INFERENTIAL SUMMARY AND CONCLUSIONS

Inferential Summary and Conclusions :

The present research endeavour was undertaken to generate the micro-level analytical data on the estuarine rural ecosystem as well as for developing the agro-ecosystem optimization strategy for the saline ecozone at Chokari. The Thesis incorporates the analytical and experimental findings. This unit is aiming at summarising the findings and deducing the conclusions from the entire thesis content. The sequence of the summary-points is based on the pattern of thesis structure. Summarization has been done unit-wise to maintain the continuity of the thesis-content presentation.

Inferential Summary and Conclusions :

1. The estuarine rural ecosystem with agricultural environment and saline edaphic zone at Chokari (Latitude 21° - 0' and 23° - 0' north and longitudes 73° - 0' and 74° - 1') forms a constituent part of Padra Taluka and Baroda District from hierarchical point of view. It is 48.5 km. away from Baroda urban ecosystem.

2. The ecosystem has pre-dominantly an agricultural environment due to lack of industrialization, urbanization or developmental projects. There is total absence of cottage industry or any other economic activity except the agriculture.

3. The entire ecosystem is naturally divided into the three zones viz. the raised non-saline zone, the ravinous zone and the saline zone including the saline coastal area.

4. The widening of the mouth of the Mahi river which flows from the north border of the ecosystem area begins here and constitutes the estuarine environment.

5. There is no forest system in this ecosystem area. The vegetational systems are supported on the waste lands and grazing lands.

6. There is no exploitation of the estuarine biota by any agency including the human population of this ecosystem area.

7. Analytical Qualitative Model (AQM) for the estuarine rural ecosystem has been generated (See epilogue).

8. Ecosystem Analytical Description Inventory (EADI) has been assembled. It is used as a tool for ecosystem analysis in the present study.

9. The ecosystem is in need of energy subsidies in terms of inputs as fertilizers and pesticides.

10. An attempt has been made to establish agro-climatological land use by recommending ecologically viable varieties for saline ecozone, thereby providing a strategy of agro-ecosystem optimization under the 'local' environment of the ecosystem.

11. The physical macro-environment of Gujarat region consists of 80-82 Kcal/Cm^2/yr influx of solar radiations and wind pressure of 1000 millibars in July - October period and 1008 millibars in January - April period. The temperature of July - October period being 25° - 29°C and January - April period 30° - 31°C constitutes hot and dry zone of the country. There is variation in rainfall values for the different zones.

12. No significant variation is found in the Baroda - Padra and Chokari physical micro-environmental aspects. The highest temperature is during April-May (39-41°C) and lowest temperature during December-January (20°-25°C). The humidity is more in December/January while gradually decreases and is lowest in April. The rainfall values fluctuate but the average is round 900-1000 mm during the season.

13. From the ecoclimatic considerations, the Gujarat region shows the major portion belonging to category of low precipitation ($<$2000 mm) and the index of water status less than 1000 mm. Chokari also belongs to this category. The ecoclimatic parameter suggests that Chokari ecosystem could support dry scrub and thorny deciduous forest or vegetation except in saline ecozones where halophytes or haloxerophytes abound.

14. A macroview of the litho-edaphology of Gujarat - clearly shows that the state has flat topography, alluvial plains, low hilly regions which belong to the deccan trap or Siwalik series. Soils are either shallow black, deep-medium black, old alluvial and coastal alluvial complexes.

15. Padra taluka shows medium black soils and coastal as well old alluvial patches with loamy area here and there.

16. The natural zonation, when analyzed and studied in detail, is found to show the three ecological zones (ecozones) of Chokari ecosystem area. The vegetational studies confirmed the ecozation of the ecosystem. Three ecozones established after a thorough cumulative data computation are (i) non-saline ecozone (ii) ravinous ecozone (iii) saline ecozone.

17. Non-saline ecozone shows black and loam soils. The zone is utilized for cultivation and habitation.

18. Saline ecozone is categorized on basis of findings in subecozones - (i) saline cultivable zone (ii) saline non-cultivable but vegetated zone (iii) saline non-cultivable and non-vegetated zone.

19. Saline zone shows three gradients of salinity i.e. 0.8%, 3.5% and 4.0% of soluble salt regions. The conductivity range of the three saline zones selected for the experimental work showed variations in conductance (millimhos/cm) (I - 1.8 to 3.5, II - 3.5 to 4.5, III - 4.5 to 5.0).

20. Patch to patch variations in the level of salinity are found in saline ecozone.

21. Seasonal variation is found in the electrical conductivity the lowest values being in rainy season while the highest values were obtained in Summer season when the 'salt crust' on the soils could be noticed.

22. The socio-cultural environment shows the symptoms of underdeveloped conditions and backwardness of human population of the ecosystem area.

23. It is found that there were five types of stresses for the backward nature of Chokari ecosystem. The five stresses are (i) economic stresses (ii) communication stresses (iii) physical and edaphic stresses (iv) agricultural operational stresses (v) interactional stresses.

24. The analysis of economic environment reveals that there were two agro production zones - 1. Managed production zone and 2. Natural production zone. The agricultural yield is poor in both zones due to the marginal farming in the first zone and due to the edaphic salinity in the second zone.

25. It is found that the entire population can be grouped into the category of marginal small area cultivators and agricultural labourers.

26. The vegetational systems are scattered and devoid of any forest species due to lack of either natural or plantation forest.

27. The analysis of vegetation shows the presence of 104 plant species belonging to 35 families according to the Bentham and Hooker's system of Classification.

28. The plant families Graminae, Compositae and Cyperaceae dominate the rest other families.

29. The maximum genera belong to the Compositae and Graminae.

30. Phenological analysis is done and a phenological calender is computed for all the 104 plant species for the purposes of utilization by grazing land management authorities as the vegetation is supported on such lands only.

31. The growth form analysis shows that herbs dominated the vegetational structure which is typical of an agricultural environment.

32. The growth period analysis shows that Annuals dominated the vegetational aspection and this is also typical of an agricultural environment.

33. Ecozonal categorization of vegetation reveals that non-saline ecozone supported semi-arid elements along with the xeric elements. Ravinous ecozone did not show much growth of vegetational patches except a few hardy species of Compositae.

34. The saline ecozone shows luxuriant growth of Suaeda stands both pure and mixed with saline grass Alueluropus. Some haloxeric plants of Xanthium and Eclipta were also recorded from this zone.

35. The quantitative estimation reveals that maximum numerical growth of plant species is on non-saline ecozone - the saline ecozone shows the lowest number.

36. The analysis of the eco-stresses on vegetation reveals that Chokari ecosystem vegetation experienced the three types of stresses viz. environmental stresses, grazing stresses and harvest stresses.

37. Land utilization analysis reveals that 53% i.e. 859.02 hectares of the land was waste land which included the uncultivable waste land, cultivable waste land and barren land. Cultivated area constituted only 35% of the total land area.

38. The total land area for grazing is only 10-11% in terms of total ecosystem land area but is 75% of the waste lands.

39. The Chokari ecosystem area is found to occupy only 2.57% of total taluka land and the agro-ecosystems formed only 1.1% of total taluka cultivation area.

40. It was found that land to man ratio is 0.21 hectare/person while that of Padra is 0.25 hectare/person. Both these ratios figures were found to be poor compared to the national ratio of 1.18 hectare/person which has now decreased to 1.09 hectare/person. The population density of Chokari is 395 persons/sq. km.

41. The computation of cultivated land to man ratio is found to indicate the backwardness of the ecosystem area. The cultivated land to man ratio for Chokari is 0.07 hectare/person - a figure which is found to be very low compared to the estimated national ratio of 0.15 and north a American (affluence) ratio of 1.7 hectare/person.

42. The poor values of habitation land to man ratio are of the order of 0.004 hectare/person.

43. The ratio of the grazing land to the owners of grazing animals is found to be 0.023 hectare/person - a figure which also indicated the poverty of grazing lands.

44. The agro-climatological land use is determined and it is found that Bajari and Banana were grown to the tune of 18% to 23% of the total area. Crops like wheat had been neglected for the reasons of economic stresses.

45. The agro-ecosystems o at Chokari shows the 'natural' or 'organic' type of farming system.

46. The irrigation is done only in the non-saline ecozone and only to the 117.5 hectares due to non-availability of irrigation tube wells.

47. Farming is monsoon-oriented and only three operations of agronomic value were done in non-saline ecozone i.e. sowing, weed-removal and harvesting.

48. The 'marginal' type of farming is predominant in the entire ecosystem area.

49. The average cultivable land possession per farmer is found to be only 0.405 hectare of land. The farmer belongs to the category of marginal farmer.

50. Fragmentation of land is found to be one of the reasons for the marginal land holdings.

51. Cropping and Harvesting Calenders were computed to know the overall seasonal phenology of the ecosystem area.

52. The agricultural yields are in this ecosystem area in both the saline and non-saline ecozone.

53. The saline ecozone agro-ecosystem are faced with the problems of fluctuating edaphic salinity due to the estuarine environment.

54. The farming of this saline ecozone was found to be of the 'Cooperative farming' type.

55. There was a mixed natural cropping with very rare mon-cropped plots. There was a diversity of the crops species in the mixed cropping pattern in saline ecozone.

56. The cooperative society members worked as agricultural labour and performed only two operations viz. the sowing and the harvesting.

57. There was found to be a low input of energy in terms of fertilizer and pesticides into the entire ecosystem area. The use of biotic energy sources was found to be intensive. The input of Urea or $(NH_4)_2SO_4$ was only 16 kg/hectare while that of organic manure was 8880 kg/hectare.

58. The pesticidal input into the agricultural environment was also quite low. It was found that only 8-10 kg/hectare of powder pesticide was used while 400 mg/hectare of the liquid ones were used.

59. The bovine structure from the comparisons of the two surveys showed an overall decreasing trend. The buffalow population decreased considerably after 1973 due to the dry conditions. The same trend was found for the cows and goats.

60. The milk production of Chokari ecosystem area is quite enough to meet the demands of the population but did not form a continuous source of income for the population.

61. Animal population yields the 'organic' source of energy in terms of 'organic' fertilizers and thus form a part of energy recycle chain.

62. The human component of the ecosystem occupies 29 hectares of the land in the twelve habitation 'spots' in the ecosystem area.

63. The ecosystem area supports population of 6210 people which is classified a socio-economically as well as culturally backward community by the taluka authorities - a fact which supported by the present analysis.

64. The analysis of educational environment and litteracy pattern revealed that Chokari is backward in this respect. The 'literate' Chokari person is educated upto sixth standard only while the 'illiterate' one has not seen the school. Such literate persons were found to be only 25% of the male component of the population. Females are all illiterate.

65. It was found that the children are encouraged to work as the labour to provide 'input' to supplement family resources.

66. The population consists of Baria Hindu families (barring only 5 muslim families) which has orthodox socio-religious beliefs and customs.

67. The analysis of revenue records yielded the data that the income of average Chokari family was in the range of Rs. 1200/- per year to Rs. 1900/- per year (barring one or two 'big' cultivators).

68. The feeding habit analysis of the human component at Chokari ecosystem area yielded the details that the population in general was belonging to the category of 'under' nourished or the 'mal' - nutrition - the latter showing the majority of the people.

69. It was found that the chief grains consumed are Bajari-Jowar-Paddy and rarely wheat. Milk products were in good use.

70. The dwelling structure analysis showed that 72% of the population occupied one storey 'pucca' house (i.e. backed brick laid with mud or clay) and 20% lived in the small katcha hutments (of straw and mud).

71. It was noticed that each 'settlement' or the 'house' left part of the space for 'cattle' keeping as well as the storage of the dry phytomass as a source of energy. This was noticed to reduce the 'living' space to a considerable extent.

72. The analysis of energy utilization by the human component showed that 'wood' was the main source of energy for fuel (cooking) purposes. Organic 'dung' was used by 12% of the total population. For the purposes of illumination kerosene was used (80.6% of the population). Electricity has reached the village but its utilization is doen only by 4% of the population due to backward economic conditions.

73. The computation of energy data showed that 8, 36, 360 kg. of wood and 230 litres of kerosene are used in the village - an index of clear cut underdeveloped condition of the ecosystem human population.

74. The analysis of human interaction showed that there is shortcoming of rural infra-structural facilities and the frequency of thee State Transport services is very low. This was seen to contribute to the backwardness of the human component.

75. The study of decomposer aspects revealed that the maximum number of actinomycetes were present in the upper or middle edaphic layer.

76. The colonial growth of fungi was found to be more compared to the slimy molds in non-saline ecozone.

77. During the evaluation of eco-behaviour, for agro-ecosystem optimization, it was found that the variety J-40 showed maximum percentage of germination in all the three salinity gradients and at all the depths of sowing. The variety Kalyansona and Sonalika performed parallel in this parameter.

78. It was also established that increase in the depth of sowing in saline edaphic zone decreases the percentage of the germination in all the varieties.

79. The germination performance of Sonalika and J-40 was affected as the salinity gradient increased.

80. The seedling mortality percentage was higher in the J-24 variety while the sonalika and Kalyansona showed a similar trend.

81. The variety J-40 showed the least mortality in all the three salinity gradients.

82. The root growth of all the varieties is adversely affected due to the salinity gradient in the soil. The increase in salinity level decreased the root growth performance. Although no significant difference amongst the varieties is noted at ten day growth period - the performance of J-40 and Sonalika roots was slightly better in higher salinity levels.

83. No significant variation in the Root-Shoot length and phytomass ratio was found in all the four varieties in the three salinity gradients.

84. The variety J-40 was found to show higher values for leaf area in all the three salinity gradients, while J-24 remained at the lower level.

85. The phytomass accumulation efficiency decreased as the salinity gradient increased in all the four varieties.

86. The variety J-40 showed better performance in even salinity gradient III showing its ability to tolerate higher salinity levels.

87. The net primary productivity was found to decrease with the increase in salinity of the edaphic substrates. The

variety J-24 showed poor values of net primary production compared to the other three varieties.

88. The variety J-40 showed an upward trend in net primary productivity during second growth phase. The values were higher compared to the first phase of growth. This made the variety perform better than the rest in higher salinity gradients (i.e. II and III).

89. No significant difference was found in the trend of root net production and shoot net production. The decreasing trend was observed in these two component compartments of production.

90. The moisture structure did not show any difference at ten and twenty day growth period in all the varieties and in all the three salinity gradients.

91. The varieties J-40 and Kalyansona were found to have slightly higher percentage of the moisture at thirty day growth period in the salinity gradient III.

92. The RGR was found to show the decreasing trend with the age in all the varieties and all the salinity gradients.

93. The variety J-40 was found to show slightly higher value for RGR in the salinity gradient III during the second growth phase.

94. The trends of NAR were found to follow these of the RGR in almost all the cases. The values of NAR for J-40 in the second growth phase in II and III salinity gradient were slightly higher - showing that the variety has increased tolerance compared to the other three varieties.

95. LAR followed the trend of RGR and NAR with the age.

96. The response of LAR to the salinity gradient did not show any consistent trend.

97. It is evident from the discussed evaluation of the eco-behaviour that the variety J-40 has good halophytic potential at the seedling phenophase in the estuarine saline edaphic complexes of Chokari ecosystem.

98. It may be concluded that the sowing of variety J-40 can yield in the better crop density at the later stage due to its tolerance of salinity at the seedling phenostage.

99. It is clear from the discussion of the ecological behaviour of varieties in the three salinity gradients that variety J-40 is suitable variety for all the three gradients of salinity.

100. It may be further concluded that all the varieties viz. J-40, Kalyansona, Sonalika except J-24 are suitable for salinity gradient I (low salinity).

101. The varieties Kalyansona and Sonalika can be used in the salinity gradient II but their performance in the gradient III is poor compared the variety J-40.

102. It is concluded that the four varieties can be arranged in their tolerance to the edaphic salinity of Chokari ecosystem at seedling phenostage as under :

J-24 < Sonalika < Kalyansona < J-40.

103. It is further pointed out that all these experimental result represents the field work research results hence have increased value of practical applicability for the optimization of agro-ecosystem of (wheat) saline ecozone at Chokari rural ecosystem.

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