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## Current Scenario of Research in Indian Geomorphology and its Future

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I am pleased and honoured to meet you here on a theme of exceptional relevance at 29th Indian Institute of Geomorphologists (IGI) Annual Conference on ‘Geomorphology and Natural Hazards’. I would like to express special thanks to the Organisers for the time and effort they have invested in organising this event. As a President, I warmly welcome all the participants who have come from all over the Country.

In this talk, I would like to comment on the ‘Current Scenario of Research in Geomorphology and its Future’. First, I will take up some matters of research practices and reflect upon the question of how it copes with undertaking research with implications for the future.

Geomorphology is an important branch of geography and is sub-field of the discipline in general and geomorphology in particular. In most of the universities of India, physical geography is being taught at undergraduate level and geomorphology at post graduation. Geomorphology has many fields like fluvial, environmental, regional, coastal, glacial, arid, karst and so on and so forth. These subjects are being taught at post graduation in many universities either as general paper or as specialisations. Research has been carried out on geomorphology and its allied fields

by geographers as well as geologists in both India and abroad.

In this connection, first of all, I want to highlight on some of the works undertaken at M.Phil and Ph.D level in different national universities.

In Punjab University research on geomorphology started in the decade of 1981-1990 where work on cycles and erosion were carried out. Joshi (1984) worked on ‘Geomorphology of the Ghaggar river in the Dun and Water Gap Locale’. The research topic of Kaur (1985) was ‘The Himalayan Main Boundary Fault Zone: A Geomorphologic Reconnaissance’. Mann, in the same year (1985) worked on ‘Geomorphic Landscape on Pinjaur, Nalagarh Dun’. A piedmont bench was the focus of study of Dulat (1986). In the same year, Sekhon worked on the ‘Geomorphology of the Markanda Terraces’. The thesis of Raina (1986) was on ‘Morphology of the Markanda Terraces’ while Bhel (1990) penned the ‘Water Gap Depositional System of the Ghaggar River’. In Punjab University, the focus of research is on various aspects of human geography while geomorphology as a sub branch of physical geography continues to contribute to <10% of the total research.

In the University of Delhi, one-third

of the research is in the field of physical geography, of which geomorphology has been a major component. 'Geomorphic Study of Sahibi River Basin' was undertaken by Kumar (1978). 'Drainage Basin of Khudia' by Basu (1979) and Kosi Basin by Ansari (1982). Singh (1989) worked on the Quantitative Geomorphology on the Third Order Drainage Basin of Kumaon Himalaya and Nilgiri Hills. Gautam (1989) worked on the 'Geomorphology of Laterites in Chota Nagpur Plateau'. The main streams of research which developed in Delhi University are regional and fluvial geomorphology.

Regional geomorphology and geo-hydrology have been the focus of research in Jawaharlal Nehru University, New Delhi. Gurjar (1975) studied about the 'Regional Structure of Longitudinal Valleys of Aravalli region'. Mohammad (1982) worked on Mewat river. Khan (1983) focused on 'Drainage Densities of the River Basins of Northern India'. In the same year (1983) Kumar worked on 'Fluvial Geomorphology of Dhauli Ganga'. Chand's (1986) research was related to the 'Geomorphology of Lahul (Central Himalayas)'. Ganjoo (1987) focused on the landslides. Research of Yadav (1981) was on 'Channel Morphology of the Upper Catchment of Narmada'. Srivastava (1988) undertook 'Morphometry under varying Lithological Condition of Basins of Indravati River'. In the same year, Meera worked on Narmada by applying remote sensing techniques and identified the structurally controlled landforms. In 1989, Sreekesh (1990) worked on the 'Hydrological Characteristics of Periyar Basin' and Mathur in 1990 studied about the slopes in the few selected topographies. Prasad (1992) did 'Morphometric Analysis of Kanchi River Basin, Ranchi Plateau'. Kumar in 1987 evaluated 'Geomorphological Evaluation of Environmental Degradation and Management in Dhavliganga Basin, Central

Himalayas'. Mathur in 1995 reviewed the 'Effect of Rockmass Strength on Hillslope Form and Development in Bundelkhand Physiographic Region'.

Human aspects of geography have been dominating in Aligarh Muslim University. Physical aspects contributed to < 18% of the research. 'Fluvial Morphology of Gangetic basin' was done by Role in 1989. Roh (1991) focused on 'Fluvial Morphology of Gangetic Delta'.

The Department of Geography of University of Allahabad is one of the pioneer departments of the Country where the research focus on geomorphology has been developed. 1/5 of the total work is related to this aspect of geography. Verma as early as in 1958 studied about the 'Geomorphology of Ranchi Plateau'. Srivastava (1977) focussed on the 'Drainage Basin Characteristics of the Bengal River'. Upadhaya (1981) undertook 'Morphometric Study of Small Drainage Basin of Southeast Chotanagpur Plateau'. Similar sort of study was undertaken by Ojha (1981) for small basins of Palamau Upland. Rangani (1985) work was on Rohtas Plateau, while in the same year Prasad focused on the 'Geomorphology of Chhindwara' and Pal on 'Upper Damodar'. Dube in 1986 studied the Environmental Geomorphology of Trans-Yamuna Region of Allahabad District. Agnihotri (1987) worked on the geomorphology of area adjoining Rewa. Bhat (1990) worked on surface hydrology of Jamthara drainage basin while Singh's (1991) focus was on morphogenesis of Rohtas Plateau. In 1992, Rastogi surveyed Belan-Son Inter stream region of Eastern Rewa Plateau. Dube in the same year worked on 'Seoti Basin'. In Allahabad University a new focus of research which developed is 'Urban Geomorphology' and this work has been carried out in the cities of Calcutta, Agra, Delhi etc.

Considerable amount (around 15%) of

the research in Banaras Hindu University is related to geographical studies which integrated both physical and human dimension. Singh in 1966 worked on the 'Changes in Courses of Rivers and Effects on Urban Settlements in the Middle Ganga Valley'. On similar lines, Asthana (1968) reviewed the Landforms and Settlements in Almora. Singh (1974) worked on Palamou upland of Chotanagpur Plateau. Gupta in 1977 studied landforms and settlements of Champawat. Jha in 1982 focused on Himalayan Ramganga Basin. Kodali (1987) worked was on geomorphology of Konar basin. A study of Bagnas-Tal-Rupa-Tal Watershed was undertaken in 1992 by Krishna.

Amongst the Indian Universities, the research on physical geography and its sub-discipline 'geomorphology' is very well developed in Calcutta University where it accounts for 40% of the total research in geography. In physical geography, regional geomorphology and fluvial geomorphology dominated the research area. As early as in 1956, Sen worked on lower Damodar basin. Nakata 1972 research was on piedmont topography of North Bengal. Basu in 1974 investigated River Dynamics of Bhagirathi Valley, West Bengal. Geomorphologies of Subarnarekha basin was studied by Mukhopadhyay in 1974 and River Terraces along Alaknanda Valley, Garhwal Himalayas was studied by Pal in the same year are worth mentioning. South Koel basin was the area of study by Desai (1981). Dutta (1982) studied Taraphini Basin of West Bengal. Chatterjee (1984) worked on the influence of Geomorphic Characteristics in Darjeeling District. Begum (1985) focused on Nature and Evolution of Landforms in a small area South of Giridih town while Panchdayi in the same year focused on Fluvial Geomorphology and Flood Characteristics of Subarnarekha Basin. Chaudhuri (1986)

analysed the Basin Characteristics of Garra River of Subarnarekha Basin and in the same year, Roy analysed the terrain of Kangsavati Basin. Pal 1988 worked on the Morphology of Coastal Track of West Bengal. In 1989, Agarwal worked on the North Koel Basin, West Bengal. Biswas (1990) carried out Landform Analysis in Rangit valley, West Bengal. Maiti in 1991 also studied the landform development of middle Mahanadi Basin, Orissa. The same sort of work was done by Maiti in the same year but on the Tarai area located in the eastern Himalayas in West Bengal. Evolution of Terrain Character of Upper Subarnarekha Basin was undertaken by Roy in 1992. Chakraborty in (1992) focused on the Geomorphology of the Sanjai Basin. Mukhopadhyay in 1993 focused on Fluvial Geomorphology of Tista basin.

The field of physical geography at large and geomorphology in particular is not developed in Osmania University, Hyderabad with < 5% of the research focusing on this stream of geography. G. Sounsravatti worked on 'Geomorphology of Chittor Basin, Tirunelveli District'. M.R. Saxena focused on the 'Geomorphic Study of Dindi Basin'.

The focus of research on geomorphology in University of Madras comprised of around 10% of the total work in the Department of Geography of this university. However, the direct work on geomorphology and its sub-branches is almost absent.

At University of Rajasthan, physical geography in general and geomorphology in particular is well developed. 1/5 of the research in this university is in this broad group. Regional geomorphology has been the foremost sub-discipline which is well developed in the university. Rao in 1976 worked on Geomorphology of Mej Basin, Rajasthan. D. Sinha (1992) focus was on Environmental Geomorphology of Bandi River Basin. In 1993 Gautam put forth

some Aspects of Geomorphology of Upper Banganga Basin, Rajasthan. In the following year (1994) Agarwal focused on Prabati Basin.

The focus on geomorphology was low in Jai Narayan Vyas University, Jodhpur. Amal Kar in 1997 worked on 'Morphology and Evolution of Aeolian Bed Formation in the Hot Desert'.

Human geography is the pivot around which the research themes revolved at Mohanlal Sukhadia University, Udaipur. The first research work on geomorphology or its allied areas was done in 1996.

At Dr. H.S. Gaur University, Sagar (now Central University) a few works are undertaken in this sub branch of geography. In 1970, R.K. Rai worked on Geomorphology of Sonar- Beawas Basin, M.P. In 1980, P. Soni, focused on Rewa plateau while two years later in 1982 L.P. Baghel studied lower Ken Basin. Later, in 1989 Goil focused on Maikal Plateau.

The number of researches on physical geography in University of Bombay, Mumbai is less than 1/5 but the focus on geomorphology is low. Damle's work was only one which focused upon the 'Environmental Geomorphology of Salcette, Goa'.

At University of Pune research pertaining to physical geography and geomorphology per se is very much developed. 33% of the research in the Department of Geography is focused on this branch. The early works of Kale in 1980 focused on Slope Morphology of Shiv Ganga Basin. Changtham (1985) focused on Laterites and the work was on Mahabaleswar Plateau. In the same year, Avhad studied the characteristics of Valley Side Slope on Katraj range. The focus of study of Vidya (1986) was on Panchganga Basin. Borse in 1987 worked on scarpland of Warandha Ghat area. Morphometric

analysis of Barana basin has been done by Salvi in 1987. Coastal landscape had been the focus of study by Telele (1988). In the same year, Ugle worked on Koyna basin. Galande in 1988 also did Morphometric Analysis of Padal Basin which is a typical Karst topography. In the same year, Patil studied the characteristics of valley forms. The following year (1989), Ghodke work was on channel bed. Awasthi in 1990 worked on Morphology of Revdanda Beach, Raigad district and in the same year Bidwe worked on weathering characteristics of Amboli Ghat area. Singh (1990) focused on fluvial geomorphology while in the same year, Belgali studied Dudh River Estuary, Palghar. In 1993, Saxsena focused on Channel Morphology of Kudki river. Pimpale (1995) used TDCN analysis in drainage development. In the 1995, Patil focus was on bad land along Tapi Channel. Keskar did the 'Geomorphic Study in Ban Ganga Estuary, Maharashtra' in 1996, while Gole (1997) focused on 'Koyna River'. Mohan (1997) worked on the Geomorphological, Sedimentological and Geochemical aspects of Mayem Lake located in Bicholim Taluk of Goa, India. The study focused on several aspects of the lake. Kodagali (1992) worked on the Geomorphology of the Central Indian Basin and the influence of topography on the distribution of Polymetallic Nodules. The major objective was to study the morphometry and geomorphology of the central Indian basin and to understand the relationship between the topography of the sea floor and the distribution of the polymetallic nodules. Prakash (2012) worked on the Sedimentological and Geotechnical studies of Coastal Sediments of Central Kerala. The major objectives of the study were mainly concerned with the establishing probable relationship between organic matter, textural, physical and geotechnical properties of the coastal sediments of Kerala;

to understand the depositional environment of coastal and marine sediments and to study the paleo-environmental condition of central Kerala coast.

Other than the above said works, some of the other studies can be cited in this regard which mostly concentrates on the north eastern states of India. Thesis of Thingo V. (1994) was on the Terrain Evaluation of Kohima District, Nagaland with special reference to geomorphology. Researchers like Mazumder (1984) worked on the Geomorphology of Tripura. The major objectives of the study was related to the geomorphic characteristics of the state in relation to the lithology and structural characteristics. It examined the evolution of the drainage system and the related features and regionalised the entire study area on the basis of physiographic facies.

These were some citations of M.Phil and Ph.D. which have been carried out in a few Indian Universities. Besides them, a number of research articles have been published by Indian Geomorphologists. A few of them are as follows- contribution of Indian geomorphologists in the regime of Fluvial Geomorphology has attained considerable attention both in-terms of conceptual and applied field of knowledge. One of the primary focuses of the fluvial geomorphologists is on geomorphic aspects of Himalayan and Peninsular rivers. Goswami (1985), Kale et al. (1997a) discussed about the seasonal characteristics of Indian rivers. These studies stated that irrespective of size and shape of the sediments, the characteristics of Indian rivers is mainly controlled by the seasonal pattern. Kale 1998 has also found significant differences in the fluvial systems in-terms of channel morphology, hydraulic geometry and flooding characteristics. Scholars like Singh 1996 and Shukla et al. 1999 focused on channel morphology and revealed in their study that in spite of a gentle slope with fine

sandy bed loads some of the world's largest river like Indus, Ganga and Brahmaputra show graded channel pattern. In the last few decades, number of attempts has been made by hydraulic engineers to establish probable relation between the channel morphology and various channel parameters. Various scholars like Agarwal (1984), Bhargav et al. (1985) too based their works on similar lines of thinking. Some of the studies conducted by Goswami (1985), Sarma and Basumallik (1984), Kale (1990) focused on the aspects like channel morphology, meander geomorphology and hydraulic dynamics while some focus was on the measurement of the rivers in terms of their width. Singh (1996), studied 221 Indian rivers and it was found that a majority of them had width ranging between 30-50 m while some large rivers had width ranging between 800-2300 m. Studies by Bajpai and Gokhale (1986) examined the probable existence of major drainage systems in between the present day Ganga-Yamuna by using satellite images. Abandoned channels, meander scars were also mapped along different rivers of Ganga plain. Number of studies focused on the channel avulsion which is an important process prevalent in Ganga plains. The above said process is well documented by Singh (1996) in the Ganga plain. Research conducted by Majumdar (1941) and Wadia (1975) primarily focussed on the impact of earthquake in influencing the characteristics of Himalayan rivers. The available records and the results obtained from the studies indicated that there is a significant impact on channel morphology and channel bed load and its association with the earthquake. Goswami (1999) reported, that 1950 Assam earthquake was responsible for the rise of water level (of about 3m) in Brahmaputra. Sarma and Basumallick (1984) in their studies depicted the immediate effects of such phenomena like neck cut off while

formation of lakes and waterfall in the rivers. Chindrang river in Assam was well documented by Wadia (1975). Works of Deodhar and Kale (1999) and Gupta et al. (1999) discussed about the incised alluvial channel of the peninsular rivers which are unlike the rivers of IGB plains where large magnitude of floods increase the width and width-depth ratio [Singh (1996)]. Apart from the channel morphology dynamics, several studies focus on the channel bars and riverine sand dunes. The work of Singh and Kumar (1974) focused on the mega ripples in the rivers like Ganga, Yamuna and Son and also attempted to focus upon process and sedimentary structures and Palaeo current pattern in the braid bars and point bars of river Ganga. Results showed that evidences of direction of bed-forms obliquely move into the channel in marginal parts rather movement of bed forms obliquely on the bed in the bar margins which was suggested in the earlier studies. Similar type of study was also done by Rajaguru et al. (1995) in an alluvial reach of Narmada river. Results of which showed similar type of pattern in the point bars of Narmada river as the study undertaken by Singh and Kumar (1974). The number of studies related to the fluvial forms and processes in the bed rock channel are fewer than the alluvial channels. Rajaguru et al. (1995) and Kale et al. (1994) made significant effort in estimating the hydraulic parameters of large floods in the bed rock reaches of Narmada and Tapi. The study of Kale and Shingade (1987) revealed that the pot holes existed in Indrayani river of the Deccan trap region and it was concluded that multiple channel pattern of bed rock is formed due to merging of grooves and pot holes in the joints of basaltic rock. Sediment load and its storage is also considered to be a subfield of fluvial geomorphology which is also young. Suspended load related study was done by Garde and Kothiyari (1986) and

they estimated the sediment deposition rate in reservoirs ranging from small, medium and large sizes. In this study, they have incorporated landuse, drainage density and rainfall. In the recent years, the sediment load in mountain region is studied by different scholars like Rawat et al. (1992), Rawat and Rawat (1994). The results showed that the regions associated with anthropogenic stress and tectonically disturbed lands many a times had higher sediment load than other regions. Rawat et al. (1992) depicted that considerably large part of the total load (61%) comprised of bed load while a small portion (31%) was related to the suspended load in the small mountainous streams. Flood morphology and impact of floods from the point of view of geomorphology was studied by different scholars. Ramaswamy (1987) focussed on the large floods in different rivers and it was found that a direct relationship existed between floods and intense cyclonic storms and depressions. Other than natural causes of flood, non-meteorological factors were also reported in a number of research papers by geomorphologists (Wadia 1975). In these studies, it was noted that the major factors affecting floods were landslides caused by heavy rains, earth quakes etc. In comparison to the Himalayan rivers, Peninsular rivers are more stable in terms of bankline and channel position in response to the flood and it is well documented by number of scholars like Rajaguru et al. (1995). Long time flood related studies were also done by number of scholars. Parthasarathy et al. (1991) studied the features of monsoon during 1901-1940 and it was found that the characteristics of the monsoon as 'zonal monsoon' while time period of 1871-1940 was found to be dominated by less stable 'meridional monsoon'. Goswami (1988) examined the sediment load and its relationship with the flood event in one of the large river of India, ie, Brahmaputra. In the paper, it was revealed

that, during flood that occurs once in at least two years, carry 95% of the annual load. On the other hand flood that occurs at an interval of 10 years carry about 3% of the annual load. In several studies, it was also found that even after flood events, in the rivers like Godavari for example the banks were largely unaffected (Majumdar 1970). In the case of river Narmada also Rajaguru et al. (1995) hardly observed any significant changes in bank line after August 1991 severe flood.

India has long coast line of about 5700 km with a number of landforms and processes that carved them. But at the same time, the studies regarding the coastal geomorphology is relatively less than the other subfields of geomorphology. In the recent past, some the researchers have seriously focused on the field and made some significant contributions. Chattopadhyaya (2002) focused on the geomorphology of the coastal plains of Kerala in terms of its emergence. Karlekar (2001) focused on the coastal configuration of Kolamb creek of Malvan, Maharashtra. In this study, he incorporated remote sensing techniques and analysed on the basis of Satellite images like IRS-1C, LISS-III PAN images. Dey (2002) studied the configuration of Digha coastline of West Bengal which is considered to be one of the erosion affected beach of West Bengal. In this work, he incorporated the landform development along the coast and risk assessment. In India, few studies are also conducted on the sea level changes. Studies undertaken by Mathur (2002) mainly concentrated on the chronology of Harappan port towns. Dwarka in Gujarat and one more site Hazira (Surat district) has come into light in this study. Kerlekar (2002) focused on the landslides and slopes failure on the Vengunla coast of Maharashtra where cases of Vevaliwadi and Khandapiwadi were taken into considerations on the basis of observations and evidences. Some of the recent studies

regarding the coastal geomorphology can be cited in this regard. Kumar et al. 2012 focus on the variations in the near shore currents in the coastal regions of Karnataka and tidal variations in the estuarine system of Sundarbans. Besides depositional features there are some studies that focused upon the rocky features like sea cliff and wave cut platforms. Mahapatra et al. 2014 focused on the shore line changes in the south Gujarat by using multi temporal satellite images.

Mehta et al. (2012), Negi et al. (2012), Raj et al. (2013) and Bajpai et al. (2015) discussed and focused upon the Karakoram Himalaya mountains by using remote sensing techniques along with ground observations where fluctuations in the snout positions, glacier feature and glacial lake were observed. In terms of glacial retreat the work of Kulkarni and Karyakarte (2014) is an important contribution. In this work, they have mapped 11000 km<sup>2</sup> area which is extended in all major climatic zones of Himalayas and it was noted that the Himalayan glaciers are retreating at a rate of few meters to 61 m/year. The study also showed that in the last 4-5 decades there is about 13% loss of glaciated areas. Bajpai et al. 2015 worked on glacial inventory for Tista river basin by using Remote Sensing and GIS techniques. A number of parameters like glaciers distribution, orientation, altitude, mean slope and aspects etc have been incorporated. In the paper the result depicted that the entire region is associated with number of glaciers ranging from very small (0.1328 km<sup>2</sup>) to large glaciers (1557 km<sup>2</sup>) area. Bahuguna et al. (2007) investigated Gangotri glacier from 1962. They have concluded that the contribution of high rate of retreat of small glaciers, climate change and glacial fragmentation are considerably influencing the sustainability of Himalayan glaciers. In terms of geomorphic evidences Mehta et al. (2012) worked on the post LGM glacial

advancement in Himalayas, a study focused on Chorabari glacier located in Garwal Himalaya. In this study, remote sensing data along with field geomorphology was substantiated with OSL dating. Bhattachaya et al. (2007) worked in the regime of outburst floods in the Sagarmatha region and incorporated hydrodynamic modelling. The study not only gave the primary information about the GLOF but also focused on the cost effectiveness of the preliminary information on the extent and impact of possible GLOF events.

In the recent years, there has been a significant progress in the field of geomorphology where major emphasis was on conventional indices like basin morphometry, gradient index as well as using structural characteristics by on field identification. Studies by Joshi et al. (2013), Dar et al. (2013), Sahu and Saha (2014), Alam et al. (2015) and Kale et al. (2014) worked on the similar lines of thought. Scholars like Maurya et al. (2008) discussed about the geomorphic evolution of coastal zones of Kachchh in late Quaternary period. At the same time, Patidar et al. (2007) focused on the fluvial geomorphology and neotectonic activity by using GPR data in Katrol hill range, Kachchh. The tectonic evolution of central Gujarat plain can be traced in the work of Maurya et al. (1995). Juyal et al. (2000) discussed on the environmental changes in the lower Mahi basin of western India in the late Pleistocene period. By using infrared stimulated luminescence they have concluded that there was evidence of two major fluvial aggradation phases. Goswami et al. (2013) worked on the foothill zones of eastern Himalayas. In this work, the inter-fluvial zone of Mal and Murti was taken into consideration and effect of neotectonic activities was analysed. Results depicted, the formation of downcutting of the rivers. The works of Devrani and Singh (2014)

in the Garhwal Himalaya is an important contribution in the tectonic geomorphology. The major objective of the study was to depict the significance of local factors and places in the process of sedimentation in the active belt of Garhwal Himalaya along Alakananda river and it was concluded that the importance of local forces is as important as to discuss about the valley fill deposits along the Himalayan valley in particular stretches. The work of Kothyari et al. (2012) is another study which focused upon the neotectonic activity in the Main Boundary Thrust (MBT) zone of Kumaon Himalaya. It was concluded that the region is neotectonically active and there are several indicators like structurally controlled drainage pattern. Malik et al. (2014) worked on the Kaladungi fault and evidence of forward and lateral propagation of fault and fault related fold was observed. Ranitoli fault fold of Kumaon Himalaya was studied by Joshi et al. (2016). In the research paper, reconstruction of the fault along with oblique slip was found by using number of geomorphic indicators. Kar et al. (2014) focused on the Matiali fan located in Darjeeling Himalaya. The authors incorporated geomorphic and sedimentological characteristics. It was concluded that there are two aggradational terraces in the river valley which are incised on the fan. In Arunachal Himalaya, the work of De Sarkat et al. (2014) can be cited. The study stated that a number of levels of terraces existed both in terms of paired and unpaired terraces along the river Kemeng.

There are several other fields of studies where geomorphic hazards and processes related to formation of soil and weathering are taken into considerations. In the recent years, the major focus of Indian scholar are on geomorphic hazards like flood and drought. Sharma et al. 2012 tried to correlate slope failure and heavy rainfall in Uttarakhand. Other scholars like Rao et al.



(2014), Rana et al. (2013), worked in the flood on the occurrences of Himalayan region from different point of view. Kale (2012) worked in the frequent flood issues in south Asia. Pandey et al. (2012) discussed about the drought condition in the Chotanagpur plateau by using geoinformatics. The results indicated that, the entire region is classified into number of indices and 8.9% area comes under the low vulnerable zone while 17.3% of the area is designated as 'very high' in terms of drought condition. Arjunan and Achyuthan (2015) worked on the weathering process in the eastern coastal region of India. The study revealed the fact that the weathering process is not only associated with the tropical weathering processes but also with saltwater spray and microbial activity.

In this discussion, a very minute portion of geomorphology as a discipline, has been projected and it can be inferred that there is a significant growth of the field in the last few decades from different perspectives that includes both logical and practical aspects of knowledge. I personally feel that there is a need to integrate geomorphology with sub disciplines of human and physical geography like urban geomorphology, bio, zoo and coastal geomorphology, orology, potamology and lithology and geomorphology, rural, urban and regional studies and geomorphology.

Another point which I personally strongly feel is that, use of modern techniques like GIS and Remote Sensing are still relatively restricted than the emphasis on field investigations whereas, this has been the strength of the subject. Hence, as a request I would end up saying that use these modern techniques but continue with the field investigations to the utmost.

In the end, I would say 'Landscape, which looks so constant, is on the move. Let us all explore and study it.' Thank you!

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NOTE: All the references which are not mentioned in the above list are of unpublished doctoral theses, and can be found in the online catalogues of the libraries of the respective Universities where they were submitted [besidesshodhganga.inflibnet.ac.in](http://besidesshodhganga.inflibnet.ac.in)