PART III

THE SYNTHESIS
8.1 SUMMARY AND FINDINGS

Based on analysis and interpretation of existing facts and figures of floods in respect of their pattern and processes of occurrence, dimension of hazards and problems, and the floods' impact on human occupancy in the flood-affected Sadiya Region, the summary and findings of the work have been outlined as stated below:

While discussing the physical basis (chapter Two) of the Sadiya Region, it is observed that the region consists physiographically of flat level plain with increasing height and slopes towards the north and north-east. Considering the micro-physiographic elements, the region may be divided into the active floodplain, the young built-up plain, and the old built-up and piedmont plain. The drainage regime in the region plays a dominant role on the geomorphological dynamics to produce the effectively changing micro landforms in the region. The drainage and waterbodies constituting peculiar hydrological and fluvial form and process bases over the thick alluvial layers resting on a tectonically disturbed and structurally complex basement have actually been responsible for the geomorphic surface simple in appearance but complex in nature. The landforms are formed and modified by rivers being heavily fed and activated by rainwater due to tropical monsoon climate characterised by dry winter and rainy summers. Natural vegetation in and around the Sadiya Region are also influencing the landform. All these combinedly form the physical bases of the study region.

Chapter Three includes the studies on the population bases of the region. It is observed that the historical ebbs and tides in the process of peopling in the Sadiya Region had occurred due to the existence of physical operators like floods, sand deposition and river bank erosion and migration on the one hand and the ethnic and administrative compulsions on the other. The present pattern of population distribution and redistribution has been practically the
result of the influences rendered mainly by floods and erosion in addition to some minor ones. The population have, however, got increased in the days after the Independence of India. The catastrophic effects of the great earthquakes of 1897 and 1950 have been found till today to reflect on physical and human bases of the region. As a result, the economy of the region has been badly affected. The communication gap due to frequently changing of the channels of the gigantic braided rivers on the south and the west of the region grows more and more and, therefore, the region becomes detached from the mainland.

The floods in the Sadiya Region occur or get enhanced naturally. They move freely in most parts with hardly any obstruction. It is observed that the floods have been more frequent with high magnitudes and intensities after the great earthquake of 1950. In recent times two high peaked floods were also recorded— one in 1979 and the other occurring in 1988, (the flood of 1988 being bigger between the two). These floods affected almost the entire land and people of the region. The peak-flood of the Lohit is estimated at 32,000 cumecs by the application of unit hydrograph principle for storm analysis. This result is found mostly to conform with the result of the empirical method used by Dickens. The peak discharge empirically estimated by Dickens method for the comparatively small river Kundil is 2500 cumecs. This quantity creates quite a big flood with very high stage that may be judged from the rating curve of the river. But to know the magnitudes of various floods with varying recurrent intervals and probabilities of occurrences, flood frequency methods were applied on both the flood stage and discharge data collected at different gauging stations in the region. Then the best method is singled out from the wide range of results obtained from different methods. The results of the befitting best methods applied on the Lohit, Kundil and the Dibang indicate a more or less conformable depth of water stages above their danger levels at different gauging stations. The floods of 200-year recurrent interval with 0.5 per cent probability of occurrence at all the gauging stations of different rivers show water stages not exceeding a depth of 2.60 m above the danger levels.
in the region. The floods of the Dihang are slightly different due to its narrow valley at the Pasighat gauging station. All these discussions are included in the Chapter Four.

Chapter Five contains the discussion on the major causes of floods in the study region. The climate characterised by heavy rainfall stands as the major factor of flood genesis in the region. The monsoon rain brings heavy downpour on the surrounding hills of the Sadiya Region which ultimately produces high floods in the bowl-shaped plain of the region. The storm-coupled 'break monsoon' has been mainly responsible for high floods in the region. The evapotranspiration and ground water depletion cannot substantially reduce the volume of surface flow during high storm rainfall period. Therefore, the region is frequently visited by floods of both flash and spill types. The flood situation in the Sadiya Region gets aggravated because of most unstable fluviogeomorphological forms and processes. The rivers have been highly braided and got enlarged because of vast amount of deposition on beds, and other situations since the great earthquake of 1950. The rivers cannot, therefore, carry the floodwaters rapidly and efficiently. The rise of the river beds because of sedimentation has caused river banks erosion and channel shifting due to which new areas come under vulnerability to intense water flow and floods. The character and behaviour of the rivers in the whole of the Sadiya Region have thus metamorphosed especially after the great earthquake of 1950. The intensity and frequency of floods and fluvial geomorphology lay the ground for dividing the region into active, moderately affected and rare flood or flood free zones.

Chapter six deals with various impacts of floods on human occupancy in the region. The discussion in this chapter reveals that density of population is increasing on both the moderately flood-affected and rare flood zones. The migration of population from the active flood zone to the moderately flood-affected and rare flood zones has been common. The micro-regional distribution of settlement sizes, the relationship between the village population sizes and their locational distances from nearest flood prone rivers, etc. reflect the impact of floods on human occupancy in the Sadiya Region. The effects of river bank erosion and channel
shifting make displace a large number of people from river bank areas. The sand deposits by floods bring mixed effects to the people. The landuse pattern, occupational characteristics and development of infrastructure have been deeply influenced by the frequency and intensity of flood events. The extent of damage in any form is highly and positively correlated with the magnitude of floods and the areas of inundation. But the damage seems to decrease after 1989 as few flood alleviation measures were undertaken or upgraded due to the effect of the great flood of 1988. The overall human occupancy in the flood-affected parts of the Sadiya Region is observed to be unstable and influenced by the hazardous conditions of the floods.

People either in individuals or in group have also been invariably responding to flood hazards in the Sadiya Region. Chapter seven discusses about the people's mode of adjustments with floods through different indigenous means, abatement and control, etc. The people of the Sadiya Region adjust themselves with the emergent situations at the time of floods by executing emergency evacuation and adjustments based on personal experiences and indigenous techniques. Preventive measures such as introduction of flood-proof structure of the dwelling houses, raised plinths, or wooden or bamboo platforms of the houses help the people in protecting from and adjusting themselves with floods. The change of agricultural practices to suitable place and time devoid of flood menace are adopted in the region to gain against the floods. People try to check floods and associated problems through sort of river training, channelling some congested drainages, developing lands and planting trees, etc. Government works for construction of ring bunds, road cum embankments and anti-erosion and river diversion works together with the measures mentioned above constitute the efforts of abatement and control of floods and erosion in the region. A study on human perception to flood hazard reveals the existence of long-standing uncertainty (in the minds) of the people of their stable life against floods, erosion and channel shifting in the Sadiya Region. Most of them are certain about the occurrence of floods in future. They are not impressed by the assistance rendered or to be rendered by the government to
relieve them of floods. The flood victims of the active flood zone are helpless as they have not ability to take a decision. Still they are reluctant to move elsewhere. They are going on by adjusting themselves with floods at their best efforts. Even then also, they often suffer from loss of adjustment and damage. Life on moderately flood-affected and rare flood zones are less unstable as there is certain extent of prosperous socio-economic development within these parts of the Sadiya Region.

8.2 CONCLUSION AND RECOMMENDATIONS

While concluding on the piece of present research work on the floods and their impact on human occupance in the Sadiya Region, it is perceived after a pretty long discussion, that the problem is simple in appearance but very complex in nature. Floods in a certain area can modify developments and aspirations of the human society in the region. The problems of floods are not limited only to physical changes but also to psychology and socio-economy of the floodplain dwellers. The present project tries its best to outline the nature of such a situation with reference to floodplain dwellers of the Sadiya Region. An indepth study on this line is of utmost necessity to draw out the relationship of man and environment. The facts and phenomena of floods and their impact on human occupance are to be monitored for a very long time and survey works are to be done in details every year after the flood(s). This type of work may help the planners to work efficiently for flood and floodplain management. Effective functioning of management plans requires participation of the people at large. This in turn requires to investigate people's behaviour and perception to the floods and their associated problems.

The six objectives of the present study were laid down to fulfil as many as four hypotheses. The first hypothesis about the rushing down of heavy snowmelt and rain waters through the three major rivers, namely the Dihang, Dibang and Lohit rendering recurrent floods in the Sadiya Region has its reflection in various parts, especially in chapters two, four and five of the work. The second hypothesis enumerating the diastrophic change of the land and rivers in the Sadiya Region effecting frequent modification of geomorphological set-up gets reflected in chapters two, three, five, six and
seven. The third hypothesis about the shifting of channels and changing of their morphology due to bank erosion on the one hand, and adverse effect on the human occupancy therein on the other, establishes its validity and profoundness in the discussions devoted to chapters five, six and seven. The last hypothesis about the adjustment and fight with the flood, and reluctance of some of the floodplain dwellers to move elsewhere has been discussed in chapters six and seven. This hypothesis is also found to be valid. Thus all these hypotheses are found to be valid as interpretation, explanation and analysis go in favour of them in relevant pages of the work. Many suggestions may be put forward to think for mitigation of the manifold flood problems in the Sadiya Region. For practical necessity and academic interests, indepth studies in certain new avenues may, however, be conducted in the following lines:

(i) A well-organised and well-planned effort to investigate the flood problems of the Sadiya Region and to do something for permanent safety of the land and people of the region from uncertainty has been a urgent need.

(ii) An assessment for the best order and functioning of networks of rainfall, water levels, water and sediment discharges records should also be made without further delay.

(iii) Well-organised efforts are required to quantitatively identify and evaluate the behaviour of the braided channels of the Dibang, Dihang and the Lohit in details for the sake of effective planning and functioning of the river training, anti-erosion and channel diversion works. Also attempts should be made to check the channel shifting and protect the banks from further erosion. The patterns of water flow, and qualities and quantities of water and sediment discharges affecting different channels and river valleys are to be studied so as to understand and manage the disturbing rivers and areas.

(iv) The flood warning systems including constant monitoring on danger levels are required very urgently for the whole region. The existing danger levels are to be reassessed as because floods now occur much before the crossing of the danger levels at some gauging stations.
(v) An integrated study of landforms, drainage, climate and people should be made in order to meet needful demands of flood protection measures to alleviate or eradicate flood problems. Various measures of such nature have been a major demand along the three giant rivers, viz. Dihang, Dibang and Lohit.

(vi) Appropriate academic and practical steps as regards river training by shortening or straightening the meanders and draining away of the water-logging areas are to be taken urgently. All these steps need proper investigation, assessment and monitoring on the situations.

(vii) Studies also be done on the prospect of more minor irrigation works mainly to supply water in the drought-prone areas. There is ample prospect, it is observed in the field, for such a need.

(viii) The government should remain vigilant for emergent rescue and relief of the people from floods during the rainy seasons. Furthermore, victims must be financially helped and the loss should be compensated for by means like insurance of crops, properties, etc. For this an action group should be ready for assessment and monitoring of the situation. At the same time a cell for flood damage monitoring and estimating the value should be established in the line of the NCAER (National Council of Applied Economic Research).

(ix) Necessary steps and follow-up action should be made to train up the floodplain dwellers with the knowledge of eco-adjustment on the one hand, and to save themselves from flood and erosion disaster at the time of heavy downpour on the other. All these need a well-planned and well-organised study.

(x) A bridge over the Lohit will accelerate the growth of the Sadiya Region with its surroundings and, therefore, this may be constructed within very a short time. For this, studies should be conducted on geology, fluvial geomorphology and engineering hydrology.

(xi) The inland water transport system within and adjacent to the Sadiya Region is to be up-graded by increasing the number of boats and by stabilising the ferry ghats in addition to making other conveniences. This needs a proper assessment.
(xii) Dredging work along channels of some rivers is to be regularly done to clear out and train the channels where and when required. This can be done through a project.

(xiii) Degradation of forest both on the banks and valleys of the rivers is to be stopped and works on afforestations are to be encouraged in the region.

(xiv) A well-integrated master-plan for the management of the Brahmaputra river will ensure the stability and progress of life in the Sadiya Region in future. In this connection the Brahmaputra should complete such a project very soon.