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REGIONAL DIFFERENTIATION IN
INDIA'S RURAL ECONOMY
A Statistical Analysis

I I R - DISCUSSION 24   1985

1. Basis and Purpose of this Paper

India's economy is still predominantly rural. In 1981 almost 75 percent of the population lived in rural areas [1] and the agricultural sector alone contributed nearly 40 percent of the net national product and provided livelihood to 60 percent of the total workforce.[2] Although the rural scene is being researched intensively at all spatial levels the question of structural differentiation of the rural economy has hardly been touched upon on a nation-wide scale.

All kinds of investigations in this direction had to be confined to the state level for the simple reason that a nation-wide comparable data base covering the whole country compiled on the basis of divisions below the state level did not exist. Any attempt at a regional differentiation at the state level was severely constrained by the fact that structural similarities undoubtedly cut across state borders, thus using the states as basic spatial units any further reduction in the number of these units would result in enormously extensive areas rendering the very purpose of the investigation meaningless. The work of Pranab Bardhan, Professor of Economics at the University of California in Berkeley, well known for his studies of rural development problems in India, provides an escape from that constraint. He has compiled a fairly big amount of data at the level of regions as they are being used by the National Sample Survey Organisation of India.[3] In fact, over the years a substantial amount of data has been accumulated on the sub-state level, although widely scattered among various sources.

The 58 agro-climatic regions used in this analysis constitute a subdivision of the whole of India for the purpose of the surveys carried out by the NSSO. They consist of groups of districts with similar population density and crop pattern. On the average a cluster of 4 to 5 homogeneous districts form a region. Most of

1

the demographic and agricultural data were available at the district level. On the other hand, estimates of the economic and institutional variables were only available at the regional level. Therefore, Bardhan computed regional averages of district level data (weighted averages when weights were available and simple averages when they were not) to make them comparable with the regional estimates by the NSS and the Reserve Bank. Bardhan has compiled data on 47 variables of the rural economy on the basis of the NSS-Regions from numerous sources [4] and has published the whole set of data recently.[5]

As a result a considerable base of fairly reliable data is available on the sub-state level. Although the NSS-Regions are in most cases still very big by any European standard (particularly in terms of population) the increase in spatial disaggregation is substantial. On the average there are 3,2 NSS-Regions to a state.

Bardhan's main purpose in analysing this set of data was to carry out some multiple regression exercises in order to explain regional cross-section variations of some important variables, like average male rate of earning per day, proportion of farm wage labour in the total rural work force, percentage of rural population in poverty.

The purpose of this paper, however, is purely descriptive. Starting from the fact, acknowledged by all scholars working in the field of rural development in India, that there exists a substantial regional variation in the rural economy, this paper attempts at identifying by means of statistical analysis a number of regional taxa which represent the greatest possible degree of separateness. This attempt is being carried out exclusively on the basis of the data published by Bardhan. The resulting spatial units can be considered as areas with a certain degree of specificity in the structure of the rural economy. Differences in that structure would imply that growth conditions for different structural units also differ and answers to specific problems may

2

demand special measures to deal with them effectively. Again, that would mean that there exists a theoretical body to explain the functioning of such diversified units which, we think, does not. But a differentiation of the kind attempted here provides a somewhat clearer structural basis for any regional approach to the problem of rural development for the whole country since it cuts across state boundaries. It may also help getting a better understanding of the broader framework of studies at lower spatial levels. But there is of course one major limitation to such investigations: they come from one particular set of data which by itself constrains the scope of the possible insights. The set of data used, however, represents considerable complexity and as the results may indicate, provides a fairly broad scope for interpretation.

Nevertheless it should be emphasized from the outset that we are fully aware of the problem given by the static nature of the exercise and that the identification of "separate" units obscures the very important fact that substantial interrelations exist between such units influencing significantly the processes operating within them. One other aspect has also to be borne in mind, that is the fact that the data concern only the early 1970s. This is due to the non-availability of a comparable set of data for more recent periods, and hence permits largely only a "historical" analysis. The different kinds of objections notwithstanding, however valid they may be, the investigations into the regional differences of the rural economy in structural terms in India can prove useful for the better understanding of specific conditions and constraints for the further development in the respective areas. It may also help in changing approaches to regional problems in different parts of the country.

2. Formal Procedure

This study starts from the assumption that different types of rural economies exist in India and that these can be identified sufficiently with the use of the available set of data. The nature of the problem therefore, is basically the one of finding a typology of rural economic structure which is expressing itself in a number of units which is smaller than the number of the 58 basic units, the NSS-Regions. The task is to create entities in such a way that these units constitute homogeneous groups. Statistical methods solving this kind of problems are known as cluster analysis.

Cluster analysis, like almost any other statistical method has to fulfill the task of reducing the amount of information incorporated in a set of data. In the case of homogeneous regional taxonomic problems this is being accomplished by the determination of a (sub)optimal partition of the set of spatial units into a smaller number of disjoint and non-empty subsets in a way that "the individual regional taxa are as homogeneous in the attribute space as possible (Principle of Internal Homogeneity) and/or that different regional taxa are as much apart in the attribute space as possible (Principle of External Separation)" [6].

All cluster analysis studies are characterized by a sequence of basic steps among which the following are the most important [7]: definition of a set of variables; computation of what are conventionally called similarities and the use of a cluster analysis method to create groups of similar entities.

The selection of variables is a critical step in the research process since it controls not only the substance of the regionalization process but has also a bearing on the choice of the similarity coefficient and the selection of an adequate regional taxonomic strategy [8]. The set of variables used in this analysis characterizes different aspects of the rural economy and society in India (see list of variables). The list of variables published

4

by Bardhan comprised 47 attributes of rural areas. These exclude all "urban" areas, which are defined by the 1971 Census as (1) having a minimum population of 5.000 inhabitants, (2) more than 75 percent of the male working population engaged in non-agricultural activities, (3) a population density of at least 1000 per square mile and (4) distinct urban characteristics. Other settlements which are municipalities, cooporations or cantonments are also classified as urban [9]. In other words, the variables refer to all territories in India which are not explicitly defined "urban".

Since the methodological procedure requires that the variables should not be correlated, at least as an approximation, a correlation matrix of all 47 variables was computed and all cases of strongly correlated variables (r > 0,6) were eliminated, thus reducing the number of variables to 35. In the case of two variables their levels were not available for a larger number of regions and hence it was not possible to reconstruct them. These variables also had to be eliminated reducing the total number to 33. In a few cases the levels of attributes were not available for a small number of regions. This problem was solved pragmatically, as widely practiced [10], by constructing simple averages of the variables concerned from the geographically surrounding comparable areas.

The set of variables employed in the analysis is related to a broad spectrum of the rural economy and society. Variable 1 (the number refers to the one indicated in the list of variables) is a structural indicator representing the relative importance of the non-agricultural sector in the area. Variables 2-5 characterize broadly the property relations in agriculture. Variables 6-10 indicate the level of technological development in the agricultural production process and the intensity of cultivation. Variables 11-13 are related to dynamic aspects of the process and its results. Variables 14-19 are indicative of the economic situation

5

of the rural population. Variables 20-27 represent different aspects of the social structure of rural society. Variables 28-33 characterize natural and geographical conditions of the agricultural production process and the rural areas. The choice of the variables is largely determined by the assumption that there exist specific relationships between these different groups of variables which can be interpreted differently in the individual homogeneous clusters. That means that different hypotheses about the rural development process or different interpretations of its structure can be deducted from the data within each cluster.

The next important step is the determination of the similarity measure adopted in the analysis. Here a distance mesure was employed, using Euclidean distance. Technically this is a dissimilarity measure [11]. Two cases are identical if each one is described by variables with the same magnitude, that means, when the distance in Euclidean space is zero. The Euclidean metric is used, because it makes the best use of the given information in the data matrix compared to other similarity measures [12].

With respect to the taxonomic strategy, that is the use of a cluster analysis method to create groups of similar entities, two basic approaches can be distinguished: Hierarchical and non-hierarchical methods.

Hierarchical (agglomerative) methods have been widely used for solving taxonomic problems. They implicitely optimize a dendogram of basic spatial units (in our case the NSS-Regions) and, generally, do not arrive at optimal partitions[13], that means they produce partitions based on a hierarchy of clusters. Additionally, they cannot be applied to large sets of data. These methods are, therefore, methodically inadequate for solving basically non-hierarchical problems.

The second group of methods, non-hierarchical or iterative partitioning methods, have not been extensively used. With respect to our analysis there is one important feature of these methods

6

which require a solution. These methods begin with an initial partition of the data set into some specified number of clusters [14]. Besides the trivial case of taking the existing partition into 58 regions there is no meaningful way for arriving at an initial partition of a number of units smaller than that. For solving this problem, one hierarchical method was applied, the solution of which was taken as the initial partition [15]. Since iterative methods make more than one pass through the data they can compensate for a poor initial partition of the data. They produce single-rank clusters that are not nested and therefore are not part of a hierarchy [16]. Thus the iterative or non-hierarchical methods can be used for improving an imperfect partition derived from hierarchical agglomerative methods.

In our case we have chosen the average linkage method solution (from among the hierarchical methods), because it avoids the chaining tendency of the single linkage method and the complete linkage method produces results which to not show high concordance to known structures [17]. How to determine the number of clusters, that is where to break the agglomerative process, is yet an unsolved problem of cluster analysis [18]. We have resorted to a formal, but still heuristic approach by looking at a significant jump in the values of the fusion coefficient, which signifies the point of the flattening of the graph of this coefficient. That indicates that no or little new information is portrayed by the following mergers of clusters [19]. The number of clusters determined in this way was 25.

The second step of the taxonomic procedure involved the application of the Hillclimbing Strategy (HC), using the result of the hierarchical method as the initial partition. The iteration process of HC is determined by the minimization of the variance criterion [20]. In this process each basic spatial unit is examined sequentially whether a better partition could be obtained by altering the taxon membership sucessively [21].

7

The result of this procedure provides centroids for each variable in each cluster, which are being used to draw a profile for each cluster, constituting the basis for the interpretation of the cluster with respect to the individual and group of variables.

VARIABLES OF RURAL ECONOMY BY NSS-REGIONS

Economic, Institutional and Technical Variables:

1	MFGP	The proportion of working population in the region in manufacturing, repair and services
2	LSPROP	Percentage of leased-in area to total area operated in each region
3	ONCPROP	Proportion of rural households owning but not operating land
4	CVLC	Coefficient of variation of land cultivated across size classes
5	CRLOP	Concentration ratio calculated from data on distribution of operated area by household operational holdings
6	MCI	Multiple cropping intensity from the district-level gross and net sown area
7	WELLIRR	Area irrigated from wells and tubewells as a proportion of total net area irrigated
8	IRRP	Area of owned irrigated land as percentage of total owned land in each region
9	FHA	Value (in Rupees) of fertilizers used per hectare of area under 19 major crops, averaged over districts in each region
10	PUMHA	The number of electric pumpsets and oil engines used per hectare of cropped area
11	OPH	Value (in Rupees) of output per hectare of 19 major crops, average 1970-71 to 1972-73
12	GEMHA	Gross capital expenditure (in Rupees) on agricultural implements, machinery and transport equipment per hectare of 19 major crops
13	GROWTH	Average of exponential annual rates of growth of output of 19 major crops of all districts in a region over the period 1962-65 to 1970-73
14	UR	The percentage rural unemployment rate on the basis of daily time disposition
15	EXPSC	Per capita monthly expenditure of the bottom decile of cultivator households in ruppees at current prices

8

| 16	WMR	Average rate of earning per manday of farm wage work for males in the 15-59 age group in ural non-cultivating wage earner households
17	MFWAGEM	Average rate of earning per manday of non-farm wage work for males in the 15-59 age group in rural non-cultivating wage earner households
18	FWAGEF	Average rate of earning per day of farm wage work for females in the 15-59 age group in rural non-cultivating wage earner households
19	EXPWR	Per capita monthly expenditure at 1960-61 prices of rural non-cultivating wage-earner households in 1970-71

Social Variables:

20	POVP	The percentage of rural population in 1972-73 below a poverty line defined as Rs 15 per capita per month at 1960-61 prices
21	MSCASTE	The proportion of scheduled caste among total rural male population in each region
22	MSTRIBE	The proportion of scheduled tribe among total rural male population in each region
23	WMPROP	The proportion of farm wage labourers in rural labour force by usual status for males in the 15-59 age group in each region
24	ATTMP	Regular (as opposed to casual) farm male labourers in the 15-59 age group as a proportion of total farm male labourers in that age group
25	DEP	The number of dependents to the total size of rural household
26	FPARCP	The proportion of women (in the age group 15-44) who are in the labour force by usual status
27	CHF	The number of children (in the age group 5-14) per head of woman (in the age group 15-44)

Geographical Variables:

28	DENS	Density of population per square kilometer in each region
29	SPARSVIL	The proportion of total inhabited villages in each region having a population of less than 200
30	SOIL	Index of soil rating of the land. A simple average of the district-level indices
31	MONRAIN	Proportion of annual normal rainfall concentrated in the June-September monsoon

9

| 32 | NRAIN | Annual normal rainfall in the region in meters calculated as simple averages of district level data |
| 33 | RAINDEF | Percentage deficit of actual rainfall in 1970-71 from normal in the region, calculated as simple averages of district level data. |

NSS-REGIONS BY STATES
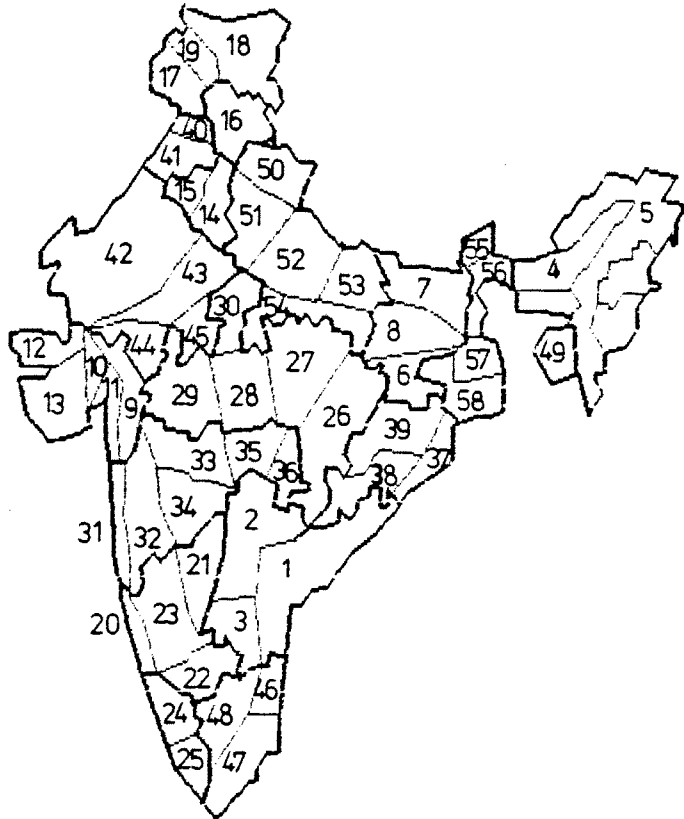
```
1       ANDHRA PRADESH-Coastal
2                       -Inland Northern
3                       -Inland Southern
4       ASSAM-Plains
5             -Hills
6       BIHAR-Southern
7            -Northern
8            -Central
9       GUJARAT-Eastern
10             -Plains Northern
11             -Plains Southern
12             -Dry Areas
13             -Saurashtra
14      HARYANA-Eastern
15             -Western
16      HIMACHAL PRADESH
17      JAMMU & KASHMIR-Mountainous
18                     -Outer Hills
19                     -Jhelum Valley
20      KARNATAKA-Coastal Ghats
21               -Inland Eastern
22               -Inland Southern
23               -Inland Northern
24      KERALA-Northern
25            -Southern
26      MADHYA PRADESH-Eastern
27                    -Inland Eastern
28                    -Inland Western
29                    -Western
30                    -Northern
31      MAHARASHTRA-Coastal
32                 -Inland Western
33                 -Inland Northern
34                 -Inland Central
35                 -Inland Eastern
36                 -Eastern
37      ORISSA-Coastal
38            -Southern
39            -Northern
40      PUNJAB-Northern
41            -Southern
42      RAJASTHAN-Western
43               -North Eastern
44               -Southern
45               -South Eastern
46      TAMIL NADU-Coastal Northern
47                -Coastal Southern
48                -Inland
49      TRIPURA
50      UTTAR PRADESH-Himalayan
51                   -Western
52                   -Central
53                   -Eastern
54                   -Southern
55      WEST BENGAL-Himalayan
56                 -Eastern Plains
57                 -Central Plains
58                 -West Plains
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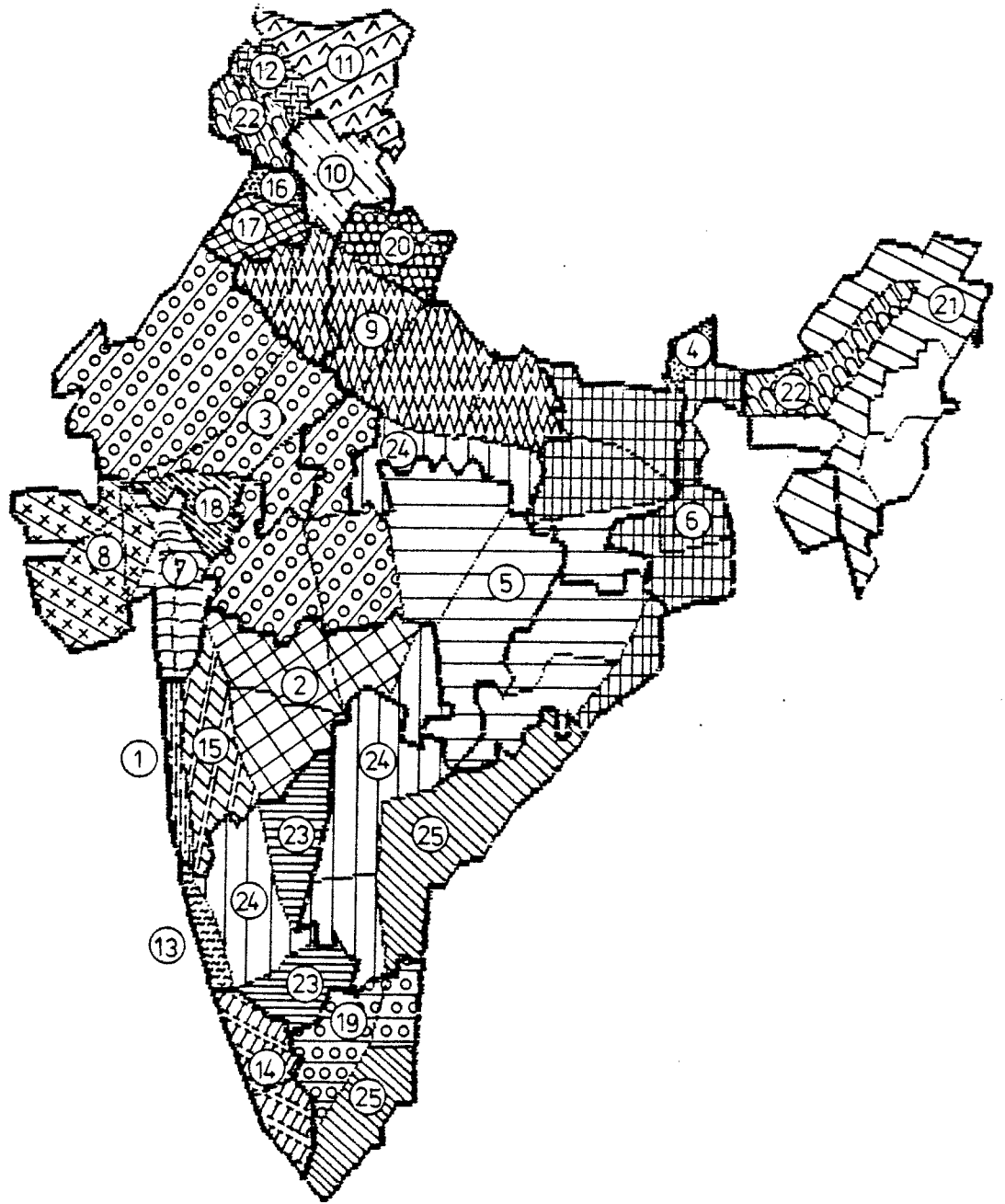
Since an accurate delimitation of NSS-Regions is not available to the authors for the purpose of illustration aproximations on the basis of geographical factors have been used.

3. The Result of Cluster Analysis

The best solution of the analysis resulted in 25 Clusters, the
spatial configuration of which can be seen below.

12

## COMPOSITION OF CLUSTERS BY NSS-REGIONS

Cluster 1: MAHARASHTRA-Coastal

Cluster 2: MAHARASHTRA-Inland Northern
                  -Inland Central
                  -Inland Eastern

Cluster 3: MADHYA PRADESH-Inland Western
                      -Western
                      -Northern
      RAJASTHAN-Western
              -North Eastern
              -South Eastern

Cluster 4: WEST BENGAL-Himalayan

Cluster 5: BIHAR-South
      MADHYA PRADESH-Eastern
                  -Inland Eastern
      ORISSA-Southern
          -Northern

Cluster 6: BIHAR-Northern
             -Central
      ORISSA-Coastal
      WEST BENGAL-Eastern Plains
                  -Central Plains
                  -Western Plains

Cluster 7: GUJARAT-Eastern
              -Plains Southern

Cluster 8: GUJARAT-Plains Northern
              -Dry Areas
              -Saurashtra

Cluster 9: HARYANA-Eastern
              -Western
      UTTAR PRADESH-Western
                  -Central
                  -Eastern

Cluster 10: HIMACHAL PRADESH

Cluster 11: JAMMU & KASHMIR-Mountainous

Cluster 12: JAMMU & KASHMIR-Jhelum Valley

Cluster 13: KARNATAKA-Coastal Ghats

Cluster 14: KERALA-Northern
            -Southern

Cluster 15: MAHARASHTRA-Inland Western

Cluster 16: PUNJAB-Northern

Cluster 17: PUNJAB-Southern

Cluster 18: RAJASTHAN-Southern

Cluster 19: TAMIL NADU-Coastal Northern
                -Inland

Cluster 20: UTTAR PRADESH-Himalayan

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Cluster  21:  ASSAM-Hills
              TRIPURA

Cluster  22:  ASSAM-Plains
              JAMMU & KASHMIR-Outer Hills

Cluster  23:  KARNATAKA-Inland Eastern
                       -Inland Southern

Cluster  24:  ANDHRA PRADESH-Inland Northern
                            -Inland Southern
              KARNATAKA-Inland Northern
              MAHARASHTRA-Eastern
              UTTAR PRADESH-Southern

Cluster  25:  ANDHRA PRADESH-Coastal
              TAMIL NADU-Coastal Southern
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14

Each cluster can be represented by this type of profile which shows the normated values of the group centroids for each variable.
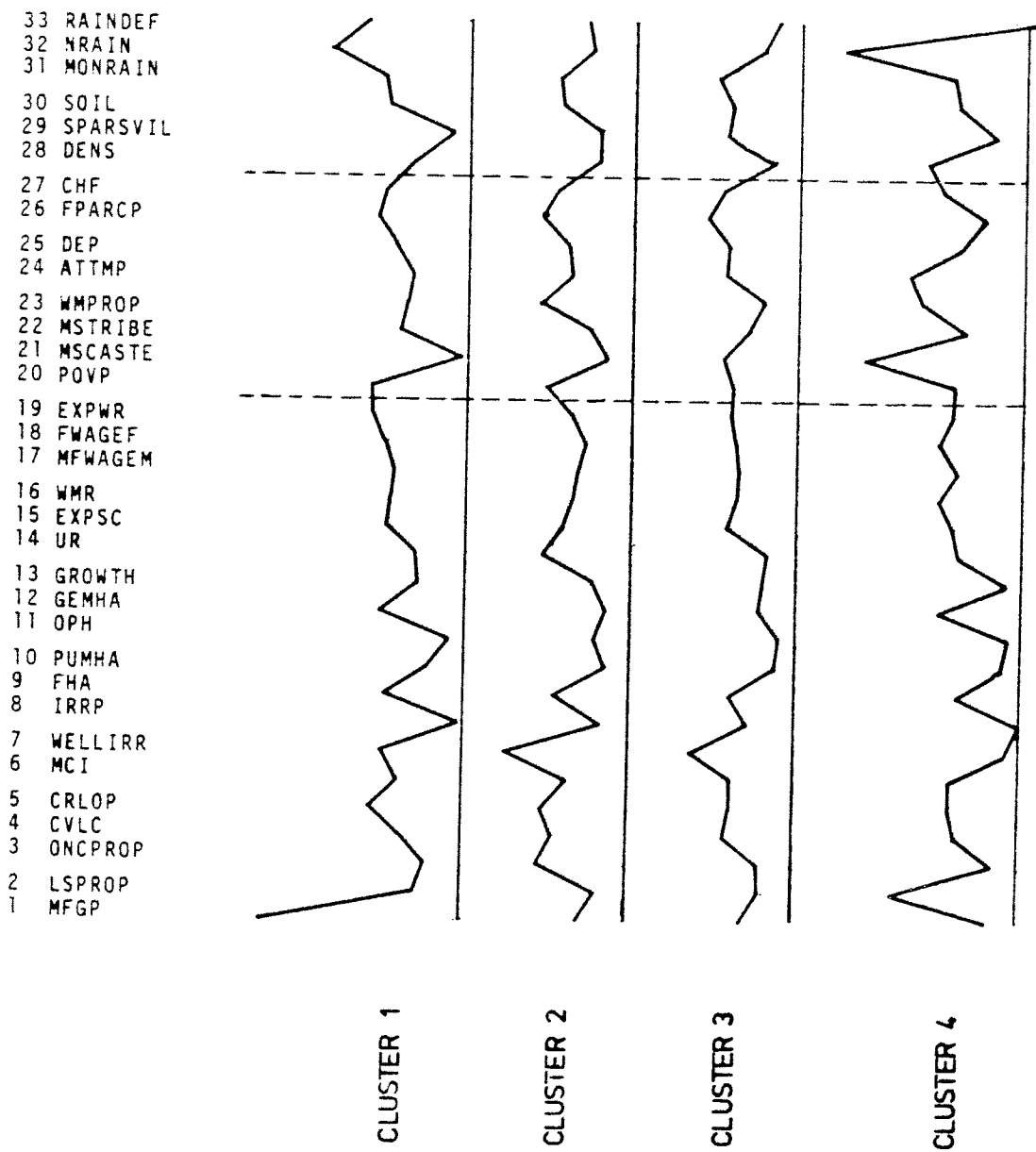
33 RAINDEF
32 NRAIN
31 MONRAIN

30 SOIL
29 SPARSVIL
28 DENS

27 CHF
26 FPARCP

25 DEP
24 ATTMP

23 WMPROP
22 MSTRIBE
21 MSCASTE
20 POVP

19 EXPWR
18 FWAGEF
17 MFWAGEM

16 WMR
15 EXPSC
14 UR

13 GROWTH
12 GEMHA
11 OPH

10 PUMHA
9 FHA
8 IRRP

7 WELLIRR
6 MCI

5 CRLOP
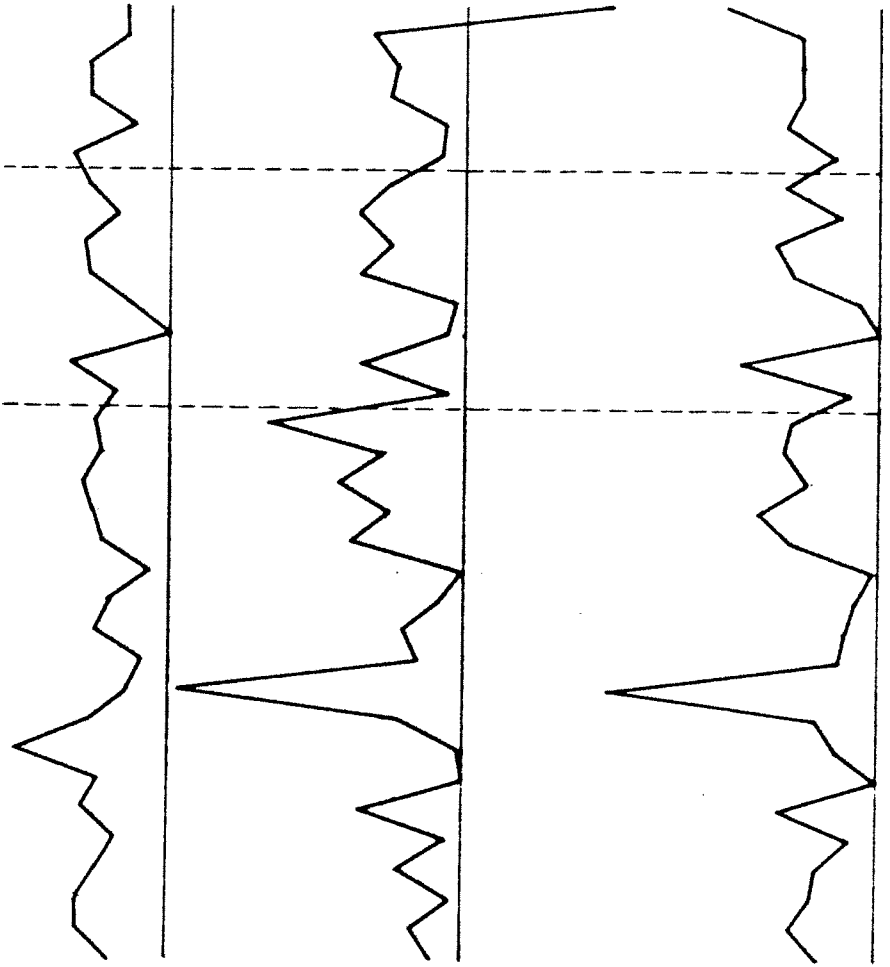4 CVLC
3 ONCPROP

2 LSPROP
1 MFGP

CLUSTER 1   CLUSTER 2   CLUSTER 3   CLUSTER 4

15

33 RAINDEF
32 NRAIN
31 MONRAIN

30 SOIL
29 SPARSVIL
28 DENS

27 CHF
26 FPARCP

25 DEP
24 ATTMP

23 WMPROP
22 MSTRIBE
21 MSCASTE
20 POVP

19 EXPWR
18 FWAGEF
17 MFWAGEM

16 WMR
15 EXPSC
14 UR

13 GROWTH
12 GEMHA
11 OPH

10 PUMHA
9 FHA
8 IRRP

7 WELLIRR
6 MCI

5 CRLOP
4 CVLC
3 ONCPROP

2 LSPROP
1 MFGP
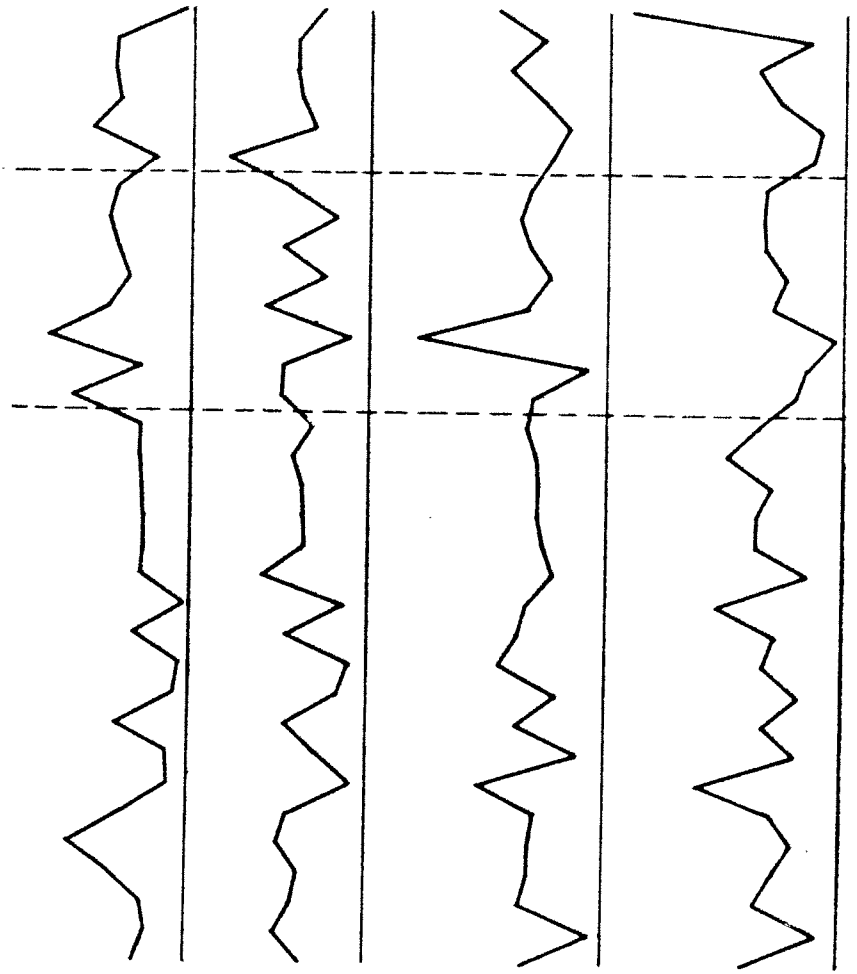
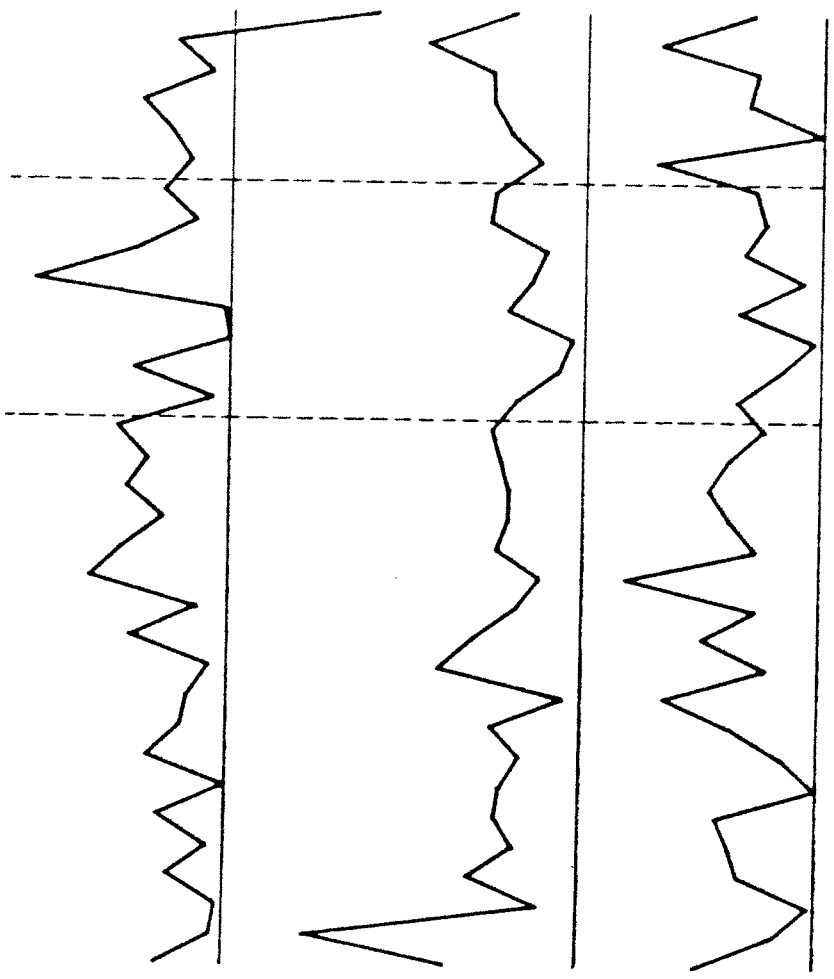CLUSTER 5   CLUSTER 6   CLUSTER 7   CLUSTER 8

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33  RAINDEF
32  NRAIN
31  MONRAIN

30  SOIL
29  SPARSVIL
28  DENS

27  CHF
26  FPARCP

25  DEP
24  ATTMP

23  WMPROP
22  MSTRIBE
21  MSCASTE
20  POVP

19  EXPWR
18  FWAGEF
17  MFWAGEM

16  WMR
15  EXPSC
14  UR

13  GROWTH
12  GEMHA
11  OPH

10  PUMHA
 9  FHA
 8  IRRP

 7  WELLIRR
 6  MCI

 5  CRLOP
 4  CVLC
 3  ONCPROP

 2  LSPROP
 1  MFGP
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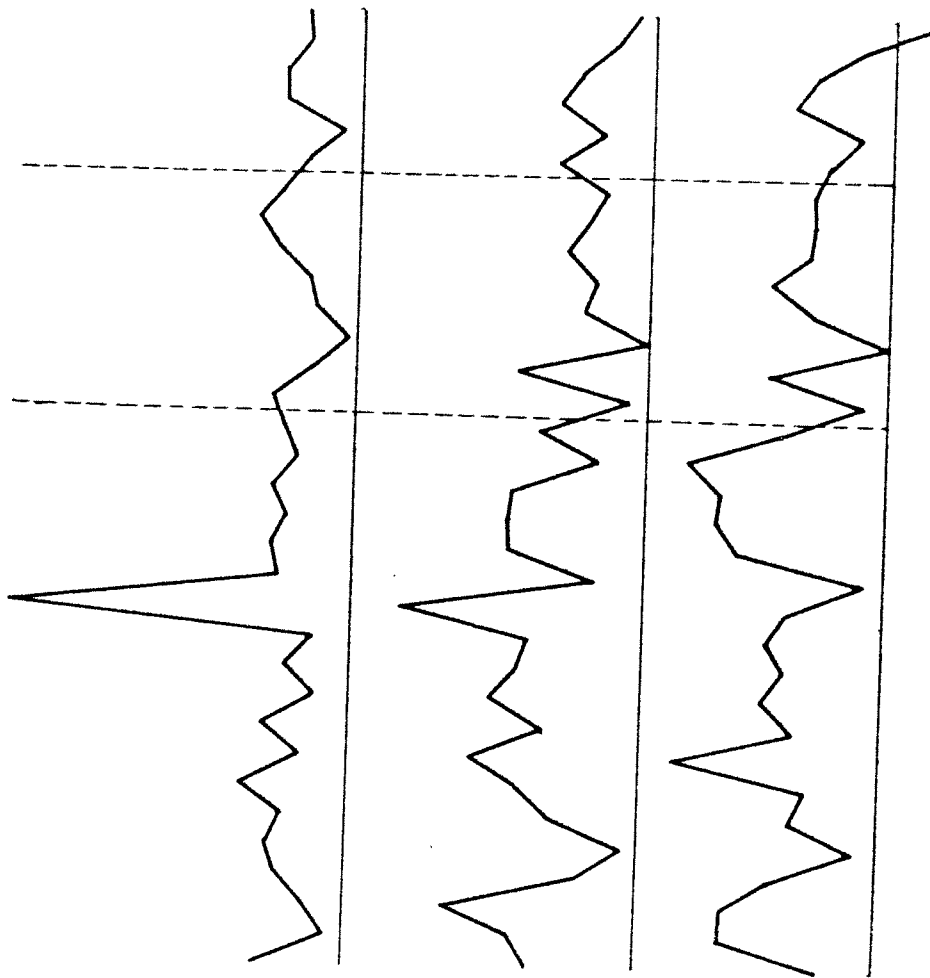CLUSTER 9

CLUSTER 10

CLUSTER 11

17

33 RAINDEF
32 NRAIN
31 MONRAIN

30 SOIL
29 SPARSVIL
28 DENS

27 CHF
26 FPARCP

25 DEP
24 ATTMP

23 WMPROP
22 MSTRIBE
21 MSCASTE
20 POVP

19 EXPWR
18 FWAGEF
17 MFWAGEM

16 WMR
15 EXPSC
14 UR

13 GROWTH
12 GEMHA
11 OPH

10 PUMHA
9 FHA
8 IRRP

7 WELLIRR
6 MCI

5 CRLOP
4 CVLC
3 ONCPROP

2 LSPROP
1 MFGP

CLUSTER 12

CLUSTER 13

CLUSTER 14

18

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33 RAINDEF
32 NRAIN
31 MONRAIN

30 SOIL
29 SPARSVIL
28 DENS

27 CHF
26 FPARCP

25 DEP
24 ATTMP

23 WMPROP
22 MSTRIBE
21 MSCASTE
20 POVP

19 EXPWR
18 FWAGEF
17 MFWAGEM

16 WMR
15 EXPSC
14 UR

13 GROWTH
12 GEMHA
11 OPH

10 PUMHA
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 6 MCI

 5 CRLOP
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 3 ONCPROP

 2 LSPROP
 1 MFGP
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CLUSTER 15
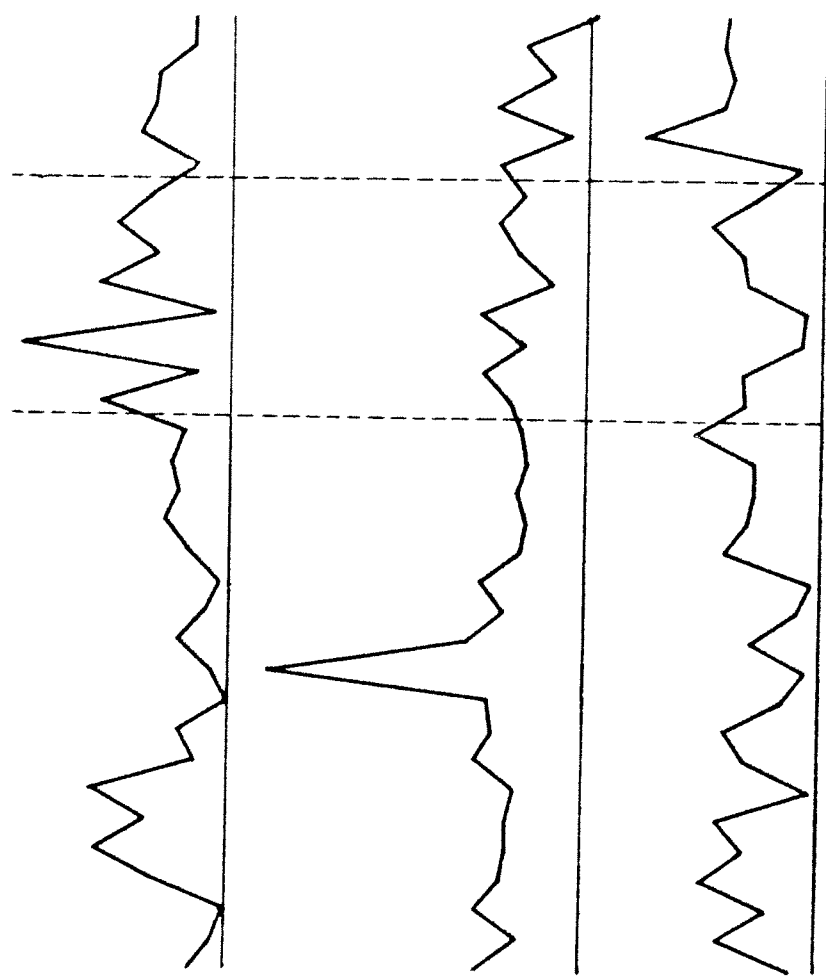
CLUSTER 16

CLUSTER 17

19

33 RAINDEF
32 NRAIN
31 MONRAIN

30 SOIL
29 SPARSVIL
28 DENS

27 CHF
26 FPARCP

25 DEP
24 ATTMP

23 WMPROP
22 MSTRIBE
21 MSCASTE
20 POVP

19 EXPWR
18 FWAGEF
17 MFWAGEM

16 WMR
15 EXPSC
14 UR

13 GROWTH
12 GEMHA
11 OPH

10 PUMHA
9 FHA
8 IRRP

7 WELLIRR
6 MCI

5 CRLOP
4 CVLC
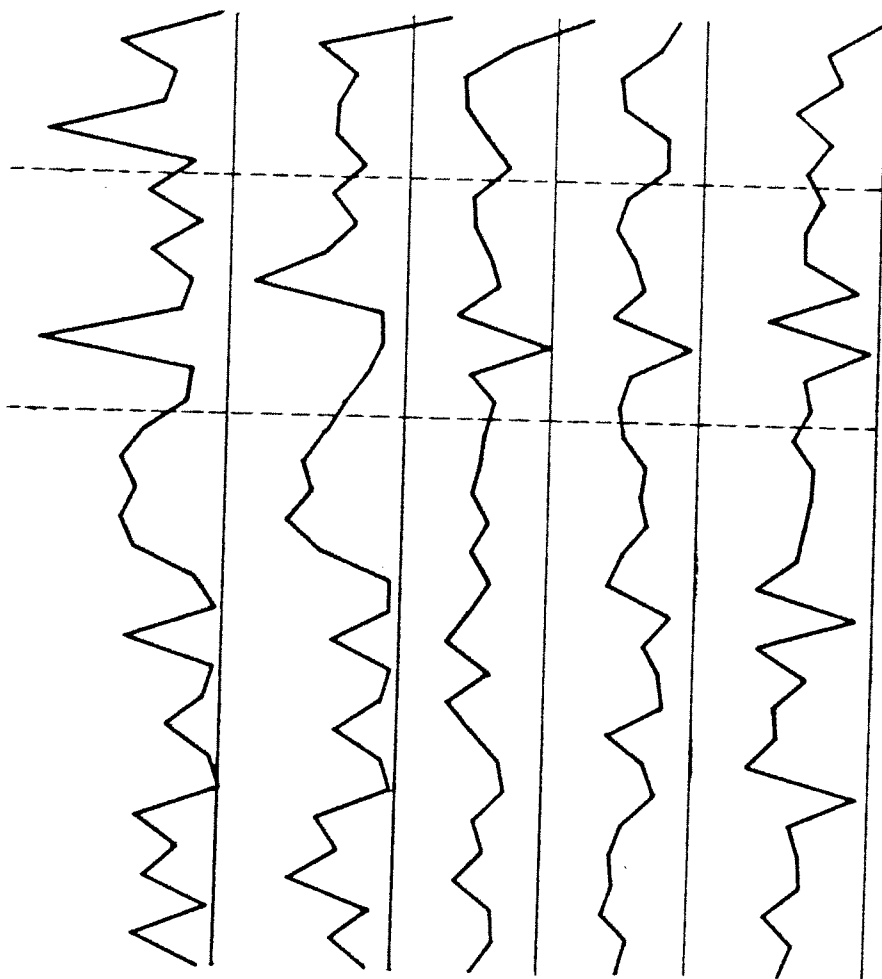3 ONCPROP

2 LSPROP
1 MFGP

CLUSTER 18

CLUSTER 19

CLUSTER 20

20

```
33 RAINDEF
32 NRAIN
31 MONRAIN

30 SOIL
29 SPARSVIL
28 DENS

27 CHF
26 FPARCP

25 DEP
24 ATTMP

23 WMPROP
22 MSTRIBE
21 MSCASTE
20 POVP

19 EXPWR
18 FWAGEF
17 MFWAGEM

16 WMR
15 EXPSC
14 UR

13 GROWTH
12 GEMHA
11 OPH

10 PUMHA
9  FHA
8  IRRP

7  WELLIRR
6  MCI

5  CRLOP
4  CVLC
3  ONCPROP

2  LSPROP
1  MFGP
```

CLUSTER 21 CLUSTER 22 CLUSTER 23 CLUSTER 24 CLUSTER 25

21

3.1. The Interpretation of Clusters

Although the set of data employed in this cluster analysis is fairly broad and the structure it depicts is very complex, the results show a high degree of plausibility on the basis of empirical evidence. One remarkable feature is the fact that certain clusters include several contiguous regions, even across state boarders. The nature of the structure in these clusters is obviously related to a number of distinct features of the rural society in these areas which originate in ethnicity, language, culture, history and natural conditions. On the other hand, the results show that the data are sensitive to a high degree of differentiation, particularly with respect to natural procuction conditions and the differences in social structure across the subcontinent. The impact of the structurally differentiating effects of the agricultural growth process is also visible from the results in the sense that dynamic areas show little differentiation involving more than one region. The higher the level of rural development the greater the tendency towards each region constituting its own distinct structure. The opposite is also obvious: the lower the degree of productivity the larger the number of regions in one cluster. However, these are very broad and generalized observations which require a much more detailed interpretation. Below, this is provided for each cluster.

Cluster 1

MAHARASHTRA-Coastal

The rural structure of this cluster appears to be strongly influenced by the vicinity of the metropolis of Bombay and by the climatic conditions of the Western Ghats. The former is reflected in the extremely high proportion of employment outside agriculture resulting in comparatively higher income levels. A relatively high level of land concentration and a low degree of technological development in agriculture seem to contribute to modest results of activity. The profile seems to indicate that the

22

favourable soil and rainfall conditions represent the most important production conditions. Although population density is modest and the proportion of depressed classes low there exists a fairly high level of poverty.

Cluster 2

MAHARASHTRA-Inland Northern
         -Inland Central
         -Inland Eastern

This relatively low density area appears to be determined by the interrelation of two rather unfavourable conditions for agricultrual production. A large proportion of non-cultivating landowning households, a high concentration of holdings and the fact of being located in a low rainfall area obviously restrict the possibility for technological development of production. This results in low rates of agricultural growth and value of output. Therefore, we find in this area relatively high unemployment and poverty rates which may also be determined by the high proportion of landless labourers for whom there is hardly any employment available outside agriculture.

Cluster 3

MADHYA PRADESH-Inland Western
           -Western
           -Northern

RAJASTHAN-Western
      -North Eastern
      -South Eastern

This vast area is obviously strongly influenced by the natural conditions for agricultural production. Low rainfall, comparatively scattered population which may be inferred from the high proportion of small villages and little opportunity for improving the technological level of production depress the results of production. There exists a low level of land holding concentration and most cultivators are operating their own land. This comparatively egalitarian social structure seems to balance somehow the difficult natural production constraints. The latter results in generally low levels of income but neither unemploy-

23

ment nor the proportion of population under the poverty line seems to be high. On the other hand it appears that in view of the small proportion of wage labourers the relatively high level of participation of women in the labour force indicates that a substantial part of the contribution for survival is being borne by women.

Cluster 4

WEST BENGAL-Himalayan

This mountainous and high rainfall area seems to be characterized to a large extent by two elements: a high proportion of scheduled castes and of leased-in land. These two elements seem to be strongly interrelated. Another indicator, the high proportion of regular labourers supports this picture. A relatively high population density together with the before mentioned characteristics would point to a rather small-scale agricultural production, which despite some degree of capital investment and input application remains at a fairly low level of productivity. Some reason for this should also be found in the topographic conditions.

Cluster 5

BIHAR-South
MADHYA PRADESH-Eastern
            -Inland Eastern
ORISSA-Southern
      -Northern

The major characteristics of this cluster which shows an extraordinarily high degree of stability even under the application of different statistical methods are closely related to the tribal societies of East-Central India. The particular structure of this very extensive area is further emphasised by the fact that it cuts across the borders of three states. The most important characteristics are the high proportion of tribal population (which is non-Aryan) and which lives widely scattered in small villages, a high degree of inequality in operational holdings, and, except for the degree of fertilizer application, very low

levels of technological development in agriculture. Despite a
relatively low population density all these elements combine to
produce a very high level of poverty which seems to be strongly
correlated with the high proportion of tribal population. The
factors together with the meager results from agricultural acti-
vity (although soil quality is good) translate into generally
very low income levels. Viewed from these general conditions the
level of unemployment seems to be surprisingly low.

Cluster 6

BIHAR-Northern
     -Central
ORISSA-Coastal
WEST BENGAL-Eastern Plains
           -Central Plains
           -Western Plains

The outstanding factor of this very populous area is the extraor-
dinarily high population density. The ownership pattern of land
shows a relatively high proportion of inequality in operated area
as well as a substantial degree of leasing-in of land. This
corresponds clearly to a relatively high proportion of labourers,
although female participation in the labour force is low. A
certain degree of technical development with respect to fertili-
zer use and capital equipment in agriculture notwithstanding,
growth and output value are very low. All these factors together
contribute to a high unemployment rate which is a clear indicator
of considerable economic and social stress in the rural areas.

Cluster 7

GUJARAT-Eastern
       -Plains Southern

This area with some degree of uncertainty in rainfall on the one
hand and a relatively high level of technological development,
particularly with respect to irrigation, on the other hand is
characterized by relatively high growth and productivity in agri-
culture. Only a very small portion of land is leased-in. The most
outstanding element is the very high proportion of tribal popula-
tion. Obviously a result of the high level of productivity, the

25

proportion of population below the poverty line is low. The low level of unemployment in this area may be interpreted either as a reflection or a consequence of it.

Cluster 8

GUJARAT-Plains Northern
         -Dry Areas
         -Saurashtra

In this largely dry area with a very high degree of uncertainty of rainfall the relatively great share of well-irrigation in total irrigation is not surprising, although the extent of the latter is comparatively small. A modest level of technological development under the conditions of very low population density and largely owner operated land yields a relatively moderate area productivity but a high growth rate. Consequently, poverty and unemployment rates are fairly low. For women in particular, the wage rates in agriculture are high.

Cluster 9

HARYANA-Eastern
        -Western
UTTAR PRADESH-Western
             -Central
             -Eastern

In the area, which this cluster delineates, the number of population is approximately the same as in Cluster 6, that means around 110 millions. Here both the level of leased-in and of owner-operated land is fairly high, but the degree of inequality is relatively low. The most important aspect, however, is the high proportion of irrigated land. Despite this fact the technological development is relatively low and consequently land productivity and growth as well. Viewing this combination of factors from another angle, one could infer considerable growth potential in this area. Although the area is densely populated, the poverty level and the proportion of labourers is fairly low, unemployment levels are even lower.

26

Cluster 10

HIMACHAL PRADESH

There is some degree of variation in holding size but very little concentration and almost all land is operated by owners. The most outstanding characteristic is the extraordinary high level of monthly expenditure of rural non-cultivating wage earners, which might be related to the plantation-type sector of the rural economy. Even farm and non-farm wage rates are comparatively high. Therefore, both unemployment rates as well as poverty levels are exceptionally low. One reason for this situation may lie in the relatively high cropping intensity.

Cluster 11

JAMMU & KASHMIR-Mountainous

High cropping intensity but low technological levels of development in agriculture seem to lead in this case nevertheless to relatively high farm wages. It has to be taken into account, however, that the proportion of labourers is very low. The population lives in smaller villages and in this area a low land productivity and almost no growth go together with equally low levels of unemployment and poverty, although the rural families seem to be larger than usual.

Cluster 12

JAMMU & KASHMIR-Jhelum Valley

This cluster represents a peasant-type of economy with a medium level of technological development and a substantial proportion of natural irrigation. However, growth and productivity are low. There is a distinctly lower degree of female labour force participation and also a low female farm wage rate and an even lower one for male farm workers. This is apparantly correlated with a fairly high rate of unemployment. The data seem to suggest that the egalitarian structure of land-holding accounts for an exceptionally low proportion of the rural population living below the poverty line. The proportion of male farm labourers in the rural

27

labour force is typically low for a peasant economy. Those who
are labourers are regular ones to a large extent.

Cluster 13

KARNATAKA-Coastal Ghats

The favourable rainfall conditions in this area and a good soil
quality promote a substantial level of cropping intensity. A
significant proportion of well-irrigated land and a high degree
of capital intensity of agricultural production result in very
high levels of productivity. Female participation in the labour
force is higher than the proportion of male farm labourers.
Together with the fact that a subtantial proportion of the labour
force is employed in manufacturing and in services, these factors
contribute to a low level of unemployment and poverty. The excep-
tionally high proportion of leased-in land seems to be an element
of relatively favourable social conditions as it improves access
to land and its product. This is particularly significant with
respect to the social structure of the area with its very small
share of underpriviledged scheduled castes and tribes.

Cluster 14

KERALA-Northern
      -Southern

This very high population density area is characterized by a
relatively high proportion of the labour force working outside
agriculture and receiving relatively good wage rates for that
kind of work. This may be connected with the fact that small
villages hardly exist and the population, even rural population,
lives in larger settlements. Variation of the size of land hol-
dings and the concentration of operated land is high. A high
degree and stability of rainfall, a high cropping intensity with
the substantial use of mechanical pumps yield a reasonable level
of productivity and growth in agriculture. Virtually all land is
operated by the owners. Although the proportion of labourers is
not particularly high, the enormous population density puts a

28

high pressure on the wage rates of wage earning households under the given social conditions. A significant aspect of this situation is represented by the extraordinarily high level of unemployment.

Cluster 15

MAHARASHTRA-Inland Western

Some degree of inequality and concentration of land holding, a relatively low proportion of the land under irrigation and the unfavourable rainfall conditions as well as a low level of technological development in agricultural production do not seem to provide any appreciable level of income and purchasing power, irrespective of the high growth rate. The relatively low population density may be a mitigating factor for the still tolerably modest levels of poverty and unemployment. That there exists some degree of social and economic stress may be inferred from the relatively high degree of female participation rate in the labour force, although the lower sections of society, particularly represented by scheduled castes and tribes, usually more under pressure, form only a very small portion of the population.

Cluster 16

PUNJAB-Northern

An important characteristic of this area is the high level of wage rates for both farm and non-farm work and of the purchasing power of the poorest 10 percent of cultivators. This seems to be strongly correlated with the high degree of development in agricultural production, both with respect to the extent of irrigation and the use of technical inputs. The high levels of productivity are obviously related to the great proportion of irrigated land. Concentration of operated land and size variation appears to be low. The proportion of leased-in land is very high. The particular combination of socio-economic and technological factors seems to account for a high rate of growth. Although the

proportion of scheduled castes of the rural population is fairly high there appears to be little indication that this section has not benefitted, as poverty levels in particular and unemployment in general are very low. Only the relatively high rate of female participation in the labour force and the relatively low wage rates for female farm work point to some degree of unequal distribution of benefits from an otherwise exceptionally favourable situation.

Cluster 17
PUNJAB-Southern

This area adjacent to the former region is determined by an extraordinarily high proportion of leased-in land, obviously from owners who do not operate farms themselves. The proportion of irrigated land is even higher, the highest among all clusters, and the degree of input and capital intensity in agricultural production is very high too. The income level of the poorest section of cultivators is particularly high which may be a reflection of the existing peculiar size distribution of land holdings in this area and the generally greater absolute sizes of land holdings. Wage rates for farm work for both male and female labourers are equally high. Contrary to that, unemployment levels and the degree of poverty are very low. The high level of development of the productive forces which seems to be somehow constrained in its growth potential by comparatively unstable rainfall conditions, appears to be able to support a relatively high proportion of regular farm workers.

Cluster 18
RAJASTHAN-Southern

A very high proportion of population from the scheduled tribes characterizes this region. The land-owning structure shows an overwhelmingly owner-operated system with fairly high rates of concentration of operated land and a high size variation. The level of technological development, obviously constrained by

30

natural conditions like low rainfall, is very low and consequent-
ly growth and productivity too. Although unemployment is low,
farm wage rates and household expenditure are equally low and
there exists hardly any employment outside agriculture. All these
factors contribute to an extraordinarily high degree of poverty
and a high female participation rate. Population density is low
and obviously people are living widely scattered as the propor-
tion of population in small villages is comparatively high.

Cluster 19

TAMIL NADU-Coastal Northern
            -Inland

An area with little and unstable rainfall, good soil, moderate
population density and a fairly high proportion of the work force
employed outside agriculture, it is characterized by a fairly
high level of technological development of agricultural produc-
tion. The most significant factor, however, is the enormously
high level of productivity of the cultivated land. As the levels
of land concentration and size variation are moderate, a high
proportion of labourers, low wage rates for farm work of both
male and female workers and a high unemployment rate indicate
that the benefits of high land productivity are being distributed
among a big number of cultivators and labourers.

Cluster 20

UTTAR PRADESH-Himalayan

Good rainfall, good soil and a low population density with most
people living in small villages characterize this mountain re-
gion. The source of moderate household expenditure, even among
the poorer section of the cultivators seems to be a high cropping
intensity and a high level of fertilizer use. Productivity and
growth, however, are very low. Some of these factors together
contribute to an exceptionally low rate of unemployment.

31

Cluster 21

ASSAM-Hills
TRIPURA

There is some degree of leasing-in, but almost all land-owning families also cultivate land themselves. Income for male and female workers seems relatively high, which might result from high cropping intensity, some degree of technological development and fertilizer application. The population contains a large proportion of scheduled tribes and lives to some extent in small villages, implying also a higher degree of spatial dispersion. Not only in this case, but obviously more generally, such a pattern coincides with low levels of unemployment and poverty.

Cluster 22

ASSAM-Plains
JAMMU & KASHMIR-Outer Hills

Some degree of size variation in land holding exists together with a certain extent of technological development in agriculture, resulting however, in low productivity and growth. There is a substantial proportion of regular workers (probably in plantations) and a fairly high level of wage rate and household expenditure. But unemployment is very low and poverty rates are moderate.

Cluster 23

KARNATAKA-Inland Eastern
         -Inland Southern

This area is characterized by a relatively high level of technological development in agriculture and by substantial growth. Income, expenditure, poverty and unemployment all concentrate in the medium range. That there is a situation of growing population pressure might be inferred from the comparatively high proportion of labourers and the extent of the female participation rate in the labour force.

32

Cluster 24

ANDHRA PRADESH-Inland Northern
                -Inland Southern
KARNATAKA-Inland Northern
MAHARASHTRA-Eastern
UTTAR PRADESH-Southern

With the exception of the use of fertilizer all technological and
performance indicators of agriculture show a very modest level.
Relatively high unemployment rates and the degree of poverty
together with a good proportion of labourers and substantial
female participation in the labour force point to a fairly diffi-
cult situation in the rural areas despite a comparatively low
density.

Cluster 25

ANDHRA PRADESH-Coastal
TAMIL NADU-Coastal Southern

A substantial proportion of non-cultivating households, a consi-
derable share of irrigated land and a degree of technological and
productivity development above average characterize this region.
However, growth is low. Although density is not high and soil
quality is favourable, unemployment is high. Income and poverty
levels are moderate, but here too the proportion of farm labou-
rers is substantial.

1) Tata Services Ltd, 1982: Statistical Outline of India 1982. Bombay: Tata Press, p.42.

2) Government of India, 1983: India. A Reference Annual 1983. New Delhi: Ministry of Information and Broadcasting, p.227.

3) National Sample Surveys (NSS) started in 1950 and were incorporated into the National Sample Survey Organisation (NSSO) set up in 1970. The activities of the NSSO cover the fields of socio-economic, industrial and agricultural statistics. An illustration of the scale of work of NSSO can be given in the field of the annual socio-economic surveys which cover about 200.000 households spread over 9000 sample villages and 5000 sample urban blocks. The subject program conforms to a cycle of surveys extending over a period of ten years. Surveys on (1) demography, health and family welfare, (2) assets, debt and investment, (3) land holdings and livestock enterprises, (4) employment, rural labour and consumer expenditure and (5) unorganised enterprises in the non-agricultural sector are carried out.

4) Census, Livestock Census, Saison and Crop Reports of various states, All India Debt and Investment Survey of the Reserve Bank of India, Fertilizer Statistics, the Bhalla-Alagh (1979) districtwise estimates on output and area of 19 major crops, Vital Staistics of India, 25th Round of the NSS on the Weaker Sections of the Rural Population, 26th Round on the Land Holdings Survey and 27th Round on Employment and Unemployment and on Consumer Expenditure.

5) Bardhan, P. 1983: "Regional Variations in the Rural Economy", Economic and Political Weekly 30 (July 23), pp. 1319-1334.

6) See Ertl, H., Fischer, M.M. and Wohlschlägl, H., 1980: "A Methodological Approach for Large Regional Taxonomic Problems: Spatial Patterns of Population Development in Austria", Papers of the Regional Science Association, Vol.44, p.119.

7) Aldenderfer, M.S. and Blashfield, R.K. 1984: Cluster Analysis. Sage University Paper No.44. Series: Quantitative Applications in the Social Sciences. Beverly Hills etc.: Sage Publications, p.12.

8) For greater detail see: Fischer, M.M.1982: Eine Methodologie der Regionaltaxonomie: Probleme und Verfahren der Klassifikation und Regionalisierung in der Geographie und Regionalforschung. Bremer Beiträge zur Geographie und Raumplanung. Hrsg. Bahrenberg et al., Heft 3, Universität Bremen.

9) Rao, V L S Prakasa, 1983: Urbanization in India. Spatial Dimensions. New Delhi: Concept Publishing Comp., p.2.

10) Fischer 1982:58

11) Fischer, M.M. 1980: "Regional Taxonomy. A Comparison of Some Hierarchic and Non-Hierarchic Strategies". Regional Science and Urban Economics 10 (1980), p.510.

12) ibid, p.524.

13) Ertl, Fischer, Wohlschlägl 1980:119

34

14)   Aldenderfer and Blashfield 1983:47

15)   For details see Fischer 1982

16)   Aldenderfer and Blashfield 1983:46

17)   ibid.,39 f.

18)   ibid., 53

19)   ibid., 54 f.

20)   Ertl, Fischer, Wohlschlägl 1980:123

21)   ibid., 123