1

"But how does it compare with the real data?"

Gerard J Gill

· Introduction

Every RRA/PRA practitioner or educator must be familiar with this type of question, although as a symptom it was, I believe, first described by Robert Chambers. What is not always clear is the condition of which the question is symptomatic. At one end of a possible spectrum it may simply represent a challenge to RRA methodology, reflecting an understandable sense of unease as to whether this radical departure from conventional methods also signifies a move away from rigour and accuracy. At the other extreme, however, there is a worry that the question is symptomatic of a rather deep and disturbing malaise: an unwillingness to accept as 'real' knowledge the insights and analyses (as distinct from mere primary data provided in response to enumerators' questions) of unschooled rural people.

I recently had the opportunity to address the question in one specific context after an RRA training workshop which our program organised and Robert Chambers and Jimmy Mascarenhas of MYRADA conducted in western Nepal[1]. During an exercise in seasonality diagramming, farmers were asked to describe the normal monthly rainfall pattern of their area by constructing bar charts on the ground with the help of materials readily to hand. As requested, they laid out stones to represent the months of the Nepali calendar (the Bikram Sambat), and then used maize grains to indicate the number of rainy days in each month and straws of different lengths to represent the relative volume of rainfall in each[2].

Lumle Regional Agricultural Research Centre (LRARC) lies about five kilometres from Maramche, the village where this seasonality diagram was constructed[3]. The Centre has reliable daily on-station rainfall (and other meteorological) data stretching back twenty years. This constitutes an invaluable resource for this particular study, permitting, as it does, comparison between the farmer-supplied information on rainfall patterns with scientifically-collected meteorological data. Triangulation through the use of secondary

[1] Jimmy is a Programme Officer with MYRADA, a Bangalore-based voluntary agency which has come to the forefront in developing participatory learning methods in recent years. I am extremely grateful to Jimmy, Robert and the workshop participants for the basic RRA information provided. Lorna Campbell did an excellent job in pulling together much of the information the Workshop generated in the form of a slide-audio training module entitled Participatory Rural Appraisal for Nepal: Concepts and Methods. Any faults or misconceptions in the interpretation of this information are my own responsibility.

[2] Like many other calendars, the Bikram Sambat has twelve months of approximately equal length. The year begins in mid-April, so that months run from mid-month to mid-month in the western calendar. There are 365 days in a year, and provision month is not fixed, but determined each year by astrology: any month can have between 29 and 32 days. This makes for difficulty in comparison with a calendar, such as the western one, which is calculated differently. (There are also local variations in the transliterations and spellings of the months shown in Figure 1).

[3] I wish to record my thanks to Director and staff of LRARC for their unstinting co-operation in both the conduct of the RRA Workshop and the provision of the meteorological data on which this paper is based. LRARC is constituted under Nepal's National Agricultural Research Centre and has been supported since its inception by the UK Overseas Development Administration.

Source: RRA Notes (1991), Issue 14, pp.5–13, IIED London

data is, of course, an established part of the RRA practitioner's tool kit. But seldom can such a rich seam of reliable, detailed and long-term secondary data have been available so close to an area where an RRA exercise has been conducted.

Before beginning to compare these two data sets, however, one fairly basic question must be answered.

· What makes a REAL rainy day?

Since both sets of data record two separate measures of rainfall (volume of rainfall and number of rainy days) it should theoretically be possible to compare both. However, there are practical problems with the latter. In particular, there is the definitional problem of what exactly constitutes a 'rainy day'. According to the LRARC agro-meteorological station (henceforth 'the met. station') figures, even 0.1 mm of rainfall makes a rainy day, but mere breath of moisture such as this will scarcely impinge upon human consciousness. Yet any other dividing line will inevitably be arbitrary and open to challenge.

Even if this difficulty could be overcome to general satisfaction, there is another problem: seasonal variation in perceptions. Rain, like all other phenomena, is inevitably viewed by people (as distinct from instruments) within a subjective frame of reference. In this particular case, the same person may perceive x millimetres of rain as a 'rainy day' during the dry season (because it is unusually wet for that time of year), but as a 'dry day' during the rainy season (because it is unusually dry for that season), so that cross-seasonal comparisons are problematic. In view of this it was decided to concentrate the present analysis on volume of rainfall only.

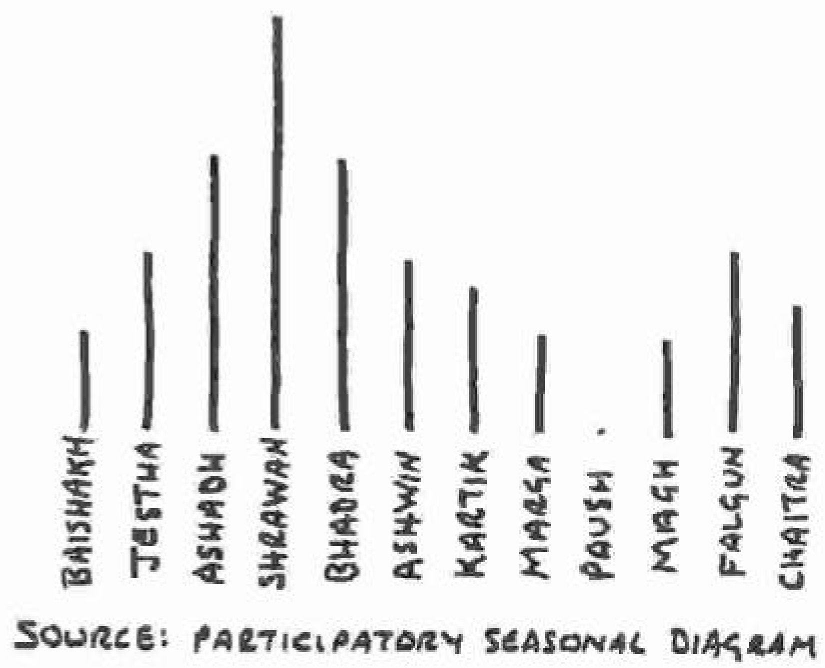
· What is the REAL rainfall pattern?

Figure 1 presents the farmers' perception of the 'normal' pattern of monthly rainfall volume. This was made by sketching on graph paper the pattern of straws which they laid out on the ground to represent volume of rainfall in each month. Figure 2 shows the means of monthly rainfall recorded at the met. station over the twenty-year period preceding the study. In this second diagram the year has been arranged to run from April to April in order to synchronize it as far as possible with the months of the Nepali year used by the farmers. Moreover the same horizontal is used on both diagrams, and the months on Figure 1 have been aligned with the gaps between the months in Figure 2 (since the months on Bikram Sambat run from mid-month to mid-month on the Western calendar), so that direct 'eyeball' comparisons should be relatively easy. In the case of the vertical scales, although the met. station data are reported in absolute values (mm), it is obviously possible for the eye to interpret these figures in purely relative terms, and so further facilitate comparison with Figure 1.

This comparison is intriguing. The figures on the main, monsoonal, rainfall period (June to September) are broadly consistent, something that can be seen despite remaining synchronization problems arising from the different timing of months in the two calendars. Certainly if the met. station data can be said to represent objective reality, the farmers' data are close enough to this for all practical (agricultural) purposes. In contrast with this, the situation in the late winter/early springtime period is obviously very different, with the farmers' secondary peak sticking up like some minor Himalayan pinnacle above the gently rising lowlands of the met. station figures. The remainder of this paper will largely concentrate on this winter/spring season, particularly the month of Falgun, in which the farmers placed the apex of the secondary peak, and, as a context for this, the two months on either side of it, Magh and Chaitra. Some attention will also be paid to the month of Paush, which precedes this trimester, for the reasons that will be explained later.

Source: RRA Notes (1991), Issue 14, pp.5–13, IIED London

Figure 1. Farmers' 'normal' monthly rainfall pattern



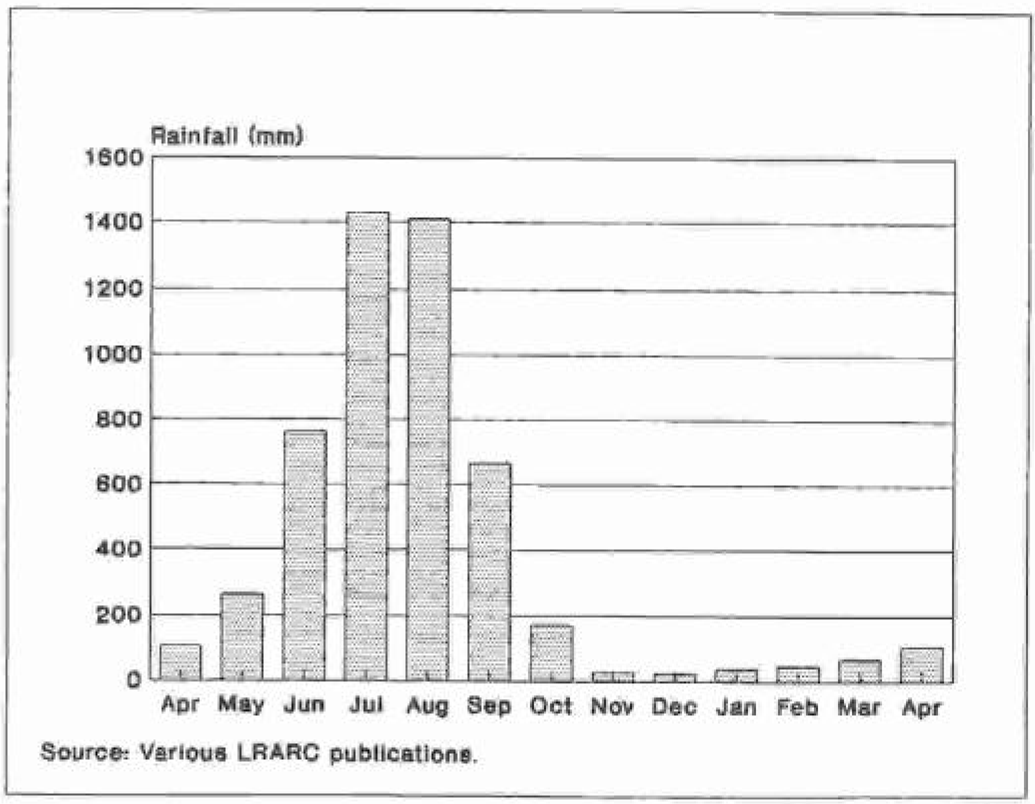
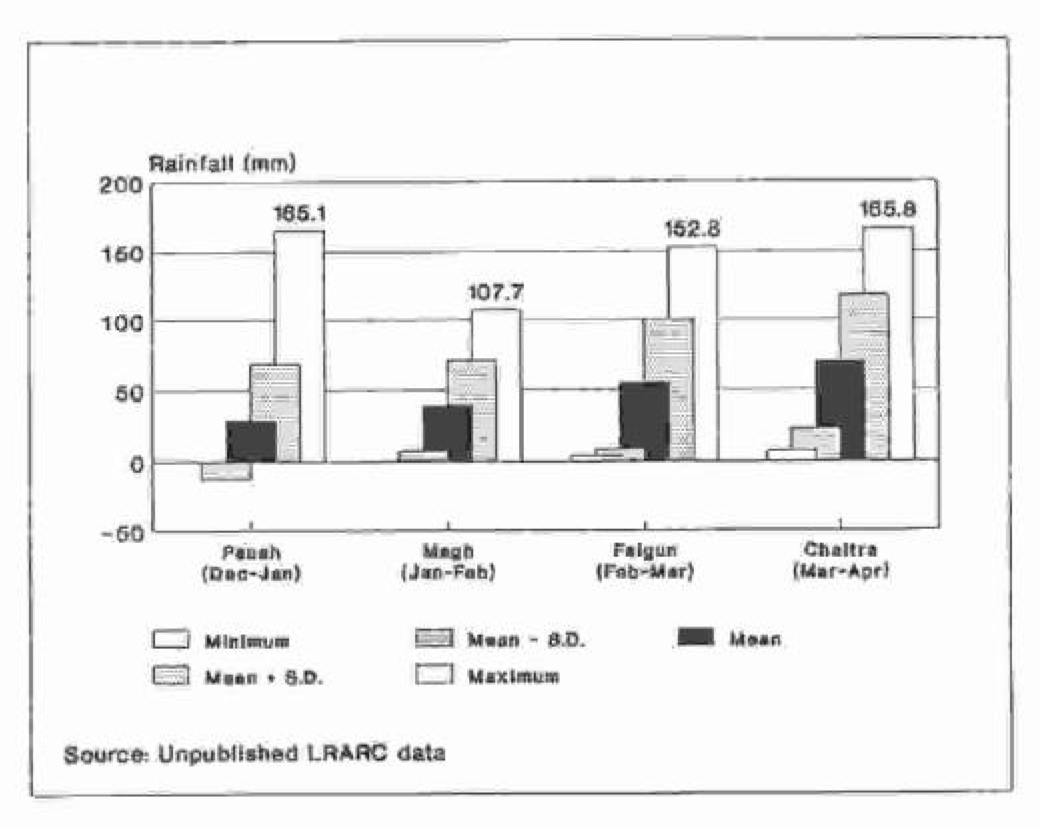


Figure 2. Met. Station's mean monthly rainfall figures (1970-1989)

Figure 3. Monthly rainfall at Lumle, Paush to Chaitra 1970-1990



As a first piece of rough-and-ready triangulation, scientists at LRARC and at the Institute of Forestry in the nearby town of Pokhara were asked whether the basic rainfall distribution of their area was unimodal or bimodal. Every one replied that it was bimodal. Some added that this was what allowed the farmers to take a crop of spring maize. They were therefore intrigued to be shown the above diagrams and to learn that the 'real' data contradict their, as well as the farmers', perceptions.

The first step in the proper analysis was obviously to get rid of the complication of having to use two different calendars. This was done by going back to the Centre's unpublished daily rainfall data and re-aggregating these in accordance with the months of the Bikram Sambat. Figure 3 shows the results. Note that in terms of monthly means, the re-aggregation does nothing to upset the pattern shown in Figure 2, namely one of slowly rising monthly figures from December to April with no sign of a secondary peak. The other statistics in Figure 3, however, show that these overall averages hide a great deal of year-to-year variability. In one case, the month of Paush, the standard deviation (S.D.) is actually greater than the mean (hence the one silly-looking negative value), while in the other months, mean and standard deviation are nearly equal. The minimum-maximum ranges are correspondingly large. This is particularly true of Paush, whose huge maximum value springs from the fact that the two heaviest daily rainfall levels ever recorded in Paush occurred in the same year.

Turning to the main period of investigation, the Magh-Falgun trimester, the daily rainfall data (Figure 4) indicate not only the extent of intra-year variability in monthly rainfall distribution (note the differences in scale comparing the four segments of this figure), but also the fact that (a) the timing of rainfall within a month shows no very obvious pattern, and (b) the relative raininess of the three months of the trimester varies very significantly from year to year. This last point can be seen rather more clearly when the daily data are aggregated into monthly totals, as in Figure 5.

Figure 4. Daily rainfall at Lumle, Magh-Chaitra

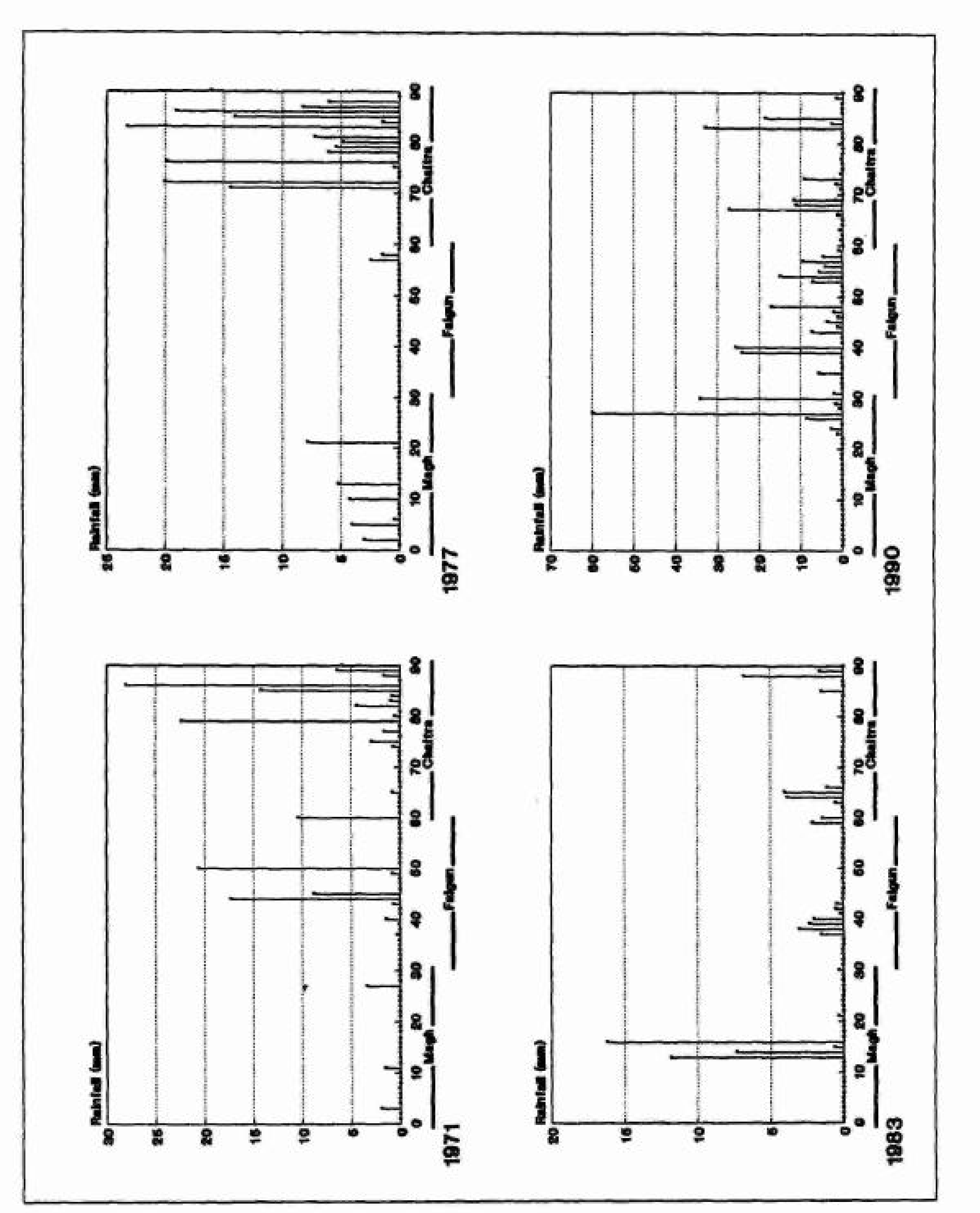
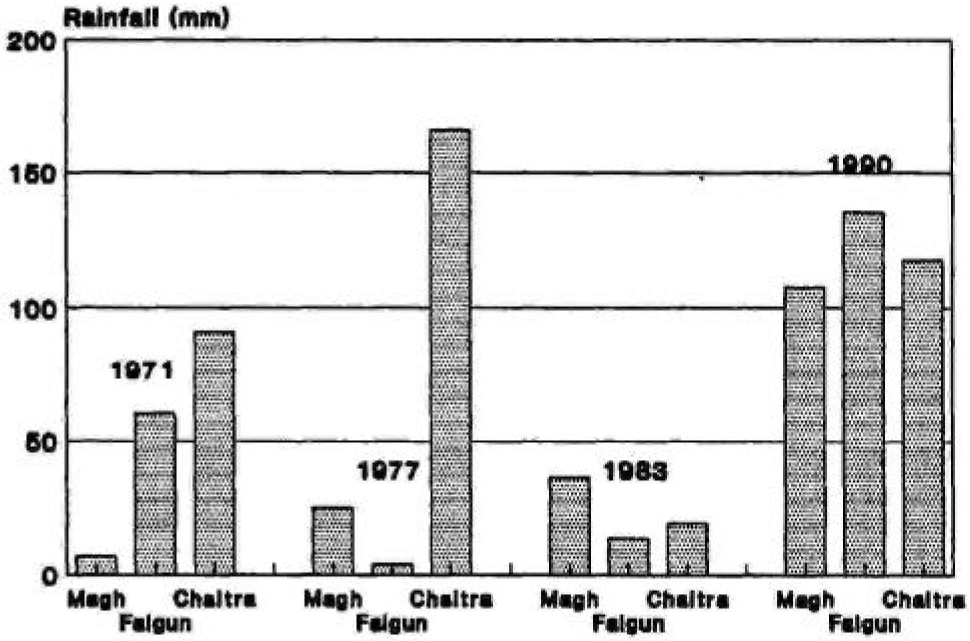


Figure 5. Examples of four basic trimestral rainfall patterns at Lumle
Source: unpublished LRARC data



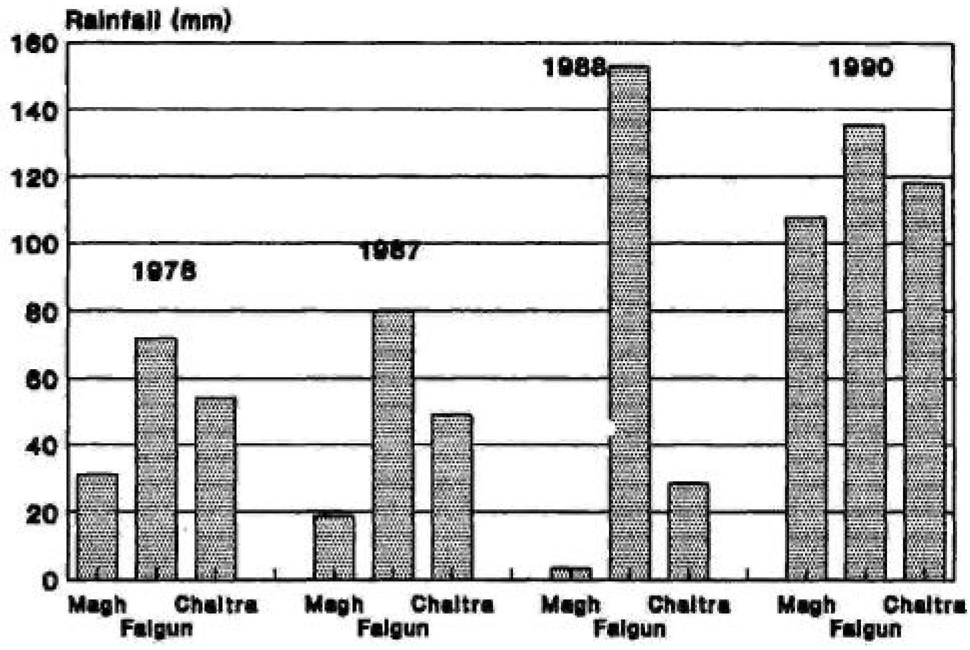


Figure 6. Inter-year variation within the same trimestral rainfall pattern
Source: unpublished LRARC data

In view of space limitations, the figures for only four years have been presented in these last two diagrams, but these are not unrepresentative of trimestral rainfall distribution across the other sixteen years. The four that were chosen were selected because they illustrate four of the most common patterns that were found. (A 'pattern' here is identified in the same (relative) terms that farmers were asked to use to identify them. Thus, for example, the 1971 pattern is that rainfall in Chaitra exceeds that in Falgun, which exceeds that in Magh. In shorthand form: {Chaitra > Falgun > Magh}).

In addition to variation between basic trimestral patterns, there is also considerable variation in relative volumes of rainfall within years having the same pattern. This is illustrated in Figure 6, which looks at four years conforming to the pattern {Falgun > Chaitra > Magh} - the one reported by the farmers as being the 'normal' one. In 1988 the Falgun peak is extremely marked, in 1990 it is relatively small, while in the other two years it is moderately pronounced. This again illustrates the complexity of the data set we are dealing with and the difficulty facing farmers (or anyone else) attempting to summarise it within a two-dimensional construct.

When the daily data for all twenty years are aggregated by year and by month, six patterns emerge, as shown in Table 1.

Looked at in this light, one begins to see a possible explanation for the apparent discrepancy between the farmers' data and those of the met. station: each series uses a different measure of central tendency when summarising the underlying frequency distribution. Both are equally legitimate, though. The met. station reports, in giving the arithmetic mean, present the most familiar of these measures. The mean has considerable merits as a summary statistic, but it is also a purely abstract measure of central tendency and need not necessarily occur in any year in a given time series.

It would therefore be misleading to describe the mean as being in any sense 'normal' or 'typical' of the series. The best measure of 'normality' or 'typicality' is the mode, i.e. the most frequently-occurring single value, or set of values, in the distribution. The above table shows that there is a tie for mode in the series in question, with two patterns each occurring six times over the twenty years. But why have the farmers chosen pattern (1) rather than (2), since both are equally common over the period?

Of course as far as the farmers' perceptions are concerned twenty years is a quite arbitrary figure - simply the period for which met. station figures are available. The farmers' time horizon(s) may be longer or shorter than this. Given the variability and complexity of the actual year-to-year, month-to-month and day-to-day figures, however, it is difficult to believe that farmers really remember patterns longer than twenty years ago. Or, if they do have some recollection of them, it is hard to believe that these memories figure as prominently as more recent ones in the intuitive calculations that must lie behind the farmers' reports of what is 'normal' or 'typical'. If we look at the years in which the two modal patterns occurred over the past twenty years, the picture is as shown in Table 2.

Table 1. Six basic spring rainfall patterns at Lumle

Pattern	Frequency
1. (Falgun > Chaitra > Magh)	6 occurrences*
2. (Chaitra > Magh > Falgun)	6 occurrences
3. (Magh > Chaitra > Falgun)	3 occurrences
4. (Chaitra > Falgun > Magh)	2 occurrences
5. (Falgun > Magh > Chaitra)	2 occurrences
6. (Magh > Falgun > Chaitra)	1 occurrences

* Pattern reported by the farmers

Table 2. Occurrences of the two modal spring rainfall patterns at Lumle

Pattern	Years
(Falgun > Chaitra > Magh)	1970, 78, 87, 88, 89, 90*
(Chaitra > Magh > Falgun)	1974, 77, 79, 81, 84, 85

*Pattern reported by the farmers

Here, then lies the most convincing explanation of the apparent discrepancy between met. station figures and those reported by the farmers. The pattern reported by the farmers as 'normal', occurred not only in the year of the study (which was conducted in the middle of Baisakh, the month after Chaitra) but also in each of the three preceding years, whereas the other 20-year modal pattern has not surfaced since 1985.

One last point has to be addressed before leaving this section, namely the large discrepancy in the relative size of the two rainfall peaks, comparing the farmers' diagram with the met. station data. While the former shows the late winter/early spring peak as being just under half the level of the monsoon peak, the latter figures show that, even in the year of heaviest falgun rainfall over the twenty-year period, the volume of rain in that month was only a tenth of that in the peak monsoon month, Shrawan.

Again one has to understand such an apparent discrepancy in context, for no-one in their right mind would seriously suggest that winter/spring rainfall patterns could approach summer levels in a monsoonal climate like Nepal's. It was suggested earlier that rainfall is viewed by people within a particular, subjective, frame of reference. While the met. station figures show rainfall as a purely meteorological phenomenon, farmers undoubtedly view it in relation to agriculture. The monsoon crop is paddy, a very water-demanding, flood-tolerant crop. In the winter-spring season, however, cropping patterns are dominated by crops like wheat, maize, buckwheat and mustard, all of which have much lower moisture requirements than paddy. If, therefore, one interprets the farmers' diagram in terms of adequacy of rainfall for agricultural purposes, the relative size of the two peaks in Figure 1 becomes readily understandable.

· Is there a REAL longer-term pattern?

At least as far as formal scientific investigation is concerned, James Rennell, eminent geographer of his day, first Surveyor General of Bengal, author of A Bengal Atlas (1779) and Memoir of a Map of Hindoostan (1783), was probably the first person to try to discern long-term patterns in the macro-climatic conditions of South Asia. At about the same time as he published the above seminal works, Rennell investigated a hypothesised relationship between annual rainfall cycles and the occurrence of sunspots. He did so in the hope of being able to forecast likely famine conditions in Bengal, but was disappointed, as others have been since. Efforts still continue to try to identify forecastable climatic patterns in the subcontinent, for similarly useful and laudable ends, but without any definitive conclusions having been reached.

It may come as a surprise, therefore, to learn that the farmers of Maramche village in the hills of western Nepal claim they can discern a cyclical pattern in the climate of their own area. They reported that once in five years the pattern was different from that shown in Figure 1. In these atypical years, they reported, there can be both rain and snow in month of Magh, and a considerable amount of rain in the month of Paush (compared to none in a normal year)[4]. Unfortunately the available met. station data do not include snowfall, so it is not possible to validate this part of the claim. This validation can be attempted only for the rainfall figures for Paush.

[4] The area lies at a latitude 28 18' North and an altitude of 1, 642 metres (5,387 feet) above sea level, so that there is a pronounced winter season and a distinct possibility of snow during it.

Figure 7 shows Paush rainfall levels, as recorded by the met. station, over the past twenty years. First, as regards the farmers' assertion that there is no rainfall in a 'normal' (for which again read 'modal') Paush, the met. station data substantiate this. In six of the twenty years no rainfall was recorded in Paush, while in at least five other years the level was so low it can be dismissed as insignificant.

As an aid to investigating the more important claim that there is a once-in-five-years pattern of heavy Paush rainfall, Figure 8 re-arranges these same data in ascending order of volume so as to make it easier to recognize any natural 'breaks' in the time series. Two such 'breaks' seem to manifest themselves. The most obvious is that between the highest year, 1988-89, and all the others. This will be examined at later. The other 'break' is that between the 43 and 66mm levels. This represents a 'jump' of 23mm, which compares with the next-highest 'jump' of only 9mm. Using a figure within this 43-66mm range - say the 50 mm level - as the dividing line between a heavy rainfall Paush and a light rainfall Paush would indeed give a picture of one year in five having abnormally heavy Paush rainfall, but such a rainfall level does not occur with any degree of regularity over the two decades. It would, of course, be foolish to expect anything like clockwork regularity in such patterns. All that one could reasonably expect would be a reasonably accurate statement of general tendencies. The question is whether there is sufficient regularity in the 'real' data for a thoughtful person to discern a pattern in a distribution such as that of Figure 7.

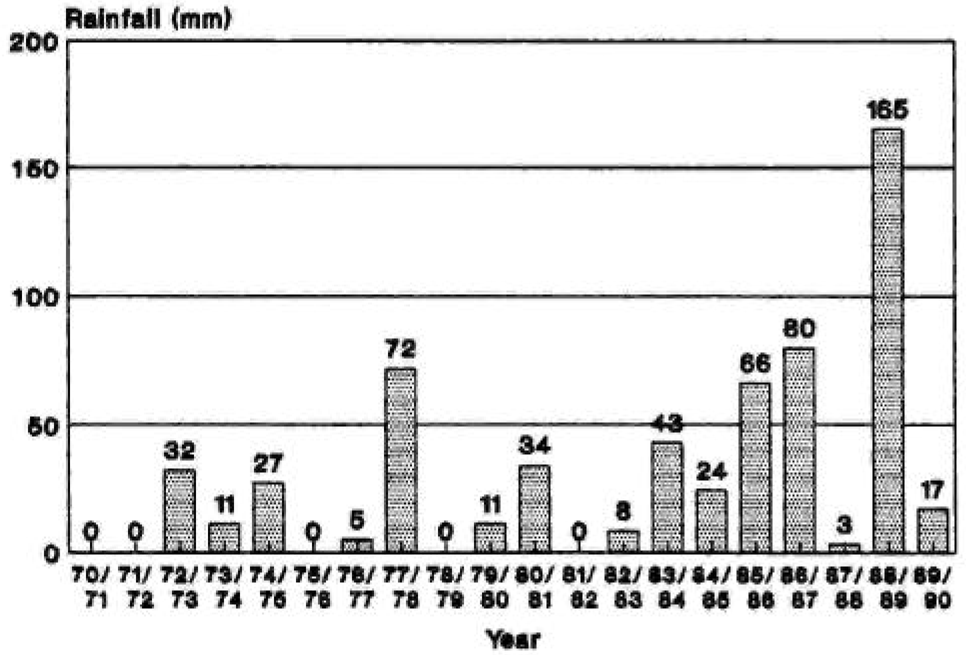
Several points should be made at this juncture. First the information given by the farmers on the 'normal' year has held up very well under examination, even when at first sight it appeared to be completely at odds with the met. station data. Second, the information about the once-in-five-years pattern was volunteered: no-one asked about patterns over a period longer than a year, or about anything other than a 'normal' year. A question that should be asked here, therefore, is whether a group of farmers, having put considerable effort into providing credible information about rainfall patterns in a 'normal' year would suddenly leap into the realm of fantasy and start making up stories about 'abnormal' years.

One way of looking at the data in Figure 7 might be to forget about 'natural breaks' and look instead at Paush rainfall figures over successive triennial periods during the two decades for which met. station data are available, looking for periods in which two dry Paushs 'sandwich' an unusually wet one. Several such triene can be seen - although, of course they do not occur exactly every five years. The most pronounced such period, also the recentmost one, is that spanning the period 1987/88 to 1989/90, when the twenty-year maximum in Paush rainfall was 'sandwiched' between two fairly dry ones. This again may be a question of perspective, with recent events tending to overshadow more distant ones.

All of the above, unfortunately, must remain in the realm of speculation. Had snowfall data been available from the met. station, one could have tested for a statistically significant association between the occurrence of snow in month of Magh and volume of rainfall in Paush. It will be a fascinating exercise now to go back to the farmers, armed with the results of the above analysis, and probe more deeply into the perceptions it seems to have uncovered - particularly those regarding the perceived once-in-five-year pattern. Such an iterative process is, of course, a crucial part of RRA. Unfortunately, in the absence of scientifically-collected data on snowfall, such iteration, while constituting a valid part of the continuing RRA process, will not serve the purposes of the present exercise.

Figure 7. Paush (mid Dec – mid Jan). Rainfall al Lumle, 1989/90

Source: unpublished LRARC data



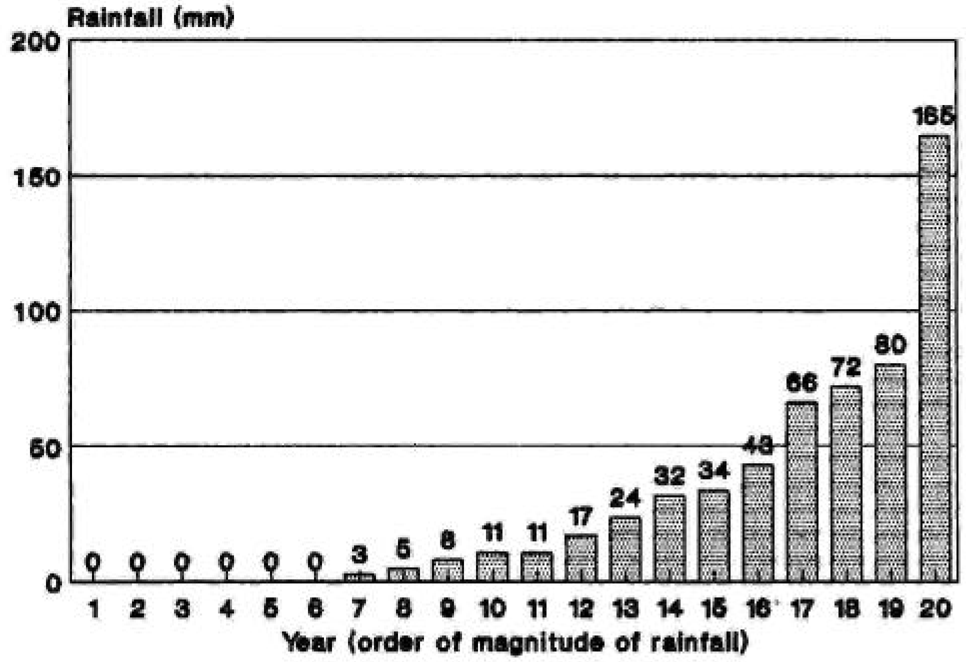


Figure 8. Paush (mid Dec – mid Jan). Rainfall at Lumle, 1970/71 – 1989/90

· Conclusions

Returning to the question with which this paper opened, it can surely be said that, insofar as scientifically-collected rainfall statistics represent the 'real' data, then the information supplied by Maramche farmers represents a remarkably good approximation. The 'goodness of fit' between the two sets of aggregates is all the more remarkable when the following points are taken into consideration.

First, the techniques of constructing seasonal rainfall diagrams were explained to the farmers, and the information they provided subsequently recorded, not by people skilled or experienced RRA techniques, but by trainees on their first practical field exercise after only a few days of participation in the classroom. Had the exercise been initiated by those more familiar with RRA concepts and procedures, and had it been followed up by iterative and interactive cross-checking in accordance with standard RRA practice, there is little doubt that the goodness of fit between the rainfall patterns described by the farmers and that derived from the met. station data would have been greater, and that at least some of the remaining (and relatively minor) apparent discrepancies between the two data sets reconciled.

A second point regards the nature of the variable itself. Climate is an extremely complex phenomenon and people are notoriously bad at recognizing long-term patterns - or even at remembering trends or specific events - in it with any degree of accuracy. How many readers (all of course highly educated) would care to challenge this assertion by drawing a diagram similar to Figure 1 for their own area of residence and then putting their perceptions to the test by comparing them to twenty years of daily rainfall figures from the local met. station? Farmers, of course, have a much greater incentive than most to overcome this natural handicap of our species, but the degree of success with which they seem to have recognized patterns within such a highly variable and complex phenomenon is still extremely impressive. If unschooled Third World farmers have developed the analytical and communication skills to do something as complicated as this, then one can presumably trust them to understand and accurately report on the many simpler systems that also lie within their experience and knowledge.

Finally, the met. station data took twenty years to collect and must have cost a tidy sum in terms of equipment, supplies and personnel. The information the farmers gave maybe took as long to amass and analyse, but it took a matter of only forty-five minutes to present, and cost very little in terms of outside resources. To make this comparison is not, of course, to suggest that agricultural research stations should abandon the rigorous collection of accurate long-term agro-climatological data and start fiddling about with bits of straw and maize grains instead! Accurate and highly detailed meteorological data form a vital input into many of the experiments in which such stations are engaged, but this level of precision is not needed for all research purposes. Where a high degree of comprehensiveness and accuracy is not necessary, to attempt to achieve it represents a misallocation of resources that could otherwise either have been saved, or used much more cost-effectively doing other things.

In this particular case, the seasonal rainfall diagram is most likely to be needed as a frame of reference for a discussion of the problem of seasonality (it having been demonstrated by many researchers that the problem of seasonal deprivation tends to peak during the rainy season)[5]. By 'stacking' monthly information on other seasonally-sensitive variables (like indebtedness, food in store, incidence of disease, temporary migration, employment, workloads, etc) under the rainfall diagram, the participants could quickly begin to home in on crucial times of year and critical seasonal problems as a prelude to identifying the most effective type, level and timings of interventions. For such purposes, a level of

[5] For a discussion of the seasonality problem, see for example, Chambers, R. Longhurst, R and Pacey, A (editors): Seasonal Dimensions to Rural Poverty. Frances Pinter (Publishers), London; and Gill, G. J. Seasonality and Agriculture in the Developing World: A Problem of the Poor and Powerless. Cambridge University Press, Cambridge, 1991.

Source: RRA Notes (1991), Issue 14, pp.5–13, IIED London

precision equal to that of Figure 1 above would be perfectly adequate.

- **Gerard J Gill,** Winrock International Institute for Agricultural Development, PO Box 1312, Kathmandu, Nepal

NOTES

Gerard J Gill: Program Leader, Policy Analysis in Agriculture and Related Resource Management Program, His Majesty's Government of Nepal/Winrock International Institute of Agricultural Development. The usual disclaimers apply.

Source: RRA Notes (1991), Issue 14, pp.5–13, IIED London