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Measuring agroecosystems properties:adaptation of matrix scoring technique

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This note is based on the adaptation of the matrix scoring technique to investigate local perceptions of agroecosystem properties, namely productivity, stability, sustainability and equity, in a recently concluded PRA workshop in Paiyur for scientists of Tamil Nadu Agricultural University, India.

• Matrix scoring

Variations of matrix rankings and scoring are used to understand farmers' decision-making processes, comparing preferences for different technological options, land use strategies, etc, between individuals and between different groups, and eliciting decision-criteria. However, the efficacy of matrices in discerning long-term performance of farming systems is yet to be explored systematically. We describe a simple, quick and informative method of exploring trade-offs among systems properties in a drought-prone region.

• Sequencing with other techniques

Informal discussions along the transect walk helped us to understand the indigenous classification of the village ecosystem into several micro-environments, such as: *Manal Kollai* (ecological niche with sandy soil), *Semman* (red soil niche), *Kollamedu* (upland), *Pallam* (lowlying region), *Kutta kollai* (a small intensively cropped land), and *Thoppumedu* (upland grove).

Participatory mapping/modelling exercises with different groups of villagers, i.e. children, women and men not only confirmed the local land type classification but also gave us a rationale for land use systems in a drought prone village. Seasonal analysis and probing of risk coping mechanisms provided us with a list of local innovators.

Mrs. and Mr. Marappan have been experimenting successfully to build diversity in their farming systems as a risk-hedging device. Diversity is marked by the wide variation in species choice, planting, cultural and harvesting practices and infinite adaptations to seasonal variations in their 7 plots. Their agroforestry system comprises coconut and cotton, coconut and sugarcane, mango and rice, mango and groundnut, four cattle, and annual crops like blackgram, greengram, lab-lab, Indian finger millet, tomato, chilly, rice, groundnut and sugarcane. Their latest experimentation is on integrating cassava into the system.

Farm profile, resource flow and nutrient flow maps constructed by the couple enabled us to appreciate their resource endowments, physical facilities, enterprise preferences for different plots' access to institutions for resources such as: technological information, mechanical energy, crop seeds and nutrients, credit and markets for disposal of marketable surplus.

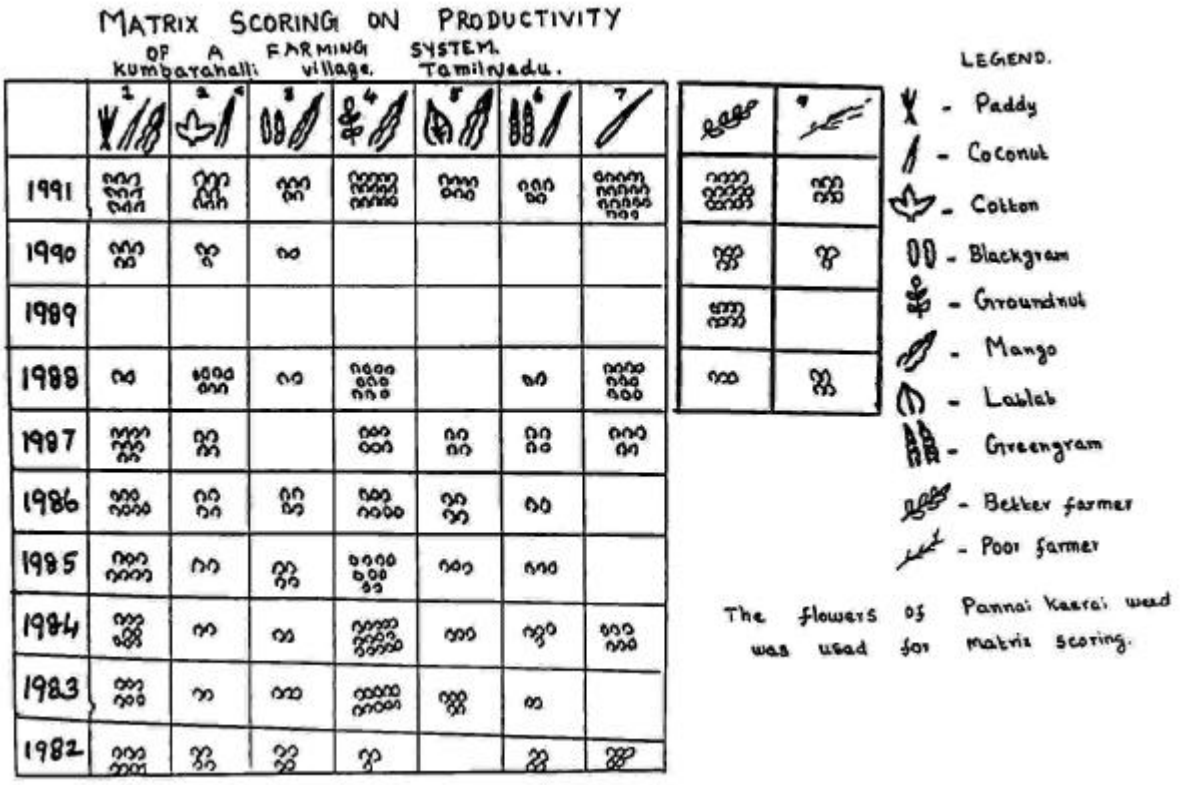
Encouraged by the couple's willingness to share their time in experimenting with various participatory methods, the next day we found ourselves once again on their doorstep. The farm maps were not disturbed. We spent some time trying to understand their views on the virtues and drawbacks of different crops and tree species combination. Subsequently, we tried to assess the long-term performance of crop-tree-livestock systems that the Marappans have developed over the years.

Source: RRA Notes (1993), Issue 17, pp.19–23, IIED London

They used leaves of different crops and trees occupying the plots to form columns that identified the seven plots. Years (written on cards) starting from the most recent to distant past, formed the ten rows. A 7 x 10 matrix was constructed with the help of *rangoli* powder. Flowers of *Pannai keerai* (Celosia argentea Linn.), a widely growing weed of which the leaves are used as spinach, from adjacent fields were collected for scoring productivity in 70 cells.

We were all struck by just how easily the Marappans could fill in the cells, row by row, starting from the immediate past, and the sense of satisfaction that they showed on completion of the scoring. Finally, we asked whether similar scoring can be done for comparable plots of a rich and a poor farmer. Mr. Marappan constructed a new matrix, 2 x 4 this time, and confessed that he could not compare realistically over all the years (Figure 1).

Figure 1



Source: RRA Notes (1993), Issue 17, pp.19–23, IIED London

• Interviewing the matrices

The focus of interviewing shifted to the two matrices now. We continued exploring climate-induced variability, inter-year, inter-plot and inter-farmer, and risk management strategies employed by different groups of farmers. The emerging analyses were as described below.

Preferred tree-crop species combination

- Mango-groundnut combination was preferred over other combinations because it provided consistently a high cash income, except in the worst year.
- Coconut-mango-paddy combination was second in preference because, besides providing rice and coconut for domestic consumption, it also provided marketable surplus of coconut and mango. That is, it combined personal use and income.
- Coconut-cotton was preferred over the other options evaluated because income is quicker.
- Longer gestation period of coconut compelled the Marappans to experiment with several crop combinations both in the earlier stages of life and later after stable yields were obtained. For instance, in 1982 and 1984, in plot no. 7, they successfully grew sugarcane as an intercrop and thereby received higher income.

The farmer family could not reveal preference among mango-blackgram, mango-greengram and coconut-greengram. The annual rainfed crops that combined personal consumption and cash inflow were also vulnerable to climatic fluctuations.

Coconut, though most profitable, is also most vulnerable to drought conditions. It took three years for the palms to recover from the worst drought of 1989. Mango trees proved hardy and withstood the moisture stress.

Inter-year comparisons

The farm family indicated that 1992 was the best year in the past decade. Other good years were: 1984, 1986 and 1988. Marappan recollected that 1975 and 1980 were relatively better years in terms of productivity in the last two decades.

The couple agreed with others that 1989 was the worst year. Villagers remembered this year for the acute shortage of drinking water. None of the seven plots provided any income and the Marappans had to draw on their previous savings. Mrs. Marappan's regular salary as a school teacher stood them in good stead.

1982, 1983 and 1985 were moderate years because the farm family could just meet consumption requirements.

The monsoon behaved erratically in the post-drought year, i.e. 1990. The pre-monsoon rains were timely, but withdrew early. Subsequently, the farmer could not complete sowing of annual crops in all the plots.

Inter-plot comparisons

The farmer preferred trees as the pivotal crop to experiment with alternate farming systems. In three plots each mango and coconut were raised as stand-alone trees, while on one plot both the species were combined. Mango (18 x 18 feet) and coconut (30 x 30 feet) trees have sufficient spacing of experimenting with several intercrops successfully.

Plot 7 (coconut alone) was intercropped with sugarcane in 1982 and 1984. Coconut started fruiting in 1987.

Inter-farmer comparisons

The Marappans identified a relatively well-endowed and a poor farmer with plots comparable to their plot no. 2.

Climatic variability affects all the farmers similarly. But coping mechanisms vary according to the managerial ability. For instance, the better farmer coped with the drought years by relying on off-farm activities. He had a fertilizer distribution outlet among other things. The fertiliser purchase decisions are usually made at the time of sowing and hence he could derive sizeable income even in the worst year. In the post-drought year, i.e. 1990, farmers are known to vigorously pursue

Source: RRA Notes (1993), Issue 17, pp.19–23, IIED London

production maximisation strategy. Initial good rains enabled the fertiliser dealer to off-load significant quantities of nutrients, though early cessation of rains affected his business.

The poorer farmer migrated temporarily to the city as wage-labour during 1989, while the Marappans drew on their savings. However, small scale operation enabled the smaller farmer to cultivate his plot intensively in the post-drought year, i.e. 1990, as compared to the Marappans.

• Sustainability analysis

Matrix scoring and its examination led us to sustainability analysis. The farm family has successfully experimented with diversity in agriculture and food habits. The choice of enterprises portfolio has been influenced by personal use and steady flow of cash income.

Inter-year climatic fluctuations led the farm family to experiment with enterprise combinations with different levels of productivity and availability potential but the flowering and fruiting patterns are significantly affected by the climatic variations. Mango has more stable production.

The tree-tree and tree-crop combinations in the farming systems has enabled the farmer to withstand ecological perturbances. The matrix scoring reveals that the system has a high degree of sustainability. The system returned to its high level of equilibrium in the post-drought years. The enterprise combination has also contributed to the stability of the system. Recognising the high water requirement of coconut palms immediately following the drought, the Marappans efficiently utilised the limited water resources by intercropping tree stands with rice, with a basin irrigation system. Thus the farm family has been able to combine crops with trees as the pivot, synergistically.

The output indicators of the farming systems as indicated by the farm family are: produce from a wide range of crops, trees and livestock; by-products such as, groundnut oil cakes that is used both as cattle feed and manure, tree leaves for feed and manure and the farmyard manure. Most of the by-products are recycled within the farm.

The impact indicators of sustainability emerging from the analysis are: ability to cope with the worst drought without resorting to asset depletion or seasonal migration, ability to generate investible surplus, the relatively good standard of living.

• Final reflections

We experimented with the adaptation of matrix scoring to get a handle on agroecosystem properties with an innovator farm family (wife-husband team). It worked well.

The trade-offs among agroecosystem properties in a given recommendation domain can best be evaluated if similar exercises are conducted with different farm families and groups. Groups have the advantage of providing multiple interpretations of scoring and variations in conflict resolutions through arguments and counter arguments. We also need to test whether mixed groups of women and men from different households would provide better insights to conflict resolution mechanisms.

Sequencing of activities and a relaxed approach to collaborative exploration is a pre-requisite to understand the reasons behind the behaviour of the farm family. It is tempting for professionals to extract information on what *they* think to be important issues. But such behaviour is often counter-productive and does not enable researchers/extentionist to learn from the farmer. Participants, both agriculturalists and professionals, can learn through the scoring and the subsequent discussions. Besides explicit articulation of preferences and criteria, it also enables to check one's assumptions about the farming system's performance.

Scoring of any kind involves implicit weighting. Inter-year, inter-plot and enterprise combination confounds the issue. It warrants further probing.

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