CHAPTER – 4

EFFICACY OF GEOGRAPHICAL CATALYSTS IN THE EVOLUTION AND TRANSFORMATION OF ENVIRONMENT INHABITED BY TRIBES

"I don't know the beginning and end of cataclysmic events."

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Evolution and transformation are multi-dimensionally everoperative phenomena in *ad–infinitum*. Naturally synchronizing elements keep on paving the way for evolution and thence transformation. It is noteworthy that during the everoperative process of evolution and transformation of environment there is tendency to maintain equilibrium in each constituent. This succinct directs to analyse the efficacy of interacting geographical phenomena or catalysts in the process.

The environment inhabited by tribes, at the first sight, emerges as a distinct entity different from its surrounding. These entities certainly infuse curiosity to explore the probable causes or catalysts for their contemporary distinctive appearance. The causes or catalysts might have been either from outside or conceived within the environment.

The quest to explore stems from the perception that geographical catalysts play a significant role in the evolution and transformation of any space. It is notable that geographical phenomena are everoperative and regulatory factors irrespective of their degree of effectiveness over space and time. In other words, imagination of complete absence of geographical role is a remote possibility.

Subsuming the past contributions, it is presumed that the process of evolution and transformation of any space passes through the following stages –

1. Pre – Historic Evolution
2. Evolution in Ancient Period
3. Evolution in Medieval Period
4. Evolution in Colonial Period
5. Evolution in Contemporary Period

4.1 A GENERAL STUDY OF TEMPORAL CHARACTERISTIC TRANSFORMATION OF THE ENVIRONMENT:

Transformation of tribal environment replicates the multitudinal evolutionary process and behaviour of physical, social and cultural phenomena in space–time continuum. And this necessitates the retrospection of related issues and realities in historical perspective. Though, antiquity of tribes has its roots in the unexplored past

but still there is necessity of analyzing the trend of temporal transformation because –

1) The survival and structure of present being, their society and culture and environment is the product of past environment and tribes' anticipation to it (Maciver, 1961; Ahmad, 1999).
2) Any difference in environment creates difference in the ways of living, which, in simultaneous reciprocation creates difference in environment through the process of constant selection and adaptation to maintain the moving equilibrium and harmony in the dynamic system.

4.1.1 Objectives:

The above mentioned axioms, dictating the geographical influence, direct to formulate following objectives for the generalization of role of temporal inter–causasive factors in the evolution of contemporary tribal environs–

1. The efficacy of human state and their interaction with other areal phenomena over time for their adaptation, survival and socio – cultural development.
2. The impact of preceding stages or stage on the physical, social and cultural environment of the following stages.
3. To estimate the evolving issues and threats in the contemporary stage, in order to combat that and generate the potentialities and create the possibilities for the survival of future generation.

4.1.2 The Bases of Generalization:

The generalization of transforming trend in resource base, population, activities, mutuality and issues depend upon the following qualitative and quantitative data.

1. Analytical review of contributions from eminent scholars.
2. Behavioural analysis of contemporary tribes to detect or churn out the nature of past mutuality between them and the physical environment.
3. Analysis of estimated projected values of spatial and population variables on the basis of mean decennial variations of 1971, 1981 and 1991.

4.1.3 Explanation and Evidences:

Transformation of tribes and their environment being a complex theme refrained many to explore the mysteries. But inspite of inadequate evidences few eminent scholars like Pathy (1982) and Ahmad (1999) made a considerable effort to renascent the theme while patching up the vast gap of unknown history. Pivotality of

the theme in understanding the crux of evolution of whole mankind and environment for creating sustainable environment cannot be denied. So, the stride is to explain the process syllogistically. Here, for lucid explanation the whole process is temporally classified as –

1. Pre–Historic Evolution
2. Evolution in Ancient Period
3. Evolution in Medieval Period
4. Evolution in Colonial Period
5. Evolution in Contemporary Period

1. Pre – Historic Evolution:

The study area possesses or possessed the following evidences of the Pre–historic period –

(i) Denuded hills of Jurassic Period (180 to 135 million years B.P.)

(ii) Basaltic lava flow of Cretaceous period and Eocene period (70–40 million years B.P.).

(iii) Elephants, horses, pigs etc. originated in Eocene period and animals of cat family, dog, bear, snail, grassiands and grass eaters evolved in Oligocene period (40 to 25 million years B.P.), when men came into existence in the Primate form.

(iv) Deciduous forests came into existence in Miocene period.

The existence of above evidences in the area is based upon the following logics –

(A) Indian sub–continent separated from the African land mass in Pliocene period (11–1 million years B.P.).

(B) The region being at the transition zone of tropical and temperate zone must have been a flourished eco–system by the end of Pliocene period because of the extension of temperate zone due to the melting of ice.

So, in the Oligocene period (40–25 million years B.P.) when Primate Man came into existence, it was already rewarded with adversities like denuded hills, meandering rivers (evolved during Jurassic Period), hard rugged terrain, obliterated forests and cold climate. Later on it faced adversities like dense forests, natural turbulence (drifting of land masses), massive floods caused due to melting of ice from the north in Pleistocene period and humid climate. These adversities might have compelled nomadic hunter–gatherer to settle on the top of hills or mountains, where from, they could have moved radially following the river flow.

Some of the crude evidences enable to conclude that population of tribes in pre–historic age was certainly very sparse and could have easily lived with their food gathering technology. The probability of population decrease or decimation cannot be denied because of erratic climate, famine malnutrition and epidemic (Pathy, 1982).

The history of modern man dates back to some tens of thousands of years. The initial decades were characterized by food gathering and hunting. Farming and rearing of cattle began only around 5500 B.C. in Holocene Period. Acculturation rate might have been much slower on the hills than on the plains, perhaps because of less favourable conditions. The possibility of a single group playing dual role of hill–inhabitants performing as a hunter–gatherer and low land or plains inhabitant performing as a farmer and rearer in the varying seasons for their sustenance cannot be deemed. The availability of Palaolithic and micro–lithic tools of Mesolithic period from Mahi and Narmada river valley contemporary to that of Sohan Valley is indicative of gradual transition from hunting–gathering to agricultural mode of production. The transition leading to settled life was certainly a march towards acculturation which is often referred as Neolithic revolution (Ahmad, 1999). The cultural traits might have diffused from the cultural nodes like Saurashtra, Eastern Rajasthan and Malwa (as mentioned by Bridget and Raymond) and reached to the region through the only open corridor between Betwa and Narmada valleys because all other sides of the region are bound with natural barriers like Mahi, Anas, Narmada rivers, Arabian sea and hills and uplands covered by dense forests. So, the possibility of diffusion and reception seems to be very less and if, then from the Malwa only (Ahmad, 1999). According to Possehl (1980), about 2100 to 1200 B.C. the hunter gatherers of North Gujarat probably had relations with agriculturists (Pathy, 1982). So from the above discussion it could be concluded that

1. The region being surrounded by linear water masses and comprised of dense forests, and hills and uplands running across it might not have provided ideal condition for free mobility and assimilation of man and cultural traits. So, it might have had less or countable population.
2. The presence of many streams and rivers which might have been perennial due to heavy rains, dense vegetative cover and less exploitation.
3. The surrounding lowlands must have had dense coverage of grass and canopy of forest, possessing rich resilient biodiversity and unhindered biogeochemical cycle.

4. The rugged or dissected topography, erratic climate, unskilled farmers and primitive technology might not have resulted into propitious cultivation. It is notable that the Palaolithic tools found by Patterson and Terra show a clear impact of climatic variation.
5. Inadequate archaeological evidences of pre–historic times might be due to natural turbulences caused by the vulcuncity in Miocene period, drifting of land masses in Pliocene, and glaciation and melting of ice in Pleistocene period. Such natural turbulences might have been continued till recent past in Holocene period and so evidences of the past might have buried under over resisting consolidated masses.

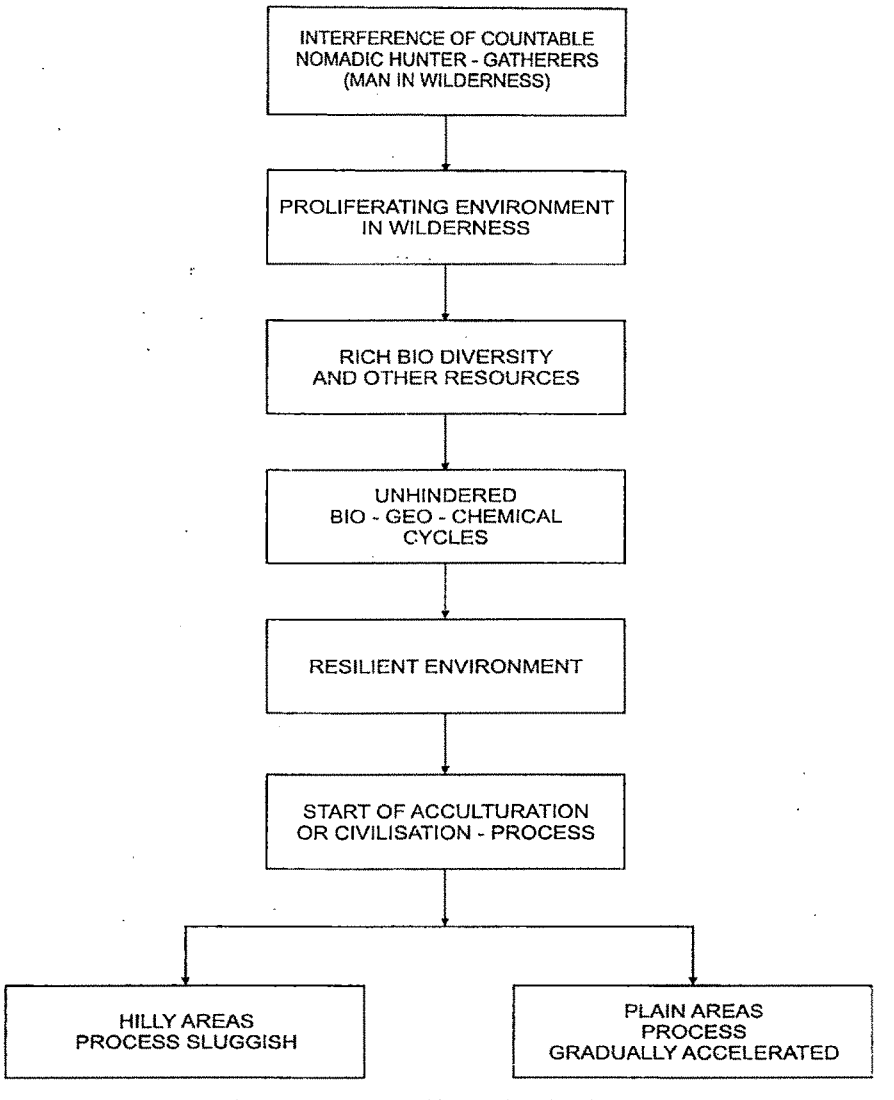


Figure 4.1: Pre–Historic Evolution

6. The initiation of pseudo farming and settling of people in the low land indicates the emergence of discriminating society. The possibility of

seasonal migration, or diurnal migration and dual role played by migrating population as hill inhabitant and lowland inhabitant, or as a gatherer hunter and peasant cannot be denied completely.

7. The cyclic or inter–causasive linkage between the different elements of environment is represented in the Figure 4.1.

2. Ancient Period

Ancient period evidentially inherited discriminating or stratified and settled or migratory confronting population. The evolution of civilizations and then powerful regimes like *janpadas* confined within the natural barriers certainly created restrictions in free–mobility of population wandering as a hunter–gatherer or shifting–cultivators. Though, history provides evidence on the assimilation of tribes with caste Hindu society and growth of power poles or power centres but it also mentions about the simultaneous existence of tribes who remained or got confined to the isolated locations like mountains, hills, plateaus and dense forests and remained outside the caste Hindu fold. The researcher describes them as socio – cultural laggards (Ghurye 1963, Elvin 1952, O'Malley 1911, Risley 1901, Vidyarthi 1973, Choudhary, 1997). The literary evidences well describe the state of resource potential of the transforming environment during the period –

1. According to Datta and Moorland (1962), the population was not much alarming between 320 B.C. to 1700 A.D. (*op. cit.* Pathy, 1982). The above statement does not deny the possibility of alarming situation but the much alarming. So, the possibility of confrontations for grabing or protecting the resources to meet the demand and secure future cannot be denied.
2. Hunter–Gatherers or peasants confined in hills or forests found themselves protected during the reign of Ashoka (Vidyarthi, 1973).
3. Their intra–region migration explains their history of retreats being pushed by few stronger sections. According to Colonel Tod (1920) and Vidyarthi (1973) Bhils were in existence in the Malwa region (adjacent to the study area) by 600 A.D. and confronted with many to protect their occupied land but each confrontation pushed them deeper and deeper into the refuse area (ibid). It is notable that the knowledge of cultivation might have altered the perception of mass and then the utility value of plains and inaccessible erratic land characterized by undulating terrain and uncertain climate.

4. The tribes or hunter–gatherers were designated as third known group and had the right to hunt, breed cattle, and to sell or hire beasts of burden (Guha, 1999).
5. The confronting *janapadas* of 6th century B.C. in possession plain areas suitable for cultivation purposes and other rich resources were defined and guarded by natural barriers like rivers, forests or hills etc. (Ahmad, 1999; Pathy, 1982).
6. The Bhils' affiliation with reigning powers and presence of Bhil kingdom around 8th and 9th century in Panchmahals dictate the richness of the area (Pathy, 1982).
7. The population of hunter–gatherers, which did not get encapsulated and subjugated with the intruding and exploding population of technologically superior cultivating population, emerged as tribe (Guha, 1999).
8. Trade of forest products and other goods from Kutch, Kathiawar, Gujarat (Arrica) and *Barygaza* (Broach) in ancient times describe the richness of bio–diversity and connectivity of the region with the outer world and India through the eastern corridor opened between Narmada and Betwa rivers (Upadhyaya, 1983).
9. Reclamation policy of land clearly indicates the need of more land for cultivation to fulfill the growing demand.
10. A special attention and deployment of Ant Mahamatya by Imperial Mauryas for the welfare of forest dwellers indicate the significance and role of tribes in society. But this could have been probably to abstain forest dwellers from rapacious exploitation of forest products (Mahto, 2001).

The above evidences and discussions reach to the following conclusions –

1. The growing population and demand led to the frequent confrontations between or within the groups which in turn resulted into the growth of power poles or power centres. They constantly tried to occupy and expand territories for satisfying demand and secure future.
2. The presence of hunter–gatherers or tribes in forests, who had the right to exploit and sell forest produce, indicate increasing rate of exploitation for profit making.

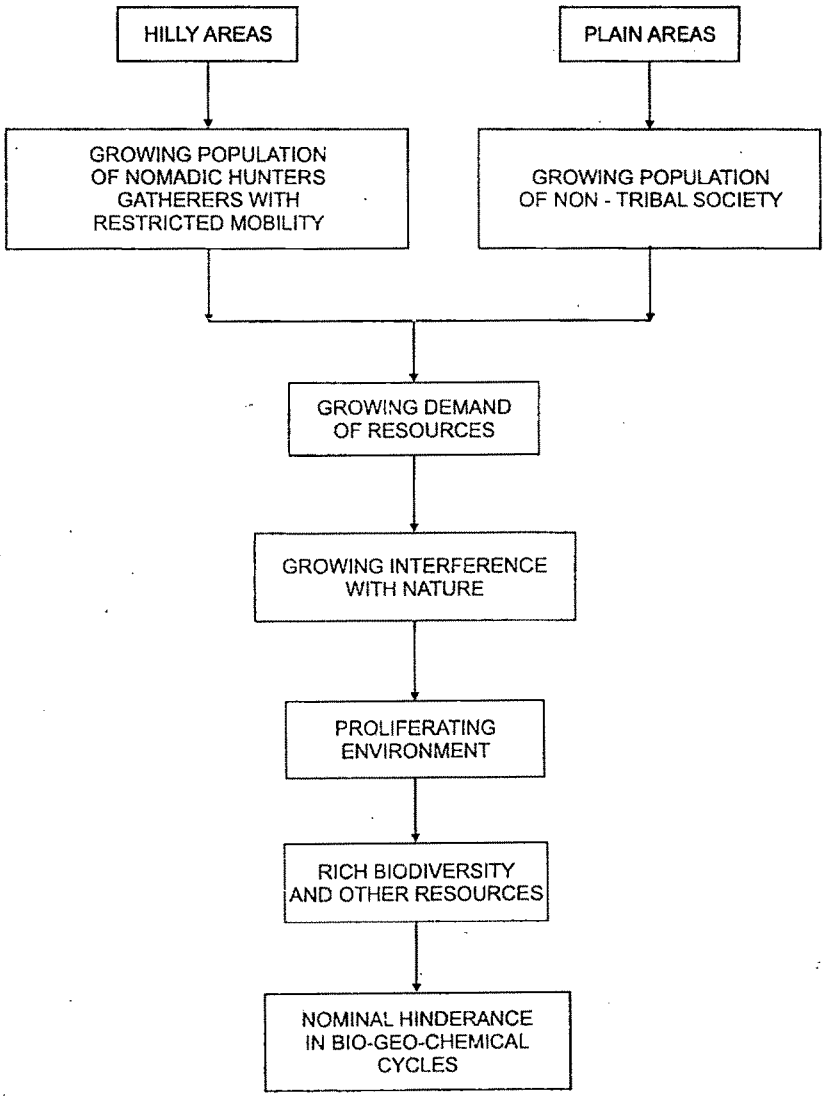


Figure 4.2: Evolution in Ancient Period

3. Land reclamation policy, trade of forest produce through ports and frequent confrontations for expansion and occupation of land and resources must have led to the rapacious exploitation. That is why the deployment of Ant Mahamatya for looking after tribal welfare seems to have had conceived intention of having vigilance and restricting the exploitation of forest resources by tribes.
4. The confrontation with intruders not only reveals the strategic but also economic viability of the environmental system.
5. The defeat from stronger sections pushed the laggards (tribes) back to forests or hills and not only abstain them from their occupied lands but also imposed indirect restrictions on exploiting forest resources.

6. A strategic geographical location, having accessibility only through a narrow spatial corridor must have remained protected from external interference and exploitation.
7. The less exploitation of forest resources due to its strategic location, intermittent restrictions from reigning authorities and forced confinement in the forests must have protected the excessive exploitation, maintained the resilient behaviour and bio–geo–chemical cycle.
8. The constant suppression must have bound them to work as landless tenants for non–tribals who were probably, technologically more developed. The interaction with non–tribals and their technologies must have developed their technological and cultural knowledge.

3. Medieval Period:

The rising population, demand, exploitation of resources to satisfy demand, frequent confrontations and contracting territory of rising tribal population, persisted even in the medieval period. The literary evidences which reveal the progressing trend of transformation in medieval period are described below –

1. Tribes, who inhabited forests some thousands of years ago, were probably enough raised by the initiation of medieval period (Guha, 1999). This indicates that by the end of medieval period the population of forest dwellers particularly Bhils must have risen effectively.
2. With increase of population, increase in production must have became necessary and in order to satisfy this demand of the growing population assimilation of some skilled groups in the society was made by offering them land within the tribal territory (Pathy, 1982). This remarkably reflect the willing assimilation of non – tribes among the tribes (the main inhabitants of the study area).
3. The confronting power poles like Mughals, Rajputs, and Marathas were well aware of the tribes' knowledge about the strategic geographical locations such as forests and hills and their battling abilities. So, in order to prove their supremacy and establish their domain in the region, each of them tried to allure tribes and include in their respective armies. One of the hidden objectives was to win their affinity and deploy their chieftains as their representative in the tribal territory to protest against rivals and collect revenue (Pathy, 1982). This period certainly snatched their Pseudo–autonomy (Vidyarthi, 1973, Pathy, 1982 , Ahmad, 1999).

4. The oppressive waves of expansionism by Mughals, Marathas, Rajputs and even local rulers made it a completely disturbed region (ibid).
5. Consecutive propagative waves of invasion and merciless exploitation by invading powers forced them to retreat deeper into the forests and remote hills. The loss and property and life compelled some to adopt Islam and looting for their survival.
6. According to Roy Burman (1969) the central Indian tribes played a bridge and buffer role between the communities living on their either side. But in this period, the tribal area, especially of the study area, being at the strategic geographical location and at the transition zone between Subahs (or *janpadas* in the ancient times) emerged as a conflict zone and compression zone. And each suppressive wave of feudalism compressed or displaced to the interiors of refuse zone (Pathy, 1982; Ahmad, 1999).
7. The Mughals, Marathas, Rajputs and others did not only subjugate and rule but also laid an effective impact on their instinctive culture. Meaning thereby, each suppressive wave took away their (tribals) autonomy, changed their mode of life, way of living and even religion (Choudhary Mamta, 1977; Joshi Vidyut, 2002).
8. Killing of Bhils by Maratha in large number (O'Malley 1976; Pathy, 1982). This reflects the probability of similar atrocities by other powers also and thence a large decrease in the number of Bhils or other tribes of the study area. Also characteristic variation in their attitude led them to retaliate with vengeance which destabilized the whole occupational structure of the peasantry economy (Pathy, 1982; Vidyarthi, 1973).
9. Bhils having no stable property had to work as crop – watcher, wood – cutter, and hunter, especially in new villages within or beside the forest, where the fields were subjected to almost incessant inroads of wild animals. In times of disorder they might also have been needed as guards. In return, they would have shared in the harvests of the village (Guha, 1999). The above statement of Guha clearly depicts the picture of richness of bio – diversity and the life of people. He also talks about the tribes having horses as their property. This indicates they might have been involved in supplying or trading of horse beside other animals.

10. In 1754 – 55, the hereditary officials of eight sub–divisions of Khandesh were addressed as follows: You and Kolis, in complicity with the Bhils have made dens in hills and by burning the property etc. of the villages are causing loss to the government. Therefore, your inheritances as well as those of the Kolis are forfeited to the state and Rajshri Madhavrao Vishwanath is to manage them (Guha, 1999). This statement clearly reveal the truth that the displaced tribes were rebuilding their settlements in the interior of forested hills after burning the property (vegetation) which seem to be very precious for the Marathas.
11. The dense population of peasant cultivators had to bear the burden of paying taxes to both Bhil chiefs (*rakhwaldars*) and Maratha Commanders. The Mountain or hill chiefs seemed to be more powerful than their counter parts in the plains as they had greater share in the levied blackmail (Guha, 1999). This clearly indicates the economic suppression of Bhils not only by Maraths but also by Bhil Chiefs.
12. The Mughal policy of land reclamation must have had negative impact on the forest resources (Pathy, 1982).

The above evidences and discussions explicitly exhibit the following characteristic features of the environment –

1. The encroachment of non–tribes and gravitating of powers in the tribal region in dictate the richness of their biome (biodiversity).
2. The presence of hunters, wood–cutters, wild animals, and restrictions made by Maratha against the building of settlement in forested hills also in dictate the rich biodiversity of the tribal land.

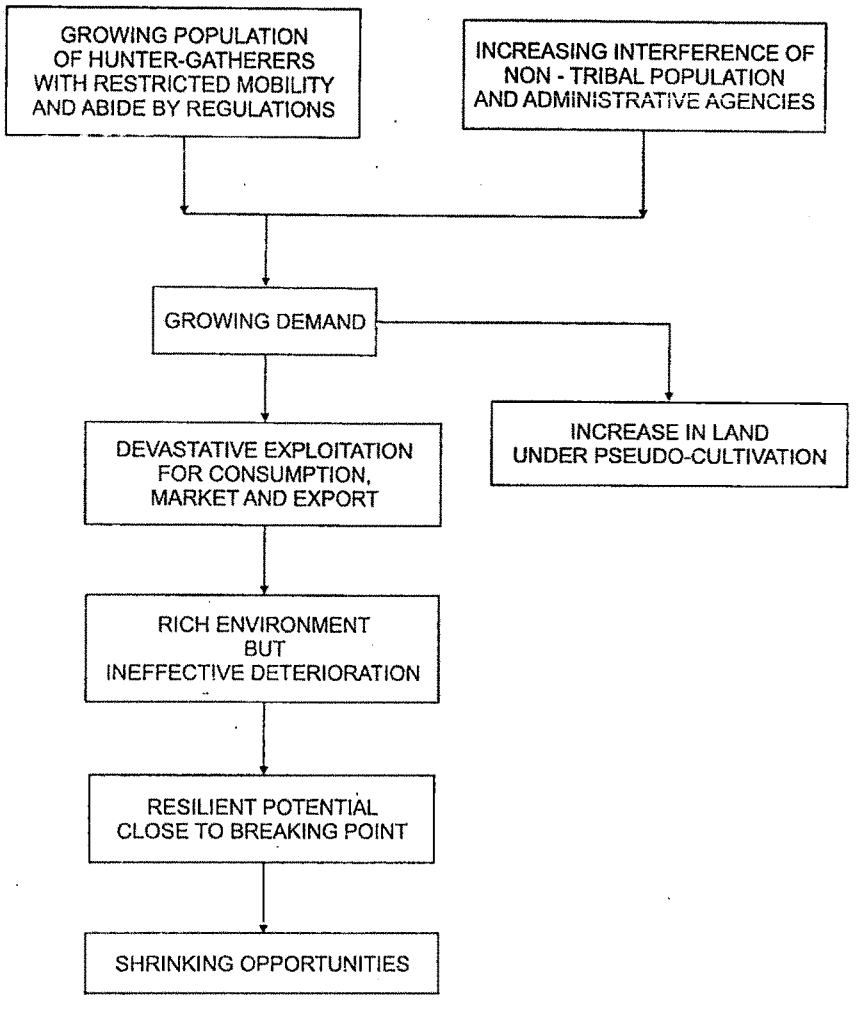


Figure 4.3: Evolution in Medieval Period

3. The growing population of tribes and non–tribes must have increased the demand of resources and thence burden on the nature which in turn must have led to the destruction of forests.
4. The shortage of labour (Pathy, 1982) might have been caused due to the dislodgement and fleering away of actual owners of land into deep forest. This in turn would have increased the burden on forest products.
5. The emergence of tribal region as a conflict zone by the gravitating powers was probably less for plains and more for forest wealth, labour and army.
6. Subsuming all the reasons, it could be concluded that the oppressive waves, displacement of tribal population, encroachment of opportunist aliens, clearing of woods for sedentary cultivation and settlements by encroachers and compressed tribes would have increased the burden on the natural resources of undulating plains and forested hills. And this would have certainly created cause for the breaking of sustainability of the environment.

The inter–causasive model of transformation in the medieval period is shown in the Figure 4.3.

4. Colonial Period:

Tribes probably were not enough powerful to keep themselves and their land and resources under their control. They remained the subject of extensive exploitation–economically, socially and culturally. The suppressive waves not only took the possession of material wealth but also of moral by marrying their beauties (Tiwari, 2002). Also, the constant suppression confrontations and displacements must have decreased their human power numerically and qualitatively.

The waves of oppressive were further propagated by Britishers more effectively. The continuity of attraction and suppression simply signify the economic magnetism of natural wealth of tribal areas and its procured proliferating sustainability far from the breaking point.

Some of the evidences which explain the environmental transformation are described below –

1. The great famine of 1899–1900 especially in the marginal lands of hilly region led to the decline of tribal population and the land was taken over by the government because of their failure in paying the revenue (Guha, 1999).
2. Money lenders protected few from the loss of their property rights but had to give their major part of produce to their money lenders. The tribes worked in their own field as serfs (ibid).
3. Protectionism (principle or practice of protecting resources or human interests) followed by Britishers was certainly in favour of themselves (ibid).
4. The large scale conversion of land for non–agricultural use, immigration, expansion of connectivity, mallacious forest management and excessive exploitation of forests during Second World War for different purposes washed away the supportive system of tribes in the time of crises (ibid).
5. The intermediary class went in hibernation and direct economic exploitation initiated to reap maximum profits (Pathy, 1982).
6. The greed for money and wealth was so intense that they not only collected land revenue, plough tax, house tax, excise duty for brewing liquor and exploited forest resources but also asked inhabitants to reclaim wastelands. It seems doubtful that they would have paid them for their labour even. And if, must have squeezed tactically (ibid).

7. Commercialisation was more conspicuous in the region of Ryotwari system (Mitra, 1977; Hockings, 1980; Pathy, 1982).
8. Frequent droughts and floods accelerated the process of immigration. This led to marked shrinkage of the means of tribal livelihood and brake down of traditional ecological equilibrium (Mitra, 1977; Pathy, 1982).
9. Mobility of tribes to new areas was almost closed. In the beginning, some of the tribes did retreat to save themselves from high extortion of land revenue. With the reservation of forests this mobility became impossible. It may be mentioned that mobility was not always to interiors or unexplored frontiers rather it was more often into other tribal or non–tribal habitats (Pathy, 1982).

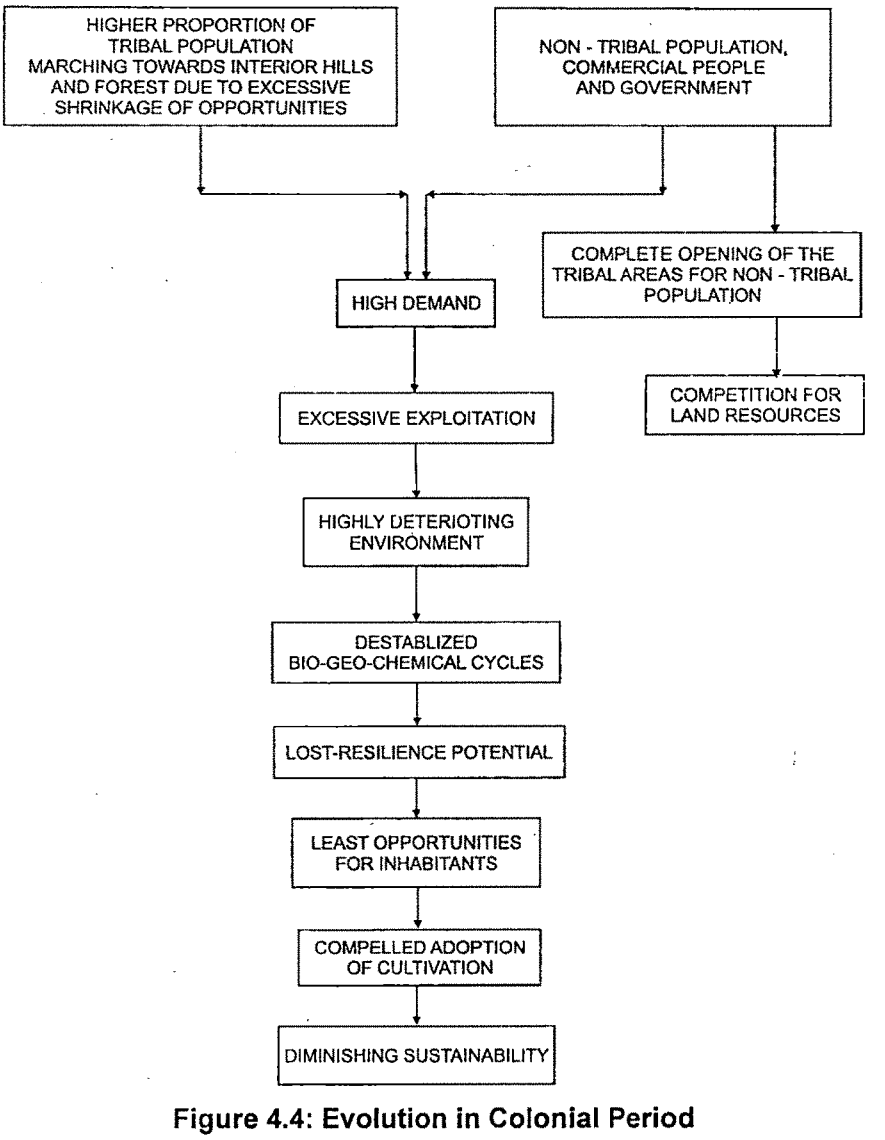


Figure 4.4: Evolution in Colonial Period

10. Survey of land and revenue fixation became the actual cause for many problems like displacement, poverty, health and disease, land alienation, indebtedness and criminalization. It broke the symbiotic relationship, the self–operative system and the prevailing communal made of livelihood (Trivedi, 1998; Kashyap, 1998; Joshi, 1998).
11. During British rule, commercial use of forests increased manifold, which resulted in more and more restrictions being imposed on tribes living in forests (Ghate, 1992). Ghate also talks about absence of any form of conservation policy, rapacious exploitation of forests for ship building, railway sleepers, etc., biased forest policy, settlement policy, confiscating (taking away of ancestral rights of land and forest) policy and exploitation of tribal labour.
12. To satisfy the demand of agro–based for industries vast stretches of forest land was brought under plough after 1860 onwards necessitated the extension of agriculture of forest areas. This approach adversely affected tribes who had already lost their inherited rights over forest resources (ibid).

Subsuming the above evidences it is reiterated that influx of non – tribals, a series of natural calamities, and suppressive calamities created by British Polices to satisfy their demand and supremacy, oppression from power puppets, and tribals' loss of traditional mode of life and loss of inheritance over their natural abodes left them with no alternative other than hiding into dense shrunken forests. But later on, even the receding or retreating mobility to the original habitats was restricted. Pathy (1982) observes that the tribal economy of the period was the creation of the colonial system.

So, from the above mentioned evidences following inter–causasive characteristics of the environment in colonial period are derived –

1. The growing population of tribes might have been combated by natural calamities and human calamities capable of causing turbulence numerically and qualitatively.
2. The land and areal resources might have depleted rapidly due to rapacious exploitation to meet the demand from industries and armies.
3. Confiscating policy might have increased burden on the shrunken forests and sources of livelihood.

4. Confiscating policy and high revenues accompanied with famines or droughts might have compelled tribes to leave their property right and escape and hide in the ambuscades.
5. Rapacious and excessive exploitation led to the deterioration of bio–diversity which in turn destabilized bio–geo–chemical cycle.
6. The role of deterioration being higher than the proliferation, resilient potential of the nature might have broken.
7. Multitudinal exploitation of man and nature must have whacked both to the destitution.
8. The shrunken or compressed opportunities might have compelled the earlier wandering and plundering tribes to adopt cultivation either as tenants or farmers. And land alienation in true sense was realized in this period (Ahmad, 1999; Choudhary, 1977).
9. The shrunken forests comprised of hills reached to saturation to absorb destitutes. It is notable that despite legislative restrictions people might have kept on taking refuge in the shrunken forests interspersed by hills because of which the British government implemented settlement and land revenue policy to protect their own economic and military interests.

5. Contemporary Period:

"Present is key to the past", a statement from legendary scholar, James Hutton, seem to be exceedingly yet realistic while studying the environmental condition of a tribal space (Singh, 1990). Multitude of features associated to the tribal space reveal, the amplitude and centripetality of problem hormones and their synergic effects in space–time continuum (Steven, 2001). The following generalized facts expose the existing realities –

1) Most of the existing crises are the imprints of past opportunism and ravenous attitude of man and consequent struggles between them for rapacious exploitation of resources. (Vidyarthi, 1982; Ahmad, 1999; Guha, 1999; Patnaik, 2000; Tiwari, 2001; Steven, 2001).
2) Beside the historical causes, the exhausted space is experiencing geographical adversities, such as – undulating rocky terrain in association with hills, uplands and mounds dissected by ephemeral streams, intercepted sparse vegetation, erratic rainfall and water scarcity. These factors are threatening the survival of growing population of tribes, dependent upon primary activities and extinction of different species of flora and fauna. (Mohanty, 2000).

3) The growing magnitude of problems with the shrinking opportunities seem to be the resultant multiplier effect of geographical adversities, government's helplessness and ever growing demand of the growing population.

   The subjugated economic laggards are experiencing –

   i. geographical adversities,
   ii. growing demand of resources to satisfy their increasing needs,
   iii. competition with the comparatively advanced immigrant non–tribal population,
   iv. degraded biodiversity, and
   v. visionless policies including prohibition acts, forest policies and land acquisition policies restrict them from their ancestral liberty, such as free mobility and exploitation of resources which in the earlier period had probably enabled them to survive and preserve themselves. (Guha, 1991; Jones, 2002; Joshi, 2002; Mishra, 2000; Sahu, 2001; Patnaik, 2000; Roberts, Acharaya, 2000; Khan, Prasad, 1994; Mahapatra, 1997; Ghate, 1992; Swaminathan, 1999; Singh, 2003).

4) They themselves are insulated in the dark by not availing the opportunity to learn and become aware of their constitutional rights, programmes and policies etc. (Patnaik, 2000; Thirupal, 2002; Lakshamaiah, 2002).
5) The tribes' traditional ways of living is excessively affected by the huge forestry, mining, urbanization, industrialization, hydro–electric power and irrigation dam projects (Jones, 2002; Homji, 1994; Haimendorf, 1985).
6) The practices of land alienation, resource exploitation, mortgaging etc. by the aliens are responsible for further aggravation of problems by limiting their opportunities (Jones, 2002; Ahmad, 1999; Vidyarthi, 1976; Sahu, 2001; Mahto, 2001; Lakshamaiah, 2002).

   It is notable that tribals remain devoid of facilities like irrigation dams, hydroelectric projects, thermal power projects, industries, reserved forests existing in the tribal regions. Most probably this is due to their lack of awareness about political system constitutional rights and approachability to the administration.

7) Tribes are migrating to the nearby urban centers in search of opportunities. They being either illiterate or less educated and unskilled get the job of a labourer on daily wages from which they could hardly manage their survival. However, the desired migration of past for livelihood is now contemplating into motivated, guided and bargained migration. The tribals, struggling for

survival, are often hired on very low daily wages by the labour-agents or contractors having contacts in urban centres. This practice reminds the colonial practice of exploitation of resources (Lal, 2002; Joshi, 2002).

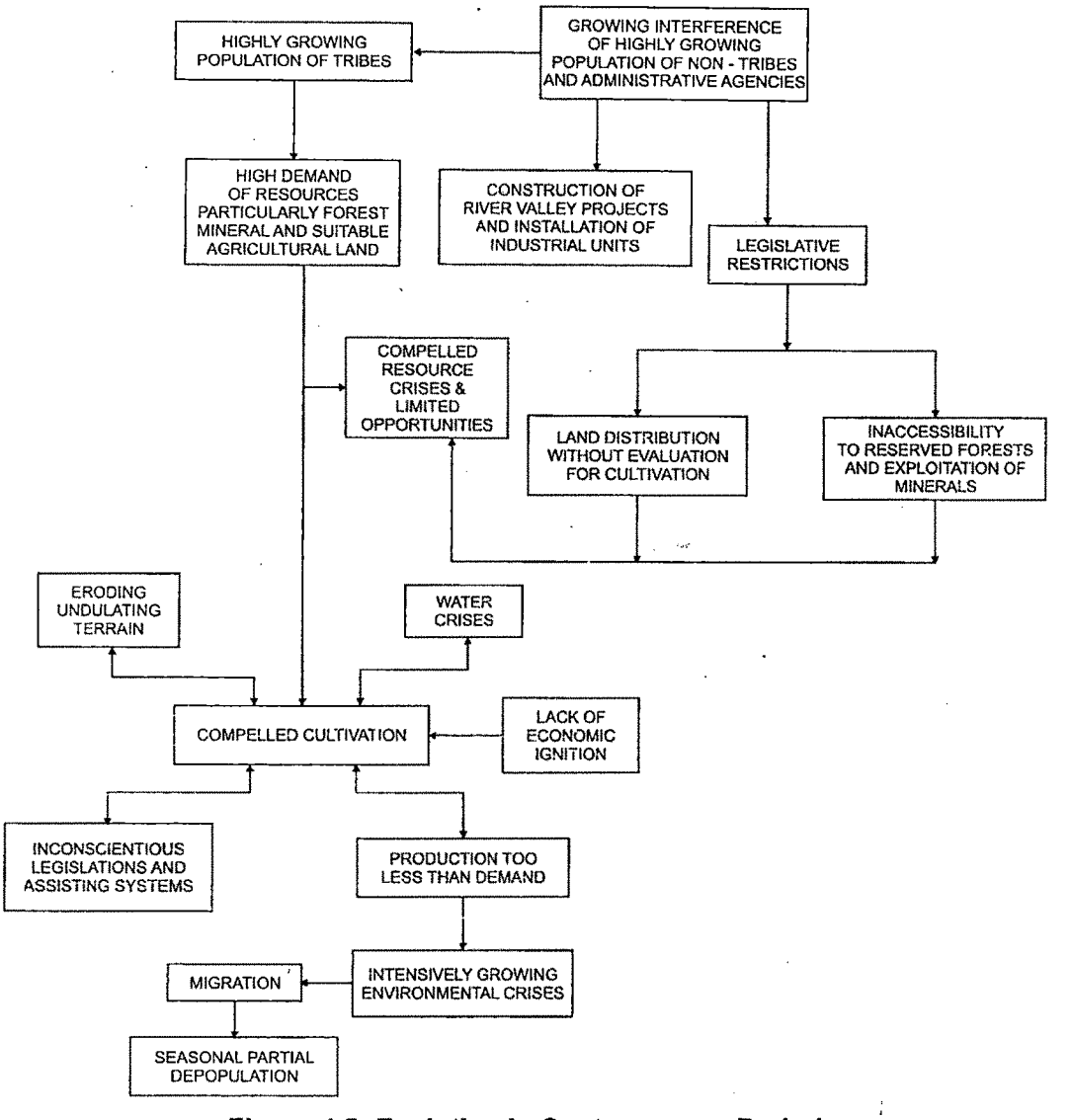


Figure 4.5: Evolution in Contemporary Period

8) It is also observed that few tribes, probably those who have availed opportunities of educational, programmes and got better lands are better settled (Dash, 2003; Ahmad, 1999; Guha, 1999).
9) The government's and non–government organisations' efforts are proving to be of little success. A few pockets and people are quenching their thirst and satisfying their hungers by availing the opportunities and accepting the various programmes. But it is just equivalent to a drop in the economic desert where the people are economically, socially, culturally and politically

underdeveloped and evolving as a distinctive human mass. And, it would not be wrong to speculate that they would emerge as a misfit space and society to their surrounding.

"The tribes, a part of Indian civilization, are yet facing problems because each developmental model or effort to uplift them resulted into some problems as a filtrate or residue such as displacement, poverty alleviation, health and disease, land alienation, indebtedness, criminalization, etc." (Kashyap, 1998).

Guha (1999) reaches to the conclusion, that they had a growing trend of socio–cultural and economy but dependent on the physical or natural environment potentials. The present civilized or cultural economies might be the culminations of ancient foragers or tribes and the tribes might be either the laggards or remnants. According to many scholars like Dash (2003), Ahmad (1999), Steven (2002) and others the contemporary deteriorating environment and socio–economic and cultural backwardness of the tribes might be related to historical processes, lack of geographical and ecological approach and lack of awareness among themselves.

The temporal transformation of space or its environment does not only signify the efficacy of time but also dynamism, more specifically the trend and intensity of dynamism. Though the Figures 4.1 to 4.5 representing the processes of evolving environment over time explains the efficacy of time but to make the study more reliable and informative, the data derived from the secondary sources for three decades related to spatial variables like forest area, irrigated area, unirrigated area, culturable waste land, uncultivable area and population variables like total population, tribal–population, literate–population, main worker population and cultivator population are analysed and on the basis of mean decennial variations the probable frequencies (data) for the past decades and the following decades are projected. The real and probable projected frequencies are graphically represented to study the temporal variation in areal phenomena. Table 4.1 and Figure 4.6 represent the areal variation of physical phenomena.

Table 4.1: Temporal Variation in Spatial Characteristics

Period	Forest Area	Irrigated Area	Unirrigated and Culturable Waste Area	Unculturable Area
2011*	25686	4311	49561	11249
1991	15821	3234	50650	13232
1971	6516	1920	51763	18294
1951*	2472	1024	52900	25310
1931*	938	576	54063	35017
1911*	356	324	55251	48447
1891*	135	182	56465	67028

* Projected Value on the basis of Mean Decennial Proportionate Variation.

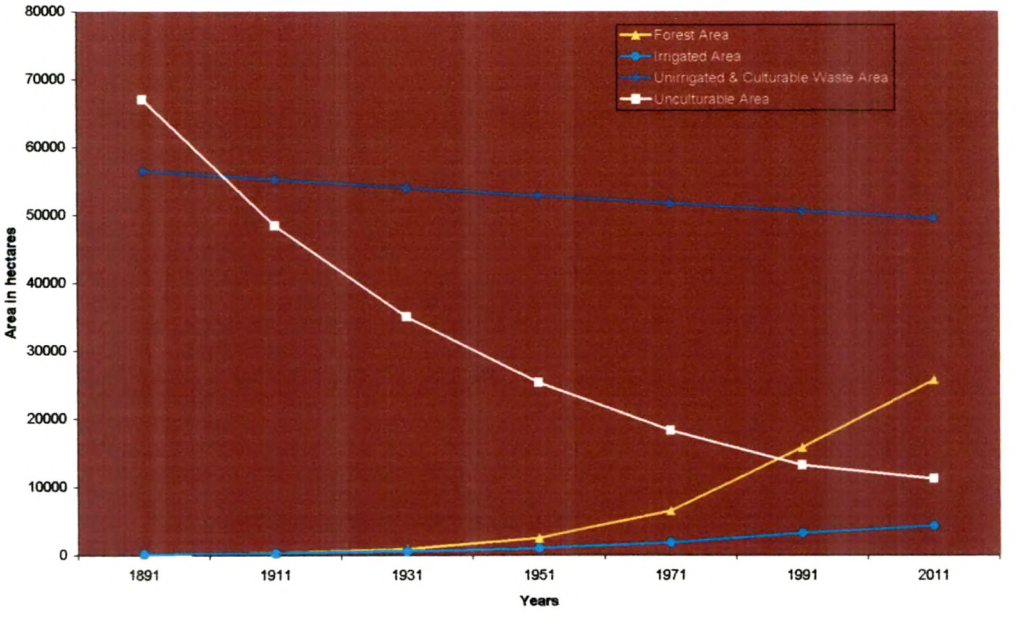


Figure 4.6: Temporal Variation in Spatial Characteristics

The above table and graph explain that with the advancement of time the forest and irrigated area have increased whereas unirrigated, culturable wastes and uncultivable area have declined. The reverse is the condition when we look to the past towards late 19th century. While peeving towards the past one significant process emerges i.e. the merging of contemporary classified area. And this merger is signifying the presence of monotonous environment without any functional or characteristic categorization. The unanimity or monotony reflects the presence of large extent of uncultivable or waste land and little proportion of forest or cultivated

land. But on the basis of historical and literary sources it could be concluded that the monotonous area of the latter part of 19th century (1891) was certainly either forest or idle unclassified land in the hilly tribal space.

The above ex–cathedra is further explicated and certified by the data relating population structure. The data projected on the basis of mean proportionate decennial variation exfoliates that about 1891 AD the population or inhabitants were countable i.e. the hilly terrain was neither inhabited by tribes nor non–tribes in large numbers. It could be easily identified from Table 4.2 and Figure 4.7 that few decades earlier to 1891 the space was sparsely populated. This is notable that if the population was considerable earlier to this than that must have been declined due to any epidemic caused by resource crisis or failure of the life supporting system i.e. deterioration of bio–diversity and other resources. The up thrust of sparse population erupts a question that what were the causes for the extinction of rich bio–diversity? This indicates the possibility of extensive interference and exploitation of forest by the alien population consisting administrative bodies and commercial people with vestige interests.

Table 4.2: Temporal Variation in Population and Occupational Structure

Period	Total Population	Tribal Population	Total Literate Population	Total Main Worker Population	Total Cultivator Population
2011*	530075	477888	266854	131999	84975
1991	285564	245299	6842	92565	71538
1971	153840	126965	17554	65369	60629
1951*	82877	65171	4501	46163	51041
1931*	44647	33452	1154	32601	42970
1911*	24052	17171	296	23022	36175
1891*	12957	8814	76	16258	30455

* Project Value on the basis of Mean Decennial Proportionate Variation.

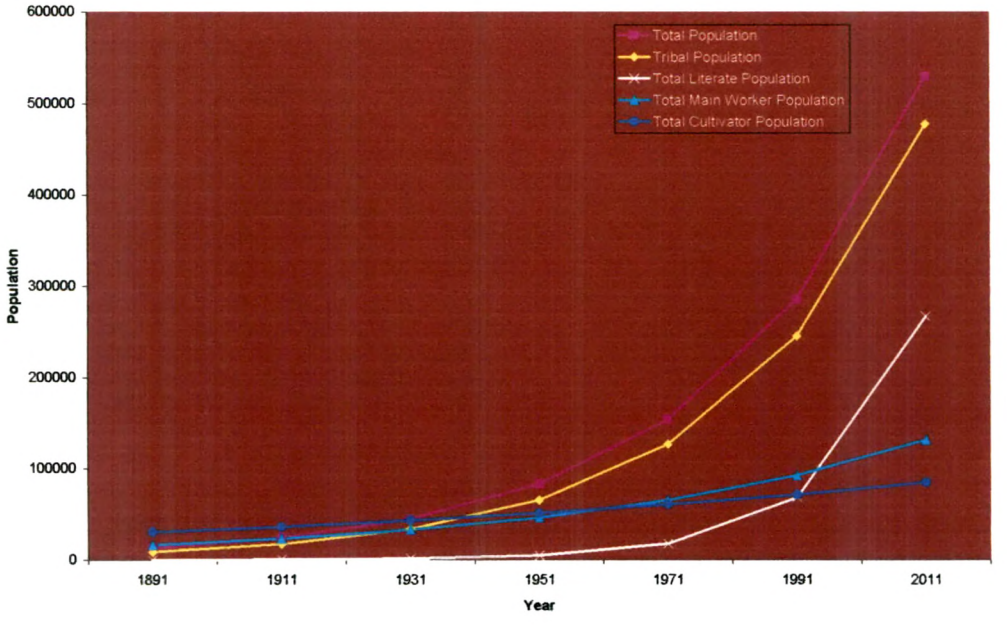


Figure 4.7: Temporal Variation in Population and Occupational Structure

Subsuming above, it is concluded that colonial regime not only exploited primitive socio–cultural laggards but also their biosphere multitudinally. In other words, technologically strong military powers broke the sustaining harmony between tribes and their environment by squeezing and leaving them in destitution for their political power and economic interests.

4.2 TEMPORAL EFFICACY OF GEOGRAPHICAL CATALYSTS:

Analysis from Annexure – VII–1, VII–2 and VII–3

Temporal transformation and evolution of the environment signifies that the monotonous space with characteristic uniformity prevailed till the end of 19th century or the functional classification of space got impetus somewhere in the 19th century and kept on growing gradually. So, this impels to study the association and efficacy of geographical phenomena in deciding the nature and course of transformation and evolution.

Environment of any space is a unified whole of many interrelated or pseudo–independent and dependent phenomena. The word 'pseudo' is used because some phenomena seem to be independent (here also examined as independent for numerical calculations and analysis), but in reality they are also dependent upon other quantitatively or qualitatively measurable phenomena. Meaning thereby, all the phenomena of an environmental system are interrelated, interactive and

interdependent. Keeping in view the quantitative aspects, substantial forms and mobility the variables are classified as independent and dependent. For analyzing the association or co variation and efficacy some substantial, basic and non–substantial spatial phenomena such as area, irrigated area, unirrigated area, culturable waste area, uncultivable area, forest area, altitude and distance from towns etc. are considered as independent variables. These independent phenomena i.e. geographical catalysts play a significant role in the evolution and transformation of environmental constituents and thence in the environmental system. Phenomena like population, tribal population, literate population, male–female ratio of literates', main worker population, male–female ratio of main workers, cultivator population and infrastructure are classified as dependent variables, as their existence, evolution and transformation is a function of geographical catalysts. In an agrarian system where population is primarily dependent upon primary activity, such as cultivation, food gathering, domestication of animals, pisciculture and hunting, is directly associated or interactive to independent catalysts.

Man's survival is dependent upon environment. So, he has been ever interactive and exploiting environment to satisfy his ever growing needs which are essential for his survival. And from the study of temporal transformation it is derived that the trend of ever growing demand, exploitation and crisis is yet operating. The situation of ever growing crisis is indicating the ever growing diminishing sustainability in space-time continuum. Major cause for diminishing sustainability is the growing inconsistency or imbalance between the rate of demand from man and rate of proliferation of environmental resources or supply from environment. It is noteworthy that some of the resources are fixed or constant for example land and some are non renewable or exhaustible for example fuel. Therefore, the need of the time is to maintain the balance between the demand and supply and simultaneously efforts are required to revive the degenerated resources. Meaning thereby, there is need of reversal in the perception, attitude and anticipation. Man must realize that mutuality demands equal anticipation.

So, the multiple regression is thought to be employed to analyze temporal transformation and mutuality or association between different dependent and independent phenomena of environment, to test the probable efficacy of independent variables on dependent variables, to formulate the multiple regression equation for finding the value of dependent variables and to predict or estimate the growing problems in the environmental system. The general form of multiple regression

equation with 'n' number of independent variable, say $X_1, X_2, X_3 \ldots\ldots\ldots\ldots X_n$, is as follows –

$$\hat{X}_0 = a + b_1X_1 + b_2X_2 + b_3X_3 \ldots\ldots\ldots\ldots + b_nX_n$$

Where,

$\hat{X}_0$ = value of dependent variable

a = constant or coefficient of multiple regression

$b_1, b_2, b_3 \ldots\ldots\ldots\ldots b_n$ = Coefficients of net regression of $X_1, X_2, X_3 \ldots\ldots\ldots\ldots X_n$ respectively

(i.e. b_1 – net regression of X_0 on X_1

b_2 – net regression of X_0 on X_2

b_3 – net regression of X_0 on X_3)

$X_1, X_2, X_3 \ldots\ldots\ldots\ldots X_n$ = Independent variables

Here, it is mentionable that in order to find out mean decennial multiple regression for three decades, the following equation is evolved by using the above equation –

$$\hat{X}_0 d_1 = \left(a + b_1X_1 + b_2X_2 + b_3X_3 \ldots\ldots\ldots\ldots + b_nX_n\right)d_1$$

$$\hat{X}_0 d_2 = \left(a + b_1X_1 + b_2X_2 + b_3X_3 \ldots\ldots\ldots\ldots + b_nX_n\right)d_2$$

$$\hat{X}_0 d_3 = \left(a + b_1X_1 + b_2X_2 + b_3X_3 \ldots\ldots\ldots\ldots + b_nX_n\right)d_3$$

$$\overline{\hat{X}_0} = \frac{\hat{X}_0 d_1 + \hat{X}_0 d_2 + \hat{X}_0 d_3}{dn}$$

Where,

$\overline{\hat{X}_0}$ = Mean decennial value of dependent variable

$\hat{X}_0 d_1 + \hat{X}_0 d_2 + \hat{X}_0 d_3 \ldots\ldots\ldots\ldots \hat{X}_0 d_n$ = Multiple regression equation of respective decades

dn = Total number of decades

4.2.1 Efficacy on Population:

1. The values of coefficient of multiple correlations 0.9259 (1971), 0.9217 (1981) and 0.8979 (1991) clearly indicate a positive correlation between geographical catalysts (independent) and population (dependent variable) irrespective of time. Meaning thereby variation in the catalysts is followed by the variation in the population.
2. The values of coefficient of multiple determinations viz. 0.8574 (1971), 0.8496 (1981) and 0.8062 (1991) clearly indicate that the catalysts (independent variables) explain about 85%, 84% and 80% of the total variation in the population (dependent variable) irrespective of time. Meaning thereby, with the variation in time the influence of varying catalysts in the variation of population do not vary significantly.
3. Most considerable fact from the summary output of three decades for population is that the probability of temporal efficacy of individual catalysts on population varies significantly.
4. The worked out multiple regression equation for estimating mean decennial value of population is

Mean Decennial Population =

$$\{(312 - 0.0002X_1 - 0.101X_2 - 0.216X_3 + 0.513X_4 + 2.651X_5 + 2.366X_6 + 1.456X_7 + 0.336X_8)^{d_1} + (1597 + 0.505X_1 - 0.201X_2 - 6.94X_3 + 0.21X_4 + 1.32X_5 + 3.05X_6 + 0.66X_7 + 0.03X_8)^{d_2} + (1191 + 4.4X_1 + 0.28X_2 - 6.4X_3 - 3.6X_4 + 1X_5 + 0.22X_6 - 2.03X_7 - 3.4X_8)^{d_3}\} \div 3$$

The Table 4.3 and Figure 4.8 represent the trend of probable efficacy of geographical catalysts on the population distribution variation.

Table 4.3: Probable Efficacy on Population

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	0.05	57	99.9
Altitude	43	52	44
Distance from Urban Centres	5	78	56
Forest Area	70	22	99
Irrigated Area	99.9	78	43
Unirrigated Area	99.9	99.9	16
Culturable Waste Area	99	63	80
Uncultivable Area	55	3.6	99

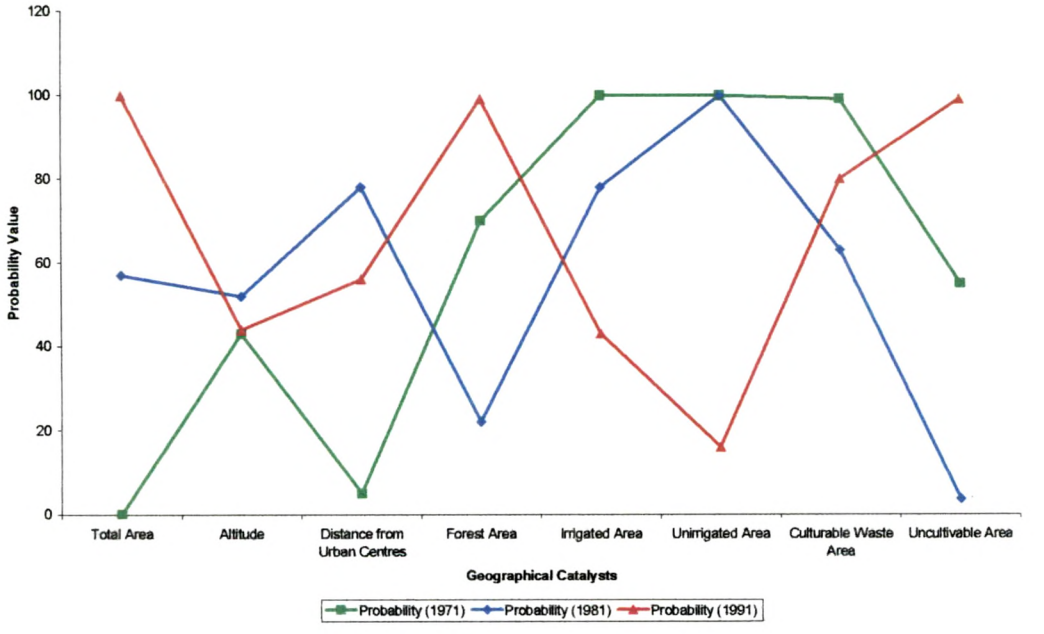


Figure 4.8: Probable Efficacy on Population

4.2.2 Efficacy on Population Density:

1. The coefficient of multiple correlations viz. 0.6315 (1971) 0.6270 (1981) and 0.6171 (1991) show a constant trend in the co–variation (relationship) between geographical catalysts and population density over time.
2. The value of coefficient of multiple determinations viz. 0.3988 (1971), 0.3932 (1981) and 0.3808 (1991) indicate that variation in catalysts explain about 39%, 39% and 38% of variation in the population density. Notable fact is the consistency in explaining the variation irrespective of time. Secondly values

also indicate perpetually in the reign of geographical catalysts in regulating the population density.

3. The temporal probable efficacy of individual catalysts on population density variation varies greatly. Most of the catalysts except altitude are showing their diminishing trend on the density of population.
4. The worked out multiple regression equation for estimating mean decennial value of population density is

Mean Decennial Population Density =

$$\{(2.67 - 0.004X_1 - 0.0001X_2 + 0.006X_3 + 0.002X_4 + 0.004X_5 + 0.004X_6 + 0.003X_7 + 0.002X_8)^{d_1} + (4.51 - 0.002X_1 - 0.0001X_2 - 0.003X_3 + 5.5X_4 + 0.001X_5 + 0.002X_6 + 2.23X_7 - 0.0005X_8)^{d_2} + (5.7 - 0.001X_1 + 0.001X_2 - 0.01X_3 - 0.002X_4 + 0.002X_5 + 0.001X_6 - 0.001X_7 - 0.001X_8)^{d_3}\} \div 3$$

4.2.3 Efficacy on Population of Tribes:

1. The coefficient of multiple correlations viz. 0.4189 (1971), 0.1629 (1981), and 0.3959 (1991) show a dwindling trend in the co–variation between geographical catalysts and tribal population distribution.
2. The coefficient of multiple determinations viz. 0.1755 (1971), 0.0265 (1981) and 0.1567 (1991) also indicate a dwindling trend in the explanation of variation in tribal population distribution by geographical catalysts.
3. The most significant emerging fact from the individual efficacy of catalysts on tribal population distribution is, the decisive role of catalysts in 1971 diminishes in 1981 and again shows a rising trend in 1991. Only distance from urban centre shows an increasing trend and becomes too significant in 1991 with the probability of 90.96 percent of efficacy on tribal distribution. The efficacy of distance from urban centre shows a reversal of similar magnitude in 1981. This could be due to the growing influence of urban centres and growing crises. In 1981 decrease in the efficacy of other variables could be because of climatic condition, water availability and plan implementation. These factors are liable to neutralize the effect of geographical catalysts temporarily. Ineffectivity could also be because of excessive growth in the population.
4. The worked out multiple regression equation for estimating mean decennial value of population of tribes is

Mean Decennial Population of Tribes =

$$\{(38.9 + 0.08X_1 + 0.036X_2 + 0.181X_3 - 0.096X_4 + 0.087X_5 - 0.076X_6 - 0.085X_7 - 0.081X_8)^{d_1} + (149.5 - 0.01X_1 - 0.005X_2 + 0.83X_3 + 0.23X_4 + 0.004X_5 - 0.02X_6 + 0.015X_7 + 0.001X_8)^{d_2} + (60.8 - 0.027X_1 + 0.01X_2 + 0.34X_3 + 0.04X_4 + 0.03X_5 + 0.026X_6 + 0.077X_7 + 0.039X_8)^{d_3}\} \div 3$$

The Table 4.4 and Figure 4.9 represent the trend of probable effectiveness of geographical catalysts on tribal population distribution.

Table 4.4: Probable Efficacy on Population of Tribes

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	98.9	11	70
Altitude	99	9	79
Distance from Urban Centres	48	64	91
Forest Area	98.6	16	89
Irrigated Area	90	2	63
Unirrigated Area	96	15	69
Culturable Waste Area	97	10	95
Uncultivable Area	98	0.39	79

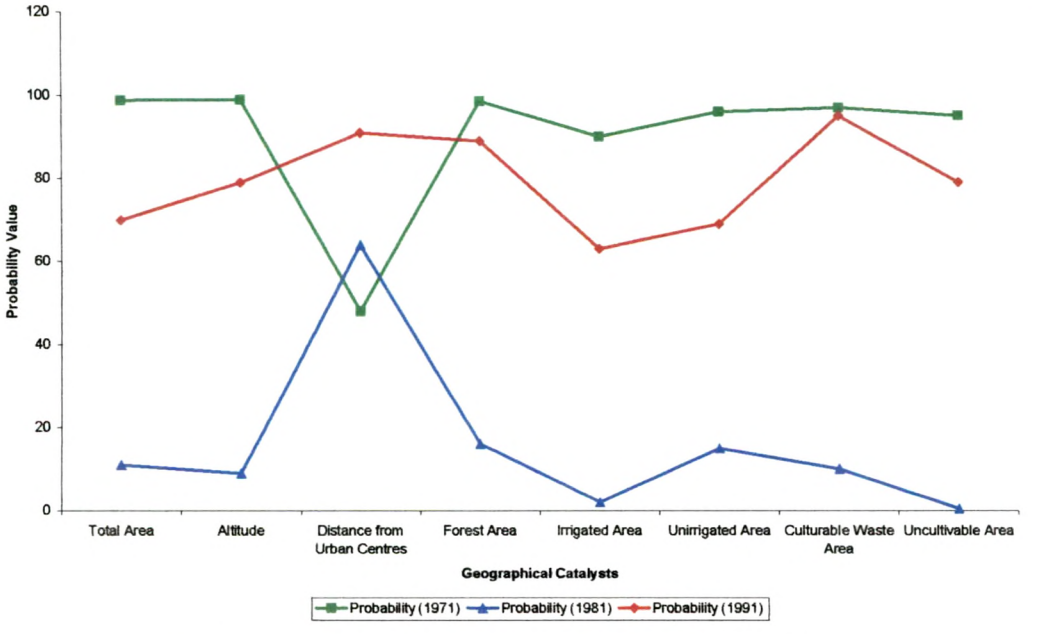


Figure 4.9: Probable Efficacy on Population of Tribes

4.2.4 Efficacy on Tribal Population Density:

1. The coefficient of correlations viz. 0.4437 (1971), 0.2587 (1981) and 0.5339 (1991) show a dwindling trend in the co–variation between catalysts and tribal population density.
2. The coefficient of multiple determinants viz. 0.1969 (1971), 0.0669 (1981) and 0.2850 (1991) indicate variation in catalysts and explain about 19%, 6% and 28% of variation in the tribal population density.
3. The probability value of efficacy of most of individual catalysts on tribal density firstly show a decreasing and then increasing trend except in the case of forest area where it follows a continuous diminishing trend. The decreasing efficacy in regressing the tribal population density could be because of natural growth in the population i.e. the behaviour of reproduction is independent from any influence inspite of their dependence upon forest. The constancy of efficacy of other independent variables also reflects the same.
4. The worked out multiple regression equation for estimating mean decennial value of tribal population density is

Mean Decennial Tribal Population Density =

$$\{(1.291 + 0.0007X_1 + 0.0006X_2 + 0.011X_3 - 0.001X_4 - 0.0006X_5 - 0.0005X_6 - 0.0014X_7 - 0.0024X_8)^{d_1} + (6.98 - 0.002X_1 - 0.0004X_2 + 0.03X_3 + 0.001X_4 + 0.001X_5 + 0.002X_6 + 0.001X_7 - 0.0001X_8)^{d_2} + (3.8 - 0.002X_1 + 0.001X_2 + 0.01X_3 + 0.0001X_4 + 0.004X_5 + 0.003X_6 + 0.002X_7 + 0.001X_8)^{d_3}\} \div 3$$

The probable efficacy of catalysts on tribal population density is well represented by the given Table 4.5 and Figure 4.10.

Table 4.5: Probable Efficacy on Tribal Population Density

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	100	99	58
Altitude	36	26	94
Distance from Urban Centres	20	24	61
Forest Area	99.9	94	18
Irrigated Area	99.9	77	82
Unirrigated Area	100	99.9	94
Culturable Waste Area	99.9	93.5	97
Uncultivable Area	99.9	97.5	85

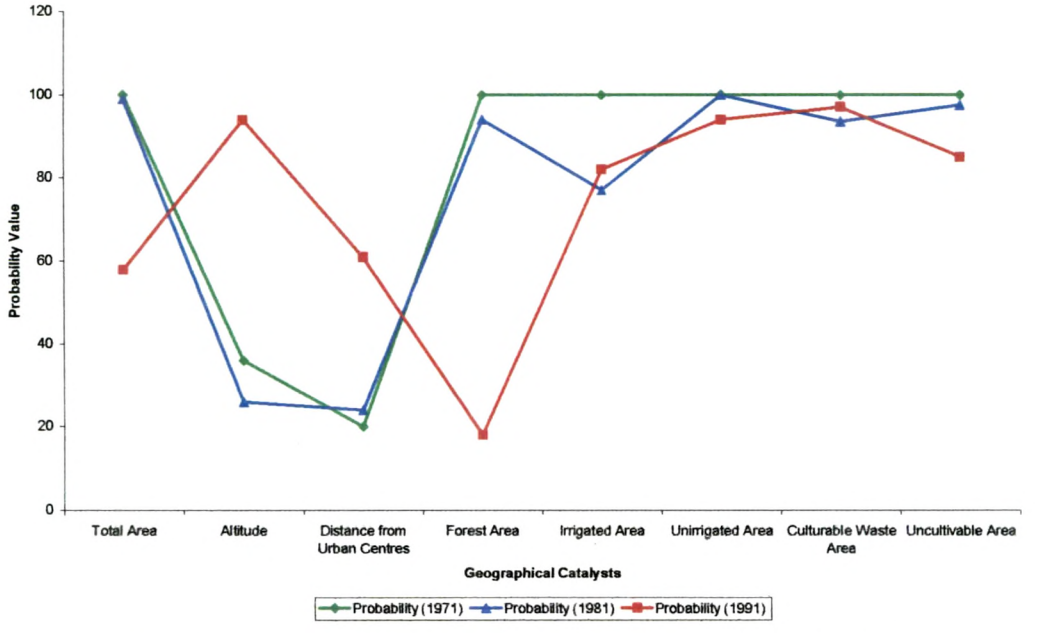


Figure 4.10: Probable Efficacy on Tribal Population Density

4.2.5 Efficacy on Tribal Arable Density:

1. The coefficient of multiple correlations viz. 0.6374 (1971), 0.3762 (1981) and 0.5789 (1991) show firstly a decreasing and then increasing co–variation between the geographical catalysts and tribal arable density.
2. The coefficient of multiple determinations viz. 0.4063 (1971), 0.1415 (1981) and 0.3351 (1991) explain about 40%, 14% and 33% of variation in tribal density by the variation in geographical catalysts.
3. The individual probable efficacy of geographical catalysts on tribal arable density is showing a gradual declining trend except in the case of altitude and

distance from urban centre. This reflects the impact of topography and urban centres on the arable density of tribal population. Meaning thereby the cultivable land at lower altitude and near to the urban centres must be having higher density. Indirectly this signifies the impact of production and diffusing opportunities from urban centres. Opportunities in the form of plans and policies such as irrigation facility must be reaching first to the villages closer to the urban centres and villages having more accessibility being at comparatively lower altitudes. This also explains variation in the distribution of literate population. The increasing efficacy of other variables beside explaining the causes for variation in literate population indirectly explain the variation in socio–economic condition because in an agrarian system there is inter–causasive relation between geographical catalysts, social, economic and cultural condition.

4. The worked out multiple regression equation for estimating mean decennial value of tribal arable density is

Mean Decennial Tribal Arable Density =

$$\{(3.26 + 0.025X_1 + 0.0006X_2 + 0.007X_3 - 0.025X_4\ 0.026X_5 - 0.028X_6 - 0.02X_7 - 0.025X_8)^{d_1} + (10.05 + 0.14X_1 - 0.001X_2 + 0.015X_3 - 0.012X_4 - 0.011X_5 - 0.019X_6 - 0.012X_7 - 0.14X_8)^{d_2} + (6.9 + 0.002X_1 + 0.34X_2 + 0.02X_3 - 0.001X_4 - 0.01X_5 - 0.34X_6 - 0.01X_7 + 0.01X_8)^{d_3}\} \div 3$$

The following Table 4.6 and Figure 4.11 represent the trend of probable efficacy of geographical catalysts on tribal arable density.

Table 4.6: Probable Efficacy on Tribal Arable Density

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	15	56	43
Altitude	42	79	98.5
Distance from Urban Centres	99.9	99.9	99.5
Forest Area	68	53	65
Irrigated Area	32	53	73.5
Unirrigated Area	44	28	65
Culturable Waste Area	55.5	27	42
Uncultivable Area	14	47	10

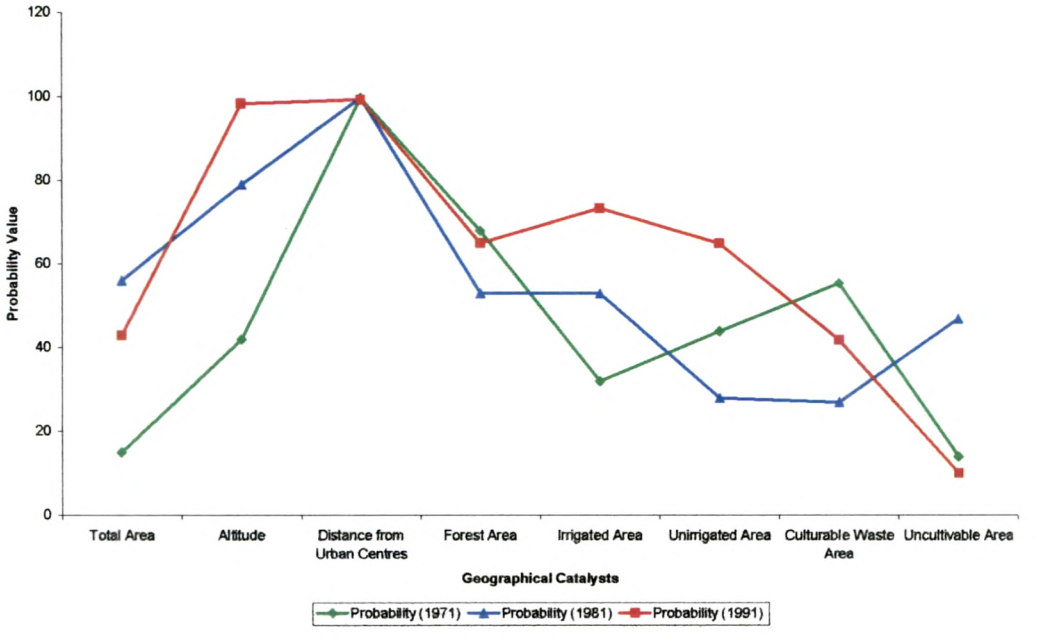


Figure 4.11: Probable Efficacy on Tribal Arable Density

4.2.6 Efficacy on Population of Literates:

1. The decennial coefficient of multiple correlations viz. 0.4745 (1971), 0.5235 (1981) and 0.4664 (1991) show a shallow parabolic trend in the co–variation between geographical catalysts and literates' distribution.
2. The coefficient of multiple determination viz. 0.2251 (1971), 0.2741 (1981), and 0.2176 (1991) also show a shallow parabolic trend and geographical catalysts explain about 22%, 27% and 21% of variation in the literates distribution. There is a gradual rise and then a fall in the role of geographical catalysts. Also they do not play a significant role in literates' population growth.
3. The trend of probable role or efficacy of individual geographical catalysts on the literate population is not uniform but the role of altitude, distance on from urban centre and irrigated area either show an increasing efficacy or constant efficacy. The increasing trend of other variables also explains the decisive role of catalysts in the socio–economic development.
4. The worked out multiple regression equation for estimating mean decennial value of population of literates is

Mean Decennial Population of Literates =

$$\{(21.43 - 0.001X_1 - 0.002X_2 - 0.315X_3 + 0.01X_4 + 0.005X_5 - 0.005X_6 + 0.008X_7 + 0.0017X_8)^{d_1} + (31.8 - 0.01X_1 - 0.004X_2 - 0.32X_3 + 0.007X_4 + 0.01X_5 + 0.003X_6 + 0.003X_7 + 0.005X_8)^{d_2} + (49.8 + 0.01X_1 - 0.01X_2 - 0.25X_3 - 0.01X_4 - 0.02X_5 - 0.01X_6 - 0.01X_7 - 0.001X_8)^{d_3}\} \div 3$$

The Table 4.7 and Figure 4.12 represent the probable trend of efficacy of geographical catalysts and literate population.

Table 4.7: Probable Efficacy on Population of Literates

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	26	50	95
Altitude	74	61	71.5
Distance from Urban Centres	36	96	53
Forest Area	6.5	77	91
Irrigated Area	35	74.5	99
Unirrigated Area	46	44.5	92
Culturable Waste Area	35	80	73
Uncultivable Area	2	57	88

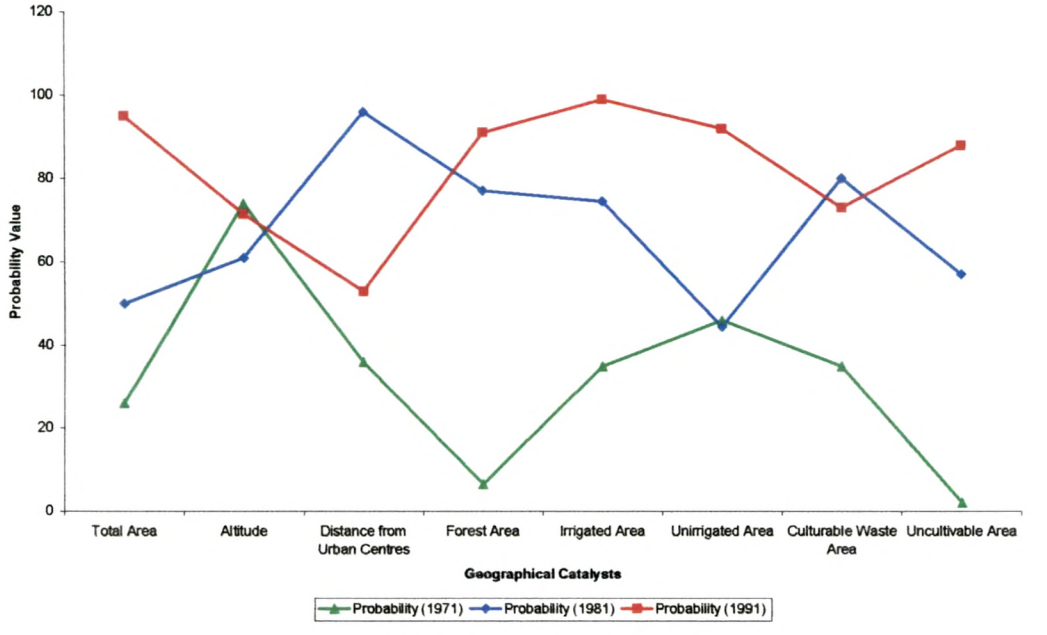


Figure 4.12: Probable Efficacy on Population of Literates

4.2.7 Efficacy on the Ratio of Male – Female Literate Population:

1. The coefficient multiple correlations viz. 0.2169 (1971), 0.3764 (1981), and 0.3951 (1991) indicate a gradual increase in the correlation between the geographical catalysts and male–female literate ratio.
2. The coefficient of multiple determinations viz. 0.4708 (1971), 0.1417 (1981) and 0.1561 (1991) indicate that variation in geographical catalysts explain about 4%, 14%, and 15% of variation in the literate ratio of population.
3. Undoubtedly the probability of effectiveness of individual catalyst varies temporally. But one significant fact about the role of catalysts is that the efficacy of functional characteristic of space certainly represents an increasing trend. The dwindling trend in the efficacy of altitude on the ratio of male–female literate population i.e. increasing impact in 1981 followed by the decreasing trend of similar magnitude in 1991 signify the prevailing efficacy of other factors. This signifies the monotony in the ratio of male–female literate population throughout the region. the impetus gained in 1981 must have diminished in the following decade. This could have been probably because of reflexive behaviour and uniform indifference of tribal population. This is further certified by the significant constant efficacy of distance from urban centres and dwindling efficacy of irrigated area similar to that of attitude. The constant but significant efficacy of urban centres clearly indicates the proper implementation of programmes and policies for enhancing literacy. Indirectly this also signifies the better social, cultural and economic condition in the villages closer to urban centres.
4. The worked out multiple regression equation for estimating mean decennial value of male–female literate population is

Mean Decennial Male–Female Literate Population =

$$\{(19.66 + 0.005X_1 - 0.007X_2 + 0.067X_3 + 0.001X_4 - 0.012X_5 - 0.011X_6 - 0.009X_7 - 0.0003X_8)^{d_1} + (3.13 + 0.005X_1 - 0.002X_2 + 0.135X_3 - 0.01X_4 - 0.01X_5 - 0.004X_6 - 0.01X_7 - 0.006X_8)^{d_2} + (2.96 - 0.003X_1 - 0.06X_2 + 0.02X_3 + 0.003X_4 + 0.01X_5 + 0.003X_6 + 0.003X_7 + 0.003X_8)^{d_3}\} \div 3$$

Table 4.8: Probable efficacy on Male – Female Literate Population

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	82	22	34
Altitude	11	86	33
Distance from Urban Centres	91	98	99.7
Forest Area	98	3	44
Irrigated Area	18	89	48
Unirrigated Area	59	39	7
Culturable Waste Area	96	28	70.5
Uncultivable Area	70	57	68

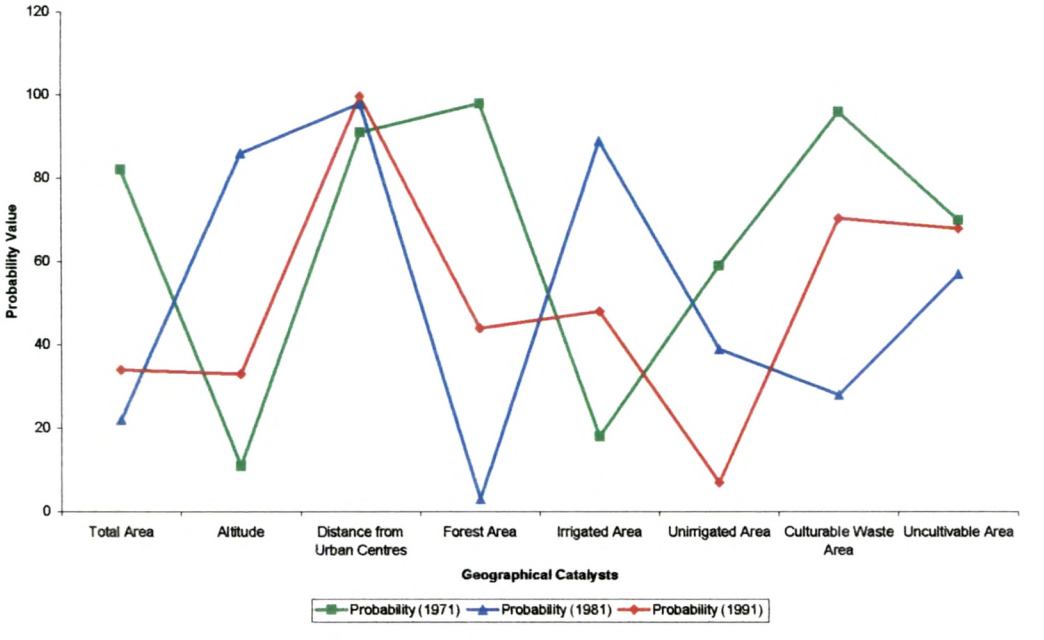


Figure 4.13: Probable Efficacy on Male – Female Literate Population

4.2.8 Efficacy on Main Worker Population:

1. The coefficient of multiple correlations viz. 0.4065 (1971), 0.3911 (1981), and 0.3565 (1991) indicate a gradual decrease in the correlation between geographical catalysts and main worker population.
2. The coefficient of multiple determinations viz. 0.1652 (1971), 0.15300 (1981) and 0.1271 (1991) indicate a gradual decrease in the efficacy of geographical catalysts. In simple words, variation in geographical catalysts explains about

16%, 15% and 12% of variation in the main worker population. Meaning thereby, a greater part of variation could be explained by involving other components or catalysts.

3. The probability of efficacy of individual catalysts certainly show dwindling trend of rise and fall except for distance from urban centres which shows a consistency in the probability of efficacy on main worker population.
4. The worked out multiple regression equation for estimating mean decennial value of main worker population is

Mean Decennial Main Worker Population =

$$\{(38.01 + 0.019X_1 - 0.0007X_2 + 0.198X_3 - 0.037X_4 - 0.004X_5 - 0.012X_6 - 0.033X_7 - 0.014X_8)^{d_1} + (36.1 - 0.002X_1 - 0.006X_2 + 0.211X_3 - 0.004X_4 + 0.028X_5 + 0.005X_6 - 0.004X_7 - 0.008X_8)^{d_2} + (26.3 + 0.004X_1 + 0.002X_2 + 0.26X_3 - 0.007X_4 - 0.01X_5 - 0.001X_6 - 0.01X_7 - 0.01X_8)^{d_3}\} \div 3$$

The Table 4.9 and Figure 4.14 represents the trend of efficacy of individual catalysts.

Table 4.9: Probable Efficacy on Main Worker Population

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	89	47.5	23
Altitude	90	28	26
Distance from Urban Centres	87	8	73
Forest Area	99.9	27	31
Irrigated Area	66	33	99.9
Unirrigated Area	86	46	36
Culturable Waste Area	73	23	13
Uncultivable Area	91	82	58

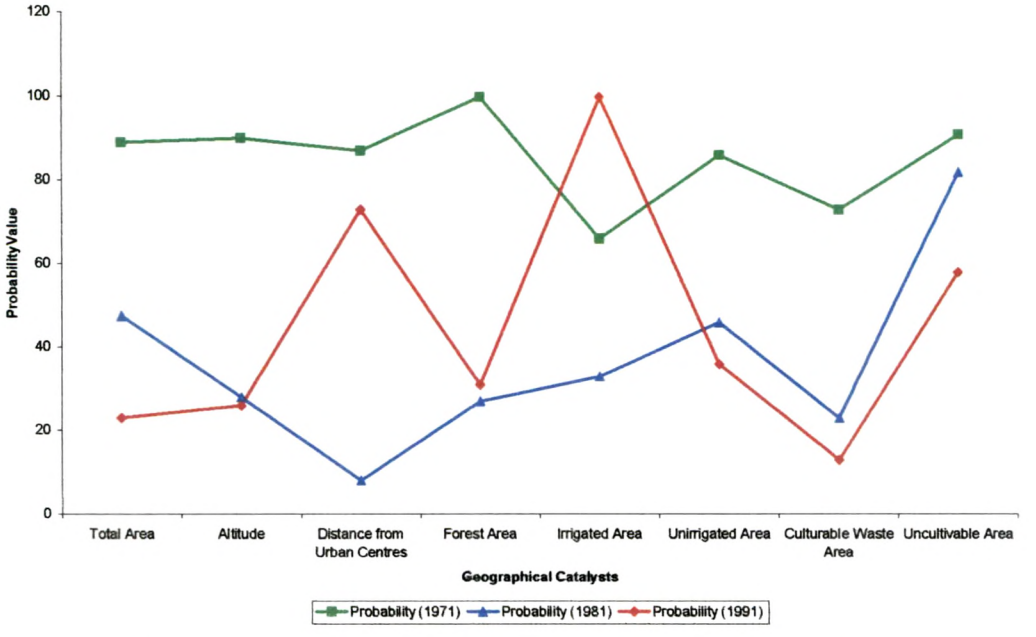


Figure 4.14: Probable Efficacy on Main Worker Population

4.2.9 Efficacy on Ratio of Male / Female Worker Population:

1. The coefficient of multiple correlations viz. 0.5206 (1971) 0.2833 (1981) and 0.5584 (1991) indicate an inverted parabolic trend i.e. first can abrupt fall and then an abrupt rise of same amplitude in the correlation between catalysts and male–female ratio of main worker and a little more from the half way to unity.
2. The coefficient of multiple determinations viz. 0.2710 (1971), 0.0802 (1981) and 0.3118 (1991) also indicate an inverted parabolic trend in the explanation of variation in the male–female ratio of main worker by catalysts. The catalysts explain only 27%, 8% and 31% of the variation in the ratio of male–female main worker.
3. The probable efficacy of most of the individual catalysts on the ratio is significant in 1971 but there after there is a fall except for the effectiveness of irrigated area, which shows increase in efficacy in 1991. The decrease in the efficacy of geographical catalysts except distance from urban centres and irrigated area dictate the growth in main worker population and diminishing effect of geographical catalysts. This clearly indicates diminishing of deterministic role of environment. This move is praiseworthy, if and only if it is in the positive direction i.e. in the direction of sustainable development. Beside this, the determining role of distance from urban centres and irrigation facility dictate the role of favourable environment. The population of main

worker must be higher in the villages closer to urban centres and villages having irrigation facilities because of better opportunities for cultivation and other works.

4. The worked out multiple regression equation for estimating mean decennial value of male / female worker population is

Mean Decennial Male / Female Worker Population =

$$\{(65.24 - 0.097X_1 - 0.04X_2 - 0.76X_3 + 0.23X_4 + 0.08X_5 + 0.09X_6 + 0.07X_7 + 0.104X_8)^{d_1} + (19.3 + 0.087X_1 - 0.02X_2 - 0.11X_3 + 0.05X_4 - 0.09X_5 + 0.08X_6 + 0.04X_7 + 0.2X_8)^{d_2} + (27 - 0.01X_1 - 0.007X_2 - 0.43X_3 + 0.02X_4 + 0.38X_5 - 0.02X_6 + 0.01X_7 + 0.04X_8)^{d_3}\} \div 3$$

4.2.10 Efficacy on Population of Cultivators:

1. The coefficient of correlations viz. 0.3911 (1971), 0.3795 (1981), and 0.3419 (1991) indicate a very minor fall in the co–variation between the geographical catalysts and cultivators distribution. In an agrarian system or a system dependent basically on primary activities the consistency in the relationship must not be amazing but must explain the determining reign of geographical catalysts though far from the unity.
2. The coefficient of multiple determination viz. 0.1530 (1971) 0.1440 (1981) and 0.1169 (1991) indicate that geographical catalysts explain about 15%, 14% and 11% of variation in cultivators population.
3. The probable efficacy of individual catalysts on cultivators' distribution shows a dwindling trend. The most significant catalysts in 1971 are distance from urban centres, forest area and culturable waste area whereas in 1991 they are irrigated and culturable wastes. Meaning thereby variations in these catalysts are liable to cause variation in the cultivator population. The decreasing efficacy of distance from urban centres on the population of cultivators signifies the exhaustion of cultivable land resource and adoption of other work by the population of villages closer to urban centres. But an increasing efficacy of irrigated area, constant efficacy of forest, culturable waste land and uncultivable land and dwindling efficacy of altitude dictate the role of favourable environment.
4. The worked out multiple regression equation for estimating mean decennial value of cultivator population is

Mean Decennial Cultivator Population =

$$\{(33.13 - 0.022X_1 + 0.0003X_2 + 0.228X_3 - 0.037X_4 - 0.003X_5 - 0.014X_6 - 0.04X_7 - 0.02X_8)^{d_1} + (22.9 - 0.01X_1 + 0.001X_2 + 0.21X_3 + 0.01X_4 + 0.031X_5 + 0.012X_6 + 0.004X_7 + 0.001X_8)^{d_2} + (16.6 - 0.004X_1 + 0.002X_2 + 0.16X_3 + 0.001X_4 + 0.01X_5 + 0.002X_6 + 0.002X_7 - 0.004X_8)^{d_3}\} \div 3$$

Table 4.10: Probable Efficacy on Population of Cultivators

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	86	77	84
Altitude	4	99	42
Distance from Urban Centres	93	60	35
Forest Area	97	81	78
Irrigated Area	13	30	96.5
Unirrigated Area	65	30	88
Culturable Waste Area	98	82	91
Uncultivable Area	81	76	60

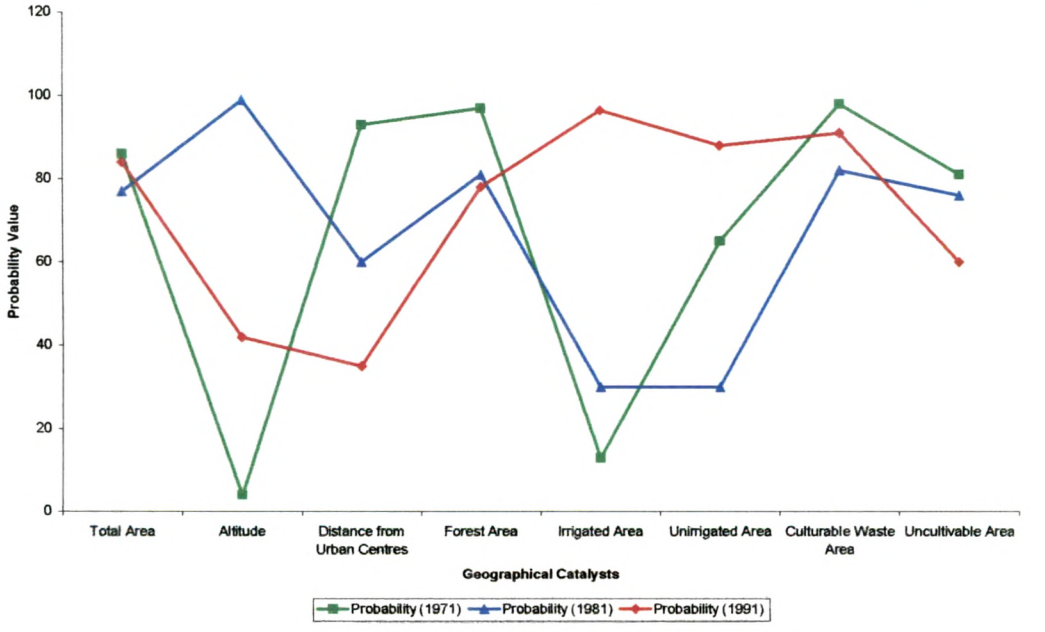


Figure 4.15: Probable Efficacy on Population of Cultivators

The Table 4.10 and Figure 4.15 represent the probable efficacy of catalysts on the cultivators' population distribution.

4.2.11 Efficacy on Infrastructure:

1. The coefficient of multiple correlations viz. 0.4394 (1971), 0.7486 (1981) and 0.7172 (1991) indicate a sudden increase and then stability in the association or co–variation between geographical catalysts and infrastructures.
2. The coefficient of multiple determinations viz. 1931 (1971), 0.5604 (1981) and 0.5143 (1991) indicate that the catalysts explain 19%, 56% and 51% of variation in the infrastructure.
3. Individual efficacy of geographical catalysts on infrastructural development varies with the varying time. In 1971 distance from urban centre and in 1991 forest area is showing significant numerical efficacy. The variation in the efficacy of catalysts in the distribution of infrastructure certainly dictates their determining role. The constancy in efficacy of altitude and irrigated area dictate the less scope of variation in the infrastructural development. The decrease in the efficacy of distance from urban centres in 1991 dictate the possibility of either decrease in the process of infrastructural development or less scope for further development. The later seems to be more resonating. The increase in the efficacy of forest could be because of the lack of necessity for infrastructural development of reserved forests. Lastly, the dwindling or varying trend of efficacy in most of the cases explain the lack of consistency in implementation and running plans and programmes, diminishing possibilities, reflexive behaviour of the system and deterministic role of environment.
4. The worked out multiple regression equation for estimating mean decennial value of infrastructure is

Mean Decennial Infrastructure =

$$\{(3.55 - 0.0005X_1 + 0.0007X_2 - 0.026X_3 + 0.0009X_4 + 0.002X_5 + 0.002X_6 + 0.002X_7 + 0.001X_8)^{d_1} + (11.2 + 0.003X_1 - 0.001X_2 + 0.01X_3 - 0.001X_4 - 0.001X_5 + 0.003X_6 - 0.002X_7 - 0.001X_8)^{d_2} + (13.5 + 0.01X_1 - 0.002X_2 - 0.02X_3 - 0.007X_4 + 0.003X_5 - 0.004X_6 - 0.006X_7 - 0.006X_8)^{d_3}\} \div 3$$

The Table 4.11 and Figure 4.16 represents probable efficacy of catalysts on infrastructural development.

Table 4.11: Probable Efficacy on Infrastructure

Geographical Catalysts	Probability (1971)	Probability (1981)	Probability (1991)
Total Area	25	73	99
Altitude	66	82	79
Distance from Urban Centres	93	32	64
Forest Area	34	29	94
Irrigated Area	50	25	40
Unirrigated Area	70	71	77
Culturable Waste Area	76	46	73
Uncultivable Area	36	41.5	88

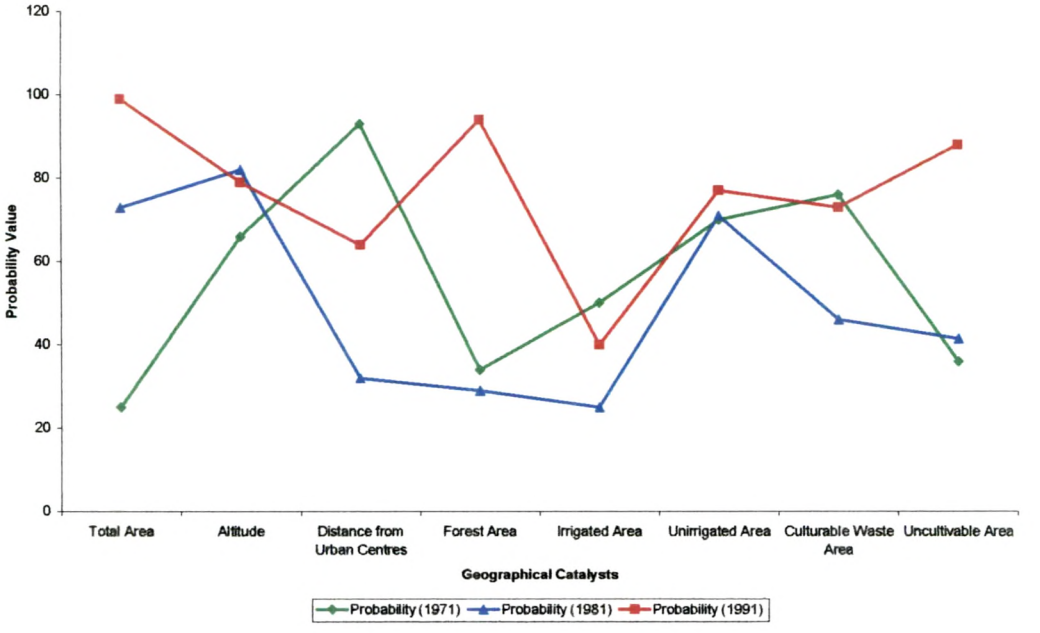


Figure 4.16: Probable Efficacy on Infrastructure

4.3 CONTEMPORARY EFFICACY OF GEOGRAPHICAL CATALYSTS:

Analyses from Annexure VII–4

The analysis of temporal efficacy of geographical catalysts on different variables, based on secondary data, paves the way to analyse the efficacy of geographical catalysts on the basis of primary data. Change in the trend of efficacy of individual geographical catalysts and also degree of correlation between independent and dependent variables direct to scrutinize the realities sustaining or existing in the contemporary stage. This section basically includes the estimation part with an objective to obtain a set of parameters (values of constant) that

minimizes the squared distance between the regression estimate and the individual observations. Thence to formulate multiple regression equation for the prediction of dependent variables, the following equation is used for producing the ideal multiple regression equation:

$$\hat{X}_0 = a + b_1X_1 + b_2X_2 + b_3X_3 \ldots\ldots\ldots\ldots + b_nX_n$$

Here, geographical catalysts are a bit different from those selected for the multiple regression analysis from secondary data in order to make analysis more precise and reliable. Besides this the distance catalysts are analysed separately.

Geographical catalysts selected as independent variable are altitude, forest area, cultivable area, soil depth, depth of water availability, distance from town or urban centres. And the dependent variables are tribal population, tribal population density, literate population, cultivable land per household, diseased population, productivity per hectare, alcohol addition, annual crime rate, malnutrition child addiction, vegetation density, household type, animal per household, annual death rate of animal and electrification.

4.3.1 Efficacy on Tribal Population:

1. The coefficient of multiple correlation 0.38 indicates the co–variation between catalysts and tribal population is far from unity.
2. The coefficient of multiple determination i.e. 0.15 indicates, variation in geographical catalysts explain only 15% of variation in tribal population distribution.
3. The probability of efficacy of individual catalysts is represented in the Table 4.12 and Figure 4.17.
4. The form of multiple regression equation for predicting the ideal value of tribal population could be:

Tribal Population =

$$38.51 + (-0.0146)X_1 + 0.0411X_2 + 0.3478X_3 + 3.0477X_4 + 0.08336X_5$$

4.3.2 Efficacy on Tribal Population Density:

1. The coefficient of multiple correlation of 0.71 indicates the co–variation between the catalysts and tribal density is close to unity.
2. The coefficient of multiple determination of 0.50 indicates, the variation of geographical catalysts explains about 50% of the variation in tribal population density.

3. The probability of efficacy of cultivable land in regressing density from mean is significant. The probability of efficacy is represented in the Table 4.12 and Figure 4.17.
4. The form of multiple regression equation for predicating the ideal value of tribal density against catalysts could be:

Tribal Population Density =

$$3.891+4.23E-06X_1+0.001591X_2+(-0.05414)X_3+0.147113X_4+0.000296X_5$$

4.3.3 Efficacy on Literate Population:

1. The coefficient of multiple correlation viz. 0.64 indicates that co–variation between the catalysts and literate population distribution is enough above the half way towards unity.
2. The coefficient of multiple determination viz. 0.41 indicates that the variation in catalysts explains about 41% variation in literate population.
3. The probability of efficacy of altitude forest area, cultivable area and soil depth in regression of literate population from ideal mean is significant. The probable efficacy of catalysts is represented in the Table 4.12 and Figure 4.17.
4. Applying general form of multiple regression equation, the ideal equation for predicting the ideal values of literate population with the variation in the values of independent variables viz. catalysts, could be:

Literate Population =

$$-8.71136+(-0.0274)X_1+0.03313X_2+0.347987X_3+8.234155X_4+0.03409X_5$$

4.3.4 Efficacy on Cultivable Land per Household:

1. The coefficient of multiple correlation of 0.93 indicates a close to perfect co–variation between the catalysts and cultivable land per household.
2. The coefficient of multiple determination of 0.86 indicates that the variation in catalysts explain about 85% of the variation in the cultivable land per household.
3. The probability of efficacy of forest area in regression of cultivable land distribution per household from the mean is significant. The probable efficacy of various catalysts is represented in the Table 4.12 and Figure 4.17
4. Application of general multiple regression equation presents the following equation in predicting the ideal value of cultivable land per household with the varying catalysts would be:

Cultivable Land per Household =

$$1.029015 + 0.000382X_1 + (-0.00067)X_2 + 0.09421X_3 + (-0.12293)X_4 + (-0.00119)X_5$$

4.3.5 Efficacy on Diseased Population:

1. The coefficient of multiple correlation of 0.34 indicates the co–variation of less degree between catalysts and diseased population.
2. The coefficient of determination of 0.12 indicates the variation in the catalysts explain about 11% of the variation in the diseased population.
3. The probability of efficacy of catalysts on diseased population in regressing from the mean is represented in the Table 4.12 and Figure 4.17
4. Application of general multiple regression equation represents the following equation for the estimation of diseased population with the varying catalysts would be:

Diseased Population =

$$1.144376 + (-0.00019)X_1 + (-0.00108)X_2 + (0.030062)X_3 + 1.392718X_4 + 0.023237X_5$$

4.3.6 Efficacy on Yield per Hectare (Average Productivity):

1. The coefficient of multiple correlation of 0.70 indicates close association between the catalysts and productivity
2. The coefficient of multiple determination of 0.49 indicate the catalysts explain about 49% of variation between the catalysts and productivity
3. The probability value of efficacy of various catalysts on productivity indicates that the variation in soil depth significantly varies the productivity. The probability of efficacy is represented in the Table 4.12 and Figure 4.17.
4. Application of general form of multiple regression equation represents the following ideal equation for prediction of productivity with the varying catalysts would be:

Yield per Hectare =

$$-5.43066 + 0.000198X_1 + (-0.00085)X_2 + (0.022063)X_3 + 2.669856X_4 + 0.007986X_5$$

4.3.7 Efficacy on Alcohol Addiction:

1. The coefficient of multiple correlation of 0.34 indicates that there is association but not significant between the variation in catalysts and alcohol addiction.
2. The coefficient of multiple determination of 0.11 indicates that the catalysts explain about 11% of variation in the alcohol addicted population distribution.

3. The probability value of efficacy indicates that no catalyst is significantly effecting the alcohol addicted population distribution. The probability of efficacy is represented in the Table 4.12 and Figure 4.17.
4. Application of general form of multiple regression equation represents the following equation for estimation:

Alcohol Addiction =

$$27.72536 - 0.00169X_1 + 0.00369X_2 + 0.173388X_3 + (-0.92726)X_4 + (-0.00556)X_5$$

4.3.8 Efficacy on Rate of Annual Crime:

1. The coefficient of multiple correlation of 0.49 indicates there is co–variation between the catalysts and annual crime rate and association is about half way towards unity.
2. The coefficient of multiple determination of 0.24 indicates that the catalysts explain about 24% of variation in the annual crime rate.
3. The probability value of efficacy of altitude and cultivable land on the annual crime variation from the mean is significant. The probability of efficacy of catalysts on annual crime is represented in the Table 4.12 and Figure 4.17.
4. Applying the general multiple regression equation the following equation could represent the ideal condition or estimate the ideal value for annual crime with the varying conditions of catalysts would be:

Rate of Annual Crime =

$$19.57 + 0.011X_1 - 0.0091X_2 - 0.123X_3 - 2.748X_4 - 0.0005X_5$$

4.3.9 Efficacy on Vegetation Density (Trees per Hectare):

1. The coefficient of multiple correlation of 0.45 indicates that the co–variation between the catalysts and vegetation density is slightly less than the half way to unity
2. The coefficient of multiple determination of 0.20 indicates that the variation in catalysts explain about 19% of the variation in vegetation density
3. The individual efficacy of catalysts is also not significant but still the efficacy of cultivable land, soil depth and depth of water availability are considerable. The probability of efficacy is represented in the Table 4.12 and Figure 4.17.
4. Applying the general form of multiple regression the ideal equation for knowing the vegetation density with the varying conditions of catalysts would be:

Vegetation Density =

$$-6.11112+5.58E-05X_1+0.000674X_2-0.04965X_3+1.755401X_4+0.018465X_5$$

4.3.10 Efficacy on House Type:

1. The coefficient of multiple correlation of 0.52 indicates that the co–variation between catalysts and house type is slightly more than the half way to unity
2. The value of coefficient of multiple determination i.e. 0.27 indicates that the variation in catalysts explains about 27% of the variation in House Type
3. The probable individual efficacy of altitude and cultivable area are significant. The probable efficacy of catalysts on house type is represented in Table 4.12 and Figure 4.17.
4. The application of general form of multiple regression equation presents the following equation for estimating the value of concrete house against particular set of conditions would be:

House Type =

$$9.35258+0.002328X_1-0.00126X_2-0.04457X_3-1.0533X_4+0.004347X_5$$

4.3.11 Efficacy on Animal Domestication per Household:

1. The value of coefficient of multiple correlation i.e. 0.36 indicates a weak co–variation between the geographical catalysts and animal domestication
2. The value of coefficient of multiple determination i.e. 0.13 indicates that the variation in catalysts explains about 12% of the variation in domestication of animals
3. The probable individual efficacy of catalysts on domestication is not significant but still the probability of efficacy of forest area cultivable land area and soil depth are noticeable. The probable efficacy of each catalyst is represented in the Table 4.12 and Figure 4.17.
4. The ideal model of multiple regression for estimating animal per house hold would be:

Animal Domestication per Household =

$$1.513042-0.0011X_1+0.003218X_2+0.037673X_3+0.861065X_4+0.000673X_5$$

4.3.12 Efficacy on Animal Death Rate:

1. The value of coefficient of multiple correlation i.e. 0.32 indicates a weak co–variation between catalysts and annual death rate of animals

2. The value of coefficient of determination i.e. 0.10 indicate that variation in catalysts explain about 10% of variation in the death rate of animals
3. The probable individual efficacy indicates no catalyst significantly affects the death rate of animals but the depth of soil is quite remarkable. The probability of efficacy is represented in the Table 4.12 and Figure 4.17.
4. The model multiple regression equation for estimating the animal annual death rate against varying catalysts would be:

Animal Death Rate =

$$3.953015 - 0.00028X_1 + 0.001692X_2 - 0.01294X_3 + 1.337684X_4 - 0.00591X_5$$

4.3.13 Efficacy on Electrification:

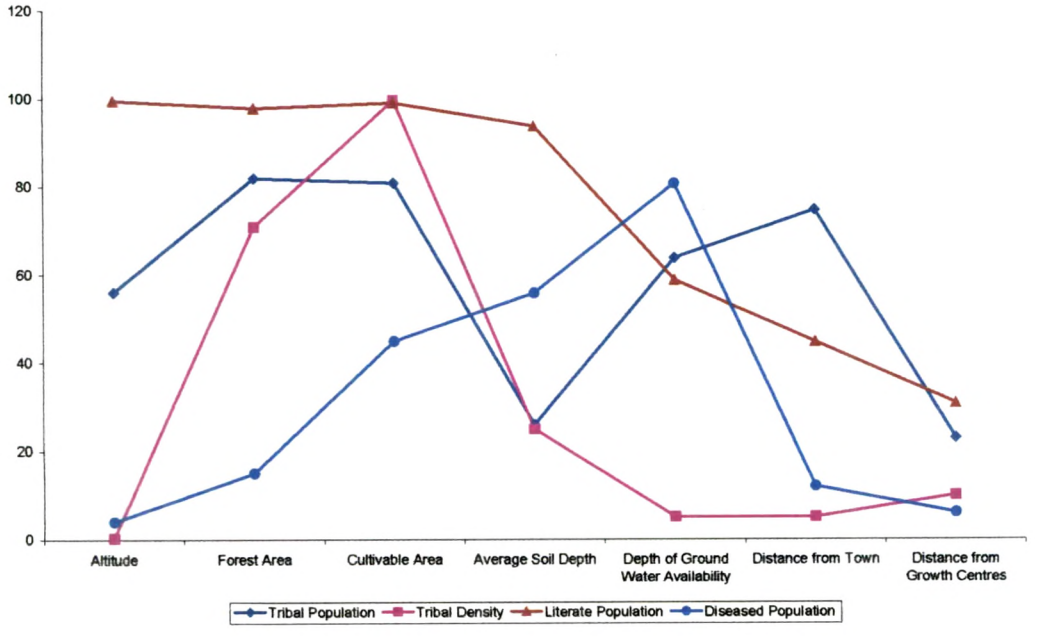
1. The coefficient of multiple correlation i.e. 0.45 indicates that the co–variation between catalysts and electrification is not significant, the value being far from unity.
2. The coefficient of multiple determination i.e. 0.21 indicates that the catalysts explain about 20% of variations in electrification.
3. Among the individual catalysts the probable efficacy of cultivable land and soil depth are significant probable efficacies of each catalysts is represented in the Table 4.17 and Figure 4.17 given.
4. The model multiple regression equation for estimating the electrification level would be:

Electrification =

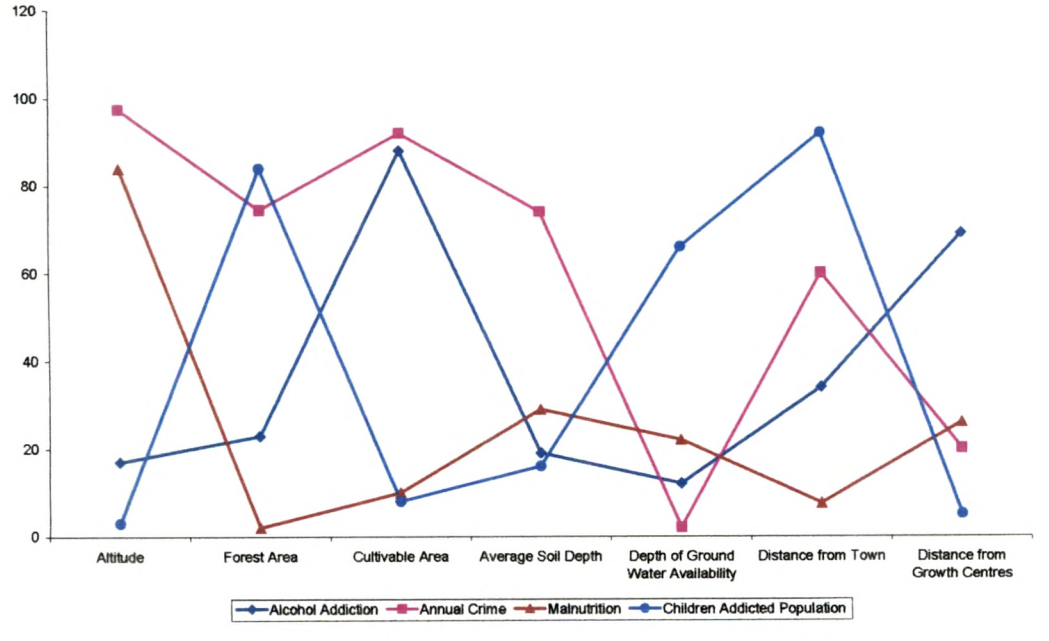
$$-2.85544 - 0.00257X_1 + 0.003698X_2 - 0.062869X_3 + 2.472423X_4 - 0.00214X_5$$

Table 4.12: Probable Efficacy of Catalysts on Different Phenomena

	Altitude	Forest Area	Cultivable Area	Average Soil Depth	Depth of Ground Water Availability	Distance from Town	Distance from Growth Centres
Tribal Population	56	82	81	26	64	75	23
Tribal Density	0.36	71	99.9	25	5	5	10
Literate Population	99.6	98	99.3	94	59	45	31
Diseased Population	4	15	45	56	81	12	6
Alcohol Addiction	17	23	88	19	12	34	69
Annual Crime	97.5	74.5	92	74	2	60	20
Malnutrition (Pellagra Cases)	84	2	10	29	22	7.5	26
Children Addicted Population	3	84	8	16	66	92	5
Cultivable Land per Household	44	48	99.9	30	30	33.5	15
Productivity	12.5	33	79	99.9	81	65	77
Domestic Vegetation Density	2	13	83.5	83	86	38.5	13
House Type	90	43	97	87	49	47.5	41
Animal per Household	46	73	86	67	6	16	13
Animal Death Rate	9	34	30	73	39	88	69
Electrification	67	62	91	94	14	27.5	81


120
100
80
60
40
20
0
Altitude
Forest Area
Cultivable Area
Average Soil Depth
Depth of Ground Water Availability
Distance from Town
Distance from Growth Centres
Tribal Population
Tribal Density
Literate Population
Diseased Population

(A)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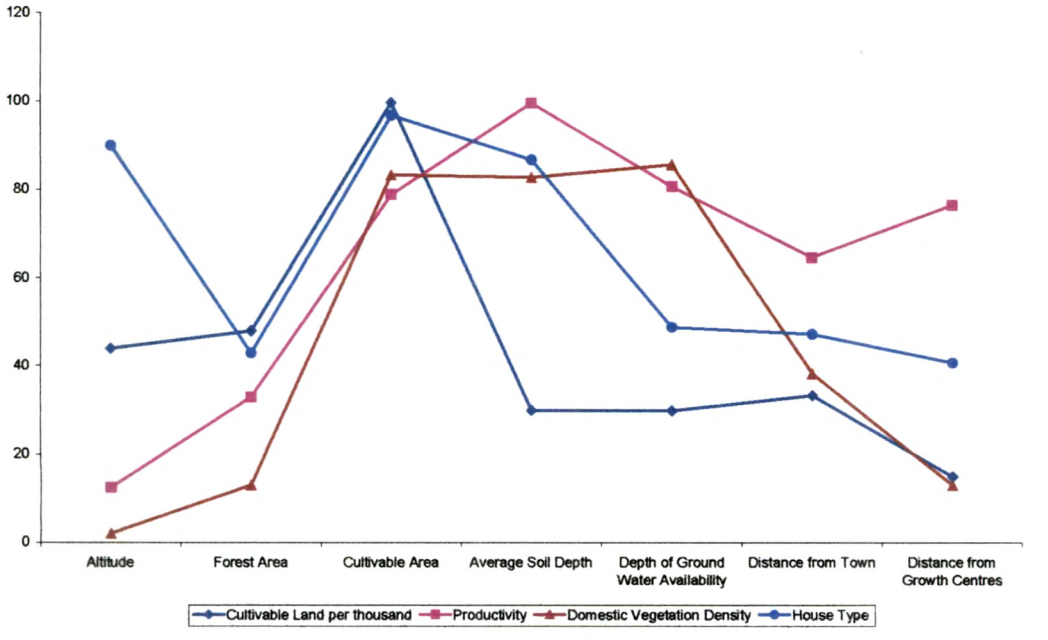
Altitude
Forest Area
Cultivable Area
Average Soil Depth
Depth of Ground Water Availability
Distance from Town
Distance from Growth Centres
Alcohol Addiction
Annual Crime
Malnutrition
Children Addicted Population

(B)



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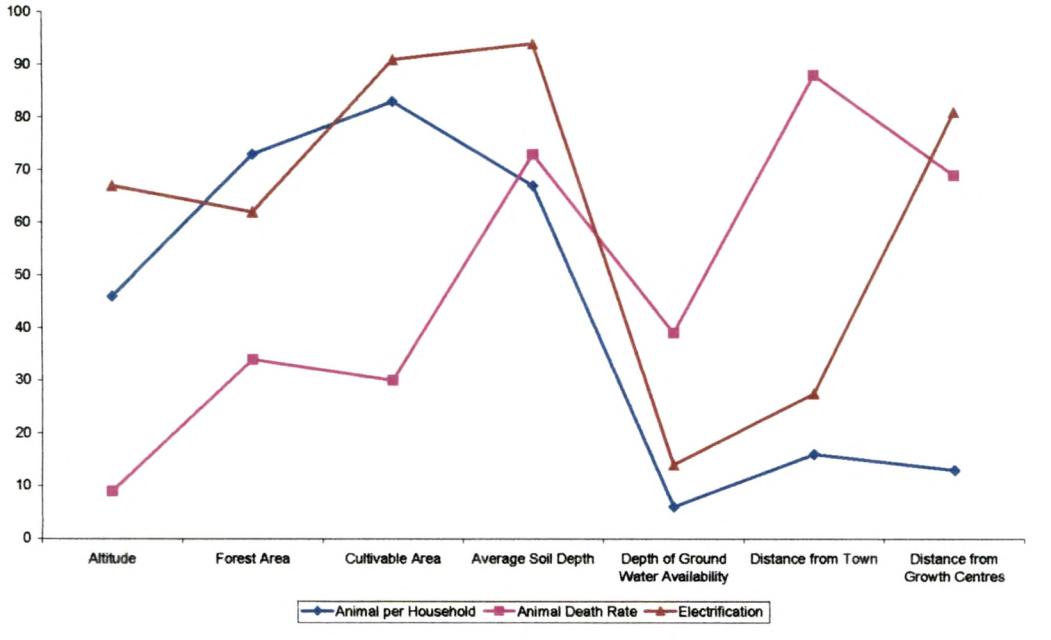

(D)

Figure 4.17: Contemporary Probable Efficacy of Catalysts on Different Phenomena

The persisting temporal efficacy of distance on tribal arable density, literate population, and main worker population distribution explains the efficacy on economic and socio-cultural development of the area at one hand and replicate their mutual dependence on the other hand.

The persisting temporal efficacy of altitude on tribal arable density and literate population explains the efficacy on economic and socio–cultural development and replicate their mutual dependence.

The temporal efficacy of irrigated area on literate population, male–female literate ratio, male–female worker ratio and cultivator population explicate the efficacy on socio – cultural and economic development and their mutual dependence.

The temporal efficacy of areal characteristic such as forest area, cultivable area, irrigated area, culturable waste land etc. on the male–female literate ratio explicate the impact on economy and socio–cultural development.

The temporal efficacy of culturable wastes on cultivator population explicates the impact of physiography on the economy of population.

The contemporary efficacy of –

Altitude on literate population, annual crime and house type explicate the efficacy on socio–cultural and economic development and mutual dependence between them.

Forest area on literate population, cultivable land per household and animal domestication explains the efficacy on socio–cultural and economic development on the one hand and mutual association between each on the other.

Soil depth on literate population, productivity, domestic vegetation, animal domestication and animal death rate explicate the efficacy on socio – cultural economic and infrastructural development and their mutual dependence.

Cultivable land on literate population, annual crime, domestic vegetation, animal domestication, electrification and house type explicate the efficacy on socio–cultural economic and infrastructural development and their mutual dependence.

The individual or composite temporal and contemporary efficacy of various independent geographical catalysts on the dependent phenomena explains either a direct or indirect but logical interlinkage between them and represents the system as a unified environmental system. And this directs the necessity of proper management of each phenomenon for sustainability of the system.

4.4 EFFICACY OF GEOGRAPHICAL VARIATION AND LOCATION IN THE SPATIAL DISTRIBUTION OF PHENOMENA:

Analysis from Annexure VIII and IX

The efficacy or role of location is considered to be one of the most significant phenomena that keep geographical study ever incubating. So, since the inception of the study it has been emphatically analysed multifariously. Here, spatial distribution of various phenomena in varying locations is analysed. This would not only assist in concluding on the efficacy but also the spatial trend or pattern of distribution i.e. the homogeneity or heterogeneity. Keeping in view the essence, the student 't' test and Anova i.e. Analysis of variance is applied for analyses.

4.4.1 General Efficacy of Forest and Non Forest Area:

Analyses from Annexure VIII–1.1

1. Null Hypothesis: There is difference between the variances of the tribal populations of forest and non–forest villages. In other words, both the samples do not come from a common normally distributed population.

   Result: The critical value of 't' with 106 degree of freedom (df) for a two tailed test at the 0.05 significance level is 1.982598 and the calculated value of 't' is 0.46. Since the calculated value is less than the critical value, the null hypothesis can be accepted.

2. Null Hypothesis: There is difference between the variances of tribal population density of forest and non–forest villages.

   Result: The critical value of 't' with 93 df for a two–tailed test at the 0.05 significance level is 1.98 and the calculated value is 4.52. Since the calculated value is greater than the critical value, the null hypothesis must be rejected and alternate of it must be accepted. Meaning thereby, there is no difference in the variance of tribal population density of forest and non–forest villages i.e. both the samples do come from the normally distributed population.

3. Null hypothesis: There is difference in the variances of population density of forest and non forest villages.

   Result: The critical value of 't', with 95 df at 0.05 significance level for two tailed test is 1.98 which is less than the calculated value i.e. 5.19. Since the critical value is less than the calculated value, null hypothesis must be rejected and the alternate hypothesis would be, "there is no significant

difference between the mean population density of forest and non–forest area.

4. Null hypothesis: The variances of literate population of forest and non–forest area are unequal.

   Result: The critical value of 't' with 103 df at 0.05 significance level for two tailed test is 1.98 where as calculated value in but the calculated value is less than the critical the null hypothesis –0.89 becomes acceptable.

5. Null hypothesis: The variances of main worker population in forest and non–forest area vary significantly.

   Result: The critical value with 102 df at 0.05 significance level for two tailed test is 1.98. The calculated value of 't' i.e. 2.11 being greater than the critical value the null hypothesis must be rejected and alternate of it can be accepted. Meaning thereby, "The variances of main worker population in forest and non–forest area do not vary significantly and belong to normal distributed population.

6. Null hypothesis: The variances of cultivator population of forest and non–forest area vary and do not come from normal distributed population.

   Result: The critical value of 't', with 106 df at 0.05 significance level for two–tailed test, 1.98 is than the calculated value i.e. –0.32. So the null hypothesis can be accepted

7. Null hypothesis: There is difference between the variances of and cultivable area of forest and non – forest area

   Result: The critical value of 't' with 99 df at 0.05 significance level for two–tailed test is 1.98 and less than the calculated value, 6.94. So the null hypothesis is rejected and alternate of it i.e. "there is no difference between variances of cultivable area of forest and non–forest area" can be accepted.

4.4.2 General Efficacy of Riverine and Non–Riverine Area:

Analyses from Annexure VIII–1.2

1. Null hypothesis: There is difference in the variances of mean temporal population density of riverine and non–riverine area.

   Result: The critical value of 't' with 105 degree of freedom (df) at 0.05 significance level is 1.98. The calculated value i.e. –0.93 being less than the critical value, the hypothesis can be accepted

2. Null hypothesis: The variances of mean temporal tribal population density in riverine and non riverine area are unequal.

Result: The critical value of 't' with 100 df at 0.05 significance level for two tailed test is 1.98 and the calculated value is –0.12. Since the calculated value is less than the critical the hypothesis can be accepted.

3. Null hypothesis: There is difference between the variances of mean temporal literates of riverine and non–riverine area.

   Result: The critical value of 't' with 83 df at 0.05 significance level for two tailed test is 1.98 whereas the calculated value is –1.74 since the calculated value is too less than the critical value hypothesis can be accepted.

4. Null hypothesis: There is difference between the variances of mean temporal main worker distribution in riverine and non–riverine areas.

   Result: The critical value of 't' with 93 df at 0.05 significance level for two tailed test is 1.98 whereas calculated value is –0.15. Since the calculated value is less than the critical value the hypothesis can be accepted.

5. Null hypothesis: There is difference between the variances of mean temporal cultivators distribution in riverine and non–riverine areas.

   Result: The critical value of 't' with 82 df at 0.05 significance level for two tailed test is 1.98 whereas calculated value is 1.08. Since the calculated value is less than the critical value, the hypothesis can be accepted.

6. Null hypothesis: There is difference between the variances of percentage of tribal population percent of riverine and non–riverine areas.

   Result: The critical value of 't' with 85 df at 0.05 significance level for two tailed test is 1.98 whereas calculated value is 1.93. Since the calculated value is less than the critical value, the hypothesis can be accepted.

7. Null hypothesis: There is difference between the variances of mean temporal forest area of riverine and non–riverine areas.

   Result: The critical value of 't' with 75 df at 0.05 significance level for two tailed test is 1.99 whereas calculated value is –0.74. Since the calculated value is less than the critical value the hypothesis can be accepted.

8. Null hypothesis: There is significant difference between the variances of mean temporal cultivable area of riverine and non–riverine area.

   Result: The critical value of 't' with 101 df at 0.05 significance level for two tailed test is 1.98 whereas the calculated value is –1.99. Since calculated value is less than the critical value the hypothesis can be accepted.

4.4.3 Contemporary Efficacy of Forest and Non–Forest Area: Analyses from Annexure VIII–2.1

1. Null Hypothesis: There is difference between the variances of tribal population density of forest and non–forest villages.
   Postulation: The critical value of 't' with 21 degree of freedom (df) at 0.05 significance level for two tailed test is 2.07 whereas calculated value is 1.02. Since the calculated value is less than the critical value the hypothesis can be accepted.
2. Null Hypothesis: There is difference between the variances of scheduled tribes population percentage of forest and non forest areas.
   Postulation: The critical value of 't' with 12 df at 0.05 significance level for two tailed test is 2.17 whereas calculated value is –1.69. The calculated value being less than critical value the hypothesis can be accepted.
3. Null Hypothesis: There is difference between the variances of percentage of literates population of forest and non–forest areas.
   Postulation: The critical value with 25 df at 0.05 significance level for two tailed test is 2.05 whereas the calculated value is –0.78. The calculated value being less than critical value the hypothesis can be accepted.
4. Null Hypothesis: There is difference between the variances of cultivable area of forest and non-forest areas.
   Postulation: The critical value of 't' with 25 df at 0.05 significance level for two tailed test is 2.04 whereas calculated value is –1.13. As the calculated value is less than critical value the hypothesis can be accepted.
5. Null Hypothesis: There is difference between the variances of soil depths of forest and non–forest areas.
   Postulation: The critical value of 't' with 21 df at 0.05 significance level for two tailed test is 2.07 whereas calculated is –0.36. So, the calculated value being less than critical value the hypothesis can be accepted.
6. Null Hypothesis: There is difference between the variances of agricultural productivity of forest and non–forest areas.
   Postulation: The critical value of 't' with 26 df at 0.05 significance level for two–tailed test is 2.05 whereas calculated value is –1.37. So, the calculated value being less than critical value the hypothesis must be accepted.
7. Null Hypothesis: There is difference between the variances of diseased population of forest and non–forest areas.

Postulation: The critical value of 't' with the 14 df at a 0.05 significance level for two tailed test is 2.14 whereas calculated value is 0.64. As the calculated value is less than critical value, the hypothesis can be accepted.

8. Null Hypothesis: There is difference between the variances of mean distance between settlement agglomerations of forest and non–forest areas.
   Postulation: The critical value of 't' with 28 df at 0.05 significance level for two tailed test is 2.04 whereas calculated value is –1.48. The calculated value being less than critical value the hypothesis can be accepted.
9. Null Hypothesis: There is difference between the variances of mean extent of villages of forest and non–forest areas.
   Postulation: The critical of 't' with 28 df at 0.05 significance level for two tailed test is 2.04 whereas calculated value is –0.07. The calculated value being less than critical value the hypothesis can be accepted.

4.4.4 Contemporary Efficacy of Riverine and Non Riverine Area: Analyses from Annexure VIII–2.2

1. Null Hypothesis: There is difference in the variances of tribal population density of riverine and non–riverine areas.
   Postulation: The critical of 't' with 20 df at 0.05 significance level for two tailed test is 2.08 whereas calculated value is 0.04. The calculated value being less than critical value, the hypothesis can be accepted.
2. Null Hypothesis: There is difference between the variances of percentage of tribal population of riverine and non riverine areas.
   Postulation: The critical value of 't' with 13 df at 0.05 significance level for two tailed test is 2.16 whereas calculated value is 1.17. The calculated value being less than critical value, the hypothesis can be accepted.
3. Null Hypothesis: There is difference in the variances of cultivable land area of riverine and non–riverine areas.
   Postulation: The critical value of 't' with 13 df at 0.05 significance level for two tailed test is 2.16 whereas calculated value is –0.33. The calculated value being less than critical value the hypothesis can be accepted.
4. Null Hypothesis: There is difference between the variances of soil depths of riverine and non–riverine areas.
   Postulation: The critical value of 't' with 25 df at 0.05 significance level for two tailed test is 2.05 whereas calculated value is –1.11. The calculated value being less than critical value the hypothesis can be accepted.

5. Null Hypothesis: There is difference between the variances of productivity of riverine and non–riverine areas.
   Postulation: The critical value of 't' with 27 at 0.05 significance level for two tailed test is 2.05 whereas calculated value is –1.52. The calculated value being less than critical value the hypothesis can be accepted.
6. Null Hypothesis: There is difference between the variances of forest area of riverine and non–riverine areas.
   Postulation: Critical value of 't' with 17 df at 0.05 significance level for two tailed test is 2.10 whereas calculated value is –0.52. The calculated value being less than critical value the hypothesis must be accepted.
7. Null Hypothesis: There is difference between the variances of mean distance between settlement agglomerations of riverine and non–riverine villages.
   Postulation: The critical value of 't' with 27 df at 0.05 significance level for two tailed test is 2.05 whereas calculated value is 0.46. The calculated value being less than critical value the hypothesis can be accepted.
8. Null Hypothesis: There is difference between the variances of mean extent of villages of riverine and non–riverine areas.
   Postulation: The critical value of 't' with 21 df at 0.05 significance level for two tailed test is 2.079 whereas calculated value is –1.35. The calculated value being less than critical the hypothesis can be accepted.

The distribution of mean temporal population, tribal density, literate population and cultivator population of forest and non–forest area vary whereas population density, main worker population and cultivable area do not vary. Variation in the distribution of demographic phenomena has inter–causasive association. The contrasting behaviour of variation in density of tribal population and no variation in density of aggregate population indicate that distribution of tribal population is the basic cause for the variation in the distribution of mean temporal population showing general distribution of population over span of three decades. Variation in the literate population could be because of either varying proportion of tribal population or difference in the implementation of programmes related to literacy development and reflexive behaviour of tribals. Variation in the population of cultivators inspite of no variation in main worker population and cultivable area could be because of variation in the favourability for cultivation and thence adoption of other functions. The adoption of other functions could be the cause for no variation in the main worker population of forest and non forest area.

The distribution of mean temporal population density, tribal population density, literate population, main worker population, cultivator population, forest area and cultivable area of riverine and non–riverine settlements vary. This might be because of concentration of settlements near water sources, especially along the ephemeral streams and around the troughs and other favourable conditions for their survival such as, satisfactory soil depth etc. Besides these, this might be due to dispersal of settlements caused due to land distribution policy, forest policies and other related legislations. Variation in the literate population could be due to lack of awakening and variation in the implementation of related plans.

The contemporary variation between the distribution of tribal density, tribal percentage, literate population, cultivable area, forest area, soil depth, productivity, diseased population, mean distance between settlement agglomerations and mean extent of settlements of forest and non–forest area and riverine and non–riverine settlements of forest and non–riverine settlements indicate persisting role of locational factors. It is notable that variation in the distribution of population is directly associated to the favourability of environment which decide the socio–economic condition of the population. The variation in the literate population and diseased population could be because of variation in socio–economic condition caused due to locational favourability. Such variations could also be because of variation implementation of plans.

The variability in favourability of historical location factors such as forests and rivers are everoperative in space–time continuum in their mode of concentration of settlements and related phenomena. It is reiterated that distribution of population is directly regulated by the favourability of environment in specific locations. A system of favourable conditions acts as nuclei or stimulant to attract the population. These nuclei have been the cause for struggle between the groups and regimes in space–time continuum. Presently, the growing demographic, social, cultural economic and areal characteristic variations are solely because of the transforming behaviour of such locations. These locations characteristically being geographical are yet operative and play decisive role in the evolution of specific system.

4.5 EFFICACY OF GEOGRAPHICAL VARIATIONS AND LOCATION: Analysis from Annexure IX

4.5.1 General Efficacy of Altitude: Analyses from Annexure IX–1.1

1. Null Hypothesis: The sample of mean temporal population density comes from a common normally distributed population or an identical population.

Postulation: The critical value of F with 2 [Between Group (BG)] and 107 [Within Groups WG)] degree of freedom (df) at 0.05 significance level is 3.08 whereas calculated value is 0.41. The calculated value being less than critical value the hypothesis is accepted.

2. Null Hypothesis: The samples of mean temporal percentage of literate population are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 7.82. The calculated value being greater than the critical the hypothesis is rejected.

3. Null Hypothesis: The samples of mean temporal tribal population densities are from identically distributed population.

   Postulation: The critical value of 'F' with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value of F is 0.18. The calculated value being less than critical value the hypothesis is accepted.

4. Null Hypothesis: The samples of temporal mean forest area are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 1.21. The calculated value being less than critical value the hypothesis is accepted.

5. Null Hypothesis: The samples of mean temporal main worker population percentage are from identically distributed population.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value of F is 4.09. The calculated value of F being greater than critical value the hypothesis is rejected.

6. Null Hypothesis: The samples of mean temporal percentage of cultivators are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value 2.78. The calculated value being less the hypothesis is accepted.

7. Null Hypothesis: The samples of mean temporal percentage of tribal population are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas the calculated value is 5.54. The calculated value being greater than critical the hypothesis is rejected.

8. Null Hypothesis: The samples of mean temporal cultivable area are from identically distributed spaces.

Postulation: The critical value of F with 2 (BG) and (WG) 107 df at 0.05 significance level is 3.08 whereas calculated value is 1.48. The calculated value being less than critical value the hypothesis is accepted.

4.5.2 General Efficacy of Distance from Urban Centres: Analyses from Annexure IX–1.2

1. Null Hypothesis: The samples of mean temporal population densities are from identically distributed spaces.

   Postulation: The critical value of F with 2 [Between the Group (BG)] and 107 [Within the Group (WG)] df at 0.05 significance level is 3.08 whereas calculated value is 0.91. The calculated value being less than critical value the hypothesis is accepted.
2. Null Hypothesis: The samples of mean temporal tribal population densities are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 0.91. The calculated value being less than critical value the hypothesis must be accepted.
3. Null Hypothesis: The samples of mean temporal literate population percentage are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 11.08. The calculated value being greater than critical value the hypothesis must be rejected.
4. Null Hypothesis: The samples of mean temporal main worker percentage are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 10.18. The calculated value being greater than critical the hypothesis value rejected.
5. Null Hypothesis: The samples of mean temporal cultivators percentage of are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 2.92. The calculated value of F being less than the critical value the hypothesis is accepted.
6. Null Hypothesis: The samples of mean temporal percentage of tribal population are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 0.89. The calculated value being less than critical value the hypothesis is accepted.

7. Null Hypothesis: The sample of mean temporal percentage of forest area is from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 0.51. The calculated value of F being less than critical value the hypothesis is accepted.

8. Null Hypothesis: The samples of mean temporal cultivable area are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 107 (WG) df at 0.05 significance level is 3.08 whereas calculated value is 1.68. The calculated value being less than critical value the hypothesis is accepted.

4.5.3 General Efficacy of Physiographic Characteristics: Analyses from Annexure IX–1.3

1. Null Hypothesis: The samples of mean temporal population densities are from identically distributed spaces.

   Postulation: The F critical value with 4 [Between the Group (BG)] and 105 [Within the Group (WG)] degree of freedom (df) at 0.05 significance level is 2.45 whereas calculated value is 0.65. The calculated value being less than the critical value the hypothesis is accepted.

2. Null Hypothesis: The samples of mean temporal tribal population densities are from identically distributed spaces.

   Postulation: The F critical with 4 (BG) and 105 (WG) df at 0.05 significance level is 2.45 whereas calculated value is 1.30. The calculated value being less than critical value the hypothesis is accepted.

3. Null Hypothesis: The samples of mean temporal percentage of literate population are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 105 (WG) df at 0.05 significance level is 2.45 whereas calculated value is 0.70. The calculated value being less than the critical value the hypothesis is accepted.

4. Null Hypothesis: The samples of mean temporal main worker population percentage are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 105 (WG) df at 0.05 significance level is 2.45 whereas calculated value is 8.64. The calculated value being greater than critical value the hypothesis is rejected.

5. Null Hypothesis: The samples of mean temporal percentage of cultivators are from identically distributed spaces.

Postulation: The critical value of F with 4 (BG) and 105 (WG) df at 0.05 significance level is 2.45 whereas calculated value is 0.71. The calculated value being less than critical value the hypothesis is accepted.

6. Null Hypothesis: The samples of mean temporal percentage of tribal population are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 105 (WG) degrees of freedom at 0.05 significance level is 2.45 whereas calculated value is 12.07. The calculated value being greater than critical value hypothesis is rejected.

7. Null Hypothesis: The samples of mean temporal forest area are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 105 (WG) df at 0.05 significance level is 2.45 whereas calculated value is 1.21. The calculated value being less than critical value the hypothesis is accepted.

8. Null Hypothesis: The sample of mean temporal cultivable area is from identically distribute spaces.

   Postulation: The F critical value with 4 (BG) and 104 (WG) df at 0.05 significance level is 2.45 whereas calculated value is 1.49. The calculated value being less than critical value the hypothesis is accepted.

4.5.4 Contemporary Efficacy of Altitude:

Analyses from Annexure IX–2.1

1. Null Hypothesis: The samples of mean distance between settlement agglomerations are from identically distributed spaces.

   Postulation: The critical value of F with 2 [Between the Groups (BG)] and 27 [Within the Groups (WG)] degree of freedom (df) at 0.05 significance level is 3.35 whereas the calculated value is 0.94. The calculated value being less, the hypothesis is accepted. (V – 4.1)

2. Null Hypothesis: The samples of percentage of electrified households of settlements are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 4.98. The calculated value being greater, the hypothesis is rejected and the alternate hypothesis may be accepted i.e. the samples of electrification of households are not from identically distributed spaces. (V – 4.2)

3. Null Hypothesis: The samples of house type are from normally distributed spaces.

Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 1.62. The calculated value being less, the hypothesis is accepted. (V – 4.3)

4. Null Hypothesis: The samples of domesticated animals are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.15. The calculated value being less, the hypothesis is accepted. (V – 4.4)

5. Null Hypothesis: The samples of per hectare domestic plantation of trees are from identically distributed population.

   Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.50. The calculated value being less, the hypothesis is accepted. (V – 4.5)

6. Null Hypothesis: The samples of diseased population are taken from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 1.65. The calculated value being less, the hypothesis is accepted. (V – 4.6)

7. Null Hypothesis: The samples of mean extent of villages are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 2.02. The calculated value being less the hypothesis is accepted. (V – 4.7)

8. Null Hypothesis: The samples of forest area are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.59. The calculated value being less the hypothesis is accepted. (V – 4.8)

9. Null Hypothesis: The samples of scheduled tribe population are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 1.85. The calculated value being less, the hypothesis is accepted. (V – 4.9)

10. Null Hypothesis: The samples of literate population are from identically distributed spaces.

Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.20. The calculated value being less the hypothesis is accepted. (V – 4.10)

11. Null Hypothesis: The samples of tribal densities are from identically distributed spaces.

    Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.21. The calculated value being less, the hypothesis is accepted. (V – 4.11)

12. Null Hypothesis: The samples of average agricultural productivity are from identically distributed spaces.

    Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 0.04. The calculated value being less, the hypothesis is accepted. (V – 4.12)

13. Null Hypothesis: The samples of soil depth are from identically distributed spaces.

    Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.98. The calculated value being less, the hypothesis is accepted. (V – 4.13)

14. Null Hypothesis: The samples of cultivable area are from identically distributed spaces.

    Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 2.26. The calculated value being less the hypothesis is accepted. (V – 4.14)

4.5.5 Contemporary Efficacy of Distance from Urban Centres: Analyses from Annexure IX–2.2

1. Null Hypothesis: The sample altitudes of villages are taken from identically distributed spaces.

   Postulation: The critical value of F with 2 [Between the Group (BG)] and 27 [Within the Group (WG)] degrees of freedom (df) at 0.05 significance level is 3.35 whereas the calculated value is 2.42. The calculated value being less than the critical value, the hypothesis is accepted.

2. Null Hypothesis: The samples of cultivable area are taken from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 0.19. Since the calculated value is less, the hypothesis is accepted.

3. Null Hypothesis: The samples of soil depth are taken from identically distributed spaces, or there is no variation in the soil depth of varying distance ranges.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 0.36. The calculated value being less, the hypothesis is accepted.

4. Null Hypothesis: The average agricultural productivity is identical what, in varying distance ranges from urban centres.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 1.64. The calculated value being less the hypothesis is accepted.

5. Null Hypothesis: The samples of tribal population densities are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 0.95. Since the calculated value is less the hypothesis is accepted.

6. Null Hypothesis: The samples of percentage of tribal literates are from identically distributed spaces.

   Postulation: The F critical value with 2 (BG) and 26 (WG) df at 0.05 significance level is 3.36 whereas calculated value is 0.20. The calculated value being less, the hypothesis is accepted.

7. Null Hypothesis: The samples of percentage of tribal population are from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 0.36. The calculated value being less, the hypothesis is accepted.

8. Null Hypothesis: The samples of percentage of forest area do not vary with the varying distance from towns i.e. the samples of forest area are taken from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.62. The calculated value being less the hypothesis is accepted.

9. Null Hypothesis: The samples of mean distance between settlement agglomerations are taken from identically distributed spaces.

   Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 4.92. The calculated value being less, the hypothesis is rejected.

10. Null Hypothesis: The samples of mean extent of village settlements are taken from identically distributed spaces.

    Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas calculated value is 0.30. The calculated value being less, the hypothesis is accepted.

11. Null Hypothesis: The samples of diseased population are taken from identically distributed spaces.

    Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.67. The calculated value being less the hypothesis is accepted.

12. Null Hypothesis: The samples of vegetation densities are from identically distributed spaces.

    Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.94. The calculated value being less, the hypothesis is accepted.

13. Null Hypothesis: The samples of domesticated animals are from identically distributed spaces.

    Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 0.15. The calculated value is less than the critical value so the hypothesis is accepted.

14. Null Hypothesis: The samples of house type are from identically distributed spaces.

    Postulation: The critical value of F with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 1.14. The calculated value being less the hypothesis is accepted.

15. Null Hypothesis: The samples percentage of electrification of households are from identically distributed spaces:

    Postulation: The F critical value with 2 (BG) and 27 (WG) df at 0.05 significance level is 3.35 whereas the calculated value is 1.08. The calculated value being less, the hypothesis is accepted.

4.5.6 Contemporary Efficacy of Physiographic Characteristics: Analyses from Annexure IX–2.3

1. Null Hypothesis: The samples of tribal population are from identically distributed spaces.

   Postulation: The F critical value with 4 [Between the Groups (BG)] and 25 [Within the Groups (WG)] degrees of freedom (df) at 0.05 significance level is

2.75 whereas the calculated value is 1.44. The calculated value being less, the hypothesis is accepted. (V – 6.1)

2. Null Hypothesis: The samples of literate population are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 1.32. The calculated value being less, the hypothesis is accepted. (V – 6.2)

3. Null Hypothesis: The samples of cultivable land area are from identically distributed spaces

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 0.87. The calculated value being less the hypothesis is accepted. (V – 6.3)

4. Null Hypothesis: The samples of tribal population densities are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 1.47. The calculated value being less, the hypothesis is accepted. (V – 6.4)

5. Null Hypothesis: The samples of soil depths are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 0.43. The calculated value being less, the hypothesis is accepted. (V – 6.5)

6. Null Hypothesis: The samples of average agricultural productivity are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 0.96. The calculated value being less, the hypothesis is accepted. (V – 6.6)

7. Null Hypothesis: The samples of per hectare domestic plantation of trees are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 1.48. The calculated value being less, the hypothesis is accepted. (V – 6.7)

8. Null Hypothesis: The samples of domesticated animals are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 1.21. The calculated value being less the hypothesis is accepted. (V – 6.8)

9. Null Hypothesis: The samples of forest areas are from identically distributed spaces.

   Postulation: The F critical value with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 0.326. The calculated value being less, the hypothesis is accepted. (V – 6.9)

10. Null Hypothesis: The samples of mean distance between settlement agglomerations are from identically distributed spaces.

    Postulation: The F critical with 4 (BG) and 25 (WG) df at 0.05 significance level is 2.75 whereas the calculated value is 1.67. The calculated value being less, the hypothesis is accepted. (V – 6.10)

According to Anova analyses based on derived mean temporal data–

1. Main worker and scheduled tribe population do not have identical distribution in the varying physiography. This implies that population distribution and their functions are controlled by physiography.
2. Literate, main worker and scheduled tribe population are not identically distributed in varying altitudinal ranges. This implies that population concentration and their development are visibly controlled by altitude.
3. Literate and main worker population is not identically distributed in varying ranges of distance from towns. This implies that cultural development is affected by distance from urban centres.

Anova analyses based on primary data explains–

1. Electrification is not identical in varying ranges of altitude. It shows that infrastructural development is not uniform.
2. Mean distance between settlements agglomerations varies with the varying ranges of distance from towns. This shows that the locations of settlements are determined by distance from the town and physiographic conditions.

The following graphs represent comparative probable efficacy of altitudinal ranges, distance ranges and physiography upon the common phenomena i.e. which are included in the Anova analyses from derived mean temporal data and primary data. The graph explicates the probable efficacy of above mentioned locational factors in the distribution of different phenomena.

So, from the above, it must be inferred that spatial distribution of phenomena are not uniform or homogeneous on the one hand and efficacies a very on the other. It also indicates the dominating decisive role of physical geographical phenomena.

Table 4.13: Probable Efficacy of Altitude, Distance from Urban Centres and Physiography on the mean decennial distribution of Phenomena

	Percentage Probability of Altitude	Percentage Probability of Distance from Urban Centres	Percentage Probability of Physiography
Tribal Population	99.5	59	100
Population Density	34	60	38
Tribal Population Density	17	60	73
Literate Population	99.9	100	42
Main Worker Population	98.4	100	100
Cultivator Population	93	95	42
Forest Area	70	40	70
Cultivable Area	77	82	80

Table 4.14: Probable Efficacy of Altitude, Distance from Urban Centres and Physiography on the Contemporary Distribution of Phenomena

	Percentage Probability of Altitude	Percentage Probability of Distance from Urban Centres	Percentage Probability of Physiography
Tribal Population	83	31	76
Tribal Population Density	19	61	77
Tribal Literate Population	19	19	72
Cultivable Land Area	80	49	0
Forest Area	88	18	51
Soil Depth	62	31	22
Productivity (yield per hectare)	5	79	56
Domestic Plantation of Trees	45	46	15
Domestication of Animals	15	15	67
Mean Distance between Settlement Agglomerations	40	60	77
Population Affected with disease	61	99	82
Electrification	99	65	0

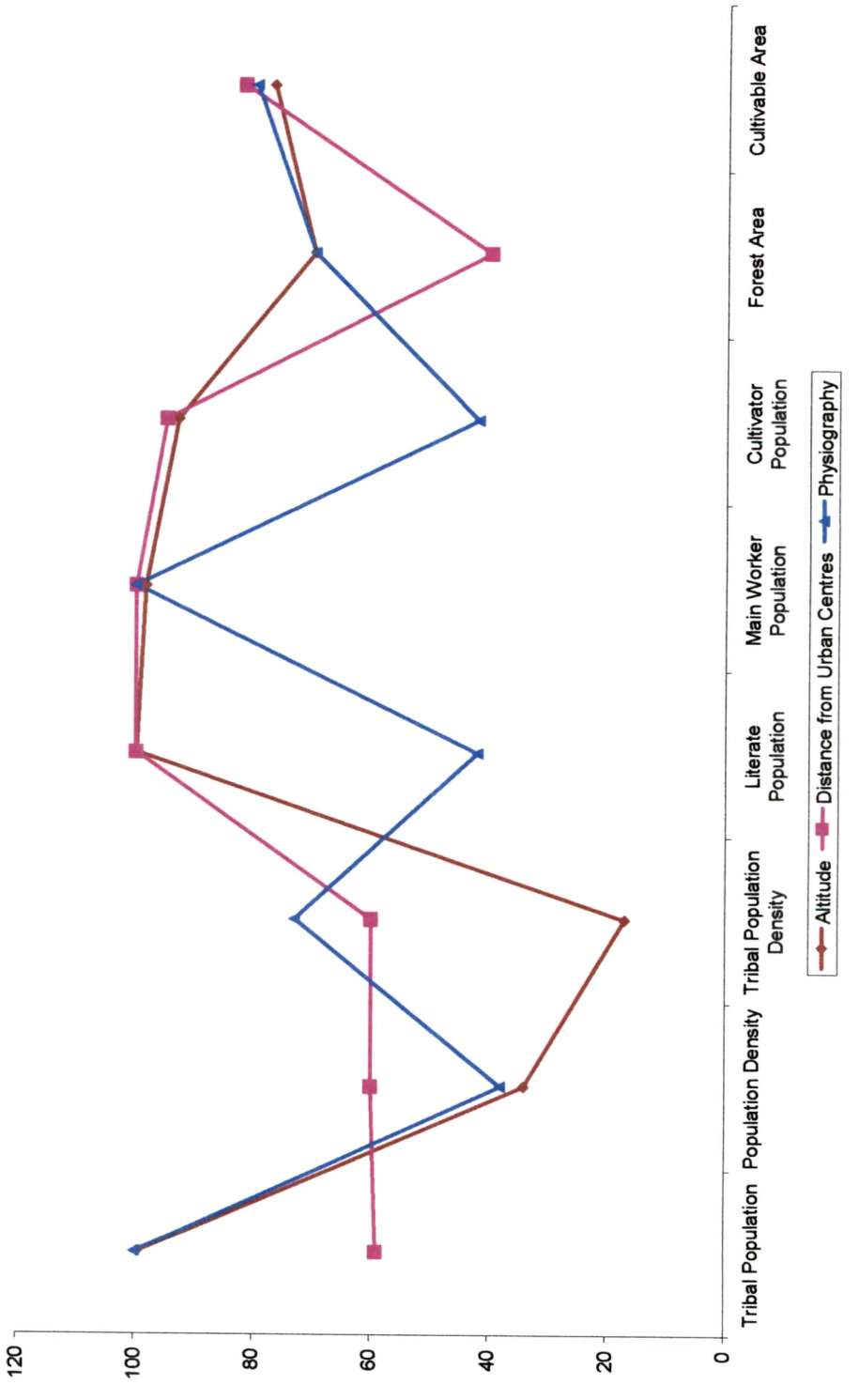

Figure 4.18: Probable Efficacy of Altitude, Distance from Urban Centres and Physiography on the mean decennial distribution of Phenomena

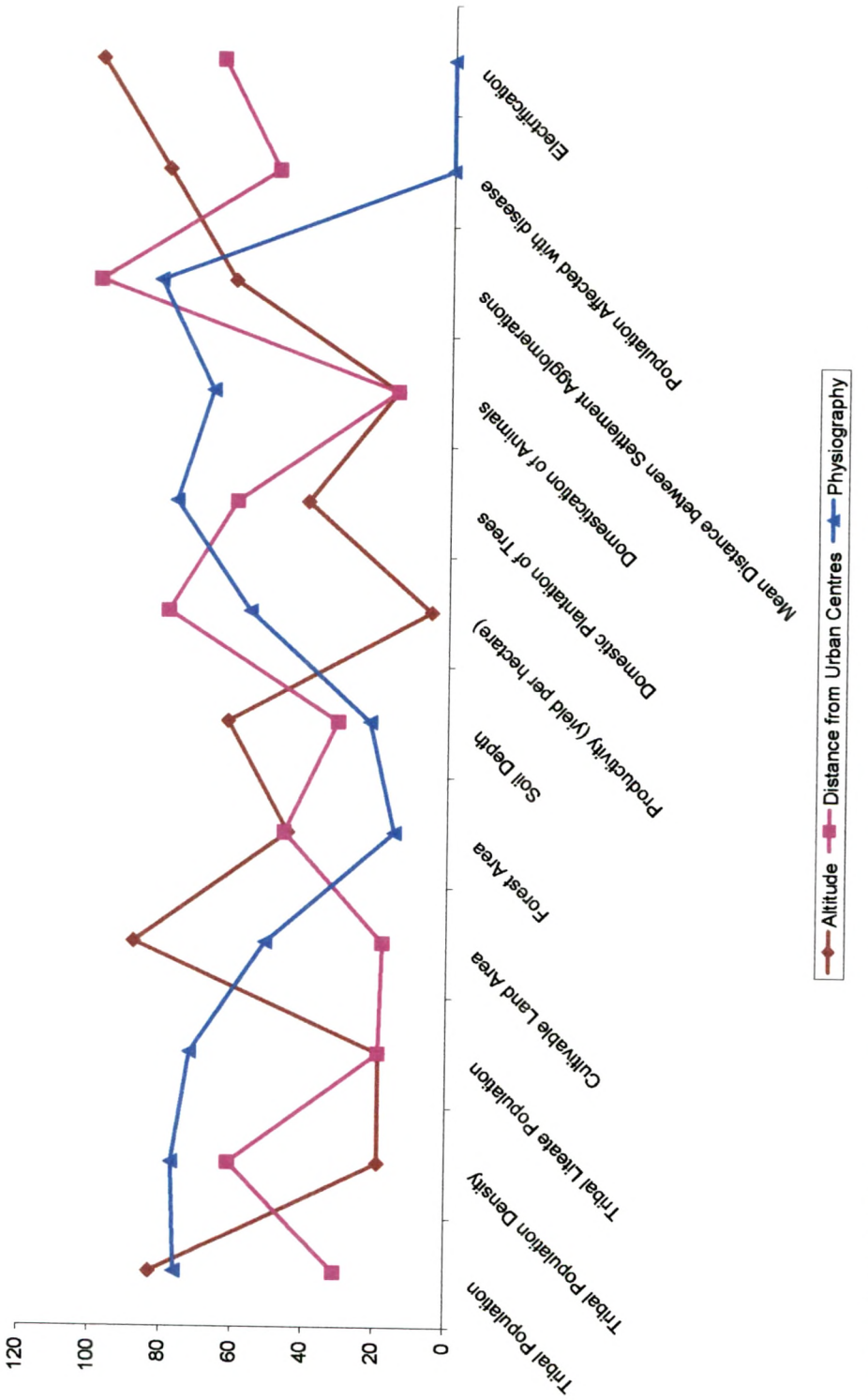

Figure 4.19: Probable Efficacy of Altitude, Distance from Urban Centres and Physiography on the Contemporary Distribution of Phenomena

CONCLUSION:

The temporal transformation of space or its environment does not only signify the efficacy of time but also dynamism, more specifically the trend and intensity of dynamism. Though the Figures 4.1 to 4.5 representing the processes of evolving environment over time explains the efficacy of time but to make the study more reliable and informative, the data derived from the secondary sources for three decades related to spatial variables like forest area, irrigated area, unirrigated area, culturable waste land, uncultivable area and population variables like total population, tribal–population, literate–population, main worker population and cultivator population are analysed and on the basis of mean decennial variations the probable frequencies (data) for the past decades and the following decades are projected. The real and probable projected frequencies are graphically represented to study the temporal variation in areal phenomena. Table 4.1 and Figure 4.6 represent the areal variation of physical phenomena.

The above table and graph explain that with the advancement of time the forest and irrigated area have increased whereas unirrigated, culturable wastes and uncultivable area have declined. The reverse is the condition when we look to the past towards late 19th century. While peeving towards the past one significant process emerges i.e. the merging of contemporary classified area. And this merger is signifying the presence of monotonous environment without any functional or characteristic categorization. The unanimity or monotony reflects the presence of large extent of uncultivable or waste land and little proportion of forest or cultivated land. But on the basis of historical and literary sources it could be concluded that the monotonous area of the latter part of 19th century (1891) was certainly either forest or idle unclassified land in the hilly tribal space.

The above ex–cathedra is further explicated and certified by the data relating population structure. The data projected on the basis of mean proportionate decennial variation exfoliates that about 1891 AD the population or inhabitants were countable i.e. the hilly terrain was neither inhabited by tribes nor non–tribes in large numbers. It could be easily identified from Table 4.2 and Figure 4.7 that few decades earlier to 1891 the space was sparsely populated. This is notable that if the population was considerable earlier to this than that must have been declined due to any epidemic caused by resource crisis or failure of the life supporting system i.e. deterioration of bio–diversity and other resources. The up thrust of sparse population erupts a question that what were the causes for the extinction of rich bio–diversity? This indicates the possibility of extensive interference and exploitation of forest by the

alien population consisting administrative bodies and commercial people with vestige interests.

Subsuming above, it is concluded that colonial regime not only exploited primitive socio–cultural laggards but also their biosphere multitudinally. In other words, technologically strong military powers broke the sustaining harmony between tribes and their environment by squeezing and leaving them in destitution for their political power and economic interests.

The persisting temporal efficacy of distance on tribal arable density, literate population, and main worker population distribution explains the efficacy on economic and socio-cultural development of the area at one hand and replicate their mutual dependence on the other hand.

The persisting temporal efficacy of altitude on tribal arable density and literate population explains the efficacy on economic and socio–cultural development and replicate their mutual dependence.

The temporal efficacy of irrigated area on literate population, male–female literate ratio, male–female worker ratio and cultivator population explicate the efficacy on socio – cultural and economic development and their mutual dependence.

The temporal efficacy of areal characteristic such as forest area, cultivable area, irrigated area, culturable waste land etc. on the male–female literate ratio explicate the impact on economy and socio–cultural development.

The temporal efficacy of culturable wastes on cultivator population explicates the impact of physiography on the economy of population.

The contemporary efficacy of –

Altitude on literate population, annual crime and house type explicate the efficacy on socio–cultural and economic development and mutual dependence between them.

Forest area on literate population, cultivable land per household and animal domestication explains the efficacy on socio–cultural and economic development on the one hand and mutual association between each on the other.

Soil depth on literate population, productivity, domestic vegetation, animal domestication and animal death rate explicate the efficacy on socio – cultural economic and infrastructural development and their mutual dependence.

Cultivable land on literate population, annual crime, domestic vegetation, animal domestication, electrification and house type explicate the efficacy on socio–cultural economic and infrastructural development and their mutual dependence.

The individual or composite temporal and contemporary efficacy of various independent geographical catalysts on the dependent phenomena explains either a direct or indirect but logical interlinkage between them and represents the system as a unified environmental system. And this directs the necessity of proper management of each phenomenon for sustainability of the system.

The distribution of mean temporal population, tribal density, literate population and cultivator population of forest and non–forest area vary whereas population density, main worker population and cultivable area do not vary. Variation in the distribution of demographic phenomena has inter–causasive association. The contrasting behaviour of variation in density of tribal population and no variation in density of aggregate population indicate that distribution of tribal population is the basic cause for the variation in the distribution of mean temporal population showing general distribution of population over span of three decades. Variation in the literate population could be because of either varying proportion of tribal population or difference in the implementation of programmes related to literacy development and reflexive behaviour of tribals. Variation in the population of cultivators inspite of no variation in main worker population and cultivable area could be because of variation in the favourability for cultivation and thence adoption of other functions. The adoption of other functions could be the cause for no variation in the main worker population of forest and non forest area.

The distribution of mean temporal population density, tribal population density, literate population, main worker population, cultivator population, forest area and cultivable area of riverine and non–riverine settlements vary. This might be because of concentration of settlements near water sources, especially along the ephemeral streams and around the troughs and other favourable conditions for their survival such as, satisfactory soil depth etc. Besides these, this might be due to dispersal of settlements caused due to land distribution policy, forest policies and other related legislations. Variation in the literate population could be due to lack of awakening and variation in the implementation of related plans.

The contemporary variation between the distribution of tribal density, tribal percentage, literate population, cultivable area, forest area, soil depth, productivity, diseased population, mean distance between settlement agglomerations and mean extent of settlements of forest and non–forest area and riverine and non–riverine settlements of forest and non–riverine settlements indicate persisting role of locational factors. It is notable that variation in the distribution of population is directly associated to the favourability of environment which decide the socio–economic

condition of the population. The variation in the literate population and diseased population could be because of variation in socio–economic condition caused due to locational favourability. Such variations could also be because of variation implementation of plans.

The variability in favourability of historical location factors such as forests and rivers are everoperative in space–time continuum in their mode of concentration of settlements and related phenomena. It is reiterated that distribution of population is directly regulated by the favourability of environment in specific locations. A system of favourable conditions acts as nuclei or stimulant to attract the population. These nuclei have been the cause for struggle between the groups and regimes in space–time continuum. Presently, the growing demographic, social, cultural economic and areal characteristic variations are solely because of the transforming behaviour of such locations. These locations characteristically being geographical are yet operative and play decisive role in the evolution of specific system.

According to Anova analyses based on derived mean temporal data–

4. Main worker and scheduled tribe population do not have identical distribution in the varying physiography. This implies that population distribution and their functions are controlled by physiography.
5. Literate, main worker and scheduled tribe population are not identically distributed in varying altitudinal ranges. This implies that population concentration and their development are visibly controlled by altitude.
6. Literate and main worker population is not identically distributed in varying ranges of distance from towns. This implies that cultural development is affected by distance from urban centres.

Anova analyses based on primary data explains–

3. Electrification is not identical in varying ranges of altitude. It shows that infrastructural development is not uniform.
4. Mean distance between settlements agglomerations varies with the varying ranges of distance from towns. This shows that the locations of settlements are determined by distance from the town and physiographic conditions.

The following graphs represent comparative probable efficacy of altitudinal ranges, distance ranges and physiography upon the common phenomena i.e. which are included in the Anova analyses from derived mean temporal data and primary

data. The graph explicates the probable efficacy of above mentioned locational factors in the distribution of different phenomena.

So, from the above, it must be inferred that spatial distribution of phenomena are not uniform or homogeneous on the one hand and efficacies a very on the other. It also indicates the dominating decisive role of physical geographical phenomena.

The geographical phenomena affect the nature of environment irrespective of time and degree of effectiveness i.e. the degree of effectiveness varies over time. It is so because variations in some phenomena have instant or immediate effects but many more show their impact in the long run. Similarly, the magnitude of effect do vary with the time, space and phenomena. For example, mining, tilling on hills and deforestation might have immediate economic effects but the impact on bio–geo–chemical cycle (life–supporting systems) would be a long–run effect of high magnitude. The efficacy of geographical catalysts on settlements, socio–cultural and economic structure of tribes, dictate a regulatory role of geographical phenomena in the evolution and transformation of environment including man.