THE UTILITY OF THE NIGERIAN PEASANT FARMER'S KNOWLEDGE IN THE MONITORING OF AGRICULTURAL RESOURCES

by David Barker[1]
Julius Ogüntoyinbo[2]
Paul Richards[3]

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Present addresses:
[1] Geography Department, Bedford College, London
[2] Geography Department, University of Ibadan, Nigeria
[3] Geography Department, School of Oriental and African Studies, London

PREFACE

Environmental problems which occur on a regional or global scale may not always be appropriately monitored by the existing types of regional or global networks. This is particularly true in the field of biological resource management where a widespread problem may simply be made up of the same local-scale phenomena consistently repeated over large areas of the earth's surface. In such cases, the monitoring network must be flexible enough to detect swiftly any indication of potentially adverse change occurring locally with sufficient frequency to alert those responsible to the possible appearance of a widespread trend. Such a system must therefore be based on an efficient information-exchange, finely-tuned at the grass-roots.

Although not without its difficulties, there are many advantages in building such a system around those most affected by the impacts of the problem.

In this context, the present exploratory survey of the utility of the Nigerian peasant farmer's knowledge for agricultural resource monitoring is rather informative.

It will come as no surprise to those agricultural scientists who have worked in West Africa that the Nigerian peasant farmer is capable of observing his environment with care and precision. With local technical back-up in short supply, he must be able to make important farming decisions based on observations of subtle changes in weather, soils, vegetation and pests. Moreover, the farmer is in regular contact with agricultural extension services and these could provide the focal points for a sensitive resource-monitoring information-exchange system.

The Report indicates that a lot more work is needed in validating the quality of the farmer's knowledge. However, the environmental problems in West Africa are so important and pressing that it would be foolish to ignore the opportunity of involving the farming community, through a structured approach, in long-term programmes for the management of their own valuable resources.

Gordon T. Goodman
Director

1.0 Introduction

1.1 Problem Reporting by Peasant Farmers

Peasant farmers in the Third World often manage their farms with a high degree of efficiency and exercise great skill in agricultural decision making. In regions where productivity is low and the margin of safety for survival small, decision making has to be more than usually subtle. Since environmental management must be effective in proportion to the amount of information available, it is not surprising that peasant farmers observe their immediate physical environment with great care. Scientists have frequently remarked on the extent of the ordinary farmer's knowledge of soils, vegetation, pests and climate. It is appropriate to ask, therefore, whether this knowledge might be successfully incorporated within the framework of an environmental monitoring system* and whether the peasant farmer might be trained and encouraged to make systematic observations of ecological phenomena on a continuing basis.

The approach suggested in this report is based on the idea of problem reporting. Farmers already discuss ecological and environmental problems with extension workers† Given formal procedures for sampling, data collection and quality control, problem reporting could form the basis of an effective low-cost agricultural resource monitoring system. Later developments might encompass the setting up of a network of farmers trained to make specific measurements and the establishment of community environmental education and management projects of a self-help kind.

The first advantage of this approach to monitoring — cf. results cited below — is that farmers immediately see the relevance of the exercise and give it their active support. Secondly, it is something which would fit into the existing pattern of rural extension services without too much upheaval. A short questionnaire on farm problems is a useful lead-in to the provision of agricultural advice, for example. The major difficulty likely to arise with monitoring based on problem reporting is that observation and evaluation are inevitably inter-

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*The word "monitoring" is used in this report in the sense of an annual inventory of environmental conditions as perceived by the peasant farmer although, as mentioned in the final section, the idea could be extended to include half-yearly, quarterly or even daily reporting.

†See section 2.2.3. for a description of the role of extension workers.

twined, sometimes inextricably so. In one way this is not a bad thing. The spatial distribution of phenomena such as pests and weeds and soil erosion is often not known in any great detail and the significance of these phenomena depends very much on the particular set of economic conditions prevailing locally. Furthermore, the importance of a deleterious environmental process may be underestimated in national planning exercises due to the fact that its impact is felt within the subsistence sector for which there are far fewer adequate statistics than for the cash crop sector. It is valuable, therefore, to have a nationally recruited sample picture of problems as seen and ranked by farmers at the village level, to set against the picture of ecological management priorities derived from more orthodox approaches to environmental planning. But, having said this, a principal objective of monitoring must be to anticipate future environmental problems. Is the farmer's knowledge likely to be of use whenever evidence of medium- and long-term environmental degradation is being sought? Provisionally, the answer would appear to be "yes". Sometimes — as in the case of the 1969–74 Sahel drought — a problem may become apparent at the village level several months or even years before it reaches the proportions of a national disaster; in such cases, a synthesis of the problems reported by farmers over an extensive region would be one way of spotting a deteriorating situation well in advance. In other cases, however, it would be desirable to record observations from farmers long before the process in question had assumed the status of even a local problem. The farmer's approach to knowledge is utilitarian and disinterested observation for observation's sake is a luxury not often affordable. This does not mean, however, that new situations go unnoticed, for experience teaches that such situations are either potential threats or are potentially exploitable. With a certain amount of training, it may prove possible to collect "observational" data of merit from farmers as well as reports of problems, which by their nature have a built-in element of evaluation.

In our view, the case for involving the peasant farmer in the monitoring process requires two distinct kinds of investigation. First, it is necessary to show that appropriate knowledge and skills are present within peasant communities, *i.e.*, that "village science"* is

*A number of not altogether satisfactory terms have been coined to cover the phenomenon in question. "People's science" has a rather more specific meaning than is intended at this juncture, while "ethno-science", "ethno-botany",

sufficiently rich to supply a monitoring programme with worthwhile information. Secondly, as a means of "quality control", some attempt must be made to relate this local knowledge to knowledge derived from more orthodox scientific sources.

The present report focuses on the first of these two issues. It attempts to investigate the scope, content and structure of farmers' knowledge concerning local environments. How, for example, are problems like drought, pests, weeds and soil erosion accounted for? How accurate is this knowledge, how is it acquired and handed on and to what extent is the distribution of useful knowledge within peasant societies correlated with variations in material and social status? Not all these questions have been answered in sufficient detail but we believe enough progress is apparent to justify further specific and comparative investigations.

The second issue — meshing together the informal discoveries of the farmer with the formal investigations of organized science for monitoring purposes — requires the setting up and evaluation of specific experimental projects. This stage has not yet been reached. The report concludes, however, with an attempt to delineate the necessary kinds of pilot studies.

1.2 Environmental knowledge and discovery in rural Nigeria — two case studies

The nature and quality of the peasant farmer's environmental knowledge is assessed through the medium of two Nigerian case studies. The first is an analysis of peasant response to a general set of questions relating to farming problems, farm management practices and agricultural innovations in the Ikale area of Okitipupa Division of Ondo State (formerly part of Western State). The second looks in greater detail at a particular problem identified in the first survey, namely, the crop damage caused by the grasshopper *Zonocerus variegatus*. An attempt is made to assess the extent of farmers' knowledge of the insect and the factors behind recent explosive insect population increases. Data have been drawn upon from surveys in three separate areas: Ikale, the Kabba region of Kwara State and Alayi in Eastern Nigeria (Imo State) (Figure 1). *Z. variegatus* has become a major pest in recent

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"folk-medicine", "folk-ecology" carry undesirable "us-and-them" connotations. We propose "village science", intending it to refer to the scale rather than the quality of knowledge and investigation involved.

years in these parts of Nigeria and the survey results give some indication of the peasant farmer's ability to cope with a new problem and to assess its environmental impact.

2.0 A case study of Ikale farmers in Western Nigeria

2.1 Background to the study

A sample of 192 farmers from five villages in Okitipupa Division, Ondo State (Figures 1 and 2) were interviewed over the period July-September, 1971. The villages all belong to a group of Yoruba-speaking people known as the Ikale.

The geographical characteristics of the villages (Figure 2) are briefly described below:

Settlement A, Iju Odo	High population density (*c.* 160 persons per km^2). Soils derived from sedimentary rocks, oil-palm bush vegetation derived from original mature secondary forest. Cassava-yam crop complex.
Settlement B, Bolorunduro	Low population density (<50 persons per km^2). Soils derived from Basement Complex igneous rocks, elements of mature secondary forest remaining. Cocoa cultivation important.
Settlement C, Ode Aye	High population density (*c.* 180 persons per km^2). Soils and vegetation transitional between types associated with settlements A and B. Yam and cassava are main crops but cocoa is an important subsidiary crop. Some low-lying and floodable land.
Settlement D, Irele (and outlying farm camps.)	Low population density (*c.* 50 persons per km^2). Soils derived from sedimentary rocks, much mature forest remaining. Yam and cassava dominant.

Settlement E, Erinje	High population density (*c.* 180 persons per km²). Swamp forest area, some remnants of which still survive. Soils derived from recent alluvial materials and of low fertility. Farming economy oriented to cassava production.

The interviews pertaining to this study were conducted in Ikale Yoruba by a skilled Ikale research assistant as part of a much larger questionnaire. The questions were asked in Ikale and the responses were translated into English on the questionnaire schedules. The larger study examined farm management practices and responses to agricultural innovations. The questions of relevance to this report were:

(i) what, if any, problems were cultivators facing on their farms?
(ii) whether they could explain the causes of these problems, when the various difficulties had commenced and whether conditions were getting worse or better?
(iii) what were their sources of advice concerning farm problems;
(iv) what changes, if any, they might make on their farms next season?
(v) what reasons they had for making these changes?

Out of 192 farmers approached, a total of 181 answered these questions, which is an encouragingly high response rate. Although the questions were part of a larger study, it was this part of the questionnaire that raised most interest as far as the interviewees were concerned. The information on farming problems was recorded in the form of sets of single sentence statements, in English, specifying the nature of each problem in turn. Recording statements in translation, though practical from the point of view of subsequent processing, was unfortunate in another sense since there is now reason to believe that the structure of the grammar of the original Yoruba used to report problems might have contained valuable information. Any future work would have to be much more sophisticated from a linguistic point of view.

The data used in this particular study had to be extracted from a much larger pre-coded data set. Copies of the questionnare, data list-

ing, coding book and the suite of sorting programmes written in Fortran, are available on request.

The current analysis proceeds by examining the response to each of the questions posed to farmers (see above) and then summarizes the conclusions. The questions aimed to probe successively more deeply into the farmer's conceptualization of his problems to try to elucidate the structure of environmental and ecological relationships as seen by the individual. It is, however, not easy to relate these cognitive structures to scientific assessments of the appropriate problems. This is to a large extent a feature common to most perception studies. An attempt to establish objective baseline criteria has been made where possible, but the difficulty is compounded by the fact that several of the problems reported on have had little or no attention from the scientific community. Further work needs to be done on this important methodological issue if farmers' reports are to be successfully utilized in monitoring contexts. A structural approach whereby individual statements are interpreted against the background of a comprehensive model of environmental cognitions would be one possibility. Alternative or complementary strategies would be to establish "ground-truth" controls by independent survey means or to establish measurement standards which farmers could be trained to implement to ensure the general comparability of reports and data originating from diverse and highly specific sources.

2.2 Results of the analysis

2.2.1 *A brief description of the problems reported by Ikale farmers*

The distribution of farmers reporting zero, one, two, etc. problems is shown below. The total number of farmers was 181.

No. of problems reported by a farmer	0	1	2	3	4	5	6	7	8	9	10	11	12
Frequency	11	22	39	52	34	19	7	6	1	0	1	0	1

Thus 11 farmers had no problems worth mentioning while at the other extreme one farmer had as many as 12 distinct difficulties. The average number of problems per farmer was 3.3, although it should be noted that the distribution is positively skewed.

Many farmers mentioned the same problems. In fact, some 308 of the 601 entries (*i.e.,* about 51 per cent) focused on six major problems. On the other hand, 40 problems were unique, *i.e.,* reported by only one farmer. Altogether, from the 601 responses, over 80 separate problems were identified, the great majority of which were ecological in nature.

It was found useful to characterize the information contained in the single sentence responses by a threefold division, as nearly all problems appeared to have a similar structural form. The answers were almost always expressed in the form of an agent, an operation (verb) and an object (or affectee). An example of this threefold division would be the response *"paàpáa* attacking cassava". Here, *paàpáa* (*i.e.,* the grasshopper *Z. variegatus*) is the agent, "attacking" is the operation and "cassava" the object. In the majority of cases, agents were pests, the objects were crops and the operation was what the farmer described the pest as doing to the crops.

The sentence elements were segregated, then reconstructed as three tables. These tables show the joint frequencies of each problem agent and problem object, each agent and problem verb, and each object and verb. The joint frequencies thus represent the total number of times each particular pair was mentioned together in stating a problem. Since many of these pairs were "absent" and others had very low frequencies, only a section of the data is show here. Thus Table 1 illustrates the joint frequencies of the most important agents and objects. Note that because the joint frequencies of agents and objects are, *a priori*, related syntactically (since they are derived from the same reported problem statement), it is not appropriate to calculate any degree of statistical relationship between pairs of objects and agents.

Z. variegatus and yam are the most frequently reported problem agents and crop objects, respectively, despite the fact that the likelihood of their coincidence as a single problem is small. Table 2 supplements Table 1 and shows, for the most commonly cited agents, objects and verbs, the frequency of each expressed as a percentage of the total number of problems. Again, yam is referred to in 45 per cent of all problems reported, while about 25 per cent of all problems specifically identify *Z. variegatus* as a pest.

Table 1, Farming problems: frequency of citation of selected agents and objects

Agents	Objects				
	Yam	Cas-sava	Cocoa	Melon	Maize
Zonocerus variegatus (grasshopper)	9	64		43	19
Insects in general	98	4	11		3
Loranthus spp. (African mistletoe: a yam parasite)	49				
Ground squirrel	16		16	4	10
Termites	34		7		1
General economic problems		1			
Yam cricket	24				
Millipedes	8	12		1	
Weeds					1
Cane rat (grasscutter)	2	18			
Lizards and other large animals				1	6
Drought			1	1	

Table 2, The number of citations of agents, objects and verbs as a percentage of the total number of problem responses

Agents	Percentage
Z. Variegatus	24.6
Insects and pests in general	22.9
Loranthus spp.	8.2
Ground squirrel	7.5
Termites	6.7
General economic problems	4.2
Yam cricket	4.0
Millipedes	3.5
Weeds	3.5
Cane rat	3.0
Lizards and large animals	2.3
Drought	2.2
Other environmental factors	1.3
Unclassified	6.1
Total	100

Objects	Percentage
Yam	44.5
Cassava	17.4
Cocoa	8.4
Melon	8.3
Maize	6.8
Other crops	3.8
Unclassified	10.8
Total	100

Verbs	Percentage
Destroys	26.0
Attacks	23.0
Eats	21.0
Uproots	3.0
Lack of	3.0
Failed	2.0
Unclassified	22.0
Total	100

The frequency of verbs occurring in problem statements is also listed in Table 2. Interestingly, the most frequently used verbs are "destroys," "attacks," and "eats," and all appear in the research assistant's translation in an active mood. This suggests that the farmer sees himself in active competition with animals and insects for his food, although it would be essential to examine the syntax of the original Yoruba replies in order to take this hypothesis much further.

Tables 3 and 4 present data on land-use changes in the sample villages. Table 3 indicates a shift away from yam to cassava cultivation between 1966 and 1971. During this period there was a net increase in both crops but the number of farmers increasing their cassava planting was the larger while, conversely, the number decreasing their yam planting was the greater. Table 4 shows the three most important crops in each settlement. Clearly cassava is more important than yam, which usually occupies second place. This

Table 3, Ikale farms on which crop growing areas changed, 1966-70

	Overall	Cassava	Yam
Increased	84	94	80
Decreased	64	55	68
Same	44	28	27
Total	192	177	175

Table 4, Crops sold in order of importance as reported by farmers

	Cassava	Yam	Plantain	Maize	Cocoa	Others
1st	106	20	1	0	10	2
2nd	23	57	7	4	1	10
3rd	4	5	18	17	4	21

raises the interesting question of whether yam is less likely to be grown in the future because of an anticipated persistence of its problems, or whether the extent of farmers' concern for yam arises from its traditional central importance in the subsistence economy.

Table 5, in contrast to Table 2, shows the percentage of respondents

Table 5, Percentage of all farmers who cite particular agents for selected objects

Object	Agent	Percentage
Yam	Insects and pests in general	54
	*Loranthus spp.**	27
	Termites	17
	Yam cricket	13
	Ground squirrel	9
Cassava	*Z. variegatus*	37
	Cane rat	8
	Millipedes	7
Cocoa	Ground squirrel	8
	Foliage drying out	5
Melon	*Z. variegatus*	24
Maize	*Z. variegatus*	10
	Ground squirrel	6

Note: Total percentages exceed 100 per cent because some farmers cited several objects or agents.
*African mistletoe — a yam parasite.

who cite particular agents and crops. Notice that when the data are described in this way another dimension of the concern for yam is revealed. Fifty-four per cent of all farmers cite insects and pests attacking yam and 27 per cent complain about the problem of yam parasitized by African mistletoe *(Loranthus spp.)*. Thirty-seven per cent of all farmers report *Z. variegatus* as attacking cassava, and 24 per cent and 10 per cent complain of its effects on melon and maize, respectively.

In general, 64 per cent of all problems were concerned with some type of insect whilst only 13 per cent related to larger animals, the most important single species being the giant ground squirrel (*Xerus erythropus*). Economic problems such as poor roads, low prices and inadequate marketing facilities did not appear to rate very highly, accounting for only 4 per cent of responses. Similarly, weeds were reported in less than 4 per cent of cases.

The problem agents were disaggregated by village to look for any marked spatial variability. The relevant information is summarized in Table 6, which shows the frequency of the most important agents in each village as a percentage of each village's total number of problems. Settlement B, Bolorunduro, reported fewer instances of *Z. variegatus*, and *Loranthus spp.* problems were less prominent than elsewhere. Bolorunduro is a recently settled village with no land shortage. The small mammal pests, especially *X. erythropus* and the cane

Table 6, Problems disaggregated by settlement and expressed as a percentage of total numbers.

Problem	All Settlements	Settlement A	B	C	D	E
	%	%	%	%	%	%
1. *Z. variegatus*	25	33	10	30	26	22
2. Unspecified "insects"	23	26	25	24	2	22
3. *Loranthus spp.*	8	9	2	10	9	10
4. Ground squirrel *X. erythropus*	8	0	14	1	18	4
5. Termites	7	1	8†	5°	7°	11°

Table 6 *(contd.)*

Problem	All Settlements	Settlement A	B	C	D	E
	%	%	%	%	%	%
6. General economic factors	4	10	7	1	0	6
7. Yam cricket *S. marginatus*	4	1	0	1	14	5
8. Millipede	4	1	0	9°	4°	0
9. Weeds	4	6	1	4	2	6
10. Cane rat *T. swinderianus*	3	2	6	2	2	4
11. Lizards* and larger animals	2	1	1	4	0	3
12. Drought†	2	0	8	1	1	0
13. Other environmental factors	1	1	0	3♦	0	0
14. Miscellaneous	5	8	18†	5	5	7
Total	100	100	100	100	100	100
All "insects"	62	62	42	70	64	59
Weeds	4	6	1	4	2	6
Larger animals	13	3	21	7	20	10
Others	21	29	36	19	14	25
Total	100	100	100	100	100	100

*Mostly affecting maize / †Mostly affecting cocoa /
°Mostly affecting yam / ♦Mostly flooding.

rat (*Thryonomys swinderianus*), are found principally in those villages around which the forest cover is thickest, namely, Irele, Bolorunduro and Erinje.

Although only a few farmers considered weeds to be a problem, their relative importance coincides precisely with the order of magnitude of population pressure on land in the five sample settlements.

Anomalies in the disaggregation perhaps worthy of further examination are that millipedes and the yam cricket (*Scapsipedus marginatus*) appear to be of importance only in Ode Aye and Irele, respectively. It is possible, however, that the yam cricket was included in the more general category of "insects and pests attack yam" in other villages.

From the above it is clear that peasant farmers are willing and able to report their problems within the somewhat arbitrary and, to them, unfamiliar circumstances of questionnaire interviews. Furthermore, their replies are precise and to the point rather than general and vague, and contain factual as well as "structural" information. It is not suggested that evidence of this kind could be used as a substitute for detailed scientific investigation. But all data collection procedures have their limitations. Orthodox monitoring using sophisticated instruments and highly trained observers is limited, in terms of cost-effectiveness, both in the area which it can cover and in the speed with which adjustments to meet new needs and requirements can be made. By using regularly repeated sample surveys or by relying on a network of farmers trained to file systematic observations and reports, we believe that it would be possible to cover large areas very cheaply indeed, with much more spatial resolution than is possible with most instrumental systems,* and to provide a preliminary warning capacity capable of drawing attention to problems requiring more detailed scientific investigation. However, this sort of monitoring work should not stop at simply reporting problems; in order to evaluate and interpret reports from farmers, there is much to be gained by probing further to determine how farmers arrive at explanations of their difficulties and what they intend to do about them.

2.2.2 *Peasant farmers' explanations of their problems*

Not surprisingly, farmers are on less sure ground when explanations

*The same approach is used by cloud physicists to obtain data on the fine-scale structure of hail storms. (See, for example, studies by the Stormy Weather Group, McGill University, Montreal, Canada).

to problems are proffered. Table 7 summarizes their explanations. Seventy-six per cent of the responses fell into the "don't know" category. The other 24 per cent produced a total of 81 different explanations, 11 per cent of which related to farm management and

Table 7. Farmers' explanations of problems

Explanation	Percentage of all explanations	Percentage of farmers who responded
Don't know	62	76
"Ecological" factors	21	24
Religious	7	
Economic	5	
Farm management	5	
Note: Sample size	192	
Farmers responding	178	
Total number of explanations given	205	

economic factors (including eight cases of lack of money), while 15 were explanations couched in religious terms. Forty-four of these 81 explanations were straightforward ecological hypotheses and correlations, many of which were quite plausible.

It is at this level of enquiry that the farmers' shrewd empirical observations, correlations and inferences can sometimes yield sensible explanations of ecological change and provide useful hints for those interested in monitoring environmental processes.

Some of the most perceptive inferences are shown below:

Problem	Explanation given
Z. variegatus destroying cassava, maize etc.	Cassava is the only green plant during the dry season (one farmer)
	It is attracted by, is associated with, breeds upon, a new weed (*Eupatorium odoratum*) (six farmers)
Too many weeds	Land not allowed to lie fallow for long enough (seven farmers)
	Due to a new road and lorries passing through the land (one farmer)
Too many insect pests	Due to insects surviving on trees after burning of the land (one farmer)
Z. variegatus (comments on seasonality)	Dead now (August) but will return from December onwards
	Situation has got better, but they will return during the dry season
	Has improved, but they have already laid their eggs (August)

2.2.3 *Sources of advice concerning farm problems*

Granted the value of the farmer's own knowledge of environmental problems, how can this information best be made available to decision-makers and planners at the national level. At present the farmer communicates with the administration primarily through the channel of the agricultural extension service, though in Western Nigeria in recent years this line of contact has been augmented by the activities of local branches of the Western State Farmers' Union, an organization set up at the instigation of, and funded by, the Ministry of

Agriculture and Natural Resources (MANR). At the time of the Ikale survey, many farmers came into contact with the field staff of the Extension Services Division, principally through Farmers' Union meetings. The Union also facilitates the organization of pilot studies and demonstration plots at village level. In trying to determine an appropriate framework for farmers to report problems, it is important, therefore, to discover what use is made of existing institutions when specific environmental difficulties are being faced.

Farmers were asked whether, if and when they had problems, they sought advice on how to cope with them. Initially, 40 farmers (21 per cent) said that they had done so and listed 69 problems by way of illustration. MANR field staff (Agricultural Assistants or Field Overseers) and the Divisional Agricultural Office in Okitipupa were cited as sources of advice for 30 problems. Another 26 problems had been aired in the Farmers' Union meeting or with the local co-operative society; "God" and "fellow farmers" were consulted three times each, and the radio was the source of advice in two cases. Table 8a lists the categories of problems raised. Forty per cent of all requests for help concerned food crops, and 29 per cent specifically concerned yam.

Respondents were then asked if they ever consulted other farmers concerning agricultural matters. Clearly the previous question had been interpreted as excluding "other farmers" because 76 persons (40 per cent) then said they did discuss problems with their colleagues. Only 18 out of the 76 had in fact answered the previous question affirmatively, three persons having cited other farmers as sources of advice and most of the remaining 15 having consulted both the extension service and fellow farmers. Not only is the degree of overlap between those consulting professional advisers and those relying on fellow farmers surprisingly small, but the actual problems discussed differ according to the source consulted. The extension service and Farmers' Union provided help with 56* problems while 135 problems were raised with "other farmers," but only in 10 cases was the same problem taken to both sources. In other words, even in the few cases where farmers consulted both peers and professional advisers, they tended to consult the two groups about different matters.

The extension service and Farmers' Union provided proportionately more information about problems in the economic category and con-

*Thus these 56 problems are a sub-set of the 63 shown in Table 8a

cerning the use of fertilizer and insecticide than did "fellow farmers" (35 per cent as opposed to 15 per cent). Conversely, proportionately more food crop problems were raised with "fellow farmers" than with extension staff etc. (57 per cent as opposed to 40 per cent) (Tables 8a and 8b).

Table 8a, Sources of advice on farm problems

	Extension service, farmers' union and other formal sources	Other farmers
Type of problem	Percentage	Percentage
Economic	13	2
Food crops	40	57
Tree crops	25	28
Fertilizer/Pesticide	22	13
Total	100	100
No of farmers	40	76
No of problems	63	135

Table 8b, Relative importance of formal and informal sources of advice for four selected groupings* of farm problems

	Insects on food crops	Insects on tree crops	Yam problems	All insects
Extension Service etc.	19%	5%	29%	29%
Other farmers	33%	1%	42%	34%

*These groupings overlap

Finally, the overall distinction being drawn between the role of the extension services and other farmers was confirmed by responses to specific questions about contact with extension workers during the previous year. Of the problems raised by farmers who had either visited the Divisional Agricultural Office or who had been visited by an extension service officer, nine concerned the setting up and maintenance of tree-crop plantations, four concerned loans and other "economic" matters, eight related to miscellaneous matters, mostly administrative, and only three directly concerned food crop farming. Incidentally it is worth noting, in passing, that willingness and opportunity to benefit from the advice of others varies from village to village. Iju Odo and Erinje — villages with reasonable access to Okitipupa, the extension services headquarters for the area — each had more contact with extension workers during 1970 than all three other villages combined. Bolorunduro, the rapidly growing farm camp on Ijebu Ode-Benin main road, has the highest overall incidence of farmers seeking advice, with 25 farmers out of a sample of 37 posing a total of 65 queries. Willingness to take part in a monitoring exercise of the kind proposed in this report is likely, therefore, to vary a good deal from place to place, but might be greatest and most beneficial in dynamic but isolated communities such as Bolorunduro which, for a variety of reasons, have been somewhat cut off from the normal work of the extension service.

To sum up, then, it is concluded that:

(a) Ikale farmers are active in discussing their farm problems (102 farmers out of a sample of 192 reported difficulties and sought advice from some source or other, but mostly from fellow farmers);

(b) there is a marked tendency for farmers to make a distinction between formal sources of advice such as the extension service and the informal help they get from fellow farmers. There is a tendency to rely on one sort of help to the exclusion of the other. At the same time, more food crop and insect problems were raised with fellow farmers than with "professional" advisers, and tree crop, fertilizer/insecticide and "economic" problems were raised more frequently with extension experts than with fellow farmers.

This second point is not a criticism of the extension service as it now operates. Money and men are never available in unlimited quantities and there is a case for the service concentrating on the provision

of specialist advice in the field of plantation agriculture and the use of fertilizers and pesticides. Indeed, in a division which had only one field extension worker per 3000 farm families (c.1968) it is a tribute to the enthusiasm of the MANR staff that over 10 per cent of the farmers in our sample had had direct dealings with the service during the previous year. The interesting point, however, is that the farmer relies on the extension service for that which it is good at providing, namely, information relating to cash crop farming and new cultivation techniques, whereas the farmer falls back on the advice of his neighbour and the community at large in matters where a substantial body of traditional wisdom and empirical expertise has accumulated. If it can be shown that this local knowledge is not static but a continuously growing body of information, grounded in regularized and institutionalized investigation procedures, albeit applicable in the first instance only to matters of longstanding concern such as yam cultivation, then it would seem feasible to recommend the idea of community-based self-help monitoring schemes, not as an alternative but as a complement to the already existing "scientific" extension service, much in the same way that herbalists, drawing on a wealth of traditional pharmacological knowledge, act as a necessary complement, whether welcome or not, to the sparsely provided medical services in many parts of Africa today.

Where "traditional" problems are put to the extension service — problems of food crops in general and yam in particular — it is primarily through the medium of the Farmers' Union. Perhaps, therefore, a suitable framework already exists in the case study area. A formalized means for recording and reporting discussions and issues raised during farmers' meetings would be a logical next step in this respect. A longer term goal would be to attempt the transition from simple monitoring to control — to work towards a situation in which farmers could seek, by collective effort, effective strategies for conserving local environment and could implement these with help and guidance from the extension service.

2.2.4 *Farmers' plans and resource management strategies*

These are summarized in Table 9a. In response to this section of the questionnaire, 156 farmers gave a total of 231 replies. Five of these were of the "too soon to say" sort and 11 were vague and general statements, such as "plans to do better". The rest were specific to a greater or lesser degree, either referring to a crop to be adopted or

Table 9a, Breakdown of positive plans for "next year" on the farm

Type of action	Insecticide or attack insects	Economic factors in general	For more cash	For more food	To increase farm size	Fertilizer	Others	Total
To act directly *i.e.* to get, buy, employ, etc.	37	7	30	26	16	5	6	127/5
To ask advice/seek remedy/reflect or pray	37	1	0	0	0	6	10	54/27
Conditional — if money, labour, etc. available	4	13	1	2	2	5	0	27/12
To aspire/try/ plan/hope/etc.	4	0	5	0	0	0	2	11/5

Sample size	192	Distribution of plans	1 plan	90 farmers
Number of farmers responding	156		2 plans	52 farmers
Total number of plans	231*		3 plans	9 farmers
Positive plans, as tabulated	219		wait and see	5 farmers

*Including five "wait and see" responses and seven negative "plans" — e.g. to abandon farming/reduce size of farm — not includ the tabulation.

abandoned, or mentioning plans to introduce fertilizer, employ more labour and so on.

Only seven replies could be characterized as negative, in the sense of plans to abandon farming or decrease the size of farms. Indeed over three-quarters of the responses were very positive, referring either to innovations to be adopted or some inadequacy to be remedied.

Table 9b, Farmers' plans classified by objective

Farmers' explanations of plans for next year *

Objectives				
To solve the insect problem	70 (30%)	Kill insects	32	(14%)
		Use insecticide	38	(16%)
To change crop pattern or planting	69 (30%)	Plant Cocoa	22	(10%)
		Plant Cashew	4	(7%)
		Plant Oil Palm	5	
		Plant Orange	4	
		Plant Kola	2	
		Plant Cassava	8	(3%)
		Plant Yam	10	(4%)
		Plant other food crops	4	(2%)
		Plant food crops in general	8	(3%)
To increase land or labour supply	30 (13%)	Increase acreage	17	(7%)
		Increase labour input	13	(6%)
Improve soil fertility/ do more weeding	20 (8%)	Use fertilizer	14	(6%)
		Improve soil	3	(1%)
		Weed more	3	(1%)
Others (including all "negative" plans)	43 (19%)	Decrease acreage	3	(1%)
		Plant less yam	1	(<1%)
		All others	39	(17%)
Total	232 (100%)		232	(99%)†

* Some plans had more than one explanation.

† Rounding error.

Table 9a attempts to classify the responses by the type of action proposed, while Table 9b presents some of the explanations of these strategies in terms of their objectives. Direct action was proposed in 58 per cent of all cases, whilst 27 per cent of responses indicated that advice was to be sought and 12 per cent were conditional upon factors such as the availability of money, labour, time and so on. Of the cited objectives (Table 9b), the majority referred either to attempts to control insects (30 per cent of responses) or to specific crops which would be introduced or increased, such as tree crops, 17 per cent, and food crops, 12 per cent. On the other hand, 13 per cent of responses concerned improved land and labour inputs and only eight per cent

Table 10, Reasons given for proposing particular strategies for the farm "next year"

Reasons	Frequency		
For subsistence*	22	(14%)	(28%)†
For cash income*	22	(14%)	(28%)†
For both cash and subsistence*	23	(15%)	(29%)†
Cause and effect (tautological)	16	(10%)	
Land is available*	4	(3%)	
Labour available/not available*	6	(4%)	
Fashion*	1	(1%)	
Rhetorical	57	(37%)	
No reason	4	(3%)	
Total	155	(100%)	

150 Farmers gave 155 responses

* "Real" as opposed to rhetorical and tautological reasons 78/155 (50%)
† Percentage of "real" reasons

related to attempts to control weeds and improve soil fertility; in the latter case, this included six per cent of farmers who specifically planned to use fertilizers.

Table 10 lists some of the reasons farmers gave for adopting particular strategies (there were 155 reasons cited from 150 farmers in all). Fifty per cent of these explanations added new information. The remainder were either rhetorical, like "for peace and progress" or tautological, such as "to kill insects" as an explanation of a decision to adopt insecticide. Taking the explanations containing new information by themselves, 28 per cent related to the need for more food, 28 per cent to the need to increase cash incomes and 29 per cent to the desire to increase returns in both the cash and subsistence sectors.

2.3 The Ikale case study — conclusions

Despite the unsophisticated approach adopted to elicit information from peasant farmers on the way they perceive their farming environment, the responses in the case study produced internally consistent answers which help explain how the Ikale farmer comprehends his problems and structures his concomitant problem-solving procedures.

The problems described are characteristic of a forest-zone community in which subsistence modes of production still play an integral part. Interest in the traditional staple, yam, is still strong despite the growing dominance of cassava. The insect problem fits into the general pattern of a community facing land shortage, though it would be interesting to know whether or not the insect situation is getting worse. It would also be interesting to know whether the apparant lack of concern for weeds — apart from *E. odoratum* — is an accurate reflection of objective circumstances.

Z. variegatus damage to melon and the problems caused by *X. erythropus, Loranthus* spp. and *S. marginatus* are details which should be of interest to the agricultural services.

Data on the groups with whom the farmer discusses his problems show that, while the extension service is having considerable impact, there is relatively little overlap between those consulting the extension service and those relying on the advice of fellow farmers. There is, in addition, little overlap in the kinds of problems discussed, extension agents being consulted about tree crops, pesticides and loans; fellow farmers about food crops, weeds and pests (especially yam pests). The problems aired in meetings of the Western State Farmers'

Union are generally of the second type, suggesting that this type of organization might be the right kind of institutional setting for monitoring some of the more neglected aspects of the forest agricultural system — especially the subsistence components.

In both explaining and expressing problems, many farmers emphasized the competition between pests and humans for food resources. This appears to reflect a *minimax* approach to agriculture, *i.e.*, an emphasis on minimizing maximum potential losses rather than maximizing potential gains, common in farming systems where subsistence is a primary consideration. Because of this approach Ikale farmers see their major strategy in terms of eliminating pests and weeds rather than, for example, improving yields through soil fertilization. Thus, although only half those mentioning insect problems directly planned to do anything about it, 16 per cent of all strategies (more than half the "insect attack" strategies) specified insecticide by name. This compares with only six per cent mentioning fertilizer. To a certain extent, the verbs used in problem reporting reflected the emphasis on insecticide, since 447 of the 601 responses employed five verbs: "destroys", "eats", "attacks", "uproots" or "kills".

Apparently the Ikale farmer sees himself involved in a head-on conflict with a readily identifiable enemy over subsistence resources and, not surprisingly, a frontal pesticidal attack has great conceptual appeal. Whether or not turning to pesticides rather than fertilizers is a good thing can be debated, but resource managers should be aware of the farmers' interpretation of the situation in order that sympathetic advice can be given and possible problems of over-exuberant use anticipated. Perhaps the emphasis might change when the struggle becomes more concerned with cash surplus than directly with food for the family to eat.

The other major group of strategies is rather mixed. Of the 29 per cent proposing to increase crop areas or plant new types of crops, those planting oil-palm, cassava and maize are most likely to escape their present difficulties. Those wishing to increase the size of their farms are in many cases subsistence motivated. Subsistence factors, such as the need for more food and the existence of more mouths to feed, certainly loom as large as the strictly cash-oriented factors, *e.g.*, "to earn more money" and "to pay for children's education", in the lists of explanations given for the adoption of proposed strategies.

If this subsistence thread in the Ikale thinking is ignored, then it might be difficult to mobilize community support for and interest in

some of the broader issues of environmental resource management. Due to increasing population pressure, enlarging the boundaries of the farm is unlikely to be a successful strategy and reduced fallow periods are already placing soils under acute pressure. Rather than provide advanced cash-crop innovations, it might prove better to strengthen the subsistence base through "intensification" procedures already latent in the local agricultural technology, such as the use of household "manures", sylvicultural fallowing and simple biological measures for insect and weed control.

3.0 Nigerian farmers and the variegated grasshopper

3.1 Introduction

In this second case study, an attempt is made to move from the general to the particular by examining farmers' responses to a particular pest, *Zonocerus variegatus*. An important aspect of the argument is to show that peasant agriculture incorporates a dynamic "searching and learning" component capable of responding to changing environmental conditions. The ability to learn from experience and to solve new as well as "traditional" problems could constitute, it will be argued, the basis for a programme going beyond simple problem reporting to a situation in which responsibility for the management and monitoring of the agricultural resource base would be vested in the local community. Our argument is that the farmers' ecological and environmental knowledge is not just a matter of static tradition handed down from time immemorial but, being based on systematic principles of observation, is capable of responding to new and changing circumstances. It would be possible, we believe, to stimulate this learning process further, while simultaneously feeding back ideas and information of value to researchers, agricultural administrators and planners. The essential proviso is that the matters to be dealt with lie within the farmers' observational scope. Economic problems are not well understood at village level because many of the key factors — determination of price, for example — operate in central markets sometimes in other continents. Cocoa prices are ultimately determined in London and New York, and if few Nigerian farmers can explain fluctuations in the price of cocoa, it is because the data they need are inaccessible. Similarly, farmers have to rely on outside information and help when grappling with "new" crops and techniques such as cocoa and the use of pesticides (though, as indicated

earlier, it might help if explicit links between traditional ideas concerning the use of "medicine" and modern pest control techniques were forged). But in the food-crop farm, the peasant farmer is in his element. Here he is dealing with familiar materials and can view the venture as a whole. The specific problems may be new, but analogies and precedents are derived from experience of past difficulties. Because he monitors the food-crop farm with such care, the ordinary farmer often provides stimulating insights when engaged in conversation by the field scientist (see, by way of examples, many of the papers published in the Nigerian Forestry Department journal *Farm and Forest*). The need is to go beyond conversation and establish an effective forum for the exchange of ideas between farmers and scientists on a regular and continuing basis.

To provide support for proposals along these lines, use will be made of results from a study by one of us (P.R.) concerning peasant farmers' knowledge of the ecology of *Z. variegatus*, the variegated grasshopper, a major pest of cassava and other crops over large parts of the forest and derived savanna zones in southern Nigeria. The study was undertaken as a component of a much larger project on the biology and control of *Z. variegatus* in Nigeria being carried out by the University of Ibadan and the Centre of Overseas Pest Research, London.* It was the frequency with which this pest was reported by the farmers in the 1971 Ikale survey that led, as an adjunct to the main biological research programme, to the setting up of a series of comparative studies of the impact of *Zonocerus* on peasant farming communities in different ecological zones in southern Nigeria. The aim of the adjunct survey was to find out when and where the insect was a pest, what damage the farmer perceived it to do, which crops were attacked most frequently in the peasant farm setting and what the farmer knew of the insect's ecology.

3.2 Methodology

A fuller account of the *Zonocerus* study is scheduled to appear some time during 1977. For the moment data from this survey are used to demonstrate that the farmer is already in the habit of carefully monitoring his environment and that he is capable of arriving at sen-

* The data are used by kind permission of Dr. Reg Chapman, director of the UI/COPR project.

sible inferences, even where the problem monitored is a new and unprecedented one.

The main research tool was the interview schedule, but sets of grasshoppers were used to test farmers' recognition of various species, and specimens of other pests, cited as affecting the farm at the same time as *Zonocerus*, were collected and preserved to allow for proper identification. More than 30 villages in six parts of the then Western, Midwest, Kwara and East Central States were chosen for fieldwork (Figure 1). A set of general questions on farm problems allowed *Zonocerus* to be assessed in the context of farmers' main problems and in the case of Ikale villages allowed direct comparisons to be made with the earlier Ikale survey. Some elementary ethnolinguistic work on naming, description and classification of insect pests was initiated at the same time. The following discussion uses data collected in 1974 in 10 Ikale villages and camps, four small towns in the forest-savanna between Kabba and the river Niger in Kwara state and three village groups in the Umuahia — Aba — Afikpo area of East Central State (now Imo State) (Fig. 1).

3.3 Results and discussion

Comparing 1971 and 1974 responses to the question about Ikale farm problems gave interesting results (Table 11). The proportion of problems classed as "economic" had increased dramatically (from 4 per cent of all stated problems in 1971 to 59 per cent in 1974). Low production and labour shortage were the main preoccupations in 1974, with lack of mechanization, poor soil and "children no longer helping" — "at school" being offered as the chief reasons. Lack of capital, storage facilities, markets, mechanical aids and roads were also stated as problems in their own right. On the ecological side, pests still occupied first place. *Zonocerus* was rarely mentioned outright in this lead-in section (note that interviewees were simply told the questionnaire was about farm problems) but *Loranthus* was specified on a number of occasions. The major new entrant into the ecological list was "poor soil", a significant category because it links so strongly with the changes in the economic list. As an aside, we might note that "poor soil" was explained as the result of "erosion" in the majority of cases, but "leaching" in others. There would seem to be little in the way of excessive sheet erosion, and hardly any gullying in the area, and it would be interesting to enquire what terms farmers were using for "erosion" in Yoruba and whether or not this implies removal of

plant nutrients, *i.e.*, leaching, rather than erosion as understood by soil scientists.

Table 11, A comparison of Ikale farmers' problems 1971 and 1974

"Ecological"	1971 Percentage	1974 Percentage	"Economic"	1971 Percentage	1974 Percentage
Pest/Insects	75	18	Loss of production	1	18
Poor soil	0	12	Labour shortage	2	18
Flooding	1	4	No storage facilities	—	5
Loranthus	8	3	No capital	1	4
Weeds	4	1	Lack of land	—	4
Drought	2	1	Lack of knowledge	—	2
Others	6	1	No mechanization	—	2
			Poor health	—	2
			Poverty	—	2
			Poor markets	—	2
			Poor transport	—	1
	96	40		4	60

1971 data 192 farmers, 601 problems
1974 data 69 farmers, 163 problems

Since two interviewers working in this area in 1974 produced broadly comparable results, it is unlikely that the 1974 data set is coloured by individual bias. This conclusion is strengthened by the fact that the 1974 schedule used with Igbo and Kabba farmers produced answers much more like the original 1971 Ikale data set. Table 12 shows that 93 per cent of all problems stated by Kabba farmers fell into the "ecological" category. Pests and weeds head the list — and where pests were reported, they ranked as "most important problem" in three out of four cases — but drought, grasshoppers and maize rust were mentioned specifically on a number of occasions. In other words, the new questionnaire still produces the old results in other geographical contexts, thus arguing that the difference between the 1971 and 1974 Ikale data sets is real. Despite the short interval between the two surveys, the shift is not entirely unexpected. Analysis of population data and man/land ratios* suggests that the Ikale farming

* See P. Richards (1976) "Ideas, environment and agricultural change: a case study of peasant farming from Western State, Nigeria". To be published. Forthcoming PhD Thesis. London University.

community was on the verge of land shortage in the late 1960's. This process was accelerated by withdrawal of nearly 10000ha. of land for oil-palm plantation in the early 1970's. There is evidence, therefore, that farmers' awareness and interpretation of problems are both consistent with and very responsive to shifts in the environmental situation.

Two points can be made at this juncture:

(i) that continuous reporting of problems is needed since the problems and their significance may change from year to year;

(ii) the speed with which Ikale farmers have reassessed their farm problem priorities is testimony to their potential efficiency as monitoring agents.

Table 12, Kabba farmers' problems, 1974

	"Ecological" Percentage	"Economic" Percentage
Pests	46	4
Weeds	20	2
Drought/Late rain	12	
Grasshoppers	8	
Late rain causing rust	1	
Others	3	
Total	94	6

80 farmers, 138 problems.

The Kabba and Igbo data sets are also of interest in this respect. Of 31 farmers in Alayi, 28 farmers mentioned poor yield of cassava as one of their principal problems. Seven farmers cited bacterial blight as the cause, while a further 14 were able to relate the spread of the disease to the incidence of thunderstorms. Recent research suggests that rain splash is a critical vector. The bacterial blight problem is a new one in the Nigerian context (the disease seems to have been

imported during the Nigerian civil war, 1967–70). Thus the Igbo farmer has been remarkably quick to assess the situation and it seems likely that the reasoning behind a shift to late-season planting for cassava as a disease-control strategy would be readily appreciated in eastern Nigeria. The Kabba farmer has been equally quick to work out simple ecological relationships, for 23 out of 24 persons offered valid explanations of weed problems (poor or overused soil, 13 cases; diffusion processes, seven cases; labour and financial difficulties, seven cases); six out of six farmers associated maize rust with late rainfall and five out of 12 linked *Zonocerus* problems to the spread of *Eupatorium* and a further 30 out of 67 farmers, doubtless having *Zonocerus* in mind, related their pest problems either to weeds (13

Table 13, Kabba farmers' explanations of farm problems

Problem	Explanation		
Pest (67 farmers)	None	23	
	Late rain	17	
	Weeds	13	*(Eupatorium,* 8)
	Evil/Natural cycle	13	
	Diffusion/Epidemic	3	
Weeds (24 farmers)	None	1	
	Poor soil	11	
	Overuse of land	2	
	Labour shortage	5	
	Spread/invasion/ came with other weeds	7	
	Financial limitations	2	
Zonocerus (12 farmers)	None	3	
	Eupatorium	5	
	Devil/Evil	2	
	Natural cycle	1	
	Late rain	1	
Maize rust (6 farmers)	Late rain	6	

80 farmers, 138 problems.
Some farmers had more than one problem and some problems had more than one explanation.

cases) or late rains (17 cases) (Table 13). *Eupatorium odoratum* was accidentally imported to Nigeria from S.E. Asia in a shipment of seedlings for the Forestry Department and became established in the fores-

Table 14, Date of first attack by *Z. variegatus* as reported by Ikale farmers, 1971 and 1974 surveys

	1971 survey	1974 survey	
Year	Number of farmers out of a total sample of 72 reporting initial attack	Number of farmers out of a total sample of 54 reporting initial attack	Number of farmers reporting exceptionally bad years
1965	5	11	1
1966	13	26	6
1967	7	7	0
1968	11	1	0
1969	0	0	0
1970	14	1	0
1971	12	1	3
1972		3	19
1973		0	0
1974		0	0

try plantation at Enugu during the 1940's*. During the late 1950's and early 1960's it spread to most parts of the forest zone of southern Nigeria, doubtless helped by the rapidly increasing rate of interaction between the various parts of the country, especially of east-west

*R. W. J. Keay, personal communication.

motor traffic. It appears to have arrived in Ikale about 1963-5. The colonization of the savanna-forest margin, as in the Kabba area, is an even more recent phenomenon. *Zonocerus variegatus* has probably been present in the forest-zone fauna all the time, but recent explosive increases in numbers seem to be recent occurrences. Table 14, showing year of first attack and bad years as reported by Ikale farmers, indicates 1965–8 as years of first attack and 1972 as an especially bad year subsequently. In other words, the Kabba and Ikale farmers are

Table 15, Ikale farmers' weeds and pests ranked in importance, 1974 data (n=33)

	Order of importance			
Weeds	First	Second	Third	Fourth
E. odoratum	30	0	0	0
Ijebu/Apiwo* weed	0	1	1	0
Igbolode†	0	1	0	0
Inuadie†	0	0	1	0
Insect pests	First	Second	Third	Fourth
Z. variegatus	2	14	3	1
S. marginatus	0	5	0	0
Emimeren (a beetle)†	0	0	2	0
Oje (a termite)†	0	0	0	2
Total weeds and pests cited	32	21	7	3

32 farmers cited 63 weeds and pests
* *Ageratum conyzoides*
† Not identified.

responding either to new problems or to changed situations and the survey/resurvey data presented in Table 14 suggests that the Ikale farmer, at least, can remember dates and can be relied upon to provide consistent oral historical data in entomological as well as in the more familiar social and political contexts hitherto exploited by social scientists.

After the general introductory questions, farmers were asked to say whether or not they had any specific insect or weed problems. For the Ikale data, 32 out of 33 farmers (not all the answers to this question have yet been analysed) cited a total of 63 weeds and pests. Table 15 shows these responses grouped into weed and insect categories and ranked by importance. *Eupatorium* was mentioned 30 times, always in first place. *S. marginatus* was specified by five farmers, in all cases appearing as the second most important weed and insect problem. Comments made on "grasshopper" damage in general indicate that this result may underestimate the importance of *Scapsipedus*, which it will be recalled was a major pest in the 1971 survey. But as has been noted, there is something of a trend away from yam cultivation, and yam pests as a whole may be losing the significance which they enjoyed in 1971.

A total of 80 Kabba farmers reported 31 5 weeds and pests, the most significant being "grasshoppers" (in fact, *Zonocerus* in all cases), *Eupatorium*, spear grass (*Imperata cylindrica*), a beetle known as *"aropile"* (probably *Asbecesta cyanipennis*) and, since this is one of Nigeria's major coffee growing regions, a "coffee caterpillar", *Neudoralia* sp. (i.e., the larva of the silk moth). The data in Table 16 are disaggregated by village, because some of these pests are highly localized (e.g., *Imperata, "aropile"*), and a clear contrast emerges between Gbedde, a settlement on higher ground, and the three lowland villages and also, in respect of some other weed and insect pests, between Gbedde and Jegge (with predominantly forest vegetation) and Amuro and Takete Ide (with predominantly derived savanna vegetation). *Zonocerus* and *Eupatorium*, it should be noted, are found in all four locations. In terms of ranking, "grasshoppers" headed the list in 37 cases and *Eupatorium* in 14 cases. Second-order problems were fairly diverse, but spear grass was cited 13 times, *"aropile"*, 10, and *Eupatorium*, 9 times.*Eupatorium* and "grasshopers" reappeared as the major third-order problems (21 and 13 citations, respectively).

The rest of the questionnaire concerned *Zonocerus* specifically. Farmers were shown five grasshopper specimens. Specimen E (*Z.*

Table 16, Weeds and pests cited by farmers in four Kabba settlements

	Grasshoppers	Silkmoth caterpillar	*Eupatorium odoratum*	Spear grass	"Majatara" (weed)	"Aropile" (insect)	"Inurin" (termite)	"Lembreku" (weed)	All other weeds	All other insects
Gbedde*§	20	10	20	0	0	0	0	1	12	17
Jegge*‡	15	6	10	17	7	0	2	0	0	18
Amuro†‡	13	5	8	3	9	12	8	6	8	8
Taketet‡	14	3	12	11	4	13	4	5	4	10
Total	62	24	50	31	20	25	14	12	24	53

n=80, No. of weeds and pests=315
*Forest ‡Lowland
†Savanna §Highland

variegatus) was recognized most frequently (27 out of 33 Ikale farmers — again, only part of the data set has yet been processed). Specimen C (*Actractamorpha aurivilii*) was recognized least often (21 times out of 33). *Zonocerus* was named by 23 farmers, 21 calling it *paàpáa*. No other species was given a specific name more than 10 times, and even then species B and D* (named 10 and 9 times respectively) were as often as not misidentified as *S. marginatus* (Ikale *"igamtete"*/*"igamtetere"*). That this was a genuine misidentification rather than the use of a broad term applicable to all three species is shown by the fact that farmers claimed that there had been yam damage caused by B and D. The general name for grasshoppers in Yoruba is *"tata"*, and in Ikale dialect it appears to have been *"agiga"*. Eight farmers used this latter term but another 11 asserted that the general name for all grasshoppers was now *paàpáa*. Presumably this word has taken over in the last 10 years or so. It should also be noted in passing that, from the complete sample of 69 Ikale farmers interviewed in 1974, only nine failed to recognize *Zonocerus*. Seven of these farmers lived in isolated forest villages north of Ode Aye and two in the swamps at Ebute Irele. All nine, incidentally, reported *E. odoratum* as a problem.

Igbo linguistic data were much more detailed. In addition, all Kabba and Igbo farmers recognized and named *Zonocerus* without hesitation. (It seems to have been recognized as a pest in Igbo communities for much longer than in Ikale). Igbo grasshopper names are highly specific, as well as highly picturesque. Only rarely were two species given identical names, there being variations from village to village and in some cases almost from family to family. The highly specific nature of the ethnolinguistic material on grasshoppers in eastern Nigeria is most probably a consequence of the wide-spread importance of these insects as human food. As many as 13 species of grasshopper as well as the praying mantis and locusts (*Locusta migratoria*) were reported as items of food in the Alayi, Umuahia and Aba areas.

After answering the question concerning years when *Zonocerus* attacks were notably severe, the farmer was then asked why they

*A —*Cantantops spissus spissus*
B — *Gymnobothrus flaviventris*
C — *Actractamorpha aurivilii*
D — *Eyprepocnemis ibandana*
E — *Z. variegatus*

were numerous in those years and why they came to his farm (these two questions were separated by several other enquiries on the schedule to try and avoid any "interference"). After noting a small initial outbreak in 1965 (the insect seems to be a newcomer to farms in the area) and reporting a large and apparently normally distributed build-up over the years 1969-73, centering on 1971, Kabba farmers provided 123 responses to the question why it was worse in these years. Late rain/drought was cited 60 times and *Eupatorium*, 37 times. Evil power/witches and enemies accounted for 15 of the remaining 26 responses. These replies are of great interest since entomological studies indicate that rainfall and *Eupatorium* are two of the factors relevant to the growth and spread of *Zonocerus* in recent years. Although empirical association is not explanation, it nevertheless has led some farmers to valid control strategies. When asked if and why the problem was getting better, 37 farmers said "no" and 25 said "yes, because the rainfall situation had become more normal" (which is only ambiguously true, because 1973, a year in which farmers recognised a tailing-off in severity of *Zonocerus* attack, was a savage year in terms of drought in the derived savanna zone of the western half of Nigeria). In addition, 15 farmers thought the improvement was also due to spraying with Gammalin and 10 thought it was because they were burning/weeding/clearing the *Eupatorium*. (But one farmer noted that as he sprayed the pest, others moved in from nearby *Eupatorium* thickets, so questioned the value of spraying).

In fact it became clear, at this point, that farmers were making an interesting distinction between the general and the particular. The true extent to which control strategies were being adopted became apparent when we asked not about the general incidence of *Zonocerus* but why it came to an individual's own farm. A total of 99 responses were given. Quite remarkably, in view of the fact that 60 out of 123 responses to the more general question had cited late rains, only four responses now mentioned rainfall. Some 39 responses cited *Eupatorium* in general and 17 specifically cited the invasion or diffusion of *Eupatorium* from neighbouring farms and villages. A further 13 responses laid the blame on enemies/evil/plague and 12 referred to the migration of the insect itself. In other words, a general consensus appears to be emerging in which a climatic factor is thought to be controlling the regional spread of the insect, and *Eupatorium* is considered responsible for the manifestly patchy incidence of the insect at the local level.

Eighty control strategies were cited as having been tried at the farm level. A total of 52 farmers had attempted insecticide spraying. Gammalin was in use, with support and encouragement from the local extension service. It is possible that the spraying strategy was suggested by MANR staff in the first place and Kabba extension workers have been commendably active in trying to combat the *Zonocerus* problem. Nevertheless, there seems reason to suppose that rapid and widespread adoption of spraying and other control strategies are in some measure a consequence of the good grasp of the basic ecology of the *Zonocerus* problem which the farmers themselves possess in this area. This conclusion is backed up by the fact that 21 farmers were either clearing or burning *Eupatorium* thickets, five times the number who were resorting to witchcraft techniques. Apart from insecticide treatments and *Eupatorium* control, a third possible control strategy suggested by current research might be to locate and dig up egg-laying sites. So far, two Kabba farmers in the sample have anticipated this and put the idea into practice.

The answers given by Ikale farmers to these two questions were interesting in a rather different way. Although the sample sizes are small and should therefore be treated with caution, they show a broadly similar response. The first Ikale survey produced a majority of "don't knows" in response to the questions about the cause of the *Zonocerus* problem, with *Eupatorium* (here called Akintola weed, in commemoration of political events at the time of its appearance) and "witches/sin/God" showing up in second and third place, respectively.

The second survey suggests a significant reduction of "don't knows" (now only 2 persons out of 24) and drought (12 out of 24) respondents) takes over as the most common explanation. Some 14 out of 24 people thought that recent improvements in the rainfall situation had caused the insect to retreat. This change would constitute evidence, if not conclusive proof, of the farming community learning from experience.

As in the Kabba case, explanations of why *Zonocerus* came to the individual's farm differed from explanations of general fluctuations. All mention of drought was again dropped but this time ecological explanations were only offered in four cases, two farmers suggesting the link with *Eupatorium* and two others noting that cassava is its food. Some 11 out of 25 persons were at a loss to explain the problem and 11 persons suggested that God, witches or the late Western Region Premier were responsible. As a consequence, 19 out of 25 farmers

had taken no action against the insect, though 14 were anxious to accept government advice and 6 planned to use insecticide.

In the final section of the questionnaire schedule, farmers were asked to assess the damage done to various crops by *Zonocerus* and to report on the relative significance of other insect pests. Damage assessments were elicited in two ways; first, by asking the farmer to state the crops attacked and to classify the damage as very severe (VS), severe (S) or moderate (M), and second, by requesting quantitative estimates of differences between yields in a good year and in a year when *Zonocerus* attack was bad. (These latter estimates do not appear to be reliable and have not been used in this report.)

A total of 60 Ikale farmers reported attacks by *Zonocerus*. Damage to cassava was reported 48 times and damage to maize and green vegetables was reported 33 and 32 times, respectively. Plantain, okro, melon and pepper also figured quite prominently in the list (Table 17). Cassava headed the very severe list (36 cases), followed by green vegetables, plantain and melon. Damage to maize was most frequently described as mild (17 times).

Table 18, listing the crops grown by the 1974 sample of Ikale far-

Table 17. Farmer assessments of crop damage due to *Z. variegatus* Ikale 1974 (n=60)

Crop	Number of farmers citing damage as:			
	Very Severe	Severe	Mild	Total mentions
Cassava	36	8	4	48
Maize	7	9	17	33
Green vegetables	17	11	4	32
Plantain	13	8	3	24
Okro	5	8	6	19
Melon	12	1	0	13
Pepper	3	5	2	10

Table 18, Crops grown by Ikale farmers in order of importance 1974 (n=69)

Order of importance (Farmers' ranking)	Cassava	Maize	Yam	Vegetable	Cocoa	Plantain	Okro	Cocoyam	Melon	Pepper
1st (69)	23	5	18	0	18	1	0	0	4	0
2nd (66)	17	18	12	2	1	3	4	5	2	0
3rd (62)	7	18	6	12	0	8	4	3	1	3
4th (60)	5	6	4	16	0	8	8	7	1	5
Total	52	47	37	30	19	20	16	15	8	8

mers, ranked according to importance, provides some basis for assessing the validity of these damage estimates. In view of the frequency with which damage to maize was classed as mild, it is interesting to note that maize is no more than a second- or third-string crop for approximately two-thirds of all farmers in the 1974 sample.

Turning to the relative importance of other pests, it should be noted that of 60 Ikale farmers reporting *Zonocerus* problems in 1974, 20 had at least one worse pest at all times (including bad years for *Zonocerus* attack). *"Oje"*, an as yet unidentified termite (?), was the most popular candidate in this respect. It is important to note also that 14 of these 20 farmers either grew cocoa or yam as their most important crop.

This compares with the result that, out of 40 farmers who recognized *Zonocerus* as their principal pest problem, 17 grew cocoa or yam as their most important crop. A chi square test suggests that farmers growing cocoa or yam as principal crop will be significantly less likely to cite *Z. variegatus* as their chief pest, *i.e.,Zonocerus* is a less important problem in communities where the incidence of yam and cocoa cultivation is high or increasing. Tables 19 and 20 show that while cocoa cultivation was increasing in 1971 in the two northern most Ikale settlements surveyed, yam cultivation had failed to keep pace with the general increase in cassava cultivation and farm size. As already suggested, this fact may explain the somewhat diminished importance of *S. marginatus* in 1974. At the same time, the evidence is fairly convinc-

Table 19. Changes in tree crop acreages, Ikale farms 1966–71

	No. of farmers growing tree crops*	Increase	Decrease	Same
Iju Odo	16	7	3	6
Bolorunduro	24	24	0	0
Ode Aye	15	15	0	0
Irele	9	9	0	0
Erinje	7	5	0	2

*Qualification — farmers having more than 100 planted trees.

ing that the increasing importance of *Zonocerus* as a pest is correlated with the spread of cassava cultivation in recent years.

Table 20 Ikale farm size changes, 1966–71 by village (n=184)

		Farms in general	Cassava growing area	Yam growing area
Iju Odo	Increase	14	20	16
	Decrease	16	13	16
	Same	8	2	2
Bolorunduro	Increase	26	24	18
	Decrease	5	6	13
	Same	6	6	5
Ode Aye	Increase	19	18	18
	Decrease	14	14	13
	Same	8	6	7
Irele	Increase	16	12	9
	Decrease	11	13	13
	Same	7	5	6
Erinje	Increase	16	12	9
	Decrease	11	13	13
	Same	7	5	6
		All farms	All cassava farms	All yam farms
All villages	Increase	91	86	70
	Decrease	57	59	68
	Same	36	24	26
		184	169	164

3.4 A concluding comment — grasshoppers on the menu.

The final section of the second case study concerns the edibility of *Zonocerus*. A follow-up survey has now been completed but, unfortunately, the only data yet processed relate to a small pilot study carried out in August 1975. Of 11 respondents in the Alayi, Umuahia and Aba areas of Imo State, nine reported that all specimens shown (A, D and E from the previous set and two additional slightly juicier-looking species to replace *G. flaviventris* and *A. aurivilii*), were eaten locally. Two persons said only *Zonocerus* was eaten, but four other kinds of edible grasshoppers were mentioned (specimens not yet identified). All respondents asserted that *Zonocerus* was the one eaten in greatest numbers.

Ten said this was because it was most numerous, one that it was the most tasty. *C. spissus spissus* was cited by all as the one eaten least frequently because it was the hardest to find. Eight respondents said more children ate grasshoppers than did adults. Three persons, all from Aba, said there was no difference between adults and children in this respect. Nobody thought that age (amongst adults), sex or wealth was likely to influence the numbers eating grasshoppers.

Nine persons reported that *Zonocerus* were sold ready to eat in the market, three adding that locusts were sold in the same way. According to eight of the sample, more *Zonocerus* were eaten in the past, most adding that people now tended to leave them to the children as a result of "civilization". The years 1968–70 and 1972 were reported as good for *Zonocerus* hunting, some adding that the insect constituted "heaven-sent relief to our people who lacked meat during the civil war". Three people said that when *Zonocerus* was numerous and eating the crops, people retaliated by eating it back!

All 11 still ate *Zonocerus* themselves. The season was from January to May, with March and April as peak months (the beginning of the pre-harvest "hungry gap"). Alayi informants — with more land and perhaps less of a hungry gap (?) — refuse late-season grasshoppers, due to parasitization by *Blaesoxipha filipjevi*. All informants said they ate fewer grasshoppers currently than in the recent past, due to the difficulty of getting hold of them (in 1974). During the good times, as many as 300–800 may be taken at a sitting. Children were thought to eat daily at least 15 or 20. Eight interviewees ate *Zonocerus* every day during the season, the remaining three, 2–3 times a week.

Three methods of preparation were reported:

(i) removing excreta and wings, boiling briefly and washing thoroughly, then frying with oil, salt and pepper;

(ii) baking, or roasting on a fire, kebab style, if there were only a few;
(iii) sometimes the insect was dried after being prepared according to recipe (i) and then sold in the market.

Everyone insisted *Zonocerus* was eaten because it was tasty rather than simply because it was cheap and plentiful.

Historically speaking, insect-eating appears to decline with rising levels of prosperity. The importance of *Zonocerus* as an ancillary food resource is likely to wane rather than increase in future, therefore. Nevertheless, it is still of considerable value as a childhood and famine-reserve nutritional supplement. Control of *Z. variegatus* will have to take this into account. Ideally, the local community should decide whether its nuisance as a pest outweighs its advantages as a food. It is in communicating evaluations of this kind to environmental management authorities that the monitoring philosophy suggested in this report could prove valuable.

4.0 Summary and general recommendations

4.1 Summary of empirical findings

Using data from a general survey of Ikale agriculture, the first case study demonstrates that farmers are able to provide lucid and concise information on environmental difficulties and that, when related to the objective circumstances of agricultural production in the area, the data in question appear to represent rational assessments of real difficulties. In general, it was found that farmers were much more concerned with ecological than with economic problems, *i.e.*, weeds and pests figured much more often than poor roads and low prices. This was interpreted in terms of the subsistence orientation of much Ikale farming in 1971. It was shown that subsistence considerations were uppermost in people's minds. It is concluded that a resource management programme with a strong foodstuff self-sufficiency component might have popular appeal.

Specific findings of interest were as follows:

(i) Aggregating the 601 problem statements made by 192 farmers showed that the dominant difficulties in this area in 1971 were pests and weeds associated with yam growing (45 per cent of all problems) and attacks by *Zonocerus variegatus* on a wide variety of crops (25 per cent of all problems). It is important to note that, in the one case, attention is focused on the object of attack, yam, and in the other on the agent of attack, *Zonocerus*. In relation to the structuring of entomological research, this suggests that a single species approach

is justified in the case of the grasshopper but that yam pests ought to be treated as a group rather than singly.

(ii) While yam was second to cassava in area grown, many more yam problems were cited. This fits in with what is known of the general shift from yam to cassava cultivation in the forest zone of Nigeria. Without raising the vexed question of whether this is desirable or inevitable, either from an ecological or an economic point of view, it is interesting to note the degree of local concern for yam, suggesting that innovations in yam cultivation might be accepted readily in this area.

(iii) Detailed agreement between problem reporting and variations in local environmental conditions was good, *e.g.*, mention of rodent and squirrel problems came exclusively from heavily forested localities and the importance of weeds matched population density conditions, thus helping to confirm the empirical soundness of the observations.

(iv) In both expressing and explaining problems, many farmers emphasized the competition between pests and humans for food resources. This, it was argued, is characteristic of farming systems where subsistence is a primary consideration. As a result, Ikale farmers saw their major strategy in terms of eliminating pests and weeds rather than improving yields through soil fertilization. Many more farmers were using, or planned to use, pesticides than fertilizer, a situation of which resource managers need to be aware.

Data on whom the farmer discusses his problems with showed that there was relatively little overlap between those consulting the extension service and those relying on the advice of fellow farmers. There was, in addition, a tendency to separation in the kinds of problem discussed, extension agents being consulted about tree crops, pesticides and loans; fellow farmers about food crops, weeds and pests, (especially yam pests). Problems aired in meetings of the Western State Farmers' Union were generally of the second type, suggesting grass-roots organizations of this type might be effective institutional settings for involving the local community in monitoring work.

The *Zonocerus* case studies also produced interesting and encouraging results. A question on general farm problems in Ikale in 1974 produced very different results from 1971. Economic as opposed to ecological problems had grown to constitute 59 per cent instead of 4 per cent of all problems cited, clearly reflecting the rapidly changing market conditions for foodstuffs in drought-affected, post-war

Nigeria, as well as internal changes in the local economy following the introduction of large-scale oil-palm plantations during the period in question. This suggests that farmers' problem assessments respond rapidly to changing conditions and further strengthens the conclusion that farmers are reliable empiricists.

Ability to identify, name and distinguish *Zonocerus* from other grasshopper specimens was, in general, very good. Kabba and Alayi farmers had a good understanding of the general biology and life cycle of *Zonocerus* — being aware of egg-laying sites, seasonal population dynamics and, in some cases, of late season parasitization by *Blaesoxipha filipjevi*, for example — but Ikale farmers were a little less certain on details, perhaps understandably so, since the pest had only appeared in any great numbers since 1965. There was generally good agreement on the dates of previous major outbreaks, and farmers were able to supply information on the severity of damage to various crops apparently independent of the importance of each crop in the local economy.

The most impressive overall understanding of the *Zonocerus* problem came from Kabba farmers, who explained its general incidence in recent years by reference to rainfall fluctuations, but in many cases accounted for its specific appearance on their farms as being due to colonization of neighbouring thickets by the herbaceous weed *Eupatorium odoratum*. These thickets do indeed appear to provide favourable breeding or feeding sites, and many Kabba farmers were anticipating advice which may emerge from studies on the biology and control of *Z. variegatus,* by cutting down *Eupatorium* and, in one or two cases, marking out and digging up egg-laying sites.

Alayi farmers attempted to control *Zonocerus* by catching and eating the insect — a positive expression of the competition between insects and man felt so strongly in a subsistence context. Children appear to be the group benefiting most, implying that the nutritional as well as financial costs of insect control in this part of Nigeria should be carefully examined. As far as this report is concerned, however, the main point is not to emphasize the nutritional value of *Zonocerus* but to stress the importance of ascertaining local perspectives where pest control programmes are being contemplated.

Thus, it appears that the ordinary farmer has much to offer a monitoring programme. By participating, he will be able to express his own views, needs and requirements and should, therefore, become much more closely identified with the overall conservation

and environmental management strategies that African governments are working towards. Further work is needed, however, to find out what happens with environmental problems other than those dealt with here and in different ecological zones. Separation of observation and assessment is also something that has to be examined in order that time lags in processing the information do not lead to the incorporation of out-of-date local assessments in eventual planning strategies. "Drought in 1972" is an empirical observation of continuing value — but acting as if people in 1976 were still worried by it could lead to planning absurdities. Responsiveness to local conditions in a monitoring programme is good, provided it is not out of phase or out of date. (A further technical paper will discuss some of the ways, therefore, in which it may prove possible to separate the strictly empirical content of a farmer's observations from the evaluation and encoding which he applies to this material to meet his own subjective requirements at any given moment.*)

The main conclusions to be stressed are that:

(i) Ecological problems are both localized and changing rapidly in themselves and in their economic significance. The peasant farmer is a good empiricist and can be used to provide early warning information that would otherwise require an expensive and therefore necessarily sparse network of observation posts. His information is to an extent a compound of two elements — empirical evidence and evaluation (*i.e.*, the significance of his data to himself). More attention to methodology may facilitate a separation of these elements, the second then becoming not waste material but essential data for a dialogue between rural folk and planners and administrators.

(ii) On the evidence so far gained, Nigerian farmers faced with ecological hazards stress natural rather than supernatural explanations and these explanations are frequently widely understood and generally accepted within a community. More needs to be known about specific environmental searching, learning and teaching processes — especially about their formal and institutional aspects in African peasant societies — but nevertheless there is little evidence so far that the knowledge which might be input to a monitoring system is tied to economic, educational or social differences. Consensus seems

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* Barker, D., "Some methodological issues in the measurement, analysis and evaluation of peasant farmers' knowledge of their environment". Forthcoming MARC Research Memorandum.

to be quite widespread, and the kind of monitoring system envisaged should, at first sight, work in a non-divisive manner for the benefit of all.

4.2 Practical proposals for incorporating peasant farmers in the monitoring process in Africa

The conclusions drawn in this report indicate the potential value of the peasant farmer's contribution to monitoring. In order to assess this potential — both in terms of feasibility and cost-effectiveness in relation to alternative procedures — it will be necessary to carry out practical experiments in the field. Extensive consultation with potential users will be required before valid testing can begin. Nevertheless, it seems valuable to indicate at this stage the outlines of two possible monitoring "packages". Detailed arrangements would depend very much on local circumstances. The recommendations below are intended for discussion, and are made in the knowledge that similar debates and even practical experiments are being conducted in the related fields of agricultural planning and community development in a number of African countries. The proposals fall into two sections:

(i) those connected with environmental monitoring in the strict sense;
(ii) those involving the broader issues of environmental resource management.

The discussion examines the aims and methods of what we term Direct Problem Reporting (DPR) and then the potential use of community-directed resource management programmes.

4.2.1 *Direct Problem Reporting (DPR)*

4.2.1.1 *Aims*. The basic aim would be to provide, at low cost, an early warning system of the existence, build-up and regional incidence of drought, soil erosion, pests, weeds, flooding and other environmental hazards. Time scales of interest would range from annual surveys to daily real-time reporting of natural disasters.

Evidence provided by farmers in regular social survey situations would constitute *prima facie* justification for commissioning specialist investigations into highlighted problems.

Subsidiary aims would be to provide information about the structure of farmers' perceptions of environmental hazards so that management strategies might be presented to the local community in a meaningful form. By aggregating data for the country or region as a

whole, a generalized "farmer's-eye" picture of environmental problems might be assembled as an input to discussions on national research strategies and priorities. A beneficial spin-off would be to encourage greater interest in, and awareness of, environmental issues at local levels.

4.2.1.2 *Justification.* Since in effect a good agricultural or veterinary extension service or development planning administration operates with the kind of philosophy implied above, it is reasonable to ask why another complicating factor should be added to rural administration. A major justification is to be found in the nature of the sampling procedure. As already shown, the contact between farmers and extension service is biased towards a relatively small group who grow crops of a particular kind or on a sufficient scale to make sustained interaction with the extension service a profitable exercise. Feedback of problems from this group does not necessarily give a reliable picture of the most pressing environmental issues in the community at large. A carefully constructed and regularly administered sample survey is needed both to overcome this kind of bias and to provide a steady flow of information on changing circumstances. There is no reason, of course, why once the sampling procedure and questionnaire designs have been worked out, extension service personnel should not administer the scheme. Such a justification would bring with it specialist back-up and cross-checking techniques for assessing the validity of data which are at present either collected in haphazard ways or not verified at all.

4.2.1.3 *Methods.* The following is an annotated list of methods which could be used:

(i) Initial survey by a specialist team
Each relevant administrative or ecological unit would be visited in turn by a specialist team to prepare a baseline survey of resources, ecology, farming systems, "village science" and current problems.

(ii) Structured tests
On the basis of its initial survey, the specialist team would construct simple questionnaires to be used on a regular basis by local extension staff, as well as a suite of structured tests — sentence completion, repertory grids, specimen recognition, crop-damage assessment

tests, etc. — which could be implemented when specific needs dictate.

(iii) Dictionary writing
This initial stage would also lead to the compilation of a dictionary of local terms and definitions of ecological significance. In some languages, names of plants, insects and soil types are specific to the town or village in question. The identification and systematic recording of local terminology and the investigation of the taxonomic basis of their meanings not only leads to improved communication but often provides information vital to an understanding of local environmental conditions. For example, the literal meaning of Igbo names for *Z. variegatus* often provided information about the insect's habits and habitat.

(iv) Regular questionnaire surveys
These would be the backbone of the reporting system. Regular surveys for a random sample of farmers, perhaps on a quarterly or half-yearly basis, would be used to collect information on farm problems and changing circumstances on the farm. Given standardized procedures for coding, classifying and processing information of this sort, the data would provide a picture of the changing pattern of problems as seen by the farmer. These questionnaires could be administered by local extension staff or community development project workers. New and extensively reported problems, heralding serious environmental difficulties, would warrant further more detailed investigation.

(v) Farmers' forums
Regular meetings of farmers of the kind described earlier in this report might be used to stimulate discussion to bring about the exchange of ideas and to improve awareness of environmental matters.

(vi) Key farmers
Particularly knowledgeable or perceptive farmers might be used as advisers to environmental research programmes. The University of Ife in Nigeria already employs herbalists and *babaláwo* in the investigation of pharmacological properties of local plants and herbal medicines. Expert farmers might be able to make similar contributions to environmental research programmes, especially in the context of soil conservation strategies, working on problems associated

with polyculture, minimum tillage, and mulching, for example.

4.2.2 *A community-directed resource management programme*

4.2.2.1 *Assumptions.* A rural development programme with a strong self-help component and a community-based decision making and administrative framework along the lines of the Tanzanian *ujamaa* (self-help) villages is presupposed.

4.2.2.2 *Aims–*

(i) to establish the use and development of the natural environmental resource-base as a community responsibility;
(ii) to provide "direction from below" for national environmental research programmes.

4.2.2.3 *Justification.* There are complex political and economic issues that make it necessary sometimes to choose between fostering individual initiative and encouraging a more broadly based community approach to development issues. Where a decision has already been taken to make a co-operative approach the key to a country's development programme, environmental monitoring will have to be much more than a simple problem-reporting activity. It will in fact become the means through which the community assumes responsibility for managing a wide range of environmental processes.

4.2.2.4 *Methods.* Some of the techniques described in Section 4.2.1 will still be appropriate. Additional developments along the following lines might be useful, however:

(i) Community resource inventory
It is suggested that all sections of the community should be involved in mapping and recording the land resources of the area. Where appropriate, local concepts and terms should be employed, and soils and vegetation maps should be zoned according to local criteria. Rainfall and river gauging stations could be set up and manned by schools and agricultural co-operatives in the area. In this context it is worth noting that the Nigerian Tobacco Company has had considerable experience in persuading tobacco grower co-operatives to maintain rainfall stations and to make use of the data from them. The result of activities along these lines would be to create village time-series data

files comprising initial inventory and subsequent re-survey material, useful both for planning purposes and as a community educational resource.

(ii) Environmental search and learning procedures and institutions
The procedures and institutions through which the community monitors the environment at present should be carefully studied to determine whether they are adequate for the enhanced role they should play. In some cases, the existing organizational infrastructure will be sufficient but, in other circumstances, innovations will be needed. An environmental management committee comprising extension officers and community development workers, together with expert farmers, herbalists and so on might be one useful line of development.

(iii) Monitoring equipment
Wherever possible, monitoring should be based on simple tests and measuring devices designed and constructed locally. Plant indicator species might be used to monitor soil fertility and rainfall; erosion and hydrological parameters might all be measured on equipment made by local carpenters and tinsmiths, under, say, the general guidance of the secondary school science master. School children should be involved as much as possible in the development and use of such equipment. This approach has been successful elsewhere, *e.g.*, Japan.

(iv) Educational benefits of monitoring
Environmental monitoring of the sort suggested here should be regarded as an exercise in community self-education. Permanent demonstration plots and experiments, relating to bush fallowing and soil erosion, for example, should be set up by the community and used both to generate scientific data and to instruct the young. Ultimately, local school teachers might help prepare relevant textbooks and teaching materials on environmental education on the basis of their experience in community resource management programmes of this sort. Also, a training programme for farmers, designed to encourage and demonstrate the value of making systematic observations and operating simple scientific measuring devices, such as rain gauges, should be established.

4.2.3 *Final comment*

The foregoing suggestions are intended to stimulate discussion. It is quite clear that just as more research is needed into the nature and quality of the villager's environmental knowledge, so it is necessary to carry out detailed assessments of the validity and practicality of the proposals made above. Nevertheless, it is more than likely that many of the problems of the African environment will only find a solution when village folk themselves are fully engaged in the search for answers. Mobilization at village level creates prospects of completely new and far-reaching sets of procedures for conservation of scarce environmental resources.

The urgency of many of the underlying environmental issues and the need for rational planning initiatives is so great that no reasonable alternatives should be left unexplored. It is in this sense, then, that we would like to open up a debate on these prospects for "alternative" approaches to monitoring the African environment; approaches which would parallel and reinforce rather than necessarily replace the major technological initiatives being pursued in orthodox scientific circles.

5.0 Acknowledgements

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Fig. 1 Survey localities in Southern Nigeria

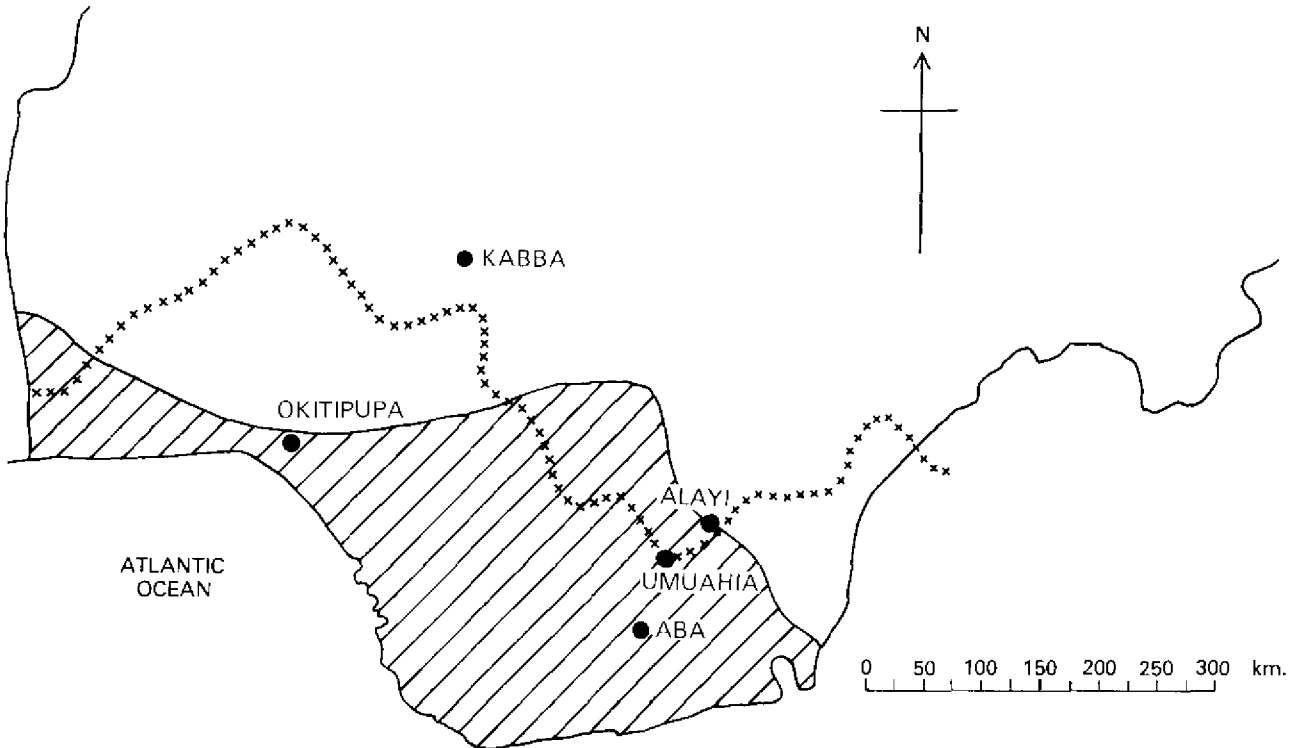

Fig.2 Location of sample settlements in Okitipupa Division