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DIMENSIONS OF QUALITY OF ENVIRONMENT IN SAHARANPUR CITY,INDIA

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ABSTRACT

The quality of environment is destroying day by day. Concern with it evokes with depletion and degradation of resources, deforestation, energy and power, food and disease. Realization has dawned upon man lately that proper environment of human habitats is much a necessity as conserving nature, eradicating disease and hunger.

The problem of environment is most acute in the settlement designated as towns and cities. The twin processes of rapidly increasing population and industrialization have caused stresses on the environment of the urban places.

The problem of quality of environment is qualitatively different between the western and eastern cities as the major problems of the western cities is related to the impairment of natural environment in the form of air, water and noise pollution which have resulted from the excessive use of resources and spontaneous land use. The problems to environment in developing cities are socio-ecological in nature.

Present study organizes the indicators of quality of urban environment into few dimensions representing intrinsic pattern of the quality of environment this is achieved by employing principal components analysis. The underlying dimensions of the quality of environment studied are general environmental status, Territorial stress, Open and green areas, water quality, waste production etc. are interpreted and spatial pattern is examined.

KEY WORDS: ***Environment, degradation, Socio- ecological, Territorial stress, waste production.***

INTRODUCTION

The quality of environment is a matter of great concern in the contemporary world. Concern with it evokes with depletion and degradation of resources, deforestation, energy and power, food and disease. Realization has dawned upon man lately that proper environment of human habitats is much a necessity as conserving nature, eradicating disease and hunger.

Present study organizes the indicators of quality of urban environment into few dimensions representing intrinsic pattern of the quality of environment this is achieved by employing principal components analysis. The underlying dimensions of the quality of environment are interpreted and spatial pattern is examined in the following pages.

STUDY AREA

The city of Saharanpur lies at the 29 p 58' N latitude and 77p 33'E longitude and enjoys a conspicuous location in the Upper Doab. It is situated at the confluence of the Paondhoi with the Dhamola river. At present it extends over an area of 28.88sq.km (Fig 1.1). Its total population is 5, 55,754.

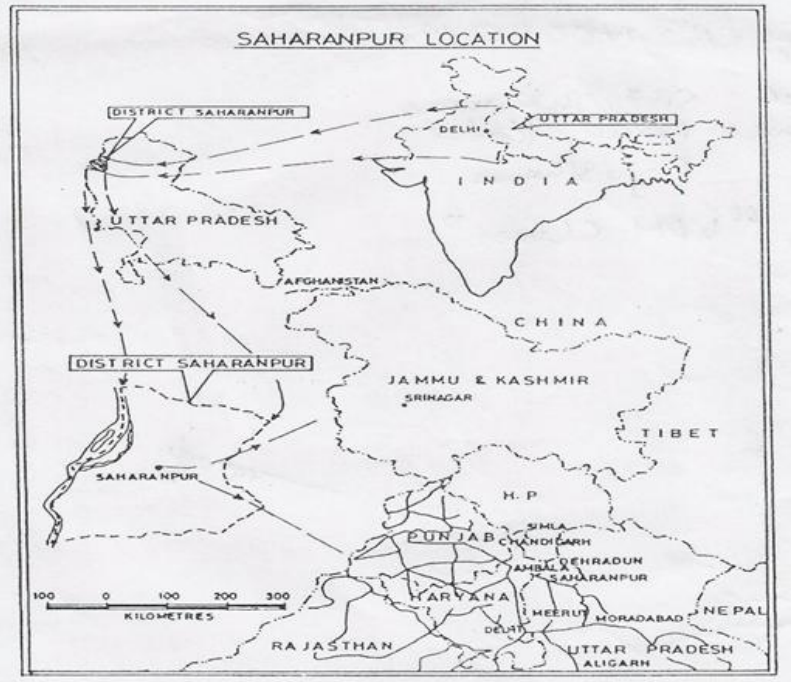


Fig 1: Location of Saharanpur

DATA BASE AND METHODS

present study is empirical in its treatment of the theme of inquiry. Information about the housing types, facilities and general environmental conditions is gathered from the household survey. The collected data is processed and compiled on the ward level, which is taken as the unit of analysis. The wards of the city are classified into four categories of very high, high, low and very low. This has been achieved by applying nested means method.

The values above the means of the larger values are designated as very high and values falling between the mean of smaller values and the grand mean are classified as low and values below the mean of smaller values are labelled as very low.

Principal Components Analysis provides a method of constructing from a large number of variables to a few new variables which are pairwise uncorrelated. Each principal component is a linear combination of the observed variables.

List of variables

1. Unauthorized housing ,
2. Planned housing
3. Very new houses
4. New houses
5. Old houses
6. Very old houses
7. Average age of housing
8. Pressure on latrines
9. Pressure on bathrooms
10. Proper ventilation
11. Type of fuel
12. Quality of fuel
13. Crowding
14. Congestion
15. Population density
16. Open and green area
17. Water logged area
18. Duration of water logging
19. Severity of water logging
20. Garbage production
21. Garbage collection and disposal
22. Temporal efficiency of garbage disposal
23. Excreta collection and disposal systems
24. Water consumption
25. Pressure on water supply
26. Quality of water supply

The principal component analysis of the above variables indicating quality of bio-physical and social environment of the city of Saharanpur has yielded six major principal components. These are as follows –

1. General environment stresses
2. Territorial stress
3. Water supply and housing facilities
4. Waste production
5. Open and green area
6. Water quality

These dimensions together explain as high as 76.88% of the total variance of all variables **(table 1.1).**

Component	Eigen value	Percent variance explained	Cumulative percentage
1.	10.92203	40.45	40.45
2.	4.15326	15.38	55.83
3.	1.61343	5.98	61.81
4.	1.51308	5.60	67.41
5.	1.30526	4.83	72.24
6.	1.25148	4.64	76.88

Table 1.1 Environmental structure of Saharanpur

The first component explains the highest variance amounting to 40.45% of the total variance. The second component explains 15.38% of all the variance. The remaining principal components are not so important and explained from 4.64 to 5.98% of the total variance.

Principal component 1 – General environmental status

This principal component is the most important dimension of the quality of environment in the Saharanpur city. The majority of the variables of livability load high on this dimension (table 1.2). Therefore, it is identified as the dimension of general environmental status.

Table 1.2 Principal component 1- General environmental status

Serial No.	Variable	Loading
1.	Unauthorized housing	0.70517
2.	Planned housing	-0.55684
3.	Average age of housing	0.14673
4.	Pucca houses	-0.89963
5.	Mixed houses	0.76891
6.	Kutcha houses	0.72430
7.	Jhuggis	0.69387
8.	Pressure on laterines	0.83152
9.	Pressure on bathrooms	0.55634
10.	Proper ventilation	-0.78955
11.	Quality of fuel	-0.49366
12.	Appropriateness of fuel burning place	-0.53909
13.	Population density	-0.00687
14.	Congestion	-0.04479
15.	crowding	0.06734
16.	Open and green area	-0.12101
17.	Density of drains	-0.13831
18.	Water logged area	0.81474
19.	Duration of water logging	0.76272
20.	Excreta disposal efficiency	-0.66581
21.	Garbage production	-0.14012
22.	Garbage disposal efficiency	-0.61192
23.	Tap water supply	-0.86992
24.	Motor pump water supply	0.19887
25.	Hand pump water supply	0.90316
26.	Pressure on water supply	0.82213
27.	Quality of water	-0.19102

The variables which load positive and high on this dimension are water supply from hand-pumps (0.903), pressure on latrines (0.83152), pressure on water supply (0.82213), water-logged area (0.81474), duration of water-logging (0.7627), mixed houses (0.76891), kutcha houses (0.72430), and unauthorized housing housing (0.70517). The variables which load positive but moderately on this dimensions are jhuggis (0.69387) and pressure on baths (0.55634). Clearly, these positive loadings indicate an environment where housing is poor with high pressure on housing facilities and where unhygienic conditions prevail as water-logging is at worst here. Main source of water supply in this environment is hand-pumps, the quality of whose supply is doubtful.

On the other hand, the variables which load high but negatively are pucca houses (-0.89963), tap water supply (-0.86692), and proper ventilation (-0.78955). The moderate negative loadings are recorded in the instance of efficiency of excreta disposal (-0.66587), efficiency of garbage disposal (-0.61192), planned housing (-0.55684), appropriateness of fuel burning place (-0.53909) and quality of fuel (-0.49366). These variables point out an environmental situation where planned and quality housing is lacking, potable municipal water is deficient, and indoor environment is highly polluted due to absence of proper ventilation and burning of low grade fuel in improper places.

These loadings and their signs are consistent and complementary to each other, pointing out a general degraded environment hazardous to health and well-being of the residents. These environmental conditions are generally obtain in localities where the urban poor concentrate. Since, they lack money, they cannot afford land prices off better locations and construction of quality and planned houses. They concentrate in low lying and unhygienic places where water-logging is a major problem. Since, in addition to money the residents of these areas also political power, local government generally does not provide these areas such basic services as potable water supply and disposal of the garbage and excreta. Thus, water-logging with the absence of sanitary services is one of the major problem in this environment.

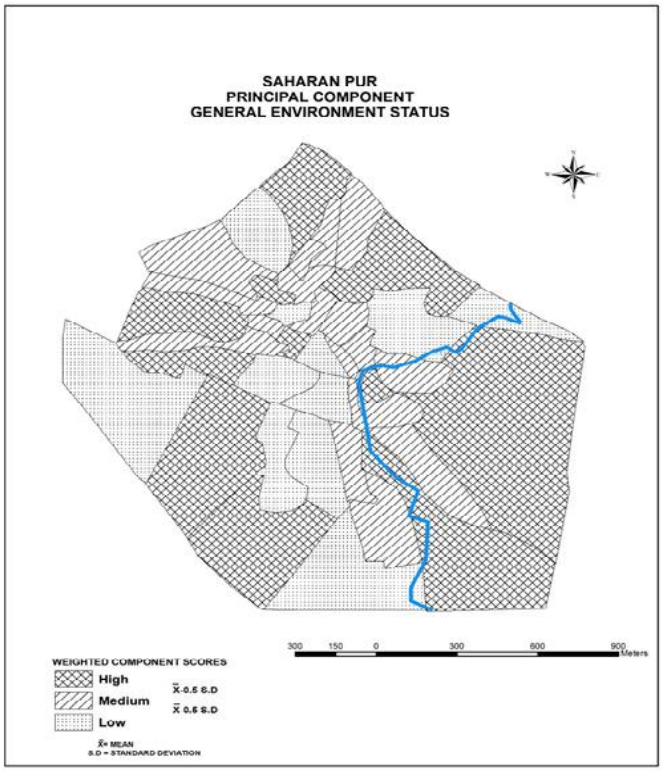


Fig 2: General Environmental Status

Principal Component 2: Territorial Stress

The territorial stress is the second most important dimension of the quality of environment. It is determined mainly by congestion, population density, crowding, density of drains, and also by age of housing, planned housing, and fuel burning. The indicators which load relationships of crowding and housing characteristics. The indicators which load significantly on this dimension of the quality of life also strengthen the underlying concept of this dimension which expresses overcrowding and the environmental conditions which are generally found to co-vary with it.

Table 1.3 Principal Component 2: Territorial Stress

Serial No.	Variable	Loading
1.	Unauthorized housing	0.04667
2.	Planned housing	-0.55684
3.	Average age of housing	0.76541
4.	Pucca houses	-0.15414
5.	Mixed houses	0.18152
6.	Kutcha houses	0.24283
7.	Jhuggis	0.09076
8.	Pressure on laterines	0.83152
9.	Pressure on bathrooms	0.55634
10.	Proper ventilation	-0.78955
11.	Quality of fuel	-0.49366
12.	Appropriateness of fuel burning place	-0.49282
13.	Population density	-0.88520
14.	Congestion	-0.89804
15.	Crowding	0.74483
16.	Open and green area	-0.12101
17.	Density of drains	0.71491
18.	Water logged area	0.81474
19.	Duration of water logging	0.76272
20.	Excreta disposal efficiency	-0.45458
21.	Garbage production	-0.14012
22.	Garbage disposal efficiency	0.09904
23.	Tap water supply	-0.45458
24.	Motor pump water supply	0.19887
25.	Hand pump water supply	0.04698
26.	Pressure on water supply	0.90316
27.	Quality of water	-0.82213

The highest positive loading is shown by congestion (0.89804) closely followed by population density (0.88520). Average age of housing (0.76541), crowding (0.74483) and density of drains (0.71491) also load positively and high on this dimension. The moderate but negative loadings of planned houses (-0.55684), fuel burning place (-0.49282) and excreta disposal (-0.45458) are also in conformity with the dimension identified as territorial stress.

This dimension thus places emphasis on the indicators which reflect on the intensity of residential use of the city space. Congestion, population density and crowding are obvious indicants of this situation. The high and positive loadings of age of housing and density of drains indicate the location in the old city where this problem is most acutely felt. Further, it is in this old part of the city where housing congestion and population density are very high.

The moderate negative loadings of planned housing, fuel burning place and excreta disposal also define location and conditions where high territorial stress generally obtains. Obviously, old areas have no elements of planning in housing and house population which due to lack of space in houses use improper places for burning of fuel e.g. rooms. Disposal of excreta is also insufficient in these areas as generally traditional service latrines abound in this area and a significant proportion of population disposes its excreta with garbage.

Thus, the wards which score high on this dimension are characterized with the conditions of overcrowding and attendant environmental and the related problems. On the contrary, the wards which score low on this dimension experience less territorial stress.

The figure shows that the territorial stress, makes a clear distinction between the core and periphery, the middle zone occupying intermediate or transitional position. The core is characterized by high levels of crowding, congestion and density whereas, the reverse is largely true of the periphery. Though it is difficult to characterize the middle zone where both medium and low levels of the territorial stress obtain but in general territorial stress gradually eases outward from the city core and conforms well with general pattern of population density so well documented and analyzed cross-culturally (Clark 1951).

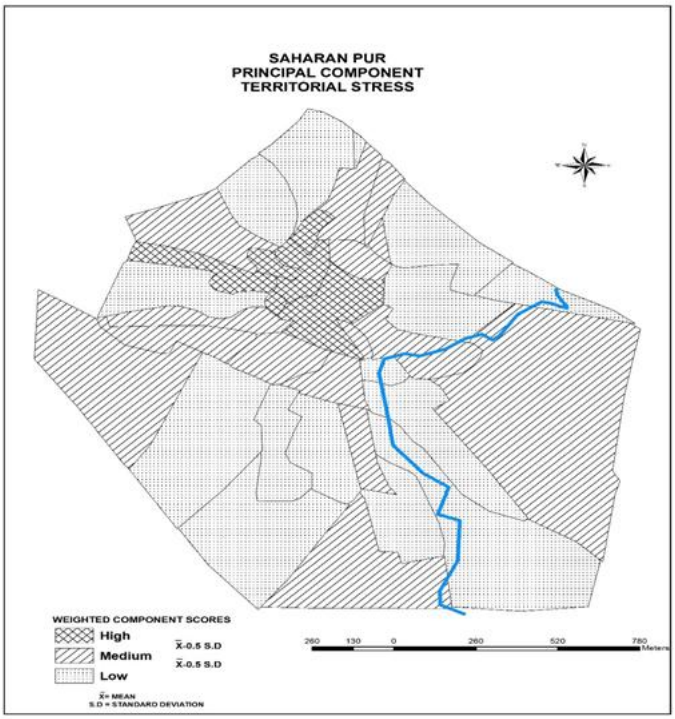


Fig.3. Territorial Stress

Principal component 3: Water Supply and Housing Facilities

This principal component explains 5.98 percent of the total variance and is the third important dimension of the quality of environment in Saharanpur. A number of indicators especially those associated with the quality of water and housing facilities load high on this dimension. That is why it is identified as the dimension. That is why it is identified as the determination of water supply and housing facilities. It is interesting to note that no indicator of the quality of environment loads positively, either high or moderate, on this dimension.

Table 1.4 Principal component 3:Water Supply and Housing Facilities .

Serial No.	Variable	Loading
1.	Unauthorized housing	0.13658
2.	Planned housing	0.25852
3.	Average age of housing	-0.06353
4.	Pucca houses	0.27244
5.	Mixed houses	-0.24805
6.	Kutcha houses	0.18152
7.	Jhuggis	-0.06219
8.	Pressure on latrines	-0.14260
9.	Pressure on bathrooms	-0.57359
10.	Proper ventilation	0.27286
11.	Quality of fuel	0.18795
12.	Appropriateness of fuel burning place	0.12412
13.	Population density	0.06824
14.	Congestion	0.11831
15.	Crowding	-0.08782
16.	Open and green area	-0.06647
17.	Density of drains	0.15634
18.	Water logged area	0.25234
19.	Duration of water logging	0.00560
20.	Excreta disposal efficiency	0.37412
21.	Garbage production	0.09394
22.	Garbage disposal efficiency	-0.16138
23.	Tap water supply	0.36375
24.	Motor pump water supply	-0.85597
25.	Hand pump water supply	-0.17350
26.	Pressure on water supply	0.03429
27.	Quality of water	0.13058

However, the loadings of indicators of excreta disposal (0.37412), tap water supply (0.36378), proper ventilation (0.27286) and pucca houses (0.27244) are significant. Together these loadings suggest an environment where water supply is good, excreta disposal is efficient and generally quality houses with proper ventilation exist in good number.

Only a single indicator, motor-pump water supply loads high (-0.85597) but negatively on this dimension. It is followed but a negative moderate loading of pressure on baths (-0.57351). These loadings signify a situation where water supply from motor-pumps is lacking and bathrooms are adequately available in houses (table).

As a whole, this dimension represents a better environment with an accent on water supply and housing facilities. All the loadings with their sign show a certain pattern of interrelationships. The quality of houses do not have pressure on housing facilities and are generally supplied with tap water by the municipality..

The wards which score high on this dimension have, in large part good water supply and less pressure on baths and vice versa. Figure exhibits spatial pattern of this dimension in Saharanpur.. In most cases, housing in these wards is planned and well provided with potable water supply.

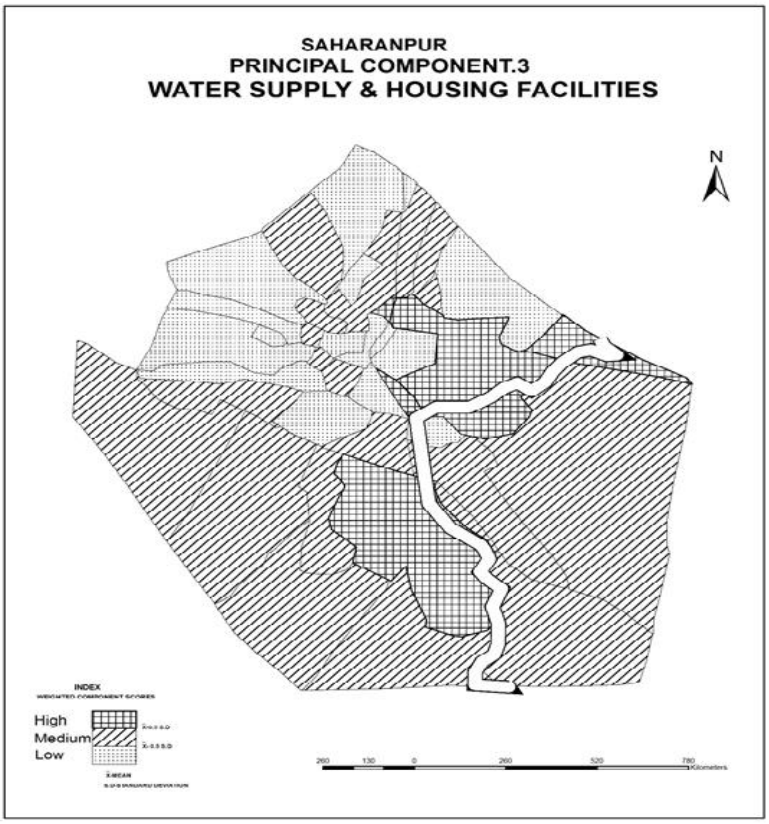


Fig 4: Water supply and housing facilities

Principal component 4: Waste Production

This principal component is another dimension of the quality of urban environment in Saharanpur. It explains as much proportion of the total variance as 5.60 percent.

Table 1.5 Principal component 4: Waste Production

Serial No.	Variable	Loading
1.	Unauthorized housing	0.29612
2.	Planned housing	-0.06169
3.	Average age of housing	-0.11193
4.	Pucca houses	-0.14194
5.	Mixed houses	0.13614
6.	Kutcha houses	0.26717
7.	Jhuggis	-0.03748
8.	Pressure on laterines	0.30093
9.	Pressure on bathrooms	0.08157
10.	Proper ventilation	-0.33464
11.	Quality of fuel	-0.35254
12.	Appropriateness of fuel burning place	-0.17921
13.	Population density	-0.10888
14.	Congestion	0.06734
15.	Crowding	0.27993
16.	Open and green area	-0.9562
17.	Density of drains	0.23965
18.	Water logged area	0.18305
19.	Duration of water logging	0.23127
20.	Excreta disposal efficiency	-0.12886
21.	Garbage production	-0.81320
22.	Garbage disposal efficiency	-0.35145
23.	Tap bwater supply	-0.04673
24.	Motor pump water supply	0.05123
25.	Hand pump water supply	0.03203
26.	Pressure on water supply	0.08706
27.	Quality of water	0.17286

This dimension is strongly associated with the single variable of garbage production (-0.81320). No other variable is strongly or moderately associated with it. However, there are several indicators whose loadings are statistically significant (Table). Among these indicators most important is waste disposal (0.35145). These two loading together describe an environment where waster production is small and its disposal is efficient. As observed earlier that the general axiom that the poor produce less garbage does not hold true in Saharanpur. Therefore, these two variables are complementary to each other and signify a residential environment of the affluent who produce less garbage which is disposed of efficiently.

However, weak but significant loadings of other variable contradict this situation. These variables are pressure on baths (0.30093), unauthorized housing (0.29612), crowding (0.27993) and jhuggis (0.26717). These represent an environment of unauthorized housing dominated by jhuggis and characterized by overcrowding and pressure on baths. Clearly, these conditions prevail in the *bastis* (settlements) of the urban poor. This conclusion is further strengthened by the negative but significant loadings of other variables. These are fuel burning place (-0.33464) and quality of fuel (-0.35254). These loadings are consistent with the positive weak loadings. These loadings indicate an environmental situation where low grade fuel mostly bio-fuel is burnt in inappropriate places. Obviously this situation generally obtained in the in the housing environment represented by the positive weak loadings.

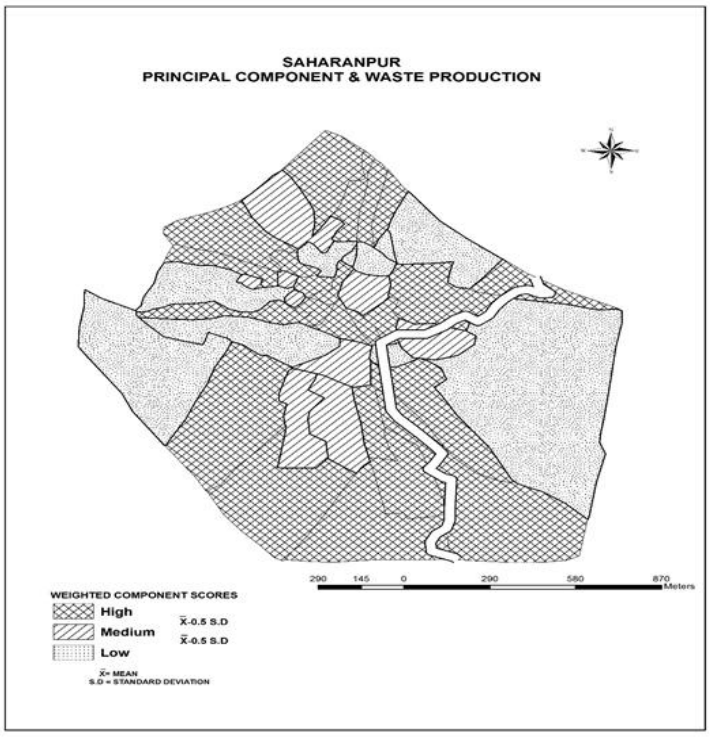


Fig 5: Waste production

Principal component 5: Open and green areas

This principal component is also a single variable dominating dimension of the quality of environment in Saharanpur. It explains 4.83 percent variance of all the variables.

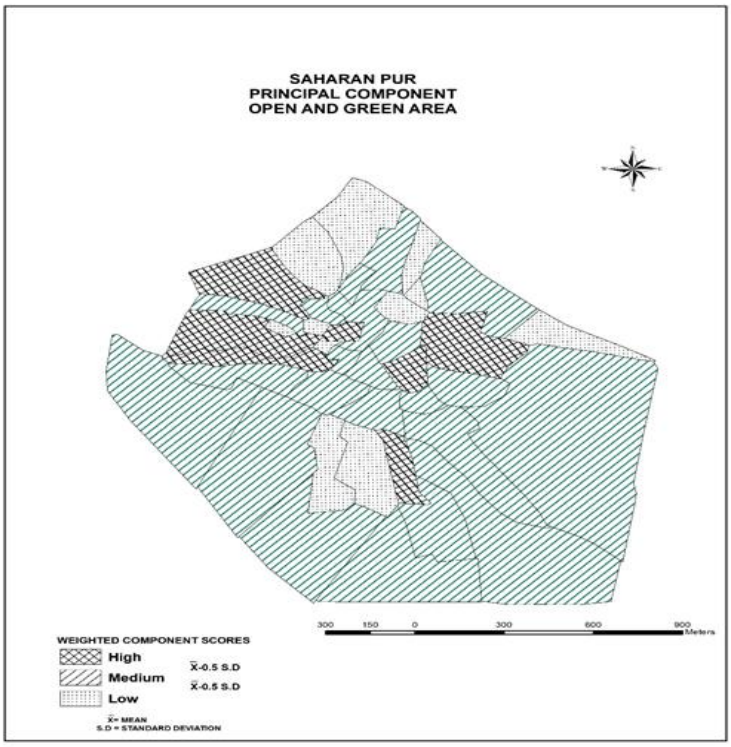
Table 1.6 Principal component 5: Open and green areas

1.	Unauthorized housing	0.33089
2.	Planned housing	0.24554
3.	Average age of housing	-0.22945
4.	Pucca houses	-0.09645
6.	Mixed houses	-0.24971
7.	Kutcha houses	0.14782
8.	Jhuggis	0.49259
9.	Pressure on laterines	-0.25679
10.	Pressure on bathrooms	-0.05734
11.	Proper ventilation	0.01522
12.	Quality of fuel	0.34246
13.	Appropriateness of fuel burning place	0.06192
14.	Population density	-0.03201
15.	Congestion	0.10888
16.	Crowding	0.27993
17.	Open and green area	0.76093
18.	Density of drains	0.22418
19.	Water logged area	-0.02768
20.	Duration of water logging	-0.14510
21.	Excreta disposal efficiency	-0.12711
22.	Garbage production	0.05137
23.	Garbage disposal efficiency	-0.23171
24.	Tap water supply	0.05238
25.	Motor pump water supply	0.07244
26.	Hand pump water supply	-0.10014
27.	Pressure on water supply	-0.14338
28.	Quality of water	0.25426

The variable that loads highest on this dimension is open and green area. It has loaded positively and is as high as 0.76093. No other variable has loaded so high on this dimension either positively or negatively. As such, it is the governing variable of this dimension which therefore, is identified as the dimension of open and green area. The next important is the positive and moderate loading of jhuggis (0.49259). These two loadings represent an environmental situation where large open and green areas are occupied by flimsy hutments (jhuggis). However, this situation is contradicted by the fact that the variable of quality of fuel has loaded significantly (0.34246) on this dimension. It means that in areas signified by this dimension, quality fuel is used which is contrary to the fact that residents of jhuggis in authorized colonies generally use polluting low-grade (generally bio-fuels). It should be noted that the contradiction pointed out by this dimension exists in reality. In fact, open and green areas are also associated with the high class residential areas which co-exist with low class residential areas in the outer zone.

The open and green area is completely absent in the core of the city but one ward of this zone has scored high on this dimension and this ward is marked for the presence of low grade housing comprising of jhuggis. Thus, the general pattern of this dimension is highly modified by the variable of jhuggis.

Fig 6: Open and Green Area



Principal component 6: Water Quality

This principal component explains the lowest variance of variables of the quality of environment among the selected principal components amounting to 4.64 percent. It is associated mainly with the measure of quality of water.

Table 1.7 Principal component 6: Water Quality

Serial No.	Variable	Loading
1.	Unauthorized housing	0.10303-
2.	Planned housing	0.19419
3.	Average age of housing	-0.23603
4.	Pucca houses	0.00753
6.	Mixed houses	0.08287
7.	Kutcha houses	-0.19254
8.	Jhuggis	0.14123
9.	Pressure on laterines	0.09049
10.	Pressure on bathrooms	-0.06076
11.	Proper ventilation	0.17210
12.	Quality of fuel	-0.46155
13.	Appropriateness of fuel burning place	-0.10296
14.	Population density	-0.13673
15.	Congestion	0.1719
16.	Crowding	0.06661
17.	Open and green area	0.12089
18.	Density of drains	-0.22627
19.	Water logged area	0.00017
20.	Duration of water logging	-0.10990
21.	Excreta disposal efficiency	-0.03776
22.	Garbage production	0.12723
23.	Garbage disposal efficiency	-0.25937
24.	Tap water supply	-0.01555
25.	Motor pump water supply	-0.05254
26.	Hand pump water supply	0.02407
27.	Pressure on water supply	-0.05389
28.	Quality of water	0.83038

It loads as high as 0.83038. it means that wards which load high on this dimension receive good quality water that means that major source of water supply in these areas is municipal tap connection. However, this dimension is also moderately loaded by the quality of fuel (-0.46155). This loading is negative, meaning thereby that quality of water and that of fuel are inversely associated. In other words, the areas receiving satisfactory water quality have households using low grade fuel.

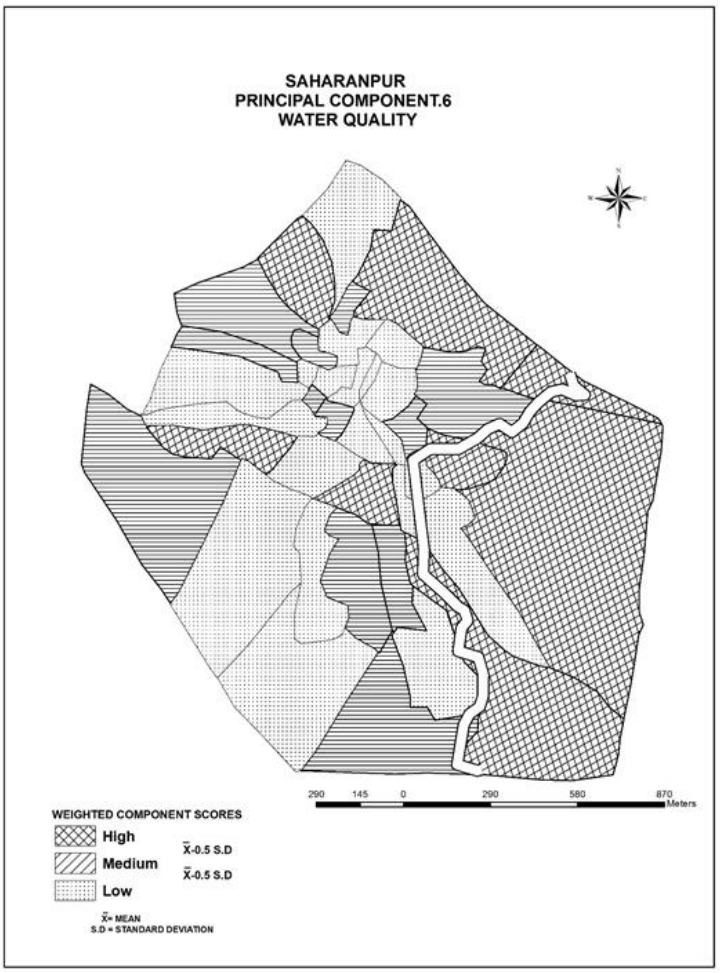


Fig 7: Water Quality

CONCLUSION

A closer examination of the meanings and patterns of these six dimensions of the quality of environment in Saharanpur suggests that are not many dimensions of it in terms of the processes which have generated them. In fact, a scrutiny of these dimensions point out that, out of them latter four are spurious because loadings of certain variables on them do not conform with the meaning suggested by their governing variables. Further, the spatial pattern of these dimensions does not confirm their interpretation. As, these dimensions do not uncover any process that has generated them. They represent very unusual environmental situations which can be described as the product of chance in the sampling process. It means that there are only two significant dimensions of the quality of environment in Saharanpur – general environmental status and territorial stress.

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