9

The use of complementary methods to understand the dimensions of soil fertility in the hills of Nepal

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• Introduction

Soil fertility in the hills of Nepal has been high on the research and development agenda for many years. Yet quantitative data on the spatial and temporal dynamics of soil fertility are few, and repetitive reports of 'low and declining soil fertility' have little meaning without a reference point. Our study set out to develop a clear understanding of the magnitude and extent of the problem and the underlying reasons for changes in soil fertility.

This paper describes how a variety of research methods were used to explore the complex issue of soil fertility. It also illustrates some of the problems faced in applying PRA by government research institutions with mandates covering large areas. It suggests that the use of conventional surveys and participatory approaches in parallel is one solution to the challenge of achieving 'breadth of coverage' whilst maintaining 'depth and quality of information'.

It is important to distinguish between different levels of participation. In the context of this study, PRA is an appropriate term. In our research, farmers' participation was primarily in the definition and analysis of the 'soil fertility problem', which had been given a high priority by farmers in previous surveys and during extensive interactions with institute staff. It is envisaged that in the follow up to the study, farmers and researchers will work together in the design and implementation of the research.

• Participatory and formal approaches in parallel

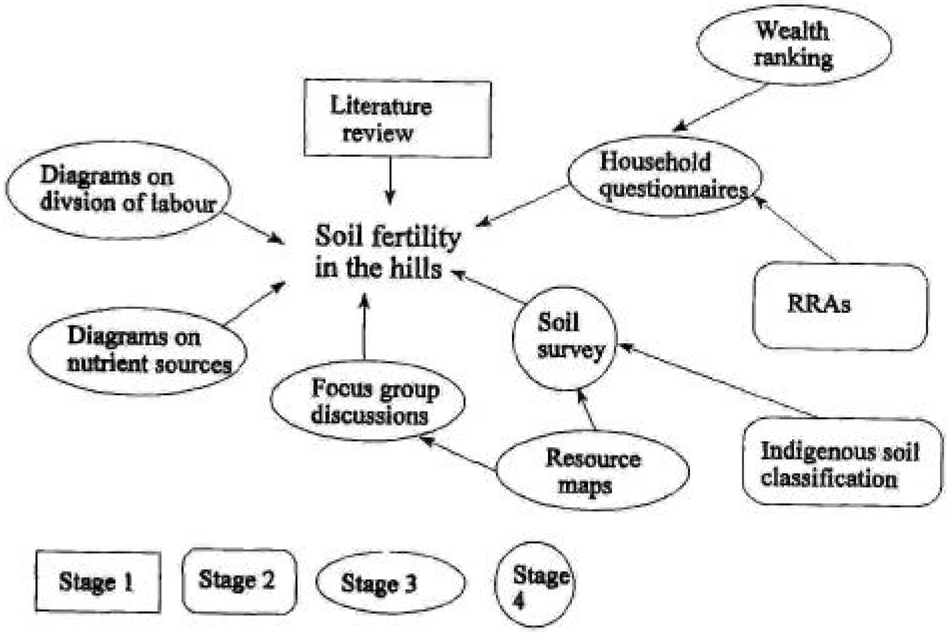
The study covered 13 villages, characterised by a range of bio-physical and socio-economic conditions to which farming systems have adapted. Realising the need for a better quantitative and qualitative understanding of the problem, the multi-disciplinary team of researchers adopted an integrated approach, using a range of methods to build a picture of soil fertility in the hills. The sequencing of methods (see Figure 1) and their likely outcomes were carefully considered in the design of the study.

At the outset, a *Literature review* was carried out to establish the existing state of knowledge. The team then visited a large number of villages and had extensive discussions (guided by a checklist) with groups of farmers. Of particular interest during these initial visits was the type of soils found in each village. These were documented using indigenous classification schemes. On the basis of these initial surveys, 13 villages were selected for more detailed investigation.

Informal group discussions guided by a checklist were held in each of the 13 villages. Farmers began by drawing *maps* to illustrate patterns of resource use and features, such as land type, forest and grazing areas, landslides, gullies, water courses and soil types. Groups which included retired soldiers produced highly detailed and technically sophisticated maps. These maps acted as a focal point for discussions on community forestry and its effect on soil fertility, erosion and changes in the resource base during the past 20 years.

Source: PLA Notes (1997), Issue 28, pp.37–41, IIED London

Figure 1. The sequence of methods adopted in the study



Hill farmers have their own detailed soil classification systems, differentiating soils on the basis of texture and colour. These were used to locate sites for *soil sample collection.*

Many valuable studies on indigenous management practices have been carried out in Nepal, but they have tended to ignore the integrated nature of farmers' management strategies. In any one field, and at any one time, a range of different practices are used together to maintain and improve soil fertility. Farmers were therefore asked to construct *soil fertility management diagrams.* Practices were then listed and one farmer was asked to distribute 20 maize grits amongst them according to their relative importance on *khet* (irrigated) and *bari* (non-irrigated) land. The grits were adjusted until a general consensus was reached. The exercise was repeated to show the importance of different practices 10-15 years previously (see Box 1). In a similar fashion, diagrams showing the relative workloads of men, women and children in different soil management activities were constructed (see Box 2).

BOX 1

SOIL FERTILITY MANAGEMENT IN TALBARI

Seven different practices are used to maintain and improve soil fertility, including:

- Farm Yard Manure (FYM)/compost;
- Terrace slicing;
- Chemical fertiliser;
- Mulches;
- Flood water;
- In-situ manuring; and
- Trash burning.

In Talbari, as in other villages, the importance of different practices has changed over time. There has been a decline in the importance of in-situ manuring and traditional practices (such as green manuring and mulching) and an increase in the use of chemical fertilisers. There is also much variation in management strategies across the hills. In low altitudes, a decline in FYM availability has been compensated for by an increase in the use of chemical fertiliser. In higher altitudes, farmers continue to rely on the traditional practices of in-situ manuring, trash burning and FYM/compost application

Source: PLA Notes (1997), Issue 28, pp.37–41, IIED London

Whilst recognising the value of PRA, many have noted the difficulties of providing the representative quantitative data that are needed for planning purposes using participatory approaches. Such data is essential in the context of a research station such as Lumle Agricultural Research Centre (where this study was based), with a mandate for agricultural research in a wide area, stretching across the eight hill districts that comprise the Western Development Region of Nepal.

Thus, a short questionnaire was designed to collect information on farmers' perceptions of fertility status, the reasons for change and the factors associated with any change in soil fertility. The questionnaire was designed to enable easy statistical analysis. *Wealth ranking* was carried out to ensure that a representative sample of households was selected for survey (see Box 3).

BOX 2

DIVISION OF LABOUR

Soil fertility management practices include:

- Cutting/carrying grass and bedding material
- Cleaning shed
- Carrying and spreading FYM
- Staying/moving goth[1]
- Slicing terrace risers
- Trapping flood water
- Burning trash in field
- Carrying chemical fertiliser
- Applying chemical fertiliser

The majority of tasks are shared between men, women and children, but the degree of involvement varies according to the nature of the work. If the relative importance of management practices is taken into account, women play the primary role as they contribute most of the labour to the most important activity of FYM preparation and application. Consideration of women's knowledge of FYM/compost preparation may improve the relevance and impact of this widely researched topic.

BOX 3

A VALID APPROACH TO WEALTH RANKING?

One limitation of conventional wealth ranking is the relative nature of the grouping process. This leads to problems when it becomes necessary (as in our case) to compare information from different villages. A household placed in the wealthiest category in one village may be placed in the lowest category in another, due to differences in village economic profiles.

To overcome this problem, this study adopted a standardised set of categories. Previous wealth ranking experiences in the hills showed that food sufficiency and pensions paid by British and Indian armies to ex-service men are the most common criteria used to rank households. Key informants were therefore asked to place households into 1 of 3 groups:

- food and/or cash surplus for 12 months or more
- home grown food lasts between 6-12 months
- home grown food sufficient for less that 6 months

The feasibility of adopting a fixed number of pre-defined groups was tested in 3 villages by comparing the results with those from a conventional wealth ranking approach carried out simultaneously by a separate group of informants. A Spearman Rank Correlation was used to test the association between the composition of the 2 groups. High levels of statistical association between these groups were found, indicating that this approach may be a rapid and effective way of classifying households which allows comparisons of households beyond the village level.

• A complex problem

There is are strong and widespread belief among farmers that soil fertility is declining: 61% and 67% of farmers reported a decline on *khet* and *bari* land respectively. Somewhat surprisingly, responses of unchanged or increasing soil fertility were significantly higher from the poorest households. This may be explained by the fact that they have smaller areas of land and thus fertilising resources are spread less thinly. As expected, fewer poorer households apply chemical fertilisers.

1 Tethered animals in temporary sheds which remain in the field depending on feed availability and manuring requirement

Source: PLA Notes (1997), Issue 28, pp.37–41, IIED London

The scale and extent of the problem, the nature of soil fertility decline and the underlying reasons for change differed significantly across the surveyed area. Three broad pictures emerged:

Case 1: In a few villages in low altitude accessible areas, the majority of farmers reported unchanged or increasing soil fertility. However, soil analysis in these villages highlighted critically low levels of organic matter, as well as nitrogen and acidification problems. Management of soil fertility increasingly relies on chemical fertilisers and many traditional practices have disappeared. (see Box 4)

Case 2: In higher altitude/inaccessible areas, the dominant opinion was that soil fertility is declining. Yet, measured soil nutrient levels are higher than for villages in Case 1. From group discussions, several key factors were identified that may account for the perceived decline in soil fertility. These include the deterioration in forest resources and a decline in livestock numbers. These villages do not have access to alternative nutrient sources.

BOX 4
SOIL FERTILITY IN HYANJA

Hyanja is a low altitude village located close to the large town of Pokhara, which provides a market for its agricultural produce. The soils in Hyanja are highly acidic and have lower levels of organic matter than other surveyed villages. This has been related to high crop intensities, low FYM/compost applications and a decline in in-situ manuring. It was somewhat surprising, therefore, to find that 45% and 62% of farmers reported that soil fertility was unchanged or increasing on *khet* and *bari* land respectively. Several reasons may account for the apparent contradiction, the most likely being that the use of chemical fertilisers, which has resulted in increased yields, has disguised an underlying deterioration in soil physical and chemical properties. This was understood by farmers who commented that soils have become hard and dry, and yields fall dramatically without the use of fertiliser.

Case 3: In between these two extremes, the picture from other villages was mixed, although there was a general pattern of low nutrient status and declining soil fertility.

This brief summary of our findings illustrates the complexity of the problem of soil fertility. It is characterised by considerable differences in the nutrient status of soil, perceived changes in soil fertility and variations in the management practices and strategies adopted by farmers in response to increasing pressures.

· Reflections on our approach

The approach adopted by the team ensured that different aspects of soil fertility were systematically explored and enabled direct comparisons of results from different villages. This was an important consideration for Lumle Agricultural Research Centre with a research mandate that covers 8 hill districts. The use of complementary approaches combined the qualitative strengths of PRA with the quantitative benefits of conventional surveys.

Information from the questionnaires on farmers' perceptions of fertility change can be easily incorporated into research planning processes. Although we anticipated at the outset that PRA would contribute qualitative strengths, this was not exclusively the case. For example, the management diagrams constructed by farmers provided quantitative information on the relative importance of different practices.

A key challenge for the future lies in identifying and developing complementary methods and approaches, that enable an optimum balance between qualitative considerations (the extent, depth and nature of farmer participation) and quantitative concerns (breadth of coverage) to be achieved. For example, wealth ranking helped to improve the degree of representation of quantitative information.

An important benefit of the diagrams was that farmers participated in the analysis process. The diagrams showing soil fertility management now and in the past, enabled farmers to identify their constraints and opportunities and revealed the strategies they have adopted as a result of changes in the external environment. The nature of farmers' responses varies widely, from the use of chemical fertilisers to increasing the proportion of leaf litter in FYM. The key point is that responses are highly location specific.

Source: PLA Notes (1997), Issue 28, pp.37–41, IIED London

The diagrams also enabled researchers to appreciate soil fertility management from the farmers' perspective i.e. a continuously evolving system, which is the outcome of a complex decision making process dictated by wider socio-economic and bio-physical circumstances.

The use of local soil classification systems proved to be an effective and rapid way of planning the soil survey. It helped distinguish soils that are important to the farmer and the use of local terms enabled us to communicate clearly and easily with rural people. The major limitation of the indigenous systems is that they are location specific. Soils are classified on the basis of farmers' experiences and consequently, a *chimtay raato maato* (red clay soil) in one village may have quite different properties to that in another. Soil analysis results were valuable in enabling a more objective understanding of different soil types.

This study represented the first phase of a project to improve the prospects for sustained agricultural productivity in the hills. As such, PRA approaches were used in conjunction with other tools in a mainly diagnostic fashion, to enable researchers to gain a clearer understanding of the issue. Lumle Agricultural Research Centre is currently in the process of preparing a research strategy based around integrated nutrient management. This aims to support farmers in their constant efforts to adjust to changes in the resource base. The maps and diagrams form an output which, in conjunction with other tools, such as resource flow models, can be used in the next phase to assist farmers to further analyse their practices, plan improvements and identify opportunities for research.

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