

EVOLUTION OF MODERN GEOGRAPHICAL THINKING AND DISCIPLINARY TRENDS IN INDIA

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Introduction

India, home of one of the world's earliest civilisations, has a long-standing intellectual tradition. The geographical studies in India began with the dawn of Indian Civilization in ancient times. Occupying a strategic location in Asia, Indian history is at crossroads of cultures from China to Europe. The contributions of Indian scholars in the ancient period are parallel to that of Chinese, Greeks and Romans¹. In this geographically diverse subcontinent of Eurasia, discoveries on nature and humanity from *Upnishads* and *Vedas* led the development of various indigenous knowledge systems. The vast galaxy of seer-scientists, philosopher-poets and sages left behind a wealth of history of thought. In fact several inventions and discoveries believed to have originated in the Western world have been studied centuries earlier by our ancestors. Looking back at the roots of Indian geography reveals very rich and strong Indian intellectual heritage, a legacy of over 2000 years old. However, the formal foundations of academic geography in India were laid in the colonial period as late as 1920s². Beginning in the 8th century, India was exposed to Islamic geographical concepts and ideas; and Muslim

geographers began to take place beside Hindu scholars in contributing to the maturing of geographical study in India. The arrival of the British and other European colonial powers in the 17th century forced an adjustment in Indian intellectual circles. Indian geography's progress in the modern times has been spectacular after Independence. After independence, geography acquired new functions in the context of national development, expansion of the educational system and strengthening of planning projects. The complete image of Indian geographical thought demands a thorough critical screening of the inherited wealth from the past and the contemporary practices which together have decisive influences on the future directions. But, the major thrust of discussion here is on the significant developments in Indian geography during the last hundred years (contemporary phase); the major leadership in the development of Indian geography; paradigmatic changes; and the challenges faced by Indian geography.

The Roots of Indian Geography

'Geography' in Hindi is called '*Bhugol*'; '*bhu*' meaning 'the Earth' and '*gol*' meaning 'round', i.e. 'the study of round earth'.

Indian astronomers propounded the theory that the earth is a sphere. The ancient Indian scholars were adepts in all fields known to humanity. Some of these scholars are listed below with their major field of study (Table 1)³. This interdisciplinary knowledge lies at the root of geographic development.

Acharya Kapil contributed to the science of cosmology. Acharya Bharadwaj is known for outstanding discoveries in aviation science. Baudhāyana was an Indian mathematician, noted for writing the earliest *Sulba Sutra*,⁴ the texts dealing with geometry and mathematical principles. Acharya Charak, crowned as the 'father of Medicine', produced *Charak Samhita* as his most renowned work, in which he has described the functions and medicinal properties of some hundred thousand plants.

Acharya Kanad, a genius in philosophy, was the pioneer expounder of realism, law of causation and the atomic theory. Acharya Sushrut, with his *Sushruta Samhita*, was another giant in the arena of medical science and his is an unparalleled work of the medical science of ancient India, popular as Ayurveda. Siddhārtha Gautama was a spiritual teacher who founded Buddhism. Panini is known for his Sanskrit grammar, and his *Ashtadhyayi* is the foundational text of the earliest known grammars of Sanskrit that stands at the beginning of the history of linguistics. Nagarjun was an extraordinary wizard of science whose research produced maiden discoveries and inventions in the faculties of chemistry and metallurgy.⁵

Table 1: The Earliest Known Indian Scholars

Name	Field
Acharya Kapil (3000 BC)	Cosmology
Acharya Bharadwaj (800 BC)	Aviation technology
Baudhāyana, (800 BC)	Mathematics
Acharya Charak (600 BC)	Medicine
Acharya Kanad (600 BC)	Physics (Atomic Theory)
Acharya Sushrut (600 BC)	Medicine (Surgery)
Gautama Buddha (563 to 483 BC)	Philosophy
Pānini (400BC)	Grammar
Nagarjuna (100 AD)	Chemistry
Āryabhata I (476–550 AD)	Mathematics & Astronomy
Varahamihir (499-587 AD)	Astrology & Astronomy
Brahmagupta (598-668)	Mathematics & Astronomy
Bhāskara I (600 - 680)	Mathematics & Astronomy
Adi Shankara (788 AD - 820 AD)	Philosophy
Aryabhata II (about 920)	Mathematics & Astronomy
Sridharacharya (AD 991)	Mathematics
Brahmadeva (1060- 1130)	Mathematics & Astronomy
Bhaskaracharya (1114-1183 AD)	Algebra

The Indian scientists, like Aryabhata-I, Varahmihira, Brahmagupta, Aryabhata-II, Sridhara and Bhaskaracharya, have shaped the course of mathematics and astronomy for the world to marvel upon. Aryabhata's Magnum Opus, *Āryabhatīyam* (498 B.C.), was the summary of Hindu mathematics up to the time. It was recognized as a masterpiece and through its translation European mathematicians got enriched by the facts that Aryabhata discovered 1,000 years before Copernicus and Galileo. Adi Shankara was an Indian philosopher who stressed the importance of Vedas, and his efforts helped Hinduism to regain strength and popularity.

Ancient Indian contribution to geography came through various fields of learning as Philosophy, Cosmology, Mathematics, Astrology & Astronomy, Physics, Chemistry & Metallurgy, Science & Technology, Medicine, and Linguistics. In fact, the Indian scholars contributed significantly in the growth and development of geography and its allied sciences. Although, the classical Indian scholars have richly contributed to the various fields of geographical study as physical geography, regional geography, climatology, mathematical and practical geography, their knowledge, particularly in astronomy (*Khagol-Shashtra*), was fascinating.

The philosophy in India developed from the common reservoir of Upanishadic ideas. This philosophic thought is classified into two broad categories viz. Orthodox (*astika*) and heterodox (*nastika*)⁶. Orthodox systems are those which accept the authority of Vedas, while

the heterodox systems are those which reject it.⁷ The ancient Indian scholars dealt with many problems pertaining to *Cosmology* (the science of Universe), *Cosmogony* (the origin of Universe) and *Cosmography* (the description of Universe). Today scientists rely on powerful telescopes and sophisticated computers to formulate cosmological theories. In former times, people got their information from traditional books of wisdom and the ancient schools of philosophy. Followers of India's ancient culture, for example, learned about the cosmos from scriptures like the *Srimad-Bhagavatam*, or *Bhagavata Purana* and the *Sankhya* School of Thought. The *Srimad-Bhagavatam* presents an earth-centered conception of the cosmos⁸.

In India, mathematics has its roots in nearly 4000 years old Vedic literature. Various treatises on mathematics were authored by Indian mathematicians in which were set forth a number of mathematical traditions for the first time. Important contributions were made by scholars like Aryabhata, Brahmagupta, and Bhaskara II. Their mathematical concepts were transmitted to the Middle East, China, and Europe and led to further developments that now form the foundations of many areas of mathematics. Vedic literature is replete with concepts of zero; Calculus; arithmetic; geometry (*rekha-ganita*); the techniques of algebra and algorithm, square root and cube root. The decimal number system in use today was first recorded in Indian mathematics⁹ In addition, trigonometry, having evolved in the Hellenistic world and having been introduced into ancient

India through the translation of Greek works, was further advanced in India¹⁰. It has been suggested that Indian contributions to mathematics have not been given due acknowledgement in modern history and that many discoveries and inventions by Indian mathematicians were known to their Western counterparts, copied by them, and presented as their own original work; and further, that this mass plagiarism has gone unrecognized due to Eurocentrism¹¹.

Astronomy is one area which has fascinated all mankind from the beginnings of history. In Indian language the science of Astronomy is called *Khagola-shastra*. The word *Khagola* is derived from the famous astronomical observatory at the University of Nalanda which was called *Khagola*. The Nalanda University was the center of education for scholars from all over Asia. Many Greek, Persian and Chinese students studied here. The lack of a telescope hindered further advancement of ancient Indian astronomy. Though it should be admitted that even with their crude instruments, the astronomers in ancient India were able to arrive at near perfect measurement of astronomical movements. The ancient scholars like Aryabhata-I, Bhaskaracharya, Brahmagupta and Varahamihira were associated with Indian astronomy. They developed their views regarding the planetary positions, planetary movements and planetary forces, and also made the related astronomical calculations. What Copernicus and Galileo propounded was suggested by Aryabhata nearly 1500 years ago.

From the Vedic times, Indians (Indo-Aryans) had classified the material world into four elements viz. Earth (*Prithvi*), fire (*Agni*), air (*Maya*) and water (*Apa*). To these four elements was added a fifth one viz. ether or *Akasha*. These five elements or *Pancha Mahabhootas* were identified with the various human senses of perception; earth with smell, air with feeling, fire with vision, water with taste and ether with sound. Since very ancient times Indians had perceived the material world as comprising these five elements and believed that these elements were physically palpable and hence comprised miniscule particles of matter. The last miniscule particle of matter which could not be subdivided further was termed *Parmanu* (the term being a combination of *Param*, meaning 'beyond' and *anu* meaning 'atom'). Thus the term *Parmanu* is suggestive of the possibility that, at least at an abstract level Indian philosophers in ancient times had conceived the possibility of splitting an atom which, as we know today, is the source of atomic energy. This Indian concept of the atom was developed independently and prior to the development of the idea in the Greco-Roman world. It was Acharya Kanada who first propounded that the *Parmanu* (atom) was an indestructible particle of matter. Indian ideas about atom and atomic physics could have been transmitted to the west during the contacts created between India and the west by the invasion of Alexander. Even after Alexander's departure, massive trade and diplomatic relations existed between Indians and Greeks (who had settled in Asia). This way, Indian

ideas travelled westwards where they were developed further. Thus, it remains a fact that Indian ideas about atom are the oldest. Parallel to the development of the concepts of atom and atomic permutations and combinations in physics there also was a similar development of ideas in the area of Chemistry & Metallurgy.

Geographical Inheritance

Although geography was not then developed as a formal discipline, early Indian scholars had a well developed geographical sense and clearly understood spatial relationships. The earliest mention of geography as a discipline is traced to *Bhagwat Purana*, the 8th century puranic text when *Bhugol*, or *Bhoogol*, a vernacular term for geography in most Indian languages, is derived from Sanskrit. A large amount of geographical information is contained in the Mahabharata and Ramayana: the two great epics still unsurpassed in the classical Indian literature.

The earth studies of ancient Indian scholars dealt with its origin, sphericity, eclipses, size and dimensions, latitudes, longitudes and local time, directions or cardinal points, earthquakes and volcanoes, atmosphere and seasons, and its physical divisions. As far as the origin of the earth is concerned, many of the facts as put forward by the ancient Indian scholars were more or less accurately known. They believed in the solidification of earth from gaseous matter. The earth's crust, according to them, is made of hard rocks (*sila*), clayey material (*bhumih*) and sandy material (*asma*). The Puranas mention the earth to be apparently

floating on the water like a sailing boat on the river. They were also aware of the fact that there is more land surface in the Northern Hemisphere. The concept of *Prithvi* (Earth) was the most basic in the study of geography. It has been profusely used in the Vedas and Puranas. The use of the term *Bhugol* for the discipline of Geography is the most appropriate and it clearly suggests that the ancient Indians endorsed the earth being a sphere, and not a flat disc as believed by some of their parallel civilizations. The facts related to the size and dimension of the earth were quite near to accuracy. It was well known to the ancient Indian scholars that the earth is an oblate spheroid slightly flattened at the poles. about 1000A.D. *Akshansh* and *Deshantar* are the terms used for 'latitudes' and 'longitudes' respectively in the ancient Indian literature. Puranas have a reference of three imaginary lines of latitudes passing through Equatorial belt, North Pole and South Pole. Accordingly, three major regions have been identified in the Literature, viz. Equatorial (*Nirakshadesha*), Northern Polar (*Meru*) and Southern Polar (*Bhadvanala*). The North Pole has been called as *Zenith* and the South Pole as *Nadir*. The South Pole was truly considered as the antipode of the North Pole, i.e. diametrically opposite to it. However, the world was not believed to exist beyond Equator, as the region here was compared to hell of the earth. The Eastern part, on the other hand, was believed to be 'the land of Gods'. This thinking is in consonance with that of the Europeans in the Early Medieval period, when the Dark Ages prevailed and the East in 'T-in-O' Maps was

assumed to be the place of *Adam* and *Eve*. The ancient Indian scholars have also drawn Prime Meridian. These imaginary lines, the position of Sun and various stars have helped them to determine local time at various places.

In Rigveda, there is formulated idea of four main directions, viz. *Purva* (East), *Paschim* (West), *Uttar* (North) and *Dakshin* (South). By adding Zenith (*Meru*) and Nadir (*Bhadvanala*) it was raised to six. But, afterwards, ten directions have been frequently mentioned in the Puranic literature. The designation of these directions in the Puranas is significant in the sense that it bears concept of the Gods dominating in each of these directions. The ten directions and the ruling deity of each is mentioned below (Table 2).

The knowledge regarding the earthquakes, atmosphere, weather, climate and seasons in this period is excellent.

For 'earthquakes' the term *bhukamp* has been used in Puranas. It was assumed that the deities of Air, Fire and Water cause the earthquakes. The ancient Indian scholars have identified the vacuum between the earth and the heaven as *Antariksha*. They were also aware of its vast extent and the occurrence of various weather phenomena here, as rain, winds, clouds, lightening, fog, and frost etc. Bhaskaracharya has conceived the thickness of this *Antariksha* around the earth to be 12 *yojans* (or 96 kms; one *yojan* being equal to about 8 kms.). As far as the knowledge about the seasons is concerned, it is based largely on the studies in India. Rigveda mentions five seasons. In Valmiki Ramayan, however, six seasons have been identified, viz. *Basant* (Spring), *Grishma* (Summer), *Prouri t/ Varsha* (Rainy), *Sharad* (Autumn), *Hemant* (Winter) and *Shishir* (severe Winter).

Table 2: Cardinal Points and the Ruling Daities as per Puranic Literature

Direction	Ruling Deity
<i>Purva</i> (East)	<i>Indra</i> (The God of Rain)
<i>Agneyay</i> (Southeast)	<i>Agni</i> (The God of Fire)
<i>Dakshina</i> (South)	<i>Yama</i> (The God of Death)
<i>Nairitya</i> (Southwest)	<i>Niriti</i> (The God of Disaster)
<i>Paschim</i> (West)	<i>Varuna</i> (The God of Water)
<i>Vayavya</i> (Northwest)	<i>Marut/Vayu</i> (The God of Air)
<i>Uttar</i> (North)	<i>Kubera</i> (The God of Wealth)
<i>Isana</i> (Northeast)	<i>Isa</i> (The God of Power)
<i>Urdhava</i> (Zenith*)	<i>Brahma</i> (The Creator of Universe)
<i>Adhoh</i> (Nadir^)	<i>Sesanaga</i> (The Universal Ocean)

*The point directly above the observer
^ The point directly below the observer

In the ancient period, the knowledge about various parts of the world was limited. It was due to the poor means of communication and transportation. Even then, the attempts were made to divide the world into several regions, on the basis of available information. Such descriptions exist in Puranas. Although incorrect, the term *Dwipa* has been used to designate various realms (continents) of the earth. Accordingly, the known world during the Puranic period was divided into seven *Dwipas* or 'regions'. These Puranic divisions exclude the American Continents, Greenland, England and Antarctica, since they were discovered only during the Age of Discovery in the late medieval period. The regions seem to have derived their names from the existing popular trees or grasses here. These seven regions were known as *Jambu Dwipa*, *Krauncha Dwipa*, *Kusha Dwipa*, *Plaksha Dwipa*, *Pushkara Dwipa*, *Shaka Dwipa* and *Shalmali Dwipa*. *Jambu dwipa* formed the centre of all these continents. In relation to the present day context, *Jambu* covered present Central Asia from North to South, including India, or the region north of Salt Sea. *Jambu*, in fact, is a bush found in Himalayan region. *Kusha* extended over present Middle East and most of Africa. The name is taken from a sacred grass, *Kusa*, used in brahmanical ceremonies. The present Eastern Asia and adjoining lands constituted *Pushkara*. The present Mediterranean region formed *Plaksha*. *Shalmali* represented the region of Eastern Africa and Madagascar Island. This region is rich in *Salmala*, the silk-cotton tree, found on the

margins of Equatorial regions of monsoon lands with moderate rainfall. Most of present Europe was *Krauncha*. Lastly, *Shaka* formed South-East Asia and adjoining Island groups. Hot and moist climate and thick evergreen forests characterize the region.

The geographical knowledge of ancient period about Indian Sub-Continent is related to its identification, people & culture and relief & drainage. In Vedic and Puranic literature, the entire country from Himalayas to Kanyakumari has been referred to as *Bharatvarsha*. This name has both geographical and historical significance. Bharata is construed by many historians as having been an Indo-Aryan king, and as king he unified the entire Indian subcontinent with the Dravidian peoples and other indigenous peoples as his subjects. According to the Mahabharata, Bharata's empire covered all of the Indian subcontinent, Afghanistan and Persia. The Republic of India is also known as Bharat after Bharata. Although, this Bharatvarsha, in ancient times was subdivided into several regions certain parts of the country are very distinctively mentioned in the ancient Indian literature. They are, e.g. *Sapta-Sindhu* (Punjab Plains), *Aryavarta* (the Aryan domain) and the region of Indus valley or the Upper Gangetic Plains. The Vedas, Epics and Puranas make mention of a series of mountains in Bharatvarsha. They are, for instance, Himalayas (*Himavat*), existing like a bow in its northern part and divided into *Antagiri* (Inner Himalayas) and *Bahyagiri* (Outer Himalayas); *Kailash Parbat*, the abode of *Apsaras* (nymphs) and *Devas* (Deities) and rich in diamonds,

minerals and other precious stones; *Vindhayans*, the extensive mountains with hundreds of peaks, variegated trees and creepers; *Mahendra Mali*, the Eastern Ghats; Sahyadri, the Western Ghats; *Rika*, the mountain range from Ken to Ton rivers north of Vindhayans; and *Suktiman*, the mountains of Khandera, Ajanta and Golkunda. The descriptions are also available for a number of Himalayan and other Inland rivers. Rigveda has mentioned various rivers originating from Himalayas, viz. Ganga, Yamuna, Brahamputra, Saraswati, Satudri (Sutlej), Asikni (Chenab), Vitasta (Jhelum), Arjikeya (upper part of Indus), Susoma (Savan), Sindhu (Indus), Kubha (Kabul), Gomati (Gomala), Krumu (Kurrum), etc. Among the inland river the important ones that get a mention are Narmada, Tapti (Tapi), Godavari, Krishna, Cauvery and Tungbhadra. However, the most elaborate descriptions exist about Ganga and Brahamputra. The religious flavour is very strong in these descriptions, as the rivers have been considered sacred, to be worshipped as Goddesses in Hindu mythology.

The Middle Ages

During the middle Ages the geographical area known to Indians extended into Southeast Asia. Hindu emigrants brought civilisation to Burma, Combodia, and Champa, and in the East Indies set up the powerful sea-states of Sri Vijaya and Majapahit. India marked the effective limits of mercantile enterprise from China in the east to Greek- Roman world in the west. During this period the Indians efficiently applied the knowledge of geography to trade, commerce and colonisation. India came into

contact with the Arabs in 712 AD when they came into Sind, but it was not until 1206 that Moslem rule started in Delhi and the geographic thought of the Arabs made an impact on the Indian society. In 1030 the Arab geographer Al-Biruni wrote the geography of India. The Arab geographical work was based on the development of the methods for making observations and using these for inventory of soil, products, and economic aspects of the area. From the 9th to the 15th century important new data were collected through direct observation by Arab and Indian geographers. After the 15th century geographical information and ideas began to emanate from Europe. These ideas were brought by the British colonialists to India. The Medieval period contributions to Indian geography came largely through the works of the Arab scholars like Al-Beruni, Ibn-Batuta and Abul Fazl. The contribution came through '*Kitab 'l Hind'* of Al-Biruni; *s Travels in India & China* during 1325-54, a travelogue of Ibn-Batuta; and '*Ain-i-Akbari*' the third volume of *Akbarnama*, of Abulfazl-i-Allavi.

The Colonial period

Geography, like all other social sciences, was historically and socially conditioned during the colonial period (i.e. until 1947). In the colonial milieu, geography developed to meet primarily the needs of the administrators in the process of expansion and consolidation of the colonial empire. One of the major goals of geographic research carried on in India under the protective umbrella of colonial authorities was to provide descriptive accounts

of the land, people and products of different parts of the Indian subcontinent to colonial administrators. Maps and gazetteers were produced to acquaint the colonial civil service with basic geographic information. Geography was introduced into Indian universities during the 1920s. During this decade a number of Indian geographers pioneered in establishing geography as an academic discipline and took the initiative to organise geographical societies to promote research and publication. India's great luminaries during this period were N. Subramanyam (Chennai), R.N. Dubey (Allahabad), K.S. Ahmad (Lahore), Tahir Rizvi (Aligarh) and S.C. Chatterjee (Patna). During this phase two leading geographical societies were established – the Indian Geographical Society at Madras (1926) and the Geographical Society of India at Calcutta (1932).

The arrival of the Europeans on Indian scene marked a novel and vigorous approach to the geography of this land. Europeans were strangers of this land and after the initial skirmishes with the regional rulers they were able to establish their foothold in India. As the prospects of territorial expansion appeared in sight, the most successful of the European powers, the British, struggled to know and learn more about India, its territory, regions, places, physical features and its resources on the one hand and its people, and their social and economic life, on the other. From the mid-19th century the British represented by the East India Company were on the prowl. To promote their knowledge of the territories and the resources they set up a number of Surveys like the Survey

of India followed by Geological, Zoological, Botanical, Linguistic, Archaeological and Anthropological Surveys. All these surveys worked to document meticulously the territories and the resources of the land. The survey work proceeded rapidly and by the end of the first quarter of the 19th century, the British had a fairly good notion of the Indian territories and by 1881, the first map of India, on a scale of “1 Inch to 32 Miles” was produced. The establishment of the Great Meridian Arc of India, passing from near Cape Comorin to Banog, near Mussorie, in 1881 and the completion of the survey of the entire sub-continent in due course was certainly a great achievement for the Survey of India, which simultaneously became a rich and reliable source of geographical information. Further, the gazetteers, the reports of the Geological, Archaeological as well as Anthropological survey of India, the Census data and reports, and statistical reports produced periodically and the climatic data from the Indian meteorological department of Government of India have been the reliable source of geographical information.

A comparative study of the concept, sources and methodology of geographical studies in the pre-colonial and colonial period shows that the aspect common to the points of view of both the periods is the centrality of space, place or region as a theme. The description of the earth has been the sheer anchor of both the periods. The Colonial geography had, to its advantage, far more authentic information of places and people-based as this information was and accurate

surveying, based on extensive fieldwork and reports. Secondly, the concept and content of geography also changed from one of mere accumulation of facts and their description, to one of systematic description and interpretation, a scheme in which the character of place and pattern of distribution of specific elements in the landscape demanded explanation. Initially in the colonial period, the emphasis in Indian geographical study was on the collection and presentation of information to illuminate the various regions of the country, and to a much lesser extent, the continuing geographical analysis of classical Indian literature. The regional cataloguing of information was later encouraged by British colonial administrators' perceived need for detailed information on areas within their responsibility. The magnificent collection of Indian district and other gazetteers was an outgrowth of such efforts. These reference books are as useful today as they were over a century ago when they first appeared. Nevertheless, these works remain primarily encyclopaedic in nature, with virtually no methodological or conceptual basis. Similarly, the Indian Census reports have made an excellent contribution to the advancement of Indian geographical knowledge and study.

Profile of Progress

Although the roots of Indian academic geography lie deep in antiquity, the discipline is now achieving maturity. Its development may be viewed as contained within a series of sequential phases¹², sketched as: (1) The Formative Stage: Pre-1950s; (2)The Informative

Stage: The 1950s; (3)The Confirmative Stage: The 1960s; and (4)The Reformative Stage: Since 1971. Following lies a brief review of the progressive transformations in the spirit and purpose of geography over the past century.

The Formative Stage: Pre-1950s

Modern geography was introduced as a British cultural import in Indian schools in the latter half of the 19th century. The outlines of a more professional and academic approach to the discipline date from the 1920s when it entered the portals of the Indian universities and was upgraded as a subject of study at the undergraduate level at Lahore in 1920, Aligarh in 1924 and at Patna in 1927. Beginning in the mid-1930s and extending up to the time of independence in 1947, Indian geography fell under the influence of three individuals trained in French universities – R.N. Dubey, M.H. Rahman and S.P. Chatterjee. These scholars gave Indian geography its first particular methodological orientation. Man-land relationships expressed through the possibilist philosophy of the great French geographers became a significant aspect of the 'newly-forming Indian geography'. German geographic philosophy and ideas correlating physical elements with cultural elements to form 'landscape', also were introduced, largely by N.R. Kar and K.R. Dikshit. Nevertheless, the outlines of Indian geographical orientations were most strongly influenced by the then current British geographical orientations. British geographical study was in a period of considerable ferment with historical, political

and economic directions, increasingly influencing basic geographical philosophy. Those most responsible for transmitting British geographical ideas to India in the early period, both regional and topical approaches, include M. Shafi, R.L. Singh, C.D. Deshpande, P. Dayal and George Kurian. Each of these individuals, together with S.P. Chatterjee, R.N. Dubey and M.H. Rahman became closely identified with the university geography departments which evolved as the leading centres for the growth and development of the discipline.

However, the pace of development was very slow so that when India ushered in the era of her independence in 1947, hardly four universities (Aligarh, Calcutta, Allahabad and Varanasi) could manage to start postgraduate teaching of geography and before the beginning of the 1950s only four more universities –Agra, Chandigarh, Madras and Patna- could join their ranks. The main reasons for its tardy progress lay in the failure to seek wide recognition as a university discipline, its strong orientation to ‘gazetteer-type geography’ which could at best play a second fiddle to disciplines like history, economics, commerce and geology, lack of qualified personnel and government/public apathy. Naturally it had to ‘fight way against vested interests and intolerance than any known in the West’. There is no wonder that the first generation of the Indian geographers was represented by those who were trained in other cognate disciplines but who opted for geography as their professional career and fought for its great cause. Among the professional geographers who made a mark during this

formative period in the history of Indian geography, the names of H.L. Chhibber, S.P. Chatterjee, R.N. Dubey, M.B. Pithawalla, G. Kuriyan, K.S. Ahmad, S.M. Ali, N.K. Bose and C.D. Deshpande may be mentioned particularly with great reverence. Although their wide-ranging research interests covered the various facets of geography, they were mostly characterised by the descriptive ideographic style having bearing towards the gazetteer trap, heterogeneity and unevenness. The role of four geographical - the Indian Geographical Society, Madras, 1926; the Geographical Society of India, Calcutta, 1932; the Bombay Geographical Association, Bombay, 1935; and the National Geographical Society of India, Varanasi, 1946 – founded during this period, in disseminating geographical knowledge and promoting geographical research also deserve special mention. The *Indian Geographical Journal* (Madras), the *Geographical Review of India* (Calcutta), the *Geographer* (Aligarh) and the *Bulletins of National Geographical Society of India* were the main geographic organs. Considering inadequate physical and personnel resources, research output both in quantity and quality was very much limited. The orientation of Indian geography to the British School was obsessive but that to the French School was also perceptible. Major contributions to Indian geography came from the workers in allied fields and organisations like the Geological Survey of India, the Indian Meteorological Department and the Survey of India.

The Informative Stage: The 1950s (The Immediate Post-Independence Period)

The Second Phase (1950-60), of course an advanced form of the preceding one, was a march towards using geography in national development. However, it followed again the prototypal framework to promote storing information, mostly on the path shown under the torchlight of the British, especially Stamp and Spate. The growth and development of the Indian geography during its informative stage started with a promising note particularly with the initiation of the planning era when the role of geographers was increasingly recognised by the National Government and the Planning Commission for carrying out regional surveys, preparing resource inventories and mapping. Several journals and serials also started in this period to serve the purpose. The most influential text book released in this period was O.H.K. Spate's *India and Pakistan* (1952). The sub-branching of geography in both streams, physical and human, took shape in the form of several publications. R.L. Singh's *Banaras: An Urban Geography* (1955) opened a new door to study city in India, which later served as a base model for further studies. With the initiatives and guidance of S.P. Chatterjee, the National Atlas & Thematic Organisation (NATMO) was established in 1956. The year 1956 with four major events – International geography Seminar (Aligarh), the foundation of the Indian Council of Geographers as a national forum and an associate body of the Indian Science Congress, the inauguration of the Indian Statistical Regional Survey (Geography Unit) and the

establishment of the National Atlas Organisation, provided a great impetus for the growth and development of geographical teaching and research which is well-reflected in the expansion of colleges and postgraduate teaching at universities, and the increasing number of geographical publications. The birth of two more geographical serials, viz. the national Geographical Journal of India in Varanasi and National Geographer in Allahabad was also a welcome.

On the eve of India's independence in 1947 only four universities- Aligarh, Calcutta, Allahabad and Banaras- offered postgraduate studies in geography. By 1950 four other universities – Agra, Punjab (Chandigarh), Madras and Patna began to offer postgraduate programmes. The next 30 years witnessed major expansion of geographic studies in India. Geographers who made major contributions to the development of the discipline during this period are S.P. Chatterjee, H.L. Chibber, M. Shafi, S.L. Kayastha, etc. Geographic studies during this period reflected an awareness of the relationship between geography and other social and physical sciences. Chatterjee approached the study of geography from the point of view of a natural scientist. His approach and methods were essentially of a physical scientist – field work, observation, mapping and the elucidation of the principals. Chatterjee believed that for anyone who hoped to write scholarly works in geography, direct observation in the field was essential, for only there could the scholar observe the patterns and associations out of which geographical problems emerged. Along

with Kurian, Chibber, Dubey, Ali and Rizvi, Chatterjee strongly influenced many of the people who were to effect the professionalisation of geography as a separate discipline in India. Their major contributions were in bringing geographic ideas and concepts acquired in Europe and finding many applications in India. George Kurian encouraged graduates to enter the teaching profession at all levels. He also made notable contribution to the development of the Indian Geographical Society, in particular its journal – the *Indian Geographical Journal*. H.L. Chibber fired people with enthusiasm for the discipline of geography. Although he always thought of himself as a student of land forms, he instilled into students the need for an understanding of human geography based soundly on the principals of physical geography and the experience in the field. Together with R.L. Singh, he had founded the National Geographical Society of India at Varanasi in 1946. With the establishment of this Society a number of scientific surveys and inventories were completed by geographers to meet the national goal of development.

After Independence, a consideration for national, regional, and even local development began to dominate the field. R.L. Singh's pioneering work on Banaras published in 1955 laid the foundation for the development of urban geography in India. Beginning in 1955, urban geography came to occupy a steadily more important segment of all geographic enquiries. The situation in India was not unlike that in Western and Western-oriented countries

generally. Urban geography, because of the increasing number of urban dwellers, the increasing concentration of power in large cities, and the continuing rapid growth of urban centres, began to be the popular field of geographic study after World War II. During the next two decades that followed the publication of R.L. Singh's book on urban geography, numerous studies of Indian towns and cities were completed at Banaras Hindu University under the guidance of R.L. Singh. Among other urban geographers K.Sita and V. Nath had major impact on the development of the subject of India. Another major thrust of Indian geography was an emphasis on local or district land use and population studies. The popularisation of such research stemmed from the importance of agriculture and the essentially rural nature of India. The inspiration now was drawn from the great British geographer and student of Asia, L. Dudley Stamp. Thus, the major preoccupations of the Indian geographers during the 1950s were the physical geography (geomorphology, hydrology, climatology, pedology and biogeography); economic geography (land use and agricultural geography, geography of trade and transport and industrial geography); human geography (urban geography and population geography); cartography; and regional planning for understanding the physical, economic and social milieus and for harnessing the resources for national planning and development. The set back to studies in historical geography is noteworthy whereas a little more awareness about geographical thought and methodology is

quite perceptible. Among the outstanding Indian geographic contributions of the 1950s, 3 deserve special mention, viz. (1) O.H.K. Spate's *India and Pakistan*, (2) the *National Atlas of India* by S.P. Chatterjee and (3) R.L. Singh's *Banaras: A Study of Urban Geography*.

As has been the case earlier, most studies by geographers still emphasised description much more than analysis. The early German and French influence was not long sustained and most Indian geographers, up to 1960s, received their advanced training in the United Kingdom. It may be admitted that the quality of teaching and research remained highly uneven with only a few strong geography departments at Aligarh, Allahabad, Banaras, Calcutta, Madras and Patna. But there was a perceptible re-orientation of the Indian geography in view of the end of the British colonial hegemony and new links with the Commonwealth countries – UK, Australia and Canada in particular, the USA, the USSR, France and West Germany; and a few methodological stirrings, subdued though they were, were causing feeble ripples in the placid waters of conservative traditionalism and consequently in started moving away by field studies and cartographic aids. After independence, since 1950s, 'quite a few early geographers trained abroad, introduced similar courses in Indian universities, many of them replicated their doctoral work through their Ph.D. students, and a patterned, often outdated, thoughtless research emerged. The result was mass production of doctoral dissertations on identical themes in slightly different regional or

local context".¹³ Obviously, it is a hard reality – "the geographical profession in India over the past half-century has failed to keep pace with the progress in theory and practice of geography internationally."¹⁴ However, that should be accepted as a source for reformation in geography.

The Confirmative Stage: The 1960s

In the history of Indian geography the 1960s may be termed as its confirmative stage. The epoch making event of the decade was the 21st International Geographical Congress held in New Delhi in 1968 under the presidentship of Prof. S.P. Chatterjee. It inspired the Indian geographic community which actively and vigorously engaged itself in research activity to conform to the international standards. As a result the number of research contributions rose. Also, during the 1960s the number of universities imparting postgraduate teaching and research in geography rose to 36 as compared to 24 in 1959. A few more geographical societies/associations came into being and started new journals of geography, e.g., *Transactions of the Indian Geographers* (Patna), *Deccan Geographer* in Secunderabad, *Geographical Outlook* (Ranchi), *Indian Journal of Geography* (Jodhpur), *Geographical Knowledge* (Kanpur), *Geographical Viewpoint* (Agra), and the two Hindi journals known as *Uttar Bharat Bhoogol Patrika* (Gorakhpur) and *Bhoodarshan* (Udaipur). Besides, the Government of India set up a National committee for Geography. The UGC appointed a Review Committee for Geography and helped

in organising several Summer/Autumn Schools/Symposia in geography.

In the 1960s, a dramatic shift occurred in the training of Indian geographers. Opportunities for Indian graduate students in the UK began to decrease as the British national economic difficulties mounted. Paradoxically university expansion at the same time in both Canada and USA offered the possibility of graduate study in North America. And the influence of American-oriented geography continued to grow. During the 1960s the major pre-occupations of the Indian geographers were Economic geography (agricultural geography and land use, industrial geography and geography of transport and trade); Human geography (urban geography, rural settlements, population geography and political geography); Physical geography (geomorphology, hydrology and climatology, pedology and biogeography); Regionalisation and regional planning; Cartography; Geographical thought and methodology; and Historical geography. Besides, Applied geography also made a debut. *Applied Geography* edited by R.L. Singh, for instance, is a landmark. Another rewarding exercise in Applied geography is Ashok Mitra's study of the levels of regional development in India¹⁵.

The Phase, 1960-70, marks the 'turning stage' towards the fashionable acceptance of quantitative and regional approaches with emphasis that information is the knowledge and its spatial pattern can provide the answer for any sort of explanation. Regional geography received the special attention – quite late in

comparison to the western counterparts. On the occasion of International Geographical Congress at New Delhi in 1968, first time held in Asia, under the editorship of R.L. Singh, the first regional work on India: "India: A Regional Geography"(1977) got released as the testimony to the devotion and integration of Indian geographers. To get geography established more widely, to make geography attractive for social sciences and humanities, and to make geography useful for others, the researchers took lead towards inter-disciplinary frame and the result was also impressive and appreciable.¹⁶ This tendency has continued in the successive decades.

The Reformative Stage: Since 1971(The maturing of Indian Geography)

Since 1970s the Indian geography has entered the reformative stage, i.e. the stage of maturity. It appears to be exposed to winds of methodological change which have swept across the international geography. Unfortunately, the Indian geography, having no basic philosophy of its own, has accepted even the naïve ideas and passing fads without any critical examination under the halo of foreign superiority. However, there is a redeeming future that it is now feeling its ground and seeking its identity by shaking off initial psychological and emotional constraints. During the last five decades several national and international events and several summer/Winter Institutes in geography have advanced the cause of geography in a big way and have provided many opportunities to Indian colleagues. Three

organisations, viz. National Geographic Society of India, Institute of Development Studies and National Book Trust in particular, have made major contributions to Indian geographic literature.

The Phase, 1980-90, seen as the 'stage of speculation', marks the arena of confidence among Indian geographers through proper selection of approaches, methodologies and terminologies, of course stemmed mostly from the British and American sources. It is noted that 'a brief and largely ineffective infatuation with techniques of Marxist methodology occurred in the 1970s and 1980s and remained concentrated largely around JNU in Delhi. By 1992 over 60 institutions of higher education offered courses in geography.¹⁷ For the most part, the leading departments of geography in India today are those of long standing. Among such institutions may be listed the departments at the University of Madras, University of Calcutta, Banaras Hindu University, Aligarh Muslim University, University of Delhi, JNU, Punjab University at Chandigarh, University of Bombay and Pune University.

Among the contemporary Indian geographers, A.B. Mukherji has set high standards of scholarship that has become legendary among students who studied with him and others who know him and his work. His contributions to the geographical literature are exceptionally wide ranging from geomorphology to cultural and historical. Moonis Raza has made significant contribution to the development of geographic education in India. The intellectual and academic roots of

geography at Delhi University were nurtured by R. Ramachandran in the 1970s. He provided the link between the early pioneering phases of geography at Delhi concerned mainly with traditional studies and the new context of regional, economic and social geography associated with the evolution of the discipline in the 1960s. In the contemporary Indian geography Rana P.B. Singh, Executive Editor (1985-1995) of the National Geographic Journal of India, is well known for his outstanding original works on social, cultural and pilgrimage geography of India.

The reformative stage began by a challenge for the first time in the history of Indian geography in 1991, when the voices were raised that Indian geography must reach its own identity and roots.¹⁸ The Phase 2000 onwards is the 'prospective stage in searching the roots' and may be accepted as a technology-mirage; of course this phase is in infancy.

Contemporary Trends & Fields of Study

In the post-independence period, geography has expanded rather fast in the university education system. This is because of the efforts of and under the leadership of the geographers like George Kurian, S.P. Chatterjee, C.D. Deshpande, V.L.S. Prakasha Rao, R.L. Singh, Mohammad Shafi, Muzaffar Ali, R.P. Misra and Manzoor Alam. These geographers have been academically active in the decades of 1950s to 1980s. As a consequence, geography got promoted as a popular discipline, particularly in the universities of Delhi, Chennai, Kolkata,

Varanasi, Aligarh, Chandigarh, Patna, Mysore, Hyderabad and Saugor. Three major institutions outside the subject but founded and led by geographers have boosted the reputation of geographers and geography in India. These are: (i) National Atlas & Thematic Mapping Organisation, (NATMO, 1957, Prof. S.P. Chatterjee); (ii) Centre for the Study of Regional Development, JNU (1970s, Prof. Moonis Raja); and (iii) The Institute of Development Studies, University of Mysore (R.P. Misra). Evidently, a number of subfields have proliferated in the discipline by now and presently the major preoccupations of the Indian geographers are Human Geography; Economic Geography; Physical Geography; Environmental Geography; Regional Geography, regional planning and development; Cartography & Thematic Mapping; and Historical geography & Geographical Thought. The studies, particularly in environmental geography, population, settlement systems, habitat ecology and applied geography have made a remarkable progress both quantitatively and qualitatively. Here follows an acknowledgement of various themes of focus in geographical perspective of the contemporary fields of learning.

Human Geography

The works in Human geography in India reflect in population, rural, urban, cultural, social, medical, and political geography. The focus of studies in Population Geography is on the temporal and spatial trends of population; analysis of population distribution and density

patterns; spatial dimensions of country's scheduled caste population and regional contrasts in its distribution, density and relative strength; indices of population concentration and temporal distribution; geographical analysis of migration patterns; population resource regionalisation; delineation of population regions;; analysis of spatial mobility; and examination of the validity of the demographic transition theory. A multi-dimensional and multi-disciplinary approach to the study of rural settlement geography in the country has led to explore the themes like the rural settlement system; rural environment; shape analysis, morphogenesis and spatio-temporal diffusion mechanism of rural settlements; social patterns and space articulation in the Indian villages; a genetic classification of settlements and their hierarchical order; analysis of inter-village spacing; the spatial pattern of dispersion, spacing and localisation of settlements; rural planning systems in terms of resources and infra-structural facilities; and the spatial organisation of central places / service centres in rural areas.

The Indian urban geography covers the works on the spatial analysis of urbanisation; the process of urbanisation; the level of urbanisation correlated with socio-economic variables and work force participation rate; the role of small towns in the urbanisation process; the phases of urbanisation in historical perspective; the trends of urbanisation; rural – urban continuum; the significance of suburbanisation in its spatial, demographic, functional and ecological dimensions, the rank-

size relationships; the demographic and spatial relationships among cities; the urban structure; analysis of metropolitan systems; urbanisation and planning as vehicles of modernisation and development; the impact of industrialisation on urban growth; analytic study of town-country relationship; market towns and their spatial development; role of small towns; use and misuse of urban land; economic base and commodity flows; the place of commercial structure in urban morphology; urban ecology; and functional classification of urban centres.¹⁹

A.B. Mukherji and Kashi Nath Singh laid the foundation for the study of cultural geography in India. Their work on the relationships between landscape, settlement patterns and cultural features covers a wide spectrum, from research on specific communities, through studies that concentrate on particular social institutions and processes. Some other works can also be identified on the subject covering the themes like study of cultural landscapes; dispersal and resettlement of refugees in independent India; study of cultural patterns and processes; geographical patterns of acceptance of family planning methods in India; an analytical account of accessibility and cultural stress in rural areas; the spatial association of pluralism and development levels in India; the evolution of clan territorial units through land occupancy; the mechanism of the diffusion of clan settlements; and the patterns of landscape, religion and folk art.

Social geography has claimed an increasing attention of the Indian geographers.

Their main themes are based, for instance, on the study of structural elements of Indian social organisation; spatial organisation of castes; religious composition of India's population and patterns of religious diversity; the social factors shaping the urban morphology; the socio-economic profile of the slums; a perceptive analysis of social patterns and social space in the Indian village; communal harmony and social space; spatial patterns of disease and hunger; the relationship between utilisation of health care facilities and the elements of rural social structure; the state of urban poor; and the impact of developmental programmes on the socio-economic conditions of the scheduled castes.

As far as the medical geography is concerned, Akhtar and Learmonth²⁰ have made substantive contributions to this branch in India. Besides, two other scholars also pioneer in this field and they are Rias Akhtar and A. Ramesh. Their work is closely associated with the scientific upsurge of medical geography. Their research on the ecology of disease in India reveals interesting relationships with environmental and behavioural factors. Other works in the field explore the themes as the impact of colonisation of malaria; the spatial incidence of malaria; the diffusion and ecology of cholera; the spatial patterns of cancer; the food production efficiency; the spatial patterns of nutrition and nutritional deficiency indices; the nutritional levels in village; the study of food intake and deficiency diseases in rural areas; the spatial perspective of health care planning in rural areas; the growth and

disparities in provisions of medical facilities; and the spatial patterns of health care facilities in India.

R.N.P. Sinha, R.D. Dikshit and Govind Saran Singh are best known for the development of political geography in India. R.D. Dikshit, particularly, has made a valuable contribution²¹ to this area by blending political theory and spatial analysis in the context of Indian nation-state. Besides, other studies have a focus on electoral geography; a perceptive analysis of voting behaviour in the assembly election; spatial structure of administrative units and the development process; boundary problems; inter-state tensions and boundary persistence; a geographical perspective on centre-state relations; the political-territorial changes in India since independence and their impact on development process; economic resource base and contemporary political patterns; and socio-political tensions in the north-eastern region.

Economic Geography

Implicit in the study of economic geography is the analysis of spatial organisation of economic activities which are directly or indirectly related to the physical or human resources of a country and its level of development. A comparison of the quality and variety of studies relating to economic geography of India reviewed in 'Progress of Geography' by S.P. Chatterjee²² with those brought out later reveals a sharp shift in emphasis. Though there are still descriptive accounts of the distribution of resources, industrial location, variations in land use

pattern, etc., recent studies have tended toward increased application of quantitative techniques in regional economic analysis. Such studies have been related to, for instance, (i) physical environment in relation to land use; (ii) resource base; (iii) population patterns; (iv) industries; (v) inter-regional Surveys, regional types, and disparities in level of economic development; (vi) regional relationship; and (vii) the economic geography of India in relation to regional and national planning. Important for the studies in economic geography have been the distributional aspects of population, regional differences in growth rates, rural-urban relationship, and population in relation to resource development, income and occupational patterns. Here, basic data, reports, maps and atlases prepared by Census Organisations from 1961 onwards provide a bench mark in the analysis of spatial patterns. It would not be overstatement to say that in the early decades of planned development in India the natural environment was given importance especially in the allocation of financial resources and inputs for agriculture in those areas where the physical environment provided near optimal conditions for the growth of crops. The traditional division of the country into mountains, plateaus, and plains and further regional division as envisaged by Stamp and later on improved by Spate provided a groundwork in the study of regional physical conditions. As far as the progress made in this direction, the basic work of mapping the landform features in detail and drawing generalised regional divisions of the country was undertaken in the National Atlas

Organisation under the dictatorship of Prof. S.P. Chatterjee.²³ However, as natural resources are very unevenly distributed, least so in relation to agriculture as a whole, studies relating to efficient use, and integrated development of mineral and power, agricultural and human resources, need top priority in studies of applied economic geography in India. The foregoing review of recent studies reveals some new trends in the development of different branches of economic geography, particularly, agricultural, industrial, resource, transport and marketing geography.

Agricultural Geography has been well received both quantitatively and qualitatively especially in the areas of study as – the trends and patterns of agricultural development; land use studies; agricultural origins and dispersals; the changing patterns of food grain production and sufficiency; the impact of Green Revolution; land use changes, arable potentials and land use development; land classification; ecological assessment of land capability; delineation of agricultural regions; spatial changes in agricultural wasteland; the patterns of agricultural colonisation of wasteland; food productivity; agricultural efficiency; agricultural planning; methods and techniques in delineation of agricultural typology; agricultural development; spatio-temporal analysis of cropping patterns and crop-associations; land use planning; agricultural change; and competitive demands for agricultural land use and non-agricultural land use. Jasbir Singh and N. Reddy are among the few Indian geographers to study agricultural geography.

Valuable contributions to the industrial geography of India have been made particularly in the fields of inter-regional industrial structure; industrial location; location of industrial agglomeration; location dynamics of Indian manufacturing industries; industrial landscape; impact of electrification on industrial development; patterns of industrial location and environmental pollution; the impact of industrialisation on rural habitat transformation; the structure of industrial employment; industrial planning; and spatial analysis of industries and industrial planning in India.

The research endeavours of Indian geographers in Resource Geography are focussed on resource inventories, their appraisal, conservation, management and development on macro and micro levels. It is well reflected in the works of R.P. Misra²⁴ and B.Thakur²⁵. NATMO has initiated a series of resource atlases – featuring forest, water, agricultural and tourist areas of India. Besides, others have taken up the issues related to population and environment; analysis of existing situation of world population growth in relation to land and food and their future prospects; scientific analysis of India's water and mineral resources; status report on forest cover; critical evaluation of sustainability of irrigation based agriculture; the maintenance and development of livestock resources; and the dominant-dependent relationship between the areas rich in resources and those which utilise them. The remote sensing and GIS have provided new techniques for scientific and

detailed appraisal of resources, their management and planning perspectives.

Transport geography has not received due attention. Still, H. Ramachandran has critically analysed complementarity of network efficiency and transport. Among others, there exist works on: correlation of road transport network structure with levels of urbanisation; analysis on patterns of transportation links; regional analysis of road accessibility; spatio-temporal analysis of road transportation; structure of transport in the city region; metropolitan transport planning and planning of rural transportation.

However, valuable contributions have been made on the study of both the rural and urban market structure and functions. Particularly, such studies belong to the spatial and structural analysis of rural transport network and its relation to society in an Indian environment; an analytic study of periodic and regulated market systems; spatial planning of rural markets; market centres and their spatial development; spatial organisation of market centres; typology of market centres; the role of market centres in regional development; place of commercial structure in urban morphology; the commodity structure of market towns; spatio-functional analysis of intra-urban markets; rural markets; locational comparability of trade centres; hierarchy and morphology of rural markets; and periodic markets and rural development.

Physical Geography

In physical geography, Geomorphology has received increasing attention from the Indian geographers who have widened their range by studies, for instance, in the evolution of landforms, fluvial geomorphology and applied geomorphology, polycyclic landscape and the surfaces of erosion, denudation chronology of the East and West Coasts of India, morphological classification of landforms, delineation of geomorphic sub-regions, morphometric evaluation of terrain and morphometric mapping in different terrain types, the landscape evolution, fluvial geomorphology and morphometry, analysis of alluvial fans, etc. The varied landforms of India attracted the attention of many early explorers and geologists and their accounts of different parts of the country were essentially descriptive. However, explanation of the origin of landforms on a scientific basis can be said to have begun in the country since the beginning of this century.²⁶ The Indian sub-continent is usually divided into (1) the Peninsula, made up mostly of Precambrian formations, Gondwanas, Deccan Traps, and Tertiary and Quaternary sediments in parts of its long coast; (2) the Extra-Peninsula, made up of rocks of ages ranging from Pre-Cambrian to Quaternary in different sections of the lofty Himalayan Mountains; and (3) the Indo-Gangetic-Brahmaputra Plains in between the first two. The Indian geomorphologists' initial discussion of Davis' ideas helped to set the tone of landform research in India. In their contributions, they have concerned themselves with physical processes and insisted on the

necessity of seeking to identify the causes and search for the cause and effect sequences. There has been a gradual change in the geomorphic methods of study and concepts. From mere description of landforms, then mapping, the stage has come to study the processes, quantify them and attempts are now being made to explain the landscape as parts of the same stochastic process, and their individual differences as related to variations of the energy intensity and mass distribution. A.B. Mukherji is a pioneer scholar in the study of landforms. K.R. Dikshit and Savindra Singh have fully incorporated the post-1950 developments in landform studies with their swing to quantitative measurements and the application of statistical techniques. Savindra Singh and R.C. Tiwari²⁷ have opened up new vistas of environmental geomorphology (Geomorphology and Environment).

Climatology has relatively lagged behind in research pursuits. However, the available studies in this field are related to the themes as the climatic conditions and water balance; agro-climatic studies in the development of Indian agriculture; areal extent of drought/flood during the south-west monsoon season; study of seasonality and regionalisation in the agriculture; the patterns of radiation and evaporation distribution; variations in the moisture regime of Indian arid zone; a perceptive analysis of temporal patterns of climatic fluctuations; and forecasting of monsoon performance over India.

Environmental Geography, Ecology & Ecosystem Research

Geography, like ecology, is concerned with the distribution, organisation and morphology of phenomena on the surface of the earth and has developed similar concepts and techniques to tackle similar problems. The development of ecology as a formal branch of study has led to the use of term 'human ecology' as a scientific substitute for human geography. With Lindeman²⁸ defining the ecosystem as 'any system composed of physical-chemical-biological processes within a space-time unit of any magnitude', a definition which clearly includes the operational range of geography, geographers began increasingly to use the ecosystem concept of their research. The ecosystem research in Indian geography is related to: (i) agro ecosystem; (ii) river ecosystem; (iii) socio-technical systems; (iv) settlements; and (v) human populations. First glimpses of ecosystem research in Indian geography undoubtedly appeared in agricultural and land use studies. Environmental geography, with a focus on ecology and ecosystem research, has vigorously emerged as the new research area since 1970s, and the Indian geographers have been addressing the issues of environment and development; environmental pollution; environmental degradation and hazards; environmental conservation, management and planning on different spatial scales; perceptive analysis of environment, development and quality of life; environmental problems and policies; environmental priorities and sustainable development; visualising regional

development as eco-development; ecology of urban environment and environmental planning; morpho-ecological management; analysis of the contribution of science and technology for development of resources and human well-being; mapping of sustainable development; and the environmental impact assessment.

Regional Geography, Regional Planning and Development

R.P. Misra, V.L.S. Prakasa Rao, L.S. Bhatt and K.V. Sundaram have made important contributions to the field. R.L. Singh's 'India: A Regional Geography' is the *magnum opus* of the Indian regional geography. Although, there remains a dearth of meso and micro regional studies in India, there has been witnessed a growing emphasis the studies on regional development and planning. Two valuable volumes have been edited by R.P. Misra,²⁹ and the strategy for regional and national planning worked out in these compendia deserves serious consideration. On the methodological plane the linkage of central place theory with that of growth pole is meaningful. L.S. Bhatt³⁰ has recognised three levels of planning in the national context, viz. the nation/macro-level, the regional/ meso-level, and the local/ micro-level. The other works in this direction have dilated upon the economic development and rates of economic growth; need for balanced regional development; problems pertaining to regional imbalances; identification of underdeveloped districts; provision of analytical framework and indicators of regional development; delineation of planning areas; and eco-development.

Cartography and Thematic Mapping

Over the years the field of cartography and thematic mapping has made great strides in the country. The main players are certainly the Survey of India, the NATMO and the Indian National Cartographic Association. *Indian Cartographer. Planning Atlas of Andhra Pradesh* (1976, S.M. Alam); *Resource Atlas of Tamil Nadu* (1983, A. Ramesh); *Planning Atlas of Uttar Pradesh* (1987, L.R. Singh); and *Census Atlas of India* (1981, B.K. Roy) are the hallmarks of geographic contributions to cartography by Indian geographers. However, the modern cartography in India exhibits the signs of integration of remote sensing and GIS as a support to mapping, decision making, planning and monitoring. There is evidence to show that in ancient Puranic literature (500 B.C.–A.D. 700), the concept of map scale and the consequent need for generalisation of geographical features on maps were fully realised. Ancient and medieval Indian works on town planning, architecture, military science, engineering and political economy indicate that the art of surveying and mensuration was fairly well developed as an aid to define the territorial limits of towns and villages, for laying out plans of civil works, and for carrying out military campaigns. The art of surveying as recorded in the manuals known as the *Sulbasutras* (science of mensuration) was fairly developed.³¹ But, Cartographic productions in the real sense of the term began with the map of India brought out by the Greek geographer, Eratosthenes (3rd century B.C.), who for the first time prepared a map portraying India. Later, Ptolemy (2nd century

A.D.) depicted India on a map of the habitable world as it was known at that time. Ptolemy's map which was repeatedly reproduced later served as the only source of cartographic information on the country up to the end of the 15th century A.D. From 16th century onwards, the Flemish, Italian, Portuguese and Dutch cartographers (as Bertoli, Gastaldi, Gerard Mercator, etc.) made considerable improvements in the art of making maps of the Indian sub-continent. Seventeenth century onwards, English cartographers started contributing to mapping efforts in India. The second half of the 18th century was marked by considerable improvement in production of good maps of India by European cartographers. Late 18th century onwards, a number of military cartographers and revenue surveyors contributed vastly to the initial development of Indian cartography, James Rennel, the first Surveyor General of Bengal (1767-1777), being the foremost of all of them. Rennel's maps and atlases were the only reliable cartographic source till well beyond the middle of the 19th century when the regular sheets of the Survey of India based on more modern instrumental observations started coming out. By the end of the 19th century, as a result of one hundred years of continued triangulation work, precision levelling and plane table surveys covering a very large part of the country, sufficient cartographic information was now available enabling the Survey of India to produce modern contour maps on uniform scales having standard sheet lines and with correct values of latitudes and longitudes. Thus, in the course of continued

survey and mapping effort for another four decades or so, India turned out to be one of the best mapped countries of the world on the eve of Independence in 1947. India is now covered by some 5000 topographical sheets at different scales, one inch to a mile or its metric equivalent (1:50,000) and smaller scales. Besides, over the years the Land Record and Revenue Survey Departments of different states have brought out some 3000 and odd standard maps of administrative divisions based on rigorous cadastral surveys.

Thematic cartography in this country got a spurt since Independence in 1947, especially after setting up in 1956 of the National Atlas and Thematic Mapping Organisation (NATMO). Thematic maps are now playing important roles in development planning in India and are being increasingly utilised by administrators, planners, technologists and specialists in different branches of social, physical, biological and earth sciences. While NATMO has been specifically set up for the preparation of general thematic maps, several other agencies also prepare special purpose and scientific maps in India. These include such organisations as the Survey of India, the Map Office of the Registrar General, National Remote Sensing Agency, Central Arid Zone Research Institute, Indian Meteorological Department, Geological Survey of India, Naval Hydrographic Office, Town and Country Planning Organisation and Departments of geography in different Indian Universities. The census data, especially relating to the period from 1951 onwards, have

proved to be of great asset to the Indian thematic cartographers for mapping the economic, social and demographic characteristics of the country. Further, as a consequence of introduction of quantitative methods, computer processing of data, automatic mapping and remote sensing techniques, rapid transformation is taking place in the field of cartography.

Historical Geography & Geographical Thought

The most significant contribution to historical geography is certainly Schwarzberg's *Atlas of South Asia*³² which portrays evaluation of Indian culture, society, economy and polity from the Stone Age to modern period. Other such research works have delved into the study of early man and his culture in Palaeolithic India; perceptive analysis of the ecological background of the Chalcolithic culture in India; India's colonial dependent economy and regional inequalities; analysis of the origins of place names and settlements; reconstruction of Bharatvarsha and its physiography; and the evolution of administrative areas. As far as the Geographical Thought in the country is concerned, the related contributions have been outlined in ICSSR's *A Survey of Research in Geography*. S.P. Chatterjee's *A Decade of Science in India: Progress of Geography (1963-1972)*, *Recent Trends in Indian Geography* by L.S. Bhatt³³ and P.P. Karan's work³⁴ supplement the efforts in this direction.

Paradigmatic Shifts

From the very beginning, modern geography as a field of scientific learning has occupied an anomalous status between natural and physical sciences- focussed on particular types of natural processes or circle of facts on the one hand, and the social sciences – focussed on particular types of societal functions and phenomena on the other.³⁵ Thus, as a discipline focused on the study of man's relationships with nature in particular segments of the earth surface, geography represented a cross-breed discipline that belonged neither to one nor to other. The result was that geography remained completely isolated from the mainstream intellectual discourse both in natural and social sciences, since the intellectual climate of the 18th and 19th century Europe was dominated by a fragmented perspective on a natural vis-à-vis social reality. The German philosopher Immanuel Kant (1724-1804) had fully appreciated this epistemological difficulty regarding the status of geography in the classification of the fields of knowledge – so that he presented a two-fold grouping of the ways of acquiring knowledge – one logical and the other physical. The former grouped the individual items into separate classes on the basis of morphological similarities in the processes of their origins. Such a scheme of classification ignored consideration of place and time of occurrence of the concerned phenomena or processes. This aspect was taken care of in Kant's Physical classification, which grouped phenomena that belonged to the same place and / or to the same time. Grouping of phenomena in

terms of time is history (or historical science, of which geology is the other example); and that in terms of space is geography (spatial science, of which astronomy is the other example). Thus, while history is narrative, geography is descriptive in approach. The two together fill up the entire circumference of human experience. By virtue of their conceptual structure, both geography and history focus on the study of phenomena of diverse origins existing together: in terms of periods (time) in the case of history, and in terms of spatial segments (regions) in the case of geography.

In everyday experience time and space are inseparable. The one cannot be imagined without the other. However, in their over enthusiasm to emulate the 19th century model of science as pre-eminently an analytical mode of thought, geographers began to view time and space (history and geography) as mutually unrelated and independent of each other. The proponents of both areal differentiation and post-Schaefer spatial science schools of thought had insisted on separation of time from space, so that spatial context was treated independent of, and unrelated to, the temporal context. Insofar as isolation from the social sciences and history was concerned, the most important reason was that, from around 1880 to the end of the First World War, a series of sweeping changes in technology and culture had given rise to distinctive modes of thinking about, and experiencing, time and space. Another important factor in the disciplinary isolation of geography during this period was that in the closing decades of the 19th century and the early

years of the 20th century, under the influence of the social Darwinist thought, as reflected in the works of Ratzel (1844-1904) and others, geography had become so closely identified with environmental determinism that with the rejection of environmentalism and physical-external explanations of social processes and formation of human consciousness, human geography was thrown out of the bathwater of environmental determinism.

By the mid-1950s geography had changed focus from area (areal differentiation and areal organisation) of space (the study of distance-based relationships- social, economic and political). This implied change over from absolute space to relative space – thus paving the way for the change-over from description to analysis, and from the study of places as unrepeatable entities to the study of areal/spatial phenomena as particular cases in the manner of the systematic sciences, so that the mathematical mode of reasoning began to be insisted upon. This was the beginning of the quantitative revolution. The pace of progress was so rapid that the revolution was over by early 1960s.³⁶ The frequency with which new ideas came into currency was so rapid thereafter that within the span of a decade we had three different ‘revolutions’ (behavioural, humanistic, radical-Marxist) following one another in quick succession. Whereas, the humanistic perspective had focussed on the role of human agency, the radical-marxists concentrated on the role of structural relationships in the explanation of man-environment system. Thus, to begin with, the two perspectives were treated as alternative

ways of looking at man's relationship with the environment. The convergence between the spatial and the historical materialist perspectives marked the change of focus in the study of geography from the earlier emphasis on *relative space* to *rational space*, so that by the end of the 1980s human geography had become increasingly focussed on *the study of the spatiality of human life* in all its manifestations – social, economic and political – thereby raising the status of human geography as a core social science discipline: one sharing active research frontiers with every other social science discipline – whatever its subject of study – since every aspect of human organisation, inevitably, is spatially rooted.

The rapprochement between spatial and the historical materialist perspective through the initiative of Marxism in the late 1960s and the 1970s (reflected in the Marxist geography of the decade) eventually led to the rise of new critical human geography around 1980. Since then, a considerable convergence between spatial and sociological perspectives has taken place.³⁷ With the adoption of structuration as a spatio-social process, the barrier that had supposedly separated the spatial perspective from the social, economic, and political spheres of man's life upon the earth surface, could no longer be sustained. This heralded the end to the almost three-quarters of a century old academic isolation of geography from the rest of social science. Today it is a universally accepted premise in social science that every aspect of human organisation— social, economic, and political- is spatially constituted. This change—

over in perspective was essentially a reflection of the changed societal perspectives in the face of globalising and post-modernist context of the late 1970s and 1980s. Thus, alongside the fall of conceptual barrier between space, society and history, the 1980s also witnessed rapprochement between the humanist and the historical materialist perspectives, so that by the end of 1980s it had come to be widely believed that the study of human geography raises theoretical questions as to the nature and relationship between the individual and society, and that human agency and social structure are equally integral to social and spatial understanding. With such a changed perspective on place and space, geography has now been transformed into an all-inclusive and open-ended field of enquiry focused on the inherent spatiality of human life in the total context of the man-environment system, thus making it simultaneously both an environmental and a social science discipline, in the true sense of the two terms. In such geography there is no dichotomy between the physical and social aspects of the discipline, between moral and material, and between time and space – so that questions of do's and don'ts have become meaningless. Thus, as part of the social science fraternity, geographers are concerned to discover not only the world in which we are living, but also to discover, as geographers, how we inhabit, reproduce and change that world.³⁸

Paradigm Changes in Indian Geography

However, considering the works carried out during the 20th century, it is clearly revealed

how the focus of Indian geography shifted from much criticised 'gazetteer approach' to relatively analytical works. The main highlights of the problems with which Indian geography is faced are over-subsistence on foreign (western) concepts and methods, consequent impoverishment of indigenous methodological system, and the growing disparity in geographical research, education and related resources - personal quality, number and overall distribution. However, it is still a big challenge and acquires a greater attention, utmost care for the identity of Indian geography. The basic need is to make our own philosophical roots stronger.

Geography in India started with a strong physical bias. In fact, most of the geographers of yesteryears came from geology and physical streams. Perhaps as a reaction against deterministic approach, as also in conformity with the shift in the discipline in England (most Indian geographers then were products of British universities), Indian geography moved from its physical bias and ultimately changed over to economic stream. And within the economic stream, emphasis came to be laid on British style urban geography. And, Indian geography tried to become a pure social science.

The conceptual framework of the discipline has undergone changes during the last hundred years. A comparison of recent geographical research publications with those of the 1920s reveals a progressive change in the conceptual framework. During the 1920s and 1930s the discipline was concerned mainly with descriptions of regions. Its objective was to provide factual information about areas to

colonial administrators. British geographers promoted this imperialist paradigm designed to serve colonial interests. The scientific publications in Indian geography in those years revealed a reluctance to explore conceptual and hence epistemological premises, and there was far too much reliance on descriptive methodology, and relationship sometimes latent, sometimes unaware with deterministic approaches. All of these pointed to a scientific community in which the prevailing attitude was that of making geography rather than thinking of geography.

During the late 1930s and early 1940s, a small group of geographers such as R.N. Dubey, S.P. Chatterjee and M.H. Rahman whose basic concepts were deeply rooted within the possibilistic thinking generally began to opt for a more critical regional account involving explanatory description and classification. These regional studies followed a standard outline of topics, starting with surface features and climate, advancing to the organic life in relation to the physical features, and then proceeding to the human inhabitants, looked at both as controlled by the environment and modifying the environment.

India's independence in 1947 and the start of the process of decolonisation were accompanied by dramatic changes in the role of geography. The focus of geographical studies shifted to national development. Under the leadership of S.P. Chatterjee the National Atlas Organisation was established at Calcutta in 1950s to provide accurate maps and spatial data for development. The Indian National

Committee for Geography set up by the Government of India organised many seminars and summer schools on a variety of topics in applied geography. Geography also began to play an important role in the work of the Census of India, the Planning Commission, Central Arid Zone Research in Jodhpur, Town and Country Planning in Delhi, Calcutta Metropolitan Planning Organisation Hyderabad Metropolitan Project, All India Soil and Land Use Survey, and the Regional Survey Unit of the Indian Statistical Institute. In these organisations geographers such as Nath, Sundaram, Misra, and Roy contributed to the development of strategies for eliminating economic differences between regions, ecological disasters, energy issues, problems of urban living, land use, industrial decentralisation, economic restructuring and many other issues related to development. All of this activity greatly increased the demand for spatial information and data. This demand has been met by a proliferation of a vast assortment of government agencies and research centres which supply data for planning, and development purposes.

During the early 1960s, the nomothetic approach began to reach India as a result of scholarly exchanges with geographers from the United States, Canada and the UK; and the Indian geographers were attracted by the persuasiveness of nomothetic approach in geography. During the early 1970s, despite all the reluctance and obstacles, theoretical and quantitative geography made some progress. In Indian geography, alongside the traditional geography, possibilist and descriptive in nature,

there appeared a different way of 'doing' geographical: nomothetic, deductive, and tending towards the theory of systems. With the introduction of quantitative techniques, the system of beliefs, methods, theories, and language of geography also changed radically, among the geographers who followed the new paradigm.

There can be no doubt that in the last hundred years Indian geography has undergone major paradigm changes: from idiographic regional descriptive theme during the colonial period to a concern with applied geography during the years following decolonisation, to a nomothetic, deductive approach alongside the traditional regional studies. The perusal of the Indian geographic literature for the last century reflects obvious signs of this change. The increased circulation of ideas and concepts outside India, and the participation of increasing number of Indian geographers in research conferences and symposia abroad facilitated emergence of pluralism in contemporary geographic research. This pluralism of the 1990s is in contrast to the monolithism that characterised the tiny circle of Indian geography in the 1930s. In one of the surveys examining 'credibility' and 'topic of concern' comparison is made between 1950s and 2000s that indicated the shifting of orientation (Table 3).³⁹

Thus, the methodological roots of contemporary geographic research in India may be traced to British, French and American geography. Links with British geography have continued through a number of Indo-British seminars and exchanges. Ties with American geography are

growing stronger as many Indian geographers have visited or studied in the US or Canada. India occupies a prominent place in world geography, and geographic research and education in colleges and universities continues to increase rapidly. There has been a sharp upturn in doctorate degrees awarded during the past decade.

Future Directions

Clearly, Indian geography is today at an important turning point. The foundation laid down after independence by geographers who are now in retirement is being challenged by newly developed or introduced methodologies or research techniques, such as remote sensing, quantitative analysis and GIS. At the same time, the Indian geographers are just now beginning to look beyond their own regional boundaries, indeed even to the rest of the world for research subjects.

The four stages of its growth sketched above reveal that geography has moved away from the initial ‘gazetteer map’ to a more descriptive / analytical framework which is still in its making and there are many gaps to be filled in. The need of the hour is to develop a methodological system of Indian geography which has its distinctive traits as an intellectual and scientific discipline that can provide a meaningful synthesis of our cultural heritage and physio-technological progress, our habits and habitats, as well as our opportunities and challenges and that can be more substantive, productive and satisfying. Modern Indian Geography, if it has to reach the status of science, must start studying our problems of life and living.⁴⁰ Unless we identify the geographical perspectives of these problems and seek an explanation, there can be no Indian geography.

Table 3: Geography: Focus of Inquiry

In 1950s, As it was	In 2000, As it is
• Areal Differentiation.....	Areal Integration
• Balanced Regional Development.....	Sustainability
• City.....	City Systems
• Climatic Types.....	Climate Change
• Dividing Land.....	Sharing Water
• External Threat.....	Internal Security
• Food Productivity.....	Food Security
• Industrial Estates.....	Industrial Parks
• Nation State.....	Globalisation & Localisation
• Political boundaries.....	Political Landscapes
• Population Explosion.....	Population Displosion
• Rule of Majority.....	Role of Minorities
• Self-Sufficiency.....	Interdependence

It is possible to make an advance in two directions: make the already existing subfields strongly problem oriented, and research for gaps that need to be filled up. In the first case, it is necessary to correct the present imbalance, subfield wise in favour of 'physical' side, and we may revive our faith by noting the contemporary studies in the USSR and Germany instead of mainly trailing the bandwagon of 'crystallized' practitioners. In the second category, there appear to be many gaps that need our attention. On the physical side, there is hardly much that has been done by geographers in the sub-fields of ecological and environmental studies as well as studies in resources and their conservation. So is the case of medical geography which spans over both the physical and human aspects. There is still a world to conquer in human geography. Identification of traditional cultural regions, social cores, and the patterns of religious, of languages including regional dialects, are some of the themes which hold an exciting prospect. Of a greater significance and urgency is the study of behavioural pattern of social and economic group in space. The interface between the physical and human is both challenging and rewarding, if we identify, through our geographical perspective, traditional regions and measure a deep impact that the forces of modern urbanisation and industrialisation are making on them. In sum, they might say that ends of the telescope need to be reversed, and we try to identify the problems in real life first and then apply suitable methodology and techniques, rather than the other way round, which we are

doing today. It would be possible, then, to make a viable contribution to the solution of our social and economic problem, and also to the approaches of theory building in geography as a science.

The most essential step in recreating Indian geography is to open up the intellectual horizon of our students through a sound programme of training in the discipline's philosophy and methodology, as it has evolved over the past 50 years, through a truly contextual perspective on the course of this development, in order that the technological, intellectual, and societal cross-currents that had necessitated the successive transformations in theory and practice of geography, are suitably underlined. Only a thorough grounding in the philosophy and methodology of the subject can help to awaken the students' consciousness about the status of geography, as a socially useful discipline. The next most important step in the reconstruction of the discipline (and the profession) pertains to the logical restructuring of syllabi at all levels but most particularly at the Bachelor's and Master's level incorporating the latest thinking on the spirit and purpose of geography.

Towards Rebuilding Indian Geography

Any disciplinary restructuring must begin with the fundamental premise that a discipline is a field of study, an organised body of information, and a method of inquiry- the three things rolled into one. The term 'field of study' refers to the nature of the data studied, and the kind of questions asked by the

practitioners of the field. Indeed, a discipline's data and its boundaries are defined by the type of questions it tries to seek answers to. Secondly, every discipline is an organised body of knowledge, so that the structure of the field refers to the way in which facts and concepts are related. Disciplinary structure includes the concepts, generalisations, and theories of the field, which give focus and direction to inquiry: The concepts are the tools of inquiry, so that they differ from discipline to discipline. A through grounding in disciplinary theory- the philosophy and methodology of the field- is therefore, the foremost priority in professional training. In this context, it should also be noted that disciplinary structures keep evolving progressively, as new information is added, and existing concepts are modified and changed to cope with it. Change also occurs following the development of new and improved techniques of collection and analysis of data which was previously considered beyond the power of the discipline to study.

As a discipline focused on the study of the earth surface as the human habitat, geography must necessarily be concerned with both physical as well as man-made elements of the landscape, which together constitute our environment. Physical and human geography, therefore, are equally essential components of the discipline. However, since the beginning of the 20th century, 'increasingly, the problems with which geographers deal are those relating to men in society and less to those concerning the physical characteristics of the earth'.⁴¹ That, by no means, downgrades the importance of

physical geography as a basic component of the discipline. It only means that the focus in research has shifted away from it. The fact remains that without a sound grounding in the knowledge about the earth environment, it is difficult for a geographer to justify fully his professional identity, which is inescapably tied to the study of places and regions as well-defined ecological entities, born out a series of relationships between a piece of land and a group of people, who have transformed that physical entity into a human creation. Concern with environment has now become so specialised, following the threat to global ecological balance in the face of overexploitation of resources beyond the natural capacity of such resources to renew themselves, that – owing to superficial attention given to the teaching of physical geography in India over the past 50 years – geography is today in danger of losing its identity as an environmental science. However, in any scheme of restructuring of courses of study in the discipline we must bear in mind the central reality that man is the measure in geography, so that we study the physical earth not for itself (as other branches of physical science do), but primarily as the human habitat. Accordingly, the central objective in the study of physical geography, since the beginning of the 20th century, has been to develop an understanding of the earth's environment and resources with a view to developing the ability to appreciate the problems, potentials, and prospects of development as posed by the local environment in different parts of the single system.

Geography in India is one of the rare examples of an established discipline in which little attention is paid to the students' training in disciplinary structure. Since around 1970 most university syllabi at the postgraduate level include a course on the history of geographical thought, essentially structured in the style of Dickinson's *Makers of Modern Geography*-focused more on the makers than the things made. Besides, the narrative seldom goes beyond the so-called quantitative revolution, so that there is all round illiteracy in respect of the post-1970 developments in geographical theory. Indeed, at no stage in his training, from the school to graduate level, is the student ever taught the basic concepts and methodology of geography. Partly this is a legacy of the British system of education. The trend to include a course on the History of Geographical Thought in our syllabi, around 1970 was influenced by the winds of change blowing over British geography at that time. This source of inspiration was soon to end as we closed the window on English, so that, conceptually speaking, Indian geography had stopped growing over the last 30 years- some exceptions here and there notwithstanding.

Serious attention to the student's training in theory and methodology of geography should, therefore, be our first priority. Another essential aspect of training of the geographer as a professing relates to toning up of his consciousness about geography as an environmental discipline, focused on the study of and in society. Other specialists in the social sciences identify the geographer as some kind of

man-environment specialist- one with adequate appreciation of environment related problems of the day. A comprehensive course on environmental appreciation prepared and imparted in collaboration with specialists in the relevant disciplines, need therefore to be urgently introduced. A third compulsory component of the postgraduate syllabi should focus on cartography, map interpretation (including the study of aerial photographs and imageries), theory and practice of social survey and field work.

Notes

1. Rana, L. (2011),
2. Singh, R.S. (2009).
3. Rana, L. (2011), op.cit.
4. The Shulba Sutras are part of the larger corpus of texts called the Shrauta Sutras, considered to be appendices to the Vedas. They are the only sources of knowledge of Indian mathematics from the Vedic period. The four major Shulba Sutras, which are mathematically the most significant, are those composed by Baudhayana, Manava, Apastamba and Katyayana. The texts have been dated from around 800 BCE to 200 CE, with the oldest being the sutra that was written by Baudhayana around 800 BCE to 600 BCE.
5. Julia Leslie, (2003), p. 154.
6. Radhakrishnan and Moore, (1957), "Contents", and pp. 453-487.
7. The āstika schools are: (i) Sankhya, a dualist exposition of mind and matter; (ii) Yoga, a school emphasizing meditation closely based on Sankhya; (iii) Nyaya or logics; (iv) Vaisheshika, an empiricist school of atomism; (v) Mimamsa, an anti-ascetic and anti-mysticist school of orthopraxy; and (vi) Vedanta, opposing Vedic ritualism in favour of mysticism. The nāstika

- schools are Buddhism, Jainism and Cārvāka, a skeptical materialist school.
8. Rana, L. (2011), op.cit
 9. Bourbaki 1998, p. 46
 10. "algebra" 2007. Britannica Concise Encyclopedia.
 11. G. G. Joseph (1997), pp:67-68.
 12. Singh, L.R. (1996), pp:1-57.
 13. Dikshit, R.D. (2001), pp: 1-18.
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 17. Noble, Allen G. (2004), p: 9.
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