: elders, political officials, chiefs	DETAILED INTERVIEWS (1–2 hours each)	Historical survey: context for problem in area
Open meeting for all in community; attendance 50–80 people	WARD WORKSHOP (3+ hours)	Definition of key issues and local priorities; discussion of problems; introduction of project
Interviews with local informants; rapid assessments of environmental situation (maps, tree lists, etc.)	VIDCO APPRAISALS	Appraisal of VIDCO-level problems, local management practices. Noting of key areas for reafforestation
VIDCO members, including committee, village heads; 30–40 people	VIDCO WORKSHOP (2–3 hours)	Planning planting activities; lists of trees needed; discussion of rules for woodland management
Local nursery run by group, school or individual	WARD NURSERY	Provision of trees to VIDCOs in line with requirements
VIDCO-organized planting	PLANTING ACTIVITIES	Community planting activities

communal indigenous woodlands. The Village Development Committee (VIDCO) structure is proving a more or less appropriate scale for community planning of tree resources. The pilot project has completed the local planning phase in Mototi Ward, Mazvihwa Communal Land.

This has revealed an immense diversity of extension needs. This is not only determined by differences in the local environment (e.g. hilly, sandy soil areas vs. heavy soil plains), but also by differences in management abilities and locally-specific requirements. For instance, among the six VIDCOs, two have planned for indigenous tree planting in the communal grazing area, one needs a gum tree woodlot for a local pole shortage, one was particularly concerned about woodland management and needed to resolve a conflict between neighbouring communities over the use of trees within the grazing area, and all wanted a mix of indigenous and exotic fruit trees for planting around homes.

This diversity reflects a very real patchiness in natural resource situations and highlights the necessity of a localized planning and management approach. This allows communities to become involved in their own resource issues and empowers them to act upon perceived problems.

Methodological Issues

Indigenous technical knowledge

The use of local knowledge can be an invaluable tool in designing focused research agendas, suggesting appropriate technological interactions and adapting extension messages. The important advantages of indigenous technical knowledge, as experienced in the Zvishavane project, should be reiterated:

(i) The identification of problems. Farmers necessarily have a holistic view of the farming system, unconstrained by disciplinary training, which enables the identification of key problems and opportunities often not apparent from a commodity-based or single-enterprise perspective. The identification of the vlei resources potential for arable and livestock production is an example.

(ii) Detailed baseline observation. Farmers are often skilled observers and can contribute an immense amount to the basic understanding of agro-ecosystem functioning. Detailed observation, often within an extended time-frame, allows a qualitative insight for further investigation that is often ignored.

(iii) Classification. Local classifications or typologies are essential to make the subsequent appraisal workable and locally applicable. Classifications derived from indigenous perceptions are generally very effective (Howe and Chambers, 1979).

(iv) Historical/local context. The value of gaining a local and time-based perspective to appraisals for development has been repeatedly stressed above. The only source of this contextual information is local knowledge.

(v) Rapid assessment. With limited resources available for exhaustive research on every facet of the problem, techniques that are rapid and cost-efficient, as well as cost-effective, are necessary. The research for the vlei project appraisal has been carried out at a number of 3–4-hour workshops and during a series of in-depth interviews lasting 1–2 hours. The cost has been minimal as these workshops and interviews have fitted into the ongoing programme of research and extension work in the area.

(vi) Farmer involvement. Farmer participatory research should not simply extract information and co-opt farmers in the research process; they should be fully involved. The revelation that their own knowledge and experience is valuable and that they can be part of the determination of local development is an important aspect. This has been a central aim of the vlei project.

There are limits, of course, to the role of indigenous technical knowledge. Local knowledge is rarely as effective in defining causality as reductionist scientific investigation. For instance, the explanation for the dry-season water rise has been variously described as the result of 'boiling underground water like a kettle', the power of benevolent ancestral spirits, and the release of water from mysterious underground caves.

Group Workshops

The vlei project has used group workshops for much of its investigation. These have a number of benefits, problems and requirements. Workshop discussions, if well facilitated, can generate dynamic and open discussions. An unstructured format is essential, as a comment from one person can spark off a train of discussion from others.

Workshops are a good place for eliciting insights on technical issues or exchanging views on appropriate technologies. For politically sensitive or secret matters a less public encounter is desirable. Similarly, for issues where there is a diversity of situations — especially socio-economic or gender based — a selected 'focus' group is preferable. Open group workshops are sometimes dominated by 'better' (usually richer) farmers or political officials — always men.

This can be overcome to some extent by successful facilitation and arrangement of the workshop. It is essential to avoid letting an appraisal workshop coincide with a political meeting or a standard extension worker's meeting. The informal, participatory and unconstrained atmosphere of the research workshop is vital to its success.

With the right atmosphere, workshops are a fruitful place for the successful interaction of researchers, extension workers and farmers. Researchers are forced to address development issues and farmers' priorities, extension workers are required to be responsive and investigative, and farmers are allowed a voice.

Grazing Schemes and Participatory Research

The Communal Lands are generally viewed as being both overstocked and overgrazed. The consequences are said to be low levels of productivity and a serious threat of irreversible degradation. The two most commonly suggested solutions are (a) a restriction of stock numbers to within the carrying capacity of the veld, and (b) improved grazing management by means of fenced paddocks (i.e. 'grazing schemes').

These are not new ideas: in one form or another they have informed state interventions in peasant land-use systems since the 1930s, when Alvord introduced the notion of 'centralization'. An examination of the history of these interventions reveals that virtually all of them failed in their objectives, in some cases (e.g. the Native Land Husbandry Act of 1951) because they generated widespread political opposition. Coercive state action to enforce compulsory destocking has always been resisted, either covertly, with farmers 'hiding' their animals in various ways, or in the form of support for guerrillas promising an end to state interference in peasant agriculture (Beinart, 1984; Ranger, 1985).

In the early 1970s, however, the promotion of Short Duration Grazing schemes proved more successful, particularly in Masvingo Province. No mention was made by extension staff of destocking measures, and instead the benefits to veld and cattle were emphasized. A much greater effort was also made to involve community leadership in the delineation of resource boundaries and in the active management of these schemes (Froude, 1974; Danckwerts, n.d.)

Since Independence grazing schemes have again been promoted and a number of pre-Independence schemes have been resuscitated. A survey in December 1986 revealed 50 schemes which claimed to be operating and a further 56 at the planning stage (Cousins, 1987). Voluntary adoption and community mobilization have been strongly emphasized by Agritex. Recently the National Conservation Strategy has reiterated the need for 'planning [which] will involve the active participation and commitment of the local communities and not be imposed upon them' (Zimbabwe, 1987, 23).

On the other hand, government policy has continued to pull strongly in the direction of 'adjusting stocking rates to within carrying capacity' (Zimbabwe, 1987, 25) and 'destocking where necessary' (Zimbabwe, 1986, 27). These two objectives — popular participation in land-use planning on the one hand, and reduction in stock numbers on the other — sit very uneasily together. The overwhelming evidence from research carried out by the Farming System Research Unit and others is that 30–40 per cent of households in the communal areas own no cattle at all, and that the majority of households have insufficient access to draught power (Zimbabwe, 1984; Farming System Research Unit, 1985). Lack of adequate draught power constitutes a major bottleneck in crop production, and so most people have a strong need to increase rather than decrease their herds (Shumba, 1984; Cliffe, 1986).

This is a complex issue and clearly not amenable to simple solutions. Part of the answer undoubtedly lies in policy shifts which would allow a much more substantial resettlement programme, more 'Model D' resettlement schemes, and the granting of permission to communal area farmers to purchase adjoining farms or ranches. All of these would address the problem by increasing the grazing area available to hard-pressed communities, and are currently the subjects of discussion within rural communities themselves.

Institutional development which allows for the effective management of common property resources also needs to be encouraged, and those communities which are already operating grazing schemes are an important source of learning about what is likely to work. In the Tagarika scheme in Mwenezi District, for example, the community has begun to discuss the principle of allocating equal shares of grazing rights, with redistribution effected by means of traditional mechanisms of lending out cattle (*kuronzera*).

But there are also technical issues to be addressed, in particular, the thorny question of stocking rates and carrying capacity, and again a participatory approach to research and extension may assist in the development of sustainable solutions to this pressing problem.

It has become clear over the last few years that terms such as 'carrying capacity' are not as unproblematic as they were once thought to be. An intense debate as to the precise definition and application of such concepts is now under way, with at least three different viewpoints being expressed: the conventional wisdom of mainstream veld and pasture science, the dissenting voice of Sandford and others, and the provocative stance adopted by Savory and advocates of Holistic Resource Management (see Cousins, 1987, for an extended summary of these positions).

These debates have been prompted by contradictory sets of evidence: on the one hand, the vegetation of the communal areas is undoubtedly very heavily utilized by livestock, and in some areas the soil is very poorly covered. In these situations serious soil erosion is probably occurring, although we have little in the way of direct measurements of the extent of permanent soil loss (Van den Wall Bake, 1986).

On the other land, although concern over stocking rates and environmental degradation in communal areas was first expressed in the 1920s, livestock numbers have continued to increase and are today probably well over the three million mark. Most Communal Lands are carrying numbers of animals which are at least twice those recommended using conventional ,estimates of carrying capacity. But many cattle, particularly in the higher rainfall regions, can be observed to be in excellent condition right at the end of the dry season, and after a drought year. As Sandford has commented:

> When actual stocking rates . . . are far in excess of carrying capacities for long periods of time then one should ask whether this apparent prolonged defiance of the Laws of Nature may not have been due to an initial underestimate of the true carrying capacity (Sandford, 1982, 57).

Sandford recommended basic research on the relationship between stocking rates, primary productivity and soil erosion, and applied research on optimum stocking rates related to the needs of peasant farmers. Unfortunately this recommendation was not acted upon, and valuable time has been lost. Tensions between the central state and local communities on the issue of land-use and settlement patterns are emerging again as the result of the pilot villagization programme, and the National Conservation Strategy announces that Agritex will undertake land-use planning in all VIDCOs within seven years. To avoid a damaging confrontation on stocking rates we urgently need to have a much better idea of the true ecological carrying capacity of communal area grazing land.

Grazing schemes, as currently designed, are a technological intervention based on an ecological model which is increasingly in question. The assumption has been that if Short Duration Grazing works on large-scale commercial ranches then it must surely be appropriate for communal areas as well — in short, a prime example of the Transfer-of-Technology paradigm.

The community-based research being carried out in Mazvihwa has begun to address both the underlying issue of ecological carrying capacity and the question of appropriate management strategies for improved and sustainable livestock production. Again, the methods have been participatory in character and similar to those used in the vlei and tree projects. Since this aspect of the research is still in an embryonic phase, it will be only briefly summarized.

From interviews with individual farmers, group discussions of the kind described above, and also from direct observations of farmers' practices and livestock behaviour, some of the properties of the dryland farming system have been identified. Two types of savannah ecosystem may be distinguished: a dystrophic type, characterized by granitic sands, in which soil nutrients constitute the major constraint, and a eutrophic type, in which soils are either clays or loams and the major constraint is soil water. These correspond broadly to the local classifications of soil types and vegetation known as *mucheche* and *chiwomvo*

Also important are riverine areas, vleis, drainage lines, and all alluvial soils. These form only a small proportion of the total land area, but together with browse are crucial to the survival of livestock at the end of the dry season. They are also important for crop production, as discussed above. They thus constitute 'key resources' in an essentially heterogeneous agro-ecosystem.

In this environment a common method of coping with drought is to move livestock from the eutrophic areas to the dystrophic, which often involves lending animals for a period of time to individuals in neighbouring communities. Mobility is a strategy that reflects spatial as well as temporal variability of forage production.

Taken together, these insights into how the existing farming system functions suggest an alternative strategy for the management of forage resources. Instead of the costly fencing of large areas of poor quality land into paddocks, for the purposes of operating a conventional rotational grazing system, it may be more useful to concentrate on community regulation of access to the 'key resources'.

For example, portions of the grazed vleis could perhaps be fenced off and reserved for selected draught or milking animals, particularly towards the end of the dry season. In general the heterogeneity of the environment needs to be recognized, and flexible, adaptive management strategies need to be devised to make optimum use of it.

Most importantly, however, to develop workable strategies the farmers themselves would have to be involved in the planning process, contributing their own knowledge of the local environment and suggesting possible avenues for further investigation and trials. The Transfer-of-Technology model, from which present-day grazing schemes seem largely to derive, needs replacing with an approach which involves research, extension and resource planning in a dynamic adaptive and learning process.

CONCLUSION

In effecting a marriage of extension and research in a participatory framework the analytical techniques and adaptive extension procedures used by the vlei and tree projects may prove useful. A participatory approach necessarily acts in a complementary way to existing strategies. It is not intended to replace mainstream research and extension efforts, but to assist in their effective operation through existing institutional structures. The failures of the Transfer-of-Technology and package model, especially in the dryland areas of Zimbabwe, suggest that the time is right to try an alternative approach.

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