CHAPTER – IX

POVERTY AND RURAL ENVIRONMENT

This chapter examines the issues of poverty and rural environment. A number of studies addressed these issues and identified the relationships. The relationship is very complex and it varied from region to region. Of late, the Government of India and the State Government realised the importance and took some steps in safeguarding the natural and environmental resources. Accordingly, the development programmes implemented in the State are being restructured / reconceptualised to achieve sustainable development. In this context, it has been realised to examine the impact of the programmes on rural environment and rural households.

Poverty is a complex phenomenon. It manifests itself in myriad ways. The poor not only suffer from low income and high unemployment, but also low life expectancy, low levels of literacy and poor health. Rural poverty is even more complex as it is reinforced by social factors. Social and economic factors operate differently in different regions. Specific targeted anti-poverty programmes started in right earnest were taken up in the Sixth Plan. The poverty alleviation efforts in India have adopted a multi-pronged approach to alleviate poverty at individual level through programmes of direct attack on poverty. Area development programmes introduced at community and regional level for enabling the poor and enhancing opportunities for the poor in rural areas. To address the compelling needs of time, the existing programmes have been revamped and restructured to make them more people friendly and also trigger the bottom-up initiatives.

The previous chapters have brought to focus the impact of Rural Development Programmes and its positive and negative externalities. For the upliftment of the poorer income groups, the Government follows general sectoral approach, which comprises a variety of sectoral schemes covering a wide spectrum. The schemes broadly classified under two categories: (i) asset buildings and (ii) income generation.

In fact, the strategy and approach of the Governmental programmes have accorded priority to the poorest among the poor. However, there are evidences to suggest that the present strategy of various programmes have failed to achieve the desired goals. A number of studies have pointed out the reasons for the failure of the programmes. It can be seen from the studies, the issue of measuring and identification of poverty groups is one among them, as poverty leads to inequitable growth of the society causing failure of the programmes.

The measurement of poverty involves two distinct problems, the specification of poverty line and determining of index of poverty. There is a vast literature in India on the definition and measurement of poverty and identification of the poor. It is a fascinating subject and a number of economists have contributed to it since 1962 in the Indian context. Commonly three measures are used to assess the poverty: (i) Head Count Ratio (HCR) (ii) the Proportionate Income Gap (PIG) / Proportionate Expenditure Gap (PEG) and (iii) the Sen's Index of Poverty.

The Head Count Ratio measures the proportion of the population in poverty, that is, the proportion of the population whose income is below a level, which is judged to be a 'poverty line'. The Proportionate Income Gap measures the short fall in the average percapita income of the poor from the poverty line. To workout the poverty line, we have used the Planning Commission, Government of India's revised statistics of Rs. 11000 per household during Ninth Plan as per 1992–93 prices. This figure suitably inflated by way of using Whole Sale Price Index numbers and worked out to Rs. 20742 at 2001–2002 prices. Further, the figure rounded off to the nearest one i.e. Rs. 20700.

A comprehensive measure of poverty, which takes into account HCR, PIG and Gini Concentration Ratio (G), is one due to Sen, who contributes distributional considerations in the measurement of poverty. The Sen's Index is given by

$$P = H [I + (1-I) G]$$

P, it may be noted, can take any value between 0 and 1; the result is closure to one, the grater the degree of poverty.

Income Poverty: In this study, household income has been used as one of the proxy indicator for measuring poverty. As discussed in the previous paragraphs, the cut off line of Rs. 20700 used as household income for a year to identify the people living below poverty. Further, the income class has been disaggregated into seven groups and categorised as follows. They are i) Destitute (below Rs. 7000), ii) Very Poor (Rs. 7000 - 14000), iii) Marginally Poor (Rs.14000 - 20700), iv) Marginally Non –Poor (Rs. 20700 – 30000), v) Better Off (Rs. 30000 - 50000), vi) Well-to-do (Rs. 50000 - 100000) and vii) Rich (Above 100000). These groups classified after identifying maximum and minimum values of the income of the surveyed sample 1890. This classification would help us to identify the population and their placements in the income hierarchy.

The table 9.1 brings to highlight the income poverty of the rural households of different agro climatic zones. On an average, annual household income of Rs. 40,065 recorded in the surveyed villages. A positive relationship could be seen in between the proportion of households and the average household income up to first five categories. The number of households increased from the destitute category of 4 (0.21%) to better off category of 510 (27%) and the household income also increased around seven times from Rs. 5050 to Rs. 37001. At the next two income levels viz. Well-to-do and Rich, the proportion and number of households decreased significantly. It has come down from 238 (13%) to 79 (4%). On the other hand, the income increased more than three times from Rs. 69323 to Rs. 231291. It is expected that the proportion of high-income households always are less in number and it shows the distribution of income among the households.

Of the total households 1890 surveyed, 29 per cent of the population were living below poverty line. It is interesting to note that the majority of the below poverty households are in the category of marginally poor. It reveals that a minimum dose is needed to lift the people from BPL. The average income of the marginally poor category was Rs. 18269. On an average Rs. 2431 is required to bring the households to the above BPL level of Rs. 20700. In the earlier chapters, we have discussed various issues in the analysis of income and the performance of SGSY in the State of Tamil Nadu. The programme SGSY has partially succeeded and met the needs of finance for their social and medical expenses. However, the SHG activities

have to be strengthened further in developing micro enterprises and to establish the clustering of enterprises, enabling them to enjoy various forms of economies of scale. This will help them to lift themselves from the BPL.

It is interesting to note that only 4 persons belonged to the category of Destitute and they hailed from NWZ, SZ and HRZ villages. Of the four households, three household members age are more than fifty and they are working as agricultural labourers and artisans. In the NWZ village, only one widow headed household and she too worked as agriculture labour to manage her family. Hence, the income of the household is very low. The average size of the household of this category is 1.75, which is far below the level of surveyed sample. Hence, their household income did not reveal the actual position of the household. In the rest of the four zone villages, there is no registration in the destitute category. In total, the proportion of the households in the destitute category is 0.21 per cent. It reveals that due to the provision of various employment opportunities through Rural Development programmes in the State of Tamil Nadu, the people have been benefited and they performed well.

In the second category ‘very poor’, five per cent of the total surveyed households registered in this and the average household income stood at Rs. 11721, which is more or less half of BPL cut off line income. In this category, highest proportion recorded in NEZ village (9%) and SZ village (7%) and the lowest proportion recorded in HAZ and WZ villages. There is no clear relationship in between the level of poverty and the zonal characteristics and other opportunities of the village households. It reveals that some of the households could not access the benefits due to lack of properties, level of community, lack of participation in political activities, etc.

At the next level, 470 households (25%) belonged to the marginally poor. Similarly, the ‘marginally non-poor’ accounted 27 per cent of the surveyed sample. In total, the marginally poor and marginally non-poor accounted 51 per cent of the total sample. It could be said that they are in the border area of the poverty cut off line.

In the marginally poor category, more than 30 per cent of the households belonged to HAZ (33%), SZ (30%) and HRZ (31%) villages. The characteristics of these zones are diametrically opposite and the opportunities for employment are also differed significantly. In the HAZ village, most of the households are working in the tea plantations. Due to deceleration in tea prices for the last two years, the labourers could not get adequate wages and employment. These labourers temporarily pushed back to the marginally poorer income groups. The SZ village is located in the dry zone of the State and the opportunities for employment is too restricted. Their skills also did not permit to switch over from one job to another. In the HRZ, due to high rainfall the working days were restricted, thereby their income and employment. However, in this zone the people actively involved and participated in the Government programmes and benefited from the schemes.

Less than 16 per cent of the households recorded only in two zones, viz. NEZ (13%) and WZ (16%). These zone villages are performed well and the employment opportunities are very high in NEZ village. This village is very close proximity to the District head quarters, and the labourers can work also in the construction activities during lean season. In the Western Zone, due to multiple and intercrop activities, the local people can get adequate employment and income. However, there is a rich scope in all the zonal villages to provide and create sustainable employment opportunities and income.

The average household income of Rs.24785 is registered in the marginally non-poor category and the proportion of households is 27 per cent. It could be said that due to various anti-poverty programmes introduced in the State, a significant proportion of the households can sustain and get income. Around two per cent differences can be seen in between the proportion of households of marginally poor and marginally non-poor categories. However, a significant difference could be observed among the zonal villages. Of the first three CDZ, NEZ, and WZ villages, the proportion of marginally poor ranged in between 13 per cent to 24 per cent. In the same zone villages, the marginally non-poor category ranged in between 29 per cent to 35 per cent. In the next three NWZ, HAZ and SZ villages, the proportion of marginally poor ranged in between 27 per cent to 33 per cent. However, the proportion of marginally non-poor have come down and varied in between 17 per cent

and 23 per cent. Of the six zonal villages, two types of relationship could be seen. Due to this inverse relationship, around 50 per cent of the households are in the marginal categories except in the HRZ. In the HRZ village, 62 per cent of the households are in the marginal category. The Government has to aim the marginally poor categories and assist to them financially and technically, to bring them up very quickly from BPL.

The proportion of households came down from 'Better Off' category to 'Rich'. Of the surveyed sample, around 43 per cent of the households belonged to these income categories. The proportion is slightly varied among the zonal villages. It is interesting to note that 79 households (4%) hailed the Rich income category. All these households enjoyed the benefits of Rural Development Programmes either income and asset creation or employment generation. It reveals that the above poverty line households still too enjoy the benefits of the programmes. Poverty alleviation strategies may not be construed as growth strategies of the country in the competitive world. Hence, the assisted households have to be monitored continuously in upgrading their technical and marketing skill, thereby they can sustain in the micro-enterprises activities. However, the Government has to pay some more attention to the BPL.

Indices of Poverty and Inequality: Table 9.2 shows the situation of poverty and income inequality of the surveyed households of seven agro-climatic zones in Tamil Nadu. In total, the HCR is 0.296. It could be said that 30 per cent of the households were living below poverty line. Among the zonal villages, the performance varied significantly and it ranged in between 18 per cent and 38 per cent. In the first three CDZ, NEZ and WZ, the proportion of households is below the level of 27 per cent. These zones enjoyed the privileges maximum and reduced the level of poverty considerably. The characteristics of these zones are not differed much and can be treated as normal area. Further, these zonal areas are not much faced various calamities occurred over the years. In the rest of the zones, each one has its own characteristics and they faced various difficulties in getting sustainable employment and income. Activity-wise, the HRZ performed well and they used the maximum amount of money earmarked through budget. The awareness and the level of literacy are very high in this region, and this region is situated adjacent to Kerala. Their

participation is very high compared to other regions. However, the level of poverty is 35 per cent in the HRZ village. It reveals that the assisted families have to be assisted further and make themselves to come up from the BPL. Of the seven zone villages, the highest level of poverty is recorded in the Southern dry belt zone. This zone village is situated nearest to the coastal area and there is no irrigation facility. Some of the families involved in the traditional activities, but they have no better market access to market their goods in a profitable way. Hence their income and profit margin is very low.

Gini Ratio is worked out to assess the distribution of income and also to compute the Sen's index of poverty. Overall, the Gini ratio was 0.275. It reveals the spectrum of income distribution is not wider. Income distribution is more than the overall average of 0.275 in four zones viz. NEZ (0.288), NWZ (0.381), SZ (0.341) and HRZ (0.284). The minimum Gini ratio is registered in the HAZ village (0.151). The nature of employment is similar in this zone village and 66 per cent of the households are plantation workers. Hence, the picture is obtained. It could be concluded that the programmes can be implemented further in a better way by way of identifying the eligible beneficiaries. This will pave them to achieve our plan goals for alleviating poverty and inequality among the rural mass.

Income Gap Ratio (IGR) gives an idea that how much income is required to lift the people from BPL. On an average, 17 per cent of additional income is required from their current income position. The IGR is varied among the zone villages, and it ranged in between 5 per cent to 26 per cent. There is no relationship in between the HCR and IGR. The dimension and focus of these ratios are differed with one another. Compared to the overall ratio of 17 per cent, only in three zones viz. NEZ (26%), WZ (25%) and NWZ (21%) ratios are more than the overall average. In the rest of the four zones, their current income has to be lifted further only to the range of 5 to 11 per cent. In general, the IGR is lower among the zone villages and it is possible to lift them within the short span of time. A collective responsibility is required both from the officials and the beneficiaries to achieve this goal of poverty alleviation.

Sen's index of poverty reflects further including HCR, Gini ratio and IGR. The computed Sen's index at the village level reflects the low level of poverty. It

varied in between 0.07 to 0.16. On comparison to the overall average (0.118), only in two zones NWZ (0.168) and SZ (0.158) villages recorded more than that. It reveals that the level of poverty is very poor in the State of Tamil Nadu and there is a little variation among the zonal villages due to the topography of the region and their participation in the Governmental programmes. Further, it shows that a minimum effort is required to make the State as completely poverty free.

***Community and Poverty*:** Caste is an endogamous institution, which is well structured and stratified in India. Gunnar Myrdal observes that the social inequality and economic inequality are intertwined. In realising the importance of the caste, the Government of India paid special attention and assisted to these socially disadvantaged groups. The commitments of the Governments are as follows:

1) To create an enabling environment that is conducive for SCs, STs, OBCs and minorities to exercise their rights freely, enjoy their privileges and be able to lead a life with confidence and dignity.
2) To ensure removal of disparities, eliminate exploitation and suppression and provide protection to the disadvantaged groups.
3) To ensure developmental benefits 'Reach the Unreached' through the equitable distribution and with social justice.
4) To ensure participation of the socially disadvantaged groups in the process of planning not merely as beneficiaries but also as partakers in the formulation of need-based programmes / projects, and in their implementation, supervision and monitoring.
5) To accelerate the on-going process of improving the socio-economic status of the disadvantaged groups through effective implementation of various policies and programmes and thus bring them on par with rest of the society.
6) To ensure a certain percentage of funds / benefits from all the relevant programmes, to flow to women belonging to these groups who are the most affected.

In view of the commitments made by the Government and practiced over last five decades, it is expected that the policies of the Government made some positive

impact on the socially disadvantaged groups. An attempt has been made to assess the poverty in terms of major caste groups among the study villages in Tamil Nadu.

Table 9.3 shows the income poverty and inequality indices of the communities in the study region. Of the total sample, 43 per cent of the households hailed from Backward Caste group and more or less equally shared by the Most Backward class (28%) and Scheduled Caste (26%). Rest of the sample households were very meagre and they belonged to the category of Scheduled Tribe (2%) and Others (1%). In others category, the sample 18 households came under the category of Forward Community.

These communal groups enjoy the privileges extended by the Government through various developmental programmes. Further, some of the communities emerged as the dominant group in the region, which facilitate them to grab the benefits. In this context, the question arises that whether the programmes have been executed as per the guidelines for the betterment of poorer income groups.

Over all, 30 per cent of the sample households living below poverty line. On comparison to the overall situation, only two communal groups' HCR is high viz. SCs (40%) and others (33%). The SCs and STs being treated as socially and economically disadvantaged groups in the country, whereas the level of below poverty is very high in the case of SCs. These communities have less land and other sources and most of them participated only in the wage employment programmes apart from their routine work. The sample size of STs is very less in number and they represented only in NWZ village. It doesn't reflect the situation of poverty among the STs in Tamil Nadu. Hence, it could not be construed that the poverty level is low as compared to STs in the State. In the case of other category, the Forward Community sample found only in the CDZ village and they too employed in traditional activities. Hence, their position is somewhat high compared to other groups of BC, MBC, and ST.

The Gini Ratio is worked out to assess the income distribution among the communal groups. Of these five communal groups identified in the sample, the Gini ratio was high in others category (0.359) and the lower ratio (0.196) was attributed to the STs. Both these groups sample size are very less in number and in total they shared around three per cent. In the rest of the majority of the groups, there is no

much variation in the Gini ratios. It reveals that there is less inequality among the communal groups and the values too registered only in the beginning level that is very close to the value Zero. Overall value 0.275 reflects the same position in the study region.

Natural Resources

Endowment of natural resources differed among the regions. These resources play a key role in achieving faster economic development of the regions as well as the development at the household level. An attempt has been made to compile the available information at the block level of the respective zone villages. The source of information for this analysis is the Institute of Remote Sensing, Anna University, Chennai. This institute compiled various information during 1998-1999, in connection with the project entitled "Identification of Recharge Areas Using Remote Sensing and GIS in Tamil Nadu". The following information has been identified from their records to make an assessment of the natural resources in the regions of the present study. They are:

i) River and Drainage,
ii) Rainfall,
iii) Geology,
iv) Geomorphology,
v) Water Level – Summer and Winter,
vi) Water Quality – Electric conductivity-micromhos/cm,
vii) Soil,
viii) Slope and
ix) Land use.

Detailed information about these parameters is discussed in the Chapter III, Area Profile of this volume. However, in view of making comparison of the information, a table has been prepared and presented in Table 9.4. This table highlights the important features of the region of Geology, Geomorphology, Geo-hydrology, etc. On juxtaposing the information among the zones, it could be concluded that there is no uniformity among the regions. Each one has its own characteristics and it has to be used within the region due to the characteristic of immobility.

Natural Resources - Composite Index: A composite index is evolved to get an aggregate picture, quantifying subjective as well as objective information. Initially, sector wise indices were computed. For this, the following formula is used to compute the objective information.

$$\text{Index} = (\text{Actual} - \text{Minimum}) / (\text{Maximum} - \text{Minimum})$$

In the case of subjective indicators viz. River under drainage, the answers were reckoned as zero and one. Zero refers to that the river and drainage facilities exist in the area. The value 'one' refers that the resources are not exist in the region.

A uniform scale is introduced to understand the environmental problems and the endowment of resources. If the index value is close to zero, it means that the resources are at higher level. On the other hand, if the value is one, it has been treated, as the region has no such resources. This methodology has been followed in assessing household environment too. Indicators meticulously examined and identified the direction of the indicators. Wherever the direction changes against the conceptualisation of the scale values, it has been subtracted from one, to make uniformity.

Weighting: The composite index is in the form of weighted average of the different indicators. A serious shortcomings with most of the studies in this area, is that while combining various physical variables either they gave them subjective weights or had them without weights (Morris David Morris, 1979). Since the indicators varied in terms of their relative importance, assigning equal weights would not be justified. Further, the weighting pattern used in the various indices produced in different studies, on the basis of various physical variables lacked theoretical justification, or even clear interpretation. While computing composite index, it is essential to attach some weights to the indicators. Any attempt to attach weights is bound to be riddled with subjectivity and value judgement unless the weights are significantly derived. In this context, it is worthwhile to review the UNRISD studies would helpful to solve the methodological and conceptual problems. The weights

were supported to reflect the degree of importance that each indicator is considered to have in the measurement of the whole. The whole problem of giving weightage revolves around the concept of 'importance'. Importance of indicator is assumed on the basis of its coefficient of correlation with other indicators. All that is meant by the use of correlation as a basis of weighting is that the more heavily indicator is the one which is most closely associated with and will best predict to others. The above method of deriving weights from average correlation coefficients could not completely solve the problem. Sometimes a highly correlated indicator may turn out to be a very weak indicator of natural resources endowment or household environment and vice versa. Conceptually, it stands to reason and reflect the real situation of the rural environment. Hence, the present exploratory study has taken into account the analysis of 'Average Correlation' to assign weights to the indicators. This model has already been employed in some of the works (Karuppaiyan, 1990).

Table 9.5 portrays the endowment of natural resources of the study villages. Since the data is available only at block level, the analysis has been made with the help of block level information of the respective study villages in Tamil Nadu. Weights are derived to the indicators selected on the basis of average correlation. The derived weights ranged in between 10.237 and 17.575. It reveals that the relative importance of the indicators selected. The lowest and highest weights were gone to the water level and water quality respectively. Water resource is one of the important resources and paves them to make use of the other resources as viable.

On an average, the Natural Resources Index (NRI) stood at 35. The data gives an idea that the State Tamil Nadu possessed rich endowment of resources. If the value is nearing to zero means, the resources are being increased / or well endowed. It is explicit that the CDZ is well endowed compared to other zones in the State. Accordingly, the computed composite index value stood at 19, conform the real facts. At the other extreme, the composite index value of SZ block is 64, it shows the poor endowment of natural resources. This Southern zone is one of the dry zones in the State and there is less potential for intensive agricultural and other activities. As per the rank, these zones can be ordered as follows: CDZ, HAZ, NEZ, NWZ, HRZ, WZ and SZ. The data reveals that the endowment of natural resources significantly differed among the agro climatic zones in Tamil Nadu.

Overall, the sectoral performances too varied significantly and the index value ranged in between 14 and 56. Relatively rainfall performance is low as compared to the river and drainage. River and drainage system prevail in all the zones, except in Southern Zone. As per the available statistics on rainfall of the last 10 years at the block level, revealed that the HAZ received good rainfall and the value is close to zero. Even though, we had treated the district Kanyakumari as high rainfall zone, the rainfall performance is not fair over the last ten years. Also the rainfall performance is very poor in NEZ, WZ and SZ.

Land use index value varied significantly among the zones. The land use performance was high (32%) in the NEZ block and very poor (69%) in the HAZ block. In the NEZ block, the proportions of land use - water bodies was relatively high, hence the performance can be seen in the zone. Slope index too is varied among the zones. Only in the first two zones CD and NE, the slope score value is zero. In the rest of the zones, the slope levels are varied significantly.

Overall the endowment of natural resources is good in the CDZ and HAZ blocks. These results would help us to understand the nexus in between the poverty and environment.

Household Environment Index: Technical Note: There are two kinds of demand for environmental resources. One is an amenity – that is, as something that directly affects peoples' well-being. The other is an input in production. The role of environmental resources is less clear when they are viewed as amenities. A few studies, however, have found that even then the income elasticity may be less than one – suggesting that for poor people such resources are necessities, not luxurious. Of late, much attention has been given to control the environmental problems arose in the urban areas of developed as well as in developing countries. The impact of these urban environmental problems gradually spread to the rural areas of the country. It has been viewed seriously and attempted to identify the rural environmental problems in the State of Tamil Nadu. These problems were emerged by way of performing various economic activities in the rural areas. These activities

may lead to over utilisation of resources and pave a path to reach unsustainable development.

In realising the importance of sustainable rural development in the country, the Government of India restructured and reconceptualised all the rural development programmes, keeping in view of the developments occurred in all regions over last five decades. The policy makers gave much emphasis on environmental aspect and try to create maximum amount of positive externalities apart from generating direct benefits to the eligible beneficiaries.

The approach of rural development programmes can be viewed as income and asset creation, employment generation and building common property resources. These programmes have been executed through line departments of State, District and Blocks. The State Governments have used their powers and merged some programmes into State sector programmes, to make the programme as efficient in achieving the goals as planned. It is expected that any activity, whether it is personal or community or Government would create positive as well as negative externalities. So far the planners have not paid much attention to quantify the negative externalities of the programmes. These negative externalities may generate adverse problems in the area, and this has to be arrested by way of taking collective action.

An attempt has been made to construct a composite index for assessing household environment. To identify the household environment, various conceptually significant indicators listed and removed some repetitive indicators to avoid the problems of input and output mix. Further, some more statistically inconsistent indicators were also removed.

Finally, it has been identified six broad sectors to construct the composite Household Environment Index. These sectors are: Tree, Water Quality, Air Quality, Housing Quality, Kitchenware and Health. These sectoral indicators reflect in different perspectives and highlight the emerging environmental problems in the country.

Methodology for formulating Index: As discussed earlier in the construction of NRI, the same methodology has been adopted to construct the HEI. Growing of trees in the homestead land is one of the good practices, which gives direct benefit to the growers and also creates positive externalities. Government of India as well as State Governments introduced various afforestation programmes viz. social forestry, community forestry etc. Apart from these schemes, some innovative schemes viz. to control female infanticide, introduced in some districts. Of the total sample surveyed, 47 per cent of the households have no trees and they do not attempt to grow any trees. It is interesting to note that the marginalized population have insecure property rights and the pay back period for the trees are very high compared to any other activities, hence they have not been motivated to grow trees. Further, they do not realise the importance of environmental benefits. The rest of the groups have possessed some varieties of trees like mango, jackfruit, tamarind, bamboo, coconut, teakwood and others. These types of trees may give some yield to the growers and indirectly it gives some good impact on the environment. In realising the importance, the possession of trees has been introduced as one of the indicator for assessing household environment. Economic value of the trees may be varied from region to region depends upon the nature, age, forms of benefits, etc. There are some trees may not give any monetary benefit directly within the short span of time but it may give some environmental impact. Hence, the number of trees possessed alone took into consideration for this analysis, to assess household environment.

In general, the index values were construed ‘zero’ as no pollution and ‘one’ as high pollution. The identified indicators can be classified as objective and subjective. Objective values were used and evolved an index without any methodological problems, by way of using the standard formula of ‘(Actual – Minimum)/(Maximum - Minimum)’. This formula has already been used in various contexts particularly in evolving Human Development Index constructed by the UNDP. In the present analysis, we have subtracted from the value one, to show the real direction of the indicators to reflect the environmental condition.

In the concept of subjective indicators, scale values have been assigned depends on the nature of the indicators. The subjective weightages have been assigned in respect of the indicators identified, keeping in view of the impact of the

environmental problems. Always zero values towards no pollution and the highest value one towards high pollution. A detailed formula has been prepared and presented in table 9.6. Most of the formulae are self-explanatory and one or two requires some additional explanation.

We have faced some technical problems in constructing Health Index. Initially, there are two indicators were identified to highlight the health condition of the rural people. The selected indicators are: type of health problems and health expenditure. In developing country like India, the health and educational goods are being treated as merit goods. Further these goods have been delivered to the population at free of cost or charged with minimum fee, depends on the case. Poorer income groups always depend upon the Government Hospitals and availed these services to set right the health problems. On the other hand, high income group people availed the private hospital services and spent huge amount of money compared to the lower income groups, hence the health expenditure has been dropped from the analysis, and this may not reflect the health condition of the rural people. At the next level, some major health problems were identified among the households. There are two types of diseases viz. acute and chronic observed in the study region.

Household level data has been standardised for aggregation. Depends on the severity of the diseases, weights were assigned to the indicators of acute and chronic diseases. In the context of acute disease, if any one of the members of the family faced the health problems more than five times during a year, it has been treated that the family faced the problem of acute diseases and the value has been reckoned as one. Weights were assigned to these indicators on the basis of severity.

After constructing six sectoral indices, a composite index has been constructed. The weights for the sectoral indicators have been derived on the basis of correlation analysis. Average correlation has been computed indicator wise and on the basis of proportion, weights were derived. The computed weights ranged in between 15 and 17.59. It shows that the indicators are closely interrelated with one another and again validates the conceptual significance in assessing the rural household environment.

Table 9.7 reveals the status of the household environment of the sample population of different agro climatic zones in Tamil Nadu. Household Environment Index (HEI) comprises of six sectoral indicators reflects individually and highlights environmental issues. These sectoral indicators are conceptually and statistically significant in evolving a composite index. This index values has been reckoned to address the level of pollution and it has been construed zero as low-level of pollution and 100 as high level of pollution. If the index values are closer to zero, it can be treated as that the households are free from pollution.

Overall, the computed composite HEI stood at 41.46. It reveals that the level of pollution crossed around 40 per cent in the rural households. It warrants some special attention in controlling pollution. The topography of the agro climatic zones is differed significantly. However, it does not reflect much in the HEI of different agro climatic zones. These composite index values varied in between 39 and 43. Only 4 per cent differences were exit in the household environment. It depicts the Tamil culture and tradition exists in the rural areas of the State. The lowest HEI value 38.965 registered in the NEZ village and the highest value 43 recorded in the WZ village. It reveals that the level of household environmenrtal problems is low in the NEZ village and somewhat high in the WZ village.

Among the sectoral indicators, a significant difference is observed. The percentage of tree index value is reached 96 and conform that 47 per cent of the households do not possess any trees in their homestead land. At the next level, HQI value too was high (62%). The performance of these two indicators is low as compared to other sectoral indicators.

It is interesting to observe that less than 20 per cent score values registered in the indices of WQI, KI and Health index. At the next level, AQI stood at 47 per cent. It shows that the people in the rural areas facing the problems of indoor air pollution. There are two major sources for indoor air pollution viz. using firewood stove and making smoke for killing mosquitoes or using mosquito mats. To kill mosquitoes, either they have used traditional method of making smoke by way of using agricultural wastes or the modern method of using mosquito mats.

Regional performance is significantly varied in respect of WQI, AQI and HI. In the rest of the indicators, there is no much variation among the zones. These indicators are closely associated with the culture of the people and they had not switched over to modern means of living. Further, their income and employment opportunities are restricted to maintain the same standard of living.

In all, the value of tree index is not scored well and it is close to the value hundred. It reveals that there is rich scope in growing trees in the homestead land. The people have to be educated and inculcated in the rural areas to grow trees and enjoy direct as well as indirect benefits. Among the zone villages, SZ village tree performance was good and the score value registered at 91 per cent. This zone is one of the dry zones and there is no possibility for intensive cultivation. Hence, the households had the practice of growing Palmyra and Coconut trees in their lands as well as in the homestead lands too. In the State of Tamil Nadu, people have the practice of making fence in their boundaries of their lands. This structure of fences paved the way to grow some trees. However, differences can be seen among the zone villages and in particular the HAZ village performance is very poor. This zone climate is conducive to grow more trees, subject to the slope of the region. Most of the marginalised groups of the study village are repatriates of Srilanka and they live in steep slope areas, hence the performance was very poor. It could be concluded that the tree growing practice among the household are not satisfactory. The practice has to be strengthened in all regions, according to the conditions of the area, particular varieties can be suggested / supplied at free of cost. This will help in controlling the environmental problems and achieve sustainable development.

In general, the water quality level is moderate and can be said as less amount of pollution. The score value is 19 per cent against the derived weights. Each village has its own problems viz. industrial activities like Sago and Sugar industries, ground water extraction in the SZ village and salinity, inadequate drainage facilities in the HAZ and HRZ villages. Naturally the potential for ground water sources differed among the zones, hence there is a possibility for water pollution. As per the index values, NEZ and SZ performs better, and the score values recorded one per cent and 10 per cent respectively. This index doesn’t reflect the position of availability of water. The water availability is relatively scarce in the Southern zone village. A poor

quality of water is found in the NWZ village and the value is 49 per cent. Due to water contamination and water borne diseases, the rural households came forward to boil the water for drinking purposes. The proxy indicator of water quality reflects the real situation of the region and it directs to provide good quality of water by way of arresting the water pollutants, particularly ground water. To make the water resources as sustainable, a proper planning is needed at the village level.

The household level air quality addresses the problem of indoor air pollution. Indoor air pollution generally may arise from two important sources in the rural areas viz. nature of energy used for cooking and controlling mosquitoes. On an average, the AQI value reached to 47 per cent. It shows that the level of indoor pollution is high. The level of indoor air pollution significantly varied among the zones. The highest score value recorded in the CDZ village. It reveals that the village population as well as in the region, rural people have the habit of making smoke in their houses from the agricultural wastes to make mosquito free. In the rest of the zone villages, of late, the rural people have used mosquito mats. The lowest value registered in the NWZ, and it stood at 38 per cent. It shows the deterioration in environmental condition. To control the mosquitoes, the rural sanitation programme has to be strengthened further as per the requirement of the region. Further, alternative-cooking energies may be introduced in the entire region to conserve the local resources.

The conditions of housing may reflect the housing quality in the rural areas. The houses were constructed as per the regional requirement and the locally available material. Only three types of houses were seen in the study villages. They are: thatched, tiled and concrete. On an average the HQI scored not well and it is 62 per cent. It reveals that the quality of housing was poor in all the regions. Even though, the Government of India introduced various housing programmes for the poor families of SCs, STs and some other economically disadvantaged groups. Of our total sample, 378 families benefited from the housing scheme. But the condition of the housing varied among the region, depends upon the participation of the beneficiaries. The perceptions of the rural families varied and they intend to move from thatched houses to concrete houses. This practice is to improve the housing condition as well as to enhance their social status. The housing score values ranged in between 57 per

cent and 67 per cent. The data reveal that the housing environment has to be improved further in all directions for better living in the rural areas of the country.

Of late, environmental scientists focussed their attention to reduce the use of environment unfriendly wares like plastics. There are four types of wares used in the rural areas, viz. earthenware, brass, aluminium and plastics. The impact of these wares varied on human health and on environment. Scientists believed in following some traditions to safeguard the environmental resources and to achieve sustainable development.

As per the overall impact of these wares identified by the Scientists, the weightages were assigned to them. Accordingly, earthenwares carry low weightage and plastic wares carry high weightage, to reflect the use and impact of the kitchenwares. If the weights are close to zero means, it could be considered as no pollution. It is interesting to observe that these households follow the traditions and they had not moved much in use of environment unfriendly products. The score values registered less than 12 per cent and ranged in between 6 per cent and 12 per cent. Even though, the plastic wares are being increased in the rural areas. This practice has to be controlled by way of using legal end economic instruments, rather than educating the people.

Health index score values were varied significantly among the zone villages. It varied in between 2 per cent and 23 per cent. HI performs well only in the CDZ village. It indirectly reveals the rural environmental condition. In the rest of the zonal villages, the computed index values didn't vary much. However, it could be appreciated that the score values are closer to zero.

In the light of the above discussion in respect of the six household environment indicators, it could be concluded that the population of the sample are very poor in respect of tree possession, housing quality and air quality. In general, the rural household environment is moving towards high pollution and this practice has to be controlled towards sustainable development.

Household Environment and Natural Resources: Environmental degradation contributes to poverty through worsened health and by constraining the productivity of those resources upon which the poor depend. Poverty restricts the poor to acting in ways that are damaging to the environment (Mink, 1993). There is evidence of a link between increased poverty and environmental degradation across the World. The poor's exposure to environmental degradation is distinctive for two reasons. First location inhibited by the poor are often environmentally vulnerable or degraded and the areas to which poor can gain access are often the riskiest for health and income generation. Second, being poor entails lacking the means to avoid the impact of environmental degradation.

Environmental degradation reduces the productivity of natural resources managed by the poor thereby perpetuating impoverishment. In locations where the poor depend on Biomass for fuel, confront increasing fuel wood scarcity, they often shift to animal dung, fodder and crop residuals for fuel, which residues the recycling of organic matter to soil and so fertility declines. The productivity under open access regime of natural resources, or of resources under deteriorating common property management, is often declining because of over use.

Several schemes of regenerating common lands through social forestry and village-wood-lot development schemes have failed because of poor peoples' short time horizon or strong time preference. Poor cannot wait for products to be harvested until trees have matured and can be harvested as lags. Efforts through JFM have produced relatively good results where products such as small timber, fodder and fuel wood can be harvested quickly.

Household environment is determined by various factors inclusive of natural resources in the region. The question arises in this context, how these factors are interrelated with one another. In view of identifying the relationships in between these variables, mean values were worked under zone wise (Table 9.8). There is no uniform relationship in between the variables. The correlation coefficient is very poor and it is not significant. Household environment index values are not varied much among the zones, whereas NRI values are varied significantly. Even though some regions have less potential of natural resources, the households are able to manage and maintain the

household environment equivalent to other regions. It reveals that the economic and social factors influenced to manage the household environment.

HEI and Community: Traditionally some of the communities were treated as socially backward and untouchables. Their occupational status is relatively very poor. Due to the special features of environmental goods, it could be expected that the level of consumption of these resources are non-rival and results in household environment. In this context, community wise household environment index is computed and presented in the table 9.9**.** The last two groups represents less in number. However, the tradition and customs of the particular communal groups may give some policy directions. The computed composite index values did not vary much among the communities. It ranged in between 40.94 and 42.55.

TI and HQI are not varied much among the five communal groups. In the context of WQI, the Most Backward class enjoy the maximum benefit from the naturally endowed resources and their score value stood at 14 per cent. At the other extreme, the STs water consumption and quality of water deteriorates further and it reached to 46 per cent. It requires some attention, particularly where the water quality deteriorates due to human activities.

AQI was relatively scored well (39%)in the community of STs and the poorest score 61 per cent reacted to other communities. It reveals the dependency of the energy for cooking and keeps away from the mosquito bites. It is interesting to note that some of the households are using biogas and LPG. In the case of firewood stove, the Government manufactured and supplied at subsidised prices to make the households as smoke / pollution free. The beneficiaries did not use these stoves due to various problems. These issues discussed in the Chapter VIII Rural Housing. The relative performance of KI is well in all the communities and varied little in between them. The score value ranged in between 6 per cent and 11 per cent. Among the communities, the STs are using still more number of earthenwares in their cooking, and it shows their tradition and faith in the articles.

HI performs well in other communities and the score value is close to zero (2%). The highest value stood at 19 per cent in the community of SCs. It could be summarised and said that the tradition and cultural traits also play the role in improving the household environment. However, it has been realised that their employment and income level alone help them to enhance the household environment. In highlighting this issue, another analysis has been done on classifying the sample population as APL and BPL.

Communal Poverty and Household Environment: Table 9.9 gives a picture on the level of poverty under various communities and their household environment. Communal and cultural traits may also help to preserve the environmental resources particularly to make the household environment as pollution free. In all, the IGR and the HEI is negatively related (r = -0.188) and it is significant at one per cent level. Among the communities, the correlation coefficients are significant only at the first two communal groups viz. BC (-0.230) and MBC (-0.211). In the rest of the communal groups, the relationships are negative, but they are not significant. Among the sectoral indicators, a uniform relationship could not be identified. It reveals that some of the households are traditionally pushed back to the lower strata in our communal hierarchy and their occupational and income levels are far below compared to other groups. However, communal rituals and customs varied among the communities and there is a possibility in controlling the use of environmental resources as pollution free. The question arises how these relationships exist among the communal groups.

The BC households are one of largest share in our sample (814) and the performance in terms of sectoral indicators was scored very poorly. Of the six indices, the relationship is positive only in two indices viz. KI and HI. Between the two indices, KI is positive and significant. The positive relationship highlights the pollution level and its implications. Negative relationship reveals that the level of pollution is being reduced, while their economic status and income levels are going up. A similar relationship can be seen in the MBC. In this community, only two variables viz. WQI and KI are positively related to the income of the households. In the rest of the indicators, the coefficients are negatively correlated and it is significant only in TI and HQI.

In the case of SCs, two indices are positively related, that is AQI and KI. The rest of the indicators are negatively related to the income level and it is significant only in HQI. Majority of the sample households enjoyed the programme benefits of rural housing. STs too have the same relationship except in HI. HI coefficient is positive and significant at one per cent level. The positive relationship shows that their health conditions deteriorate, while the level of income increases. These relationships varied among the communal groups and the household environmental indicators.

Level of Poverty and Household Environment: A symbiotic relationship can be seen in between the poverty and environment. There is no uniform relationship in between these variables among the regions of the world. Environmentalists have tried to identify the cause and effect in between the level of poverty and environmental condition. All of them faced various methodological and conceptual problems and tried to resolve the issues through various approaches. However, there is a rich scope in this area to do research and give some concrete policies to achieve sustainable rural development.

An attempt has been made here to identify the relationships at household level in between the variables of poverty and household environment. Household environment is determined by various factors of economic, social and cultural. Of these, economic factors play a major role in accessing the resources. Accessing CPRs and environmental resources are equal to all categories of population. In certain cases exclusive principle applies to keep away from the benefits of the resource. The question arises in this context, what would be the relationship in between the income gap ratio and the indices of household environment.

Spearman's correlation was worked out in all categories of variables. Income gap ratio lies in between negative and positive values. If the value is zero, there is no income gap in between the poverty cut off line income Rs. 20700. Negative values indicate that there is a gap in income and their income level has to be raised further to bring in the APL category. On the other hand, the household environment index values have been construed 'zero' as no pollution and 'one' as high pollution.

Keeping in view of the nature and conceptualisation of the variables, analysis has been done here.

In general, the worked out correlation coefficients among the zones in between the IGR and HE are significant except in the villages of HAZ and HRZ. The correlation coefficient of HAZ village is positive and it is significant. In the rest of the cases negative relationships are observed in between the variables. The negative relationships reveal that the income level of the household increases, the household environment is moving towards no pollution, that means to reach '0' level in the score values.

The 'r' values are negative in all zone villages in between the IGR and TI. Of these zones, except in the HAZ village, the computed 'r' values are significant at one per cent level. It shows a negative relationship in between these variables and highlights that the high income group households able to grow more number of trees. In the case of HAZ village too, negative relationship can be seen, but it is not significant. This is a welcome trend among the high-income groups, however the low-income group population have meagre amount of land resources and further they have not grown any trees in their homestead lands.

Similarly AQI and IGR are negatively correlated in all the zone villages. These coefficients are significant at 1 per cent level in the zones of CDZ, NEZ, and NWZ. In the SZ village, the 'r' value is significant at 5 per cent level. It shows that the intensity of indoor air pollution has been reduced significantly, while the household income level increases.

The correlation coefficients of WQI and IGR gives a different picture compared to the earlier indices of AQI and TI. Overall 'r' value alone is significant at one per cent level. Among the zones, the relationships are not significant and the positive 'r' values recorded in the NEZ, HAZ and SZ villages. It warrants some special attention to control the deterioration of the water quality in the regions of NEZ and SZ. In the case of HAZ, due to the chill climate more or less throughout the year, the people have been forced to boil the water for consumption of human as well as animal population. Hence a different picture is obtained in the HAZ village. In the rest

of the four zone villages, the ‘r’ values are negative but they are significant. However, it establishes the negative relationship in between the level of income and water quality.

Among the zone villages, a similar picture obtained in between the HQI and IGR. Except in the region of HRZ, all other coefficients are significant and established the inverse relationship in between the variables. It shows that the high-income group populations are moving towards better housing thereby they are living in good condition.

A positive relationship can be seen in between in between IGR and KI. It gives some alarm signal in the use of kitchenwares. The income level increases, the use of environment unfriendly wares have been increasing in all the villages.

Finally, the relationship in between the IGR and HI gives a complex picture among the zone villages. Except HAZ village, the relationships are negative in between the variables. Of these, the relationship is significant only in the SZ village.

Table 9.10 explains the level of poverty and household environment. In all the identified indicators, the score values did not vary much. It confirms the characteristics of environmental goods viz. non-rivalness, non-excludability, free-rider problem, etc. Household relationships were identified among the poverty class of BPL and APL. Of the six indices, the coefficients are negatively correlated only in three indices viz. TI, HQI and HI in both categories of households of BPL and APL. In the BPL category, only one index that is KI is significant. At the other extreme, there are four indices are significant at one per cent level. They are TI (-0.229), AQI (-0.147), HQI (-0.152) and KI (0.202). Of these, KI alone is positive and significant.It could be concluded that the income level is related to the household environment, even though some of the public goods / environmental goods are treated as free goods.

Table 9.1 Poverty Spectrum: A Zone wise Analysis

Sl.No.	Poverty Spectrum	Agro Climatic Zone								Average Household Income
		Cauvery Delta	North East	Western	North West	High Altitude	Southern	High Rainfall	Total	
		n = 270	n = 270	n = 270	n = 270	n = 270	n = 270	n = 270	N = 1890	(in Rs.)
1	**Destitute** (Below 7000)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.37)	0 (0.00)	2 (0.74)	1 (0.37)	4 (0.21)	5050.00
2	**Very Poor** (7000 - 14000)	9 (3.33)	24 (8.89)	7 (2.59)	14 (5.19)	2 (0.74)	19 (7.04)	11 (4.07)	86 (4.55)	11721.63
3	**Marginally Poor** (14000 - 20700)	64 (23.70)	35 (12.96)	43 (15.93)	73 (27.04)	90 (33.33)	82 (30.37)	83 (30.74)	470 (24.87)	18269.52
4	**Marginally Non Poor** (20700 - 30000)	79 (29.26)	94 (34.81)	84 (31.11)	63 (23.33)	47 (17.41)	52 (19.26)	84 (31.11)	503 (26.61)	24785.33
5	**Better off** (30000 - 50000)	71 (26.30)	54 (20.00)	76 (28.15)	65 (24.07)	100 (37.04)	80 (29.63)	64 (23.70)	510 (26.98)	37001.49
6	**Well- to - do** (50000 - 100000)	34 (12.59)	42 (15.56)	46 (17.04)	38 (14.07)	26 (9.63)	25 (9.26)	27 (10.00)	238 (12.59)	69323.82
7	**Rich** (Above 100000)	13 (4.81)	21 (7.78)	14 (5.19)	16 (5.93)	5 (1.85)	10 (3.70)	0 (0.00)	79 (4.18)	231291.77
	Total	270 (100)	270 (100)	270 (100)	270 (100)	270 (100)	270 (100)	270 (100)	1890 (100)	40065.52

Source : Computed

Note : Figures in Parentheses are Percentages to the total

Table 9.2 Indices of Poverty and Inequality: Household Income by Zone

Sl.No	Agro Climatic Zone	Sample	HCR	Gini Ratio	IGR	Sen's Index
1	**Cauvery Delta**	270	0.270	0.206	0.107	0.079
2	**North East**	270	0.219	0.288	0.260	0.103
3	**Western**	270	0.185	0.253	0.251	0.082
4	**North West**	270	0.326	0.381	0.215	0.168
5	**High Altitude**	270	0.341	0.151	0.077	0.074
6	**Southern**	270	0.381	0.341	0.111	0.158
7	**High Rainfall**	270	0.352	0.284	0.057	0.114
	All	1890	0.296	0.275	0.169	0.118

Source: Computed

Table 9.3 Indices of Poverty and Inequality: Household Income by Community

Sl.No.	Community	Sample	HCR	Gini Ratio	IGR	Sen's Index
1	Backward Castes	814 (43.07)	0.268	0.277	0.146	0.103
2	Most Backward Castes	523 (27.67)	0.247	0.269	0.174	0.098
3	Scheduled Castes	491 (25.98)	0.397	0.278	0.202	0.169
4	Scheduled Tribes	44 (2.33)	0.273	0.196	0.062	0.067
5	Others	18 (0.95)	0.333	0.359	0.173	0.157
	All	1890 (100)	0.296	0.275	0.168	0.118

Source: Computed Note: Figures in parentheses are percentages to the total

Table 9.4 Endowment of Natural Resources: Block wise Information

Sl. No	Particulars	Kumbakonam	Vikkravandi	Papireddipatti	Bhavani	Coonoor	Thiruppulani	Killiyur
1	River & Drainage	Yes	Yes	Yes	Yes	Yes	No	Yes
2	Rainfall (Max)	1881	1305	1640.6	922.6	2189	1185	1329
	(Min)	668	204	636.4	424	1118	128	689
3	Geology	Levee Sand, and Clay	Hornblende Biotite, Gneiss Charnokite Alluvium	Hard Cryslalline Rock Charnokite Foliated Gnesses	Hard and Flood Plains of Archean age Gneiss Granites and Pyroxenite	Cryslalline Rock of Archean age and full of Charnokite	Alluvium Terrain Sedements	Garnet, Sillimanate Graphite Gneiss and Garnet Biotite gneiss
4	Geomorphology	Flood plains Delta Plains Levee complexes	Pediments Burial Pediments Deep and Flood Plains	Burial Pediments Deep Burial Pediments Sallow Valley Hill and Hill top Sediments	Donudational hills and Deep Buried Pediments and Flood Plains	Deflection Sloppe, Less Dissected Plateau	Deltaic Plains Sand Dunes Beach Ridges	Less Dissected Plateaus.Sedimenary Plains and Coastal Plains
5	Water level (Summer)	4.7 - 5.8	10.3 - 16.6	2.94 - 9.47	6.27 - 11.5	1.47 - 2.68	2.75 - 8.56	19.08 - 35.20
	Meter (Winter)	1.6 - 2.6	7.03 - 15.65	4.41 - 19.07	1.61 - 8.07	2.00 - 2.91	2.91 - 4.15	19.06 - 35.45
6	Water Quality Ec-micromhos/cm	740 - 1340	1500 - 4000	925 - 1375	1626 - 1762	170 - 660	540 - 13000	500 - 1000
7	Soil Group (A)	87	16	33	18	0	29.91	0
	Soil Group (B)	12	50	33	75	85.88	17.62	52
	Soil Group (C)	1	34	34	70	14.12	18.75	48
	Soil Group (D)	0	0	0	0	0	33.72	0
8	Slope	Level Slope	Level Slope	Steep Slope Strongly Slope	Very Gently Sloping	Terrain Mostly Sloping	Flat Terrain with Gentle Slope	Moderately Sloping
9	Land Use (Plant)	69	34	35	68	67	77.25	95
	(Settlement)	22	6	15	8	7	0.77	4
	(Water Bodies)	7	59	50	8	1	9.43	1
	(Waste Lands)	2	1	0	16	25	12.55	0

Source: Institute of Remote Sensing, Anna University, Chennai, 1999

Table 9.5 Natural Resources: Composite Index

Sl.No	Indices	Weight	Agro Climatic Zone							Total
			Cauvery Delta	North East	Western	North West	High Altitude	Southern	High Rainfall	
1	Land Use Index (LUI)	16.021	9.624 (60.07)	5.152 (32.16)	7.979 (49.81)	8.488 (52.98)	11.024 (68.81)	6.599 (41.19)	4.615 (28.80)	7.640 (47.69)
2	Slope Index (SI)	12.129	0.000 (0.00)	0.000 (0.00)	4.043 (33.33)	10.107 (83.33)	12.129 (100.00)	2.021 (16.67)	6.064 (50.00)	4.909 (40.48)
3	Soil Group Index (SGI)	14.088	1.409 (10.00)	3.730 (26.47)	6.921 (49.12)	3.357 (23.83)	3.621 (25.70)	7.421 (52.68)	4.404 (31.26)	4.409 (31.30)
4	Water Level Index (WLI)	10.237	0.722 (7.05)	4.209 (41.12)	1.999 (19.53)	2.878 (28.12)	0.071 (0.70)	1.707 (16.67)	10.237 (100.00)	3.117 (30.45)
5	Water Quality Index (WQI)	17.575	1.728 (9.83)	6.458 (36.74)	3.537 (20.13)	2.033 (11.57)	0.000 (0.00)	17.575 (100.00)	0.926 (5.27)	4.608 (26.22)
6	Average Rainfall Index (ARI)	14.783	5.157 (34.89)	11.984 (81.06)	12.573 (85.05)	6.797 (45.98)	0.000 (0.00)	13.252 (89.64)	8.223 (55.62)	8.284 (56.03)
7	River Drainage Index (RDI)	15.167	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	15.167 (100.00)	0.000 (0.00)	2.167 (14.29)
8	Natural Resources Index (NRI)	100.00	18.640	31.532	37.052	33.660	26.845	63.743	34.469	35.134
	Rank		**1**	**3**	**6**	**4**	**2**	**7**	**5**	
	Household Environment Index (HEI)		42.746	38.965	43.021	42.718	40.022	40.352	42.395	41.460

Source: Computed

Note: Figures in parentheses are percentages to the total weights derived
Correlation Coefficient for the NRI and HEI is 0.143 (0.76)

Table 9.6 Technical Note: Computation of Environmental Indices

Sl.No	Indices	Formulae
	Household Environment Index (H E I)	**(T I*** 15.030)+ (**W Q I *** 15.186) +(**A Q I *** 18.611) +(**H Q I *** 17.450) + (**K I *** 16.132)+(**HI *** 17.590)
1	**Tree Index (TI)**	1- ((Actual – Minimum) / (Maximum – Minimum))
2	**Water Quality Index (WQI)**	(QBI + DBI) / 2
	Quantity Boiled Water Index (QBI)	(Actual – Minimum) / (Maximum – Minimum)
	Drinking Boiled Water Index (DBI)	Yes = 1, No = 0
3	**Air Quality Index (AQI)**	(MCI+ OI) / 2
	(i) Mosquito Control Index (MCI)	(CMI + MMI) / 2
	Control Method Index (CMI)	No = 0, Traditional = 0.5,Modern = 1
	Mosquito Mat Index (MMI)	(Actual – Minimum) / (Maximum – Minimum)
	(ii) Oven Index (OI)	(((Fire wood * 1) + (Kerosene * 0.75)+ (LPG * 0.5) + (Bio Gas * 0)) / 2.25) / No of Ovens in Use
4	**Housing Quality Index (HQI)**	1 – ((HTI + HVI) / 2)
	Housing Type Index (HTI)	Thatched = .25, Asbestos = 0.5, Tiled = 0.75, Concrete = 1
	Housing Value Index (HVI)	(Actual – Minimum) / (Maximum – Minimum)
5	**Kitchenware Index (KI)**	((EI * 0.1) + (BI * .25) + (ESI*0.5) (+AI * .75) + (PI * 1)) / 2.6
	Earthenware Index (EI)	(Actual – Minimum) / (Maximum – Minimum)
	Aluminiumware Index (AI)	(Actual – Minimum) / (Maximum – Minimum)
	Brassware Index (BI)	(Actual – Minimum) / (Maximum – Minimum)
	Ever Silverware Index (ESI)	(Actual – Minimum) / (Maximum – Minimum)
	Plastic ware Index (PI)	(Actual – Minimum) / (Maximum – Minimum)
6	**Health Index (HI)**	((Fever *0 .25) + (Headache * 0.25) + (Stomach ache *0 .75) + (Dysentery *0 .75) +(Chronic*1))/3

Source: Computed

Table 9.7 Household Environment: Composite Index

Sl.No	Indicators	Weight	Agro Climatic Zone							Total
			Cauvery Delta	North East	Western	North West	High Altitude	Southern	High Rainfall	
			n = 270	n = 270	n = 270	n = 270	n = 270	n = 270	n = 270	N = 1890
1	Tree Index (TI)	15.03	14.17 (94.29)	14.89 (99.04)	14.69 (97.70)	14.36 (95.52)	14.94 (99.39)	13.71 (91.21)	14.71 (97.86)	14.49 (96.43)
2	Water Quality Index (WQI)	15.19	3.04 (20.03)	0.16 (1.07)	2.70 (17.78)	7.50 (49.40)	2.37 (15.58)	1.57 (10.31)	3.34 (21.96)	2.95 (19.45)
3	Air Quality Index (AQI)	18.61	11.91 (63.97)	7.37 (39.60)	8.66 (46.54)	7.00 (37.59)	7.90 (42.44)	8.54 (45.88)	9.28 (49.84)	8.66 (46.55)
4	Housing Quality Index (HQI)	17.45	11.76 (67.37)	11.52 (66.03)	10.84 (62.09)	10.15 (58.16)	9.90 (56.72)	11.84 (67.88)	9.84 (56.38)	10.84 (62.09)
5	Kitchenware Index (KI)	16.13	1.60 (9.90)	1.89 (11.74)	2.17 (13.44)	0.89 (5.53)	1.49 (9.24)	1.68 (10.40)	1.99 (12.30)	1.67 (10.36)
6	Health Index (HI)	17.59	0.27 (1.54)	3.13 (17.81)	3.97 (22.56)	2.82 (16.05)	3.43 (19.51)	3.02 (17.16)	3.25 (18.49)	2.84 (16.16)
	Household Environment Quality Index (HEI)	100.00	42.75	38.97	43.02	42.72	40.02	40.35	42.40	41.46

Source: Computed

Note: Figures in Parentheses indicate Percentages to weights derived

Table 9.8 Poverty and Household Environment: Zero Order Correlation by Zone

SL.NO	Indicators	Agro Climatic Zone							All
		Cauvery Delta	North East	Western	North West	High Altitude	Southern	High Rainfall	
1	Tree Index (TI)	-0.206** (0.00)	-0.209** (0.00)	-0.267** (0.00)	-0.253** (0.00)	-0.110 (0.07)	-0.321** (0.00)	-0.129* (0.03)	-0.19s9** (0.00)
2	Air Quality Index (AQI)	-0.199** (0.00)	-0.203** (0.00)	-0.041 (0.51)	-0.169** (0.01)	-0.037 (0.55)	-0.141* (0.02)	-0.041 (0.50)	-0.026 (0.26)
3	Water Quality Index (WQI)	-0.032 (0.42)	0.027 (0.65)	-0.028 (0.65)	-0.072 (0.24)	0.115 (0.06)	0.020 (0.74)	-0.008 (0.90)	-0.083** (0.00)
4	Housing Quality Index (HQI)	-0.329** (0.00)	-0.254** (0.00)	-0.198** (0.00)	-0.253** (0.00)	-0.137* (0.02)	-0.276** (0.00)	-0.004 (0.94)	-0.195** (0.00)
5	Kitchenware Index (KI)	0.220** (0.00)	0.365** (0.00)	0.155** (0.01)	0.344** (0.00)	0.280** (0.00)	0.195** (0.00)	0.257** (0.00)	0.217** (0.00)
6	Health Index (HI)	-0.017 (0.78)	-0.047 (0.44)	-0.057 (0.35)	-0.061 (0.32)	0.071 (0.25)	-0.156** (0.01)	-0.054 (0.38)	-0.050* (0.03)
7	Household Environment Index (HEI)	-0.274** (0.00)	-0.251** (0.00)	-0.171** (0.00)	-0.242** (0.00)	0.09 (0.14)	-0.32** (0.00)	-0.04 (0.52)	-0.188** (0.00)

Source: Computed

Note: Figures in parentheses are Level of significance
*Significant at 5 % Level
**Significant at 1 % Level

Table 9.9 Poverty and Household Environment: Zero Order Correlation by Community

Sl.No	Indicators	Backward Castes	Most Backward Castes	Scheduled Castes	Scheduled Tribes	Other Castes	All
		n = 814	n = 523	n = 491	n = 44	n = 18	n = 1890
1	Tree Index (TI)	-0.238**	-0.208**	-0.082	-0.262	-0.471*	-0.199**
		(0.00)	(0.00)	(0.07)	(0.25)	(0.05)	(0.00)
2	Water Quality Index (WQI)	-0.013	0.022	-0.032	-0.243	-0.324	-0.026
		(0.71)	(0.62)	(0.48)	(0.09)	(0.19)	(0.26)
3	Air Quality Index (AQI)	-0.179**	-0.069	0.057	0.186	-0.034	-0.083**
		(0.00)	(0.12)	(0.20)	(0.11)	(0.89)	(0.00)
4	Housing Quality Index (HQI)	-0.230**	-0.285**	-0.134**	-0.042	-0.259	-0.195**
		(0.00)	(0.00)	(0.00)	(0.23)	(0.30)	(0.00)
5	Kitchenware Index (KI)	0.159**	0.269**	0.165**	0.447	0.226	0.217**
		(0.00)	(0.00)	(0.00)	(0.79)	(0.37)	(0.00)
6	Health Index (HI)	0.011	-0.066	-0.064	0.062**	-0.239	-0.050*
		(0.76)	(0.13)	(0.16)	(0.00)	(0.34)	(0.03)
7	Household Environment Index (HEI)	-0.230**	-0.211**	-0.076	-0.123	-0.378	-0.188**
		(0.00)	(0.00)	(0.09)	(0.43)	(0.12)	(0.00)

Source: Computed

Note: Figures in parentheses are Level of significance
*Significant at 5 % Level
**Significant at 1 % Level

Table 9.10 Level of Poverty and Household Environment

Sl.No	Indicators	Weight	Average Index Scores			Correlation Coefficients		
			BPL	APL	All	BPL	APL	All
			n = 560	n = 1330	N = 1890	n = 560	n = 1330	N = 1890
1	Tree Index (TI)	15.030	14.34	14.87	14.49	-0.051	-0.229**	-0.199**
			(95.39)	(98.91)	(96.43)	(0.23)	(0.00)	(0.00)
2	Water Quality Index (WQI)	15.186	2.95	2.97	2.95	-0.085	0.005	-0.026
			(19.40)	(19.56)	(19.45)	(0.04)	(0.85)	(0.26)
3	Air Quality Index (AQI)	18.611	8.56	8.90	8.66	0.044	-0.147**	-0.083**
			(46.01)	(47.85)	(46.55)	(0.30)	(0.00)	(0.00)
4	Housing Quality Index (HQI)	17.450	10.48	11.69	10.83	-0.004	-0.152**	-0.195**
			(60.03)	(66.97)	(62.09)	(0.92)	(0.00)	(0.00)
5	Kitchenware Index (KI)	16.132	1.74	1.50	1.67	0.125**	0.202**	0.217**
			(10.81)	(9.30)	(10.36)	(0.00)	(0.00)	(0.00)
6	Health Index (HI)	17.590	2.80	2.95	2.84	-0.072	-0.028	-0.050*
			(15.91)	(16.76)	(16.16)	(0.09)	(0.31)	(0.03)
	Household Environment Quality Index (HEI)	100	40.86	42.88	41.46	-0.061	-0.186**	-0.188**
			(40.86)	(42.88)	(41.46)	(0.15)	(0.00)	(0.00)

Source: Computed

Note: Figures in Parentheses represent the Percentages to the total weights derived
Figures in Parentheses represent the Levels of Significance of Correlation Coefficients
*Significance at 5 % Level
**Significance at 1 % Level